



RADIO TEST REPORT

Test Report No.: 33CE0266-SH-02-C

Applicant : Toshiba Corporation
Type of Equipment : Notebook Computer
Model No. : Satellite U930
FCC ID : CJ6UPSU7FPC2
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.
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: November 17 to December 4, 2012

Tested by:

Tatsuya Arai
Engineer of WiSE Japan,
UL Verification Service

Approved by :

Toyokazu Imamura
Leader of WiSE Japan,
UL Verification Service

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



UL Japan, Inc.

Shonan EMC Lab.

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 33CE0266-SH-02-C

[illegible]

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SECTION 1: Customer information

Company Name : Toshiba Corporation
Address : 2-9, Suehiro-cho, Ome-shi, Tokyo, 198-8710 Japan
Telephone Number : +81 42 834 1050
Facsimile Number : +81 42 830 7331
Contact Person : Toshiyuki Echigo

SECTION 2: Equipment under test (E.U.T.)**2.1 Identification of E.U.T.**

Type of Equipment : Notebook Computer
Model Number : Satellite U930
Serial Number : Refer to 4.2 in this report.
Rating : DC19V
Country of Mass-production : China
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : November 14, 2012
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: Satellite U930 (referred to as the EUT in this report) is a Notebook Computer.

Derived models of the EUT:

Model	Touch screen function
Satellite U930 (EUT)	-
Satellite U930t	Yes
Satellite U935	-
Satellite U935t	Yes

Model: Satellite U930/ Satellite U930t has a different sales channel with Satellite U935/Satellite U935t.

Clock frequency(ies) in the system : 40MHz (XTAL)

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Radio specification:

Bluetooth:

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth : 79MHz
Channel spacing : 1MHz (BDR/EDR mode), 2MHz (Low Energy mode)
Type of modulation : FHSS, DSSS
Antenna type : PIFA
Antenna gain with cable loss : 3.24dBi
Antenna connector type : U.FL
ITU code : F1D, G1D

Refer to the test report: 33CE0266-SH-02-B for Bluetooth part (other than Low Energy mode).

When Bluetooth is used, IEEE 802.11 a/b/g/n is not transmitted.

Wireless LAN:

Equipment type : Transceiver
Frequency of operation : 2.4GHz: 2412-2462MHz (IEEE 802.11b, 11g, 11n-HT20)
2422-2452MHz (IEEE 802.11n-HT40)
W52: 5180-5240MHz (IEEE 802.11a, 11n-HT20)
5190-5230MHz (IEEE 802.11n-HT40)
W53: 5260-5320MHz (IEEE 802.11a, 11n-HT20)
5270-5310MHz (IEEE 802.11n-HT40)
W56: 5500-5700MHz (IEEE 802.11a, 11n-HT20)
5510-5670MHz (IEEE 802.11n-HT40)
W58: 5745-5825MHz (IEEE 802.11a, 11n-HT20)
5755-5795MHz (IEEE 802.11n-HT40)
Bandwidth : 20MHz (IEEE 802.11a/b/g/n), 40MHz (IEEE 802.11n)
Channel spacing : 5MHz (2.4GHz),
20MHz (11a, 11n (HT20, 5GHz)), 40MHz (11n (HT40, 5GHz))
Type of modulation : DSSS, OFDM
Antenna type : PIFA
Antenna gain with cable loss : 3.24dBi (2.4GHz),
3.64dBi (W52), 3.73dBi (W53), 4.77dBi (W56), 4.97dBi (W58)
Antenna connector type : U.FL
ITU code : D1D, G1D

Refer to the test report: 33CE0266-SH-02-A/D/E for Wireless LAN part.

Operation temperature range : 0 to +80 deg.C

FCC 15.31 (e)

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

FCC 15.203

The EUT has a unique coupling/antenna connector (U.FL). Therefore the equipment complies with the requirement.

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2012, final revised on August 13, 2012 and effective September 12, 2012
 Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
 Section 15.207 Conducted limits
 Section 15.209 Radiated emission limits, general requirements
 Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz,
 and 5725-5850MHz

The EUT will be tested for compliance with FCC Part 15 Subpart B by the customer.

3.2 Procedures & Results

Item	Test Procedure *1)	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.10:2009	FCC 15.207	-	N/A	5.0dB Freq.: 27.64840MHz Detection: Average Phase: N Mode: Tx 2442MHz	Complied
6dB bandwidth	ANSI C63.10:2009	FCC 15.247 (a)(2)	Conducted	N/A	* See data	Complied
Maximum peak output power	ANSI C63.10:2009	FCC 15.247 (b)(3)	Conducted	N/A		Complied
Out of band emission & Restricted band edges	ANSI C63.10:2009	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	1.6dB Freq.: 2483.500MHz Polarization: Horizontal Detection: Average Mode: Tx 2480MHz	Complied
Power density	ANSI C63.10:2009	FCC 15.247 (e)	Conducted	N/A	* See data	Complied

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

*1) These tests were also referred to KDB 558074 (FCC), "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99%)	ANSI C63.10:2009, 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.

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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) 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 test

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

Radiated emission test

The data listed in this test report meets the limits unless the uncertainty is taken into consideration.

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
☐ No.1 semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☐ No.2 semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
☒ No.3 semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
☐ No.4 semi-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
☐ No.1 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☐ No.2 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
☒ No.3 shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
☐ No.4 shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
☒ No.5 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☐ No.6 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
☒ No.7 shielded room	-	-	2.76 x 3.76 x 2.4	2.76 x 3.76	-

3.6 Test setup, Test data & Test instruments

Refer to APPENDIX 1 to 3.

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SECTION 4: Operation of E.U.T. during testing

4.1 Operating mode

Test item	Mode	Tested frequency
All items	Transmitting Hopping OFF (Low Energy), Payload: PRBS9	2402MHz, 2442MHz, 2480MHz

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

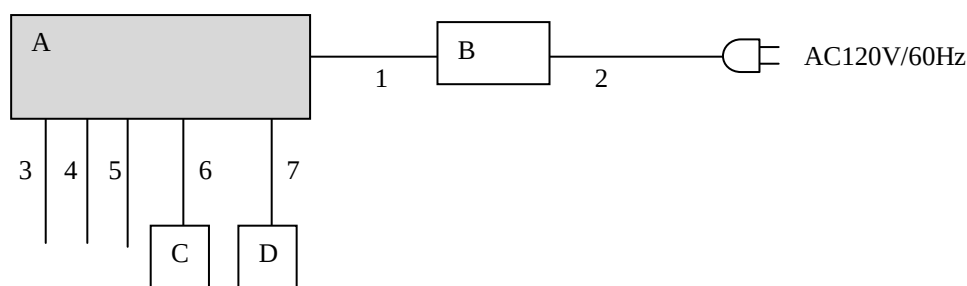
Power settings: Fixed

Test software: DRTU version 1.5.7.0432 (Intel)

Antenna port used: AUX (Bluetooth is transmitted from this port only.)

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

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	Notebook Computer	Satellite U930	*1)	Toshiba	EUT *2)
B	AC Adaptor	PA5096U-1ACA	G71C000FF1100	Toshiba	-
C	Mouse	MO28UOL	453859	Lenovo	-
D	Headphones	HP-H500N	-	AudioComm	-

*1) XC134402H: Maximum peak output power test, XC125749H: Other test

*2) Intel® Centrino® Advanced -N 6235 (Model: 6235ANHMW, FCC ID: PD96235ANH) is installed in the EUT.

List of cables used

No.	Cable Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	1.7	Unshielded	Unshielded	-
2	AC	1.7	Unshielded	Unshielded	-
3	HDMI	3.0	Shielded	Shielded	-
4	USB	2.0	Shielded	Shielded	-
5	USB	1.8	Shielded	Shielded	-
6	Audio	1.2	Unshielded	Unshielded	-
7	Mouse	1.8	Unshielded	Unshielded	-

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SECTION 5: Conducted emission

5.1 Operating environment

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

5.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 0.8m above the conducting ground plane.

The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.

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

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

Photographs of the set up are shown in APPENDIX 3.

5.3 Test conditions

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

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT 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 1

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SECTION 6: Radiated emission

6.1 Operating environment

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

6.2 Test configuration

EUT was placed on a urethane platform of nominal size, 0.5m by 0.5m, raised 0.8m above the conducting ground plane. The rear of EUT was aligned and flushed with rear of tabletop.
Photographs of the set up are shown in APPENDIX 3.

6.3 Test conditions

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

6.4 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 *1)	Peak
IF Bandwidth	120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 3MHz Detector: RMS	RBW: 100kHz VBW: 300kHz

*1) Average Power Measurement was measured based on 10.2.3.3 and 8.2.1 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

The carrier level and noise levels were confirmed at each tilt angle of LCD of EUT to see the angle of maximum noise, and the test was made at the tilt angle of 90 deg. (below 1GHz) / 135 deg. (above 1GHz) that has the maximum noise.

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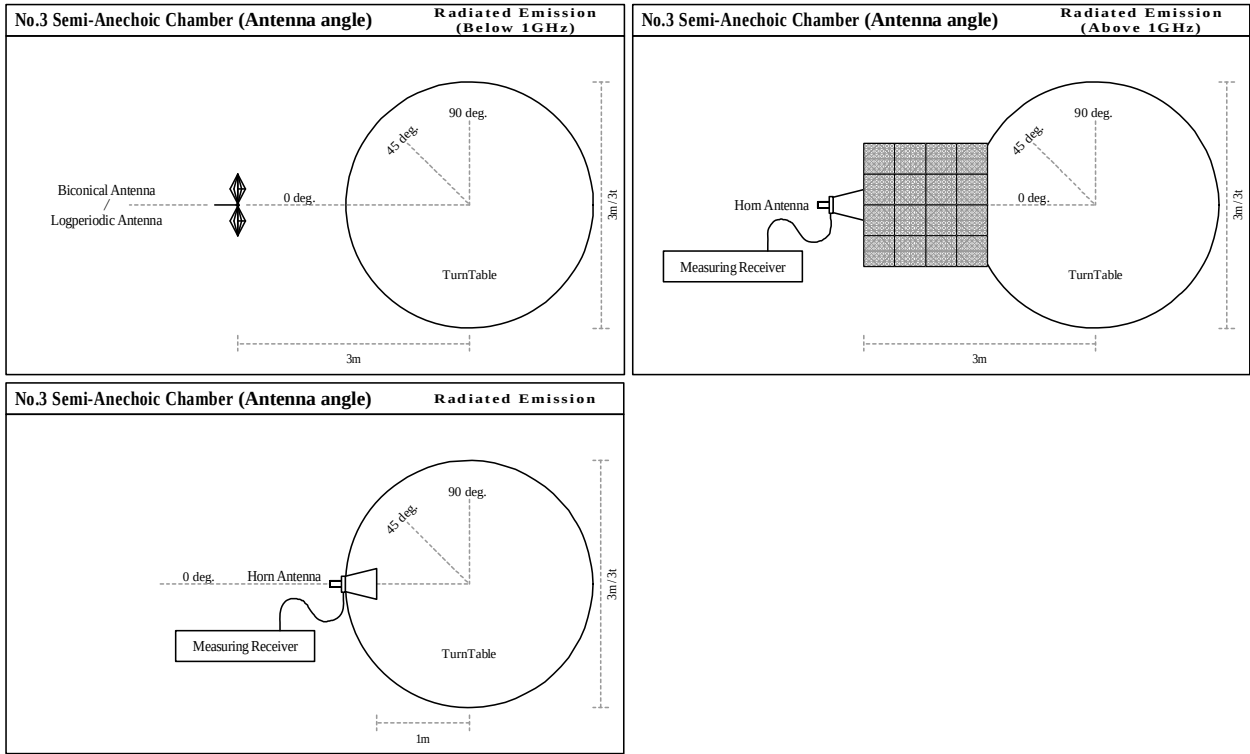
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Figure 1. Antenna angle



6.5 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.

6.6 Results

Summary of the test results : Pass
* No noise was detected above the 3rd order harmonics.

Refer to APPENDIX 1

SECTION 7: Out of band emissions (Antenna port conducted)

Test procedure

The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port. In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement. In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=10kHz)

Summary of the test results: Pass
Refer to APPENDIX

SECTION 8: 6dB bandwidth & Occupied bandwidth (99%)

Test procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port. The test was measured based on Method 7.1 Option 1 and 7.2 Option 2 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX

SECTION 9: Maximum peak output power

Test procedure

The Maximum Peak Output Power was measured with a power meter connected to the antenna port. The test was measured based on Method 8.1.3 Option 3 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX

SECTION 10: Peak power density

Test procedure

The peak power density was measured with a spectrum analyzer connected to the antenna port.

Instrument used : Spectrum Analyzer
RBW / VBW : 3kHz / 9.1kHz

The test was measured based on Method 9.1 Option 1 of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass
Refer to APPENDIX

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Contents of APPENDIXES

APPENDIX 1: Data of Radio tests

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

APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Conducted emission
Radiated emission

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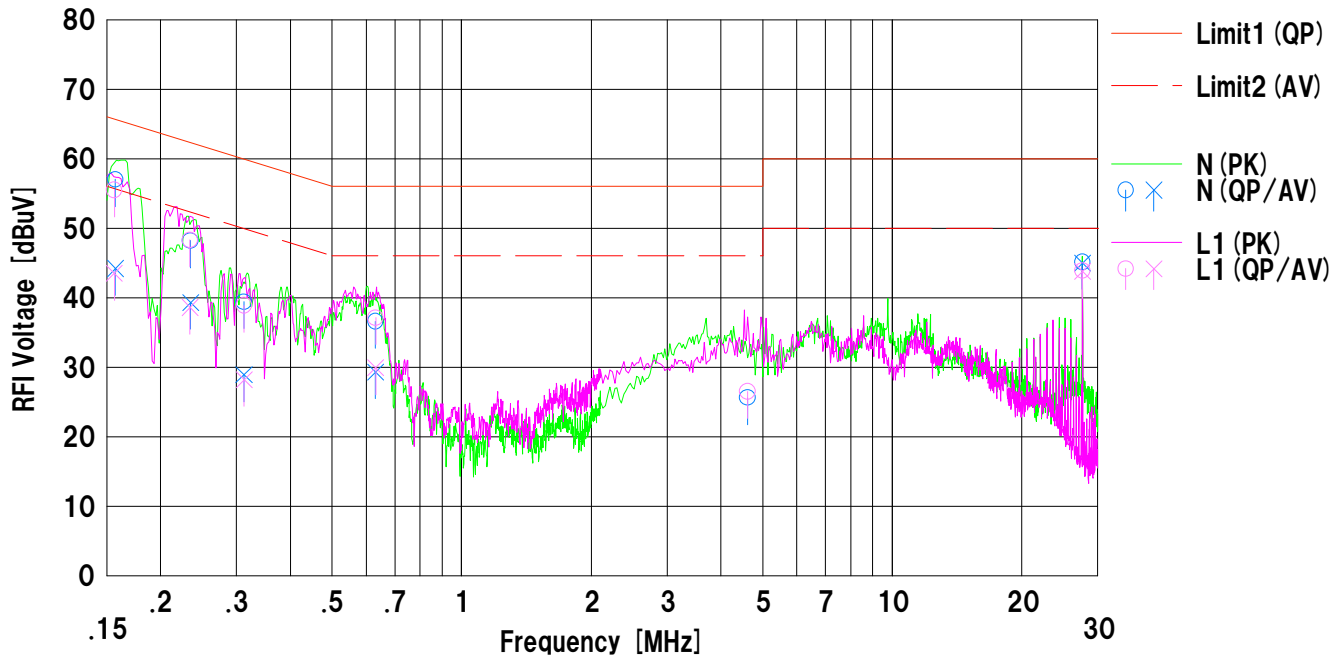
DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2012/12/04

Mode : Bluetooth, LE, Tx 2442MHz
Report No. : 33CE0266-SH-02-C
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C / 39%RH

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

Engineer : Tatsuya Arai



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	0.15690	44.3	31.5	12.7	57.0	44.2	65.6	55.6	8.6	11.4	N	
2	0.23460	35.5	26.6	12.7	48.2	39.3	62.2	52.2	14.0	12.9	N	
3	0.31240	26.7	16.2	12.7	39.4	28.9	59.9	49.9	20.5	21.0	N	
4	0.63100	23.9	16.6	12.7	36.6	29.3	56.0	46.0	19.4	16.7	N	
5	4.61600	12.7	---	12.9	25.6	---	56.0	46.0	30.4	---	N	
6	27.64840	31.3	31.2	13.8	45.1	45.0	60.0	50.0	14.9	5.0	N	
7	0.15620	42.8	30.8	12.7	55.5	43.5	65.6	55.6	10.1	12.1	L1	
8	0.23380	35.6	25.9	12.7	48.3	38.6	62.3	52.3	14.0	13.7	L1	
9	0.31250	26.2	15.5	12.7	38.9	28.2	59.9	49.9	21.0	21.7	L1	
10	0.63150	24.4	17.2	12.7	37.1	29.9	56.0	46.0	18.9	16.1	L1	
11	4.61607	13.6	---	12.9	26.5	---	56.0	46.0	29.5	---	L1	
12	27.64840	30.1	30.0	13.8	43.9	43.8	60.0	50.0	16.1	6.2	L1	

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

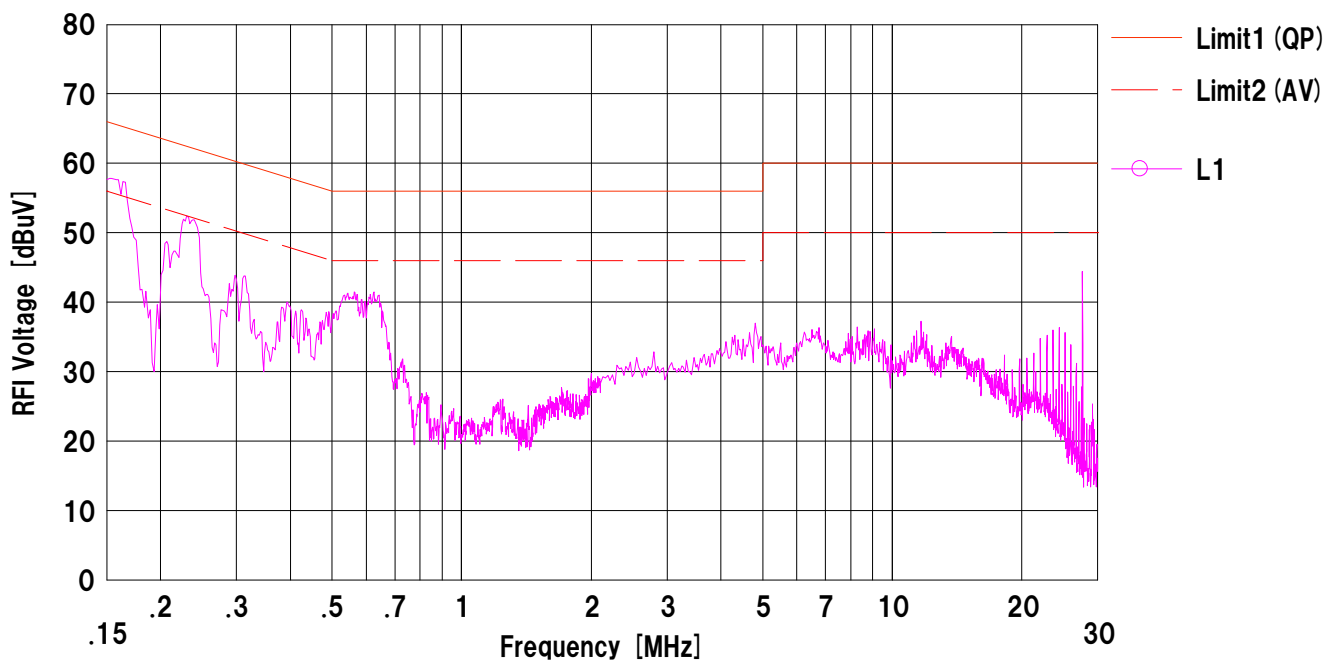
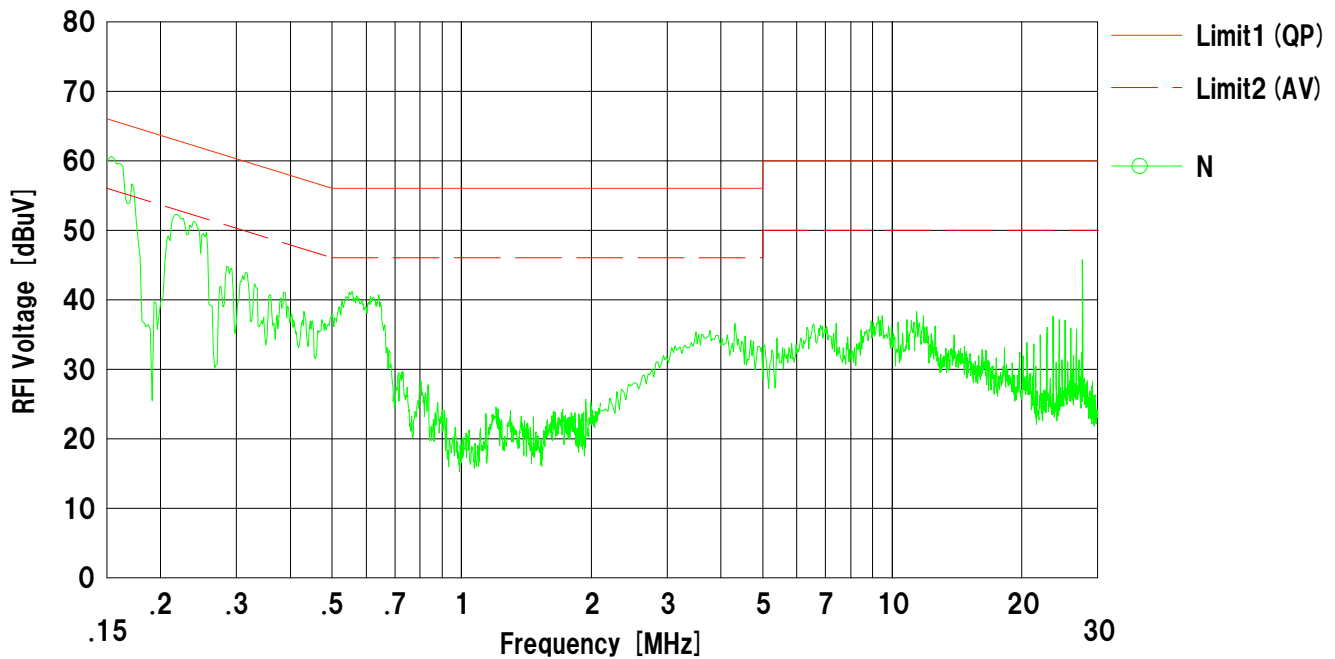
DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2012/12/04

Mode : Bluetooth, LE, Tx 2402MHz
Report No. : 33CE0266-SH-02-C
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C / 39%RH

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

Engineer : Tatsuya Arai



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

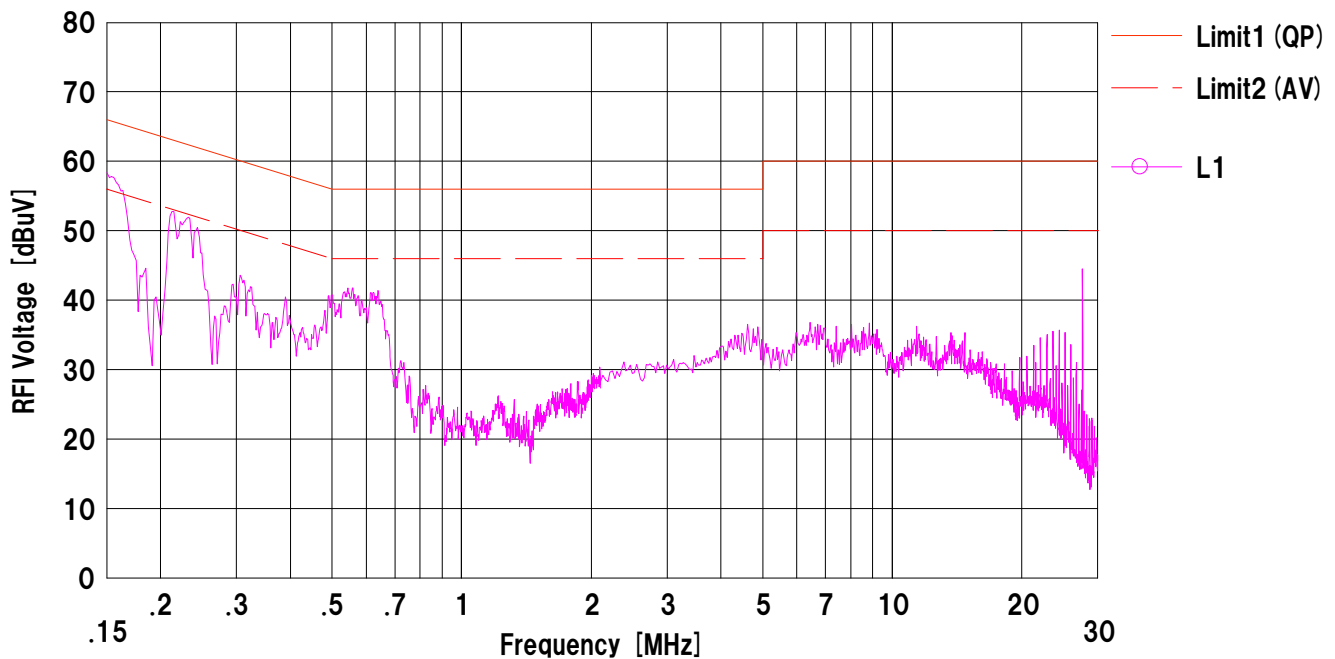
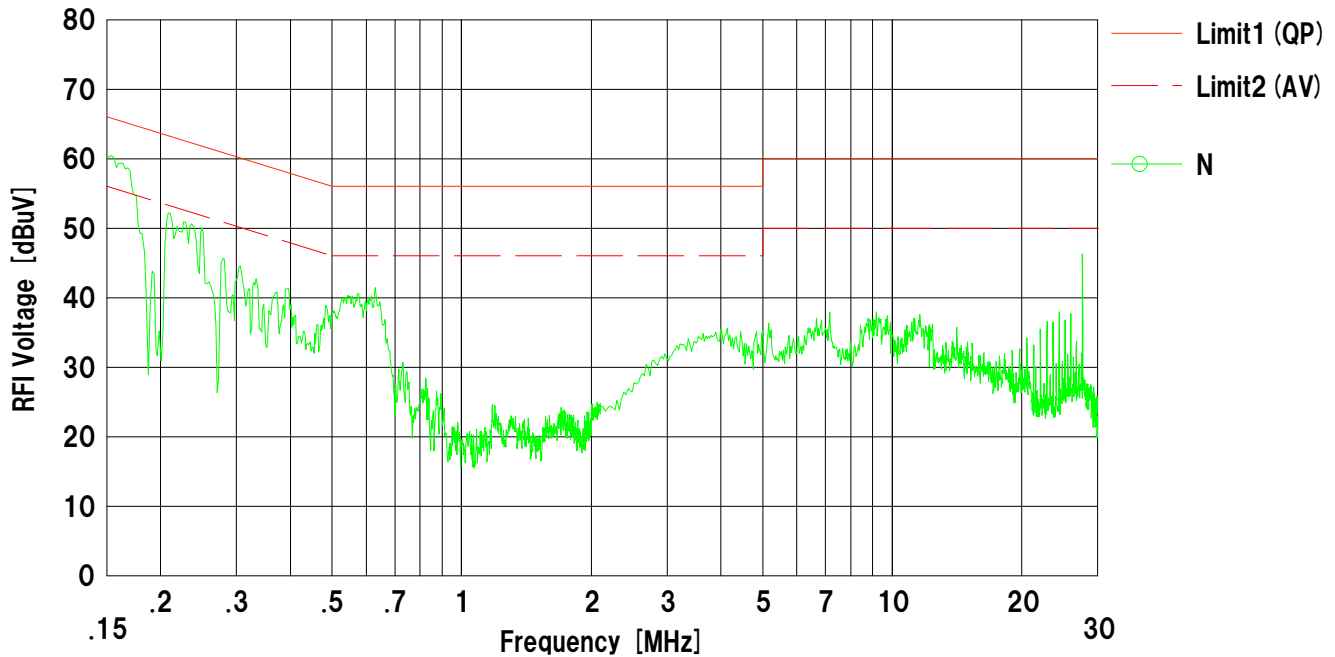
DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2012/12/04

Mode : Bluetooth, LE, Tx 2480MHz
Report No. : 33CE0266-SH-02-C
Power : AC 120V / 60Hz
Temp./Humi. : 25deg.C / 39%RH

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

Engineer : Tatsuya Arai

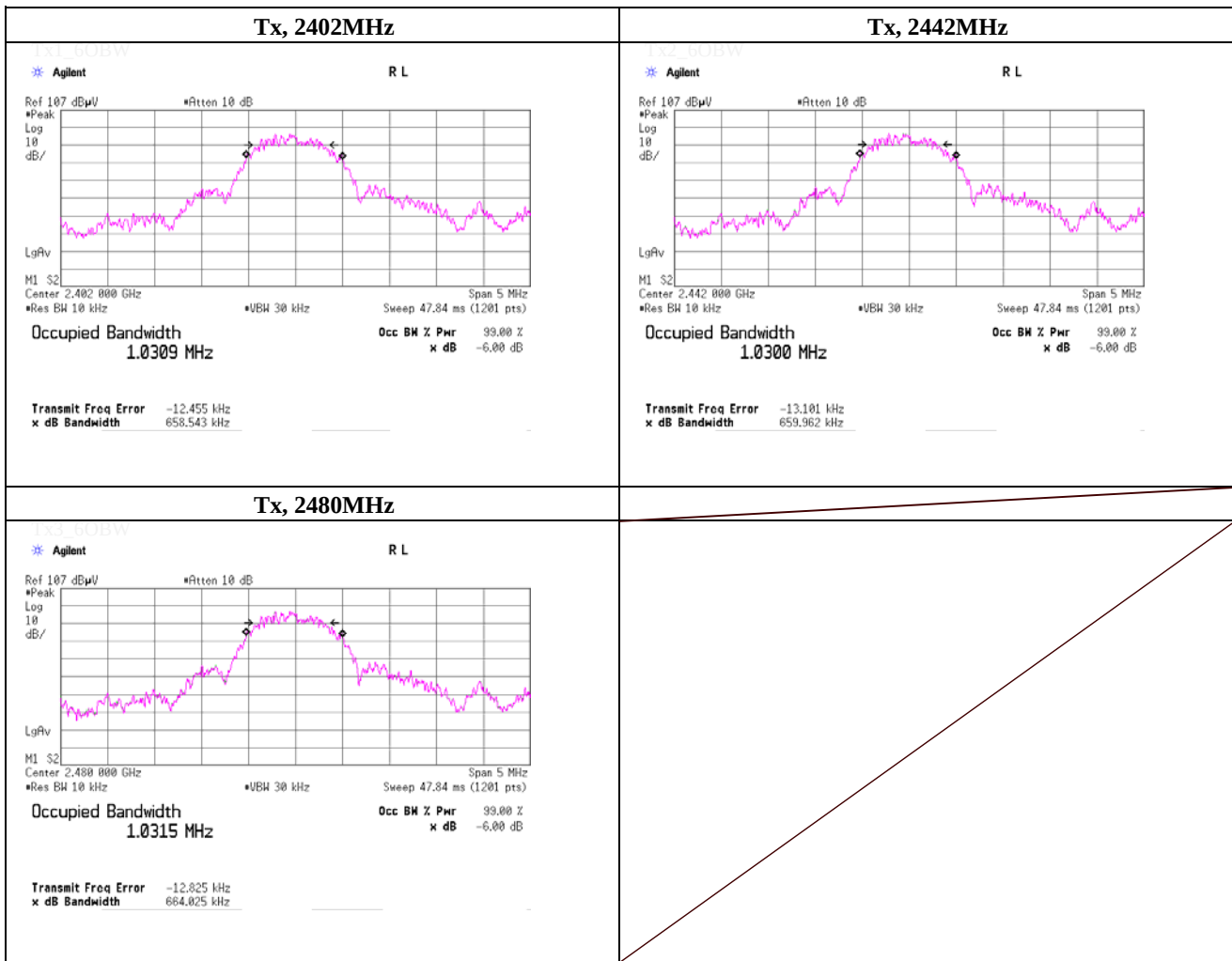


Calculation:Result [dBuV] =Reading [dBuV] +C.Fac (LISN+Cable+ATT) [dB]
LISN: SLS-05

-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	11/28/2012	
Temperature / Humidity	22deg.C , 50%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth Low Energy, PN9	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2402.0000	0.659	> 0.500
2442.0000	0.660	> 0.500
2480.0000	0.664	> 0.500

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Maximum Peak Conducted Output Power

(Option 3)

Test place UL Japan, Inc. Shonan EMC Lab. No.7 Shielded Room
 Date November 17, 2012
 Temperature / Humidity 24deg.C , 34%RH
 Engineer Kenichi Adachi
 Mode Tx, Bluetooth Low Energy, PN9,

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

Ch	Freq. [MHz]	P/M (Peak) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
Low	2402.0	-4.16	0.74	10.00	6.58	4.55	30.00	1000	23.42
Mid	2442.0	-3.66	0.75	10.00	7.09	5.12	30.00	1000	22.91
High	2480.0	-3.17	0.75	10.00	7.58	5.73	30.00	1000	22.42

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

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Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date November 28, 2012 December 2, 2012
Temperature / Humidity 24deg.C , 35 %RH 23deg.C , 30 %RH
Engineer Shinichi Takano Kenichi Adachi
Mode Tx, 2402 MHz
 Tx, Bluetooth Low Energy, PN9

(* 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.	82.112	QP	43.4	6.8	7.5	32.2		25.5	40.0	14.5	233	211	
Hori.	149.279	QP	43.1	14.8	7.7	32.1		33.5	43.5	10.0	201	323	
Hori.	179.294	QP	41.6	15.8	7.8	32.1		33.1	43.5	10.4	189	183	
Hori.	313.494	QP	32.2	14.3	8.6	32.0		23.1	46.0	22.9	100	278	
Hori.	2241.954	PK	49.0	27.2	14.0	41.3		48.9	73.9	25.0	133	147	
Hori.	2281.956	PK	50.9	27.3	14.1	41.3		51.0	73.9	22.9	133	147	
Hori.	2390.000	PK	45.9	27.4	14.2	41.4		46.1	73.9	27.8	129	148	
Hori.	2521.924	PK	51.3	27.6	14.3	41.4		51.8	73.9	22.1	100	151	
Hori.	2561.973	PK	50.0	27.7	14.3	41.4		50.6	73.9	23.3	100	151	
Hori.	4804.000	PK	48.2	31.1	6.8	41.2		44.9	73.9	29.0	100	120	
Hori.	7206.000	PK	46.5	36.6	8.3	41.4		50.0	73.9	23.9	100	0	
Vert.	32.265	QP	34.0	17.1	6.5	32.2		25.4	40.0	14.6	100	67	
Vert.	82.112	QP	50.2	6.8	7.5	32.2		32.3	40.0	7.7	100	273	
Vert.	149.279	QP	43.3	14.8	7.7	32.1		33.7	43.5	9.8	100	59	
Vert.	179.294	QP	39.2	15.8	7.8	32.1		30.7	43.5	12.8	100	341	
Vert.	313.494	QP	31.1	14.3	8.6	32.0		22.0	46.0	24.0	100	296	
Vert.	2241.966	PK	49.8	27.2	14.0	41.3		49.7	73.9	24.2	100	171	
Vert.	2282.009	PK	52.4	27.3	14.1	41.3		52.5	73.9	21.4	100	171	
Vert.	2390.000	PK	46.0	27.4	14.2	41.4		46.2	73.9	27.7	100	218	
Vert.	2521.950	PK	50.5	27.6	14.3	41.4		51.0	73.9	22.9	117	214	
Vert.	2562.011	PK	49.7	27.7	14.3	41.4		50.3	73.9	23.6	117	214	
Vert.	4804.000	PK	48.6	31.1	6.8	41.2		45.3	73.9	28.6	100	213	
Vert.	7206.000	PK	47.2	36.6	8.3	41.4		50.7	73.9	23.2	100	0	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	2241.954	AV	39.9	27.2	14.0	41.3	4.1	43.9	53.9	10.0	133	147	
Hori.	2281.956	AV	43.3	27.3	14.1	41.3	4.1	47.5	53.9	6.4	133	147	
Hori.	2390.000	AV	36.7	27.4	14.2	41.4	4.1	41.0	53.9	12.9	129	148	
Hori.	2521.924	AV	44.0	27.6	14.3	41.4	4.1	48.6	53.9	5.3	100	151	
Hori.	2561.973	AV	42.3	27.7	14.3	41.4	4.1	47.0	53.9	6.9	100	151	
Hori.	4804.000	AV	39.0	31.1	6.8	41.2	4.1	39.8	53.9	14.1	100	120	
Hori.	7206.000	AV	38.5	36.6	8.3	41.4	4.1	46.1	53.9	7.8	100	0	
Vert.	2241.966	AV	42.2	27.2	14.0	41.3	4.1	46.2	53.9	7.7	100	171	
Vert.	2282.009	AV	45.9	27.3	14.1	41.3	4.1	50.1	53.9	3.8	100	171	
Vert.	2390.000	AV	36.9	27.4	14.2	41.4	4.1	41.2	53.9	12.7	100	218	
Vert.	2521.950	AV	42.6	27.6	14.3	41.4	4.1	47.2	53.9	6.7	117	214	
Vert.	2562.011	AV	41.4	27.7	14.3	41.4	4.1	46.1	53.9	7.8	117	214	
Vert.	4804.000	AV	39.1	31.1	6.8	41.2	4.1	39.9	53.9	14.0	100	213	
Vert.	7206.000	AV	38.3	36.6	8.3	41.4	4.1	45.9	53.9	8.0	100	0	

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

*8.2.4 Alternative 1 was applied to AV detection, since the duty cycle is less than 98% and video triggering or signal gating cannot be used.

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

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	97.1	27.4	14.2	41.4		97.3	-	-	Carrier
Hori.	2398.648	PK	52.0	27.4	14.2	41.4		52.2	77.3	25.1	
Hori.	2400.000	PK	54.7	27.4	14.2	41.4		54.9	77.3	22.4	
Vert.	2402.000	PK	97.9	27.4	14.2	41.4		98.1	-	-	Carrier
Vert.	2398.654	PK	52.7	27.4	14.2	41.4		52.9	78.1	25.2	
Vert.	2400.000	PK	55.8	27.4	14.2	41.4		56.0	78.1	22.1	

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

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Facsimile : +81 463 50 6401

Radiated Emission

Test place UL Japan, Inc. Shonan EMC Lab. No.3 Semi Anechoic Chamber
 Date November 28, 2012 December 2, 2012
 Temperature / Humidity 24deg.C , 35 %RH 23deg.C , 30 %RH
 Engineer Shinichi Takano Kenichi Adachi
 Mode Tx, 2442 MHz
 Tx, Bluetooth Low Energy, PN9

(* 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.	82.124	QP	43.3	6.8	7.5	32.2		25.4	40.0	14.6	224	228	
Hori.	149.341	QP	43.7	14.8	7.7	32.1		34.1	43.5	9.4	202	311	
Hori.	179.236	QP	41.8	15.8	7.8	32.1		33.3	43.5	10.2	186	185	
Hori.	313.441	QP	32.3	14.3	8.6	32.0		23.2	46.0	22.8	100	273	
Hori.	2281.965	PK	50.6	27.3	14.1	41.3		50.7	73.9	23.2	100	145	
Hori.	2321.959	PK	51.4	27.3	14.1	41.4		51.4	73.9	22.5	100	145	
Hori.	2521.951	PK	49.6	27.6	14.3	41.4		50.1	73.9	23.8	100	151	
Hori.	2561.943	PK	51.5	27.7	14.3	41.4		52.1	73.9	21.8	100	151	
Hori.	4884.000	PK	47.9	31.3	6.9	41.1		45.0	73.9	28.9	100	130	
Hori.	7326.000	PK	47.6	36.6	8.6	41.4		51.4	73.9	22.5	100	0	
Vert.	32.267	QP	33.8	17.1	6.5	32.2		25.2	40.0	14.8	100	81	
Vert.	82.124	QP	50.3	6.8	7.5	32.2		32.4	40.0	7.6	100	279	
Vert.	149.341	QP	43.1	14.8	7.7	32.1		33.5	43.5	10.0	100	68	
Vert.	179.236	QP	39.1	15.8	7.8	32.1		30.6	43.5	12.9	100	338	
Vert.	313.543	QP	31.2	14.3	8.6	32.0		22.1	46.0	23.9	100	299	
Vert.	2281.968	PK	51.7	27.3	14.1	41.3		51.8	73.9	22.1	100	173	
Vert.	2322.007	PK	51.5	27.3	14.1	41.4		51.5	73.9	22.4	100	173	
Vert.	2521.955	PK	48.8	27.6	14.3	41.4		49.3	73.9	24.6	125	214	
Vert.	2561.952	PK	49.8	27.7	14.3	41.4		50.4	73.9	23.5	125	214	
Vert.	4884.000	PK	47.5	31.3	6.9	41.1		44.6	73.9	29.3	111	214	
Vert.	7326.000	PK	47.2	36.6	8.6	41.4		51.0	73.9	22.9	100	0	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	2281.965	AV	43.5	27.3	14.1	41.3	4.1	47.7	53.9	6.2	100	145	
Hori.	2321.959	AV	44.2	27.3	14.1	41.4	4.1	48.3	53.9	5.6	100	145	
Hori.	2521.951	AV	41.7	27.6	14.3	41.4	4.1	46.3	53.9	7.6	100	151	
Hori.	2561.943	AV	43.5	27.7	14.3	41.4	4.1	48.2	53.9	5.7	100	151	
Hori.	4884.000	AV	38.3	31.3	6.9	41.1	4.1	39.5	53.9	14.4	100	130	
Hori.	7326.000	AV	37.7	36.6	8.6	41.4	4.1	45.6	53.9	8.3	100	0	
Vert.	2281.968	AV	44.7	27.3	14.1	41.3	4.1	48.9	53.9	5.0	100	173	
Vert.	2322.007	AV	45.3	27.3	14.1	41.4	4.1	49.4	53.9	4.5	100	173	
Vert.	2521.955	AV	40.5	27.6	14.3	41.4	4.1	45.1	53.9	8.8	125	214	
Vert.	2561.952	AV	42.5	27.7	14.3	41.4	4.1	47.2	53.9	6.7	125	214	
Vert.	4884.000	AV	38.7	31.3	6.9	41.1	4.1	39.9	53.9	14.0	111	214	
Vert.	7326.000	AV	38.0	36.6	8.6	41.4	4.1	45.9	53.9	8.0	100	0	

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

*8.2.4 Alternative 1 was applied to AV detection, since the duty cycle is less than 98% and video triggering or signal gating cannot be used.

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

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 November 28, 2012 December 2, 2012
Temperature / Humidity 24deg.C , 35 %RH 23deg.C , 30 %RH
Engineer Shinichi Takano Kenichi Adachi
Mode Tx, 2480 MHz
 Tx, Bluetooth Low Energy, PN9

(* 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.	82.131	QP	43.4	6.8	7.5	32.2		25.5	40.0	14.5	228	217	
Hori.	149.261	QP	43.0	14.8	7.7	32.1		33.4	43.5	10.1	199	310	
Hori.	179.302	QP	41.5	15.8	7.8	32.1		33.0	43.5	10.5	187	192	
Hori.	313.453	QP	32.6	14.3	8.6	32.0		23.5	46.0	22.5	150	277	
Hori.	2319.972	PK	50.9	27.3	14.1	41.4		50.9	73.9	23.0	132	148	
Hori.	2359.970	PK	51.3	27.4	14.1	41.4		51.4	73.9	22.5	132	148	
Hori.	2483.500	PK	54.1	27.5	14.3	41.4		54.5	73.9	19.4	100	149	
Hori.	2600.019	PK	51.0	27.7	14.4	41.4		51.7	73.9	22.2	100	154	
Hori.	2639.965	PK	49.1	27.8	14.4	41.4		49.9	73.9	24.0	100	154	
Hori.	4960.000	PK	47.4	31.6	6.9	41.0		44.9	73.9	29.0	100	125	
Hori.	7440.000	PK	47.0	36.7	8.8	41.5		51.0	73.9	22.9	100	0	
Vert.	32.254	QP	33.9	17.1	6.5	32.2		25.3	40.0	14.7	100	78	
Vert.	82.131	QP	50.2	6.8	7.5	32.2		32.3	40.0	7.7	100	264	
Vert.	149.261	QP	43.0	14.8	7.7	32.1		33.4	43.5	10.1	100	65	
Vert.	179.302	QP	39.2	15.8	7.8	32.1		30.7	43.5	12.8	100	342	
Vert.	313.453	QP	31.3	14.3	8.6	32.0		22.2	46.0	23.8	100	289	
Vert.	2319.977	PK	51.7	27.3	14.1	41.4		51.7	73.9	22.2	100	172	
Vert.	2359.961	PK	51.5	27.4	14.1	41.4		51.6	73.9	22.3	100	172	
Vert.	2483.500	PK	53.0	27.5	14.3	41.4		53.4	73.9	20.5	100	212	
Vert.	2599.957	PK	50.9	27.7	14.4	41.4		51.6	73.9	22.3	113	216	
Vert.	2639.992	PK	49.5	27.8	14.4	41.4		50.3	73.9	23.6	113	216	
Vert.	4960.000	PK	47.6	31.6	6.9	41.0		45.1	73.9	28.8	108	216	
Vert.	7440.000	PK	47.5	36.7	8.8	41.5		51.5	73.9	22.4	100	0	

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	2319.972	AV	44.1	27.3	14.1	41.4	4.1	48.2	53.9	5.7	132	148	
Hori.	2359.970	AV	44.3	27.4	14.1	41.4	4.1	48.5	53.9	5.4	132	148	
Hori.	2483.500	AV	47.8	27.5	14.3	41.4	4.1	52.3	53.9	1.6	100	149	
Hori.	2600.019	AV	43.9	27.7	14.4	41.4	4.1	48.7	53.9	5.2	100	154	
Hori.	2639.965	AV	41.2	27.8	14.4	41.4	4.1	46.1	53.9	7.8	100	154	
Hori.	4960.000	AV	38.9	31.6	6.9	41.0	4.1	40.5	53.9	13.4	100	125	
Hori.	7440.000	AV	37.8	36.7	8.8	41.5	4.1	45.9	53.9	8.0	100	0	
Vert.	2319.977	AV	44.2	27.3	14.1	41.4	4.1	48.3	53.9	5.6	100	172	
Vert.	2359.961	AV	44.5	27.4	14.1	41.4	4.1	48.7	53.9	5.2	100	172	
Vert.	2483.500	AV	46.3	27.5	14.3	41.4	4.1	50.8	53.9	3.1	100	212	
Vert.	2599.957	AV	43.4	27.7	14.4	41.4	4.1	48.2	53.9	5.7	113	216	
Vert.	2639.992	AV	40.8	27.8	14.4	41.4	4.1	45.7	53.9	8.2	113	216	
Vert.	4960.000	AV	38.8	31.6	6.9	41.0	4.1	40.4	53.9	13.5	108	216	
Vert.	7440.000	AV	37.6	36.7	8.8	41.5	4.1	45.7	53.9	8.2	100	0	

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

*8.2.4 Alternative 1 was applied to AV detection, since the duty cycle is less than 98% and video triggering or signal gating cannot be used.

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

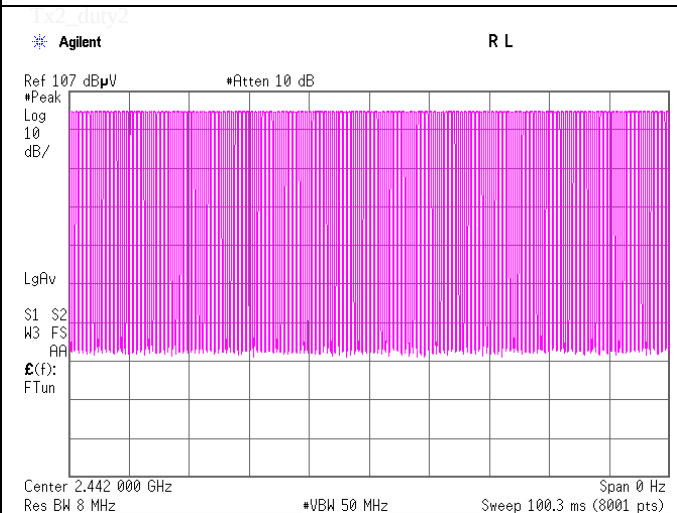
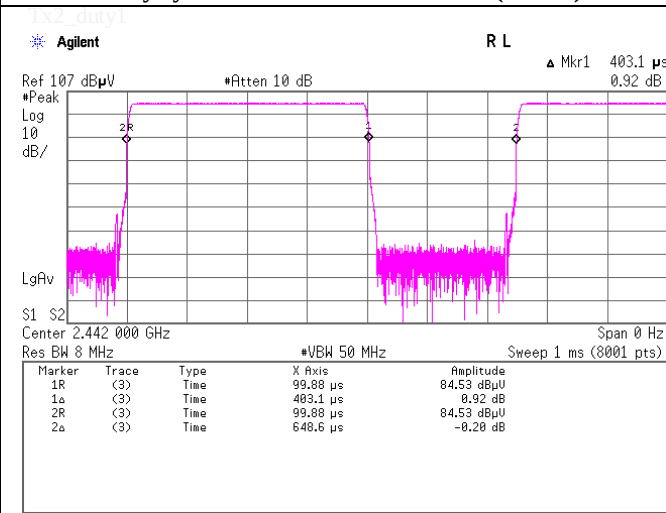
Distance factor : 15GHz -40GHz : 20log(3.0m/1.0m)= 9.5dB

Duty Factor Calculation chart

Tx, Bluetooth Low Energy, PN9

Duty Factor Calculation

Duty Factor: $20\log(1/\text{duty cycle}) = 4.1\text{dB}$
duty cycle = $0.4031 / 0.6486 = 0.621$ (62.1%)



UL Japan, Inc.

Shonan EMC Lab.

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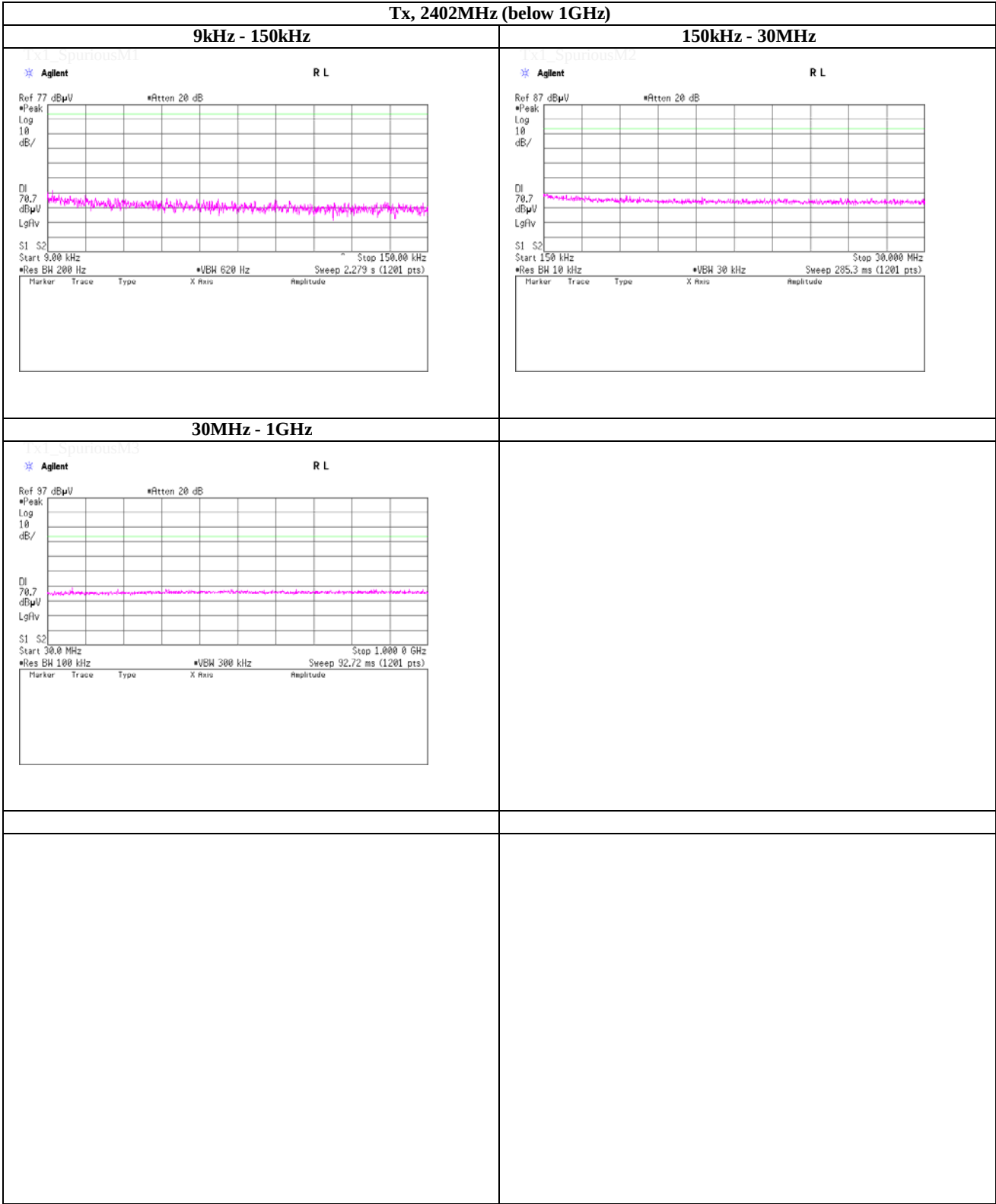
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(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9

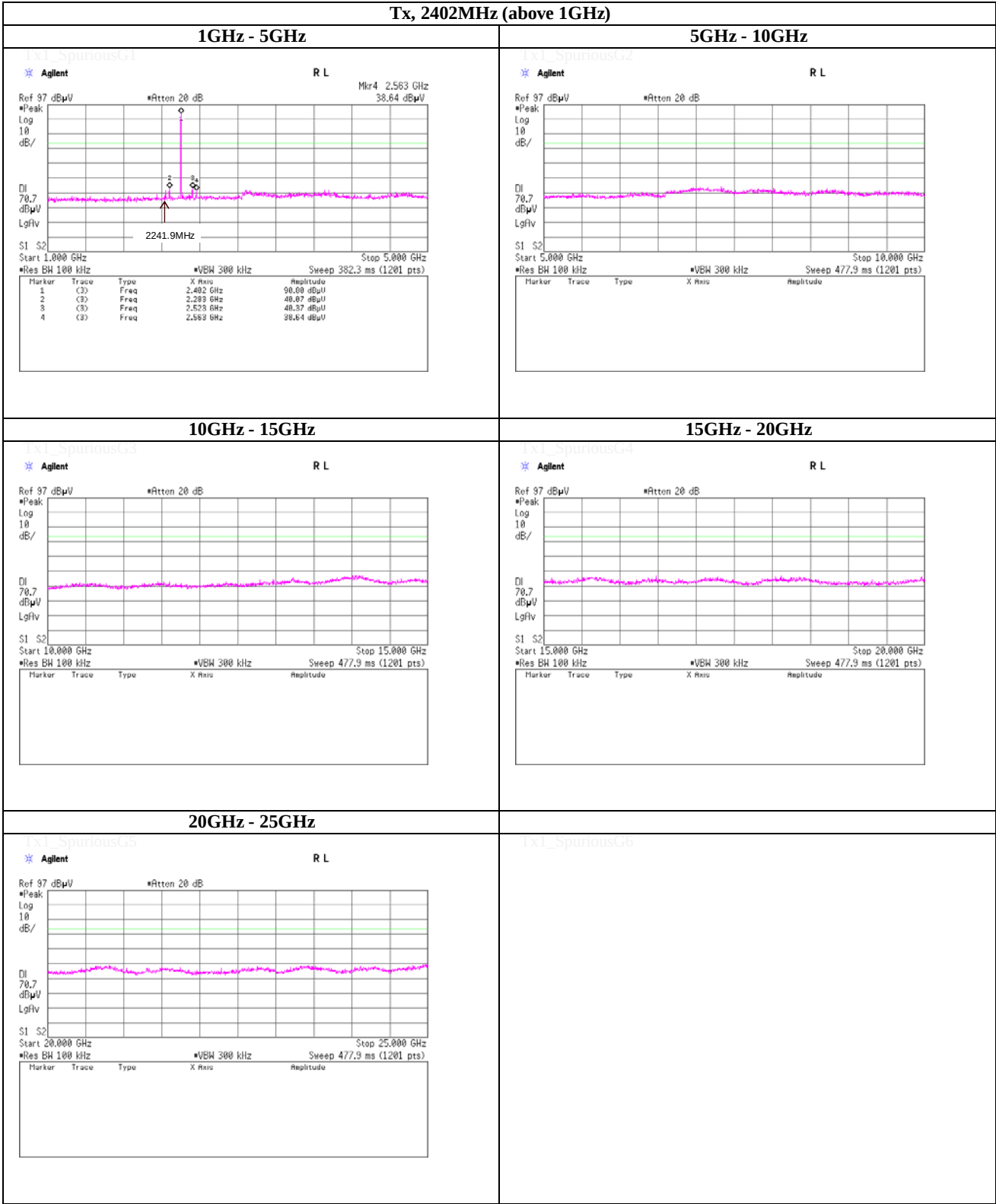
Tx, 2402MHz (below 1GHz)



(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9

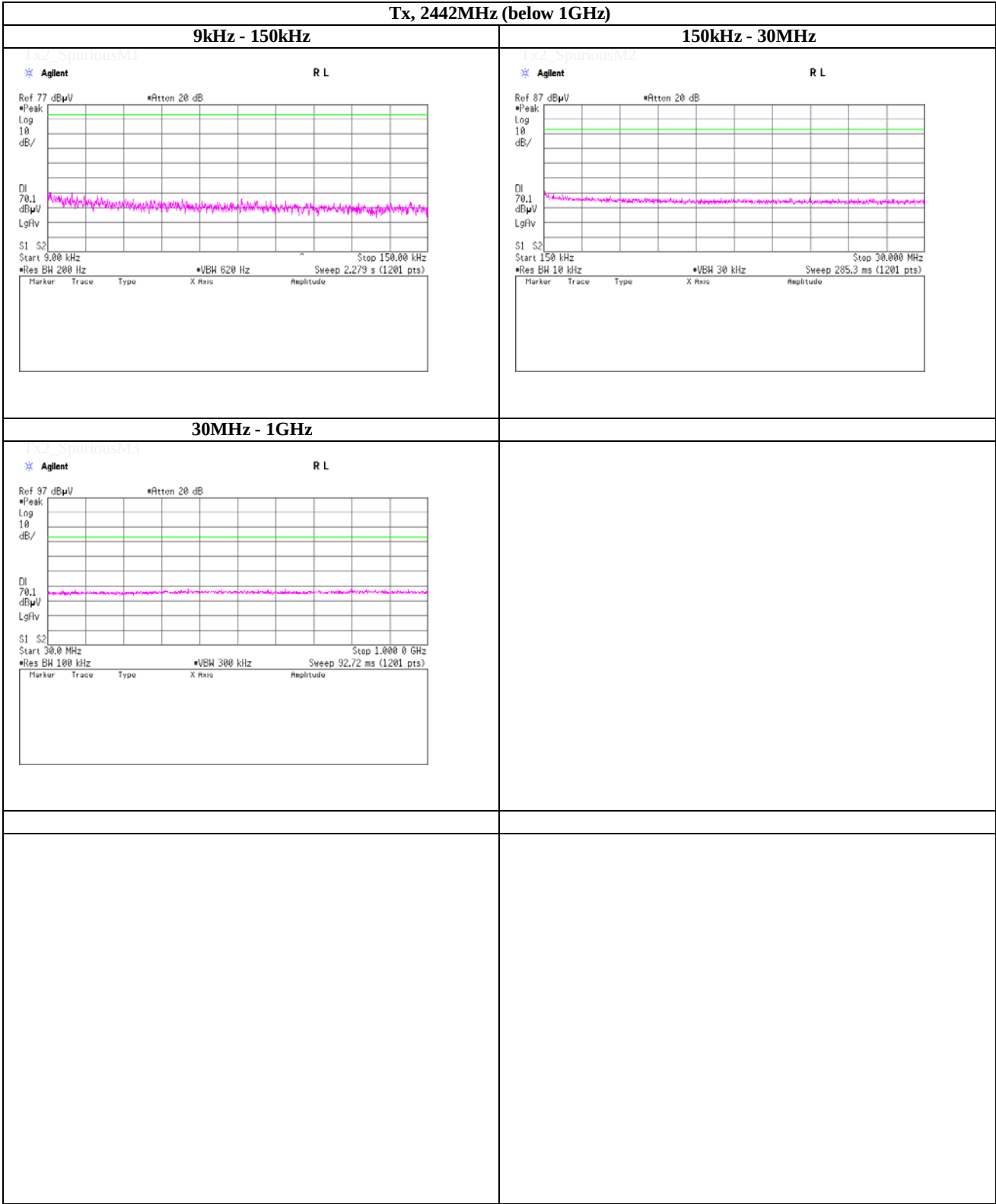
Tx, 2402MHz (above 1GHz)



(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9

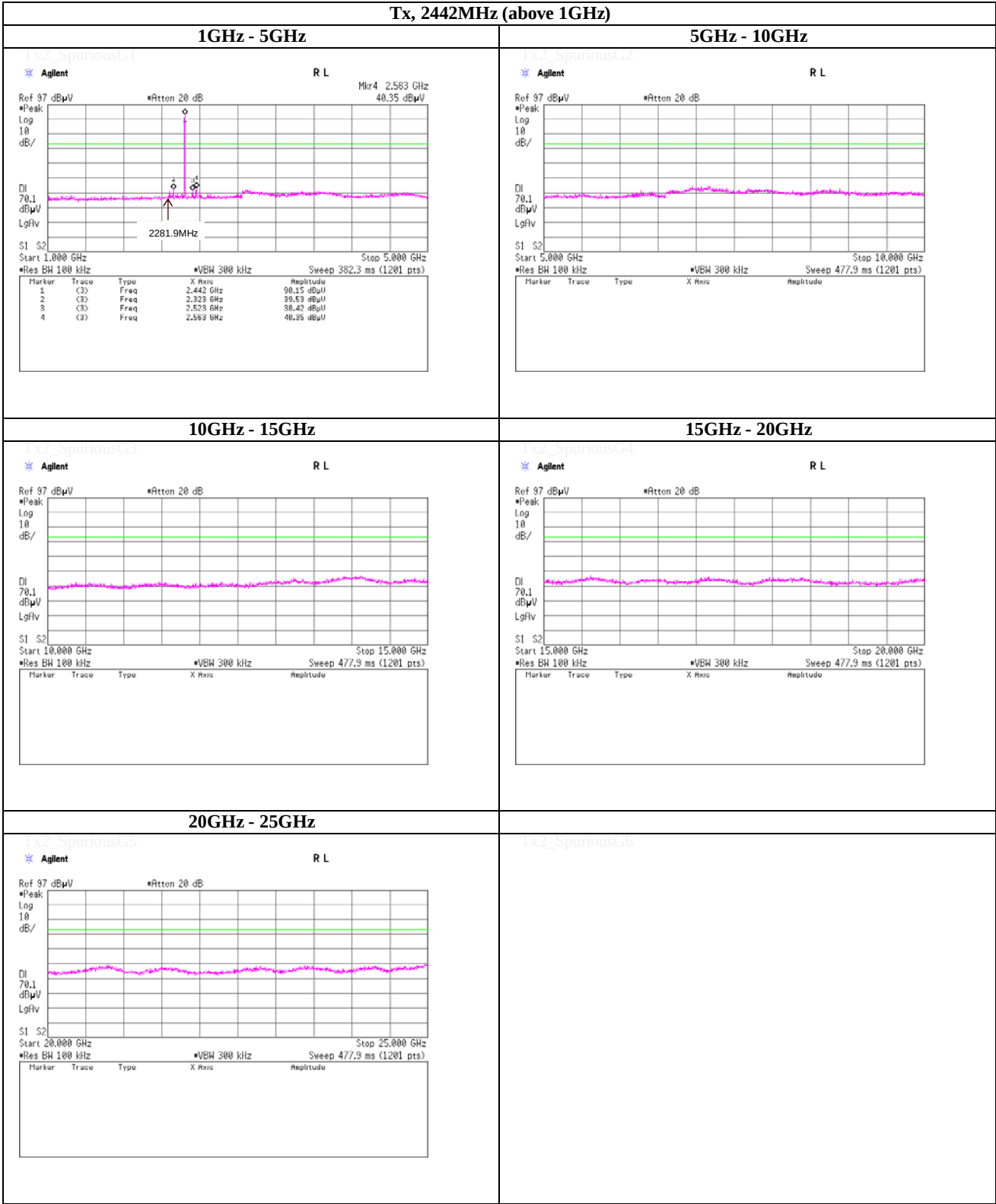
Tx, 2442MHz (below 1GHz)



(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9

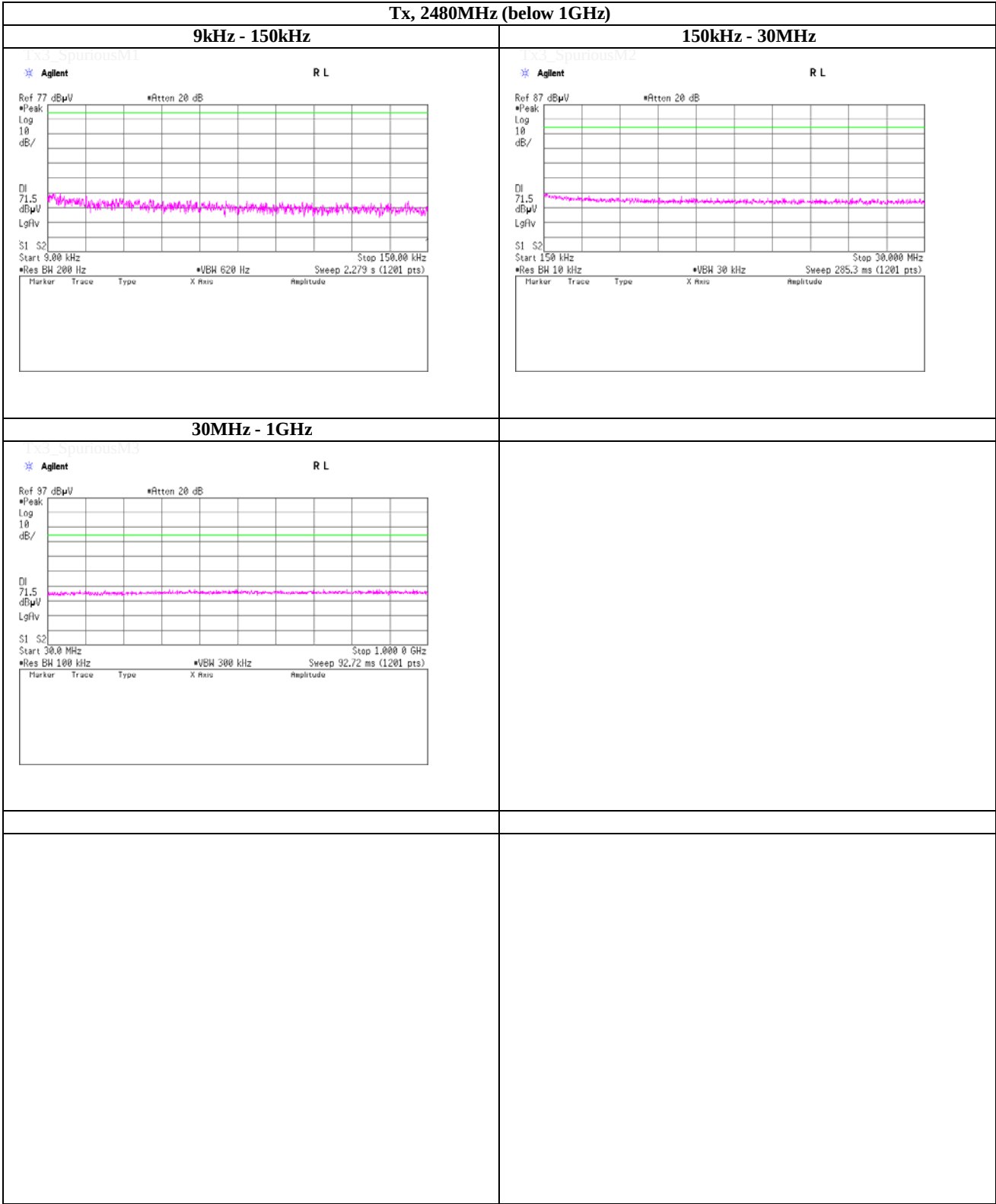
Tx, 2442MHz (above 1GHz)



(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9

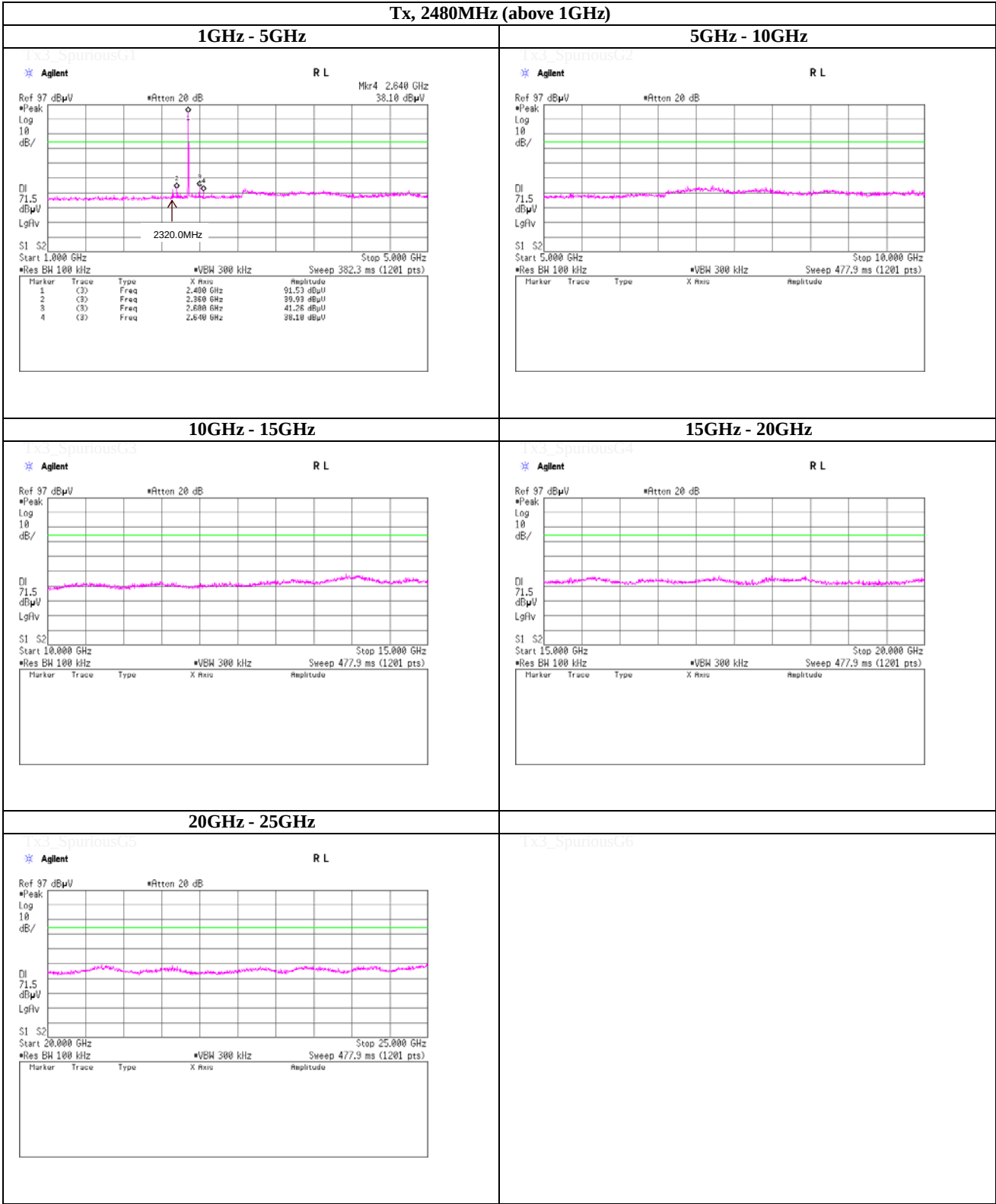
Tx, 2480MHz (below 1GHz)



(Reference chart) Spurious emission (Conducted)

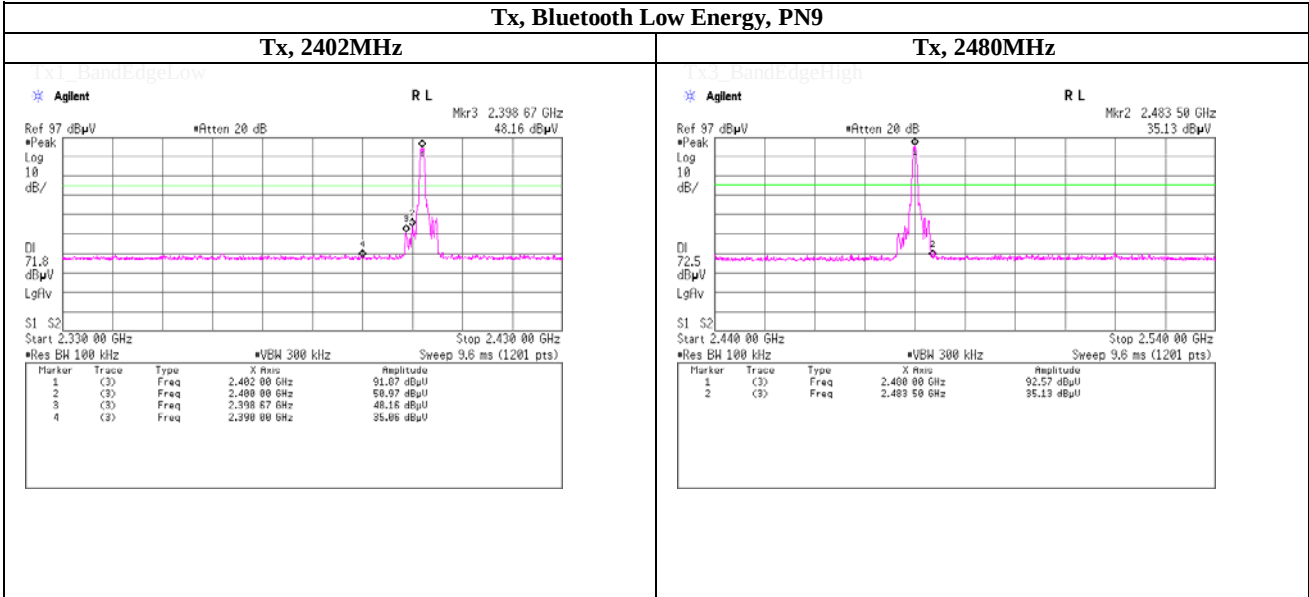
Tx, Bluetooth Low Energy, PN9

Tx, 2480MHz (above 1GHz)



(Reference chart) Spurious emission (Conducted)

Band Edge compliance



Maximum Power Spectral Density

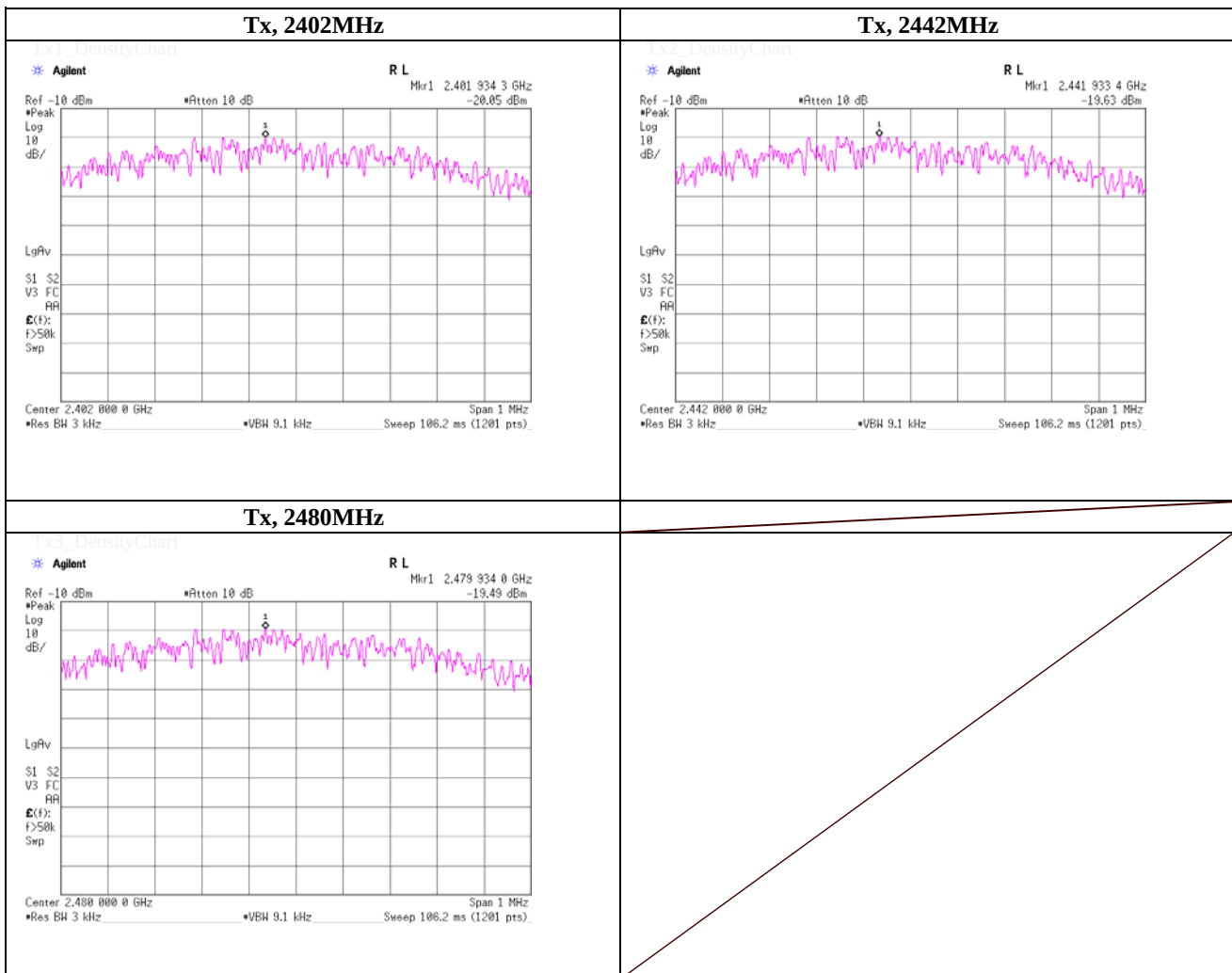
(Option 1)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.5 Shielded Room
Date	11/28/2012	
Temperature / Humidity	22deg.C , 50%RH	
Engineer	Akio Hayashi	
Mode	Tx, Bluetooth Low Energy, PN9	

Ch. Freq. [MHz]	Freq. Reading [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.0000	2401.93	-20.05	1.51	10.00	-8.54	8.00	16.54
2442.0000	2441.93	-19.63	1.50	10.00	-8.13	8.00	16.13
2480.0000	2479.93	-19.49	1.51	10.00	-7.98	8.00	15.98

Sample Calculation:

Result = Reading + Cable Loss + Atten. Loss

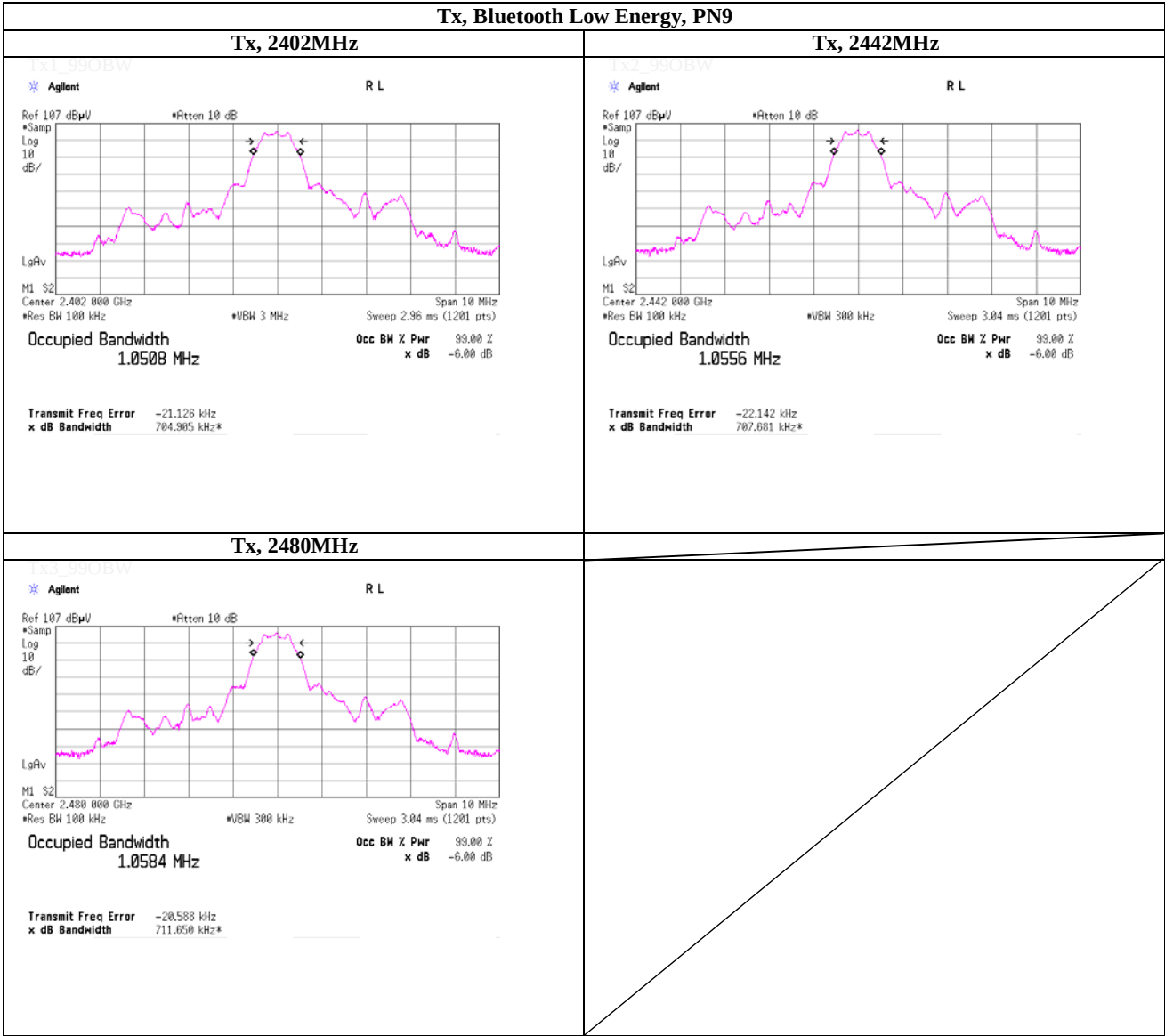
**UL Japan, Inc.****Shonan EMC Lab.**

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth



APPENDIX 2

Test Instruments

EMI test equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT	2012/03/16 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2011/12/05 * 12
SCC-G27	Coaxial Cable	Junkosha	MWX241-01000KM SKMS	SEP-20-12-001	AT	2012/09/26 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2012/11/15 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2012/03/26 * 12
SCC-H4	Microwave cable	Hirose Electric	U.FL-2LP-066J1-A-(200)	-	AT	Pre Check
SCC-H5	Microwave cable	Hirose Electric	U.FL-2LP-066J1-A-(200)	-	AT	Pre Check
STM-G4	Terminator	Weinschel	M1459A	U6592	AT	2012/07/18 * 12
KPM-08	Power meter	Anritsu	ML2495A	6K00003356	AT	2012/09/14 * 12
KPSS-04	Power sensor	Anritsu	MA2411B	012088	AT	2012/09/14 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2012/09/21 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2012/07/18 * 12
SCC-G03	Coaxial Cable	Suhner	SUCOFLEX 104A	46499/4A	RE	2012/04/10 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2012/05/22 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2012/08/17 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2012/02/06 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2012/03/16 * 12
SJM-11	Measure	PROMART	SEN1935	-	RE/CE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFL,MF)	-	RE/CE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2011/12/27 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2011/12/27 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2012/09/11 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2012/02/06 * 12
SJM-08	Measure	PROMART	SEN1935	-	RE	-
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2012/03/30 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2012/03/12 * 12
SCC-G17	Coaxial Cable	Suhner	SUCOFLEX 104A	46291/4A	RE	2012/03/12 * 12

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

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

Test Item :

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

APPENDIX 2

Test Instruments

EMI test equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2012/10/08 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2012/10/08 * 12
SAT6-03	Attenuator	JFW	50HF-006N	-	RE	2012/02/10 * 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	2012/04/10 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2012/02/10 * 12
STR-03	Test Receiver	Rohde & Schwarz	ES140	100054/040	RE	2012/06/14 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE/CE	2012/02/07 * 12
SAT6-07	Attenuator	JFW	50HF-006N	-	RE	2012/02/17 * 12
SCC-C9/C10/SRSE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-271(RF Selector)	CE	2012/04/10 * 12
SLS-05	LISN	Rohde & Schwarz	ENV216	100516	CE	2012/02/23 * 12
SAT3-03	Attenuator	JFW	50HF-003N	-	CE	2012/02/17 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2012/03/26 * 12

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