



RADIO TEST REPORT

Test Report No.: 10007368S-A

Applicant : Sony Corporation
Type of Equipment : Personal Audio System
Model No. : ICF-CS20BT
FCC ID : AK8ICFCS20BT
Test regulation : FCC Part15 Subpart C: 2012
Test result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

Date of test: April 1 to 10, 2013

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

Approved by : T. Imamura
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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Shonan EMC Lab.

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13-EM-F0429

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SECTION 1: Customer information

Company Name : Sony Corporation
Brand Name : SONY
Address : 2-10-1 Osaki, Shinagawa-ku, Tokyo, 141-8610 Japan
Telephone Number : +81-50-3750-4417
Facsimile Number : +81-50-3750-6572
Contact Person : Shigeru Higai

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

2.1 Identification of E.U.T.

Type of Equipment : Personal Audio System
Model Number : ICF-CS20BT
Serial Number : Refer to 4.2.
Rating : AC120V, 60Hz
Country of Mass-production : China
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : March 28, 2013
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: ICF-CS20BT (referred to as the EUT in this report) is a Personal Audio System.

Clock frequency(ies) in the system : 32.768kHz (Clock IC), 4MHz (USB IC), 16MHz (Bluetooth)

Radio specification:

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth & channel spacing : 1MHz & 1MHz
Type of modulation : FHSS
Antenna type : Pattern Antenna
Antenna gain : 2.0287dBi
Antenna connector type : Integral
Operation temperature range : +5 to +35 deg.C.

FCC 15.31 (e)

The equipment provides the wireless transmitter with stable power supply (DC4V). Therefore, the equipment complies with the requirement.

FCC 15.203

The equipment and its antenna comply with this requirement since this 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 : Test specification: FCC Part 15 Subpart C: 2012,
final revised on December 27, 2012 and effective January 28, 2013
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,
and 5725-5850MHz

The EUT has been tested for compliance with FCC Part 15 Subpart B. Refer to the test report: 10007368S-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	14.6dB Freq.: 0.15076MHz Detection: Quasi-Peak Phase: L1 Mode: Tx 2441MHz, 3-DH5	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		6.5dB Freq.: 297.927MHz Polarization: Vertical Detection: Quasi-Peak Mode: Tx 2441MHz, DH5	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)	9kHz-30MHz	3.7 dB	3.7 dB	3.6 dB
	30MHz-300MHz	4.9 dB	5.1 dB	4.9 dB
	300MHz-1GHz	5.0 dB	5.2 dB	4.9 dB
	1GHz-15GHz	4.8 dB	4.8 dB	4.9 dB
Radiated emission (Measurement distance: 1m)	15GHz-18GHz	5.6 dB	5.6 dB	5.6 dB
	18GHz-40GHz	4.6 dB	4.3 dB	4.4 dB

*1: SAC=Semi-Anechoic Chamber

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

Conducted emission

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

Radiated emission

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

Antenna port conducted test

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

Spurious emission (Conducted) measurement (below 1GHz) uncertainty for this test was: (±) 1.7dB

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

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

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

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

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3.5 Test location

UL Japan, Inc. Shonan EMC Lab.

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Telephone number : +81 463 50 6400

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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
<input type="checkbox"/> No.1 semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input type="checkbox"/> No.2 semi-anechoic chamber	697847	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	697847	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 checked="" 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	-

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

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

*Remarks: Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not affect the output power and bandwidth of the EUT.
As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

The EUT has no inquiry mode.

Software: ISRT Ver.1.0.48.3245
(Power setting: BDR: 0 x 3b, EDR: 0 x 2e)

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

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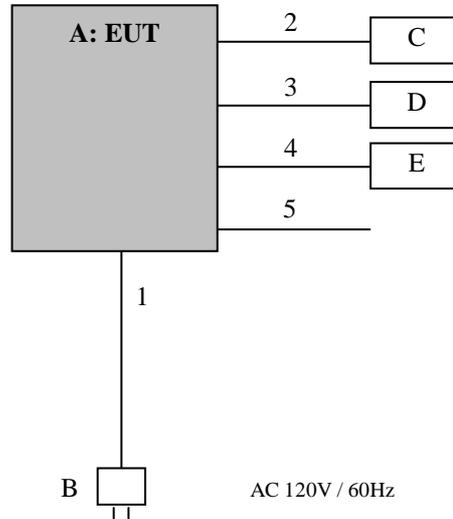
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4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Personal Audio System	ICF-CS20BT	*1)	Sony	EUT
B	AC Adapter	AC-OT	001	Sony	-
C	iPhone	A1429	013351002137273	Apple	-
D	iPhone	A1429	013346001853623	Apple	-
E	AM loop antenna	-	-	Sony	-

*1) Antenna terminal conducted tests: 2, Conducted/Radiated emission tests: 4

List of cables used *2)

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	DC	1.5	Unshielded	Unshielded	-
2	USB	1.0	Shielded	Shielded	-
3	Audio In	2.0	Shielded	Shielded	-
4	AM antenna	0.8	Unshielded	Unshielded	-
5	FM antenna	0.7	Unshielded	Unshielded	-

*2) 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)
Temperature : See test data (APPENDIX)
Humidity : See test data (APPENDIX)

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. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the input power source. 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 within a Shielded room. The EUT was connected to a Line Impedance Stabilization Network (LISN). 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

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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.

Summary of the test results: Pass
Refer to APPENDIX

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

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SECTION 12: Radiated emission

12.1 Operating environment

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

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 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.

12.3 Test conditions

Frequency range : 30MHz to 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.

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.

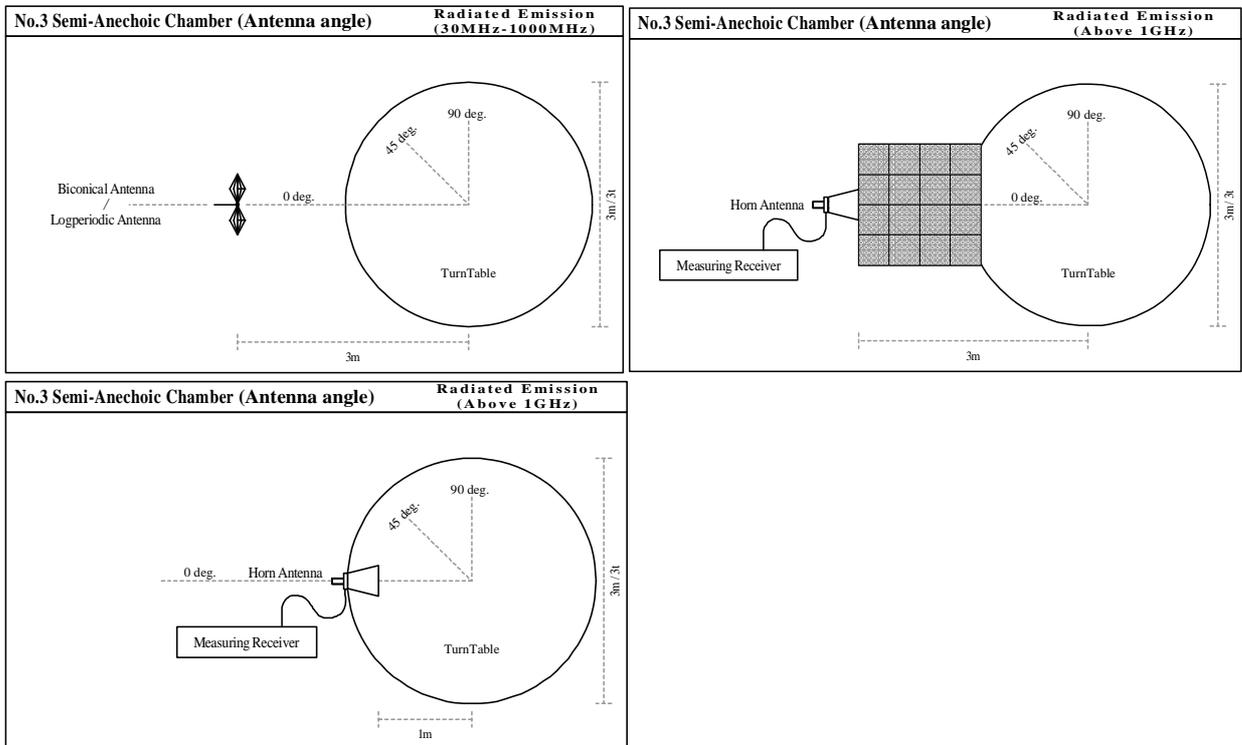
The EUT was tested in the direction normally used.

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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 *No noise was detected above the 5th order harmonics.

Refer to APPENDIX

Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

Conducted emission
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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DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/04/10

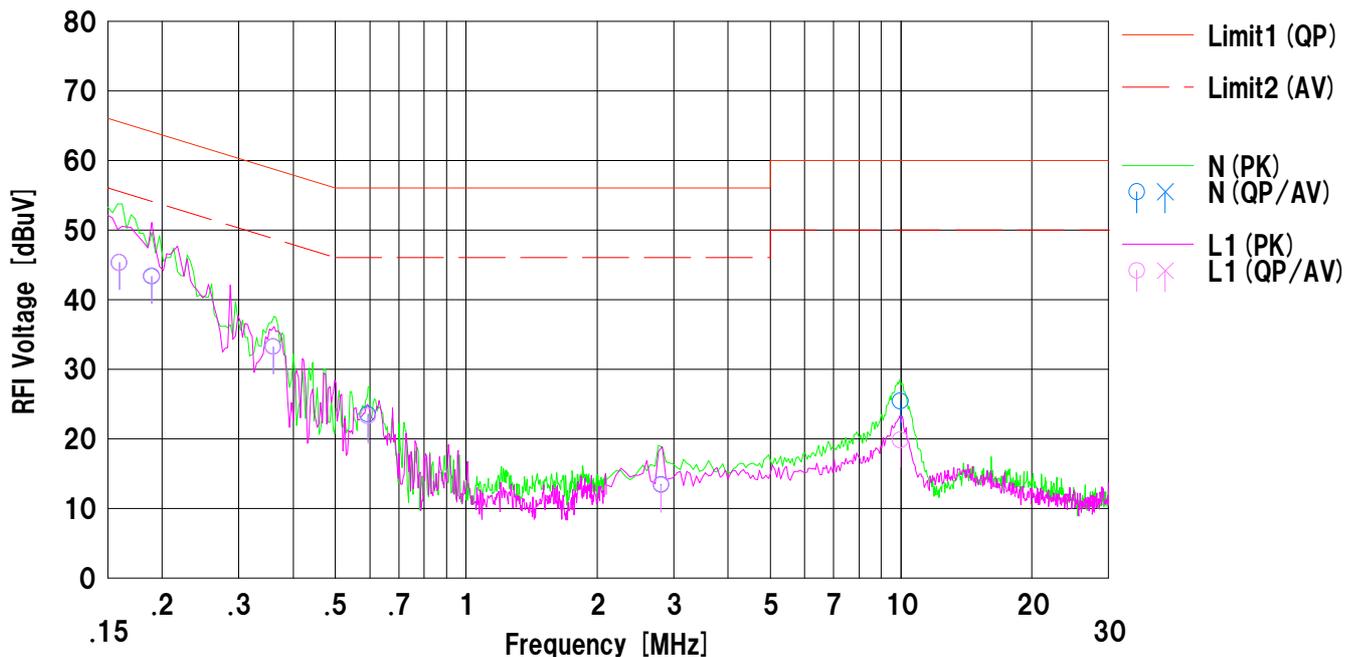
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : ICF-CS20BT
Serial No. : 4

Mode : Bluetooth TX DH5 2441MHz
Order No. : 10007368S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 23deg.C/29%RH

Remarks : -

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

Engineer : Wataru Kojima



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	0.15937	32.4	---	12.9	45.3	---	65.4	55.4	20.1	---	N	
2	0.18938	30.4	---	12.9	43.3	---	64.0	54.0	20.7	---	N	
3	0.36033	20.3	---	12.9	33.2	---	58.7	48.7	25.5	---	N	
4	0.59436	10.6	---	12.9	23.5	---	56.0	46.0	32.5	---	N	
5	2.80724	0.3	---	13.1	13.4	---	56.0	46.0	42.6	---	N	
6	9.96433	11.4	---	14.0	25.4	---	60.0	50.0	34.6	---	N	
7	0.15937	32.4	---	12.9	45.3	---	65.4	55.4	20.1	---	L1	
8	0.18938	30.5	---	12.9	43.4	---	64.0	54.0	20.6	---	L1	
9	0.36033	20.3	---	12.9	33.2	---	58.7	48.7	25.5	---	L1	
10	0.59436	10.3	---	12.9	23.2	---	56.0	46.0	32.8	---	L1	
11	2.80724	0.2	---	13.1	13.3	---	56.0	46.0	42.7	---	L1	
12	9.96433	5.8	---	14.0	19.8	---	60.0	50.0	40.2	---	L1	

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/04/10

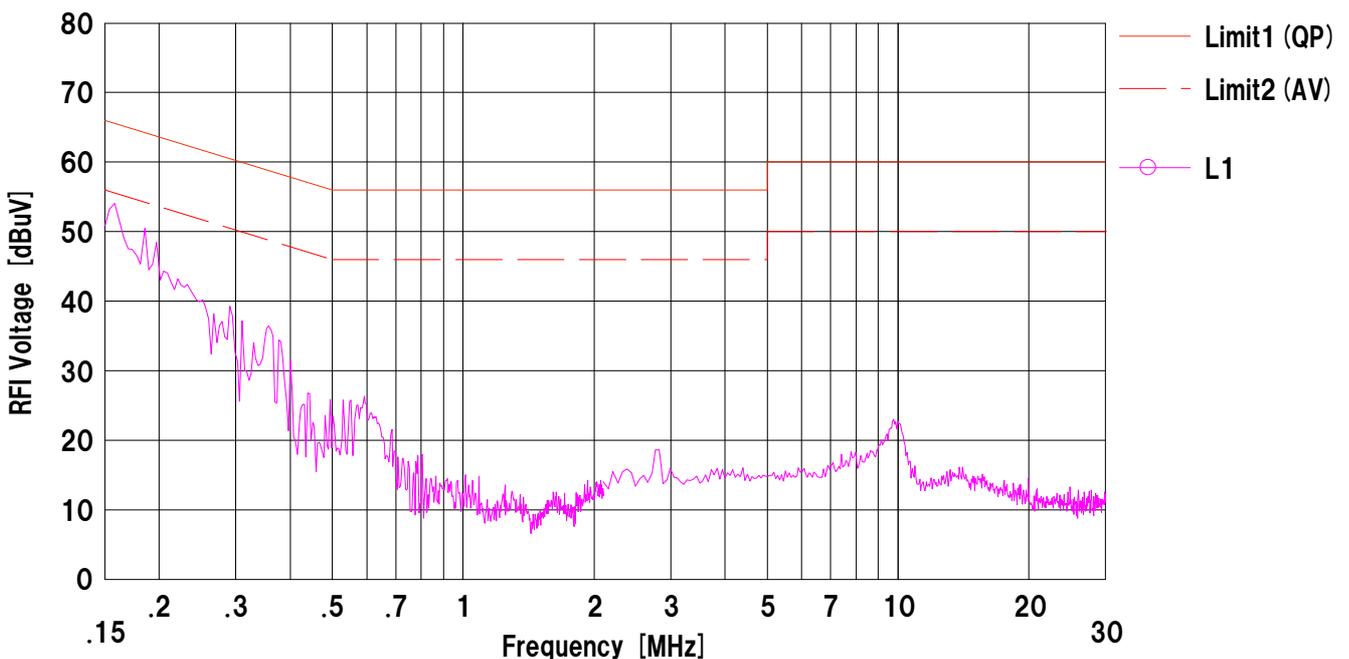
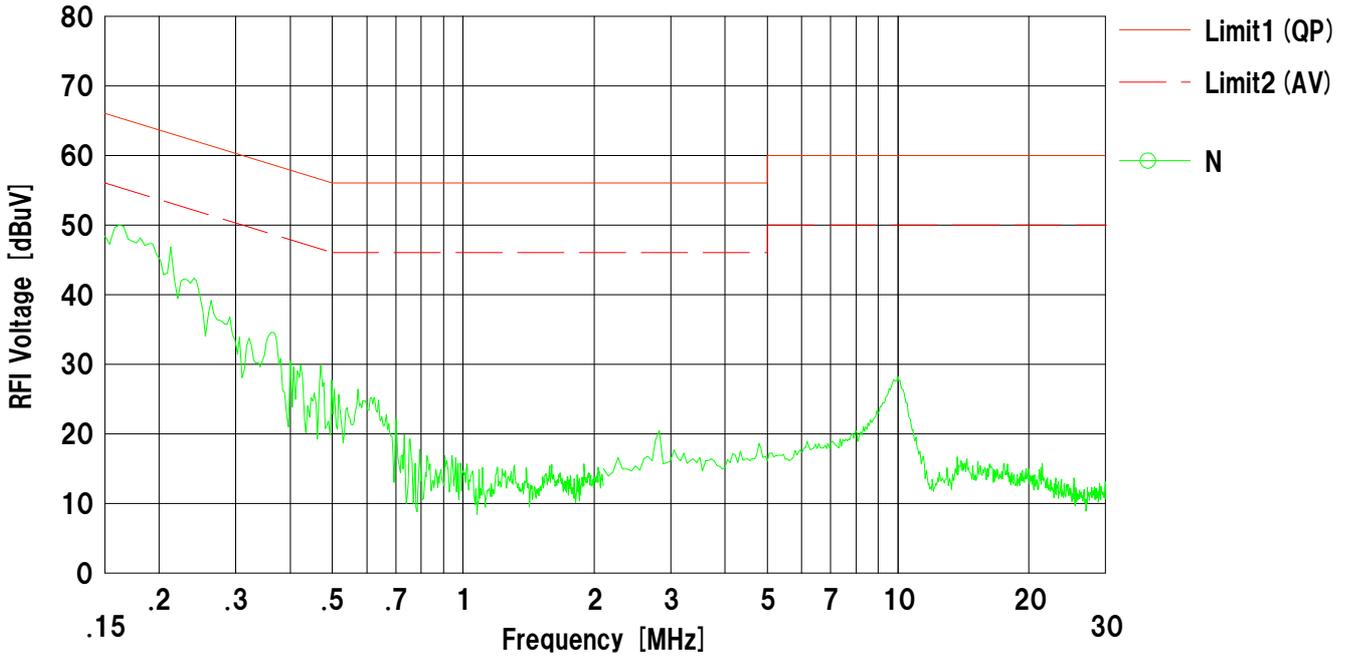
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : ICF-CS20BT
Serial No. : 4

Mode : Bluetooth TX DH5 2402MHz
Order No. : 10007368S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 23deg.C/29%RH

Remarks : -

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

Engineer : Wataru Kojima



DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/04/10

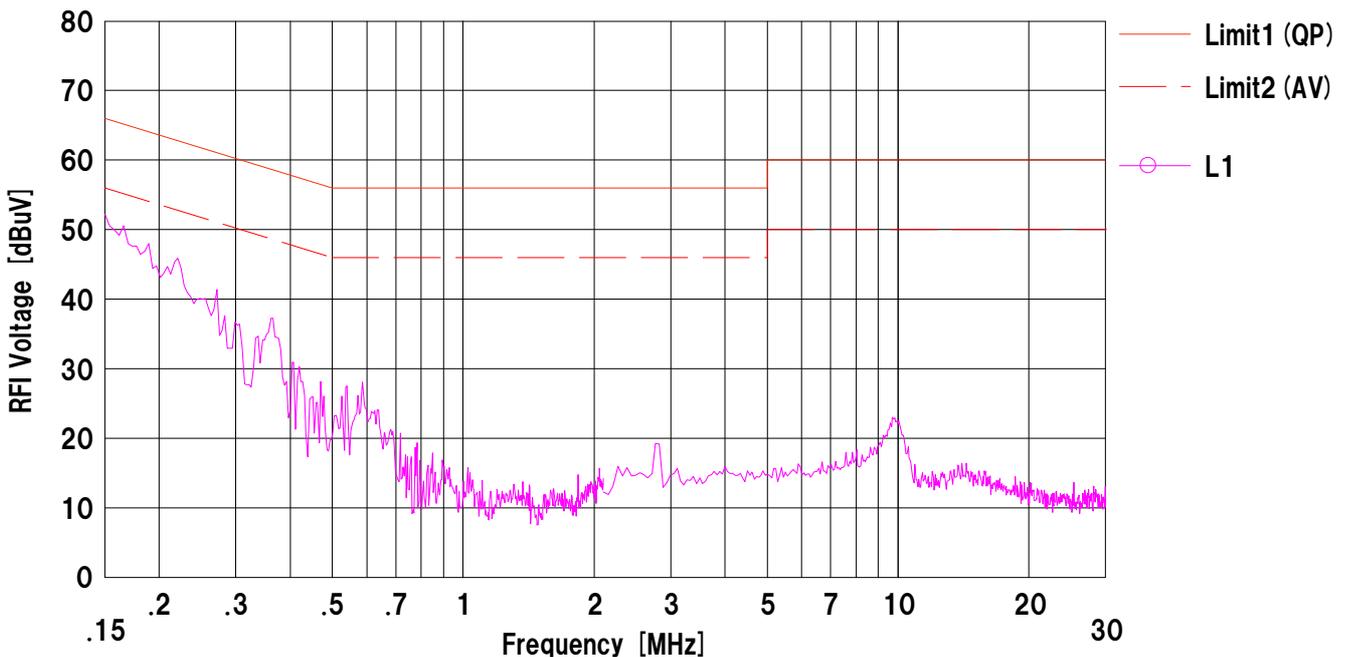
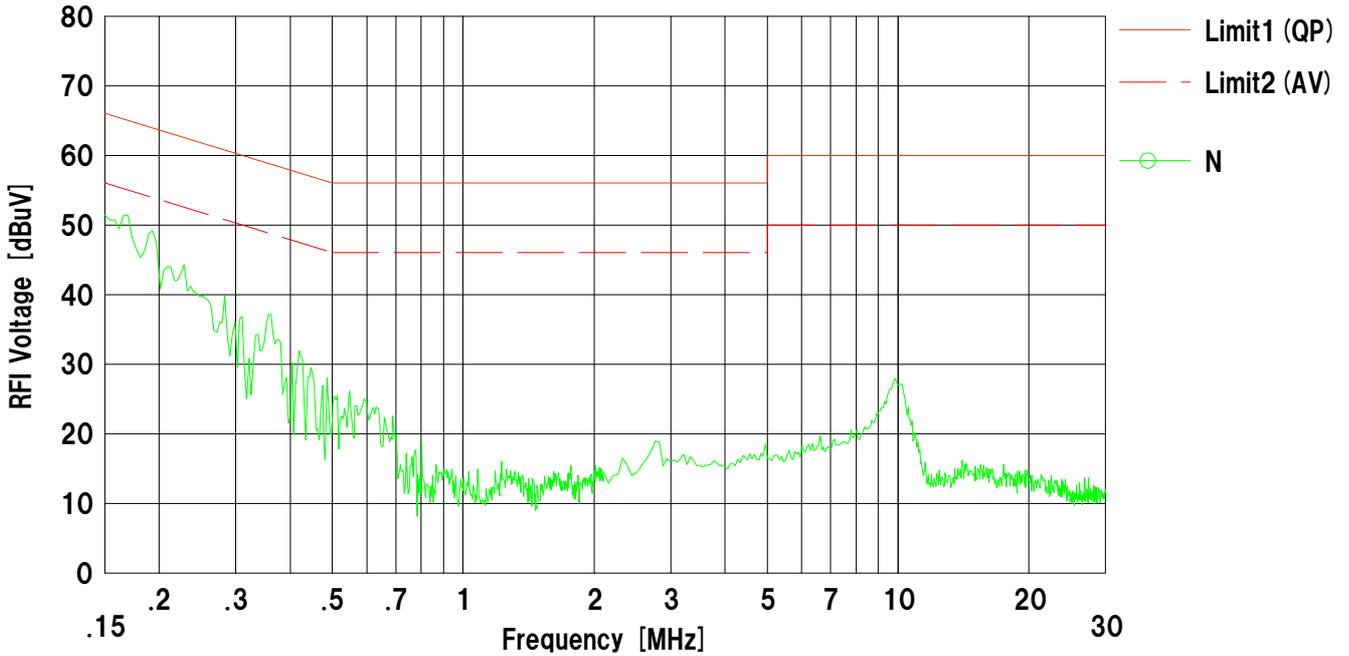
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : ICF-CS20BT
Serial No. : 4

Mode : Bluetooth TX DH5 24 MHz
Order No. : 10007368S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 23deg.C/29%RH

Remarks : -

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

Engineer : Wataru Kojima



DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/04/10

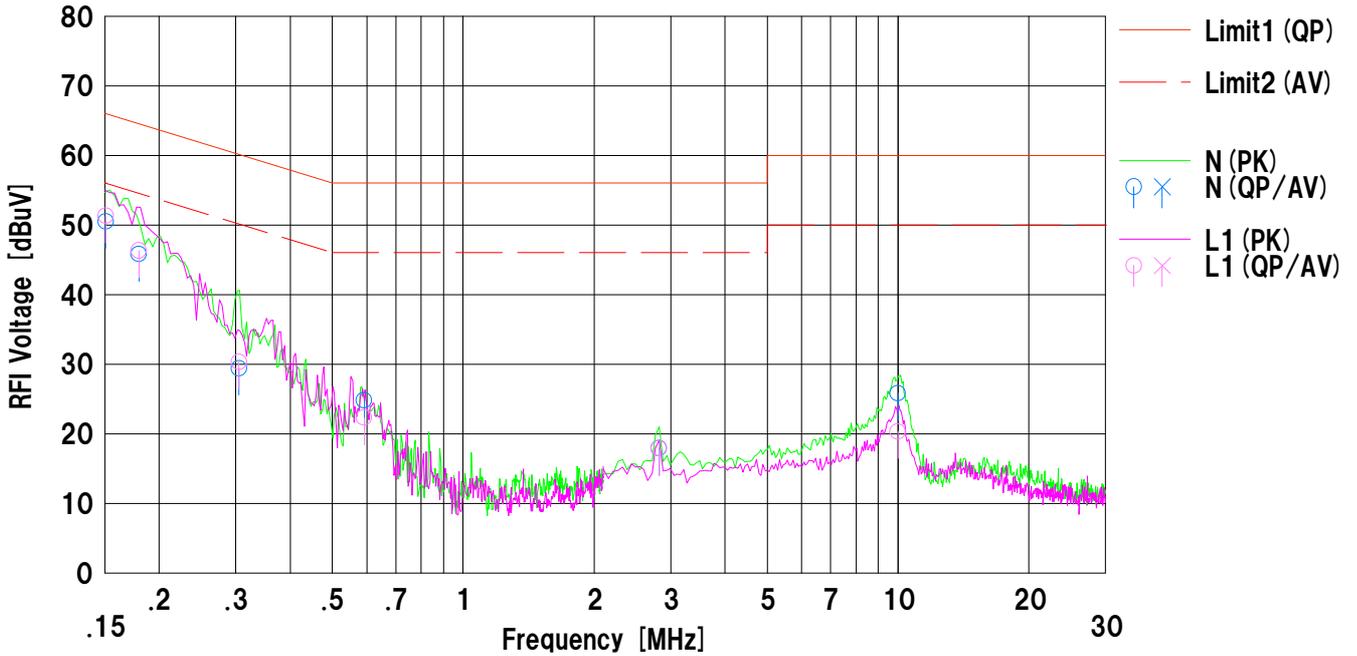
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Order No. : 10007368S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 23deg.C/29%RH

Remarks : -

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

Engineer : Wataru Kojima



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	0.15076	37.6	---	12.9	50.5	---	65.9	55.9	15.4	---	N	
2	0.17978	32.9	---	12.9	45.8	---	64.4	54.4	18.6	---	N	
3	0.30500	16.5	---	12.9	29.4	---	60.1	50.1	30.7	---	N	
4	0.59204	11.9	---	12.9	24.8	---	56.0	46.0	31.2	---	N	
5	2.82279	4.8	---	13.1	17.9	---	56.0	46.0	38.1	---	N	
6	9.99070	11.8	---	14.0	25.8	---	60.0	50.0	34.2	---	N	
7	0.15076	38.4	---	12.9	51.3	---	65.9	55.9	14.6	---	L1	
8	0.17978	33.4	---	12.9	46.3	---	64.4	54.4	18.1	---	L1	
9	0.30500	17.4	---	12.9	30.3	---	60.1	50.1	29.8	---	L1	
10	0.59204	9.4	---	12.9	22.3	---	56.0	46.0	33.7	---	L1	
11	2.82279	4.8	---	13.1	17.9	---	56.0	46.0	38.1	---	L1	
12	9.99070	6.3	---	14.0	20.3	---	60.0	50.0	39.7	---	L1	

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/04/10

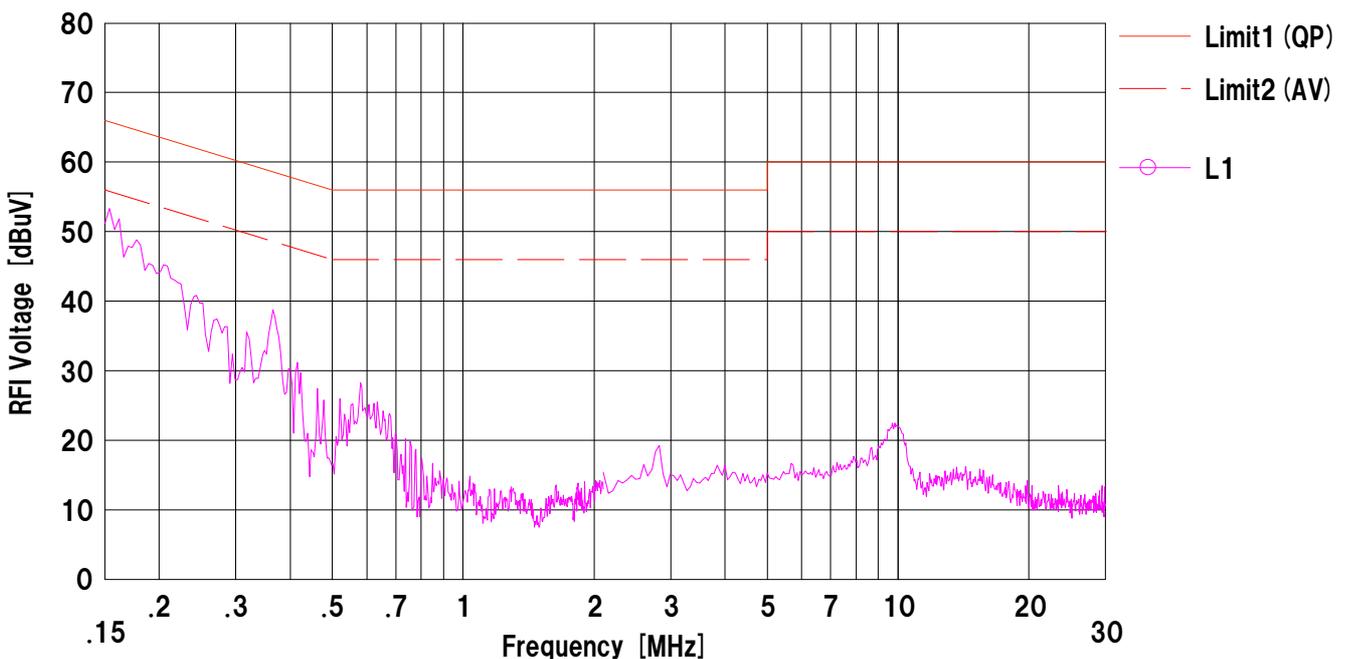
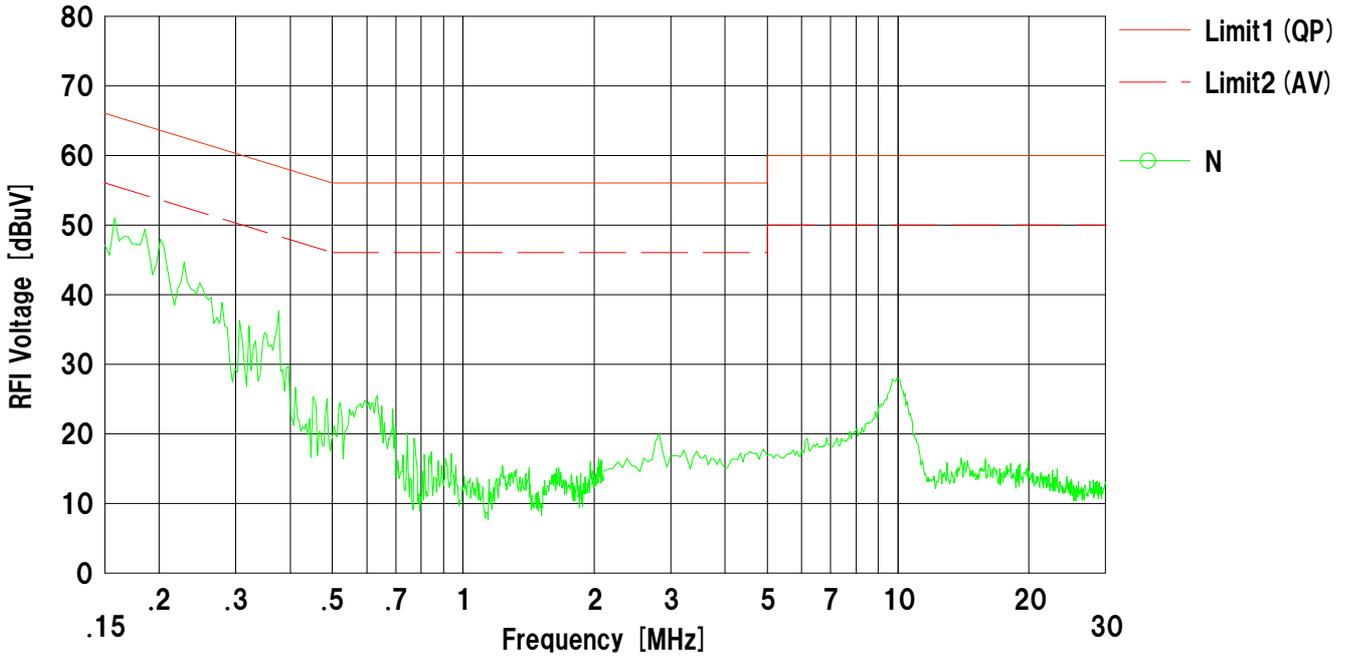
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : ICF-CS20BT
Serial No. : 4

Mode : Bluetooth TX 3DH5 2402MHz
Order No. : 10007368S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 23deg.C/29%RH

Remarks : -

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

Engineer : Wataru Kojima



DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/04/10

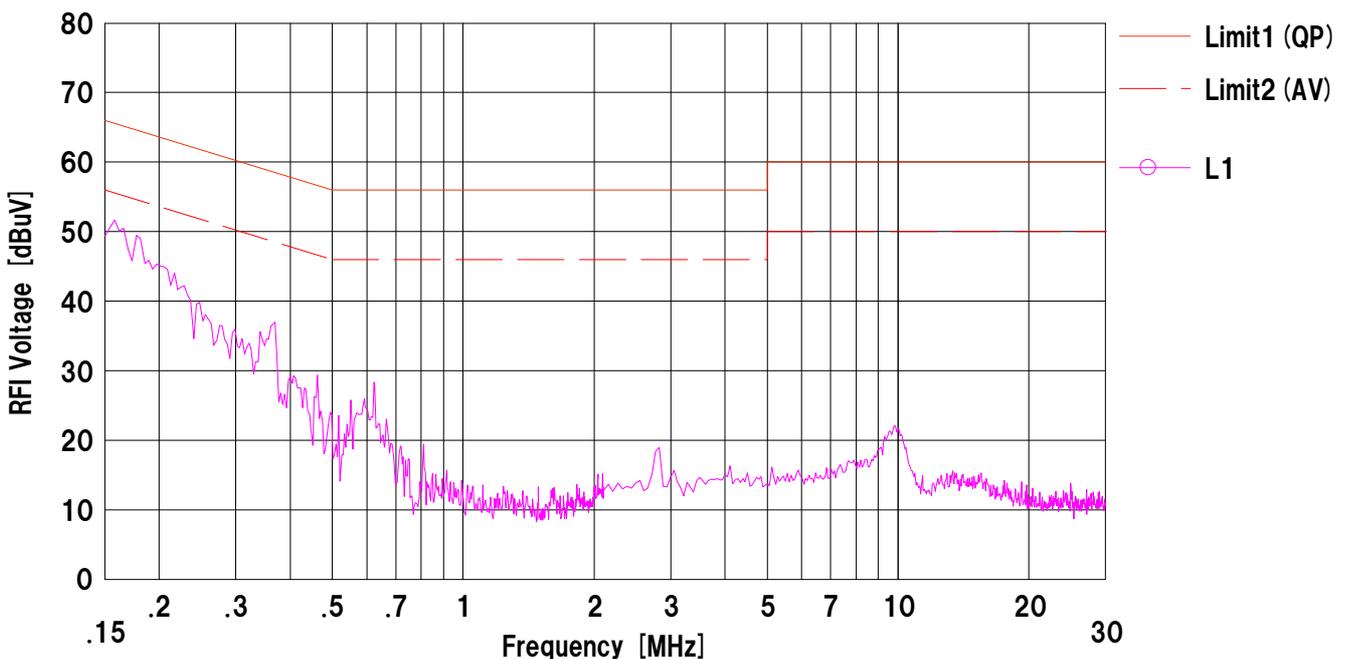
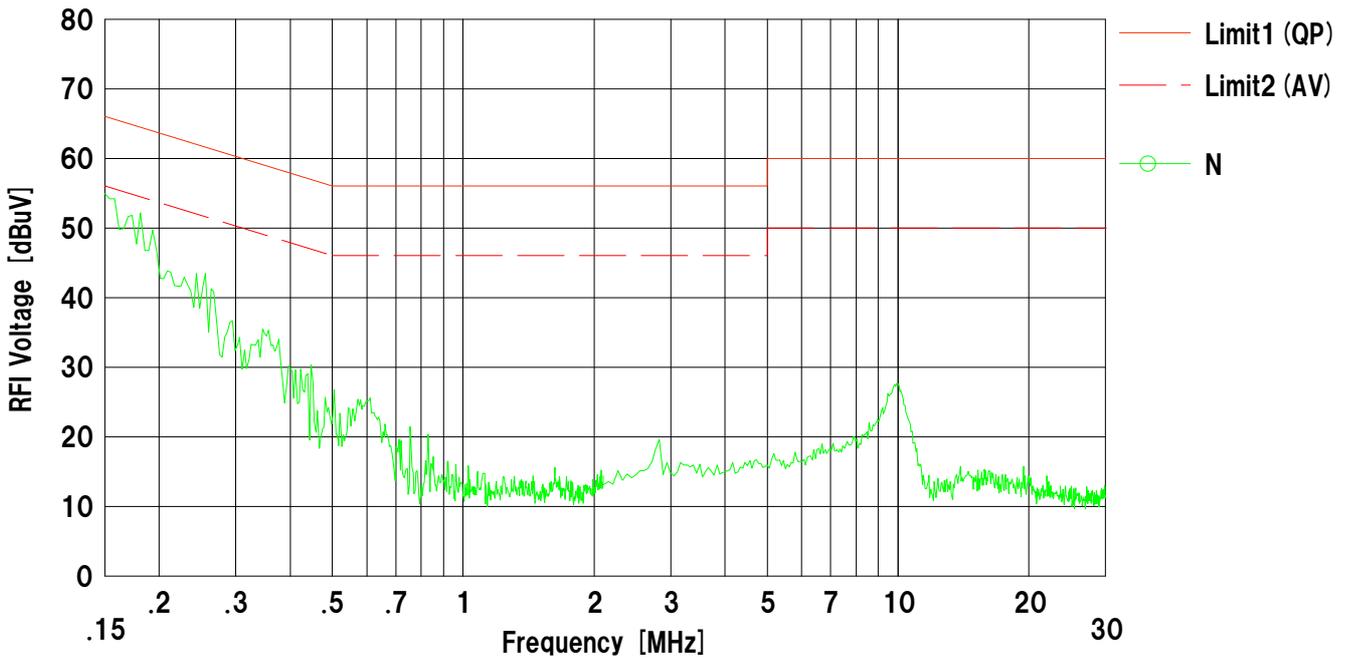
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : ICF-CS20BT
Serial No. : 4

Mode : Bluetooth TX 3DH5 2480MHz
Order No. : 10007368S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 23deg.C/29%RH

Remarks : -

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

Engineer : Wataru Kojima



20dB Bandwidth and Carrier Frequency Separation

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date April 1, 2013
Temperature / Humidity 23 deg.C , 32 %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	0.996	1.000	>= 0.664
DH5	2441.0	0.948	1.000	>= 0.632
DH5	2480.0	0.960	1.000	>= 0.640

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

No limit applies to 20dB Bandwidth.

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Shonan EMC Lab.

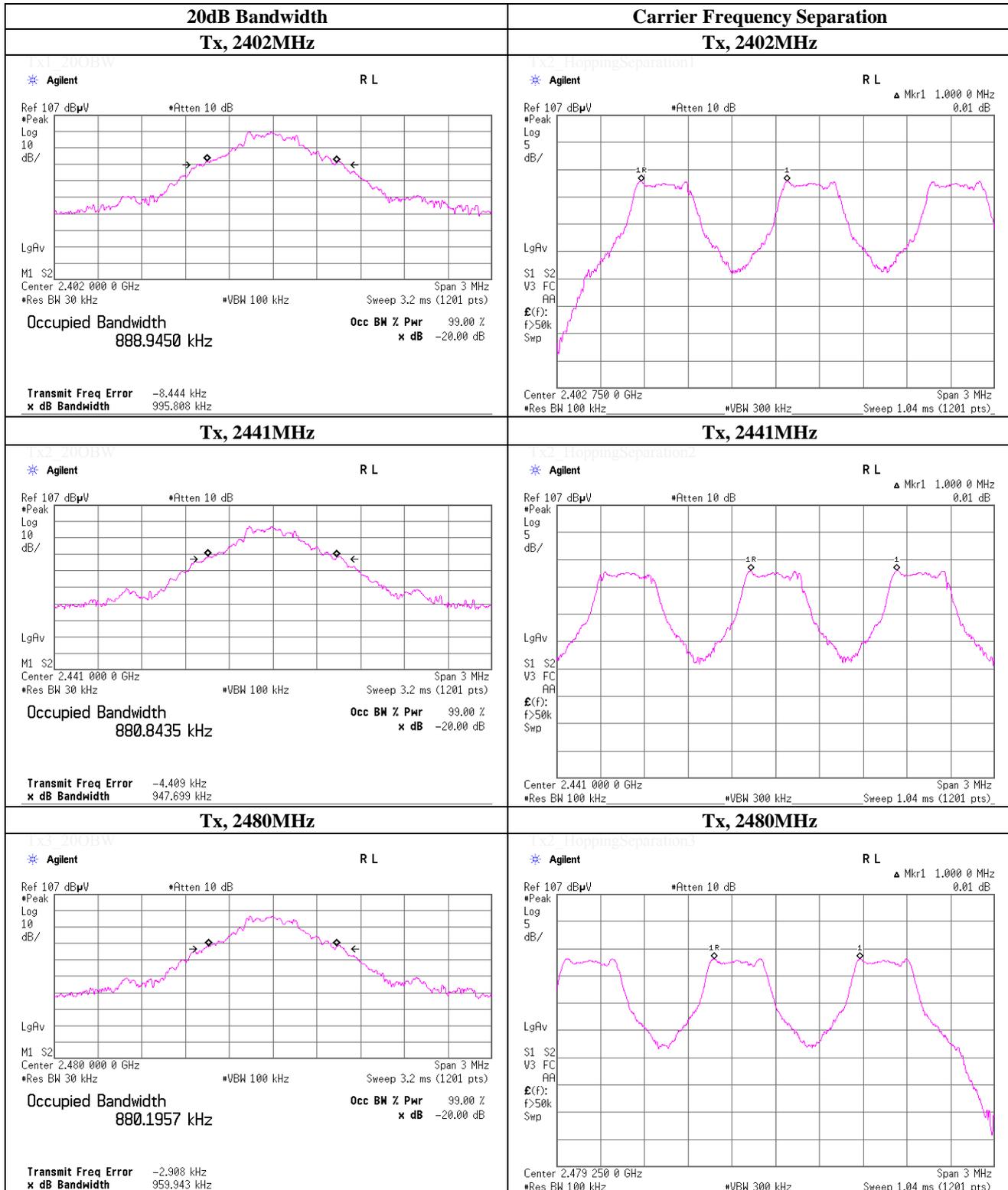
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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.

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20dB Bandwidth and Carrier Frequency Separation

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 1, 2013
 Temperature / Humidity 23 deg.C , 32 %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	1.264	1.000	>= 0.843
3-DH5	2441.0	1.264	1.000	>= 0.843
3-DH5	2480.0	1.260	1.000	>= 0.840

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

No limit applies to 20dB Bandwidth.

UL Japan, Inc.

Shonan EMC Lab.

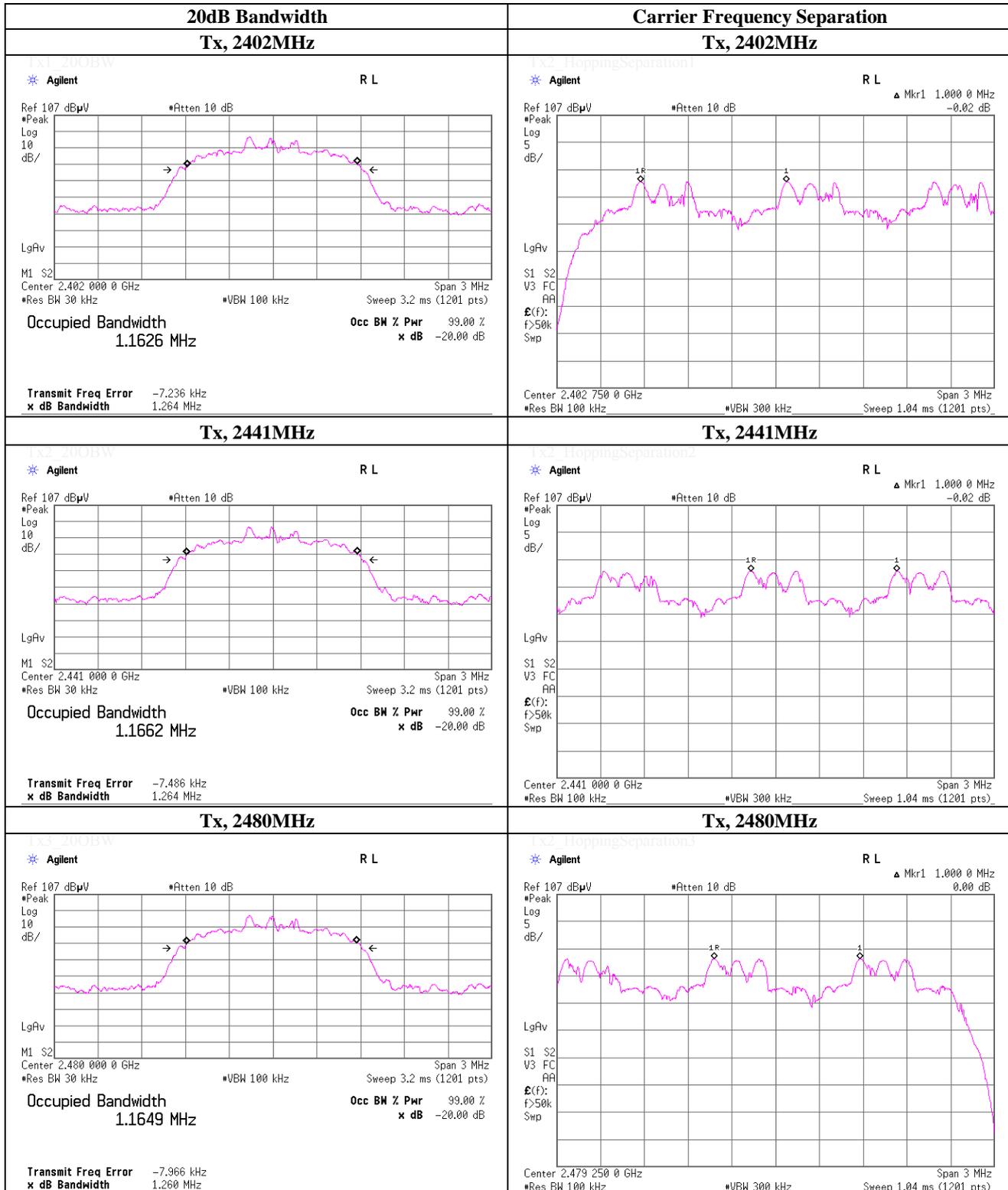
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, EDR, PRBS9



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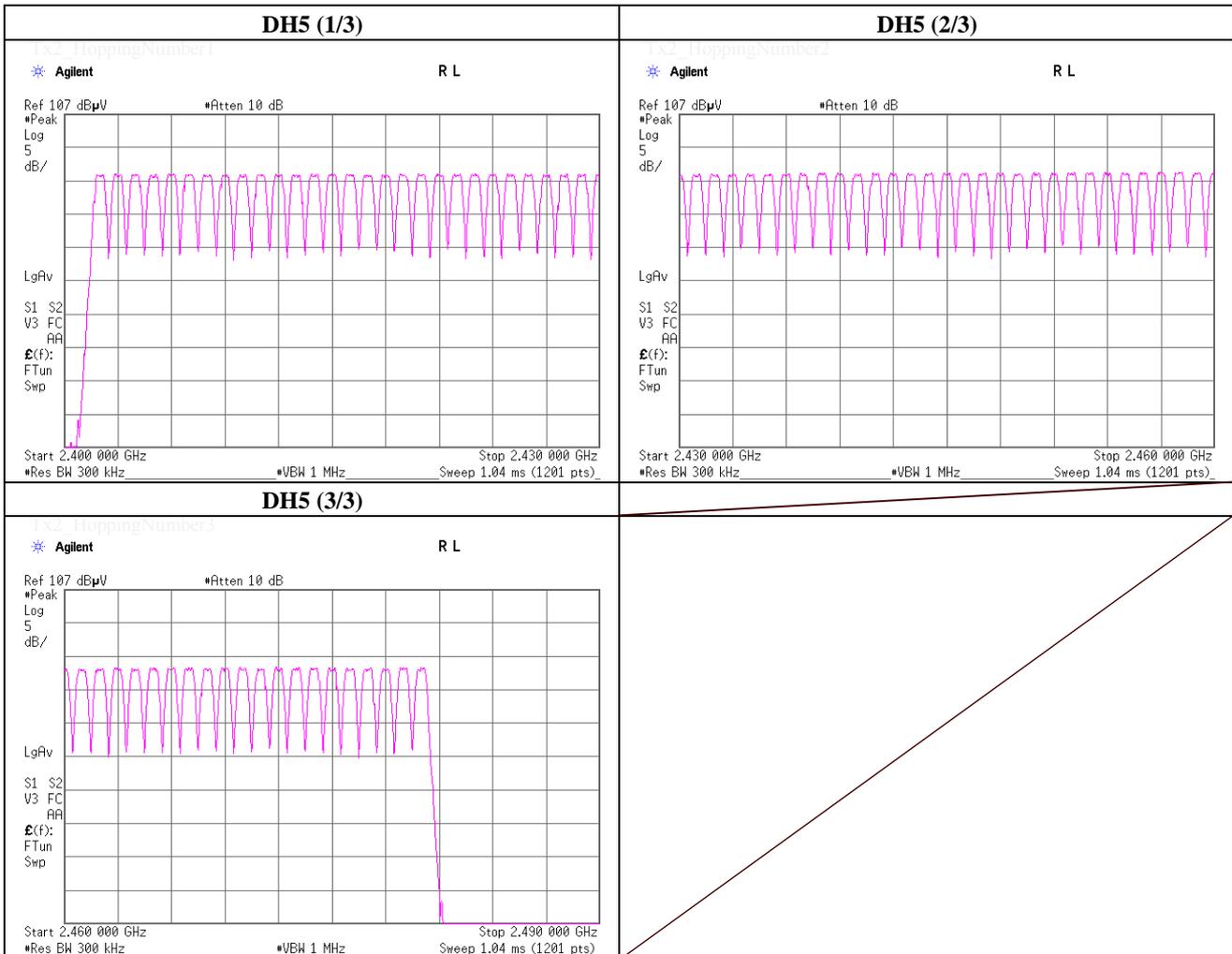
Facsimile : +81 463 50 6401

Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	April 1, 2013	
Temperature / Humidity	23 deg.C , 32 %RH	
Engineer	Shinichi Takano	
Mode	Tx, Bluetooth, BDR, PRBS9	

Mode	Number of Channel [times]	Limit [times]
DH5	79	>= 15

* Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification.



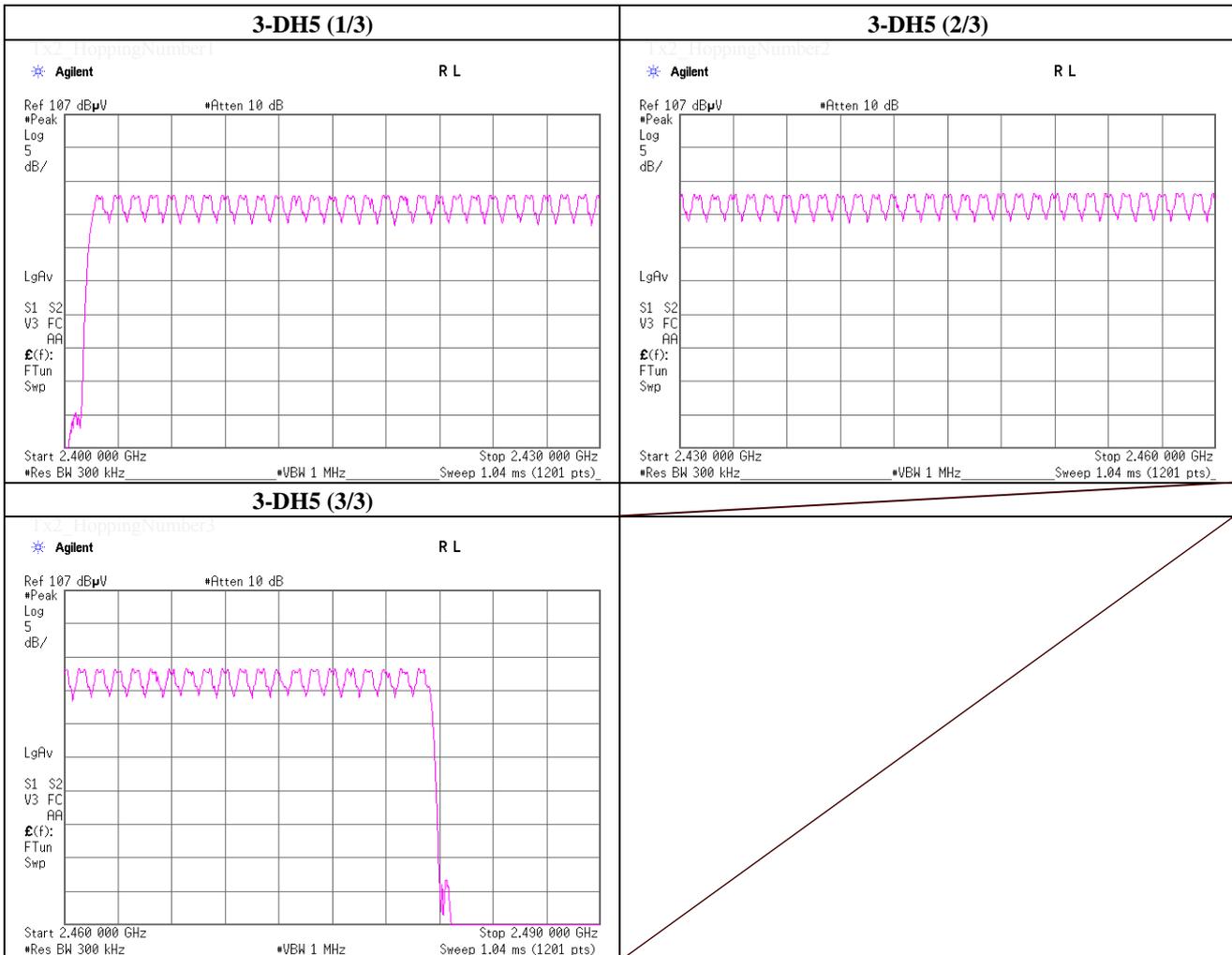
UL Japan, Inc.
Shonan EMC Lab.
 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN
 Telephone : +81 463 50 6400
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Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	April 1, 2013	
Temperature / Humidity	23 deg.C , 32 %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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Dwell Time

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 1, 2013
 Temperature / Humidity 23 deg.C , 32 %RH
 Engineer Shinichi Takano
 Mode Tx, Bluetooth, BDR, PRBS9

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4)	Length of transmission time [msec]	Result [msec]	Limit [msec]
DH1	50.4 / 5.0 sec. x 31.6 sec. = 319 times	0.399	127	400
DH3	24.2 / 5.0 sec. x 31.6 sec. = 153 times	1.655	253	400
DH5	16.6 / 5.0 sec. x 31.6 sec. = 105 times	2.904	305	400

Sample Calculation

Result = Number of transmission x Length of transmission time

*Average data of 5 tests.

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	50	50	50	51	50.4
DH3	21	27	22	28	23	24.2
DH5	19	14	20	14	16	16.6

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 $N=79$.

UL Japan, Inc.

Shonan EMC Lab.

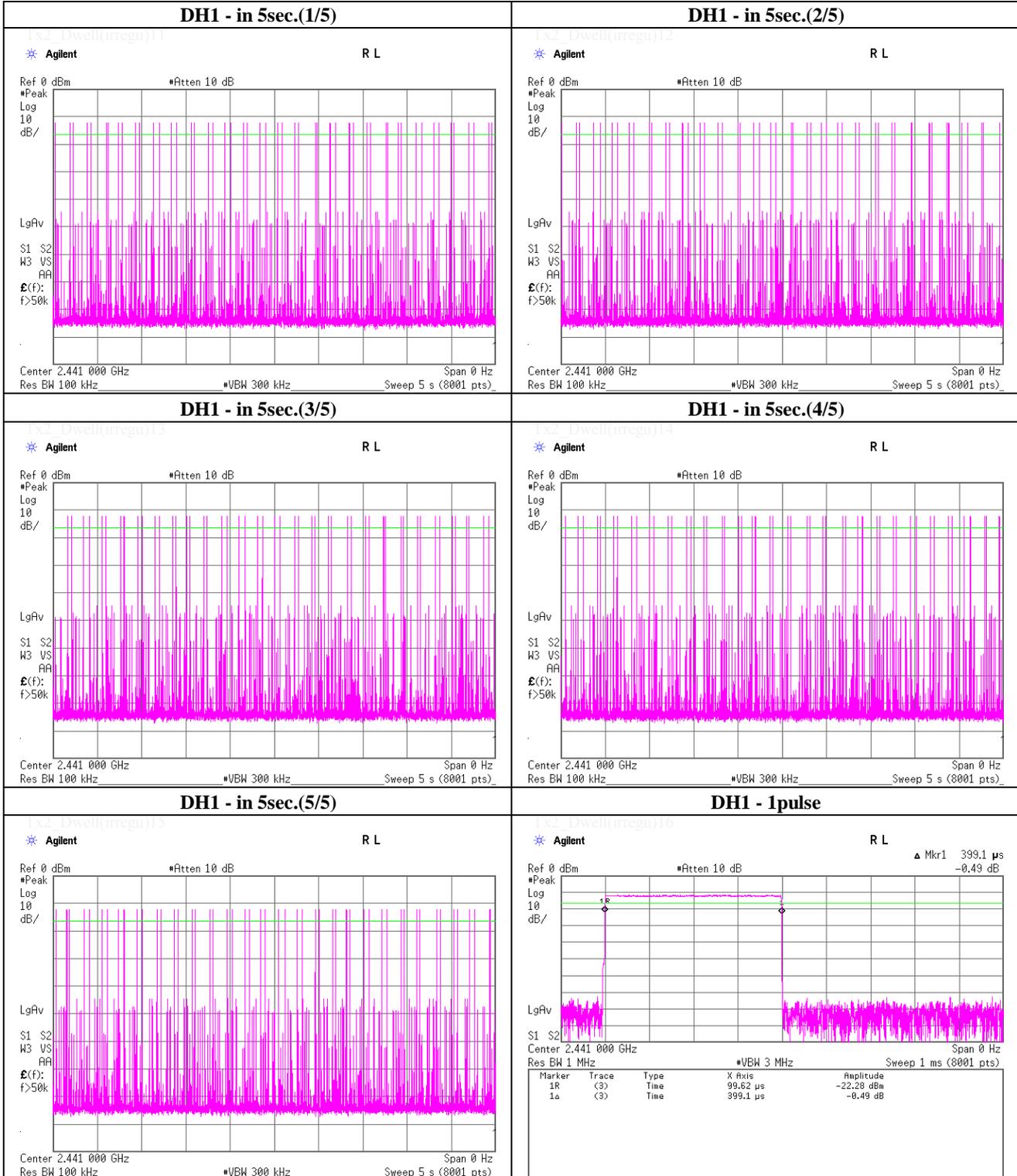
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Dwell time

Tx, Bluetooth, BDR, PRBS9



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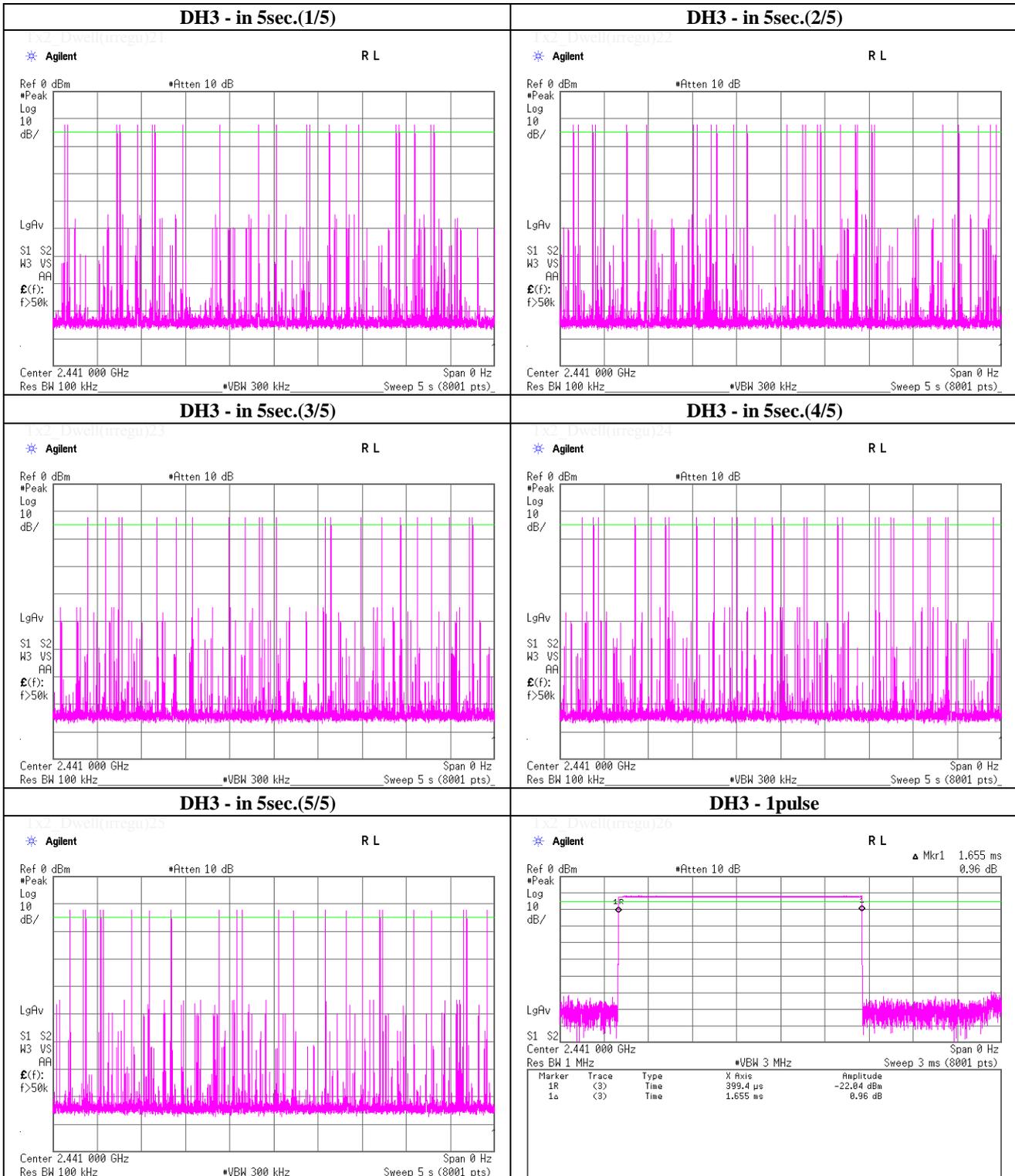
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Dwell time

Tx, Bluetooth, BDR, PRBS9



UL Japan, Inc.

Shonan EMC Lab.

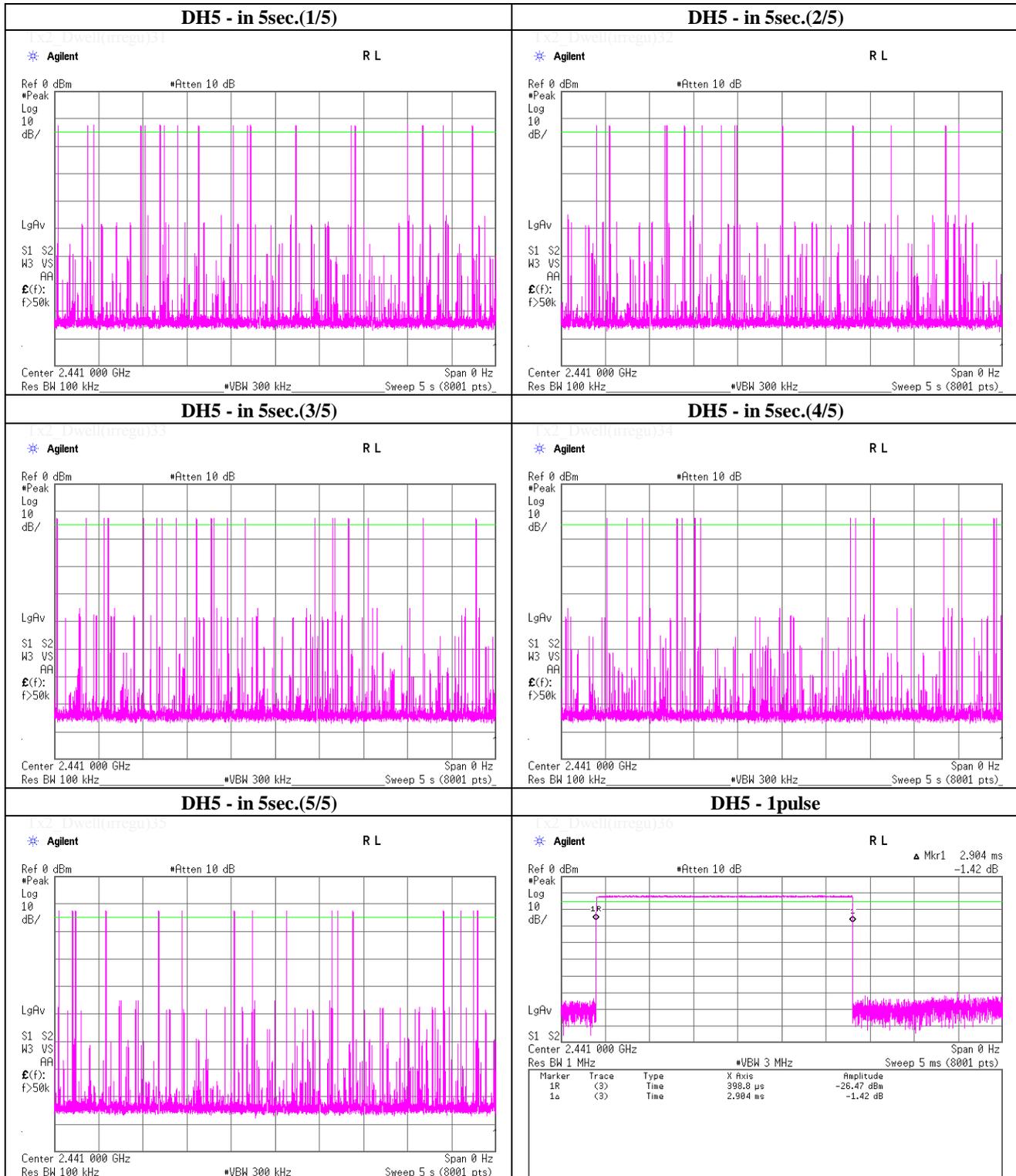
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Telephone : +81 463 50 6400

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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 1, 2013
 Temperature / Humidity 23 deg.C , 32 %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	50.8 / 5.0 sec. x 31.6 sec. = 322 times	0.410	132	400
3-DH3	24.2 / 5.0 sec. x 31.6 sec. = 153 times	1.661	254	400
3-DH5	17.4 / 5.0 sec. x 31.6 sec. = 110 times	2.913	320	400

Sample Calculation

Result = Number of transmission x Length of transmission time

*Average data of 5 tests.

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
3-DH1	51	51	51	51	50	50.8
3-DH3	21	27	22	28	23	24.2
3-DH5	16	17	17	18	19	17.4

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 $N=79$.

UL Japan, Inc.

Shonan EMC Lab.

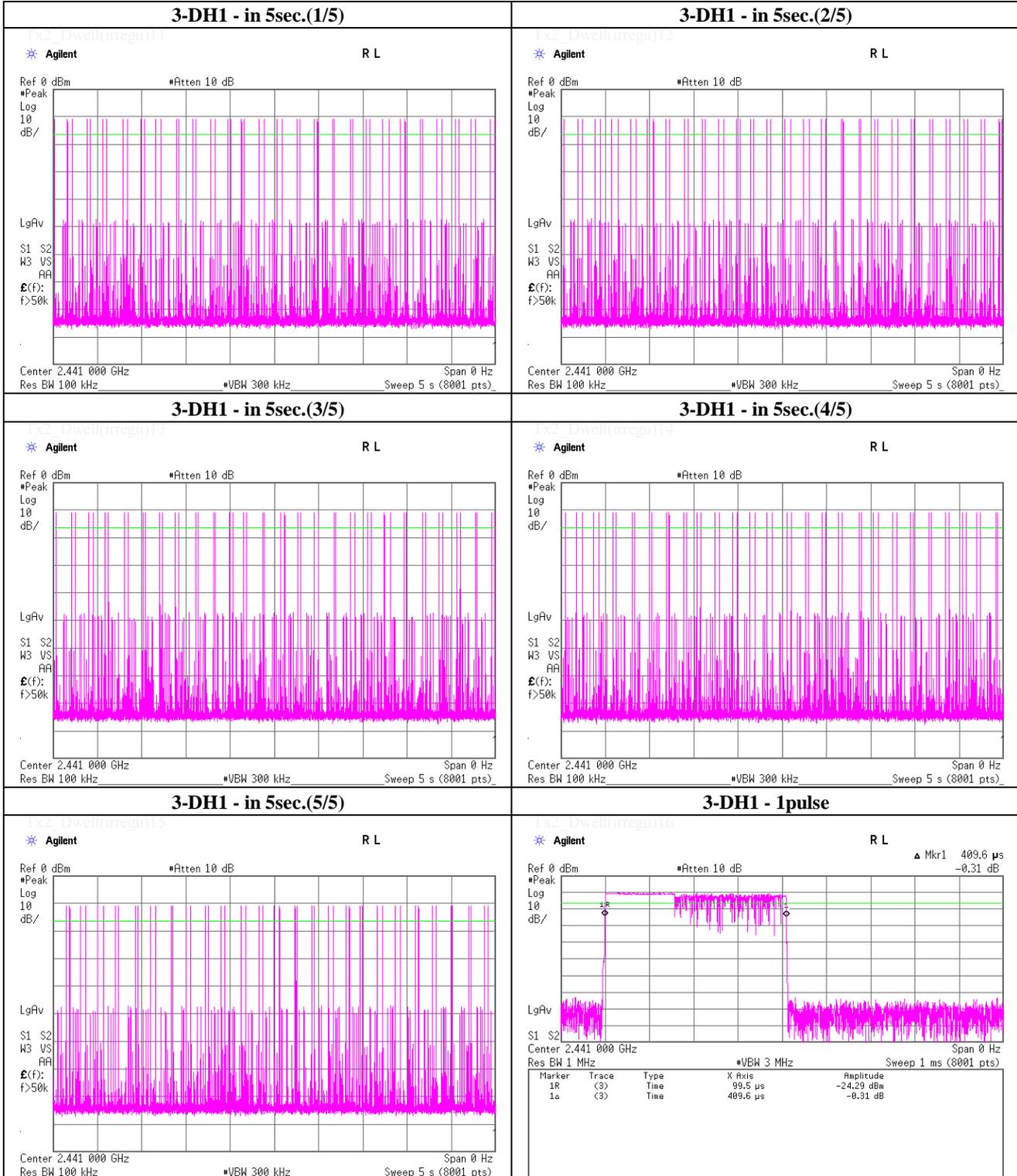
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Dwell time

Tx, Bluetooth, EDR, PRBS9



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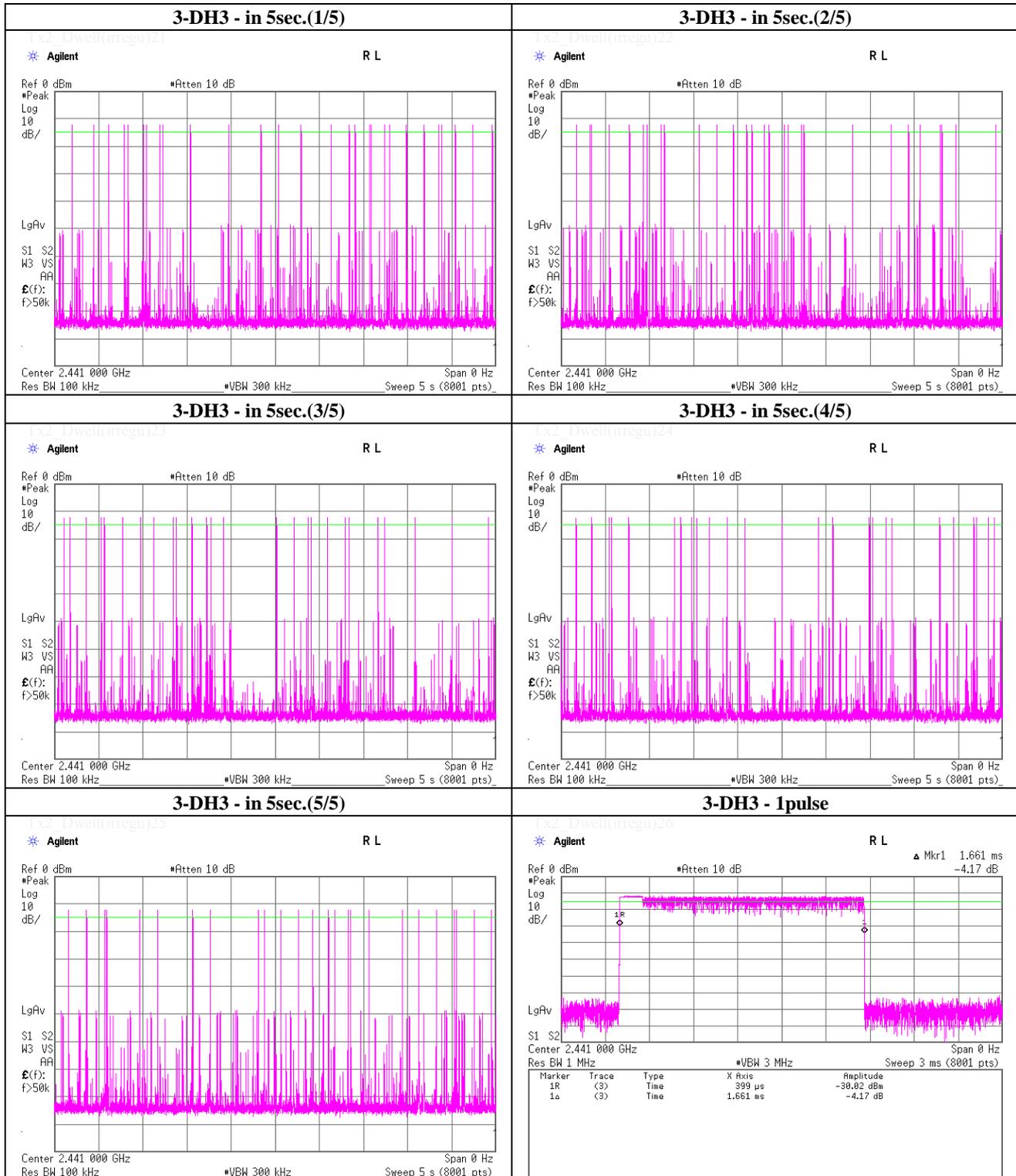
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Dwell time

Tx, Bluetooth, EDR, PRBS9



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Shonan EMC Lab.

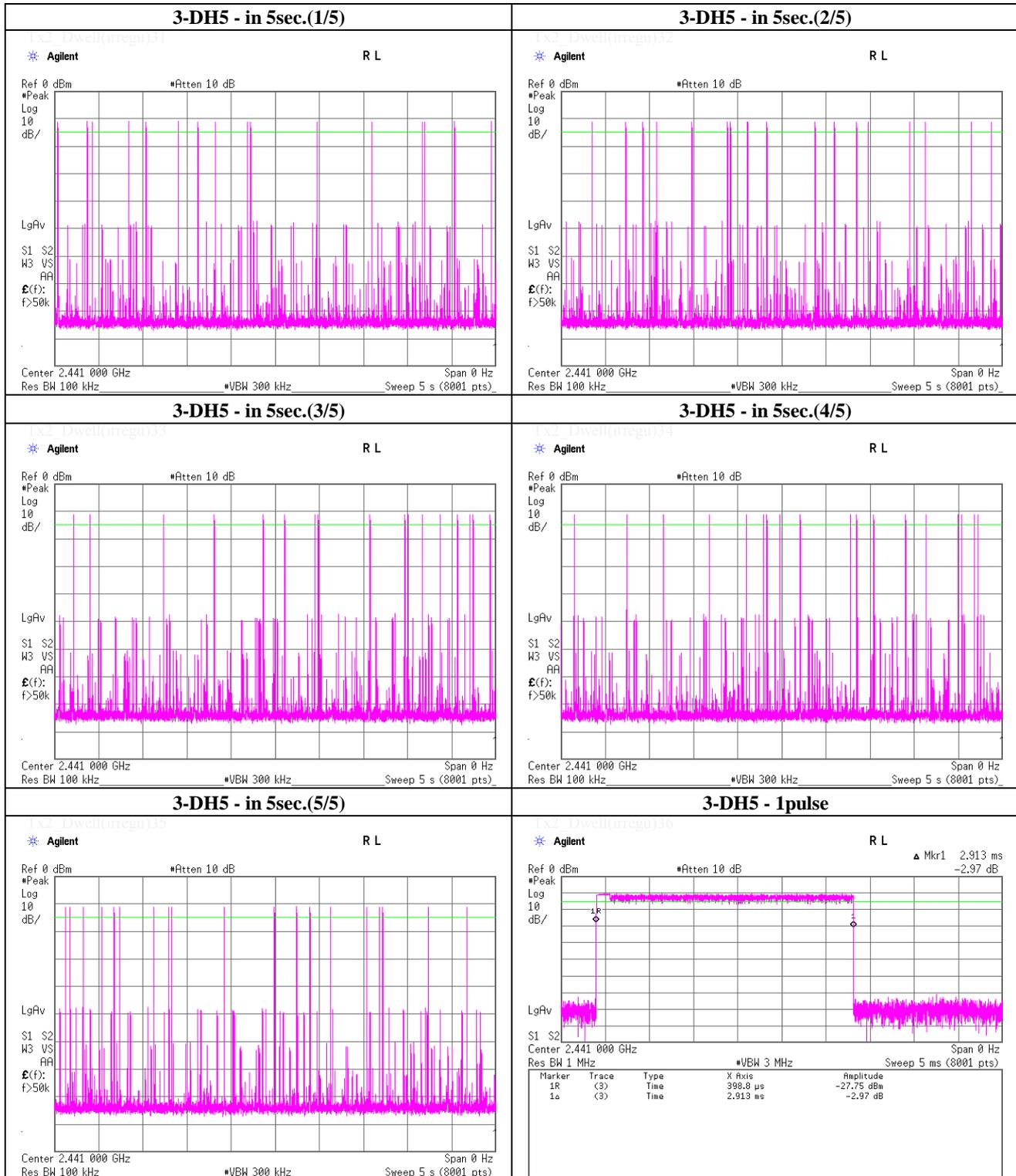
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Dwell time

Tx, Bluetooth, EDR, PRBS9



UL Japan, Inc.

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Maximum Peak Conducted Output Power (Conducted)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date April 1, 2013
 Temperature / Humidity 23 deg.C , 32 %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	-8.39	0.76	9.97	2.34	1.71	20.97	125	18.63
DH5	2441.0	-8.24	0.77	9.97	2.50	1.78	20.97	125	18.47
DH5	2480.0	-8.02	0.78	9.97	2.73	1.87	20.97	125	18.24
2-DH5	2402.0	-10.11	0.76	9.97	0.62	1.15	20.97	125	20.35
2-DH5	2441.0	-9.93	0.77	9.97	0.81	1.21	20.97	125	20.16
2-DH5	2480.0	-9.72	0.78	9.97	1.03	1.27	20.97	125	19.94
3-DH5	2402.0	-9.83	0.76	9.97	0.90	1.23	20.97	125	20.07
3-DH5	2441.0	-9.62	0.77	9.97	1.12	1.29	20.97	125	19.85
3-DH5	2480.0	-9.46	0.78	9.97	1.29	1.35	20.97	125	19.68

Sample Calculation:

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

UL Japan, Inc.
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date April 2, 2013 April 3, 2013
 Temperature / Humidity 22 deg.C , 35 %RH 22 deg.C , 47 %RH
 Engineer Shinichi Takano Wataru Kojima
 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.	62.399	QP	38.5	7.6	6.9	32.2		20.8	40.0	19.2	297	194	
Hori.	207.800	QP	34.4	16.4	8.0	32.0		26.8	43.5	16.7	162	0	
Hori.	240.200	QP	36.7	16.9	8.2	32.0		29.8	46.0	16.2	150	163	
Hori.	287.900	QP	36.6	19.0	8.5	32.0		32.1	46.0	13.9	150	358	
Hori.	295.736	QP	32.2	19.4	8.5	32.0		28.1	46.0	17.9	127	1	
Hori.	615.265	QP	25.1	19.1	9.9	31.9		22.2	46.0	23.8	162	268	
Hori.	2385.900	PK	47.2	27.4	14.2	41.4		47.4	73.9	26.5	100	208	
Hori.	2390.000	PK	46.1	27.4	14.2	41.4		46.3	73.9	27.6	100	208	
Hori.	4804.000	PK	49.3	31.1	6.8	41.2		46.0	73.9	27.9	100	99	
Hori.	7206.000	PK	48.6	36.6	8.3	41.4		52.1	73.9	21.8	113	88	
Hori.	9608.000	PK	42.8	38.5	9.5	38.9		51.9	73.9	22.0	100	0	
Hori.	12010.000	PK	44.2	39.4	10.9	39.4		55.1	73.9	18.8	100	0	
Hori.	2385.900	AV	35.5	27.4	14.2	41.4		35.7	53.9	18.2	100	208	
Hori.	2390.000	AV	33.7	27.4	14.2	41.4		33.9	53.9	20.0	100	208	
Hori.	4804.000	AV	38.0	31.1	6.8	41.2		34.7	53.9	19.2	100	99	
Hori.	7206.000	AV	35.5	36.6	8.3	41.4		39.0	53.9	14.9	113	88	
Hori.	9608.000	AV	31.1	38.5	9.5	38.9		40.2	53.9	13.7	100	0	
Hori.	12010.000	AV	31.4	39.4	10.9	39.4		42.3	53.9	11.6	100	0	
Vert.	159.214	QP	39.5	15.2	7.8	32.1		30.4	43.5	13.1	100	206	
Vert.	178.395	QP	39.7	15.7	7.8	32.1		31.1	43.5	12.4	100	196	
Vert.	207.800	QP	32.6	16.4	8.0	32.0		25.0	43.5	18.5	100	279	
Vert.	240.200	QP	36.4	16.9	8.2	32.0		29.5	46.0	16.5	100	245	
Vert.	287.900	QP	38.6	19.0	8.5	32.0		34.1	46.0	11.9	100	12	
Vert.	2385.900	PK	47.0	27.4	14.2	41.4		47.2	73.9	26.7	100	176	
Vert.	2390.000	PK	46.0	27.4	14.2	41.4		46.2	73.9	27.7	100	176	
Vert.	4804.000	PK	49.0	31.1	6.8	41.2		45.7	73.9	28.2	100	239	
Vert.	7206.000	PK	46.8	36.6	8.3	41.4		50.3	73.9	23.6	100	111	
Vert.	9608.000	PK	44.1	38.5	9.5	38.9		53.2	73.9	20.7	100	0	
Vert.	12010.000	PK	43.1	39.4	10.9	39.4		54.0	73.9	19.9	100	0	
Vert.	2385.900	AV	34.7	27.4	14.2	41.4		34.9	53.9	19.0	100	176	
Vert.	2390.000	AV	33.7	27.4	14.2	41.4		33.9	53.9	20.0	100	176	
Vert.	4804.000	AV	37.8	31.1	6.8	41.2		34.5	53.9	19.4	100	239	
Vert.	7206.000	AV	36.0	36.6	8.3	41.4		39.5	53.9	14.4	100	111	
Vert.	9608.000	AV	31.0	38.5	9.5	38.9		40.1	53.9	13.8	100	0	
Vert.	12010.000	AV	31.5	39.4	10.9	39.4		42.4	53.9	11.5	100	0	

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

*The 10th harmonic was not seen so the result was its base noise level.

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	96.3	27.4	14.2	41.4	96.5	96.5	-	-	Carrier
Hori.	2400.000	PK	54.7	27.4	14.2	41.4	54.9	54.9	76.5	21.6	
Vert.	2402.000	PK	94.5	27.4	14.2	41.4	94.7	94.7	-	-	Carrier
Vert.	2400.000	PK	50.4	27.4	14.2	41.4	50.6	50.6	74.7	24.1	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

UL Japan, Inc.

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Telephone : +81 463 50 6400

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date April 2, 2013 April 3, 2013
Temperature / Humidity 22 deg.C , 35 %RH 22 deg.C , 47 %RH
Engineer Shinichi Takano Wataru Kojima
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.	62.349	QP	38.3	7.6	6.9	32.2		20.6	40.0	19.4	299	177	
Hori.	176.300	QP	34.4	15.7	7.8	32.1		25.8	43.5	17.7	200	155	
Hori.	201.766	QP	40.6	16.3	8.0	32.0		32.9	43.5	10.6	147	152	
Hori.	207.800	QP	36.0	16.4	8.0	32.0		28.4	43.5	15.1	150	172	
Hori.	240.200	QP	37.0	16.9	8.2	32.0		30.1	46.0	15.9	150	155	
Hori.	288.000	QP	42.8	19.0	8.5	32.0		38.3	46.0	7.7	117	0	
Hori.	312.012	QP	46.6	14.2	8.6	31.9		37.5	46.0	8.5	100	359	
Hori.	358.954	QP	41.8	15.3	8.9	31.9		34.1	46.0	11.9	100	340	
Hori.	4882.000	PK	49.4	31.3	6.9	41.1		46.5	73.9	27.4	100	96	
Hori.	7323.000	PK	48.3	36.6	8.4	41.4		51.9	73.9	22.0	100	228	
Hori.	9764.000	PK	44.0	38.7	9.5	38.9		53.3	73.9	20.6	100	0	
Hori.	12205.000	PK	44.3	39.5	10.9	39.3		55.4	73.9	18.5	100	0	
Hori.	4882.000	AV	39.3	31.3	6.9	41.1		36.4	53.9	17.5	100	96	
Hori.	7323.000	AV	35.7	36.6	8.4	41.4		39.3	53.9	14.6	100	228	
Hori.	9764.000	AV	31.5	38.7	9.5	38.9		40.8	53.9	13.1	100	0	
Hori.	12205.000	AV	32.0	39.5	10.9	39.3		43.1	53.9	10.8	100	0	
Vert.	176.300	QP	41.5	15.7	7.8	32.1		32.9	43.5	10.6	100	146	
Vert.	207.800	QP	34.5	16.4	8.0	32.0		26.9	43.5	16.6	100	176	
Vert.	240.200	QP	32.0	16.9	8.2	32.0		25.1	46.0	20.9	100	90	
Vert.	297.927	QP	43.5	19.5	8.5	32.0		39.5	46.0	6.5	100	349	
Vert.	4882.000	PK	49.5	31.3	6.9	41.1		46.6	73.9	27.3	100	241	
Vert.	7323.000	PK	48.5	36.6	8.4	41.4		52.1	73.9	21.8	100	212	
Vert.	9764.000	PK	43.9	38.7	9.5	38.9		53.2	73.9	20.7	100	0	
Vert.	12205.000	PK	44.7	39.5	10.9	39.3		55.8	73.9	18.1	100	0	
Vert.	4882.000	AV	39.8	31.3	6.9	41.1		36.9	53.9	17.0	100	241	
Vert.	7323.000	AV	35.6	36.6	8.4	41.4		39.2	53.9	14.7	100	212	
Vert.	9764.000	AV	31.6	38.7	9.5	38.9		40.9	53.9	13.0	100	0	
Vert.	12205.000	AV	32.0	39.5	10.9	39.3		43.1	53.9	10.8	100	0	

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

*The 10th harmonic was not seen so the result was its base noise level.

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

UL Japan, Inc.

Shonan EMC Lab.

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date April 2, 2013 April 3, 2013
 Temperature / Humidity 22 deg.C , 35 %RH 22 deg.C , 47 %RH
 Engineer Shinichi Takano Wataru Kojima
 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.	62.332	QP	38.9	7.6	6.9	32.2		21.2	40.0	18.8	354	359	
Hori.	176.300	QP	29.2	15.7	7.8	32.1		20.6	43.5	22.9	200	163	
Hori.	207.800	QP	35.1	16.4	8.0	32.0		27.5	43.5	16.0	150	171	
Hori.	240.200	QP	35.0	16.9	8.2	32.0		28.1	46.0	17.9	150	352	
Hori.	304.000	QP	47.6	14.0	8.6	32.0		38.2	46.0	7.8	149	359	
Hori.	319.998	QP	47.4	14.4	8.6	32.0		38.4	46.0	7.6	100	0	
Hori.	2483.500	PK	48.2	27.5	14.3	41.4		48.6	73.9	25.3	100	132	
Hori.	4960.000	PK	48.5	31.6	6.9	41.0		46.0	73.9	27.9	100	234	
Hori.	7440.000	PK	47.1	36.7	8.5	41.5		50.8	73.9	23.1	100	143	
Hori.	9920.000	PK	43.5	39.0	9.7	38.9		53.3	73.9	20.6	100	0	
Hori.	12400.000	PK	44.1	39.5	10.8	39.3		55.1	73.9	18.8	100	0	
Hori.	2483.500	AV	34.7	27.5	14.3	41.4		35.1	53.9	18.8	100	132	
Hori.	4960.000	AV	37.9	31.6	6.9	41.0		35.4	53.9	18.5	100	234	
Hori.	7440.000	AV	35.2	36.7	8.5	41.5		38.9	53.9	15.0	100	143	
Hori.	9920.000	AV	31.2	39.0	9.7	38.9		41.0	53.9	12.9	100	0	
Hori.	12400.000	AV	31.6	39.5	10.8	39.3		42.6	53.9	11.3	100	0	
Vert.	161.807	QP	37.4	15.3	7.7	32.1		28.3	43.5	15.2	100	195	
Vert.	176.300	QP	37.7	15.7	7.8	32.1		29.1	43.5	14.4	100	130	
Vert.	207.800	QP	33.6	16.4	8.0	32.0		26.0	43.5	17.5	100	175	
Vert.	240.200	QP	31.5	16.9	8.2	32.0		24.6	46.0	21.4	100	168	
Vert.	290.805	QP	33.6	19.1	8.5	32.0		29.2	46.0	16.8	100	194	
Vert.	304.000	QP	38.9	14.0	8.6	32.0		29.5	46.0	16.5	100	354	
Vert.	2483.500	PK	48.4	27.5	14.3	41.4		48.8	73.9	25.1	100	153	
Vert.	4960.000	PK	48.3	31.6	6.9	41.0		45.8	73.9	28.1	100	184	
Vert.	7440.000	PK	47.6	36.7	8.5	41.5		51.3	73.9	22.6	115	216	
Vert.	9920.000	PK	44.3	39.0	9.7	38.9		54.1	73.9	19.8	100	0	
Vert.	12400.000	PK	43.9	39.5	10.8	39.3		54.9	73.9	19.0	100	0	
Vert.	2483.500	AV	34.8	27.5	14.3	41.4		35.2	53.9	18.7	100	153	
Vert.	4960.000	AV	37.9	31.6	6.9	41.0		35.4	53.9	18.5	100	184	
Vert.	7440.000	AV	35.5	36.7	8.5	41.5		39.2	53.9	14.7	115	216	
Vert.	9920.000	AV	31.2	39.0	9.7	38.9		41.0	53.9	12.9	100	0	
Vert.	12400.000	AV	31.6	39.5	10.8	39.3		42.6	53.9	11.3	100	0	

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

*The 10th harmonic was not seen so the result was its base noise level.

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

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date April 2, 2013 April 3, 2013
 Temperature / Humidity 22 deg.C , 35 %RH 22 deg.C , 47 %RH
 Engineer Shinichi Takano Wataru Kojima
 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.	62.230	QP	39.9	7.6	6.9	32.2		22.2	40.0	17.8	232	172	
Hori.	207.800	QP	37.6	16.4	8.0	32.1		29.9	43.5	13.6	150	198	
Hori.	240.200	QP	37.0	16.9	8.2	32.0		30.1	46.0	15.9	150	358	
Hori.	287.900	QP	35.0	19.0	8.5	32.0		30.5	46.0	15.5	150	2	
Hori.	303.996	QP	48.1	14.0	8.6	32.0		38.7	46.0	7.3	144	0	
Hori.	319.997	QP	46.5	14.4	8.6	32.0		37.5	46.0	8.5	100	355	
Hori.	2390.000	PK	45.9	27.4	14.2	41.4		46.1	73.9	27.8	100	203	
Hori.	4804.000	PK	47.8	31.1	6.8	41.2		44.5	73.9	29.4	100	187	
Hori.	7206.000	PK	46.8	36.6	8.3	41.4		50.3	73.9	23.6	100	0	
Hori.	9608.000	PK	43.2	38.5	9.5	38.9		52.3	73.9	21.6	100	0	
Hori.	12010.000	PK	43.6	39.4	10.9	39.4		54.5	73.9	19.4	100	0	
Hori.	2390.000	AV	33.6	27.4	14.2	41.4		33.8	53.9	20.1	100	203	
Hori.	4804.000	AV	37.3	31.1	6.8	41.2		34.0	53.9	19.9	100	187	
Hori.	7206.000	AV	34.6	36.6	8.3	41.4		38.1	53.9	15.8	100	0	
Hori.	9608.000	AV	31.6	38.5	9.5	38.9		40.7	53.9	13.2	100	0	
Hori.	12010.000	AV	31.3	39.4	10.9	39.4		42.2	53.9	11.7	100	0	
Vert.	138.678	QP	32.4	14.4	7.5	32.1		22.2	43.5	21.3	100	124	
Vert.	161.718	QP	37.9	15.3	7.7	32.1		28.8	43.5	14.7	100	185	
Vert.	177.078	QP	34.8	15.7	7.8	32.1		26.2	43.5	17.3	100	151	
Vert.	207.800	QP	32.1	16.4	8.0	32.1		24.4	43.5	19.1	100	170	
Vert.	240.200	QP	33.8	16.9	8.2	32.0		26.9	46.0	19.1	100	210	
Vert.	287.900	QP	33.9	19.0	8.5	32.0		29.4	46.0	16.6	100	343	
Vert.	296.758	QP	34.5	19.4	8.5	32.0		30.4	46.0	15.6	100	359	
Vert.	2390.000	PK	45.6	27.4	14.2	41.4		45.8	73.9	28.1	100	227	
Vert.	4804.000	PK	48.2	31.1	6.8	41.2		44.9	73.9	29.0	100	228	
Vert.	7206.000	PK	47.1	36.6	8.3	41.4		50.6	73.9	23.3	100	0	
Vert.	9608.000	PK	44.3	38.5	9.5	38.9		53.4	73.9	20.5	100	0	
Vert.	12010.000	PK	43.3	39.4	10.9	39.4		54.2	73.9	19.7	100	0	
Vert.	2390.000	AV	33.5	27.4	14.2	41.4		33.7	53.9	20.2	100	227	
Vert.	4804.000	AV	37.3	31.1	6.8	41.2		34.0	53.9	19.9	100	228	
Vert.	7206.000	AV	34.6	36.6	8.3	41.4		38.1	53.9	15.8	100	0	
Vert.	9608.000	AV	31.6	38.5	9.5	38.9		40.7	53.9	13.2	100	0	
Vert.	12010.000	AV	31.3	39.4	10.9	39.4		42.2	53.9	11.7	100	0	

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

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

*The 10th harmonic was not seen so the result was its base noise level.

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]		Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	93.2	27.4	14.2	41.4		93.4	-	-	Carrier
Hori.	2400.000	PK	43.3	27.4	14.2	41.4		43.5	73.4	29.9	
Vert.	2402.000	PK	91.9	27.4	14.2	41.4		92.1	-	-	Carrier
Vert.	2400.000	PK	44.0	27.4	14.2	41.4		44.2	72.1	27.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 13GHz)) - Gain(Amprifier)

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date April 2, 2013 April 3, 2013
 Temperature / Humidity 22 deg.C , 35 %RH 22 deg.C , 47 %RH
 Engineer Shinichi Takano Wataru Kojima
 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.	62.144	QP	35.2	7.6	6.9	32.2		17.5	40.0	22.5	243	161	
Hori.	176.300	QP	31.0	15.7	7.8	32.1		22.4	43.5	21.1	150	160	
Hori.	207.800	QP	33.0	16.4	8.0	32.0		25.4	43.5	18.1	150	200	
Hori.	240.200	QP	35.2	16.9	8.2	32.0		28.3	46.0	17.7	150	196	
Hori.	304.000	QP	41.0	14.0	8.6	32.0		31.6	46.0	14.4	150	15	
Hori.	311.180	QP	41.0	14.2	8.6	32.0		31.8	46.0	14.2	100	359	
Hori.	503.760	QP	29.1	17.5	9.4	32.0		24.0	46.0	22.0	134	175	
Hori.	4882.000	PK	49.1	31.3	6.9	41.1		46.2	73.9	27.7	100	194	
Hori.	7323.000	PK	47.5	36.6	8.4	41.4		51.1	73.9	22.8	100	0	
Hori.	9764.000	PK	43.8	38.7	9.5	38.9		53.1	73.9	20.8	100	0	
Hori.	12205.000	PK	44.0	39.5	10.9	39.3		55.1	73.9	18.8	100	0	
Hori.	4882.000	AV	39.4	31.3	6.9	41.1		36.5	53.9	17.4	100	194	
Hori.	7323.000	AV	34.3	36.6	8.4	41.4		37.9	53.9	16.0	100	0	
Hori.	9764.000	AV	31.5	38.7	9.5	38.9		40.8	53.9	13.1	100	0	
Hori.	12205.000	AV	32.0	39.5	10.9	39.3		43.1	53.9	10.8	100	0	
Vert.	138.373	QP	35.2	14.4	7.5	32.1		25.0	43.5	18.5	100	147	
Vert.	162.484	QP	37.8	15.3	7.7	32.1		28.7	43.5	14.8	100	183	
Vert.	176.300	QP	37.8	15.7	7.8	32.1		29.2	43.5	14.3	100	152	
Vert.	207.800	QP	31.9	16.4	8.0	32.0		24.3	43.5	19.2	100	215	
Vert.	240.200	QP	30.8	16.9	8.2	32.0		23.9	46.0	22.1	100	359	
Vert.	298.358	QP	32.8	19.5	8.5	32.0		28.8	46.0	17.2	100	42	
Vert.	304.000	QP	36.7	14.0	8.6	32.0		27.3	46.0	18.7	100	1	
Vert.	4882.000	PK	47.5	31.3	6.9	41.1		44.6	73.9	29.3	100	176	
Vert.	7323.000	PK	46.2	36.6	8.4	41.4		49.8	73.9	24.1	100	0	
Vert.	9764.000	PK	43.7	38.7	9.5	38.9		53.0	73.9	20.9	100	0	
Vert.	12205.000	PK	45.1	39.5	10.9	39.3		56.2	73.9	17.7	100	0	
Vert.	4882.000	AV	36.0	31.3	6.9	41.1		33.1	53.9	20.8	100	176	
Vert.	7323.000	AV	34.3	36.6	8.4	41.4		37.9	53.9	16.0	100	0	
Vert.	9764.000	AV	31.6	38.7	9.5	38.9		40.9	53.9	13.0	100	0	
Vert.	12205.000	AV	32.0	39.5	10.9	39.3		43.1	53.9	10.8	100	0	

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

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

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

*The 10th harmonic was not seen so the result was its base noise level.

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

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date April 2, 2013 April 3, 2013
 Temperature / Humidity 22 deg.C , 35 %RH 22 deg.C , 47 %RH
 Engineer Shinichi Takano Wataru Kojima
 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.	207.800	QP	32.1	16.4	8.0	32.0		24.5	43.5	19.0	200	328	
Hori.	240.200	QP	38.1	16.9	8.2	32.0		31.2	46.0	14.8	100	177	
Hori.	304.000	QP	45.6	14.0	8.6	32.0		36.2	46.0	9.8	149	0	
Hori.	319.995	QP	43.8	14.4	8.6	31.9		34.9	46.0	11.1	100	359	
Hori.	559.460	QP	25.3	18.3	9.7	32.0		21.3	46.0	24.7	150	120	
Hori.	2483.500	PK	46.8	27.5	14.3	41.4		47.2	73.9	26.7	100	126	
Hori.	4960.000	PK	46.7	31.6	6.9	41.0		44.2	73.9	29.7	100	218	
Hori.	7440.000	PK	43.4	36.7	8.5	41.5		47.1	73.9	26.8	100	0	
Hori.	9920.000	PK	44.0	39.0	9.7	38.9		53.8	73.9	20.1	100	0	
Hori.	12400.000	PK	43.9	39.5	10.8	39.3		54.9	73.9	19.0	100	0	
Hori.	2483.500	AV	34.1	27.5	14.3	41.4		34.5	53.9	19.4	100	126	
Hori.	4960.000	AV	35.1	31.6	6.9	41.0		32.6	53.9	21.3	100	218	
Hori.	7440.000	AV	34.7	36.7	8.5	41.5		38.4	53.9	15.5	100	0	
Hori.	9920.000	AV	32.0	39.0	9.7	38.9		41.8	53.9	12.1	100	0	
Hori.	12400.000	AV	31.5	39.5	10.8	39.3		42.5	53.9	11.4	100	0	
Vert.	177.570	QP	39.1	15.7	7.8	32.1		30.5	43.5	13.0	100	135	
Vert.	207.800	QP	30.6	16.4	8.0	32.0		23.0	43.5	20.5	100	195	
Vert.	240.200	QP	33.0	16.9	8.2	32.0		26.1	46.0	19.9	100	175	
Vert.	304.000	QP	37.5	14.0	8.6	32.0		28.1	46.0	17.9	100	21	
Vert.	2483.500	PK	47.7	27.5	14.3	41.4		48.1	73.9	25.8	100	194	
Vert.	4960.000	PK	47.5	31.6	6.9	41.0		45.0	73.9	28.9	100	211	
Vert.	7440.000	PK	46.8	36.7	8.5	41.5		50.5	73.9	23.4	100	0	
Vert.	9920.000	PK	43.1	39.0	9.7	38.9		52.9	73.9	21.0	100	0	
Vert.	12400.000	PK	43.8	39.5	10.8	39.3		54.8	73.9	19.1	100	0	
Vert.	2483.500	AV	34.5	27.5	14.3	41.4		34.9	53.9	19.0	100	194	
Vert.	4960.000	AV	37.6	31.6	6.9	41.0		35.1	53.9	18.8	100	211	
Vert.	7440.000	AV	34.7	36.7	8.5	41.5		38.4	53.9	15.5	100	0	
Vert.	9920.000	AV	32.0	39.0	9.7	38.9		41.8	53.9	12.1	100	0	
Vert.	12400.000	AV	31.5	39.5	10.8	39.3		42.5	53.9	11.4	100	0	

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

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

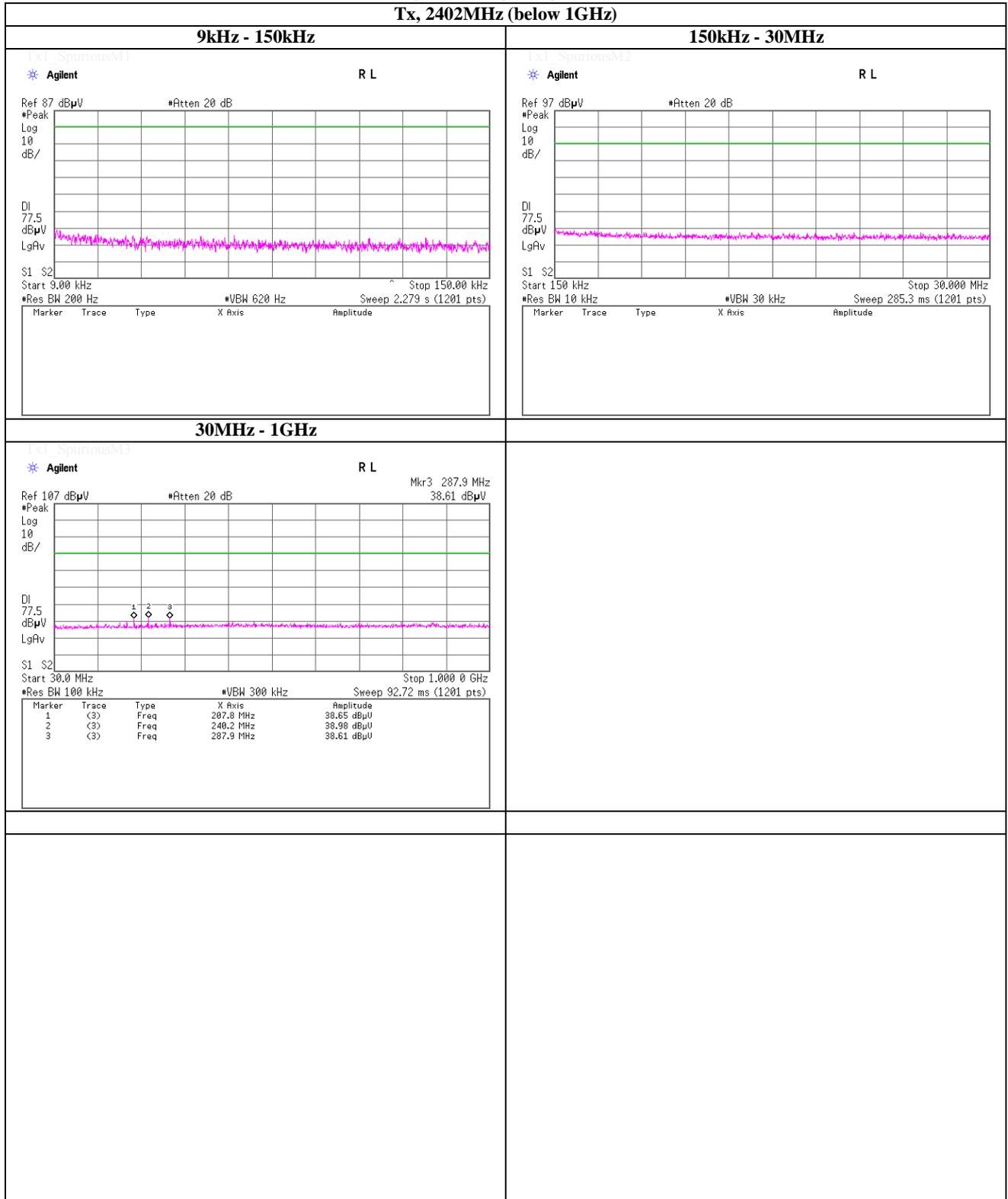
*The 10th harmonic was not seen so the result was its base noise level.

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

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2402MHz (below 1GHz)



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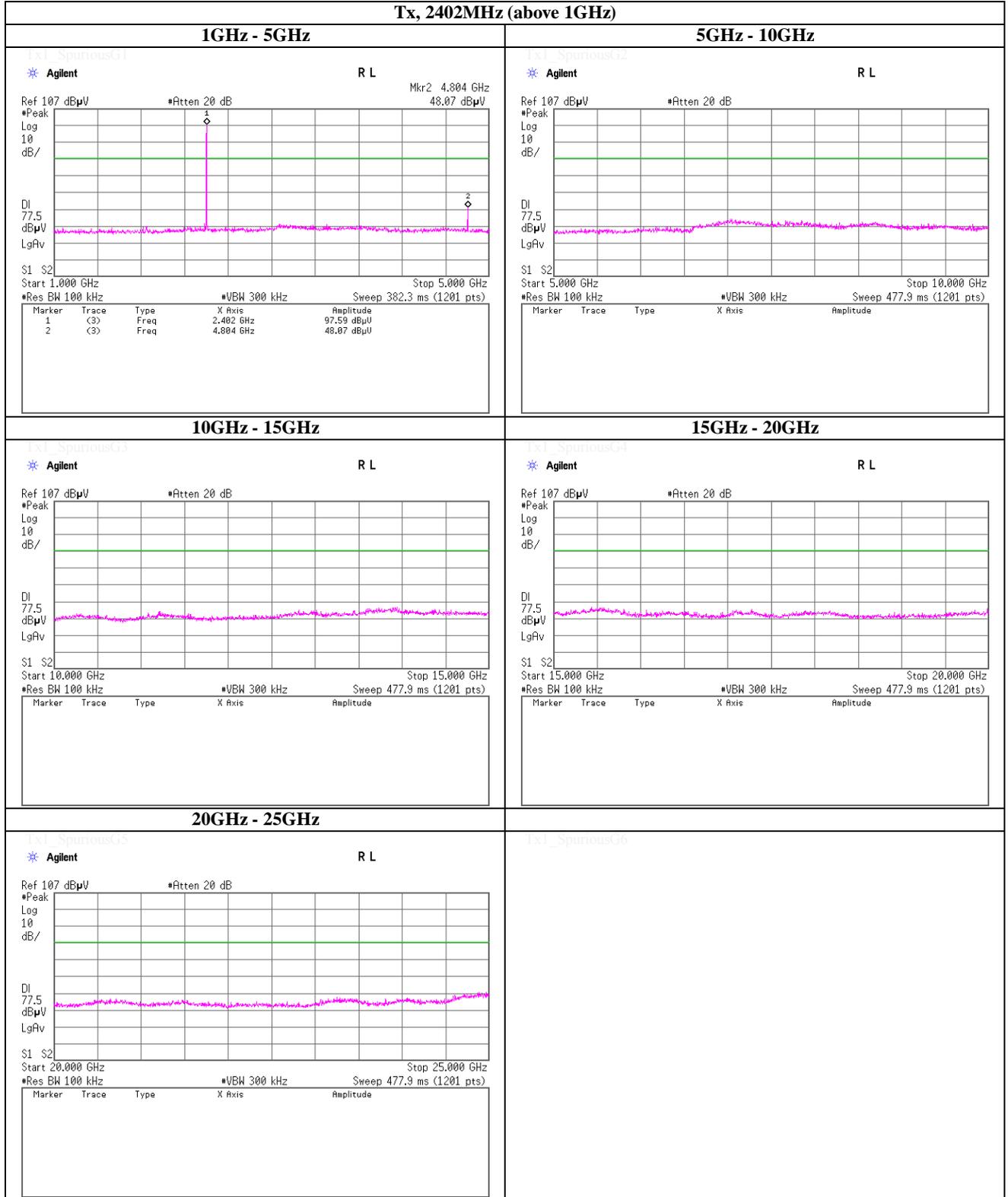
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2402MHz (above 1GHz)



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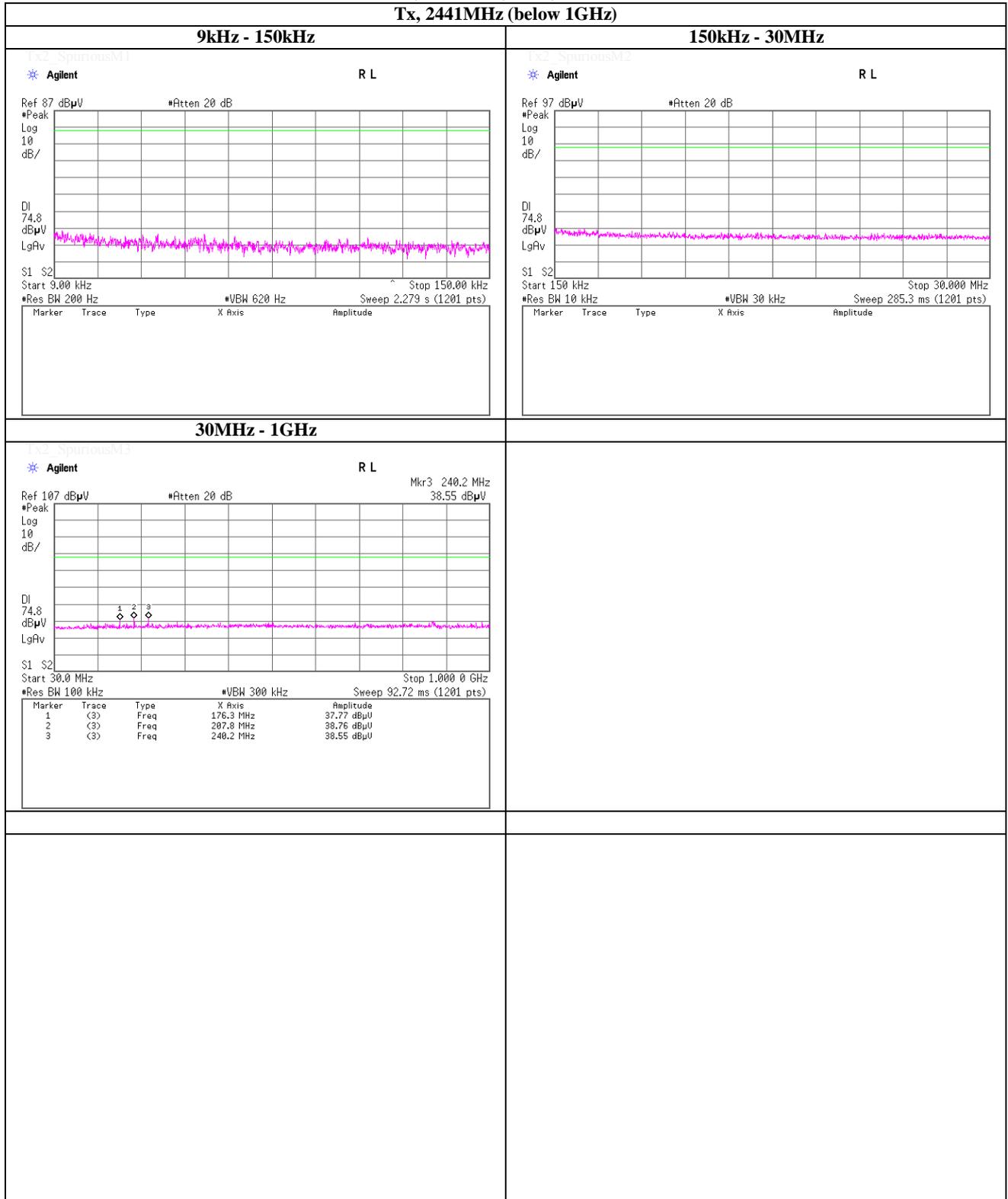
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2441MHz (below 1GHz)



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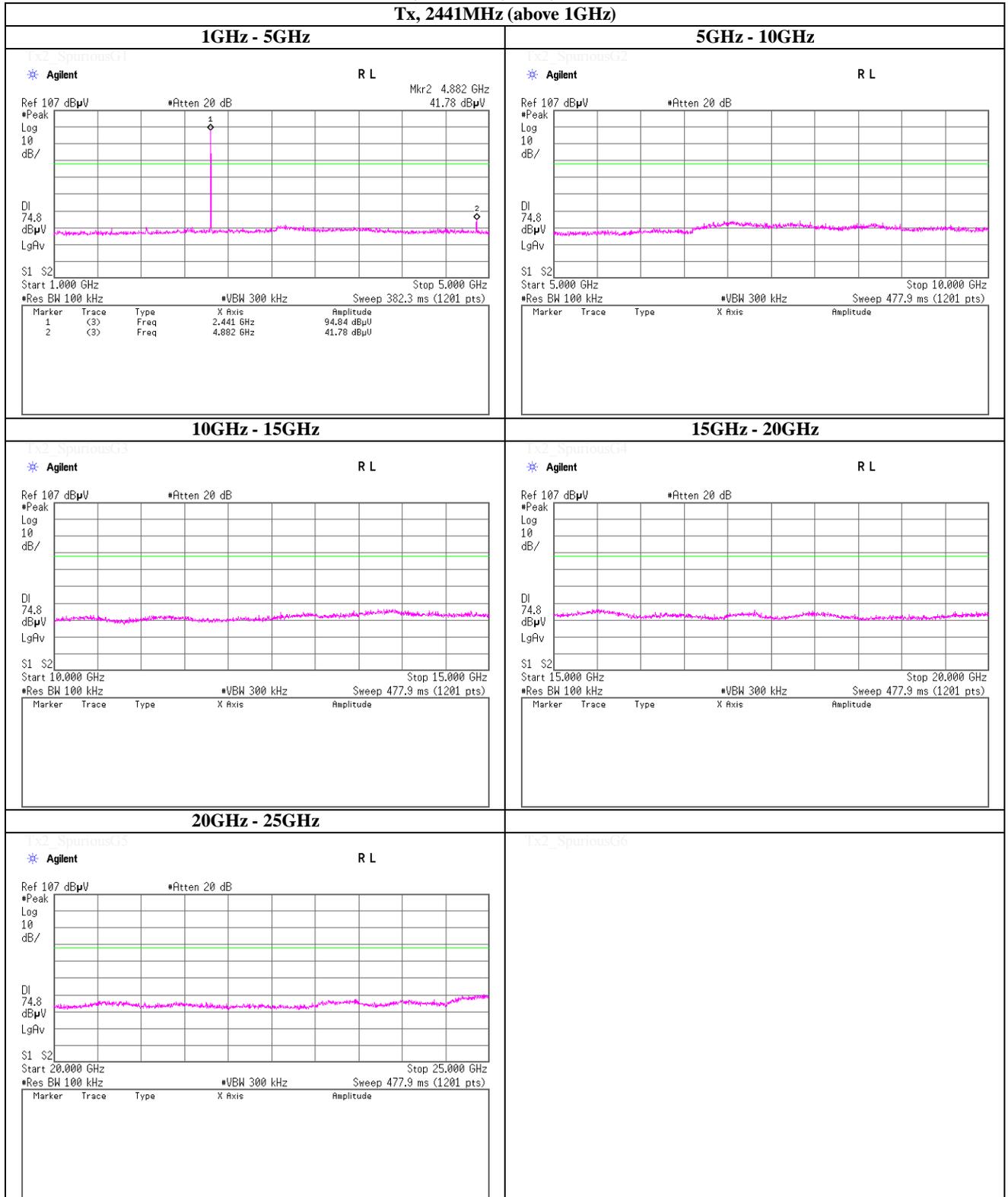
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2441MHz (above 1GHz)



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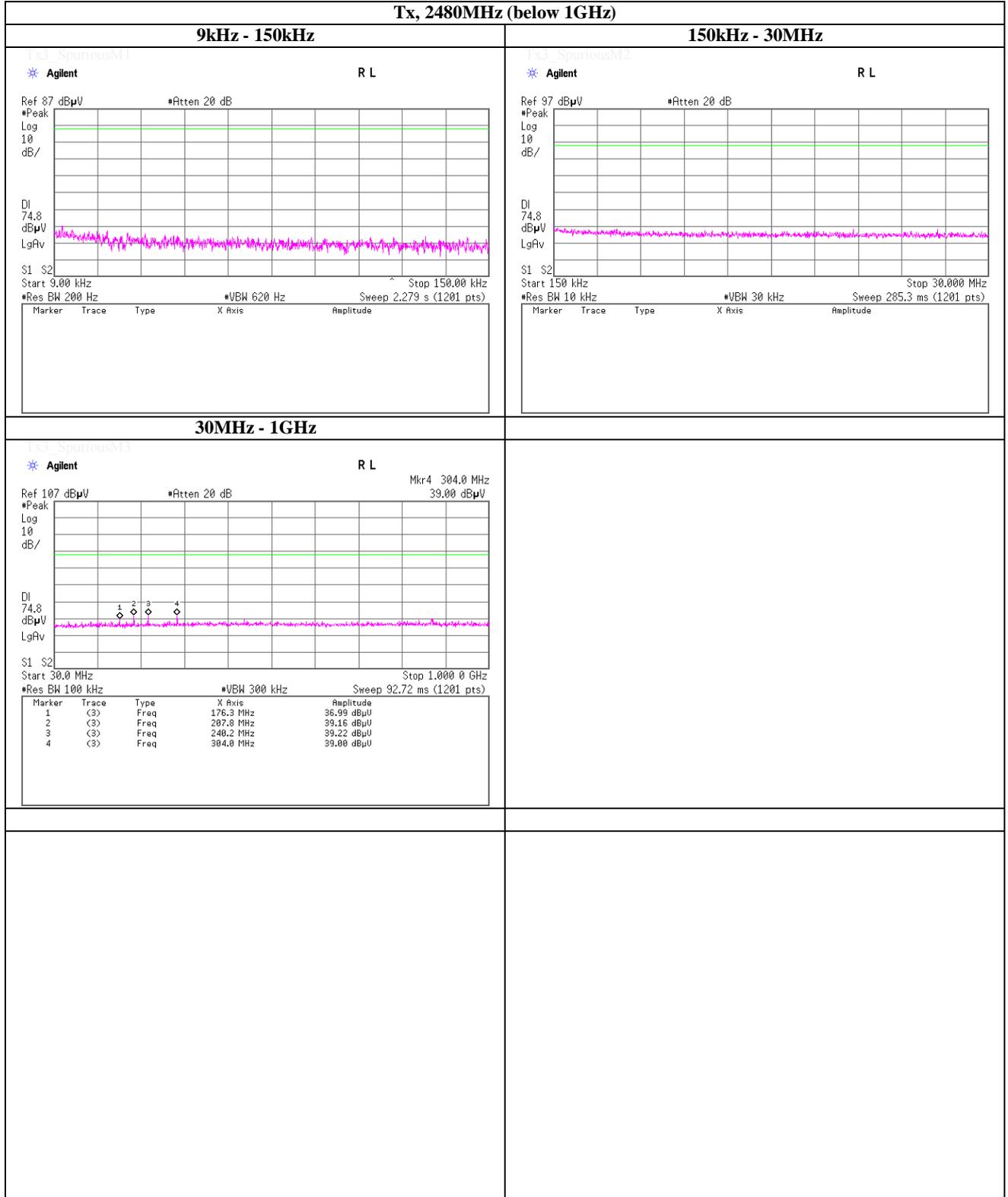
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2480MHz (below 1GHz)



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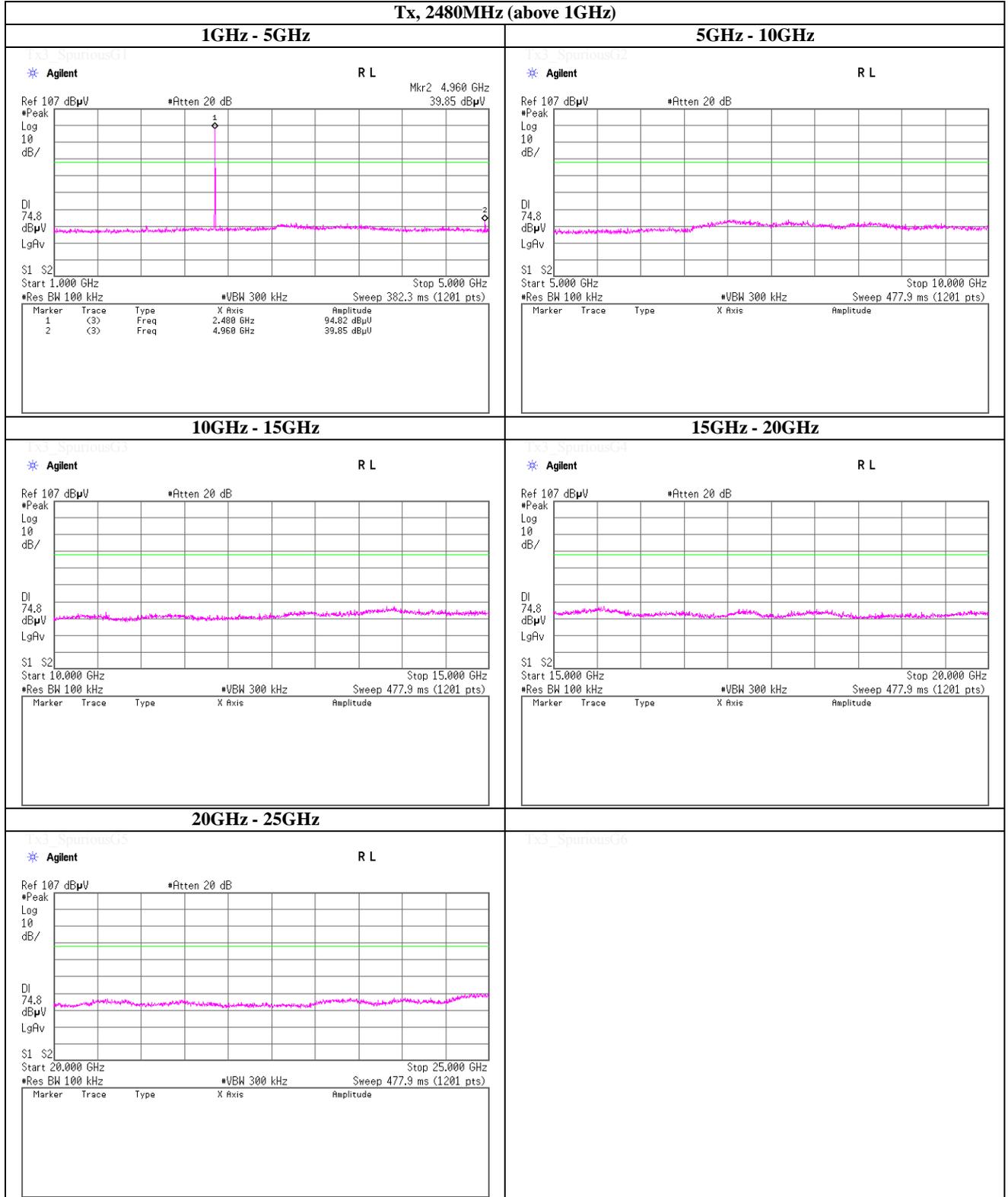
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2480MHz (above 1GHz)



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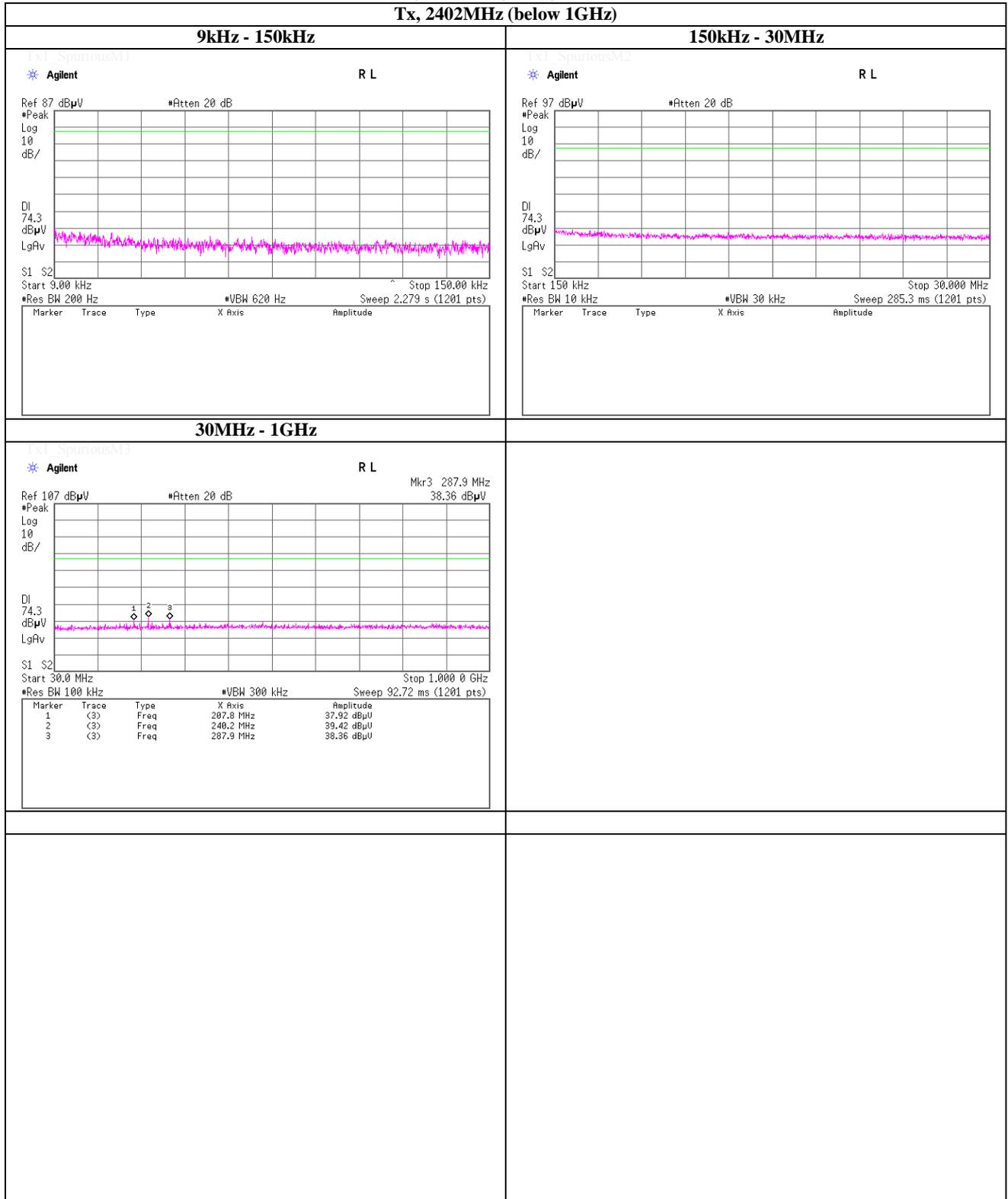
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2402MHz (below 1GHz)



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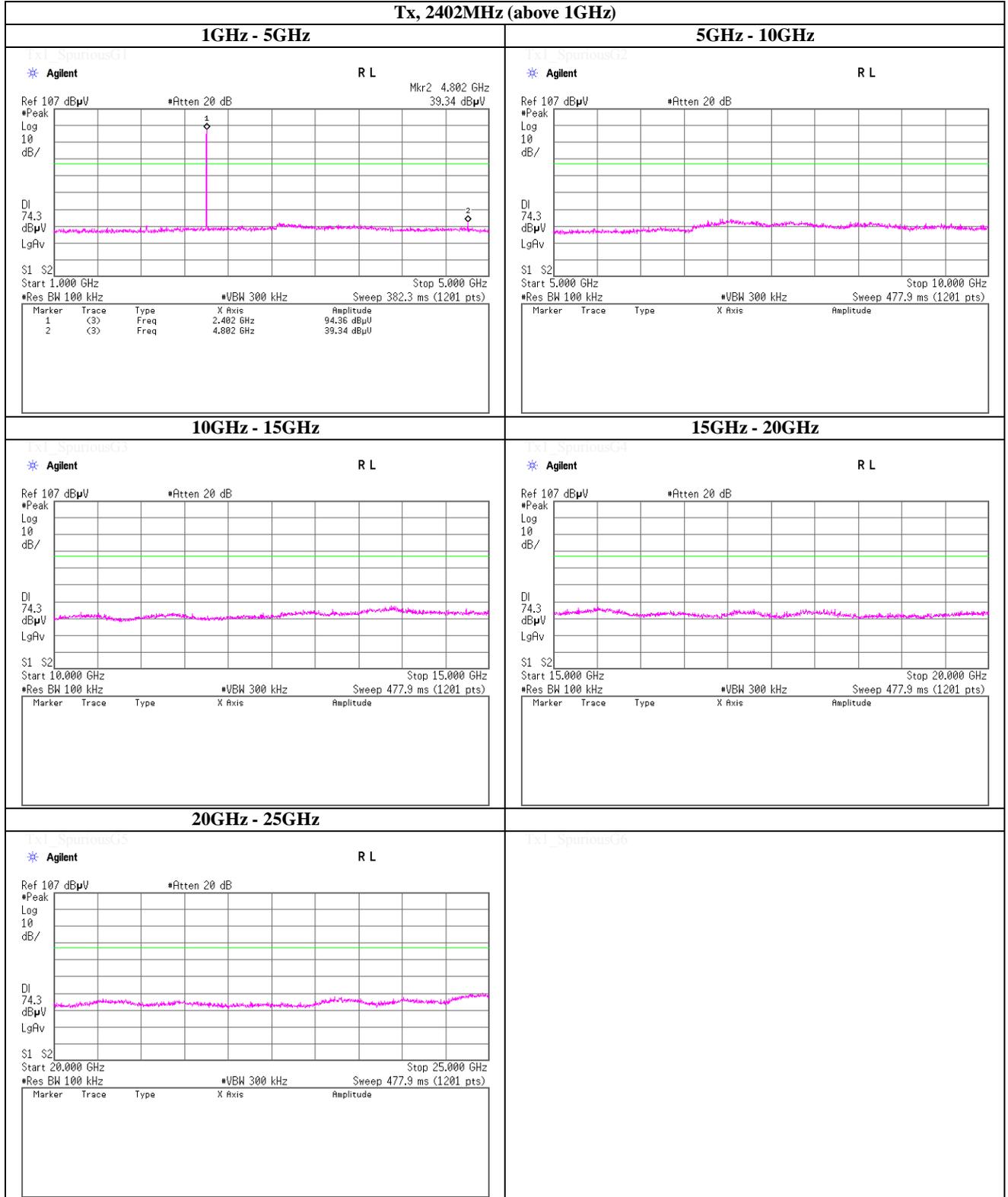
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2402MHz (above 1GHz)



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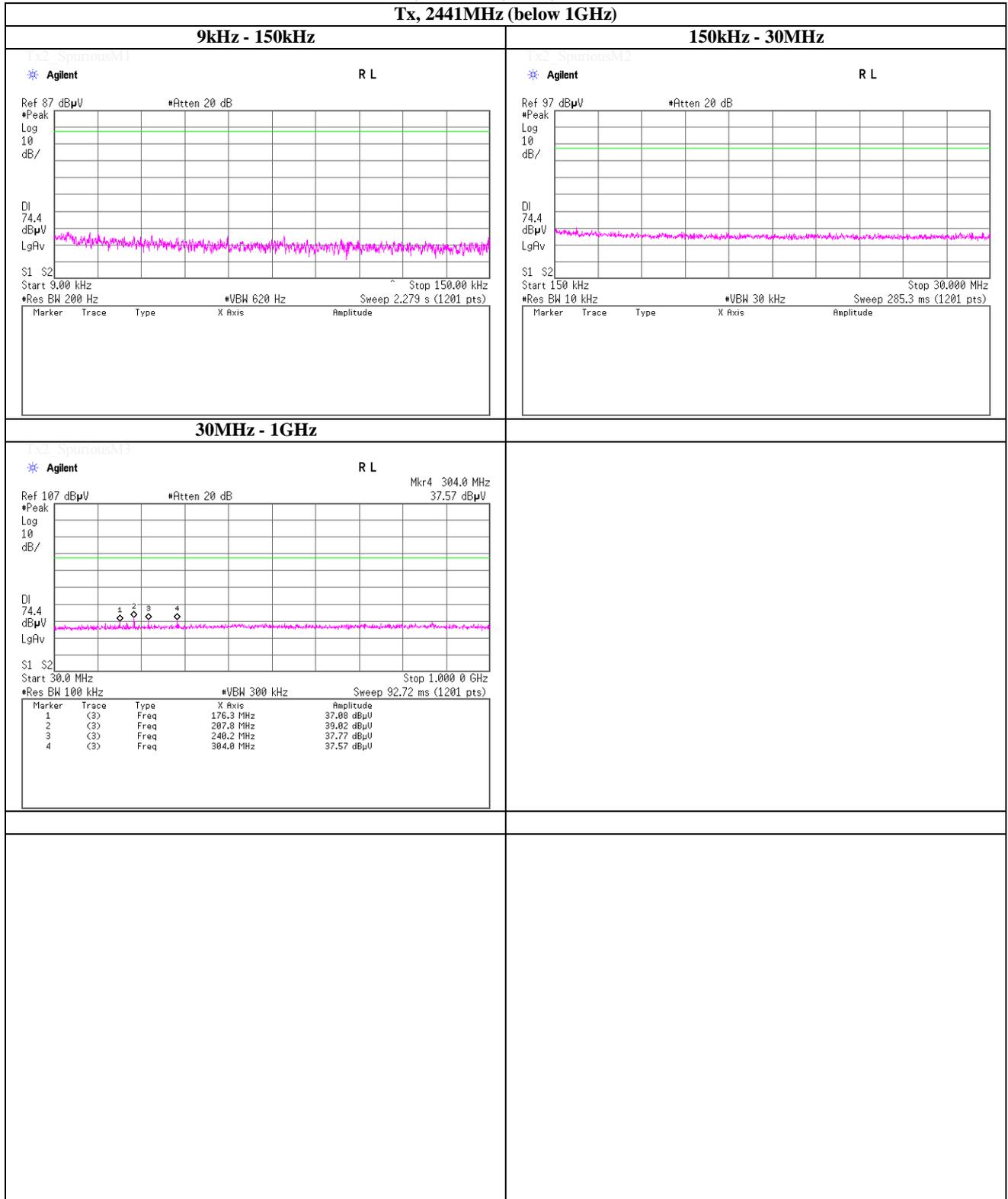
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2441MHz (below 1GHz)



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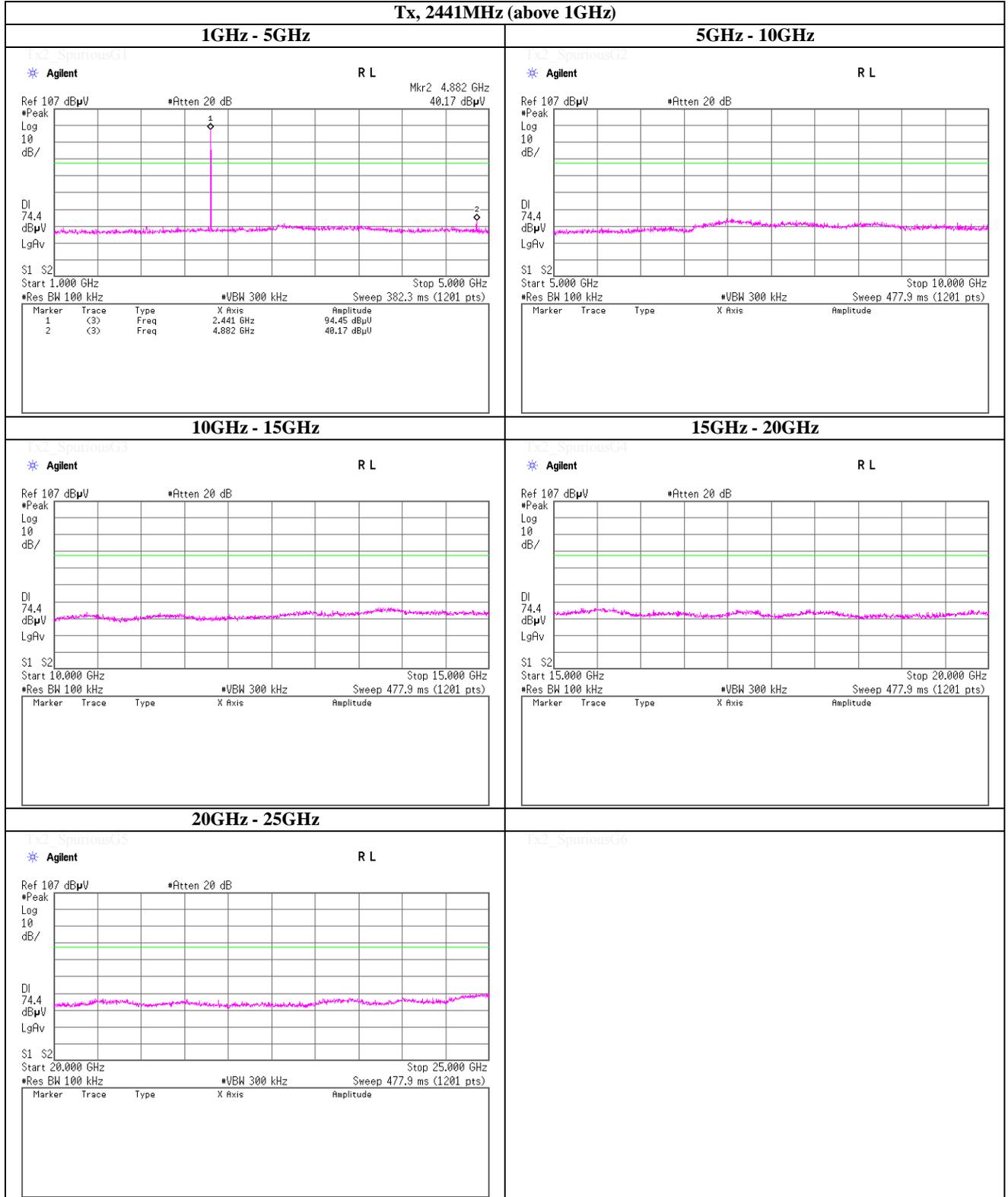
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2441MHz (above 1GHz)



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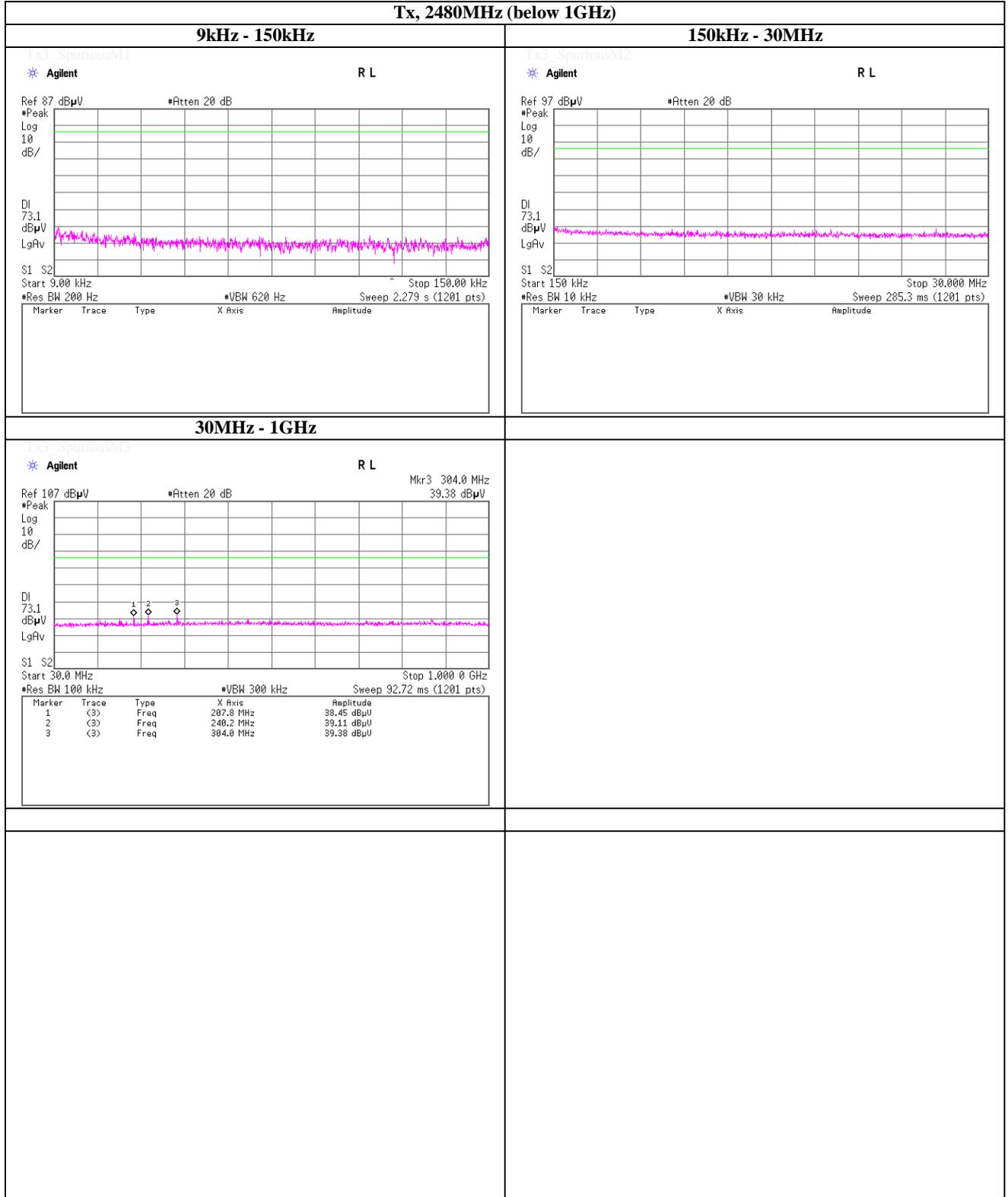
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2480MHz (below 1GHz)



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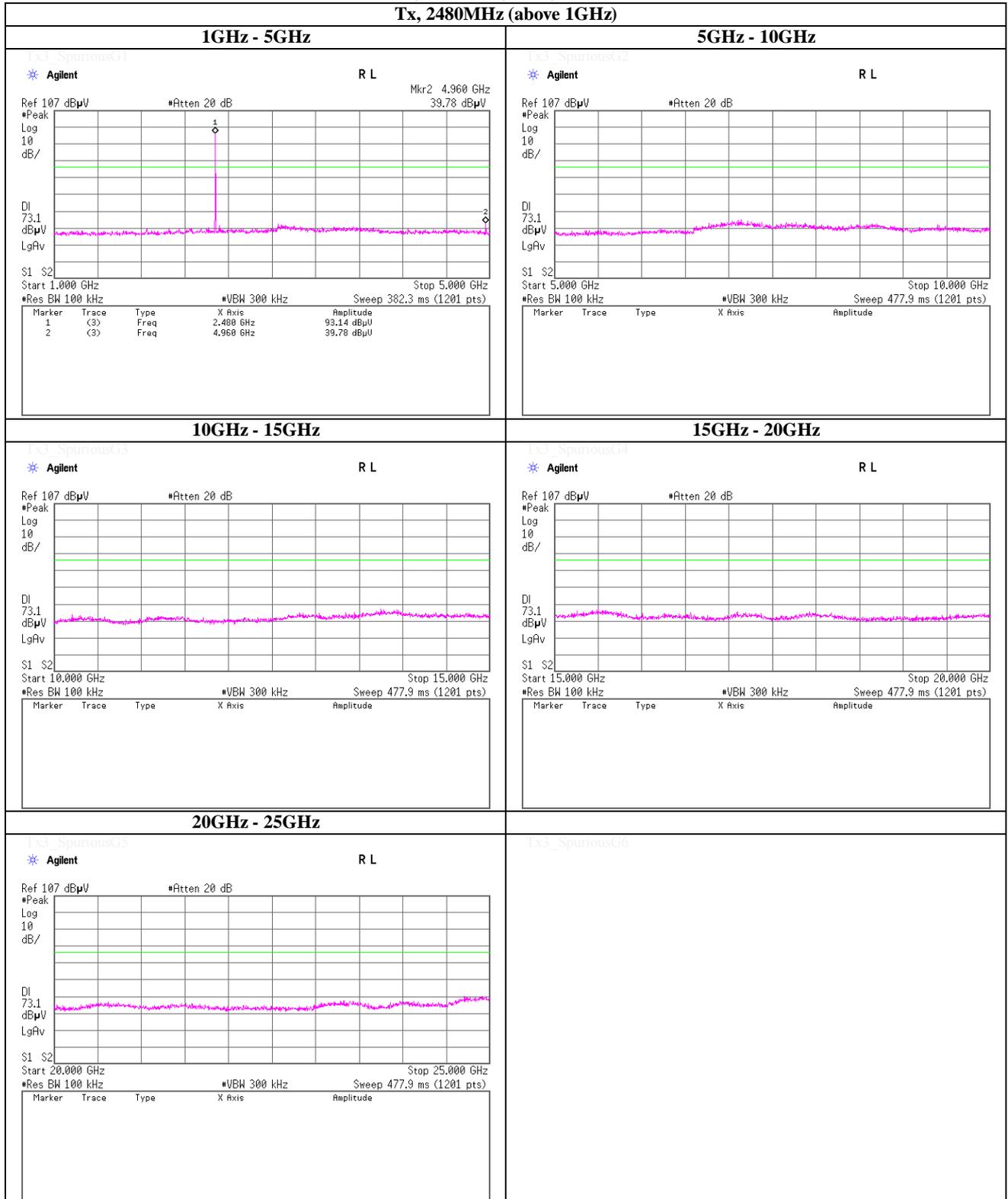
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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, EDR, PRBS9

Tx, 2480MHz (above 1GHz)



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Shonan EMC Lab.

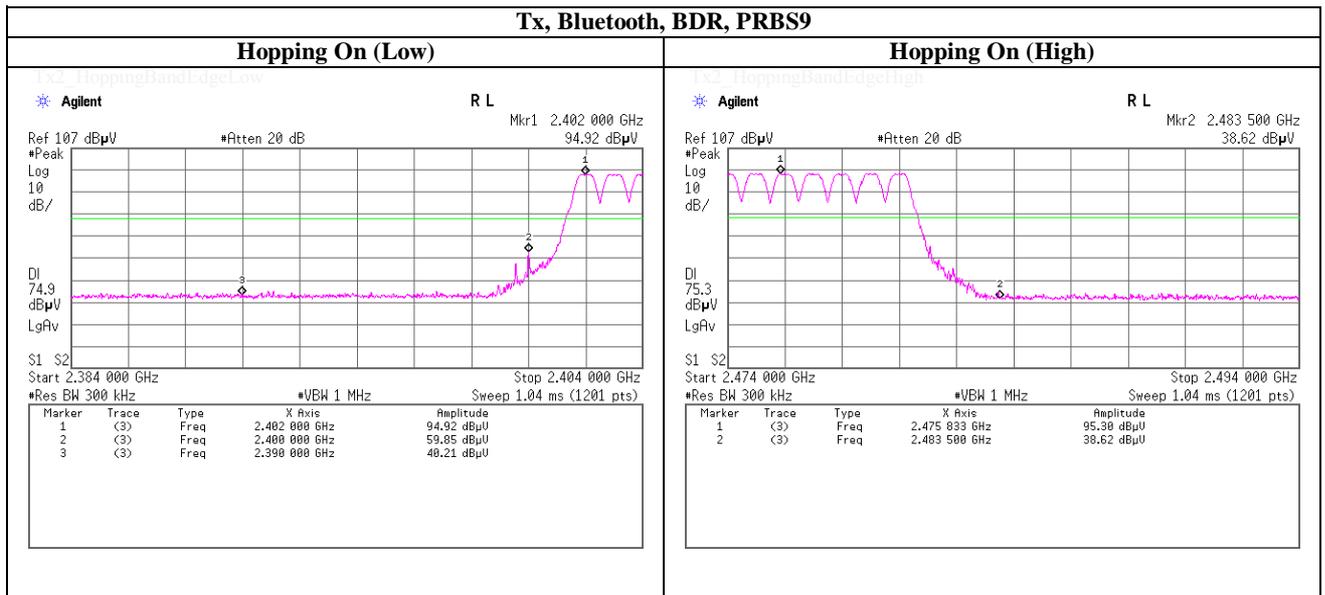
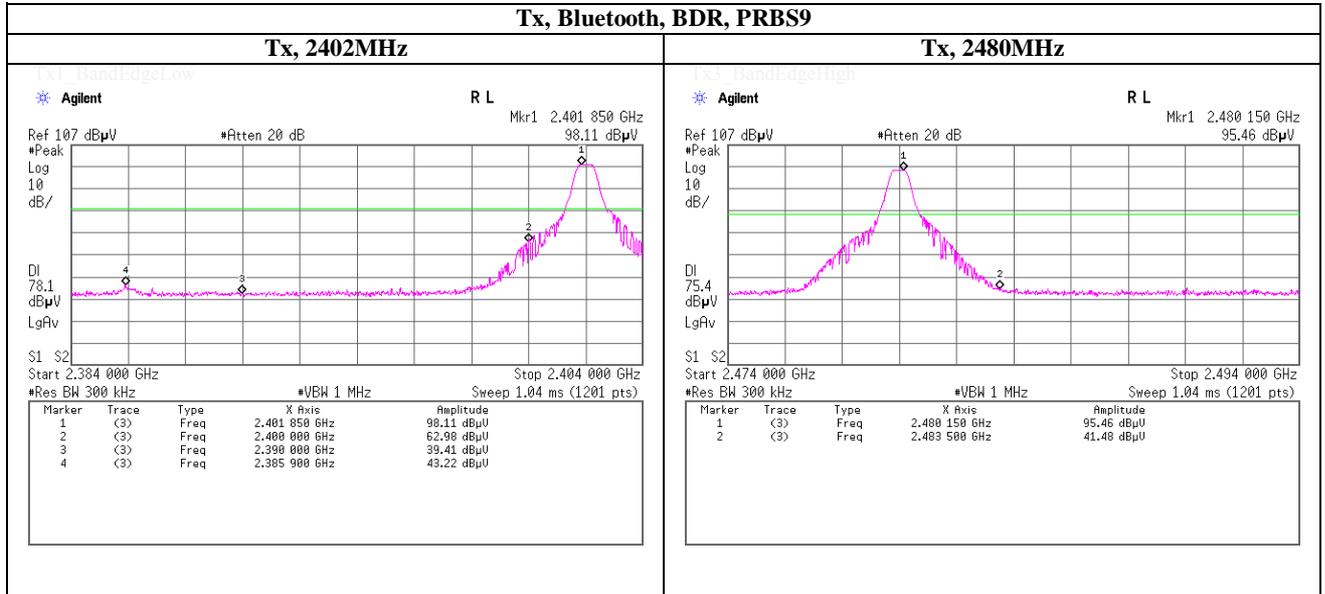
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Spurious emission (Conducted)

Band Edge compliance



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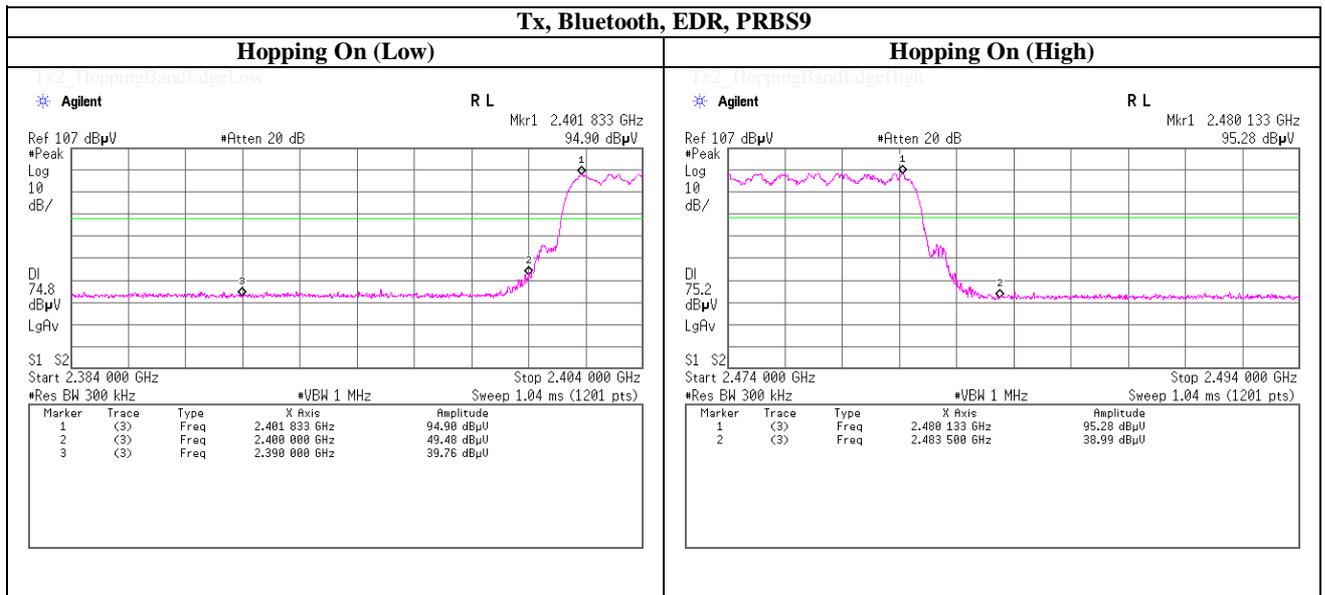
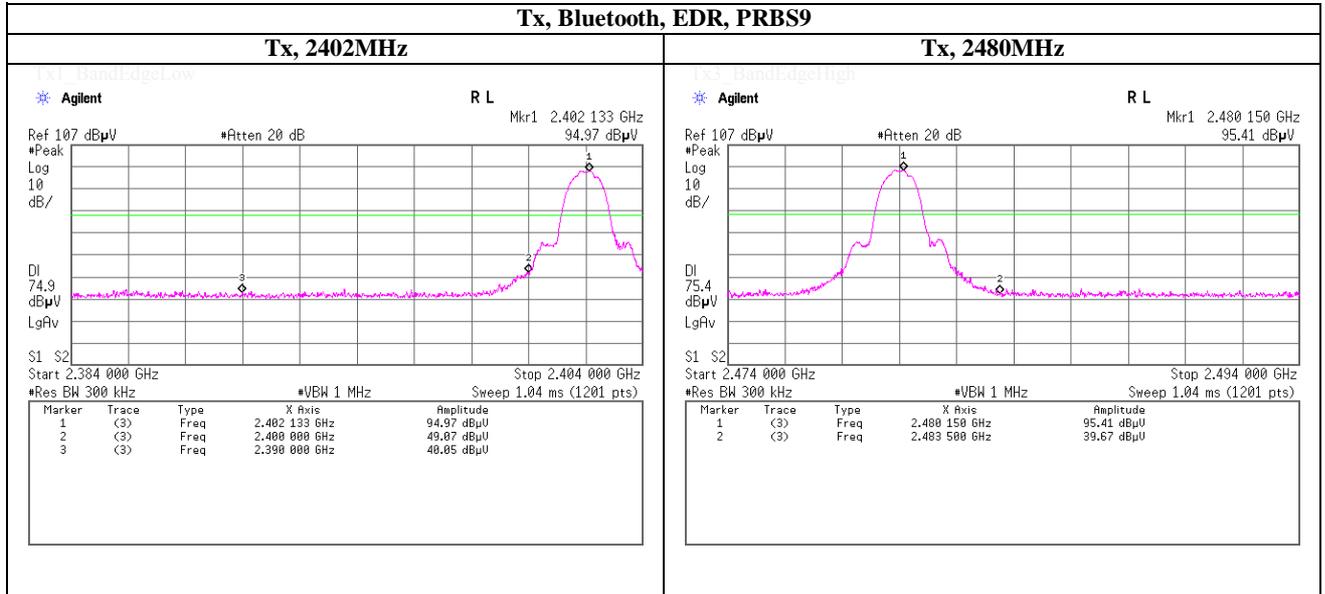
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

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Spurious emission (Conducted)

Band Edge compliance



UL Japan, Inc.

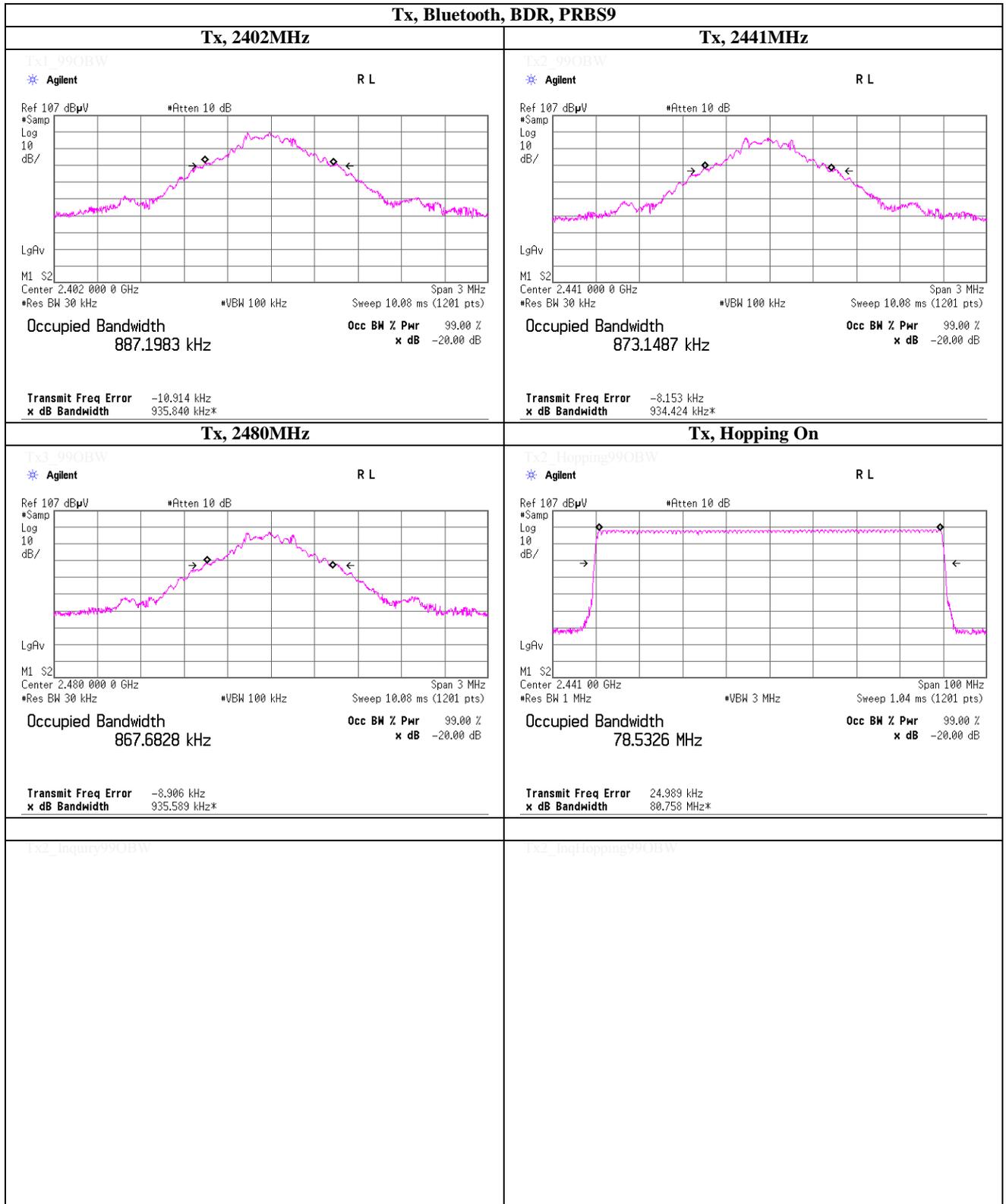
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99% Occupied Bandwidth



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99% Occupied Bandwidth

Tx, Bluetooth, EDR, PRBS9	
Tx, 2402MHz	Tx, 2441MHz
<p style="text-align: center;">Tx1_990BW</p> <p style="text-align: center;">* Agilent R L</p> <p>Ref 107 dBµV #Atten 10 dB</p> <p>#Samp Log 10 dB/</p> <p>LgAv</p> <p>M1 S2</p> <p>Center 2.402 000 0 GHz Span 3 MHz</p> <p>#Res BW 30 kHz #VBW 100 kHz Sweep 10.00 ms (1201 pts)</p> <p>Occupied Bandwidth 1.1612 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p>Transmit Freq Error -7.888 kHz x dB Bandwidth 1.251 MHz*</p>	<p style="text-align: center;">Tx2_990BW</p> <p style="text-align: center;">* Agilent R L</p> <p>Ref 107 dBµV #Atten 10 dB</p> <p>#Samp Log 10 dB/</p> <p>LgAv</p> <p>M1 S2</p> <p>Center 2.441 000 0 GHz Span 3 MHz</p> <p>#Res BW 30 kHz #VBW 100 kHz Sweep 10.00 ms (1201 pts)</p> <p>Occupied Bandwidth 1.1587 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p>Transmit Freq Error -7.808 kHz x dB Bandwidth 1.250 MHz*</p>
<p style="text-align: center;">Tx3_990BW</p> <p style="text-align: center;">* Agilent R L</p> <p>Ref 107 dBµV #Atten 10 dB</p> <p>#Samp Log 10 dB/</p> <p>LgAv</p> <p>M1 S2</p> <p>Center 2.480 000 0 GHz Span 3 MHz</p> <p>#Res BW 30 kHz #VBW 100 kHz Sweep 10.00 ms (1201 pts)</p> <p>Occupied Bandwidth 1.1581 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p>Transmit Freq Error -8.122 kHz x dB Bandwidth 1.250 MHz*</p>	<p style="text-align: center;">Tx2_Hopping990BW</p> <p style="text-align: center;">* Agilent R L</p> <p>Ref 107 dBµV #Atten 10 dB</p> <p>#Samp Log 10 dB/</p> <p>LgAv</p> <p>M1 S2</p> <p>Center 2.441 00 GHz Span 100 MHz</p> <p>#Res BW 1 MHz #VBW 3 MHz Sweep 1.04 ms (1201 pts)</p> <p>Occupied Bandwidth 78.7178 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p>Transmit Freq Error -18.244 kHz x dB Bandwidth 81.103 MHz*</p>
<p style="text-align: center;">Tx2_Inquiry990BW</p>	<p style="text-align: center;">Tx2_InqHopping990BW</p>

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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	2013/03/04 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2013/03/16 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2012/04/06 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2013/04/09 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2013/04/09 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2013/03/07 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2013/02/12 * 12
SAT6-03	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2012/10/08 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271 (RF Selector)	RE	2013/04/03 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2012/10/08 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2013/02/27 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2013/02/27 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE,CE	-
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2012/09/21 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFLMF)	-	RE,CE	-
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
STR-03	Test Receiver	Rohde & Schwarz	ESI40	100054/040	RE	2012/06/14 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2012/12/18 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2012/12/18 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2013/03/14 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2013/03/19 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2013/03/16 * 12
SCC-C9/C10/SRSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-271 (RF Selector)	CE	2013/04/03 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2013/02/21 * 12
SAT3-05	Attenuator	JFW	50HF-003N	-	CE	2013/02/12 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2013/03/07 * 12
STM-05	Terminator	TME	CT-01 BP	-	CE	2013/01/16 * 12
STR-03	Test Receiver	Rohde & Schwarz	ESI40	100054/040	CE	2012/06/14 * 12

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

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

Test Item :

- CE: Conducted emission ,
- RE: Radiated emission ,
- AT: Antenna terminal conducted tests