



Test report No. : 10009801S-A
Page : 1 of 58
Issued date : June 7, 2013
Revised date : June 25, 2013
FCC ID : AK8SR5BT50

RADIO TEST REPORT

Test Report No.: 10009801S-A

Applicant : Sony Corporation
Type of Equipment : Personal Audio System
Model No. : SRS-BTS50
FCC ID : AK8SR5BT50
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: May 16 to 18, 2013

Tested by: H. Shirasawa

Hikaru Shirasawa
Engineer of WiSE Japan,
UL Verification Service

Approved by : T. Amamura

Toyokazu Imamura
Leader of WiSE Japan,
UL Verification Service



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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 : +81-50-3750-7634
Facsimile Number : +81-50-3750-6572
Contact Person : Maeda Toshihiro

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

2.1 Identification of E.U.T.

Type of Equipment : Personal Audio System
Model Number : SRS-BTS50
Serial Number : Refer to 4.2.
Rating : AC100-240V, 50/60Hz (AC adapter)
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 : May 2, 2013
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: SRS-BTS50 (referred to as the EUT in this report) is a Personal Audio System.

Clock frequency(ies) in the system : 1.2 MHz (DC-DC converter), 26 MHz (Bluetooth)

Radio specification (Bluetooth part):

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth & channel spacing : 1MHz & 1MHz
Type of modulation : FHSS
Antenna type : Chip
Antenna gain : 2.2dBi
Antenna connector type : None
Operation temperature range : +5 to +35 deg.C.

FCC 15.31 (e)

The RF transmitter is constantly provided voltage (DC1.35V) through the regulator regardless of input voltage. 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: 10009801S-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	18.7dB Freq.: 0.35270MHz Detection: Quasi-Peak Phase: L1 Mode: Tx 2441MHz, 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		10.0dB Freq.: 12010.000MHz Polarization: Horizontal Detection: Average Mode: Tx 2402MHz, 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

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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 checked="" 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.

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: CSR Blue Test3 Ver.2.5.0.93
(Power setting: BDR: 7 x 37, EDR: 72 x 43)

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

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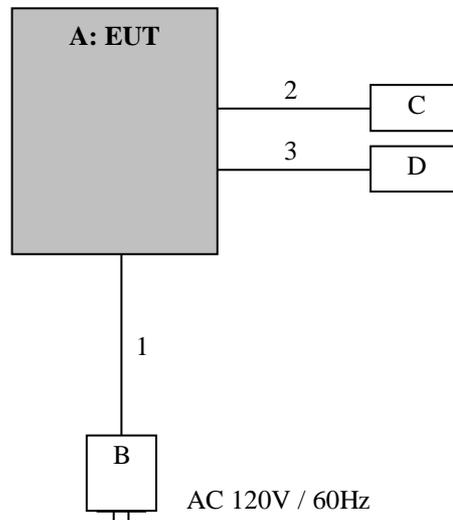
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4.2 Configuration and peripherals



* 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	SRS-BTS50	*1)	Sony	EUT
B	AC Power Adapter	AC-E5212	A253575	Sony	-
C	Portable Media Player	NW-S764	6386472	Sony	-
D	Wireless Speaker System	SRS-BTV5	9900077	Sony	-

*1) Antenna terminal conducted tests: 28, Conducted/Radiated emission tests: 27

List of cables used

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	DC	1.8	Unshielded	Unshielded	-
2	Audio (Stereo-Mini)	1.5	Shielded	Shielded	-
3	Audio (Stereo-Mini)	1.5	Shielded	Shielded	-

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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.

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, a CISPR average detector. The conducted emission measurements were made with the following detection of the test receiver.

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

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

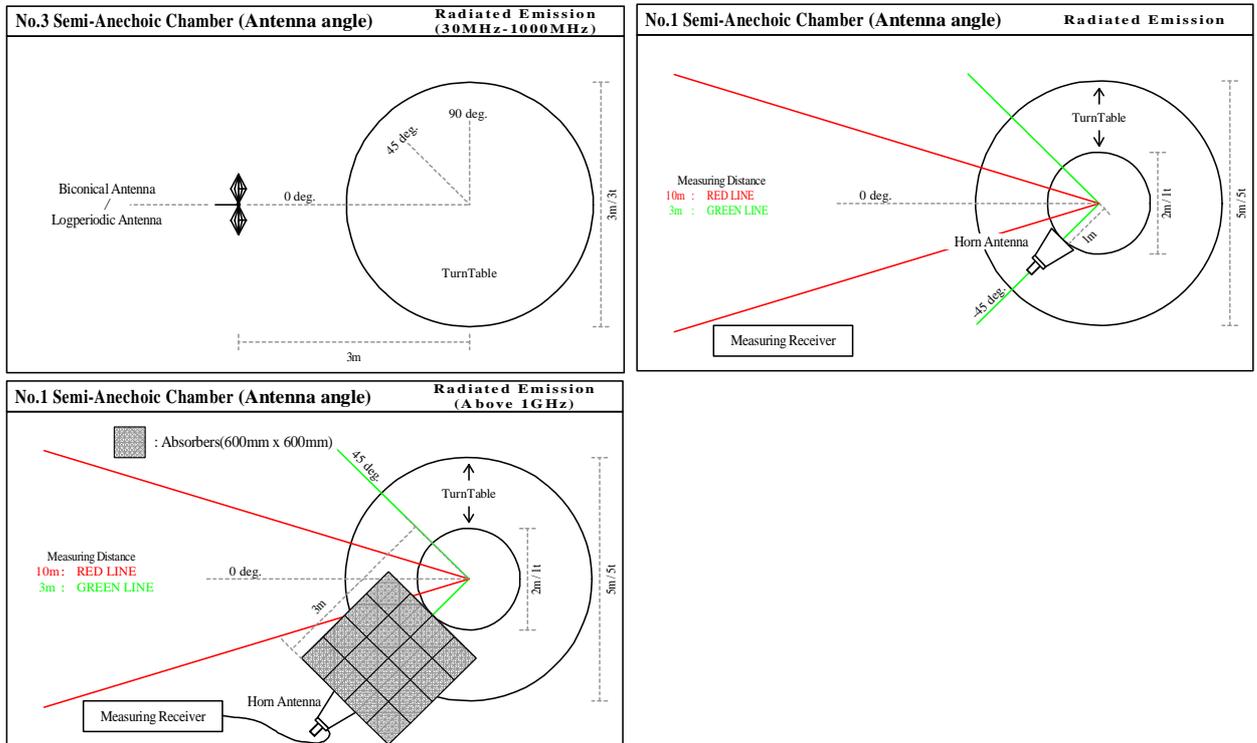
The EUT was tested in the direction normally used since there was no difference in the result caused by direction.

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Figure 1. Antenna angle



12.5 Band edge

Band edge level is below the limits of FCC 15.209. 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

Conducted emission
Radiated emission

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DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/05/18

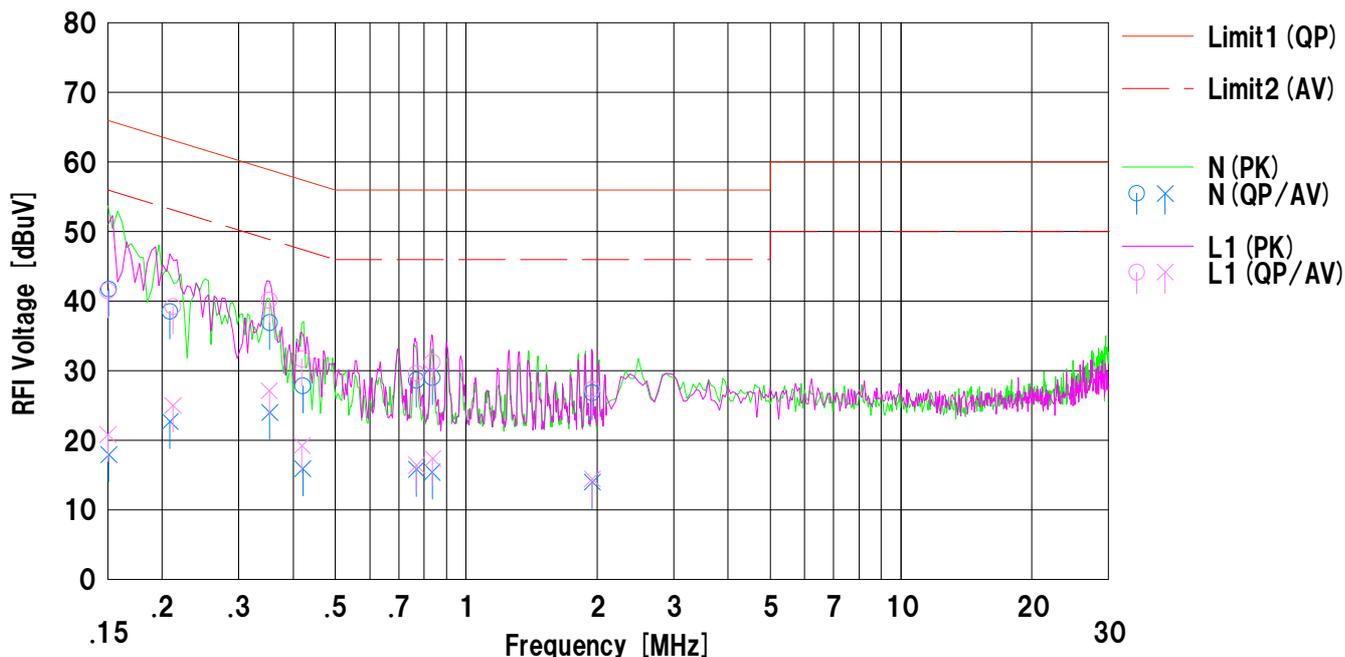
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : SRS-BTS50
Serial No. : 27

Mode : Bluetooth TX DH5 2441MHz
Order No. : 10009801S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 26deg.C/45%RH

Remarks : -

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

Engineer : Akira Sato



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	0.15073	28.8	5.0	12.9	41.7	17.9	65.9	55.9	24.2	38.0	N	
2	0.20830	25.6	9.8	12.9	38.5	22.7	63.2	53.2	24.7	30.5	N	
3	0.35340	24.0	11.1	12.9	36.9	24.0	58.8	48.8	21.9	24.8	N	
4	0.42100	14.9	3.0	12.9	27.8	15.9	57.4	47.4	29.6	31.5	N	
5	0.76860	15.7	2.9	12.9	28.6	15.8	56.0	46.0	27.4	30.2	N	
6	0.83540	16.1	2.5	12.9	29.0	15.4	56.0	46.0	27.0	30.6	N	
7	1.94860	13.8	1.0	13.0	26.8	14.0	56.0	46.0	29.2	32.0	N	
8	0.15000	28.6	7.9	12.9	41.5	20.8	66.0	56.0	24.5	35.2	L1	
9	0.21178	26.3	12.1	12.9	39.2	25.0	63.1	53.1	23.9	28.1	L1	
10	0.35270	27.2	14.2	12.9	40.1	27.1	58.8	48.8	18.7	21.7	L1	
11	0.41920	18.8	6.3	12.9	31.7	19.2	57.4	47.4	25.7	28.2	L1	
12	0.76950	16.7	3.5	12.9	29.6	16.4	56.0	46.0	26.4	29.6	L1	
13	0.83660	18.3	4.5	12.9	31.2	17.4	56.0	46.0	24.8	28.6	L1	
14	1.95000	14.3	1.4	13.0	27.3	14.4	56.0	46.0	28.7	31.6	L1	

DATA OF CONDUCTED EMISSION TEST

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Date : 2013/05/18

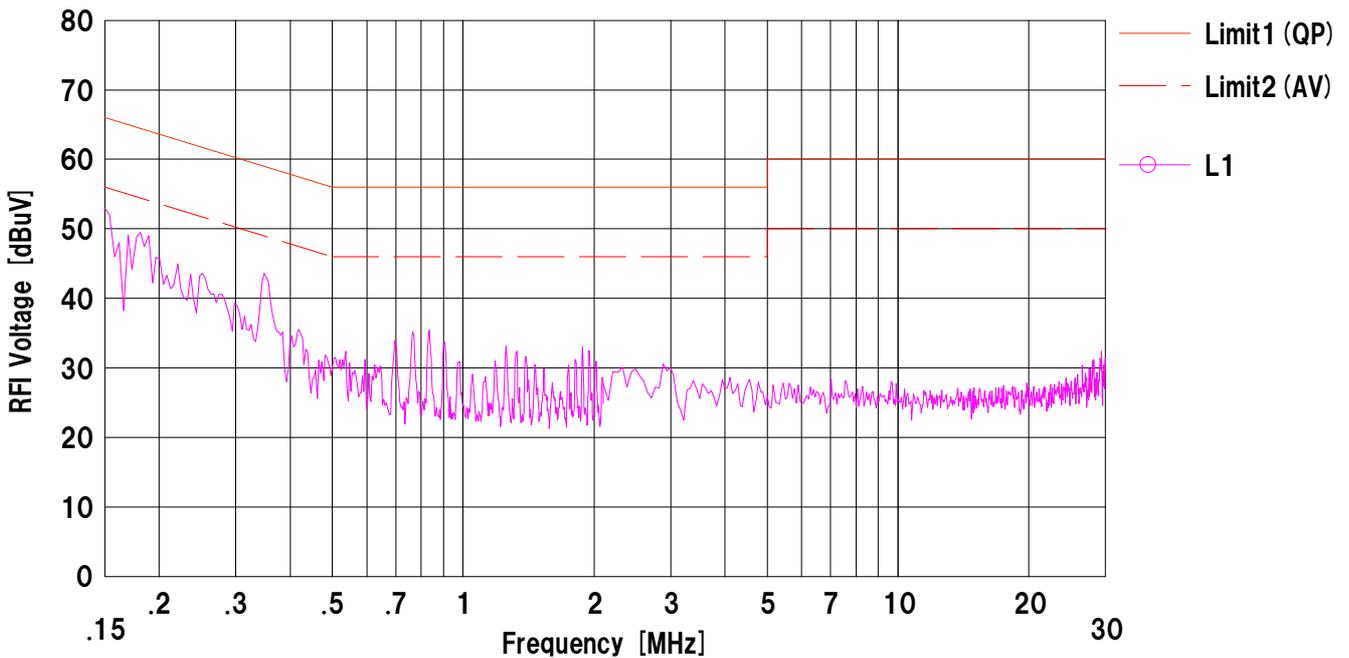
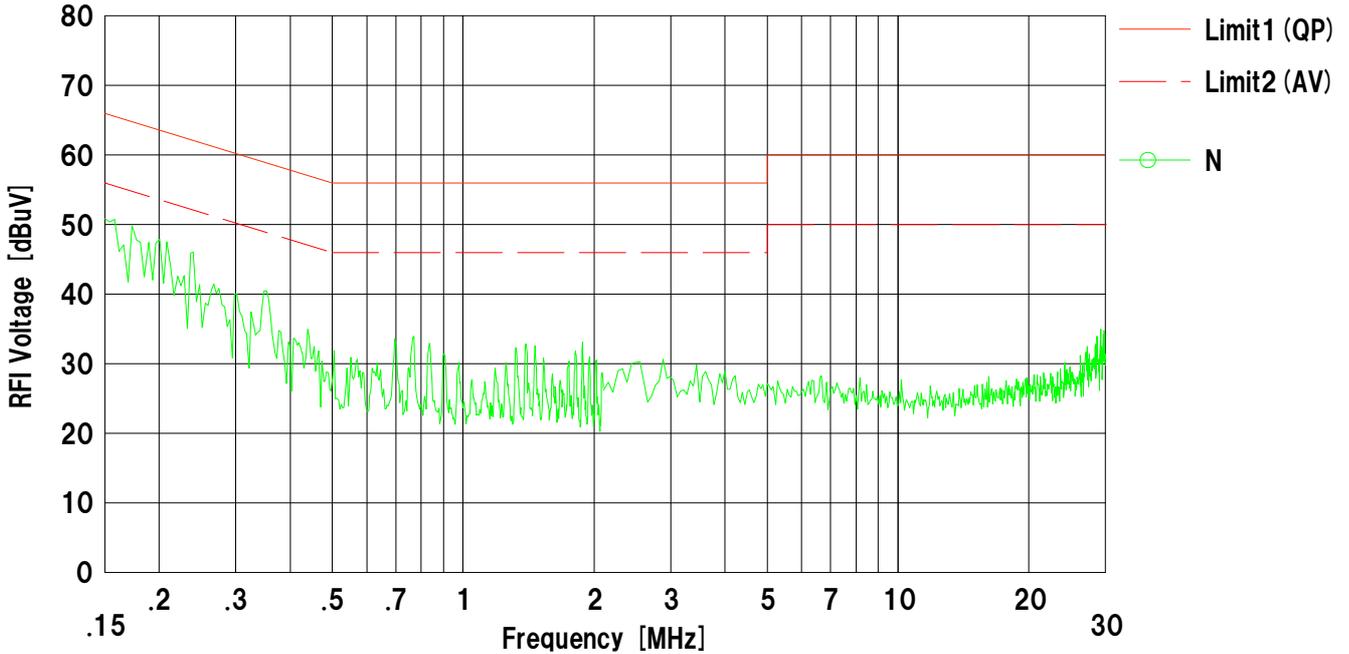
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : SRS-BTS50
Serial No. : 27

Mode : Bluetooth TX DH5 2402MHz
Order No. : 10009801S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 26deg.C/45%RH

Remarks : -

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

Engineer : Akira Sato



DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/05/18

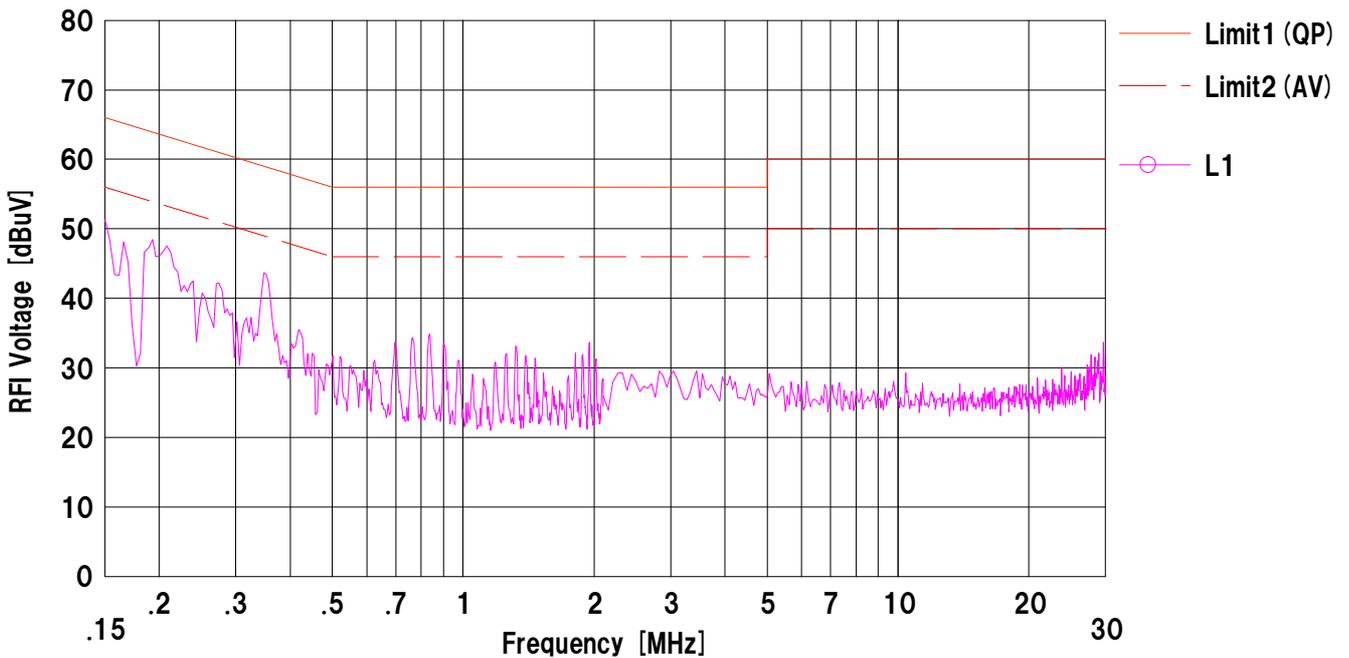
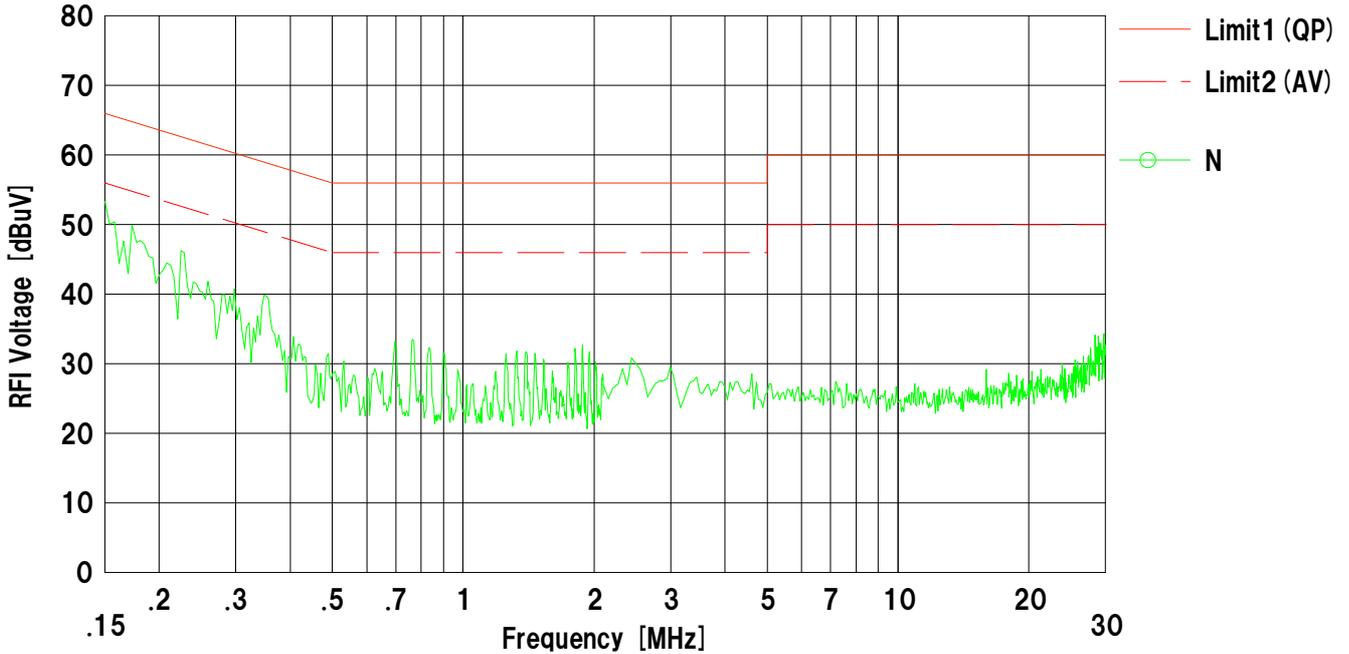
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : SRS-BTS50
Serial No. : 27

Mode : Bluetooth TX DH5 2480MHz
Order No. : 10009801S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 26deg.C/45%RH

Remarks : -

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

Engineer : Akira Sato



DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/05/18

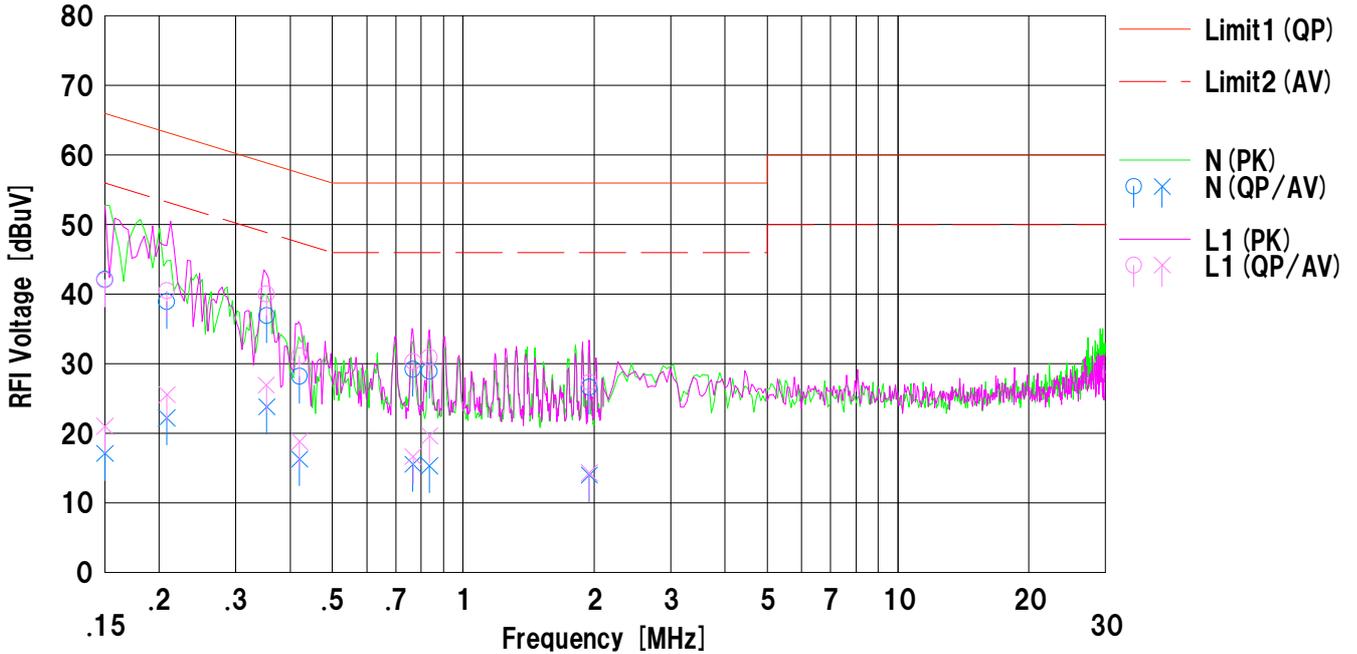
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : SRS-BTS50
Serial No. : 27

Mode : Bluetooth TX 3DH5 2441MHz
Order No. : 10009801S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 26deg.C/45%RH

Remarks : -

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

Engineer : Akira Sato



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	4.2	12.9	42.1	17.1	66.0	56.0	23.9	38.9	N	
2	0.20817	26.0	9.3	12.9	38.9	22.2	63.2	53.2	24.3	31.0	N	
3	0.35340	24.0	10.9	12.9	36.9	23.8	58.8	48.8	21.9	25.0	N	
4	0.42040	15.3	3.4	12.9	28.2	16.3	57.4	47.4	29.2	31.1	N	
5	0.76620	16.3	2.6	12.9	29.2	15.5	56.0	46.0	26.8	30.5	N	
6	0.83592	16.0	2.4	12.9	28.9	15.3	56.0	46.0	27.1	30.7	N	
7	1.94860	13.6	1.0	13.0	26.6	14.0	56.0	46.0	29.4	32.0	N	
8	0.15000	29.1	8.1	12.9	42.0	21.0	66.0	56.0	24.0	35.0	L1	
9	0.20850	27.6	12.6	12.9	40.5	25.5	63.2	53.2	22.7	27.7	L1	
10	0.35280	27.1	14.0	12.9	40.0	26.9	58.8	48.8	18.8	21.9	L1	
11	0.42020	18.2	5.9	12.9	31.1	18.8	57.4	47.4	26.3	28.6	L1	
12	0.76700	17.4	3.7	12.9	30.3	16.6	56.0	46.0	25.7	29.4	L1	
13	0.83680	18.0	6.7	12.9	30.9	19.6	56.0	46.0	25.1	26.4	L1	
14	1.94880	14.3	1.3	13.0	27.3	14.3	56.0	46.0	28.7	31.7	L1	

DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/05/18

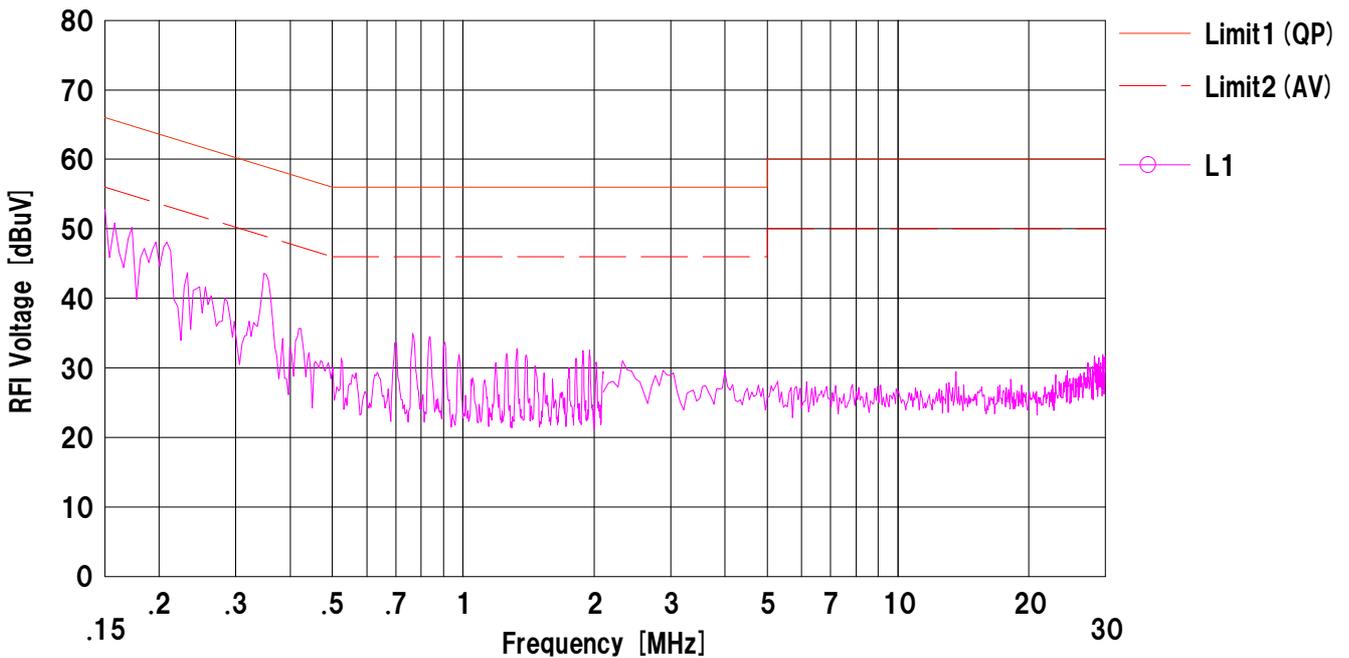
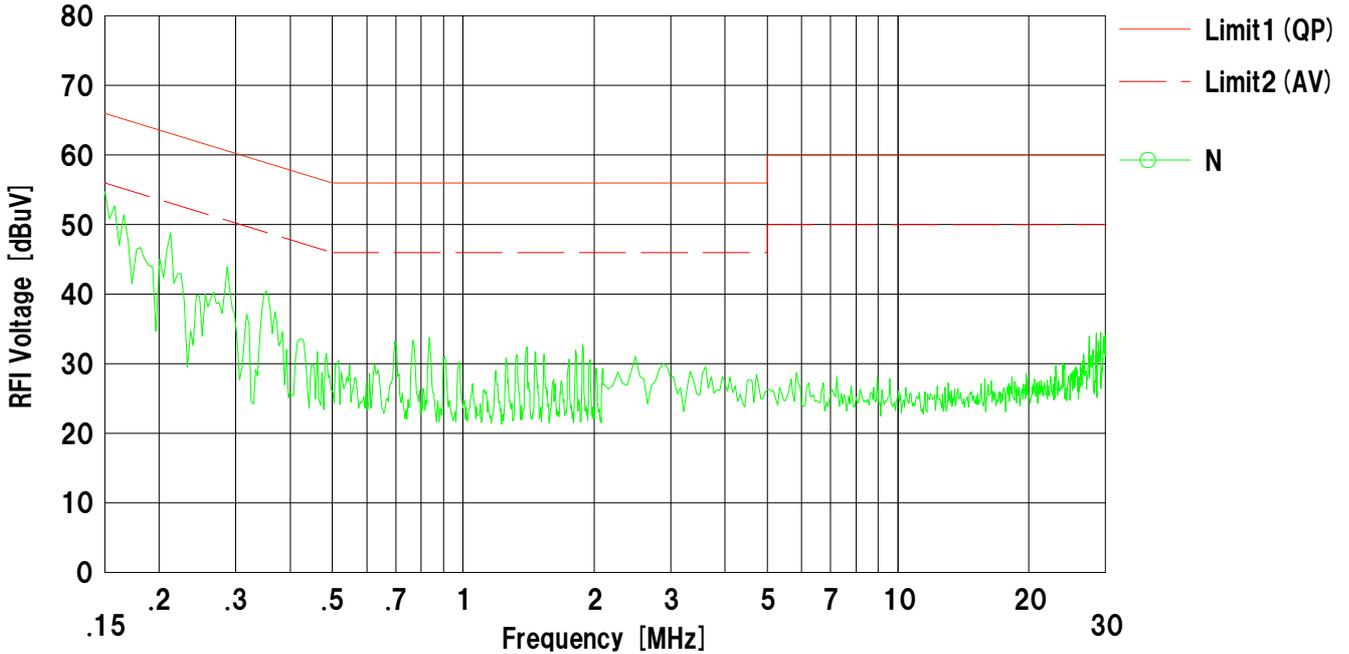
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : SRS-BTS50
Serial No. : 27

Mode : Bluetooth TX 3DH5 2402MHz
Order No. : 10009801S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 26deg.C/45%RH

Remarks : -

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

Engineer : Akira Sato



DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2013/05/18

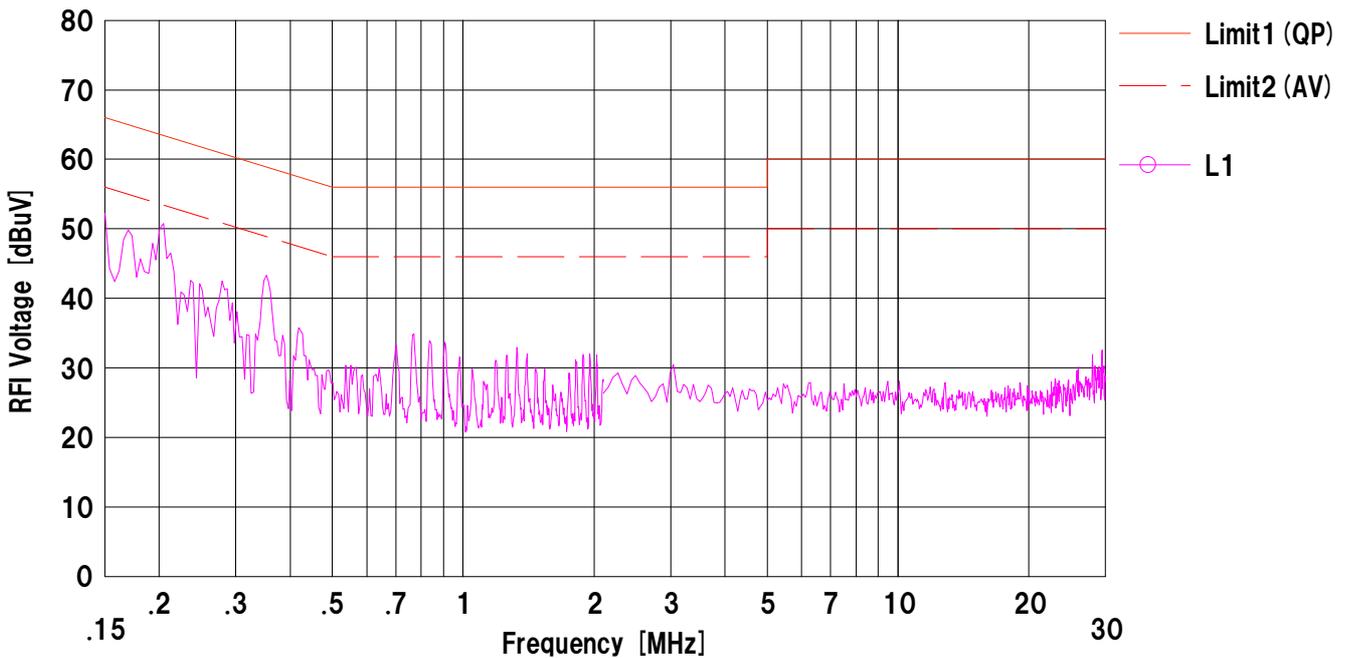
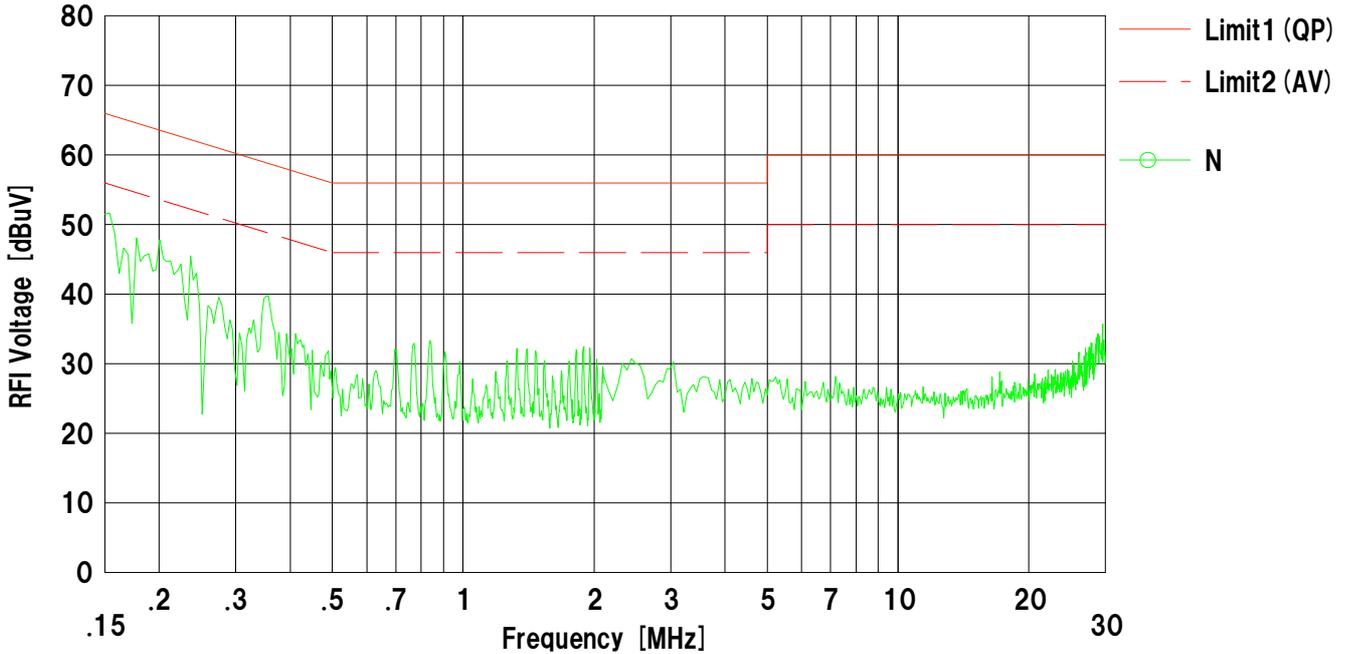
Company : Sony Corporation
Kind of EUT : Personal Audio System
Model No. : SRS-BTS50
Serial No. : 27

Mode : Bluetooth TX 3DH5 2480MHz
Order No. : 10009801S
Power : AC120V/60Hz SinglePhase
Temp./Humi. : 26deg.C/45%RH

Remarks : -

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

Engineer : Akira Sato



20dB Bandwidth and Carrier Frequency Separation

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date May 16, 2013
 Temperature / Humidity 28 deg.C , 44 %RH
 Engineer Hikaru Shirasawa
 Mode Tx, Bluetooth, BDR, PRBS9

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency Separation [MHz]
DH5	2402.0	0.941	1.000	>= 0.627
DH5	2441.0	0.978	1.000	>= 0.652
DH5	2480.0	0.950	1.000	>= 0.633

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

No limit applies to 20dB Bandwidth.

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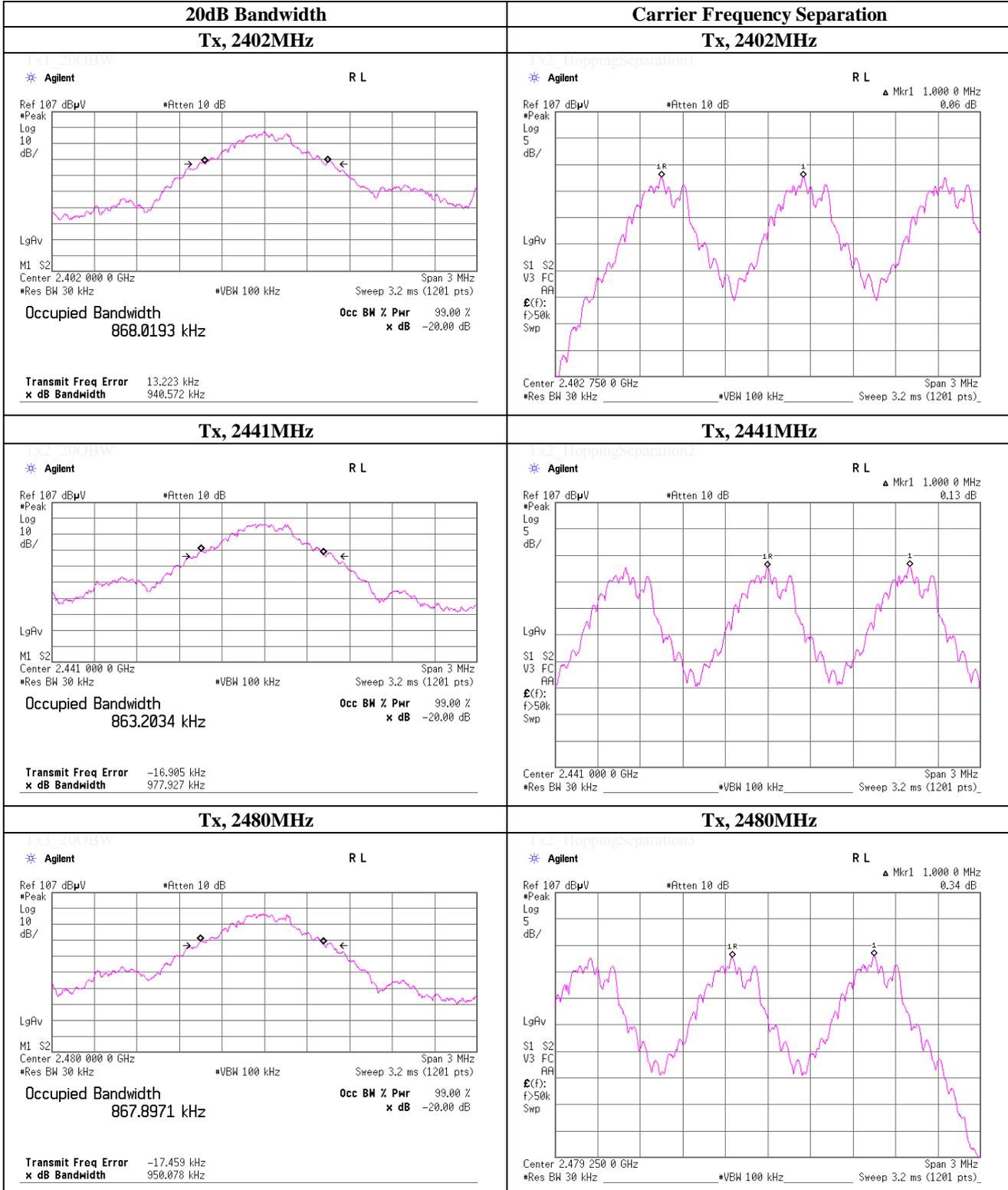
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, BDR, PRBS9



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 May 16, 2013
 Temperature / Humidity 28 deg.C , 44 %RH
 Engineer Hikaru Shirasawa
 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	1.260	1.000	>= 0.840
3-DH5	2480.0	1.284	1.000	>= 0.856

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

No limit applies to 20dB Bandwidth.

UL Japan, Inc.

Shonan EMC Lab.

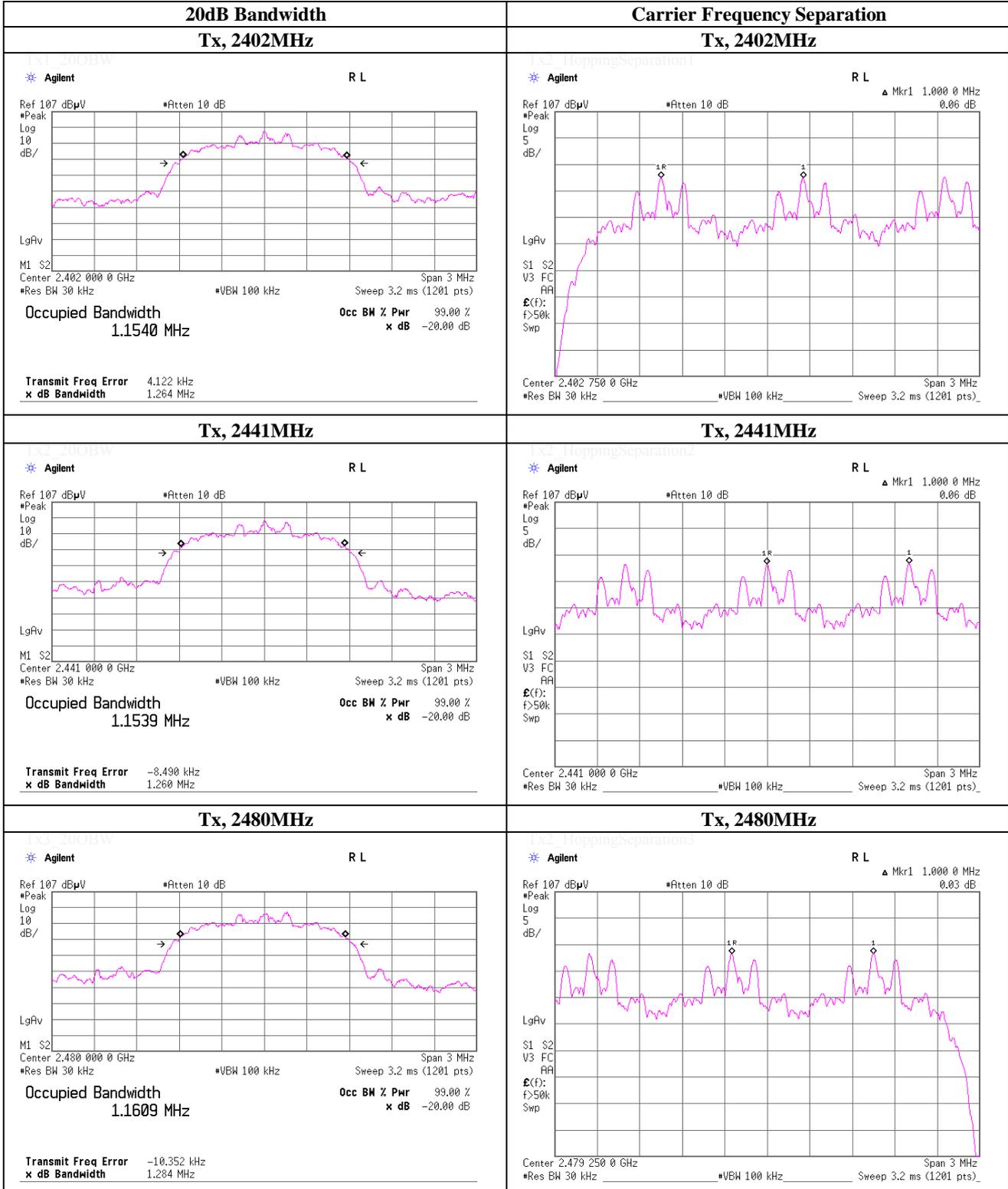
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20dB Bandwidth and Carrier Frequency Separation

Tx, Bluetooth, EDR, PRBS9



UL Japan, Inc.

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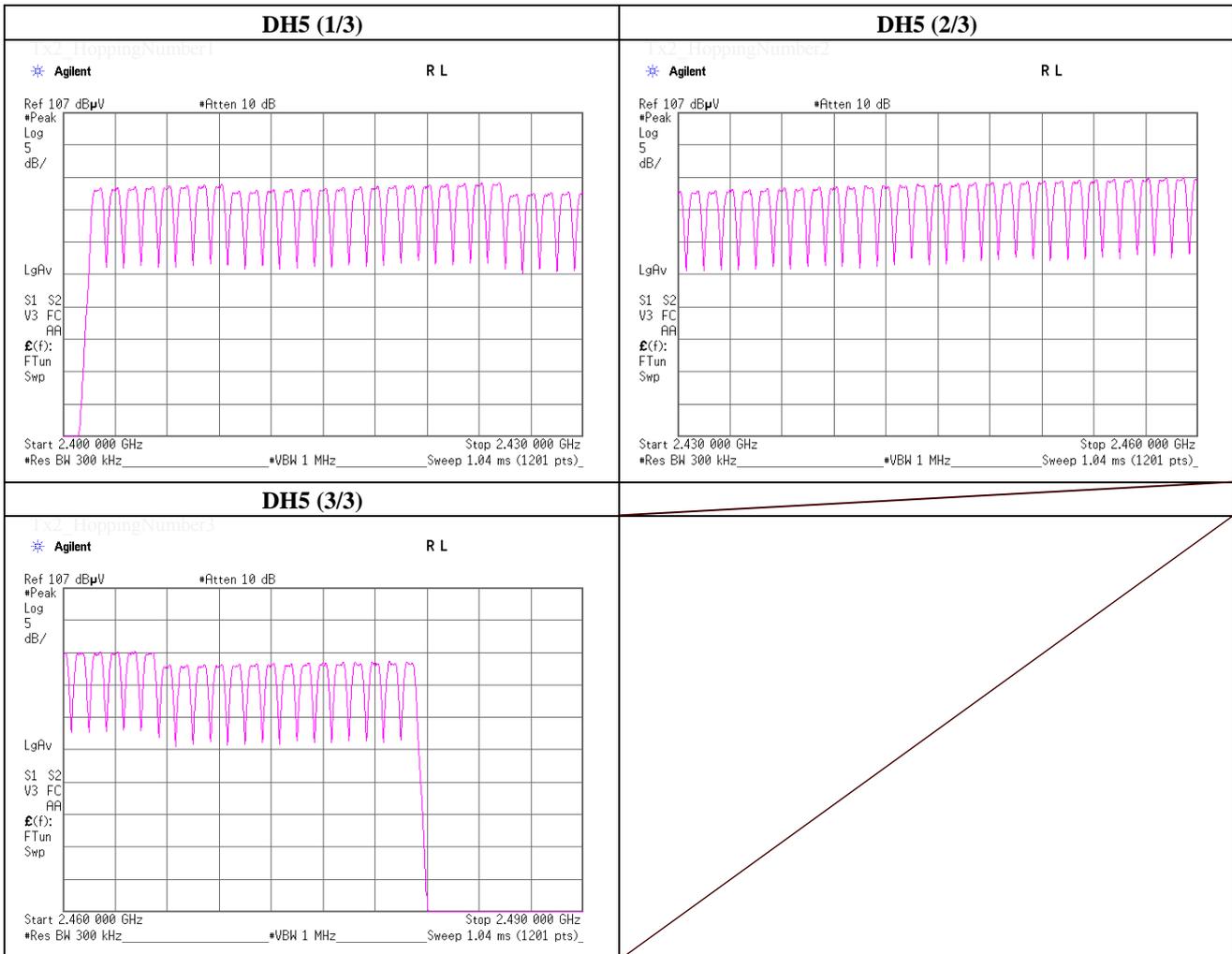
Facsimile : +81 463 50 6401

Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	May 16, 2013	
Temperature / Humidity	28 deg.C , 44 %RH	
Engineer	Hikaru Shirasawa	
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.

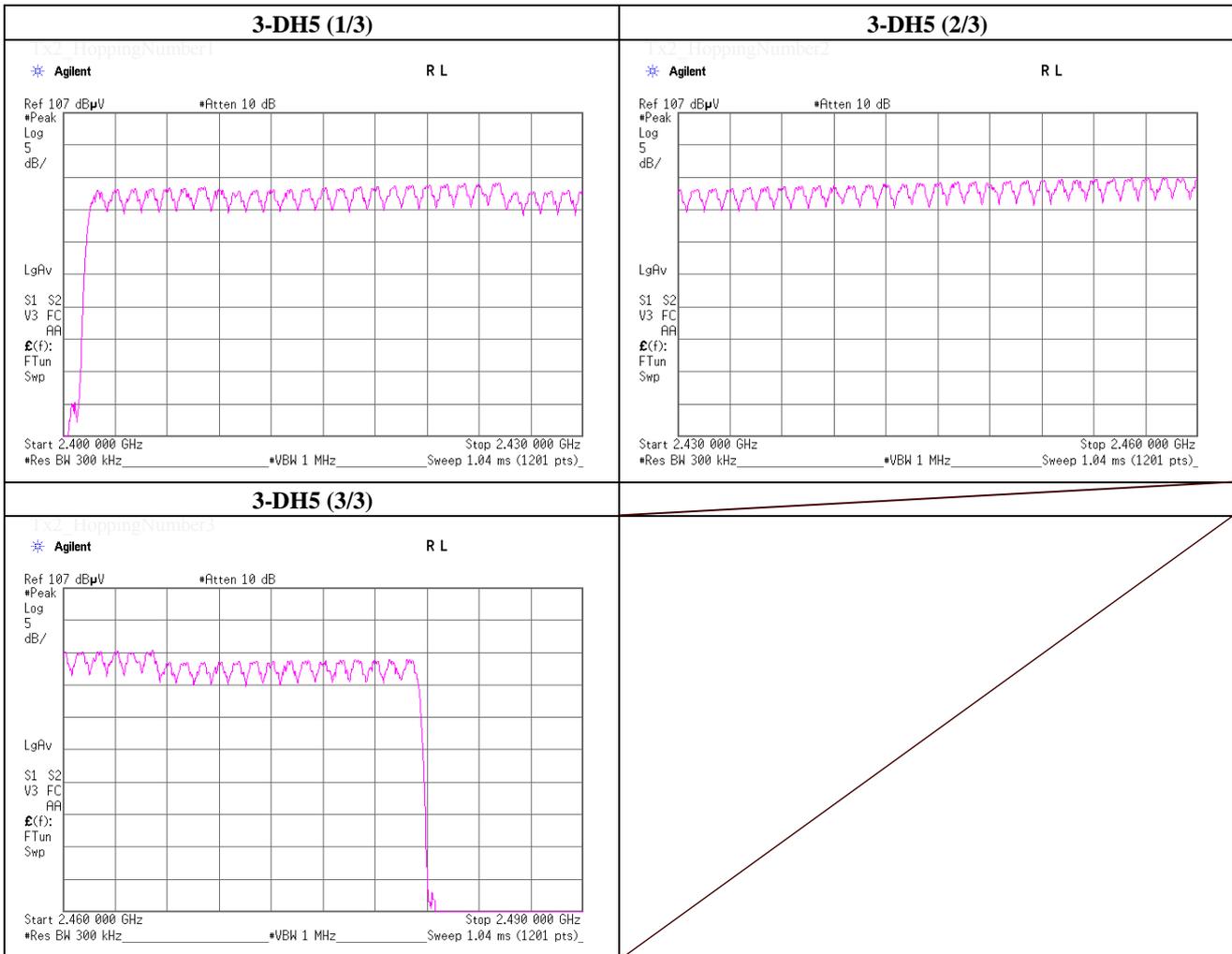


Number of Hopping Frequency

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	May 16, 2013	
Temperature / Humidity	28 deg.C , 44 %RH	
Engineer	Hikaru Shirasawa	
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.



Dwell Time

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date May 16, 2013
 Temperature / Humidity 28 deg.C , 44 %RH
 Engineer Hikaru Shirasawa
 Mode Tx, Bluetooth, BDR, PRBS9

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period	Length of transmission time [msec]	Result [msec]	Limit [msec]
DH1	50.0 / 5.0 sec. x 31.6 sec. = 316 times	0.401	127	400
DH3	26.0 / 5.0 sec. x 31.6 sec. = 165 times	1.659	274	400
DH5	17.0 / 5.0 sec. x 31.6 sec. = 108 times	2.907	314	400

Sample Calculation

Result = Number of transmission x Length of transmission time

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

UL Japan, Inc.

Shonan EMC Lab.

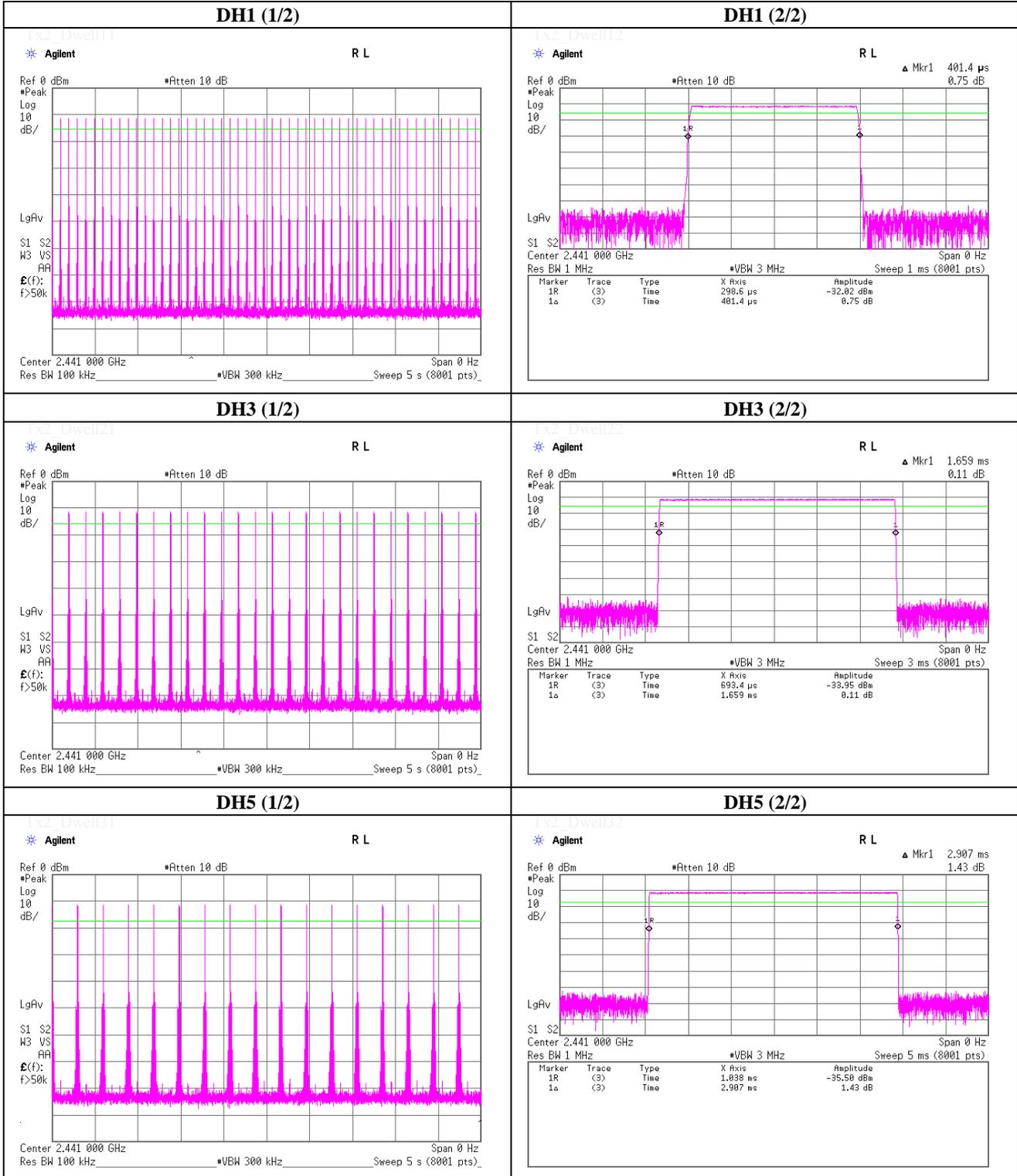
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Dwell time

Tx, Bluetooth, BDR, PRBS9



UL Japan, Inc.

Shonan EMC Lab.

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Dwell Time

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date May 16, 2013
 Temperature / Humidity 28 deg.C , 44 %RH
 Engineer Hikaru Shirasawa
 Mode Tx, Bluetooth, EDR, PRBS9

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4) second	Length of transmission time [msec]	Result [msec]	Limit [msec]
3-DH1	50.0 / 5.0 sec. x 31.6 sec. = 316 times	0.414	131	400
3-DH3	26.0 / 5.0 sec. x 31.6 sec. = 165 times	1.665	275	400
3-DH5	17.0 / 5.0 sec. x 31.6 sec. = 108 times	2.914	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.

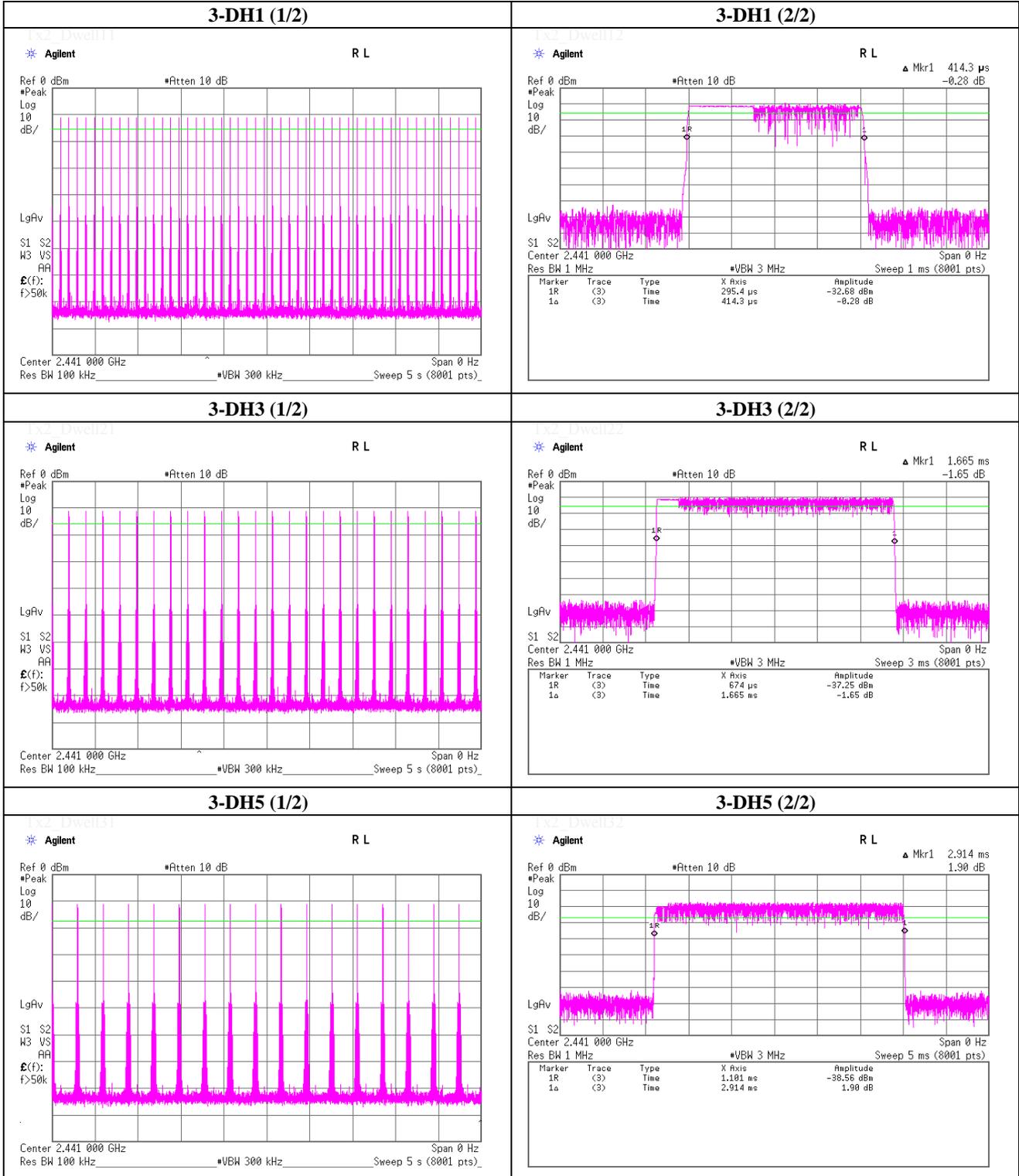
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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Dwell time

Tx, Bluetooth, EDR, PRBS9



UL Japan, Inc.

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Maximum Peak Conducted Output Power (Conducted)

Test place UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
 Date May 16, 2013
 Temperature / Humidity 28 deg.C , 44 %RH
 Engineer Hikaru Shirasawa
 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	-11.29	1.14	9.98	-0.17	0.96	20.97	125	21.14
DH5	2441.0	-10.91	1.15	9.98	0.22	1.05	20.97	125	20.75
DH5	2480.0	-10.97	1.15	9.98	0.16	1.04	20.97	125	20.81
2-DH5	2402.0	-10.02	1.14	9.98	1.10	1.29	20.97	125	19.87
2-DH5	2441.0	-9.33	1.15	9.98	1.80	1.51	20.97	125	19.17
2-DH5	2480.0	-9.27	1.15	9.98	1.86	1.53	20.97	125	19.11
3-DH5	2402.0	-9.38	1.14	9.98	1.74	1.49	20.97	125	19.23
3-DH5	2441.0	-8.66	1.15	9.98	2.47	1.77	20.97	125	18.50
3-DH5	2480.0	-8.61	1.15	9.98	2.52	1.79	20.97	125	18.45

Sample Calculation:

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

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Shonan EMC Lab.

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Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 and No.3 Semi Anechoic Chamber
Date	May 17, 2013	May 18, 2013
Temperature / Humidity	20 deg.C , 40 %RH	26 deg.C , 44 %RH
Engineer	Hikaru Shirasawa	Akira Sato
Mode	Tx, 2402.0 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.	480.000	QP	22.4	17.2	9.4	31.9	17.1	46.0	28.9	100	0	
Hori.	2390.000	PK	47.1	27.6	14.2	40.9	48.0	73.9	25.9	100	49	
Hori.	2399.183	PK	49.0	27.6	14.2	40.9	49.9	73.9	24.0	100	49	
Hori.	2400.000	PK	50.0	27.6	14.2	40.9	50.9	73.9	23.0	100	49	
Hori.	2557.000	PK	50.0	27.8	14.4	40.9	51.3	73.9	22.6	100	0	
Hori.	4804.000	PK	55.0	31.2	6.8	41.8	51.2	73.9	22.7	100	169	
Hori.	7206.000	PK	50.3	36.0	7.9	41.4	52.8	73.9	21.1	100	0	
Hori.	9608.000	PK	48.6	38.1	9.3	40.6	55.4	73.9	18.5	100	0	
Hori.	12010.000	PK	47.7	39.0	10.0	39.9	56.8	73.9	17.1	100	0	
Hori.	2390.000	AV	36.3	27.6	14.2	40.9	37.2	53.9	16.7	100	49	
Hori.	2399.183	AV	40.0	27.6	14.2	40.9	40.9	53.9	13.0	100	49	
Hori.	2400.000	AV	39.3	27.6	14.2	40.9	40.2	53.9	13.7	100	49	
Hori.	2557.000	AV	38.7	27.8	14.4	40.9	40.0	53.9	13.9	100	0	
Hori.	4804.000	AV	46.8	31.2	6.8	41.8	43.0	53.9	10.9	100	169	
Hori.	7206.000	AV	36.8	36.0	7.9	41.4	39.3	53.9	14.6	100	0	
Hori.	9608.000	AV	35.5	38.1	9.3	40.6	42.3	53.9	11.6	100	0	
Hori.	12010.000	AV	34.8	39.0	10.0	39.9	43.9	53.9	10.0	100	0	
Vert.	57.075	QP	37.4	8.8	6.6	32.2	20.6	40.0	19.4	100	161	
Vert.	74.942	QP	34.0	6.5	7.1	32.1	15.5	40.0	24.5	100	163	
Vert.	105.804	QP	30.8	11.0	7.2	32.1	16.9	43.5	26.6	100	127	
Vert.	2390.000	PK	45.0	27.6	14.2	40.9	45.9	73.9	28.0	100	175	
Vert.	2399.183	PK	48.5	27.6	14.2	40.9	49.4	73.9	24.5	100	175	
Vert.	2400.000	PK	48.8	27.6	14.2	40.9	49.7	73.9	24.2	100	175	
Vert.	2557.000	PK	46.0	27.8	14.4	40.9	47.3	73.9	26.6	100	0	
Vert.	4804.000	PK	54.3	31.2	6.8	41.8	50.5	73.9	23.4	100	175	
Vert.	7206.000	PK	49.2	36.0	7.9	41.4	51.7	73.9	22.2	100	0	
Vert.	9608.000	PK	48.0	38.1	9.3	40.6	54.8	73.9	19.1	100	0	
Vert.	12010.000	PK	45.7	39.0	10.0	39.9	54.8	73.9	19.1	100	0	
Vert.	2390.000	AV	34.6	27.6	14.2	40.9	35.5	53.9	18.4	100	175	
Vert.	2399.183	AV	38.4	27.6	14.2	40.9	39.3	53.9	14.6	100	175	
Vert.	2400.000	AV	38.3	27.6	14.2	40.9	39.2	53.9	14.7	100	175	
Vert.	2557.000	AV	34.6	27.8	14.4	40.9	35.9	53.9	18.0	100	0	
Vert.	4804.000	AV	46.7	31.2	6.8	41.8	42.9	53.9	11.0	100	175	
Vert.	7206.000	AV	36.7	36.0	7.9	41.4	39.2	53.9	14.7	100	0	
Vert.	9608.000	AV	35.7	38.1	9.3	40.6	42.5	53.9	11.4	100	0	
Vert.	12010.000	AV	33.0	39.0	10.0	39.9	42.1	53.9	11.8	100	0	

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

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

*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.1 and No.3 Semi Anechoic Chamber
Date	May 17, 2013	May 18, 2013
Temperature / Humidity	20 deg.C , 40 %RH	26 deg.C , 44 %RH
Engineer	Hikaru Shirasawa	Akira Sato
Mode	Tx, 2441.0 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.	480.000	QP	21.9	17.2	9.4	31.9	16.6	46.0	29.4	150	0	
Hori.	2597.000	PK	50.4	27.9	14.4	40.9	51.8	73.9	22.1	100	60	
Hori.	4882.000	PK	51.6	31.3	6.8	41.7	48.0	73.9	25.9	100	107	
Hori.	7323.000	PK	50.0	36.2	7.9	41.4	52.7	73.9	21.2	100	0	
Hori.	9764.000	PK	47.9	38.1	9.5	40.6	54.9	73.9	19.0	100	0	
Hori.	12205.000	PK	46.4	38.9	9.9	39.9	55.3	73.9	18.6	100	0	
Hori.	2597.000	AV	39.0	27.9	14.4	40.9	40.4	53.9	13.5	100	60	
Hori.	4882.000	AV	42.0	31.3	6.8	41.7	38.4	53.9	15.5	100	107	
Hori.	7323.000	AV	36.5	36.2	7.9	41.4	39.2	53.9	14.7	100	0	
Hori.	9764.000	AV	35.2	38.1	9.5	40.6	42.2	53.9	11.7	100	0	
Hori.	12205.000	AV	34.5	38.9	9.9	39.9	43.4	53.9	10.5	100	0	
Vert.	34.560	QP	25.0	16.3	6.5	32.2	15.6	40.0	24.4	100	173	
Vert.	56.276	QP	37.6	9.0	6.6	32.2	21.0	40.0	19.0	100	216	
Vert.	74.810	QP	35.0	6.5	7.1	32.1	16.5	40.0	23.5	100	151	
Vert.	105.009	QP	31.4	10.9	7.2	32.1	17.4	43.5	26.1	100	252	
Vert.	2597.000	PK	49.4	27.9	14.4	40.9	50.8	73.9	23.1	100	173	
Vert.	4882.000	PK	54.0	31.3	6.8	41.7	50.4	73.9	23.5	100	166	
Vert.	7323.000	PK	50.0	36.2	7.9	41.4	52.7	73.9	21.2	100	0	
Vert.	9764.000	PK	48.5	38.1	9.5	40.6	55.5	73.9	18.4	100	0	
Vert.	12205.000	PK	48.0	38.9	9.9	39.9	56.9	73.9	17.0	100	0	
Vert.	2597.000	AV	36.9	27.9	14.4	40.9	38.3	53.9	15.6	100	173	
Vert.	4882.000	AV	46.1	31.3	6.8	41.7	42.5	53.9	11.4	100	166	
Vert.	7323.000	AV	36.6	36.2	7.9	41.4	39.3	53.9	14.6	100	0	
Vert.	9764.000	AV	35.5	38.1	9.5	40.6	42.5	53.9	11.4	100	0	
Vert.	12205.000	AV	34.5	38.9	9.9	39.9	43.4	53.9	10.5	100	0	

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

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

*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.1 and No.3 Semi Anechoic Chamber
Date	May 17, 2013	May 18, 2013
Temperature / Humidity	20 deg.C , 40 %RH	26 deg.C , 44 %RH
Engineer	Hikaru Shirasawa	Akira Sato
Mode	Tx, 2480.0 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.	480.000	QP	21.8	17.2	9.4	31.9	16.5	46.0	29.5	100	359	
Hori.	2483.500	PK	43.5	27.6	14.3	40.9	44.5	73.9	29.4	100	63	
Hori.	2637.000	PK	49.4	28.0	14.5	41.0	50.9	73.9	23.0	100	63	
Hori.	4960.000	PK	51.6	31.5	6.9	41.5	48.5	73.9	25.4	100	155	
Hori.	7440.000	PK	49.3	36.3	8.0	41.4	52.2	73.9	21.7	100	0	
Hori.	9920.000	PK	48.6	38.1	9.5	40.7	55.5	73.9	18.4	100	0	
Hori.	12400.000	PK	47.1	38.9	9.8	39.8	56.0	73.9	17.9	100	0	
Hori.	2483.500	AV	32.6	27.6	14.3	40.9	33.6	53.9	20.3	100	63	
Hori.	2637.000	AV	38.8	28.0	14.5	41.0	40.3	53.9	13.6	100	63	
Hori.	4960.000	AV	42.7	31.5	6.9	41.5	39.6	53.9	14.3	100	155	
Hori.	7440.000	AV	36.2	36.3	8.0	41.4	39.1	53.9	14.8	100	0	
Hori.	9920.000	AV	35.5	38.1	9.5	40.7	42.4	53.9	11.5	100	0	
Hori.	12400.000	AV	34.4	38.9	9.8	39.8	43.3	53.9	10.6	100	0	
Vert.	34.267	QP	25.6	16.4	6.5	32.2	16.3	40.0	23.7	100	117	
Vert.	55.992	QP	37.6	9.1	6.6	32.2	21.1	40.0	18.9	100	173	
Vert.	104.284	QP	30.8	10.8	7.3	32.1	16.8	43.5	26.7	100	246	
Vert.	2483.500	PK	44.5	27.6	14.3	40.9	45.5	73.9	28.4	100	168	
Vert.	2637.000	PK	49.0	28.0	14.5	41.0	50.5	73.9	23.4	100	152	
Vert.	4960.000	PK	54.3	31.5	6.9	41.5	51.2	73.9	22.7	100	166	
Vert.	7440.000	PK	49.0	36.3	8.0	41.4	51.9	73.9	22.0	100	0	
Vert.	9920.000	PK	48.5	38.1	9.5	40.7	55.4	73.9	18.5	100	0	
Vert.	12400.000	PK	46.9	38.9	9.8	39.8	55.8	73.9	18.1	100	0	
Vert.	2483.500	AV	33.8	27.6	14.3	40.9	34.8	53.9	19.1	100	168	
Vert.	2637.000	AV	37.6	28.0	14.5	41.0	39.1	53.9	14.8	100	152	
Vert.	4960.000	AV	46.4	31.5	6.9	41.5	43.3	53.9	10.6	100	166	
Vert.	7440.000	AV	36.3	36.3	8.0	41.4	39.2	53.9	14.7	100	0	
Vert.	9920.000	AV	34.1	38.1	9.5	40.7	41.0	53.9	12.9	100	0	
Vert.	12400.000	AV	34.5	38.9	9.8	39.8	43.4	53.9	10.5	100	0	

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

*Distance factor [dB](15GHz - 40GHz) = $20 \times \log(3.0[m] / 1.0[m]) = 9.5$ [dB]

*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.1 and No.3 Semi Anechoic Chamber
Date	May 17, 2013	May 18, 2013
Temperature / Humidity	20 deg.C , 40 %RH	26 deg.C , 44 %RH
Engineer	Hikaru Shirasawa	Akira Sato
Mode	Tx, 2402.0 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.	480.000	QP	21.9	17.2	9.4	31.9	16.6	46.0	29.4	100	0	
Hori.	2390.000	PK	48.3	27.6	14.2	40.9	49.2	73.9	24.7	100	0	
Hori.	2400.000	PK	56.3	27.6	14.2	40.9	57.2	73.9	16.7	100	0	
Hori.	2557.000	PK	48.3	27.8	14.4	40.9	49.6	73.9	24.3	100	37	
Hori.	4804.000	PK	53.0	31.2	6.8	41.8	49.2	73.9	24.7	100	108	
Hori.	7206.000	PK	50.0	36.0	7.9	41.4	52.5	73.9	21.4	100	0	
Hori.	9608.000	PK	48.8	38.1	9.3	40.6	55.6	73.9	18.3	100	0	
Hori.	12010.000	PK	47.8	39.0	10.0	39.9	56.9	73.9	17.0	100	0	
Hori.	2390.000	AV	36.4	27.6	14.2	40.9	37.3	53.9	16.6	100	0	
Hori.	2400.000	AV	42.4	27.6	14.2	40.9	43.3	53.9	10.6	100	0	
Hori.	2557.000	AV	37.3	27.8	14.4	40.9	38.6	53.9	15.3	100	37	
Hori.	4804.000	AV	41.0	31.2	6.8	41.8	37.2	53.9	16.7	100	108	
Hori.	7206.000	AV	36.7	36.0	7.9	41.4	39.2	53.9	14.7	100	0	
Hori.	9608.000	AV	35.6	38.1	9.3	40.6	42.4	53.9	11.5	100	0	
Hori.	12010.000	AV	34.5	39.0	10.0	39.9	43.6	53.9	10.3	100	0	
Vert.	33.901	QP	26.4	16.5	6.5	32.2	17.2	40.0	22.8	100	224	
Vert.	56.266	QP	36.5	9.0	6.6	32.2	19.9	40.0	20.1	100	150	
Vert.	74.280	QP	35.1	6.5	7.1	32.1	16.6	40.0	23.4	100	164	
Vert.	2390.000	PK	46.0	27.6	14.2	40.9	46.9	73.9	27.0	100	300	
Vert.	2400.000	PK	51.9	27.6	14.2	40.9	52.8	73.9	21.1	100	300	
Vert.	2557.000	PK	48.6	27.8	14.4	40.9	49.9	73.9	24.0	100	0	
Vert.	4804.000	PK	54.0	31.2	6.8	41.8	50.2	73.9	23.7	100	168	
Vert.	7206.000	PK	49.8	36.0	7.9	41.4	52.3	73.9	21.6	100	0	
Vert.	9608.000	PK	48.1	38.1	9.3	40.6	54.9	73.9	19.0	100	0	
Vert.	12010.000	PK	45.5	39.0	10.0	39.9	54.6	73.9	19.3	100	0	
Vert.	2390.000	AV	36.3	27.6	14.2	40.9	37.2	53.9	16.7	100	300	
Vert.	2400.000	AV	39.1	27.6	14.2	40.9	40.0	53.9	13.9	100	300	
Vert.	2557.000	AV	36.4	27.8	14.4	40.9	37.7	53.9	16.2	100	0	
Vert.	4804.000	AV	43.2	31.2	6.8	41.8	39.4	53.9	14.5	100	168	
Vert.	7206.000	AV	36.7	36.0	7.9	41.4	39.2	53.9	14.7	100	0	
Vert.	9608.000	AV	35.6	38.1	9.3	40.6	42.4	53.9	11.5	100	0	
Vert.	12010.000	AV	32.4	39.0	10.0	39.9	41.5	53.9	12.4	100	0	

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

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

*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.1 and No.3 Semi Anechoic Chamber
Date	May 17, 2013	May 18, 2013
Temperature / Humidity	20 deg.C , 40 %RH	26 deg.C , 44 %RH
Engineer	Hikaru Shirasawa	Akira Sato
Mode	Tx, 2441.0 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.	480.000	QP	21.9	17.3	9.4	31.9	16.7	46.0	29.3	100	0	
Hori.	2597.000	PK	47.8	27.9	14.4	40.9	49.2	73.9	24.7	100	92	
Hori.	4882.000	PK	50.4	31.3	6.8	41.7	46.8	73.9	27.1	100	99	
Hori.	7323.000	PK	49.3	36.2	7.9	41.4	52.0	73.9	21.9	100	0	
Hori.	9764.000	PK	48.1	38.1	9.5	40.6	55.1	73.9	18.8	100	0	
Hori.	12205.000	PK	47.6	38.9	9.9	39.9	56.5	73.9	17.4	100	0	
Hori.	2597.000	AV	36.0	27.9	14.4	40.9	37.4	53.9	16.5	100	92	
Hori.	4882.000	AV	38.7	31.3	6.8	41.7	35.1	53.9	18.8	100	99	
Hori.	7323.000	AV	36.6	36.2	7.9	41.4	39.3	53.9	14.6	100	0	
Hori.	9764.000	AV	35.0	38.1	9.5	40.6	42.0	53.9	11.9	100	0	
Hori.	12205.000	AV	34.4	38.9	9.9	39.9	43.3	53.9	10.6	100	0	
Vert.	34.132	QP	26.4	16.5	6.5	32.2	17.2	40.0	22.8	100	231	
Vert.	55.847	QP	37.1	9.1	6.6	32.2	20.6	40.0	19.4	101	171	
Vert.	74.624	QP	34.9	6.5	7.1	32.1	16.4	40.0	23.6	100	165	
Vert.	2597.000	PK	47.4	27.9	14.4	40.9	48.8	73.9	25.1	100	172	
Vert.	4882.000	PK	53.0	31.3	6.8	41.7	49.4	73.9	24.5	100	162	
Vert.	7323.000	PK	47.3	36.2	7.9	41.4	50.0	73.9	23.9	100	0	
Vert.	9764.000	PK	48.5	38.1	9.5	40.6	55.5	73.9	18.4	100	0	
Vert.	12205.000	PK	48.2	38.9	9.9	39.9	57.1	73.9	16.8	100	0	
Vert.	2597.000	AV	35.0	27.9	14.4	40.9	36.4	53.9	17.5	100	172	
Vert.	4882.000	AV	43.0	31.3	6.8	41.7	39.4	53.9	14.5	100	162	
Vert.	7323.000	AV	36.6	36.2	7.9	41.4	39.3	53.9	14.6	100	0	
Vert.	9764.000	AV	35.6	38.1	9.5	40.6	42.6	53.9	11.3	100	0	
Vert.	12205.000	AV	34.4	38.9	9.9	39.9	43.3	53.9	10.6	100	0	

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

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

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Radiated Emission

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 and No.3 Semi Anechoic Chamber
Date	May 17, 2013	May 18, 2013
Temperature / Humidity	20 deg.C , 40 %RH	26 deg.C , 44 %RH
Engineer	Hikaru Shirasawa	Akira Sato
Mode	Tx, 2480.0 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.	480.000	QP	21.8	17.2	9.4	31.9	16.5	46.0	29.5	100	0	
Hori.	2483.500	PK	45.2	27.6	14.3	40.9	46.2	73.9	27.7	100	59	
Hori.	2637.000	PK	48.9	28.0	14.5	41.0	50.4	73.9	23.5	100	55	
Hori.	4960.000	PK	51.4	31.5	6.9	41.5	48.3	73.9	25.6	100	152	
Hori.	7440.000	PK	49.4	36.3	8.0	41.4	52.3	73.9	21.6	100	0	
Hori.	9920.000	PK	48.4	38.1	9.5	40.7	55.3	73.9	18.6	100	0	
Hori.	12400.000	PK	47.3	38.9	9.8	39.8	56.2	73.9	17.7	100	0	
Hori.	2483.500	AV	32.4	27.6	14.3	40.9	33.4	53.9	20.5	100	59	
Hori.	2637.000	AV	37.7	28.0	14.5	41.0	39.2	53.9	14.7	100	55	
Hori.	4960.000	AV	40.4	31.5	6.9	41.5	37.3	53.9	16.6	100	152	
Hori.	7440.000	AV	36.6	36.3	8.0	41.4	39.5	53.9	14.4	100	0	
Hori.	9920.000	AV	36.2	38.1	9.5	40.7	43.1	53.9	10.8	100	0	
Hori.	12400.000	AV	34.3	38.9	9.8	39.8	43.2	53.9	10.7	100	0	
Vert.	34.159	QP	26.7	16.4	6.5	32.2	17.4	40.0	22.6	100	215	
Vert.	56.125	QP	37.7	9.1	6.6	32.2	21.2	40.0	18.8	100	219	
Vert.	74.633	QP	35.4	6.5	7.1	32.1	16.9	40.0	23.1	100	146	
Vert.	104.881	QP	31.4	10.9	7.3	32.1	17.5	43.5	26.0	100	283	
Vert.	2483.500	PK	45.0	27.6	14.3	40.9	46.0	73.9	27.9	100	118	
Vert.	2637.000	PK	48.5	28.0	14.5	41.0	50.0	73.9	23.9	100	0	
Vert.	4960.000	PK	52.2	31.5	6.9	41.5	49.1	73.9	24.8	100	170	
Vert.	7440.000	PK	49.4	36.3	8.0	41.4	52.3	73.9	21.6	100	0	
Vert.	9920.000	PK	46.0	38.1	9.5	40.7	52.9	73.9	21.0	100	0	
Vert.	12400.000	PK	46.6	38.9	9.8	39.8	55.5	73.9	18.4	100	0	
Vert.	2483.500	AV	34.4	27.6	14.3	40.9	35.4	53.9	18.5	100	118	
Vert.	2637.000	AV	36.1	28.0	14.5	41.0	37.6	53.9	16.3	100	0	
Vert.	4960.000	AV	42.0	31.5	6.9	41.5	38.9	53.9	15.0	100	170	
Vert.	7440.000	AV	36.5	36.3	8.0	41.4	39.4	53.9	14.5	100	0	
Vert.	9920.000	AV	34.0	38.1	9.5	40.7	40.9	53.9	13.0	100	0	
Vert.	12400.000	AV	34.5	38.9	9.8	39.8	43.4	53.9	10.5	100	0	

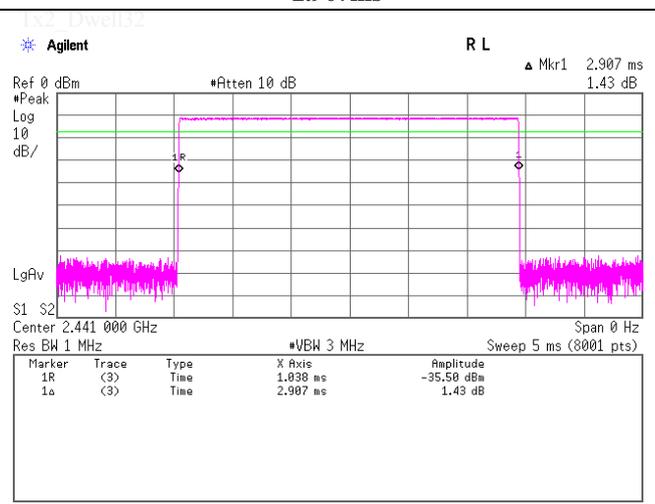
Result = Reading + Ant Factor + Loss(Cable+Attenuator+Filter-Distance factor(above 15GHz)) - Gain(Amplifier)

*Distance factor [dB](15GHz - 40GHz)= 20 x log (3.0[m] / 1.0[m]) = 9.5 [dB]

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

Dwell time factor Calculation chart

Dwell time factor Calculation Tx, Bluetooth, BDR, PRBS9

Worst 100ms Dwell time factor = $20\log((2.907 \times 2)/100) = -24.71\text{dB}$	1cycle On time : 2.907ms															
<p>ON time of some channel during 100ms: Twice This is the worst case in hopping sequence of Bluetooth.</p>	 <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1R</td> <td>(3)</td> <td>Time</td> <td>1.838 ms</td> <td>-35.50 dBm</td> </tr> <tr> <td>1Δ</td> <td>(3)</td> <td>Time</td> <td>2.907 ms</td> <td>1.43 dB</td> </tr> </tbody> </table>	Marker	Trace	Type	X Axis	Amplitude	1R	(3)	Time	1.838 ms	-35.50 dBm	1Δ	(3)	Time	2.907 ms	1.43 dB
Marker	Trace	Type	X Axis	Amplitude												
1R	(3)	Time	1.838 ms	-35.50 dBm												
1Δ	(3)	Time	2.907 ms	1.43 dB												

VBW (Average) setting

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

UL Japan, Inc.

Shonan EMC Lab.

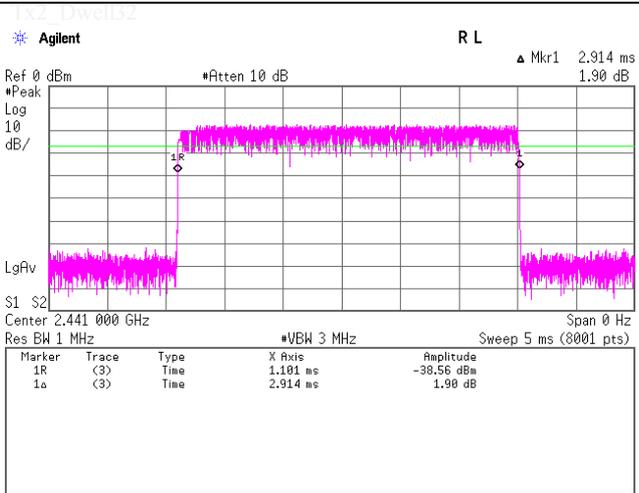
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN

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Dwell time factor Calculation chart

Dwell time factor Calculation Tx, Bluetooth, EDR, PRBS9

Worst 100ms Dwell time factor = $20\log((2.914 \times 2)/100) = -24.69\text{dB}$	1cycle On time : 2.914ms															
<p>ON time of some channel during 100ms: Twice This is the worst case in hopping sequence of Bluetooth.</p>	 <p style="font-size: small;"> Tx2_Dwell32 Agilent R L #Peak 1.90 dB #Atten 10 dB Mkr1 2.914 ms 1R LgAv S1 S2 Center 2.441 000 GHz Span 0 Hz Res BW 1 MHz #VBW 3 MHz Sweep 5 ms (8001 pts) </p> <table border="1" style="width: 100%; font-size: x-small;"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Type</th> <th>X Axis</th> <th>Amplitude</th> </tr> </thead> <tbody> <tr> <td>1R</td> <td>(3)</td> <td>Time</td> <td>1.181 ms</td> <td>-38.56 dBm</td> </tr> <tr> <td>1Δ</td> <td>(3)</td> <td>Time</td> <td>2.914 ms</td> <td>1.90 dB</td> </tr> </tbody> </table>	Marker	Trace	Type	X Axis	Amplitude	1R	(3)	Time	1.181 ms	-38.56 dBm	1Δ	(3)	Time	2.914 ms	1.90 dB
Marker	Trace	Type	X Axis	Amplitude												
1R	(3)	Time	1.181 ms	-38.56 dBm												
1Δ	(3)	Time	2.914 ms	1.90 dB												

VBW (Average) setting

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

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Shonan EMC Lab.

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Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2402MHz (below 1GHz)



UL Japan, Inc.

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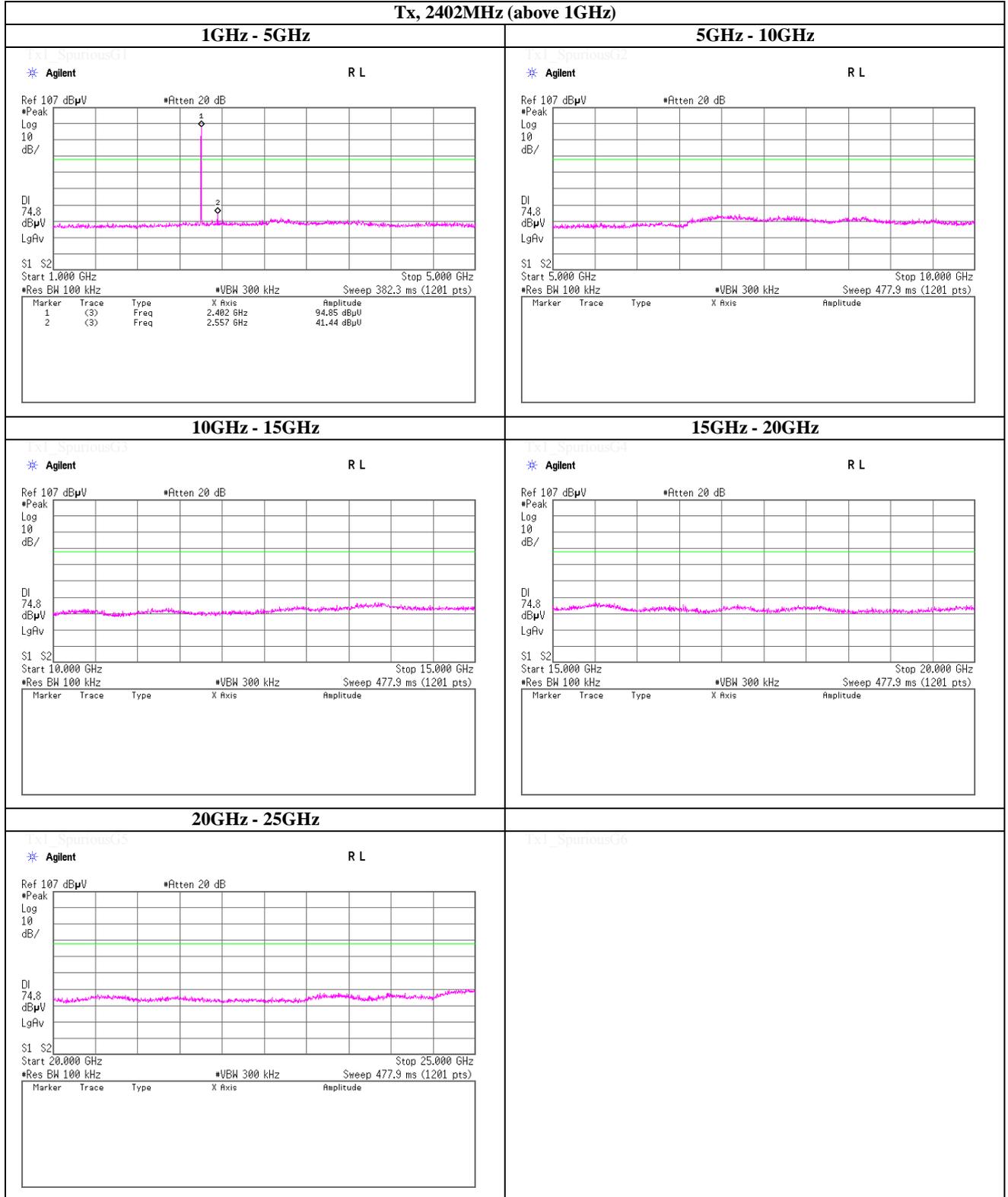
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2402MHz (above 1GHz)



UL Japan, Inc.

Shonan EMC Lab.

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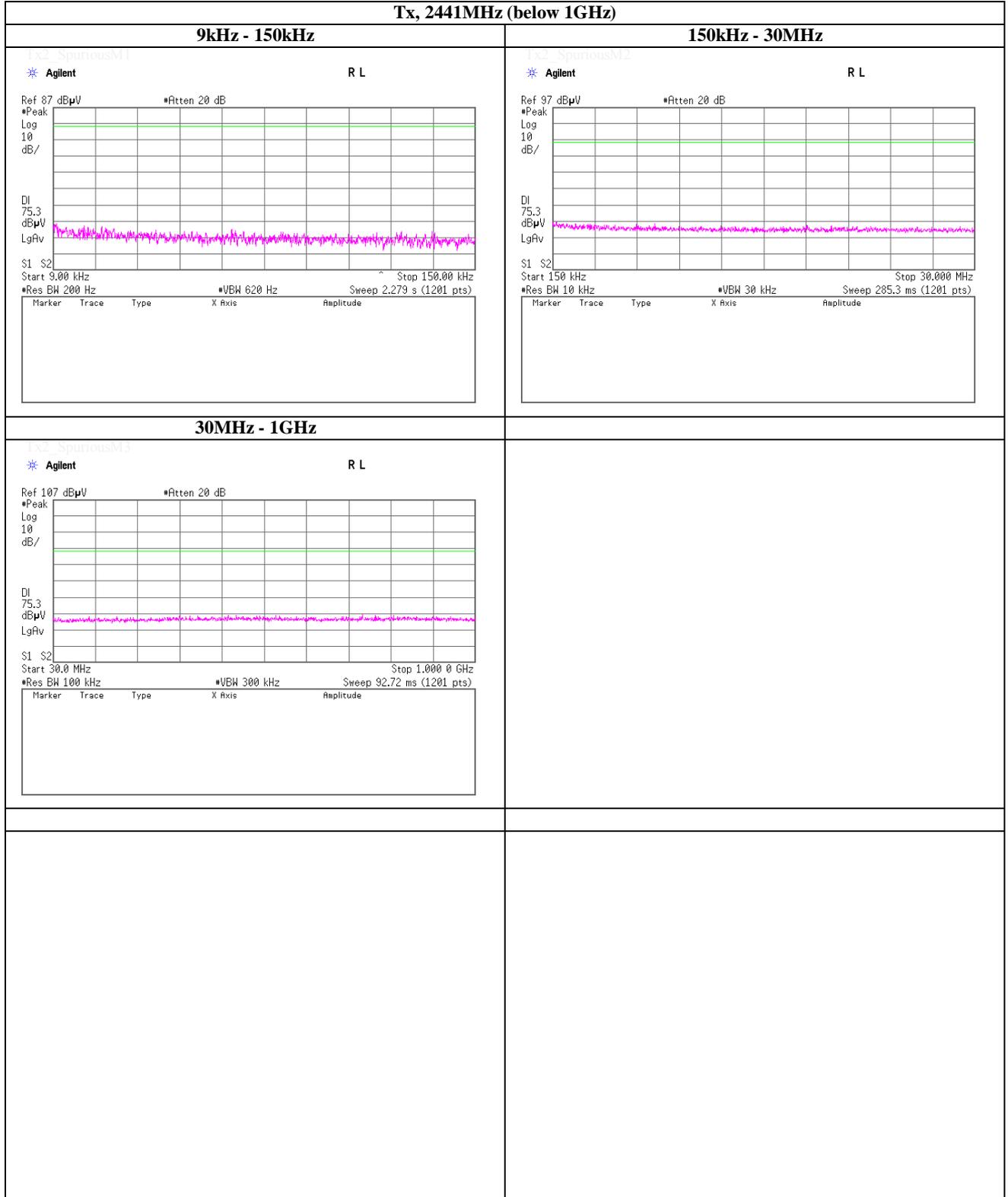
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2441MHz (below 1GHz)



UL Japan, Inc.

Shonan EMC Lab.

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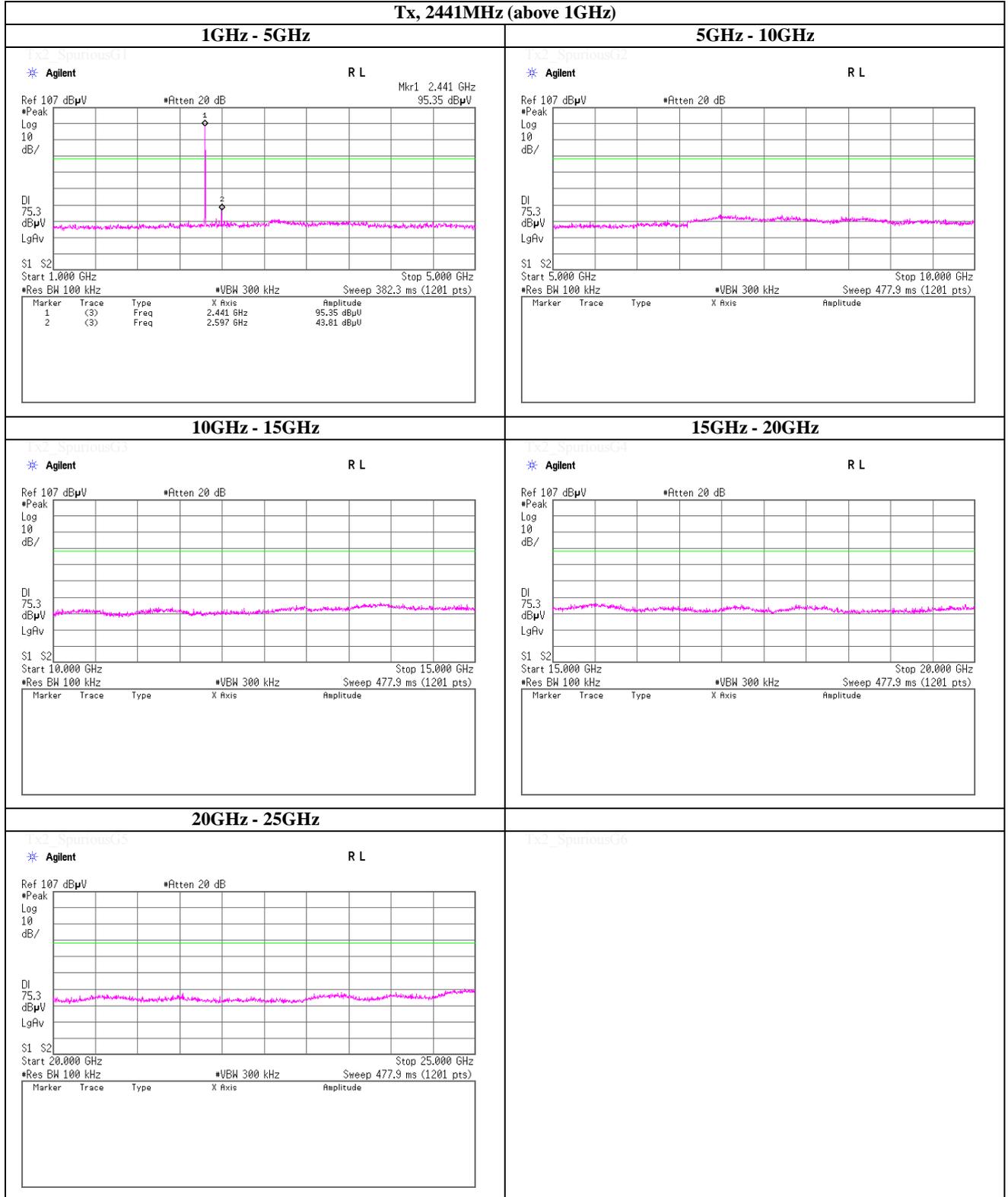
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Spurious emission (Conducted)

Tx, Bluetooth, BDR, PRBS9

Tx, 2441MHz (above 1GHz)



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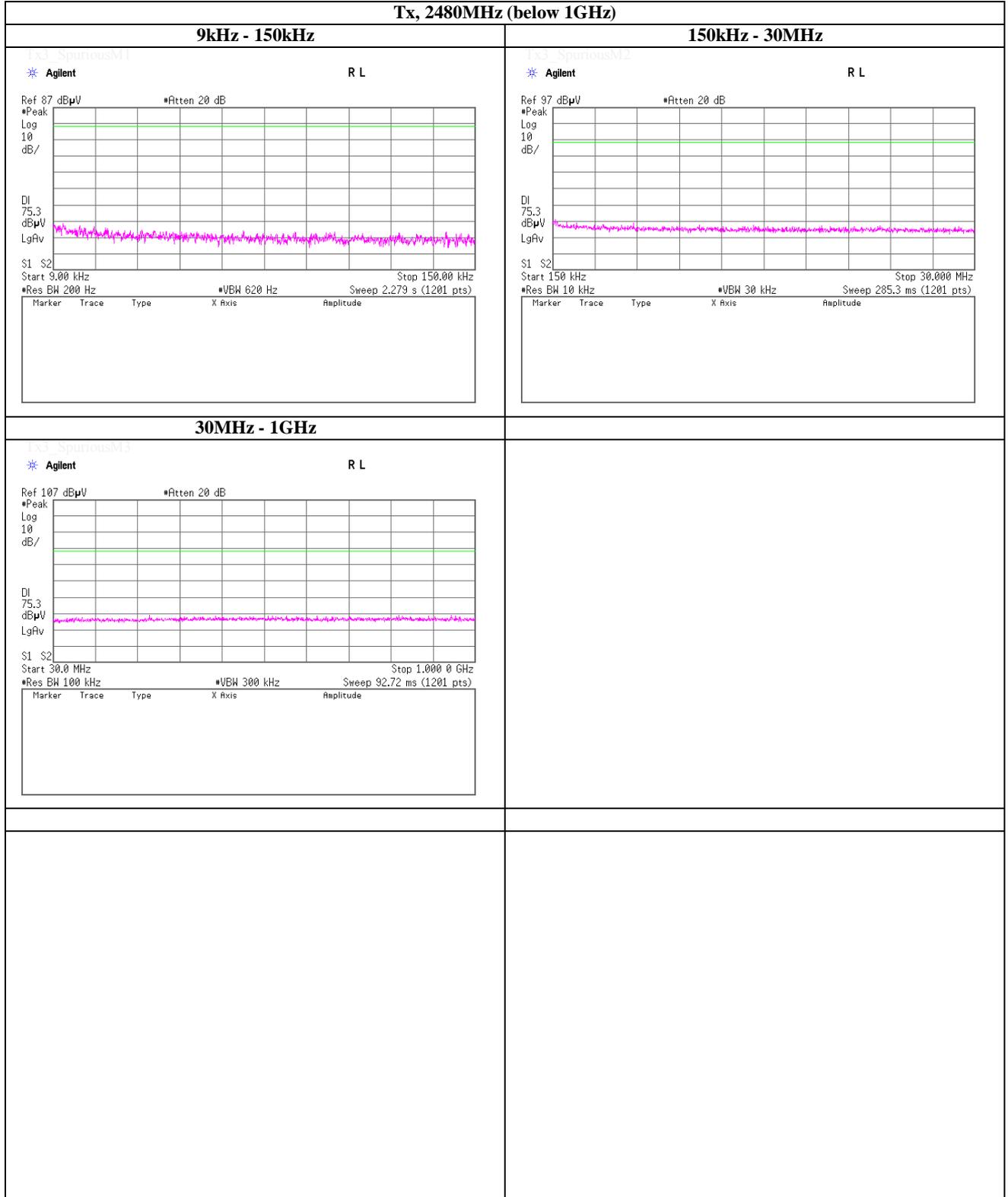
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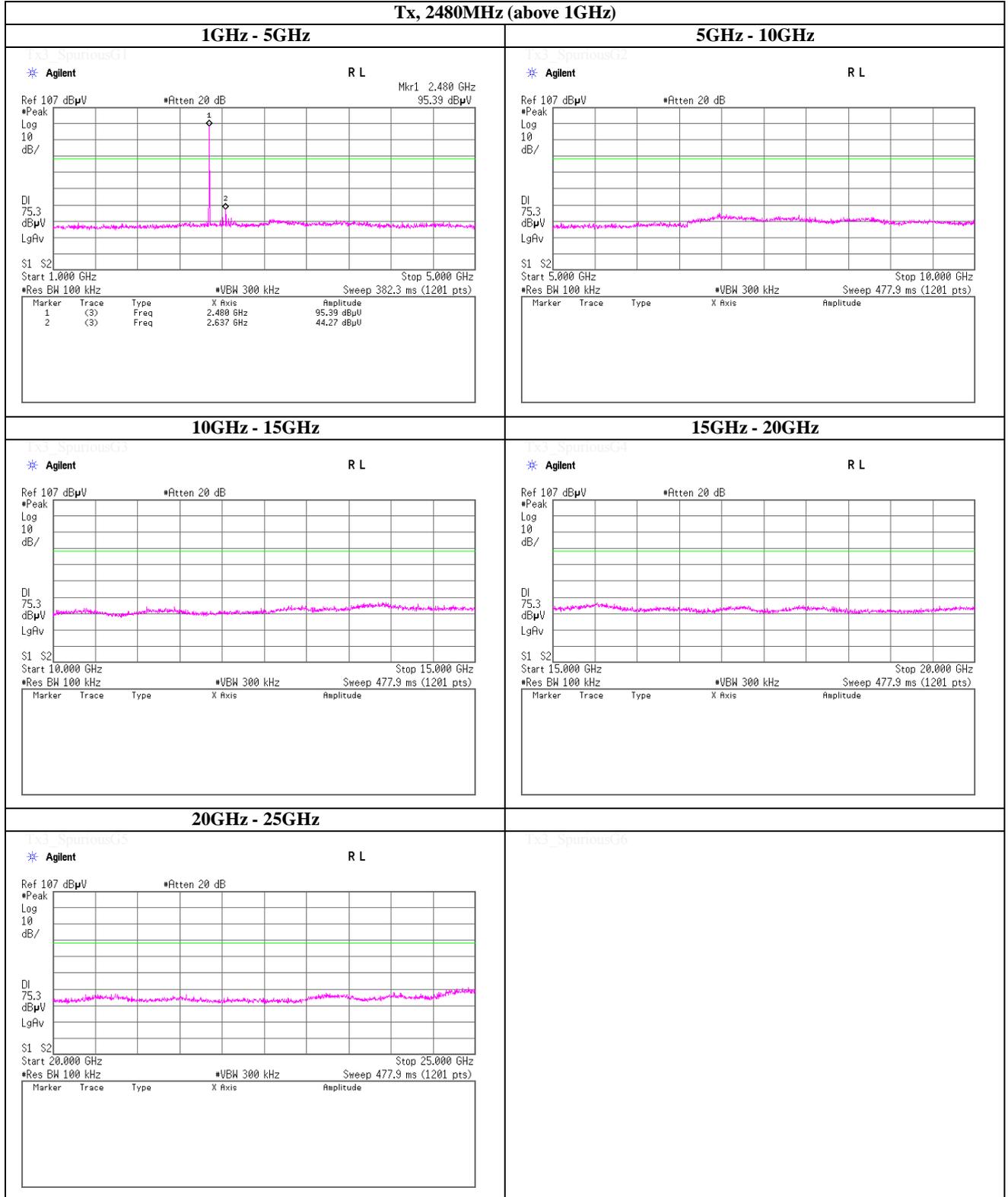
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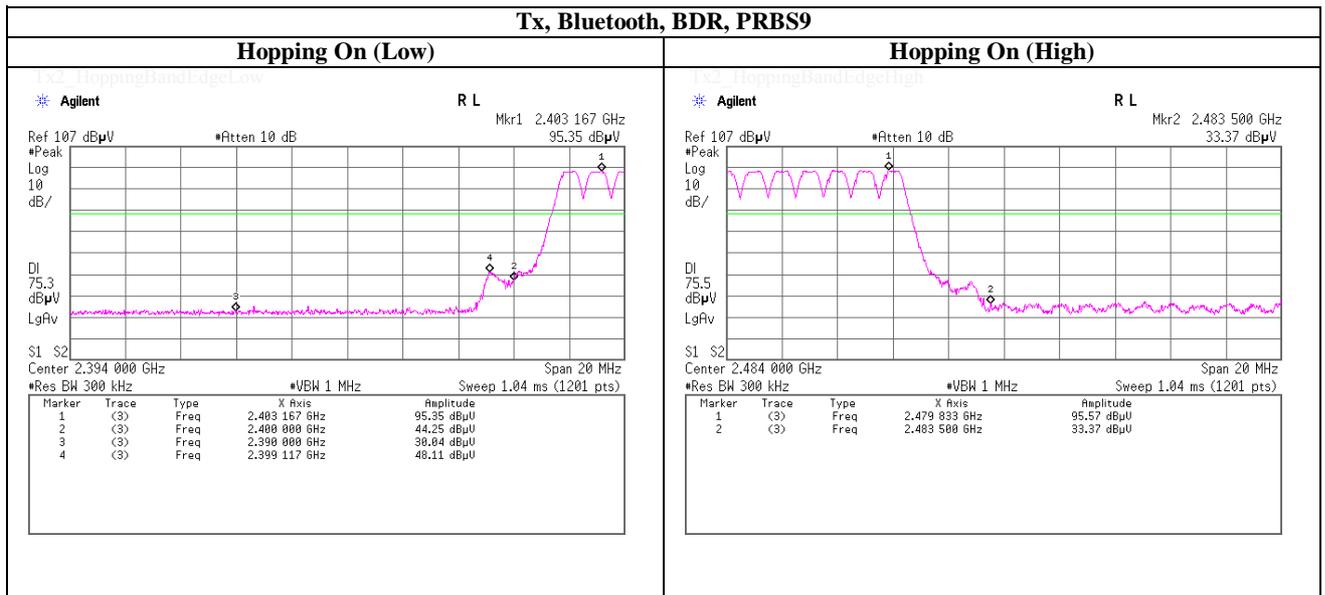
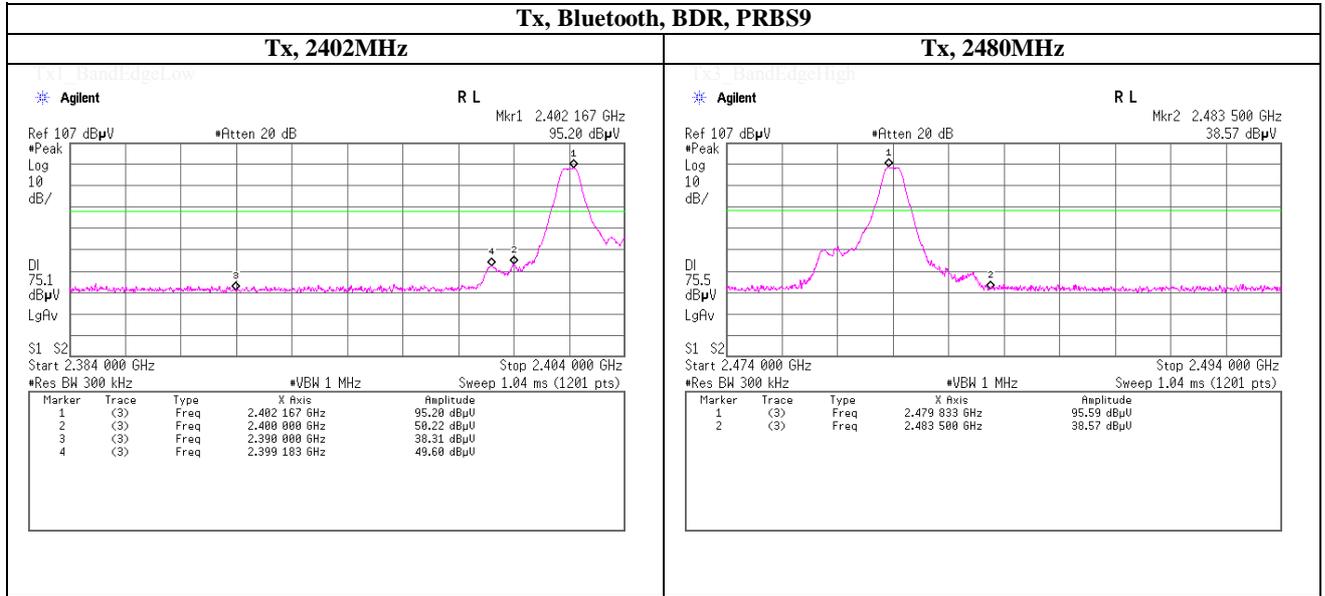
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Spurious emission (Conducted)

Band Edge compliace



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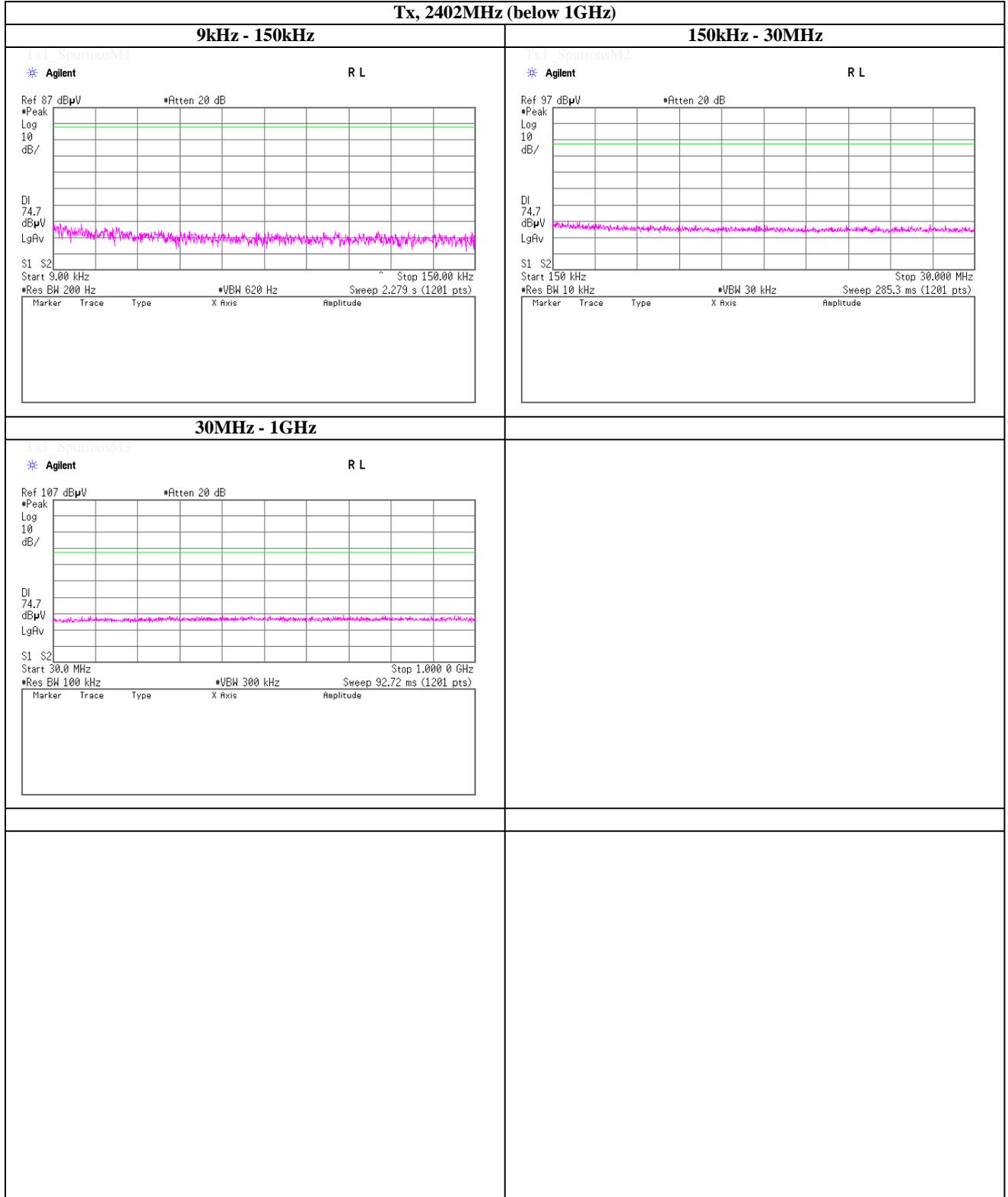
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Tx, 2402MHz (below 1GHz)



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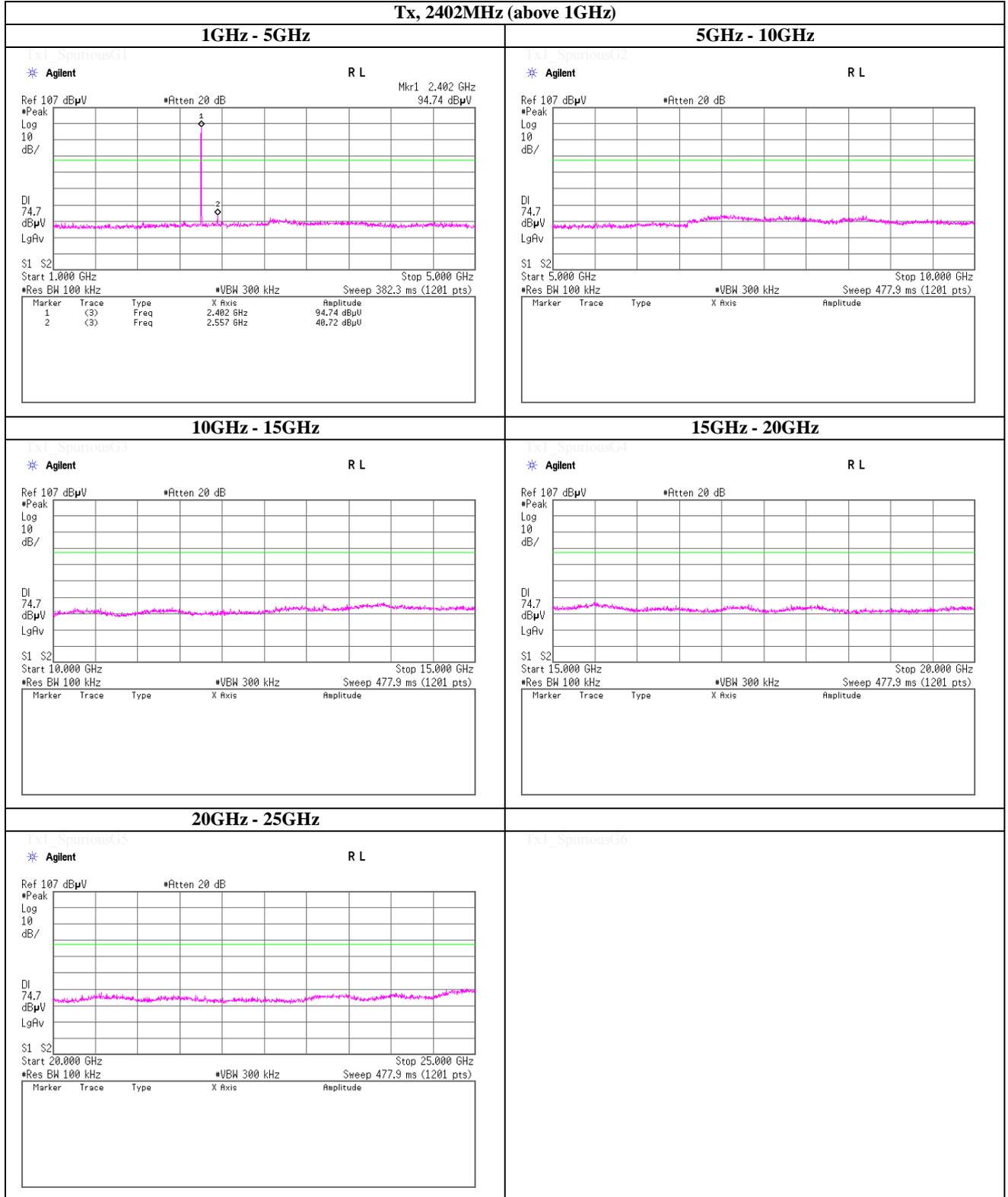
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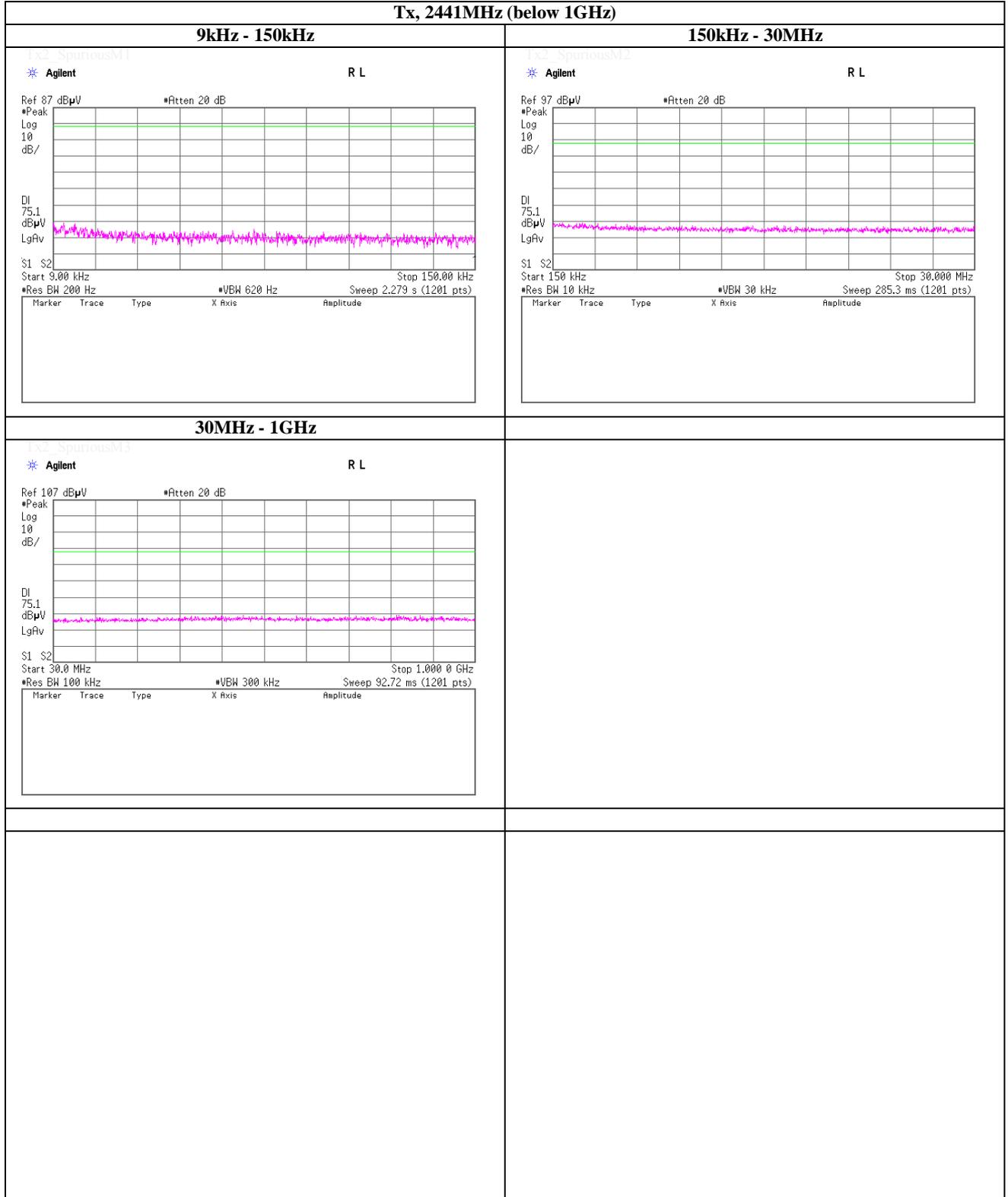
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Tx, 2441MHz (below 1GHz)



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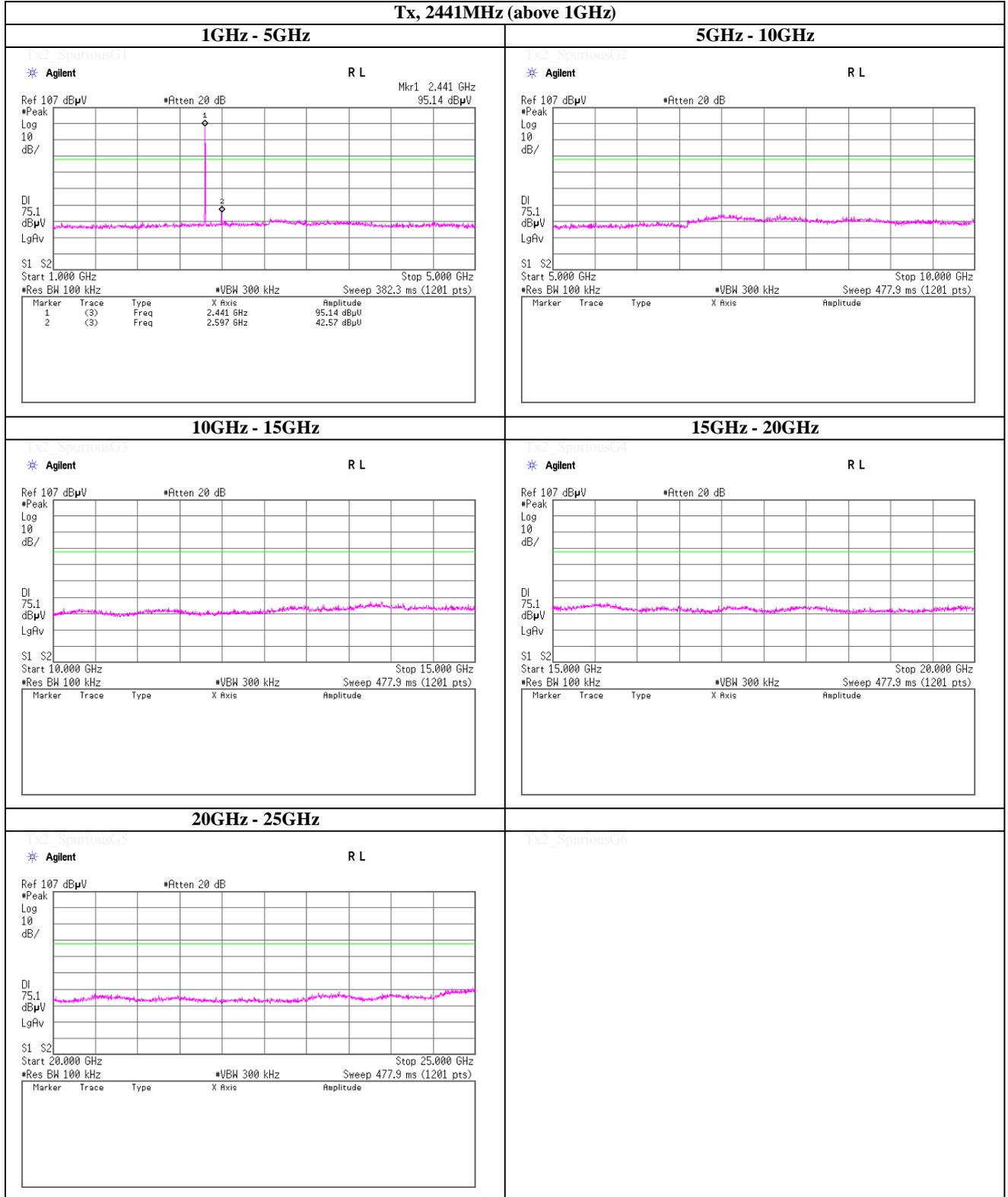
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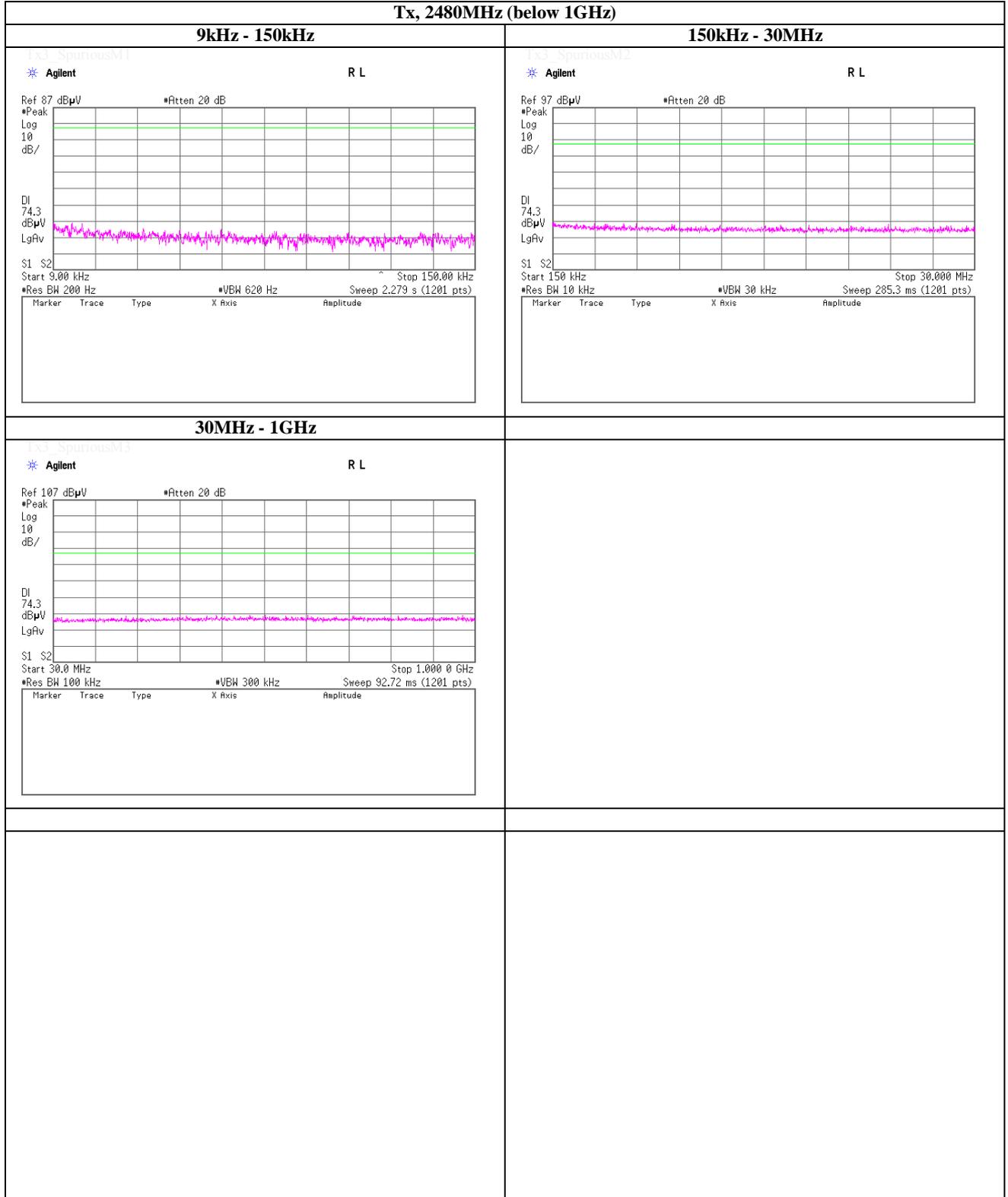
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Tx, 2480MHz (below 1GHz)



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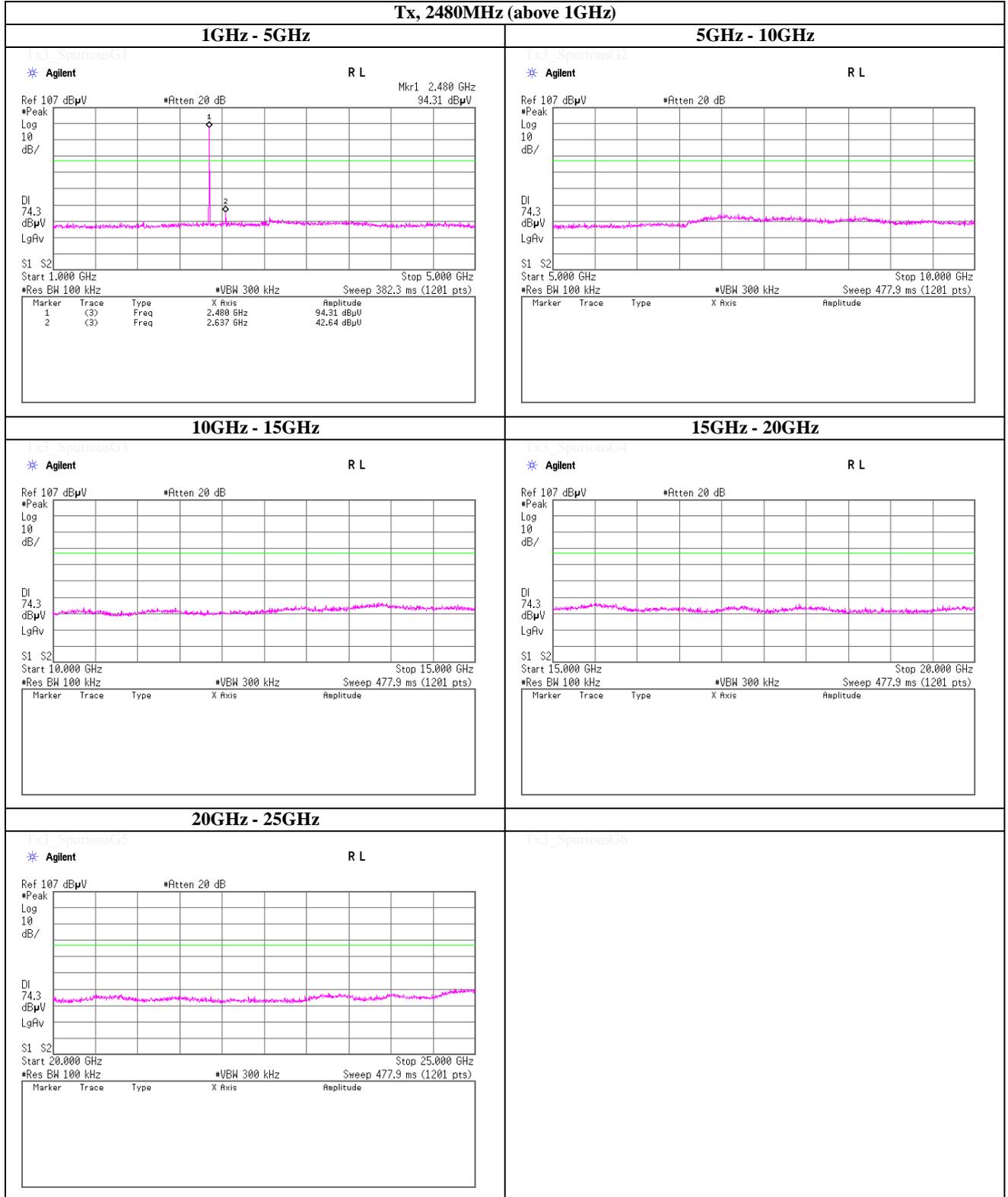
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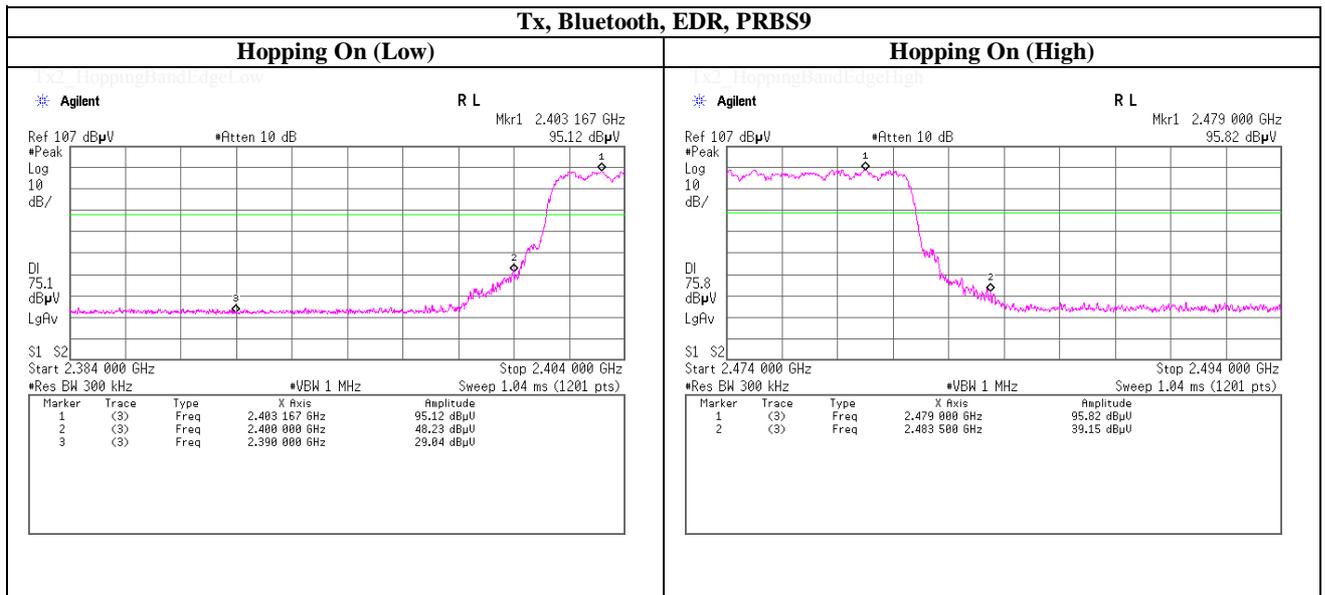
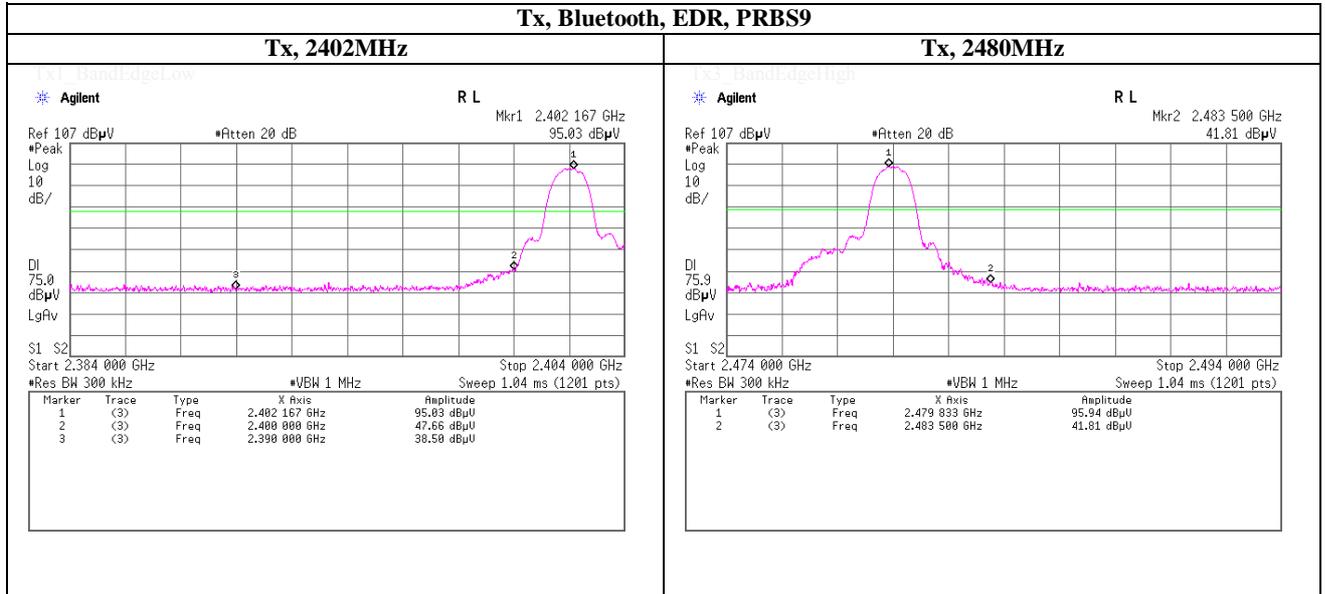
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Spurious emission (Conducted)

Band Edge compliance



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99% Occupied Bandwidth

Tx, Bluetooth, BDR, PRBS9	
<div style="text-align: center;">Tx, 2402MHz</div> <p style="font-size: small;">Tx1 99%OBW * Agilent R L Ref 107 dBµV *Atten 10 dB #Samp Log 10 dB/ LgAv M1 S2 Center 2.402 000 0 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 10.08 ms (1201 pts) Occupied Bandwidth 876.7617 kHz Occ BW % Pwr 99.00 % x dB -20.00 dB Transmit Freq Error 10.454 kHz x dB Bandwidth 938.230 kHz*</p>	<div style="text-align: center;">Tx, 2441MHz</div> <p style="font-size: small;">Tx1 99%OBW * Agilent R L Ref 107 dBµV *Atten 10 dB #Samp Log 10 dB/ LgAv M1 S2 Center 2.441 000 0 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 10.08 ms (1201 pts) Occupied Bandwidth 867.4022 kHz Occ BW % Pwr 99.00 % x dB -20.00 dB Transmit Freq Error -18.230 kHz x dB Bandwidth 938.523 kHz*</p>
<div style="text-align: center;">Tx, 2480MHz</div> <p style="font-size: small;">Tx1 99%OBW * Agilent R L Ref 107 dBµV *Atten 10 dB #Samp Log 10 dB/ LgAv M1 S2 Center 2.480 000 0 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 10.08 ms (1201 pts) Occupied Bandwidth 867.1997 kHz Occ BW % Pwr 99.00 % x dB -20.00 dB Transmit Freq Error -19.488 kHz x dB Bandwidth 935.015 kHz*</p>	<div style="text-align: center;">Tx, Hopping On</div> <p style="font-size: small;">Tx2 Hopping%OBW * Agilent R L Ref 107 dBµV *Atten 10 dB #Samp Log 10 dB/ LgAv M1 S2 Center 2.441 00 GHz Span 100 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1.04 ms (1201 pts) Occupied Bandwidth 78.5004 MHz Occ BW % Pwr 99.00 % x dB -20.00 dB Transmit Freq Error 9.055 kHz x dB Bandwidth 80.691 MHz*</p>

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99% Occupied Bandwidth

Tx, Bluetooth, EDR, PRBS9	
<div style="text-align: center;">Tx, 2402MHz</div> <p style="font-size: small;">Tx1 99%OBW * Agilent R L Ref 107 dBµV *Atten 10 dB #Samp Log 10 dB/ LgAv M1 S2 Center 2.402 000 0 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 10.08 ms (1201 pts)</p> <p style="text-align: center;">Occupied Bandwidth 1.1588 MHz</p> <p style="text-align: right;">Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p style="font-size: x-small;">Transmit Freq Error 2.920 kHz x dB Bandwidth 1.254 MHz*</p>	<div style="text-align: center;">Tx, 2441MHz</div> <p style="font-size: small;">Tx1 99%OBW * Agilent R L Ref 107 dBµV *Atten 10 dB #Samp Log 10 dB/ LgAv M1 S2 Center 2.441 000 0 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 10.08 ms (1201 pts)</p> <p style="text-align: center;">Occupied Bandwidth 1.1574 MHz</p> <p style="text-align: right;">Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p style="font-size: x-small;">Transmit Freq Error -9.825 kHz x dB Bandwidth 1.251 MHz*</p>
<div style="text-align: center;">Tx, 2480MHz</div> <p style="font-size: small;">Tx1 99%OBW * Agilent R L Ref 107 dBµV *Atten 10 dB #Samp Log 10 dB/ LgAv M1 S2 Center 2.480 000 0 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 10.08 ms (1201 pts)</p> <p style="text-align: center;">Occupied Bandwidth 1.1565 MHz</p> <p style="text-align: right;">Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p style="font-size: x-small;">Transmit Freq Error -10.501 kHz x dB Bandwidth 1.249 MHz*</p>	<div style="text-align: center;">Tx, Hopping On</div> <p style="font-size: small;">Tx2 Hopping%OBW * Agilent R L Ref 107 dBµV *Atten 10 dB #Samp Log 10 dB/ LgAv M1 S2 Center 2.441 00 GHz Span 100 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1.04 ms (1201 pts)</p> <p style="text-align: center;">Occupied Bandwidth 78.6044 MHz</p> <p style="text-align: right;">Occ BW % Pwr 99.00 % x dB -20.00 dB</p> <p style="font-size: x-small;">Transmit Freq Error 58.232 kHz x dB Bandwidth 80.877 MHz*</p>

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APPENDIX Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2013/04/09 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2013/04/09 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT	2013/03/04 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2013/04/09 * 12
SCC-G11	Coaxial Cable	Suhner	SUCOFLEX 102	31595/2	AT	2013/03/16 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2013/03/07 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2012/09/11 * 12
SAF-04	Pre Amplifier	TOYO Corporation	TPA0118-36	1440489	RE	2013/03/19 * 12
SCC-G01	Coaxial Cable	Suhner	SUCOFLEX 104A	46497/4A	RE	2013/04/09 * 12
SCC-G21	Coaxial Cable	Suhner	SUCOFLEX 104	296169/4	RE	2012/05/22 * 12
SHA-01	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	RE	2012/08/20 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2013/02/27 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2012/10/04 * 12
SJM-08	Measure	PROMART	SEN1935	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFLMF)	-	CE/RE	-
KAT10-S2	Attenuator	Agilent	8490D 010	06036	RE	2012/12/18 * 12
KFL-01	Highpass Filter	Hewlett Packard	84300 80038	004	RE	2013/04/03 * 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
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2013/02/12 * 12
SAT6-06	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2012/10/08 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2013/04/03 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2012/10/08 * 12
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	-	CE/RE	-
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2012/09/21 * 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	ES140	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 disturbance voltage