



RADIO TEST REPORT

Test Report No.: 10022739S

Applicant : **Aplix IP Holdings Corporation**
Type of Equipment : **JM1**
Model No. : **JM1L2S**
FCC ID : **O8CJM1L2S**
Test regulation : **FCC Part15 Subpart C: 2012**
Test result : **Complied**

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

Date of test: June 28 - 30, 2013

Tested by:

S. Takano

Shinichi Takano
Engineer of WiSE Japan,
UL Verification Service

Approved by :

G. Ishiwata

Go Ishiwata
Manager of WiSE Japan,
UL Verification Service



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

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10022739S

[illegible]

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SECTION 1: Customer information

Company Name : Aplix IP Holdings Corporation
Address : Shinjuku Eastside Square 13F 27-30, Shinjuku 6-chome, Shinjuku-ku, Tokyo,
160-0022 Japan
Telephone Number : +81-50-3786-1702
Facsimile Number : +81-80-8462-0681
Contact Person : Isamu Shimosako

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

2.1 Identification of E.U.T.

Type of Equipment : JM1
Model Number : JM1L2S
Serial Number : Refer to 4.2 in this report.
Rating : DC3.3V
Country of Mass-production : Japan, China, Taiwan, Korea
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : June 28, 2013
Modification of EUT : No modification by the test lab.

2.2 Product description

Model: JM1L2S (referred to as the EUT in this report) is JM1.

Clock frequency(ies) in the system : 16MHz, 32.768kHz

<Radio part>

Equipment type : Transceiver
Frequency of operation : 2402-2480MHz
Bandwidth : 79MHz
Channel spacing : 2MHz
Type of modulation : DSSS
Antenna type : Chip
Antenna gain : 0.5dBi
Antenna connector type : None
ITU code : F1D
Operation temperature range : -20 to +75 deg.C

FCC 15.31 (e) / 212

The RF transmitter has its own regulator. 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 / 212

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna 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 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

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	22.8dB Freq.: 0.47571MHz Detector: QP Phase: L1 Mode: Tx 2440MHz	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	9.6 dB Freq.: 4960.000MHz Polarization: Vertical 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 v03r01 (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 C63.4:2009 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.

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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 has enough margin, more than the 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
☒ 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	-

3.6 Test setup, Data of EMI & Test instruments

Refer to APPENDIX 3 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, 2440MHz, 2480MHz

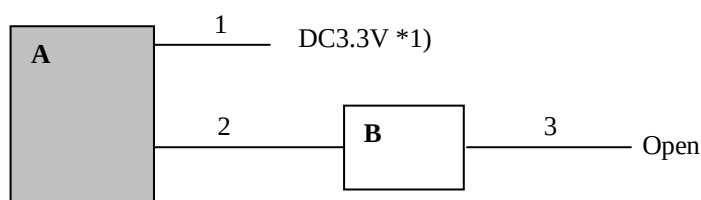
*EUT has the power settings by the software as follows;

Power settings: "0005"(Transmit power level)

Test software: CSR uEnergy Test Application, version 2.0.0.99

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	JM1	JM1L2S	*2)	Aplix IP Holdings Corporation	EUT
B	SPI-USB Convertor Board	CNV001	001	Aplix IP Holdings Corporation	-

*1) DC Power Supply (Model No.: PAN35-10A) was used for DC input.

*2) Conducted / Radiated emission:2, Other test: 1

List of cables used

No.	Cable Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC	0.9+0.5	Unshielded	Unshielded	-
2	SPI	0.65	Unshielded	Unshielded	-
3	LAN	1.0	Shielded	Shielded	Cat.5e

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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.

Photographs of the set up are shown in APPENDIX 3.

5.3 Test conditions

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

5.4 Test procedure

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

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: 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 8.1 Option 1 and 8.2 Option 2 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass

Refer to APPENDIX 1

SECTION 7: 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 9.1.3 PKPM1 of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass

Refer to APPENDIX 1

SECTION 8: 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 1

SECTION 9: 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 / 9kHz

The test was measured based on Method 10.2 PKPSD of KDB 558074 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247".

Summary of the test results: Pass

Refer to APPENDIX 1

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SECTION 10: Radiated emission

10.1 Operating environment

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

10.2 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.

Photographs of the set up are shown in APPENDIX 3.

10.3 Test conditions

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

10.4 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 12.2.5.1 and 12.2.5.2 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 position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Worst case:

Antenna polarization	Carrier (Band edge)	Spurious		
		Below 1GHz	1-18GHz	18-25GHz
Horizontal	X	X	X	Y
Vertical	Z	X	Z	X

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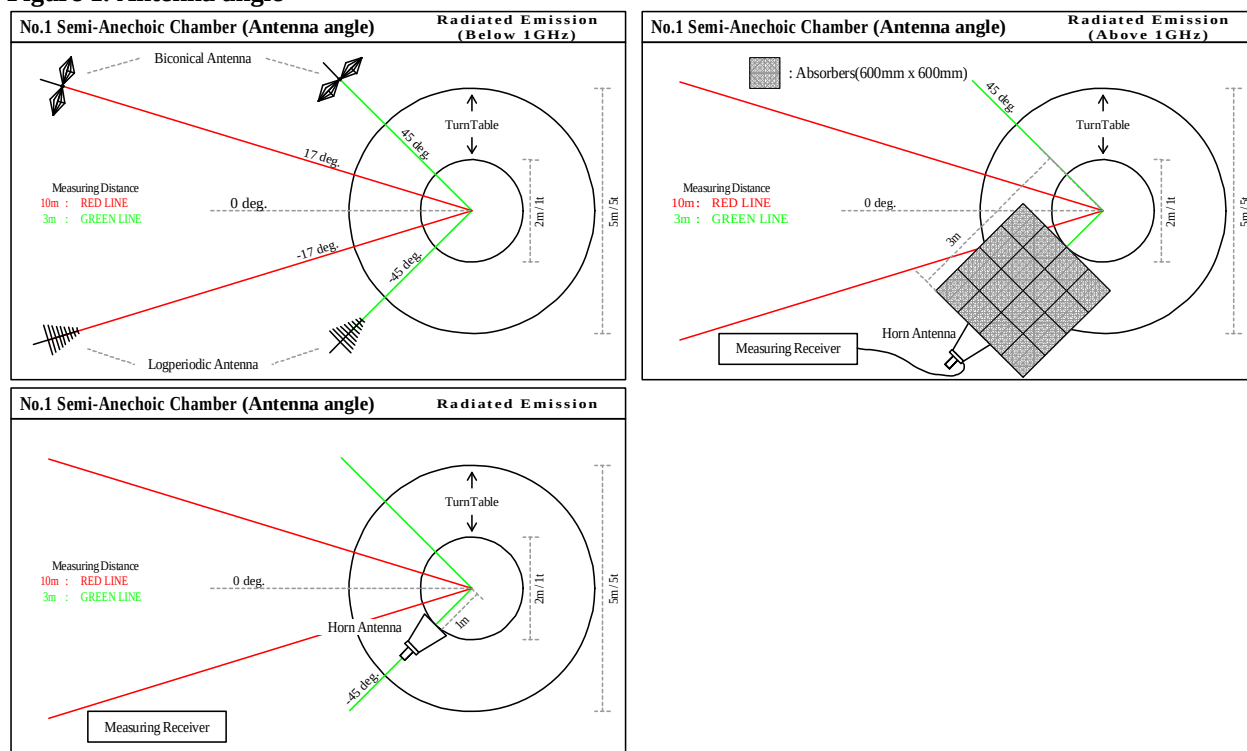
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Figure 1. Antenna angle



10.5 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.

10.6 Results

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

Refer to APPENDIX 1

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APPENDIX 2: Test instruments

Test instruments

APPENDIX 3: Photographs of test setup

Conducted emission
Radiated emission
Pre-check of worst position

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DATA OF CONDUCTED EMISSION TEST

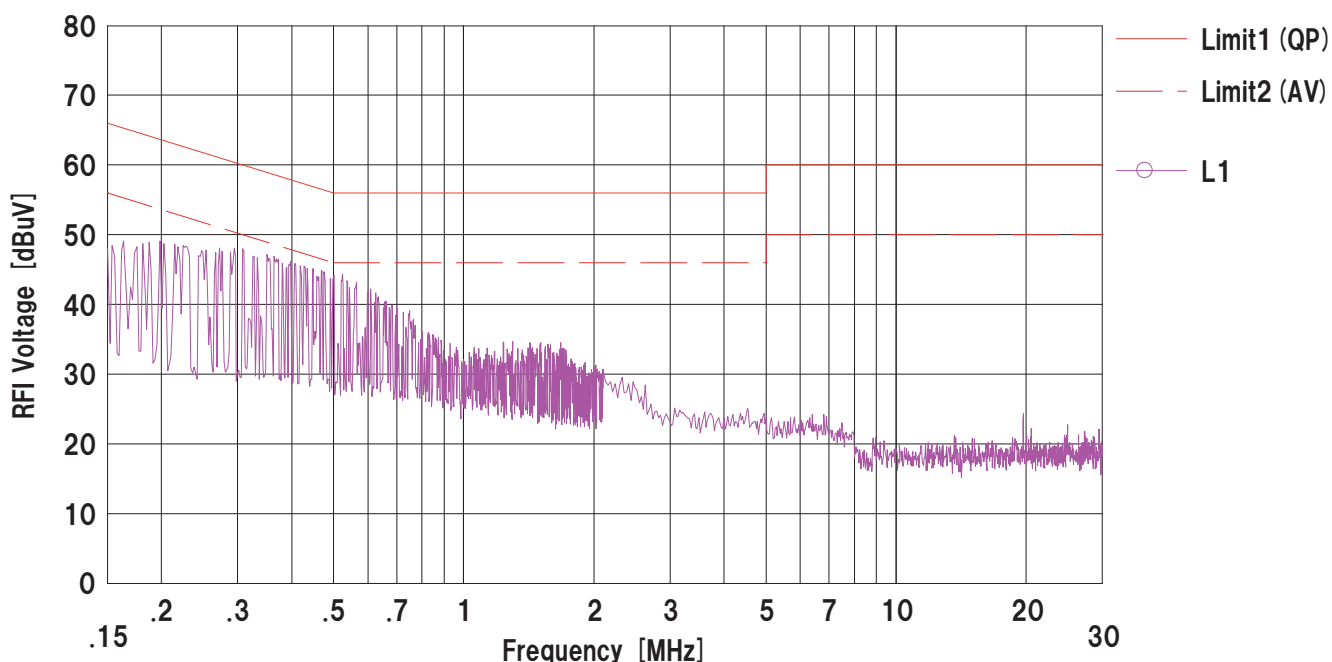
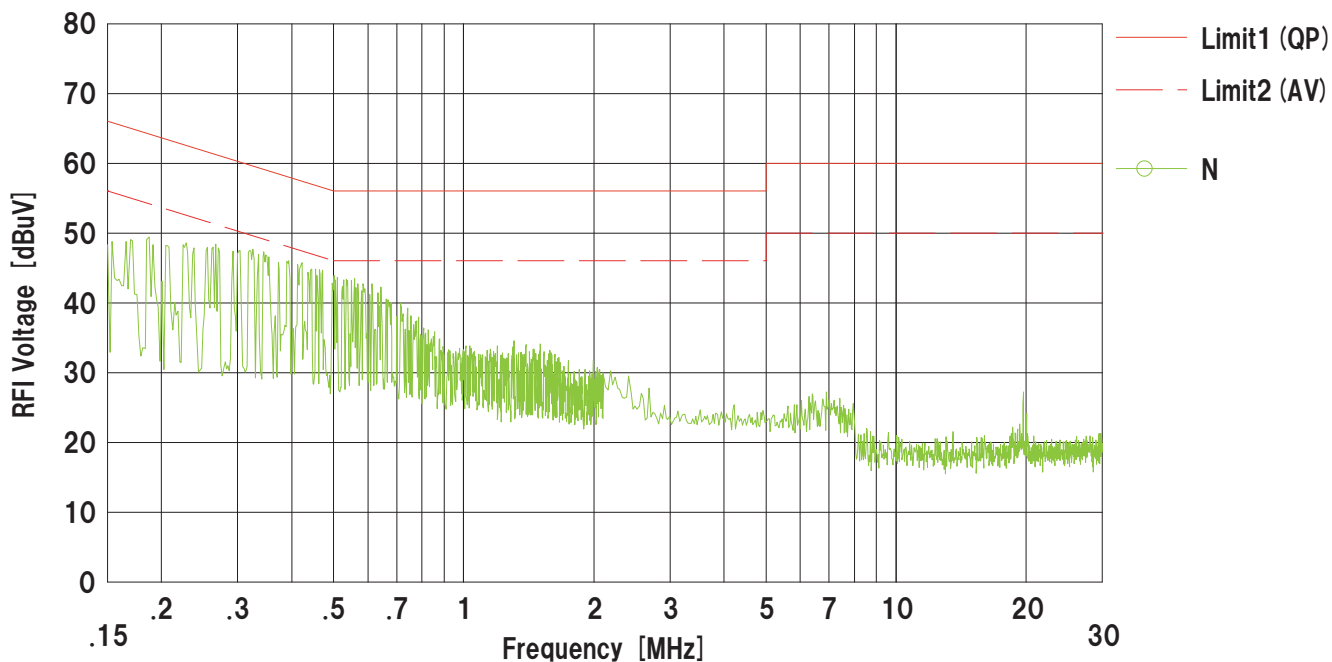
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2013/06/30

Company : Aplix IP Holdings Corporation
Kind of EUT : JM1
Model No. : JM1L2S
Serial No. : 2
Remarks : DC Power Supply Unit (AC120V/60Hz)

Mode : Tx 2402MHz
Report No. : 10022739S
Power : DC3.3V
Temp./Humi. : 24deg.C. / 54%RH

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

Engineer : Shinichi Takano



DATA OF CONDUCTED EMISSION TEST

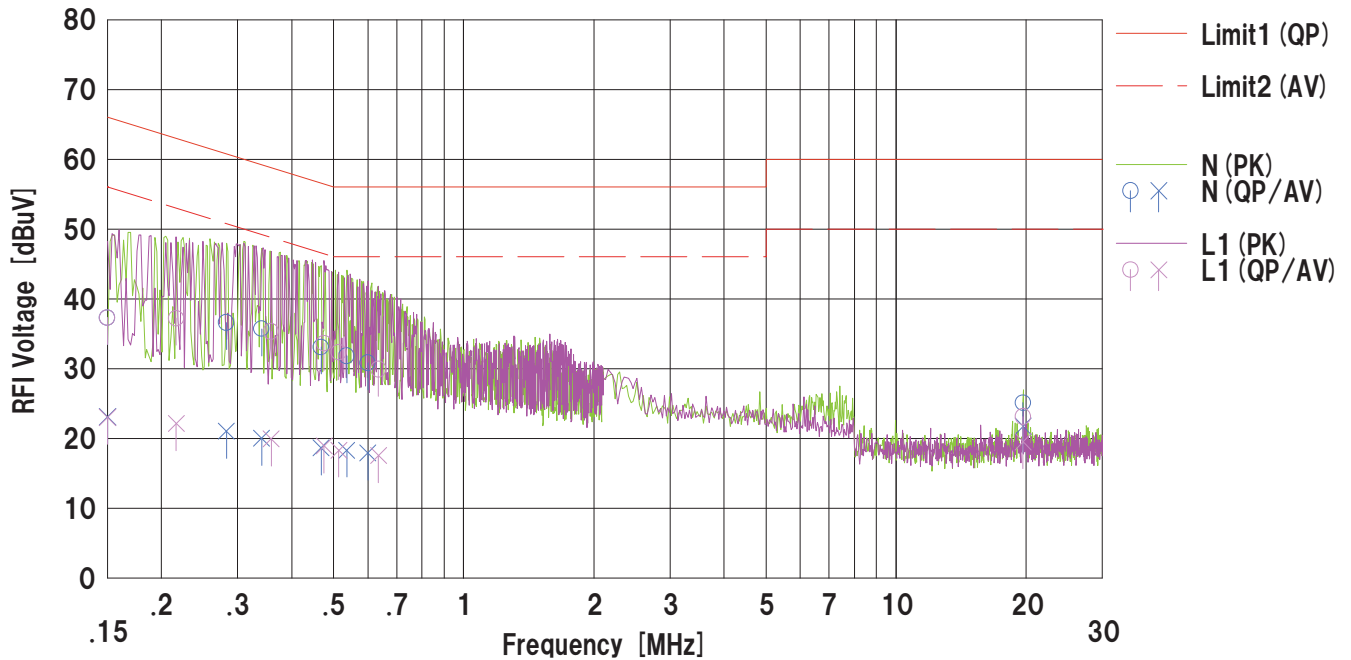
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2013/06/30

Company : Aplix IP Holdings Corporation
Kind of EUT : JM1
Model No. : JM1L2S
Serial No. : 2
Remarks : DC Power Supply Unit (AC120V/60Hz)

Mode : Tx 2440MHz
Report No. : 10022739S
Power : DC3.3V
Temp./Humi. : 24deg.C. / 54%RH

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

Engineer : Shinichi Takano



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	24.6	10.4	12.7	37.3	23.1	66.0	56.0	28.7	32.9	N	
2	0.28266	23.9	8.3	12.7	36.6	21.0	60.7	50.7	24.1	29.7	N	
3	0.34108	23.0	7.3	12.7	35.7	20.0	59.1	49.1	23.4	29.1	N	
4	0.46784	20.5	6.0	12.6	33.1	18.6	56.5	46.5	23.4	27.9	N	
5	0.53619	19.2	5.7	12.6	31.8	18.3	56.0	46.0	24.2	27.7	N	
6	0.60040	18.1	5.2	12.7	30.8	17.9	56.0	46.0	25.2	28.1	N	
7	19.66300	11.5	8.1	13.6	25.1	21.7	60.0	50.0	34.9	28.3	N	
8	0.15000	24.6	10.3	12.7	37.3	23.0	66.0	56.0	28.7	33.0	L1	
9	0.21630	24.6	9.5	12.6	37.2	22.1	62.9	52.9	25.7	30.8	L1	
10	0.35861	22.6	7.2	12.7	35.3	19.9	58.7	48.7	23.4	28.8	L1	
11	0.47571	21.0	6.3	12.6	33.6	18.9	56.4	46.4	22.8	27.5	L1	
12	0.51453	19.7	5.7	12.6	32.3	18.3	56.0	46.0	23.7	27.7	L1	
13	0.63555	17.2	4.8	12.7	29.9	17.5	56.0	46.0	26.1	28.5	L1	
14	19.66450	9.5	5.9	13.6	23.1	19.5	60.0	50.0	36.9	30.5	L1	

DATA OF CONDUCTED EMISSION TEST

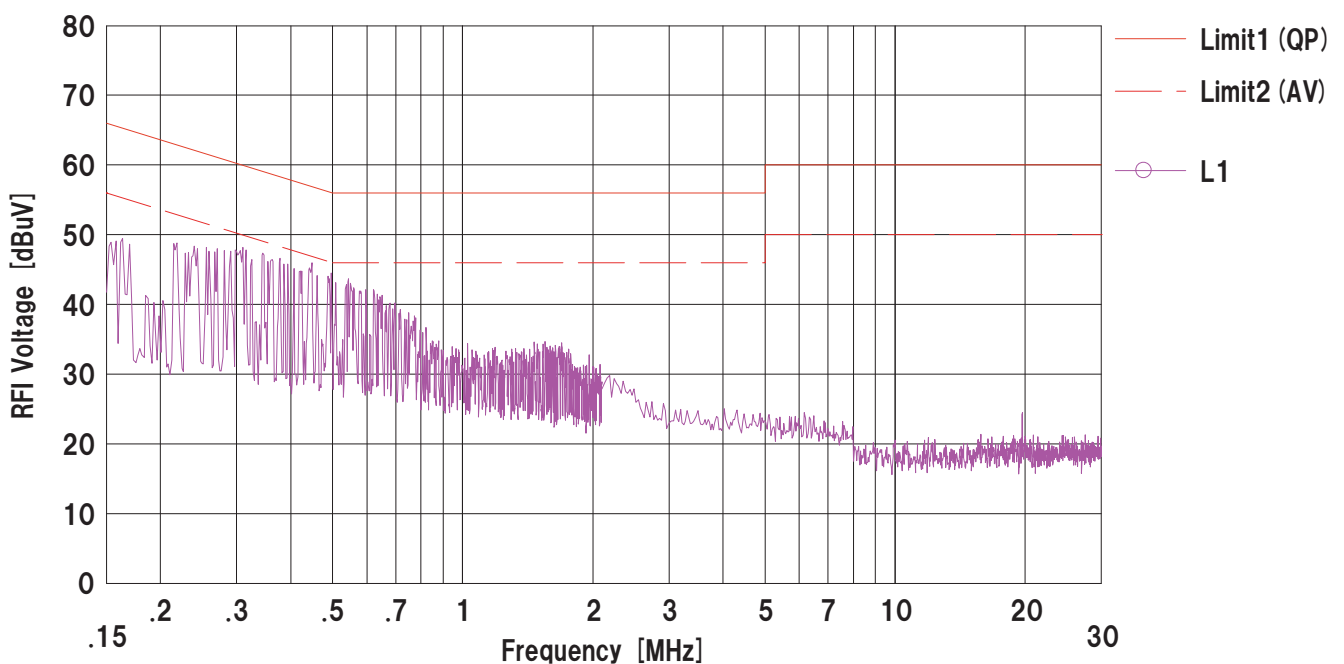
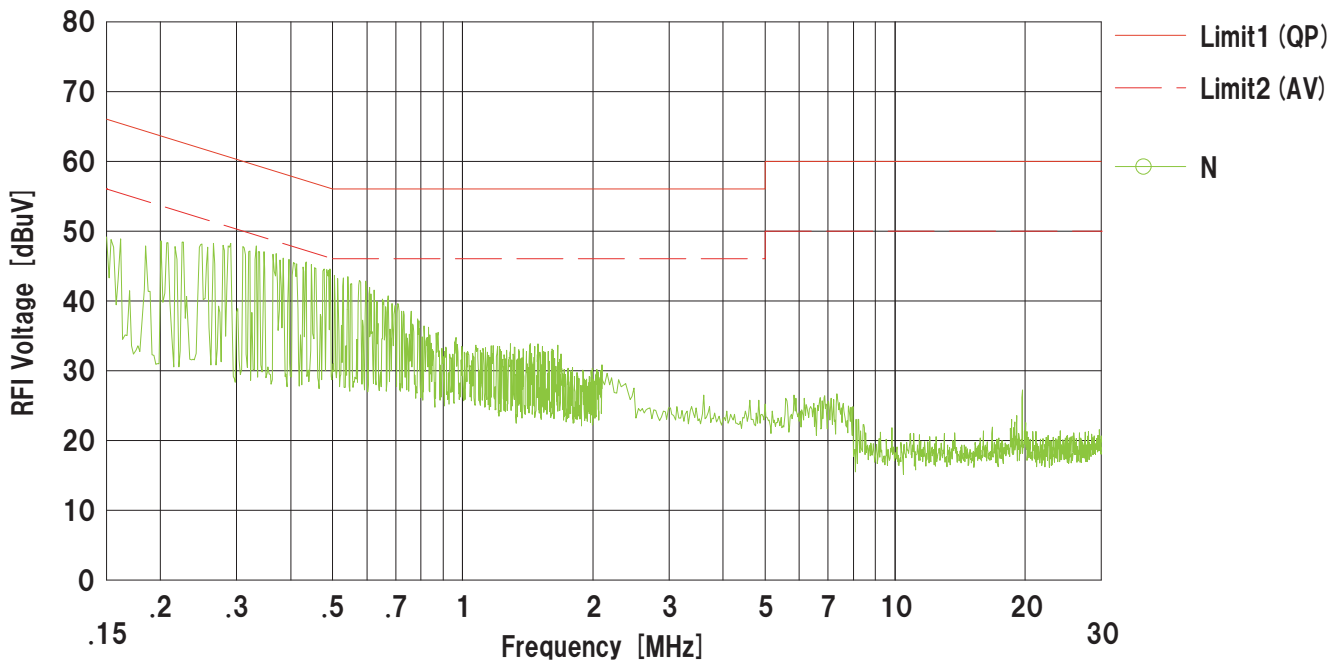
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2013/06/30

Company : Aplix IP Holdings Corporation
Kind of EUT : JM1
Model No. : JM1L2S
Serial No. : 2
Remarks : DC Power Supply Unit (AC120V/60Hz)

Mode : Tx 2480MHz
Report No. : 10022739S
Power : DC3.3V
Temp./Humi. : 24deg.C. / 54%RH

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

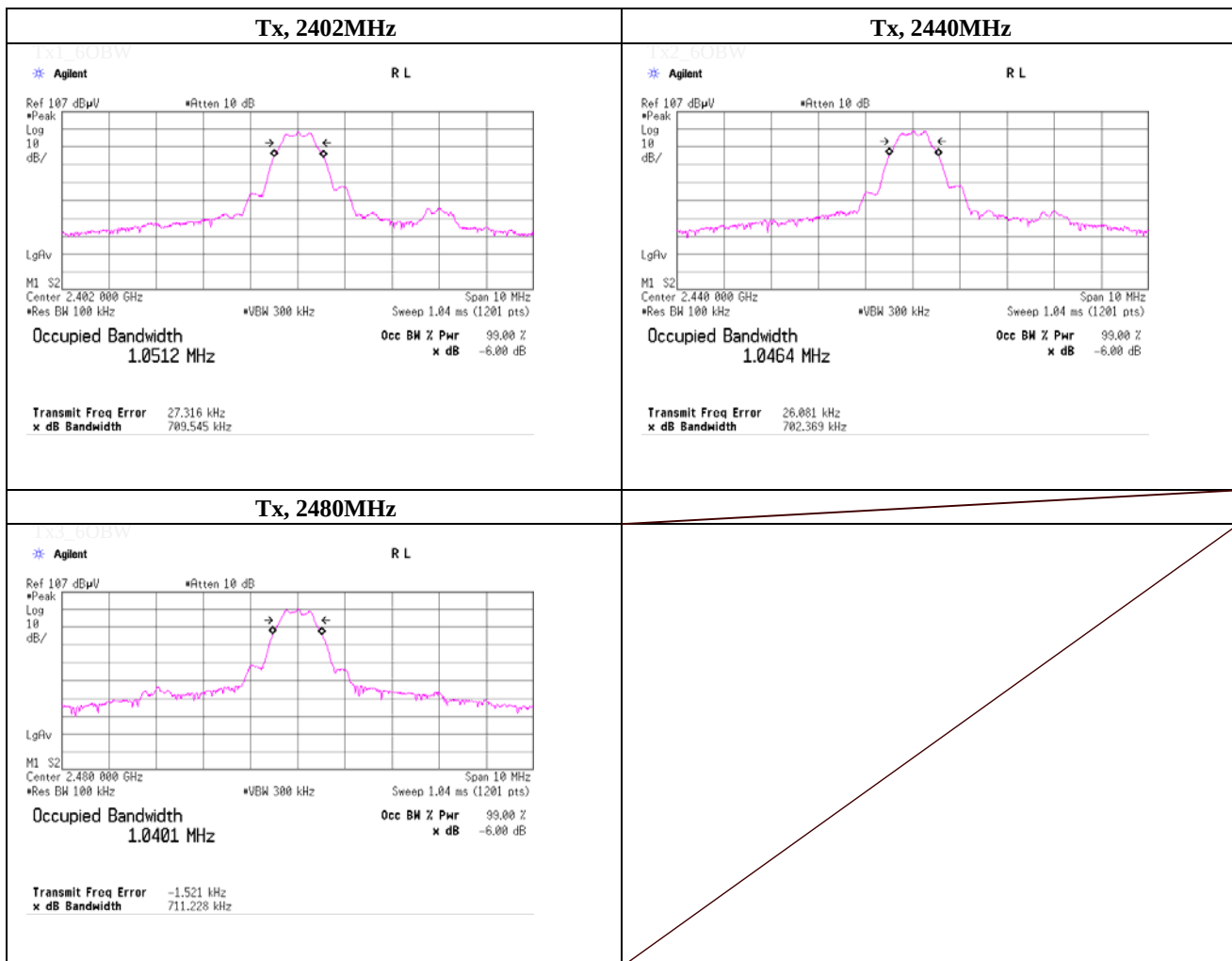
Engineer : Shinichi Takano



-6dB Bandwidth

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Shielded Room
Date	June 28, 2013	
Temperature / Humidity	26deg.C , 51%RH	
Engineer	Shinichi Takano	
Mode	Tx, Bluetooth Low Energy, PN9,	

Freq. [MHz]	-6dB Bandwidth [MHz]	Limit [MHz]
2402.0000	0.710	> 0.500
2440.0000	0.702	> 0.500
2480.0000	0.711	> 0.500

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Maximum Peak Conducted Output Power

(PKPM1)

Test place UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date June 28, 2013
Temperature / Humidity 26deg.C , 51%RH
Engineer Shinichi Takano
Mode Tx, Bluetooth Low Energy, PN9,

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

Ch	Freq.	P/M (Peak Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
Low	2402.0	-10.78	0.74	9.98	-0.06	0.99	30.00	1000	30.06
Mid	2440.0	-10.03	0.76	9.98	0.71	1.18	30.00	1000	29.29
High	2480.0	-9.31	0.76	9.98	1.43	1.39	30.00	1000	28.57

Sample Calculation:

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

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Radiated Emission

Test place No.1 Semi Anechoic Chamber
 Date June 30, 2013
 Temperature / Humidity 24 deg.C, 62 %RH
 Engineer Shinichi Takano
 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.	352.003	QP	40.1	15.2	7.4	31.8	30.9	46.0	15.1	184	132	
Hori.	715.988	QP	31.2	20.9	9.3	32.0	29.4	46.0	16.6	100	359	
Hori.	2385.906	PK	45.9	27.6	14.1	40.9	46.7	73.9	27.2	100	146	
Hori.	2390.000	PK	47.3	27.6	14.1	40.9	48.1	73.9	25.8	100	146	
Hori.	2530.064	PK	44.8	27.7	14.4	40.9	46.0	73.9	27.9	100	146	
Hori.	2561.995	PK	45.2	27.8	14.4	40.9	46.5	73.9	27.4	100	146	
Hori.	4804.000	PK	52.1	31.2	6.6	41.8	48.1	73.9	25.8	110	222	
Hori.	7206.000	PK	47.6	36.0	8.3	41.4	50.5	73.9	23.4	100	0	
Hori.	19227.970	PK	49.7	40.7	-2.5	45.3	42.6	73.9	31.3	108	188	
Hori.	2390.000	AV	35.9	27.6	14.1	40.9	36.7	53.9	17.2	100	146	
Vert.	128.005	QP	38.3	13.7	8.2	31.8	28.4	43.5	15.1	100	259	
Vert.	204.001	QP	33.2	16.7	9.2	31.8	27.3	43.5	16.2	100	139	
Vert.	352.004	QP	40.7	15.2	7.4	31.8	31.5	46.0	14.5	100	239	
Vert.	655.985	QP	32.3	20.1	9.1	32.1	29.4	46.0	16.6	100	132	
Vert.	2386.060	PK	46.1	27.6	14.1	40.9	46.9	73.9	27.0	138	203	
Vert.	2390.000	PK	47.2	27.6	14.1	40.9	48.0	73.9	25.9	138	203	
Vert.	2530.102	PK	46.6	27.7	14.4	40.9	47.8	73.9	26.1	138	203	
Vert.	2562.064	PK	46.2	27.8	14.4	40.9	47.5	73.9	26.4	138	203	
Vert.	4804.000	PK	50.2	31.2	6.6	41.8	46.2	73.9	27.7	100	244	
Vert.	7206.000	PK	47.1	36.0	8.3	41.4	50.0	73.9	23.9	100	0	
Vert.	19227.970	PK	48.6	40.7	-2.5	45.3	41.5	73.9	32.4	105	177	
Vert.	2390.000	AV	35.8	27.6	14.1	40.9	36.6	53.9	17.3	138	203	

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

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

Average measurement value with duty factor

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]	Remark
Hori.	2385.906	AV	36.1	27.6	14.1	40.9	3.7	40.6	53.9	13.3	
Hori.	2530.064	AV	36.0	27.7	14.4	40.9	3.7	40.9	53.9	13.0	
Hori.	2561.995	AV	35.7	27.8	14.4	40.9	3.7	40.7	53.9	13.2	
Hori.	4804.000	AV	43.2	31.2	6.6	41.8	3.7	42.9	53.9	11.0	
Hori.	7206.000	AV	37.3	36.0	8.3	41.4	3.7	43.9	53.9	10.0	
Hori.	19227.970	AV	44.0	40.7	-2.5	45.3	3.7	40.6	53.9	13.3	
Vert.	2386.060	AV	35.9	27.6	14.1	40.9	3.7	40.4	53.9	13.5	
Vert.	2530.102	AV	36.2	27.7	14.4	40.9	3.7	41.1	53.9	12.8	
Vert.	2562.064	AV	36.7	27.8	14.4	40.9	3.7	41.7	53.9	12.2	
Vert.	4804.000	AV	41.1	31.2	6.6	41.8	3.7	40.8	53.9	13.1	
Vert.	7206.000	AV	37.4	36.0	8.3	41.4	3.7	44.0	53.9	9.9	
Vert.	19227.970	AV	42.1	40.7	-2.5	45.3	3.7	38.7	53.9	15.2	

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

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.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	88.8	27.6	14.1	40.9	89.6	-	-	
Hori.	2400.000	PK	43.0	27.6	14.1	40.9	43.8	69.6	25.8	
Vert.	2402.000	PK	88.5	27.6	14.1	40.9	89.3	-	-	
Vert.	2400.000	PK	42.8	27.6	14.1	40.9	43.6	69.3	25.7	

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

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Radiated Emission

Test place No.1 Semi Anechoic Chamber
 Date June 30, 2013
 Temperature / Humidity 24 deg.C, 62 %RH
 Engineer Shinichi Takano
 Mode Tx, 2440 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.	352.007	QP	40.4	15.2	7.4	31.8	31.2	46.0	14.8	150	127	
Hori.	716.012	QP	31.8	20.9	9.3	32.0	30.0	46.0	16.0	100	356	
Hori.	2503.982	PK	46.4	27.7	14.3	40.9	47.5	73.9	26.4	192	160	
Hori.	2519.962	PK	46.2	27.7	14.3	40.9	47.3	73.9	26.6	192	160	
Hori.	4880.000	PK	53.2	31.3	6.6	41.7	49.4	73.9	24.5	106	255	
Hori.	7320.000	PK	46.9	36.2	8.1	41.4	49.8	73.9	24.1	100	0	
Hori.	19531.960	PK	49.5	40.8	-2.4	45.2	42.7	73.9	31.2	109	99	
Vert.	128.008	QP	38.8	13.7	8.2	31.8	28.9	43.5	14.6	100	7	
Vert.	200.007	QP	33.1	16.6	9.1	31.8	27.0	43.5	16.5	100	135	
Vert.	352.014	QP	40.4	15.2	7.4	31.8	31.2	46.0	14.8	100	230	
Vert.	656.035	QP	32.5	20.1	9.1	32.1	29.6	46.0	16.4	100	77	
Vert.	2503.994	PK	46.6	27.7	14.3	40.9	47.7	73.9	26.2	100	359	
Vert.	2520.024	PK	47.2	27.7	14.3	40.9	48.3	73.9	25.6	100	359	
Vert.	4880.000	PK	50.9	31.3	6.6	41.7	47.1	73.9	26.8	100	203	
Vert.	7320.000	PK	46.4	36.2	8.1	41.4	49.3	73.9	24.6	100	0	
Vert.	19531.950	PK	49.5	40.8	-2.4	45.2	42.7	73.9	31.2	109	170	

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

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

Average measurement value with duty factor

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]	Remark
Hori.	2503.982	AV	37.1	27.7	14.3	40.9	3.7	41.9	53.9	12.0	
Hori.	2519.962	AV	36.6	27.7	14.3	40.9	3.7	41.4	53.9	12.5	
Hori.	4880.000	AV	43.5	31.3	6.6	41.7	3.7	43.4	53.9	10.5	
Hori.	7320.000	AV	36.4	36.2	8.1	41.4	3.7	43.0	53.9	10.9	
Hori.	19531.960	AV	42.7	40.8	-2.4	45.2	3.7	39.6	53.9	14.3	
Vert.	2503.994	AV	37.2	27.7	14.3	40.9	3.7	42.0	53.9	11.9	
Vert.	2520.024	AV	37.1	27.7	14.3	40.9	3.7	41.9	53.9	12.0	
Vert.	4880.000	AV	42.9	31.3	6.6	41.7	3.7	42.8	53.9	11.1	
Vert.	7320.000	AV	36.6	36.2	8.1	41.4	3.7	43.2	53.9	10.7	
Vert.	19531.950	AV	43.1	40.8	-2.4	45.2	3.7	40.0	53.9	13.9	

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

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

Radiated Emission

Test place No.1 Semi Anechoic Chamber
 Date June 30, 2013
 Temperature / Humidity 24 deg.C, 62 %RH
 Engineer Shinichi Takano
 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.	352.014	QP	40.1	15.2	7.4	31.8	30.9	46.0	15.1	175	146	
Hori.	714.979	QP	32.1	20.8	9.3	32.0	30.2	46.0	15.8	100	359	
Hori.	2483.500	PK	58.9	27.6	14.2	40.9	59.8	73.9	14.1	100	239	
Hori.	2511.984	PK	47.3	27.7	14.3	40.9	48.4	73.9	25.5	100	239	
Hori.	2543.920	PK	47.3	27.8	14.4	40.9	48.6	73.9	25.3	100	239	
Hori.	2560.022	PK	46.5	27.8	14.4	40.9	47.8	73.9	26.1	100	239	
Hori.	4960.000	PK	51.9	31.5	6.7	41.5	48.6	73.9	25.3	100	260	
Hori.	7440.000	PK	45.9	36.3	8.1	41.4	48.9	73.9	25.0	100	0	
Hori.	19828.020	PK	49.5	40.9	-2.3	45.1	43.0	73.9	30.9	107	97	
Hori.	2483.500	AV	40.8	27.6	14.2	40.9	41.7	53.9	12.2	100	239	
Vert.	128.011	QP	38.6	13.7	8.2	31.8	28.7	43.5	14.8	100	235	
Vert.	200.007	QP	33.4	16.6	9.1	31.8	27.3	43.5	16.2	100	159	
Vert.	352.006	QP	40.2	15.2	7.4	31.8	31.0	46.0	15.0	100	226	
Vert.	657.012	QP	32.0	20.1	9.1	32.1	29.1	46.0	16.9	100	313	
Vert.	2483.500	PK	59.1	27.6	14.2	40.9	60.0	73.9	13.9	100	342	
Vert.	2511.950	PK	46.8	27.7	14.3	40.9	47.9	73.9	26.0	100	342	
Vert.	2543.976	PK	47.8	27.8	14.4	40.9	49.1	73.9	24.8	100	342	
Vert.	2559.930	PK	47.2	27.8	14.4	40.9	48.5	73.9	25.4	100	342	
Vert.	4960.000	PK	51.6	31.5	6.7	41.5	48.3	73.9	25.6	126	242	
Vert.	7440.000	PK	46.6	36.3	8.1	41.4	49.6	73.9	24.3	100	0	
Vert.	19827.970	PK	48.7	40.9	-2.3	45.1	42.2	73.9	31.7	106	172	
Vert.	2483.500	AV	41.0	27.6	14.2	40.9	41.9	53.9	12.0	100	342	

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

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

Average measurement value with duty factor

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]	Remark
Hori.	2511.984	AV	37.3	27.7	14.3	40.9	3.7	42.1	53.9	11.8	
Hori.	2543.920	AV	37.4	27.8	14.4	40.9	3.7	42.4	53.9	11.5	
Hori.	2560.022	AV	37.1	27.8	14.4	40.9	3.7	42.1	53.9	11.8	
Hori.	4960.000	AV	43.6	31.5	6.7	41.5	3.7	44.0	53.9	9.9	
Hori.	7440.000	AV	36.4	36.3	8.1	41.4	3.7	43.1	53.9	10.8	
Hori.	19828.020	AV	42.5	40.9	-2.3	45.1	3.7	39.7	53.9	14.2	
Vert.	2511.950	AV	37.2	27.7	14.3	40.9	3.7	42.0	53.9	11.9	
Vert.	2543.976	AV	37.7	27.8	14.4	40.9	3.7	42.7	53.9	11.2	
Vert.	2559.930	AV	37.6	27.8	14.4	40.9	3.7	42.6	53.9	11.3	
Vert.	4960.000	AV	43.9	31.5	6.7	41.5	3.7	44.3	53.9	9.6	
Vert.	7440.000	AV	36.4	36.3	8.1	41.4	3.7	43.1	53.9	10.8	
Vert.	19827.970	AV	41.9	40.9	-2.3	45.1	3.7	39.1	53.9	14.8	

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

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

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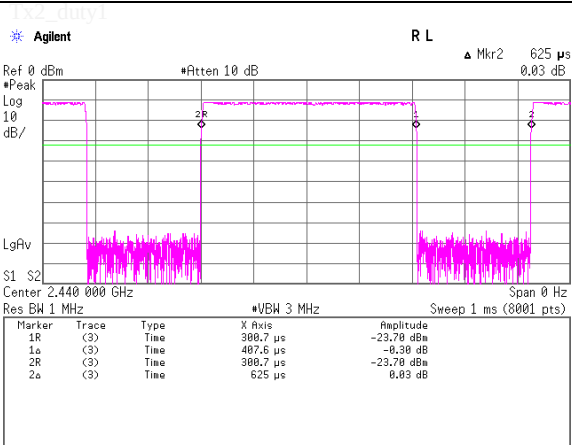
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Duty Factor Calculation chart

Tx, Bluetooth Low Energy, PN9,

Duty Factor Calculation

Duty Factor: $20\log(1/\text{duty cycle}) = 3.7\text{dB}$ duty cycle = $0.4076 / 0.625 = 0.652$ (65.2%)

Tx2_duty2

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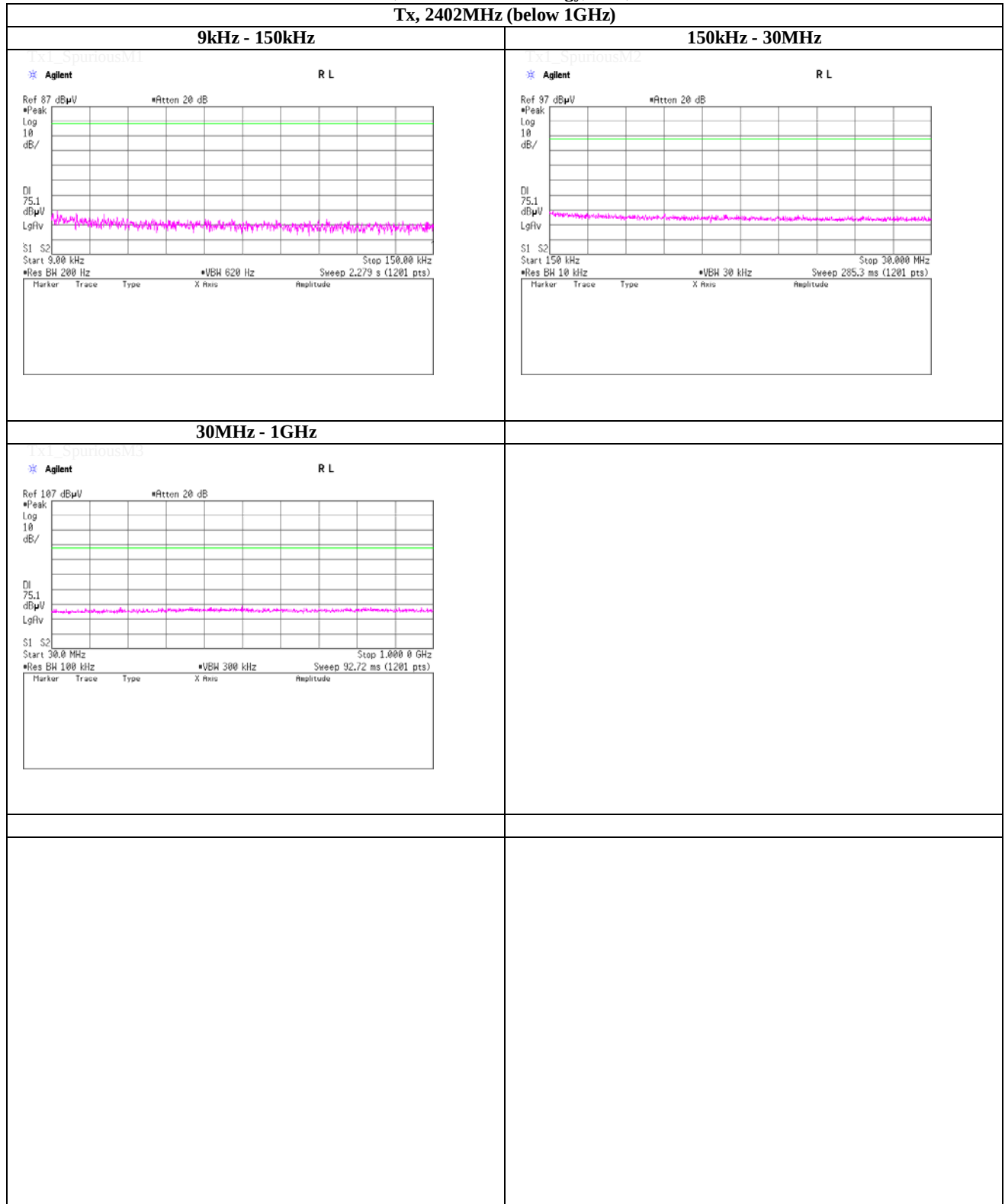
Telephone : +81 463 50 6400

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(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9,

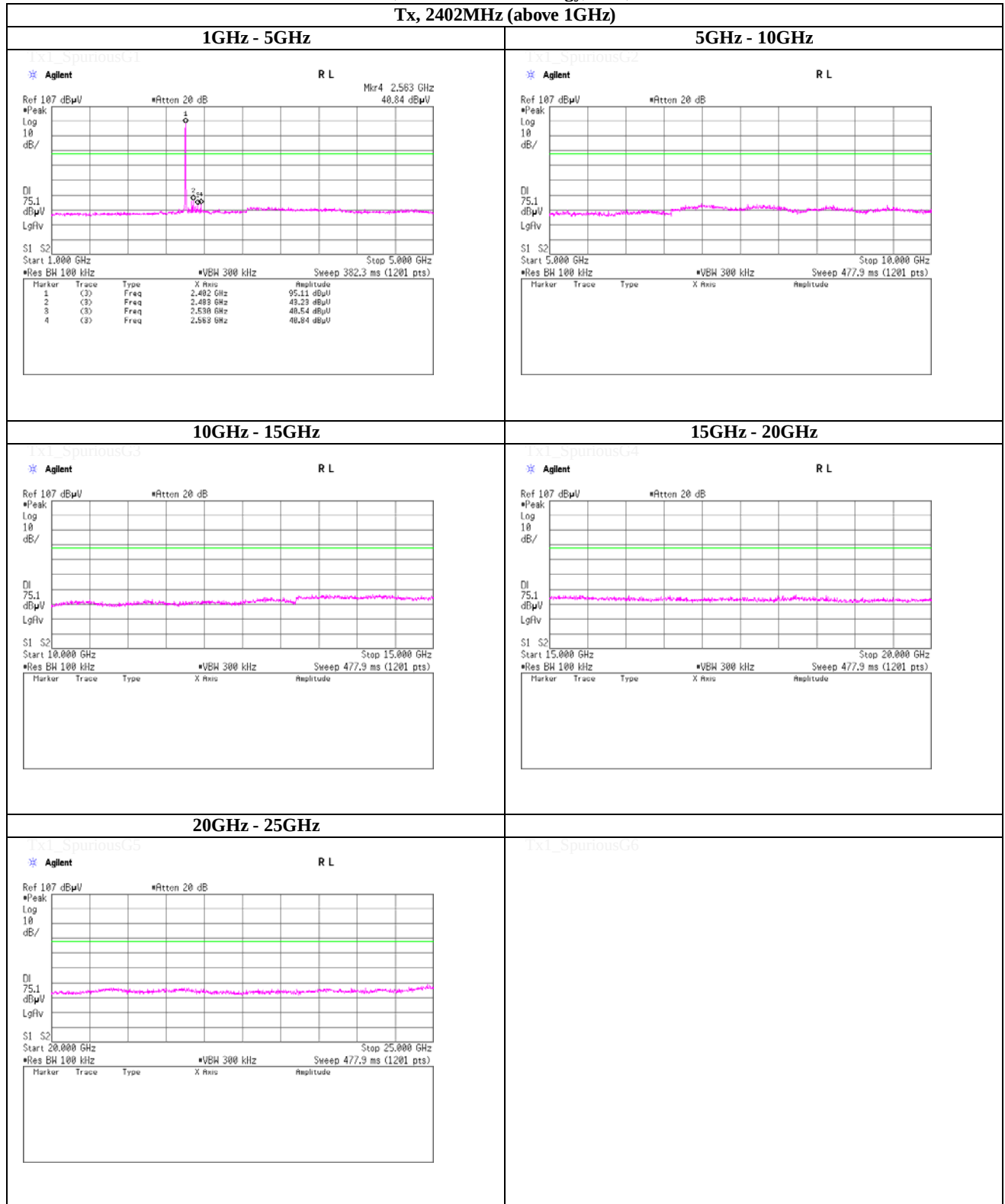
Tx, 2402MHz (below 1GHz)

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(Reference chart) Spurious emission (Conducted)**Tx, Bluetooth Low Energy, PN9,****Tx, 2402MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.**

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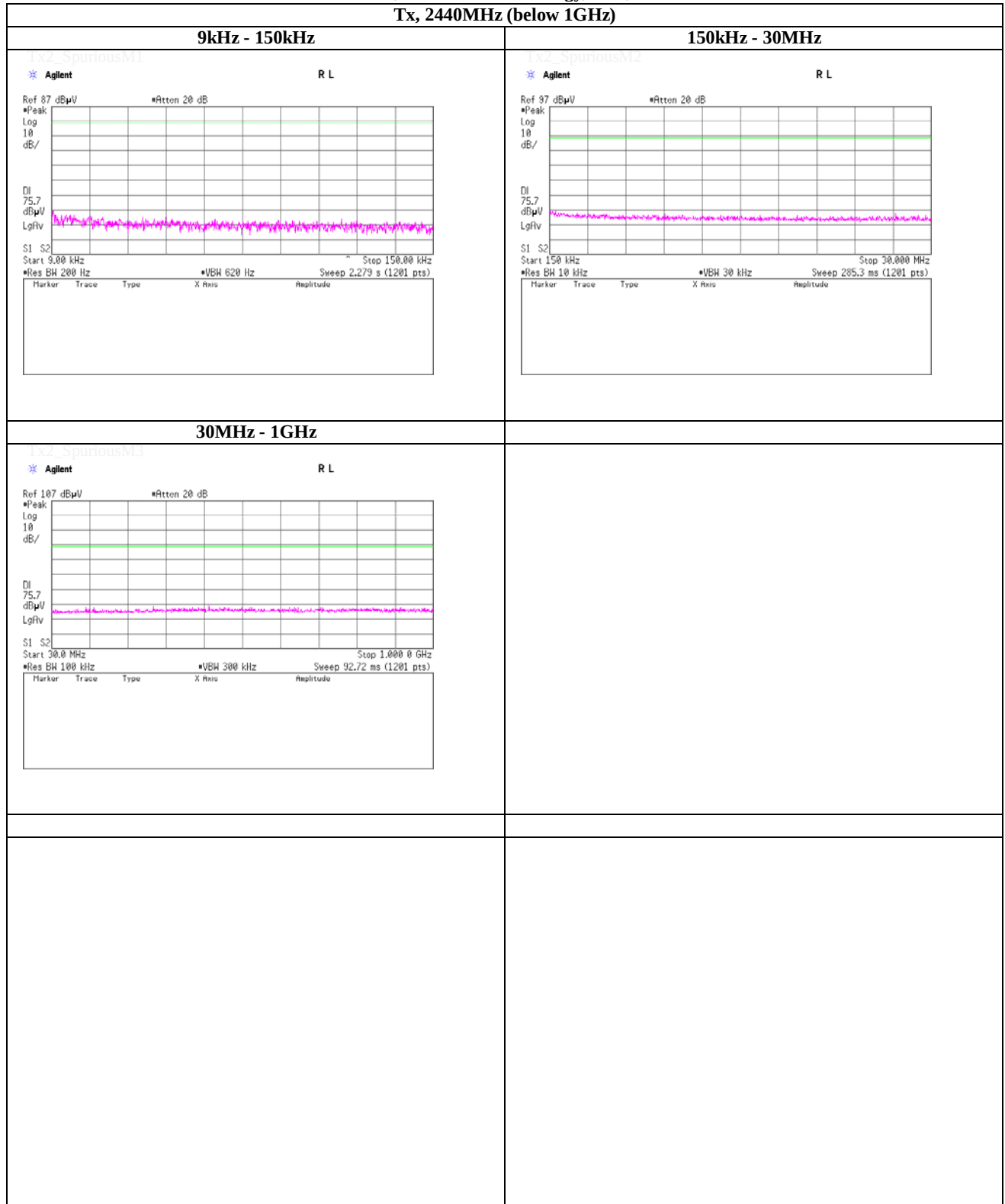
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(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9,

Tx, 2440MHz (below 1GHz)

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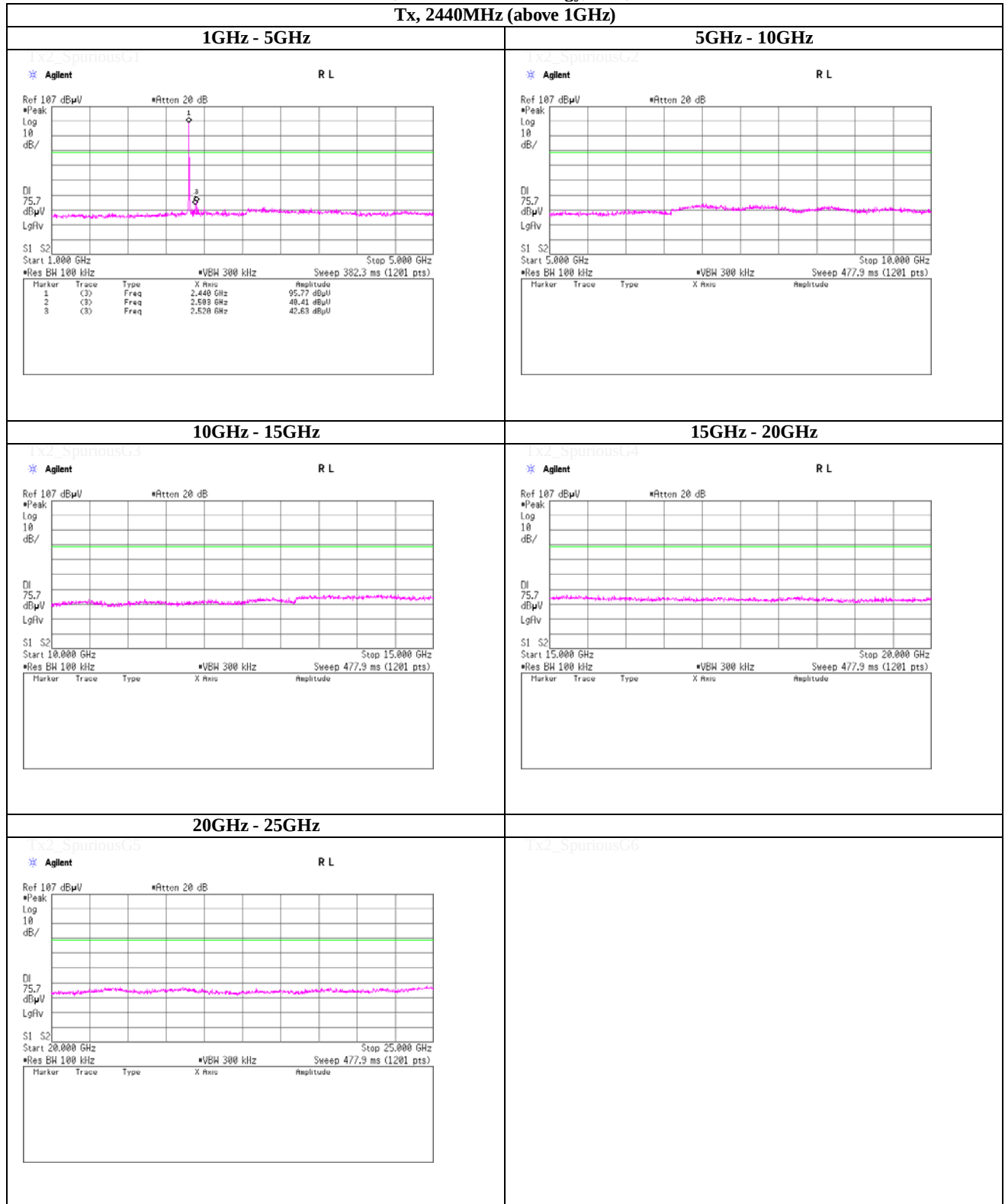
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(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9,

Tx, 2440MHz (above 1GHz)

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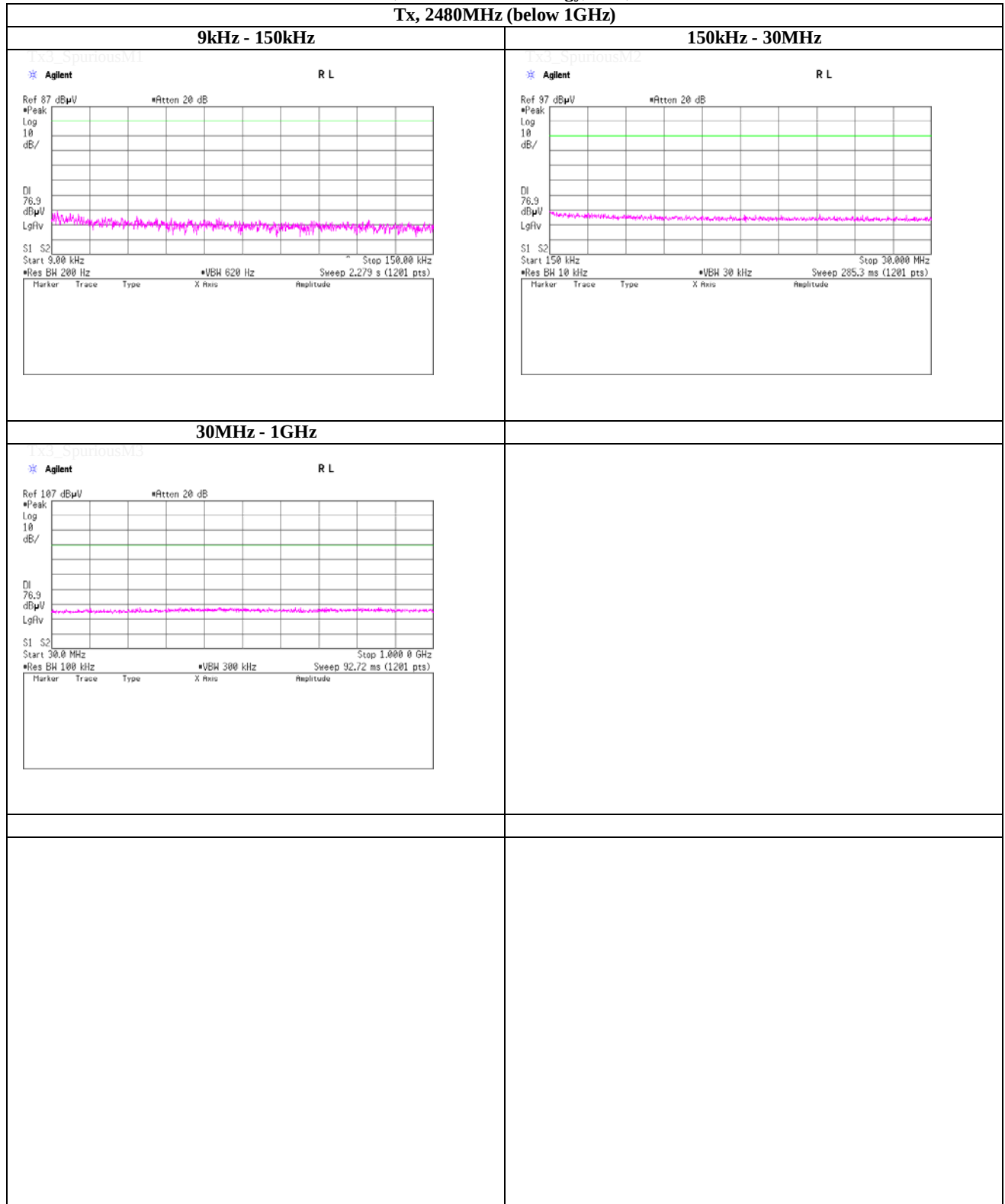
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(Reference chart) Spurious emission (Conducted)

Tx, Bluetooth Low Energy, PN9,

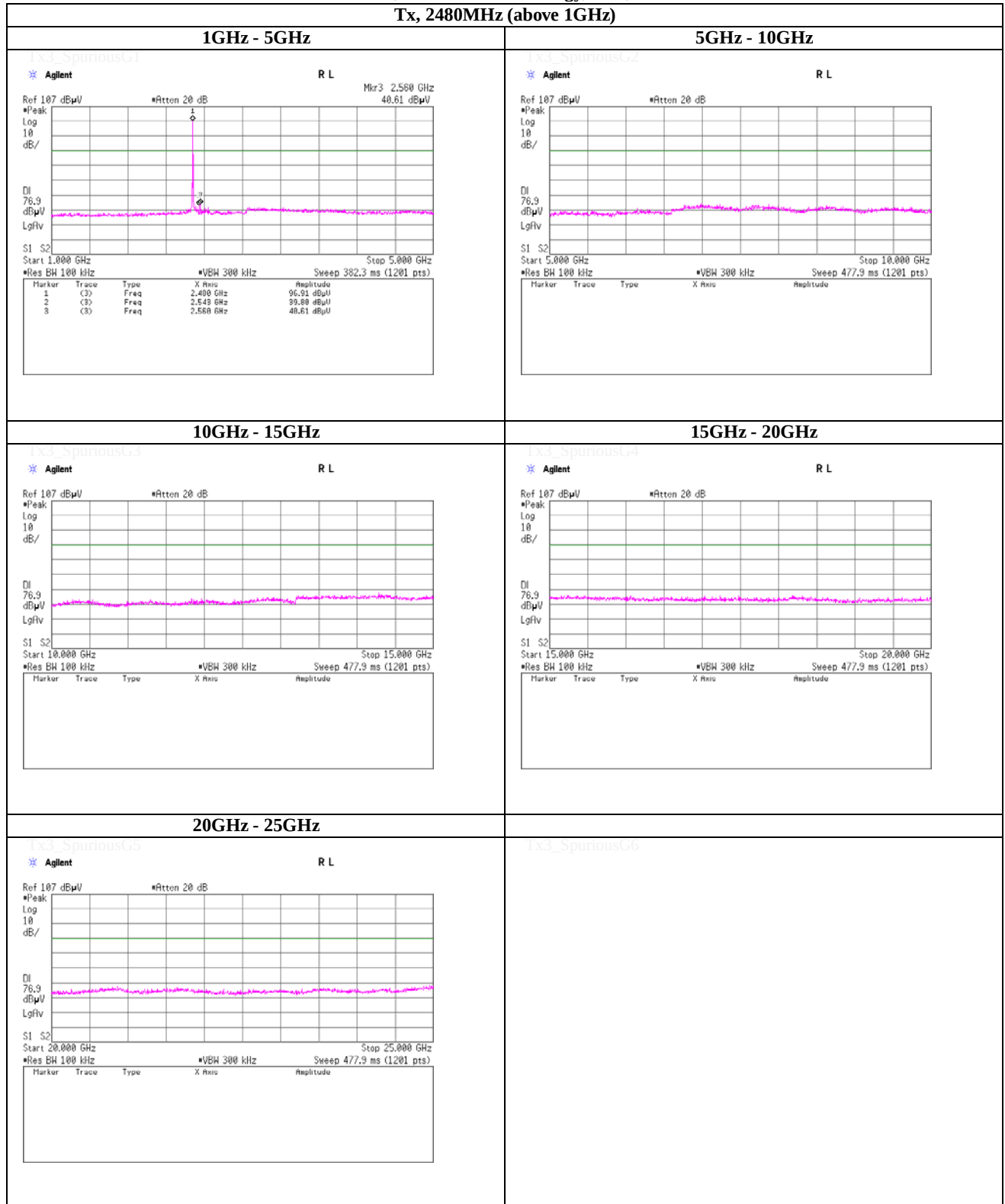
Tx, 2480MHz (below 1GHz)

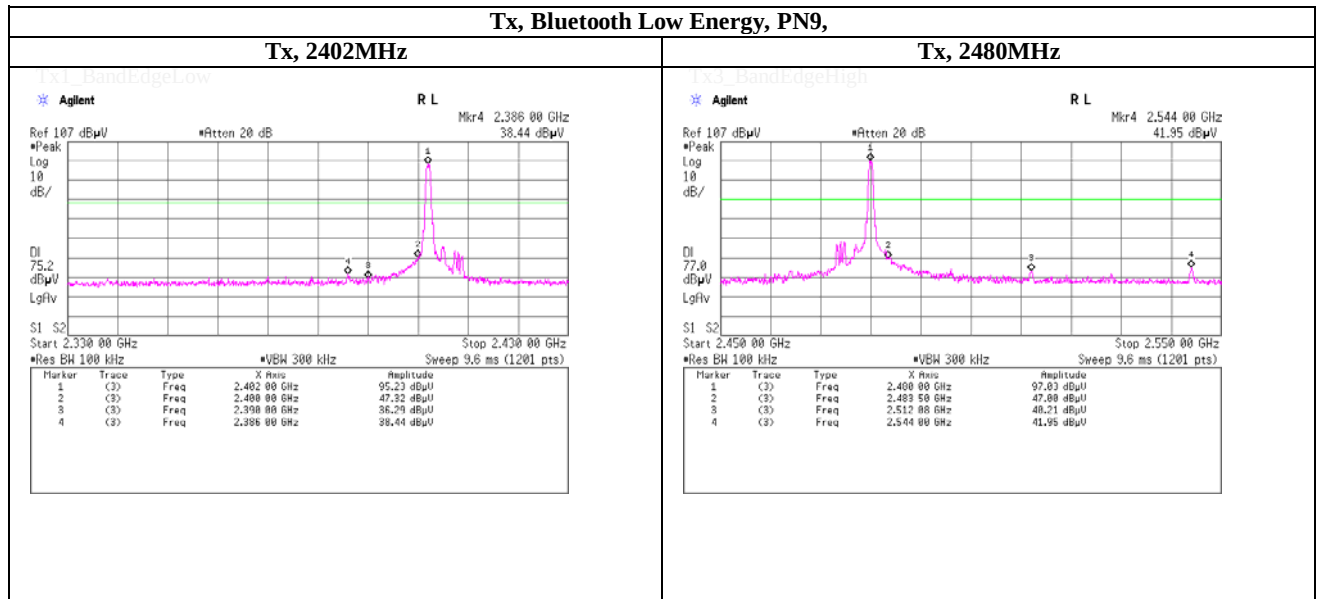
**UL Japan, Inc.****Shonan EMC Lab.**

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(Reference chart) Spurious emission (Conducted)**Tx, Bluetooth Low Energy, PN9,****Tx, 2480MHz (above 1GHz)****UL Japan, Inc.****Shonan EMC Lab.****1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa 259-1220 JAPAN****Telephone : +81 463 50 6400****Facsimile : +81 463 50 6401**

(Reference chart) Spurious emission (Conducted)**Band Edge compliance****UL Japan, Inc.****Shonan EMC Lab.**

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Maximum Power Spectral Density

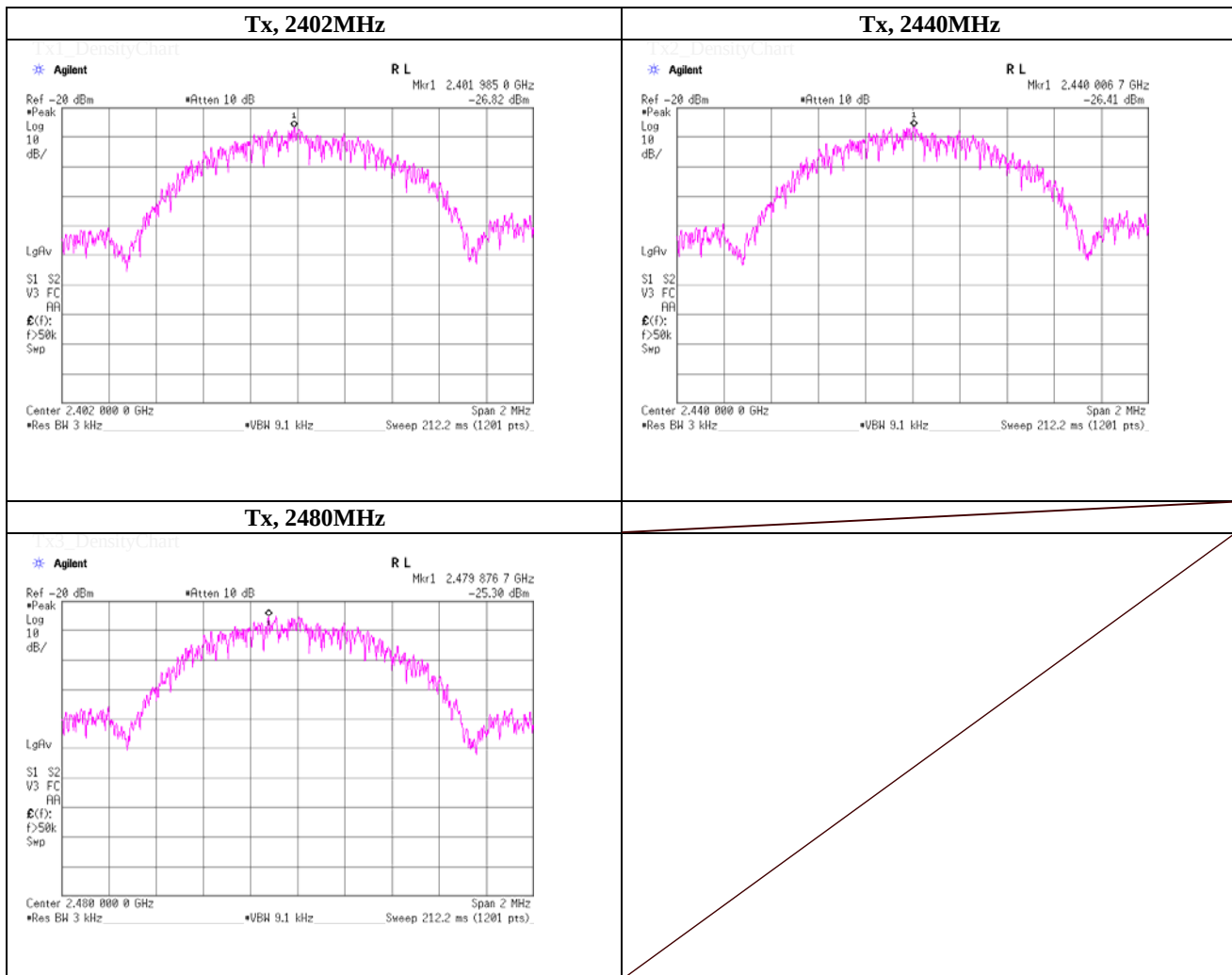
(PKPSD)

Test place	UL Japan, Inc. Shonan EMC Lab.	No.1 Shielded Room
Date	June 28, 2013	
Temperature / Humidity	26deg.C , 51%RH	
Engineer	Shinichi Takano	
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	2401.99	-26.82	0.74	9.98	-16.10	8.00	24.10
2440.0000	2440.01	-26.41	0.76	9.98	-15.67	8.00	23.67
2480.0000	2479.88	-25.30	0.76	9.98	-14.56	8.00	22.56

Sample Calculation:

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

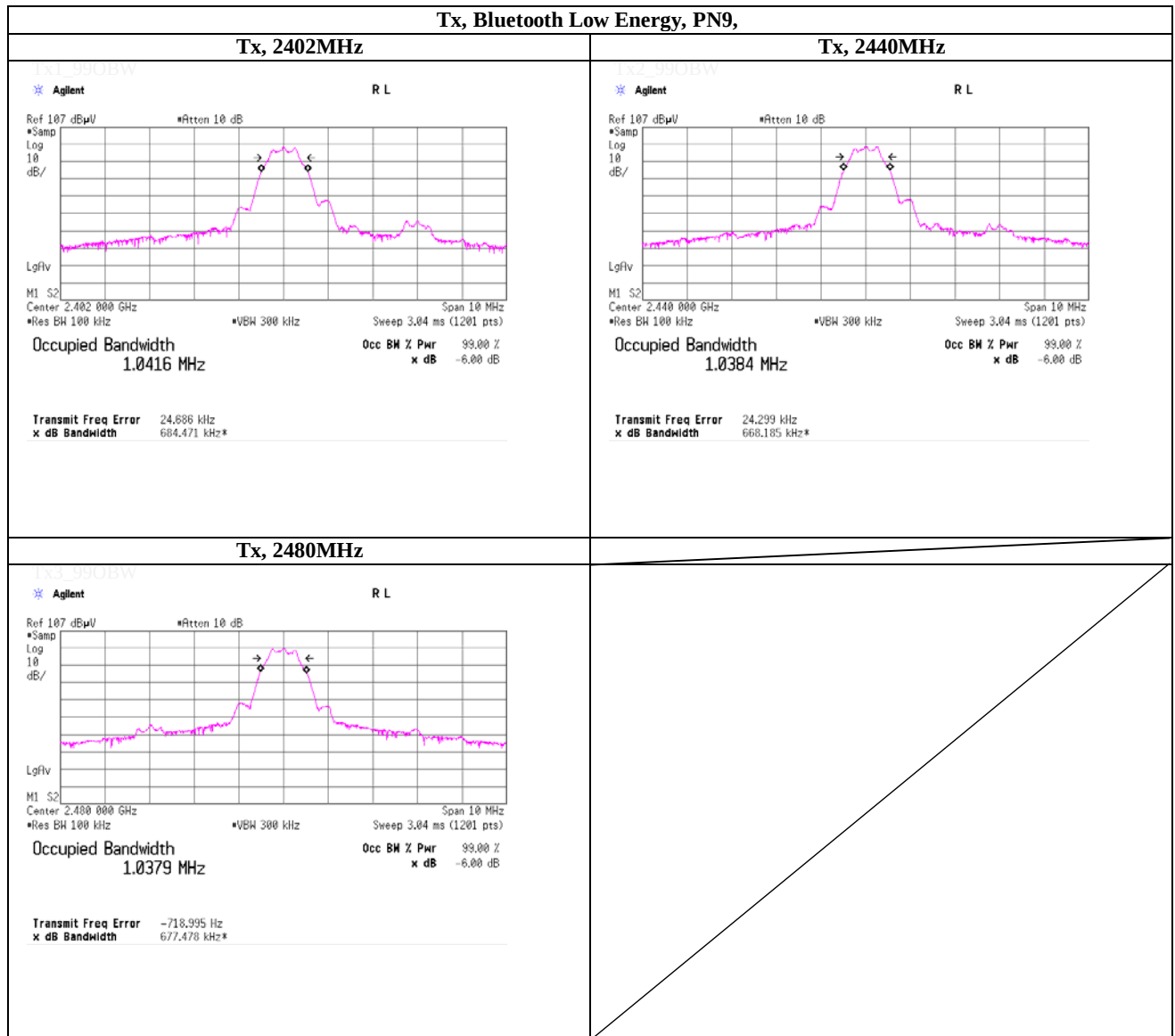
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99% Occupied Bandwidth



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APPENDIX 2

Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT,RE	2013/03/28 * 12
SCC-G11	Coaxial Cable	Suhner	SUCOFLEX 102	31595/2	AT	2013/03/16 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2013/04/09 * 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
SOS-02	Humidity Indicator	A&D	AD-5681	4063343	AT,CE	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	2013/05/22 * 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
SJM-08	Measure	PROMART	SEN1935	-	RE,CE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE, RFI,MF)	-	RE,CE	-
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2012/12/18 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2012/12/18 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2013/03/14 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2013/03/19 * 12
SCC-G18	Coaxial Cable	Suhner	SUCOFLEX 104A	46292/4A	RE	2013/03/16 * 12
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2013/02/12 * 12
SAT6-05	Attenuator	JFW	50HF-006N	-	RE	2013/02/12 * 12
SAT3-04	Attenuator	JFW	50HF-003N	-	RE	2013/02/12 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2012/10/08 * 12
SCC-A1/A3/A5/A7/A8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	RE	2013/04/04 * 12
SCC-A2/A4/A6/A7/A8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	RE	2013/04/04 * 12
SLA-01	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0888	RE	2012/11/18 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE,CE	2012/10/04 * 12
SCC-A12/A13/SRSE-01	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-269(RF Selector)	CE	2013/04/04 * 12
SLS-01	LISN	Rohde & Schwarz	ENV216	100511	CE	2013/02/22 * 12
SAT3-03	Attenuator	JFW	50HF-003N	-	CE	2013/02/12 * 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