



Test report No. : 10959367S-A
Page : 1 of 44
Issued date : October 21, 2015
Revised date : November 9, 2015
FCC ID : GT3FC022

RADIO TEST REPORT

Test Report No. : 10959367S-A

Applicant : SMK Corporation
Type of Equipment : Bluetooth Smart Module
Model No. : BTS01
FCC ID : GT3FC022
Test regulation : FCC Part 15 Subpart C: 2015
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: October 2 to 9, 2015

Representative test engineer:

Y. Ishikawa

Yosuke Ishikawa
Engineer
Consumer Technology Division

Approved by:

T. Imamura

Toyokazu Imamura
Leader
Consumer Technology Division



- ☒ 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.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10959367S-A

[illegible]

CONTENTS	PAGE
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Conducted Emission.....	10
SECTION 6: Radiated Spurious Emission	11
SECTION 7: Antenna Terminal Conducted Tests.....	12
APPENDIX 1: Test data	13
Conducted Emission	13
6dB Bandwidth	19
Maximum Peak Output Power	21
Average Output Power	22
Radiated Spurious Emission	24
Conducted Spurious Emission	35
Power Density	36
99%Occupied Bandwidth	38
APPENDIX 2: Test instruments	39
APPENDIX 3: Photographs of test setup	41
Conducted Emission	41
Radiated Spurious Emission	43
Worst Case Position	44

SECTION 1: Customer information

Company Name	:	SMK Corporation
Address	:	5-5, Togoshi 6-chome, Shinagawa-ku, Tokyo 142-8511, Japan
Telephone Number	:	+81-3-3785-1395
Facsimile Number	:	+81-3-3785-2804
Contact Person	:	Masakuni Jinno

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

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth Smart Module
Model No.	:	BTS01
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 2.1 V to DC 3.6 V
Receipt Date of Sample	:	September 28, 2015
Country of Mass-production	:	Japan, China, Malaysia, Phillipines, Hungary, U.S.A., Mexico
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab.

2.2 Product Description

Model: BTS01 (referred to as the EUT in this report) is a Bluetooth Smart Module.

General Specification

Clock frequency(ies) in the system	:	16 MHz
------------------------------------	---	--------

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Antenna type	:	PWB printed antenna
Antenna Gain	:	-0.16 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on September 8, 2015
 Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
 Section 15.207 Conducted limits
 Section 15.247 Operation within the bands 902-928MHz,
 2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4-2009 7. AC powerline Conducted Emission measurements IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	14.4 dB 0.45320 MHz, L1, AV Tx 2402 MHz, Sample : 90F0A37B 0.46402 MHz, L1, AV Tx 2480 MHz, Sample : 90F0AF1D	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	2.1 dB 12010 MHz, AV, Horizontal Tx 2402 MHz, Sample : 90F0A37B 12010 MHz, AV, Vertical Tx 2402 MHz, Sample : 90F0AF1D	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

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

*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v03r03 12.2.7.

* In case any questions arise about test procedure, ANSI C 63.10:2013 is also referred.

However, there is one deviation from ANSI C 63.10:2013. (ANSI C63.10:20013 is Non-accreditation)

Measurement height is not 1.5 m, but 0.8 m.

FCC Part 15.31 (e)

The RF Module has its own regulator. The RF part is constantly provided voltage (DC 1.2 V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 / 212

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

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

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 $k = 2$.
Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)		
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	3.6 dB	3.4 dB	3.4 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.7 dB	3.5 dB	3.5 dB
	30 MHz-300 MHz	4.9 dB	4.9 dB	4.7 dB
	300 MHz-1 GHz	5.0 dB	5.0 dB	4.8 dB
	1 GHz-13 GHz	4.9 dB	4.9 dB	4.9 dB
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB
	18 GHz-40 GHz	4.5 dB	4.3 dB	4.3 dB

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.76 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.79 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.08 dB
Spurious emission (Conducted) below 1GHz	1.5 dB

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 report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
JAB Accreditation No. RTL02610

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
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.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

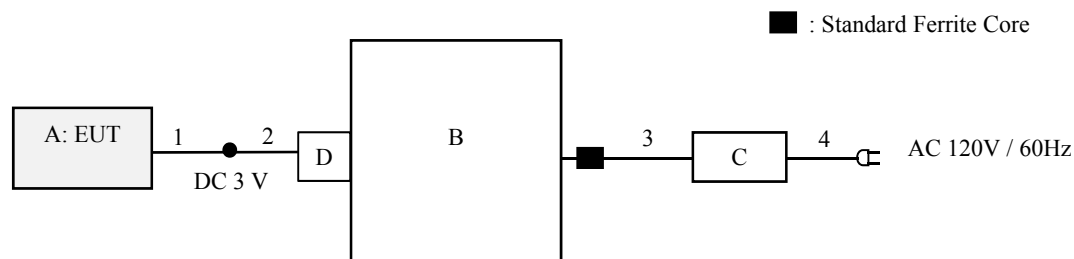
Mode	Remarks*
Bluetooth Low Energy	PRBS9
*The worst condition was determined based on the test result of Maximum Peak Output Power (s/n:90F0A39A, Low Channel)	
*Power of the EUT was set by the software as follows; Power settings: Fixed Software: Test Tool for BLE Module v1.3.0	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission, Spurious Emission 6dB Bandwidth Maximum Peak Output Power Power Density, 99% Occupied Bandwidth	Bluetooth Low Energy	2402 MHz, 2440 MHz, 2480 MHz

4.2 Configuration and peripherals

For Antenna Terminal conducted test and Radiated Emission test



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Smart Module	BTS01	90F0A39A *1) 90F0AF1C *1) 90F0A37B *2) 90F0AF1D *2)	SMK	EUT *3)
B	Laptop Computer	7666-77J	LV-B8PZ8 08/05	Lenovo	-
C	AC Adapter	92P1213	11S92P1213Z1ZDDZ92 C2B0	Lenovo	-
D	Jig	LCS UTCM V1.2	-	-	-

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

*3) The crystal NX2016SA is used for Serial: 90F0A39A and 90F0A37B and the crystal FCX-06 is used for 90F0AF1C and 90F0AF1D. The two crystals are compatible and are electrically identical having same radio parameters.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal	0.1	Unshielded	Unshielded	-
2	USB	1.0	Shielded	Shielded	-
3	DC	1.8	Unshielded	Unshielded	-
4	AC	1.0	Unshielded	Unshielded	-

UL Japan, Inc.

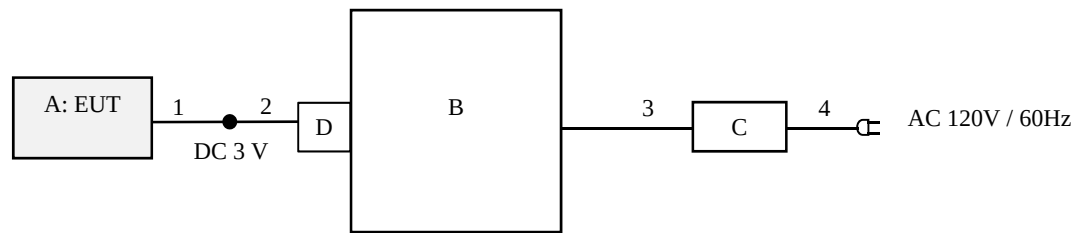
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

For Conducted Emission Test



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Smart Module	BTS01	90F0A37B 90F0AF1D	SMK	EUT
B	Laptop Computer	E1Q57PA#ABJ	5CB3310KHW	Hewlett Packard	-
C	AC Adapter	PPP009L-E	3453442403	Hewlett Packard	-
D	Jig	LCS UTCM V1.2	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal	0.1	Unshielded	Unshielded	-
2	USB	1.0	Shielded	Shielded	-
3	DC	1.7	Unshielded	Unshielded	-
4	AC	1.7	Unshielded	Unshielded	-

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m 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 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a shielded room.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz – 30 MHz
Test data	: APPENDIX
Test result	: Pass

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r03".

EUT was placed on a polystyrene platform of nominal size, 0.5 m by 0.5 m, raised 0.8 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

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

Test Antennas are used as below;

Frequency	30 MHz to 300 MHz	300 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *2)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: 12.2.5.2 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz
Test Distance	3m	3 m (below 13 GHz), 1 m *1) (above 13 GHz)		3 m (below 13 GHz), 1 m *1) (above 13 GHz)

*1) Distance Factor: $20 \times \log(3.0 \text{ m} / 1.0 \text{ m}) = 9.5 \text{ dB}$

*2) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r03"

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.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 30 M - 25 GHz
Test data : APPENDIX
Test result : Pass

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Sample	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	10 kHz	30 kHz				

*1) Max hold was applied as Worst-case measurement.
 *2) Reference data
 *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r03".
 *4) 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.
 (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Sample : 90F0A37B

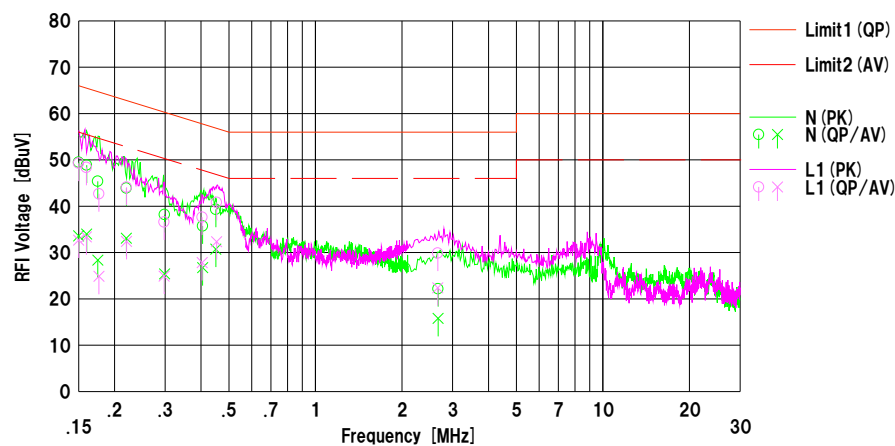
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/10/07

Mode : Tx 2402 MHz
Power : AC120V / 60Hz
Temp./Humi. : 25 deg.C / 40 %RH

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

Engineer : Yusuke Tanikawara



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	0.15001	37.10	21.20	12.39	49.49	33.59	66.00	56.00	16.5	22.4	N	
2	0.16002	36.50	21.60	12.38	48.88	33.98	65.46	55.46	16.5	21.4	N	
3	0.17486	33.00	16.00	12.37	45.37	28.37	64.73	54.73	19.3	26.3	N	
4	0.21994	31.50	20.70	12.40	43.90	33.10	62.82	52.82	18.9	19.7	N	
5	0.29856	25.80	13.00	12.40	38.20	25.40	60.28	50.28	22.0	24.8	N	
6	0.40527	23.30	14.30	12.43	35.73	26.73	57.74	47.74	22.0	21.0	N	
7	0.45022	26.90	18.30	12.43	39.33	30.73	56.87	46.87	17.5	16.1	N	
8	2.67105	9.60	3.20	12.58	22.18	15.78	56.00	46.00	33.8	30.2	N	
9	0.15001	36.90	20.30	12.39	49.29	32.69	66.00	56.00	16.7	23.3	L1	
10	0.15965	36.00	21.00	12.38	48.38	33.38	65.48	55.48	17.1	22.1	L1	
11	0.17651	30.30	12.50	12.37	42.67	24.67	64.65	54.65	21.9	29.7	L1	
12	0.22015	31.70	20.00	12.40	44.10	32.40	62.81	52.81	18.7	20.4	L1	
13	0.29756	24.20	12.50	12.40	36.60	24.90	60.31	50.31	23.7	25.4	L1	
14	0.40348	25.20	15.40	12.43	37.63	27.83	57.78	47.78	20.1	19.9	L1	
15	0.45320	28.40	19.90	12.43	40.83	32.33	56.82	46.82	15.9	14.4	L1	
16	2.66347	17.30	9.80	12.58	29.88	22.38	56.00	46.00	26.1	23.6	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN:SLS-02

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Emission
Sample : 90F0A37B

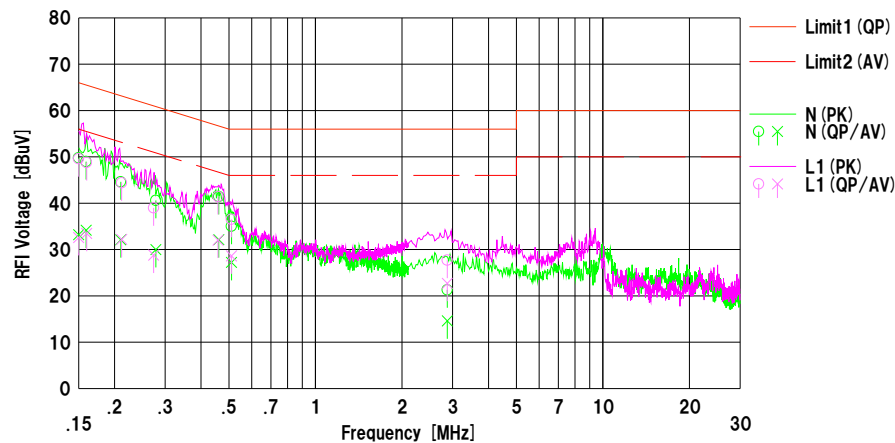
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/10/07

Mode : Tx 2440 MHz
Power : AC120V / 60Hz
Temp./Humi. : 25 deg.C / 40 %RH

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

Engineer : Yusuke Tanikawara



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	0.15001	37.40	20.80	12.39	49.79	33.19	66.00	56.00	16.2	22.8	N	
2	0.15936	36.60	21.80	12.38	48.98	34.18	65.50	55.50	16.5	21.3	N	
3	0.21023	32.20	19.70	12.40	44.60	32.10	63.20	53.20	18.6	21.1	N	
4	0.27855	28.20	17.60	12.40	40.60	30.00	60.86	50.86	20.2	20.8	N	
5	0.46086	29.00	19.70	12.43	41.43	32.13	56.68	46.68	15.2	14.5	N	
6	0.51038	22.60	14.80	12.42	35.02	27.22	56.00	46.00	20.9	18.7	N	
7	2.87505	8.70	2.00	12.60	21.30	14.60	56.00	46.00	34.7	31.4	N	
8	0.15001	37.20	20.20	12.39	49.59	32.59	66.00	56.00	16.4	23.4	L1	
9	0.15997	36.40	21.10	12.38	48.78	33.48	65.47	55.47	16.6	21.9	L1	
10	0.21169	32.00	19.80	12.40	44.40	32.20	63.14	53.14	18.7	20.9	L1	
11	0.27357	26.60	16.40	12.40	39.00	28.80	61.01	51.01	22.0	22.2	L1	
12	0.45803	29.00	19.60	12.43	41.43	32.03	56.73	46.73	15.3	14.7	L1	
13	0.51003	24.10	16.20	12.42	36.52	28.62	56.00	46.00	19.4	17.3	L1	
14	2.87634	15.10	10.10	12.60	27.70	22.70	56.00	46.00	28.3	23.3	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN + Cable + ATT) [dB]
LISN: SLS-02

Conducted Emission
Sample : 90F0A37B

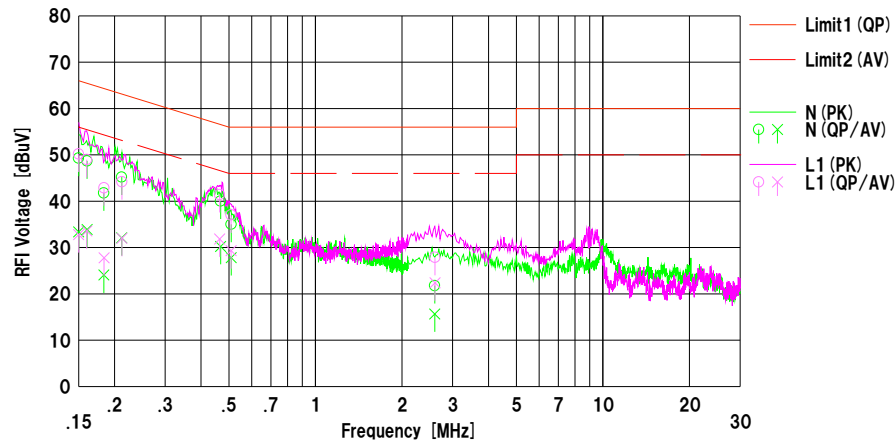
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/10/07

Mode : Tx 2480 MHz
Power : AC120V / 60Hz
Temp./Humi. : 25 deg.C / 40 %RH

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

Engineer : Yusuke Tanikawara



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	0.15001	36.90	21.00	12.39	49.29	33.39	66.00	56.00	16.7	22.6	N	
2	0.18057	36.30	21.50	12.38	48.68	33.88	65.43	55.43	16.7	21.5	N	
3	0.18360	29.40	11.70	12.38	41.78	24.08	64.32	54.32	22.5	30.2	N	
4	0.21192	32.80	19.70	12.40	45.20	32.10	63.13	53.13	17.9	21.0	N	
5	0.46779	27.60	17.80	12.43	40.03	30.23	56.55	46.55	16.5	16.3	N	
6	0.50948	22.60	15.40	12.42	35.02	27.82	56.00	46.00	20.9	18.1	N	
7	2.60057	9.20	3.10	12.57	21.77	15.67	56.00	46.00	34.2	30.3	N	
8	0.15001	37.80	20.40	12.39	50.19	32.79	66.00	56.00	15.8	23.2	L1	
9	0.16017	36.60	21.20	12.38	48.98	33.58	65.46	55.46	16.4	21.8	L1	
10	0.18382	30.50	15.40	12.38	42.88	27.78	64.31	54.31	21.4	26.5	L1	
11	0.21217	31.80	19.60	12.40	44.20	32.00	63.12	53.12	18.9	21.1	L1	
12	0.46435	29.00	19.40	12.43	41.43	31.83	56.61	46.61	15.1	14.7	L1	
13	0.50893	24.60	16.90	12.42	37.02	29.32	56.00	46.00	18.9	16.6	L1	
14	2.60596	15.30	9.80	12.57	27.87	22.37	56.00	46.00	28.1	23.6	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN:SLS-02

Conducted Emission
Sample : 90F0AF1D

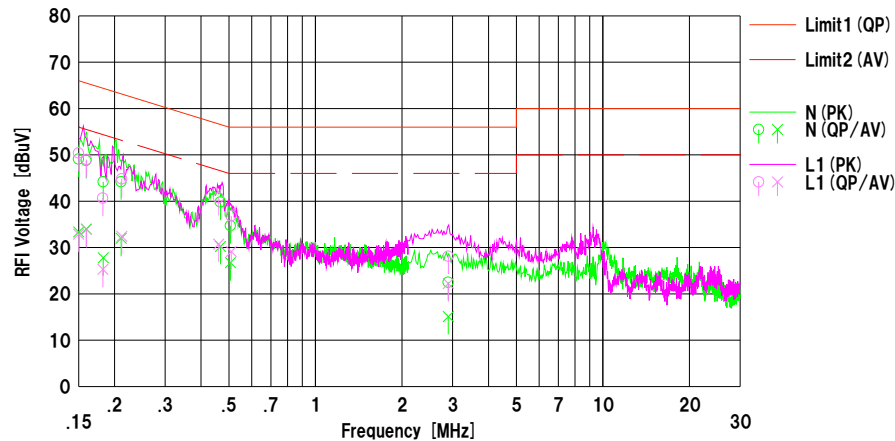
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/10/07

Mode : Tx 2402 MHz
Power : AC120V / 60Hz
Temp./Humi. : 25 deg.C / 40 %RH

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

Engineer : Yusuke Tanikawara



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	0.15001	36.70	21.00	12.39	49.09	33.39	66.00	56.00	16.9	22.6	N	
2	0.15945	36.40	21.60	12.38	48.78	33.98	65.49	55.49	16.7	21.5	N	
3	0.18273	31.80	15.40	12.38	44.18	27.78	64.36	54.36	20.1	26.5	N	
4	0.21097	31.80	19.60	12.40	44.20	32.00	63.17	53.17	18.9	21.1	N	
5	0.46744	27.40	17.80	12.43	39.83	30.23	56.56	46.56	16.7	16.3	N	
6	0.50617	22.30	14.30	12.42	34.72	26.72	56.00	46.00	21.2	19.2	N	
7	2.89857	9.90	2.50	12.60	22.50	15.10	56.00	46.00	33.5	30.9	N	
8	0.15001	38.00	20.50	12.39	50.39	32.89	66.00	56.00	15.6	23.1	L1	
9	0.15990	36.60	21.50	12.38	48.98	33.88	65.47	55.47	16.4	21.5	L1	
10	0.18222	28.30	12.90	12.38	40.68	25.28	64.38	54.38	23.7	29.1	L1	
11	0.21201	32.40	20.00	12.40	44.80	32.40	63.13	53.13	18.3	20.7	L1	
12	0.46069	28.30	18.30	12.43	40.73	30.73	56.68	46.68	15.9	15.9	L1	
13	0.50950	24.40	16.70	12.42	36.82	29.12	56.00	46.00	19.1	16.8	L1	
14	2.89982	15.50	9.60	12.60	28.10	22.20	56.00	46.00	27.9	23.8	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN:SLS-02

Conducted Emission
Sample : 90F0AF1D

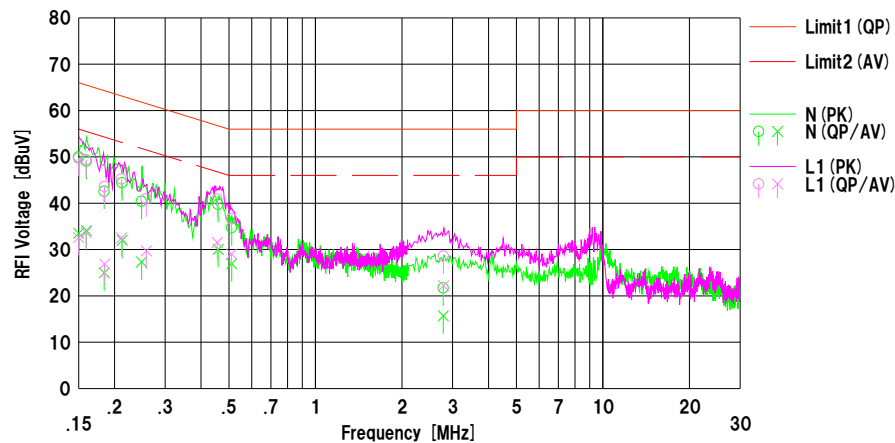
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/10/07

Mode : Tx 2440 MHz
Power : AC120V / 60Hz
Temp./Humi. : 25 deg.C / 40 %RH

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

Engineer : Yusuke Tanikawara



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	0.15001	37.60	21.10	12.39	49.99	33.49	66.00	56.00	16.0	22.5	N	
2	0.15967	36.70	21.70	12.38	49.08	34.08	65.48	55.48	16.4	21.4	N	
3	0.18413	30.20	12.60	12.38	42.58	24.98	64.30	54.30	21.7	29.3	N	
4	0.21251	32.00	19.60	12.40	44.40	32.00	63.11	53.11	18.7	21.1	N	
5	0.24839	28.00	14.90	12.40	40.40	27.30	61.81	51.81	21.4	24.5	N	
6	0.45874	27.30	17.60	12.43	39.73	30.03	56.72	46.72	16.9	16.6	N	
7	0.51129	22.30	14.50	12.42	34.72	26.92	56.00	46.00	21.2	19.0	N	
8	2.78492	9.10	3.10	12.59	21.69	15.69	56.00	46.00	34.3	30.3	N	
9	0.15001	37.30	20.20	12.39	49.69	32.59	66.00	56.00	16.3	23.4	L1	
10	0.15927	37.00	21.30	12.38	49.38	33.68	65.50	55.50	16.1	21.8	L1	
11	0.18460	31.20	14.50	12.38	43.58	26.88	64.28	54.28	20.7	27.4	L1	
12	0.21164	32.80	20.10	12.40	45.28	32.50	63.14	53.14	17.9	20.6	L1	
13	0.25801	28.50	17.30	12.40	40.90	29.70	61.50	51.50	20.6	21.8	L1	
14	0.45556	28.40	19.10	12.43	40.83	31.53	56.77	46.77	15.9	15.2	L1	
15	0.51046	24.20	16.60	12.42	36.62	29.02	56.00	46.00	19.3	16.9	L1	
16	2.78924	16.00	9.60	12.59	28.59	22.19	56.00	46.00	27.4	23.8	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN + Cable + ATT) [dB]
LISN: SLS-02

Conducted Emission
Sample : 90F0AF1D

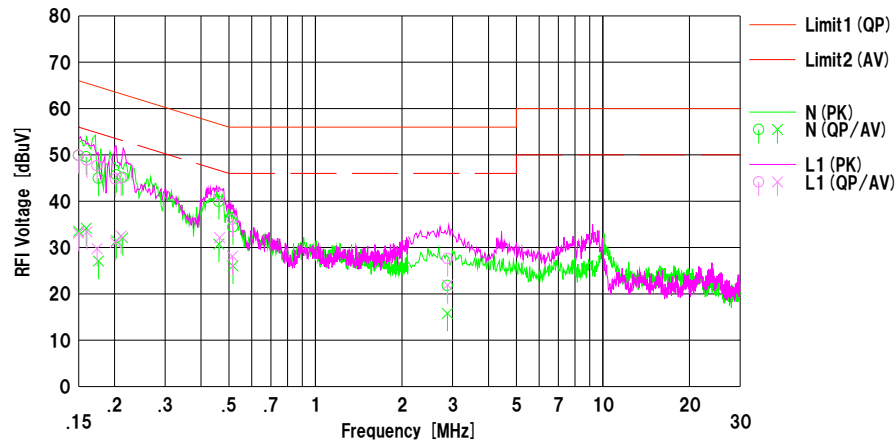
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2015/10/07

Mode : Tx 2480 MHz
Power : AC120V / 60Hz
Temp./Humi. : 25 deg.C / 40 %RH

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

Engineer : Yusuke Tanikawara



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	0.15001	37.50	21.10	12.39	49.89	33.49	66.00	56.00	16.1	22.5	N	
2	0.15947	37.20	21.80	12.38	49.58	34.18	65.49	55.49	15.9	21.3	N	
3	0.17594	32.60	14.70	12.37	44.97	27.07	64.68	54.68	19.7	27.6	N	
4	0.20282	33.30	19.10	12.39	45.69	31.49	63.49	53.49	17.8	22.0	N	
5	0.21355	32.70	19.70	12.40	45.10	32.10	63.07	53.07	17.9	20.9	N	
6	0.46135	27.50	18.30	12.43	39.93	30.73	56.67	46.67	16.7	15.9	N	
7	0.51632	22.00	13.60	12.42	34.42	26.02	56.00	46.00	21.5	19.9	N	
8	2.87828	9.20	3.20	12.60	21.80	15.80	56.00	46.00	34.2	30.2	N	
9	0.15001	37.50	20.70	12.39	49.89	33.09	66.00	56.00	16.1	22.9	L1	
10	0.15024	36.50	21.00	12.38	48.88	33.38	65.45	55.45	16.5	22.0	L1	
11	0.17397	35.30	17.40	12.37	47.67	29.77	64.77	54.77	17.1	25.0	L1	
12	0.20148	32.40	18.70	12.39	44.79	31.09	63.55	53.55	18.7	22.4	L1	
13	0.21104	32.60	20.10	12.40	45.00	32.50	63.16	53.16	18.1	20.6	L1	
14	0.46402	28.90	19.70	12.43	41.33	32.13	56.62	46.62	15.2	14.4	L1	
15	0.51451	23.70	15.70	12.42	36.12	28.12	56.00	46.00	19.8	17.8	L1	
16	2.88264	15.00	9.30	12.60	27.60	21.90	56.00	46.00	28.4	24.1	L1	

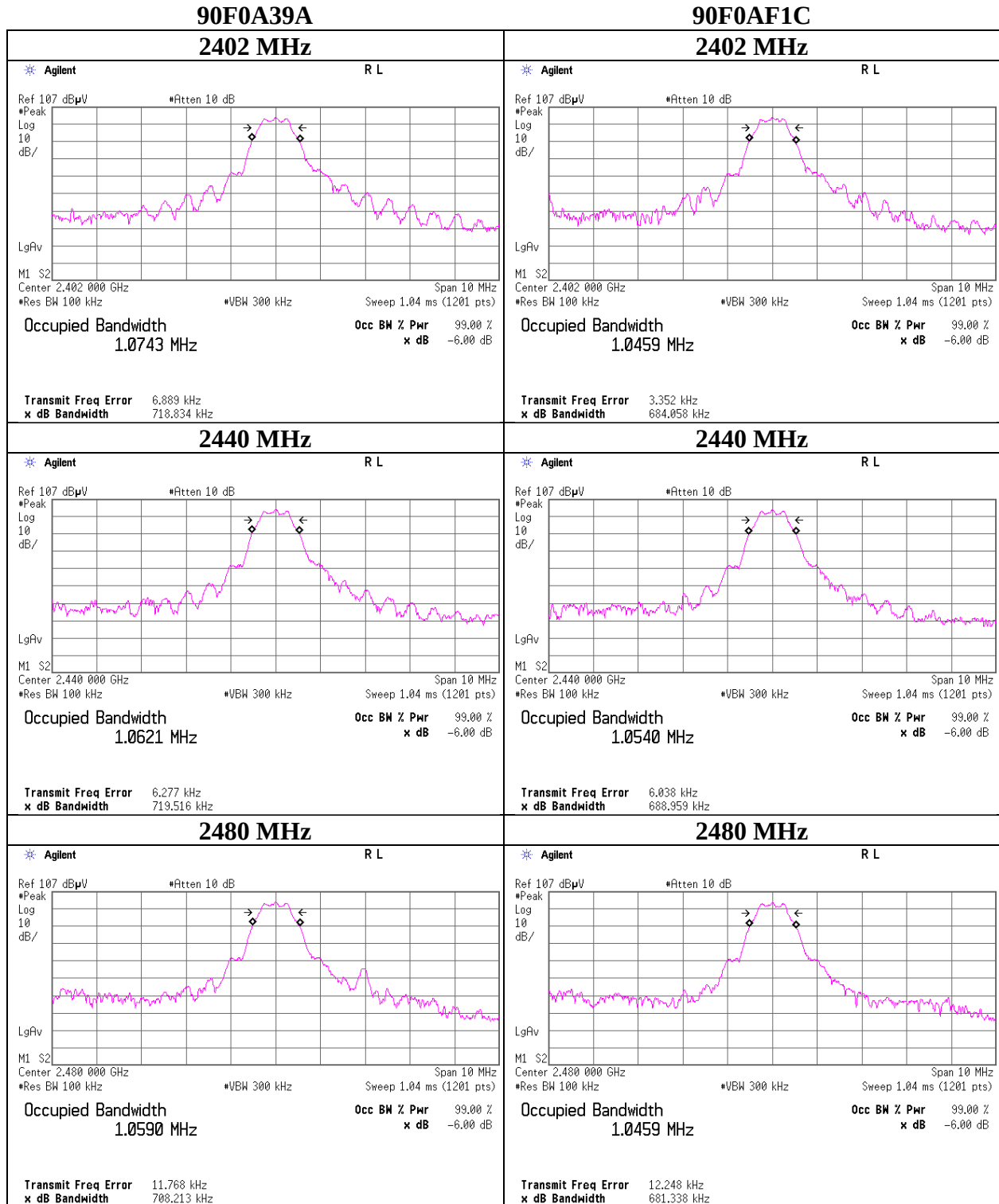
Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN+Cable+ATT) [dB]
LISN:SLS-02

6dB Bandwidth

Test place Shonan EMC Lab. No.1 Measurement Room
Report No. 10959367S-A
Date October 9, 2015
Temperature / Humidity 25 deg. C / 40 % RH
Engineer Yosuke Ishikawa
Mode Tx BT LE

Sample	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
90F0A39A	2402	0.719	> 500
	2440	0.720	> 500
	2480	0.708	> 500
90F0AF1C	2402	0.684	> 500
	2440	0.689	> 500
	2480	0.681	> 500

6dB Bandwidth



Maximum Peak Output Power

Test place Shonan EMC Lab. No.1 Measurement Room
Report No. 10959367S-A
Date October 9, 2015
Temperature / Humidity 25 deg. C / 40 % RH
Engineer Yosuke Ishikawa
Mode Tx BT LE

Sample : 90F0A39A

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.13	0.62	9.99	4.48	2.81	30.00	1000	25.52
2440	-6.13	0.63	9.99	4.49	2.81	30.00	1000	25.51
2480	-6.25	0.63	9.99	4.37	2.74	30.00	1000	25.63

Sample : 90F0AF1C

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-6.27	0.62	9.99	4.34	2.72	30.00	1000	25.66
2440	-6.27	0.63	9.99	4.35	2.72	30.00	1000	25.65
2480	-6.39	0.63	9.99	4.23	2.65	30.00	1000	25.77

Sample Calculation:

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

*The equipment and cables were not used for factor 0 dB of the data sheets.

Average Output Power (Reference data)

Test place	Shonan EMC Lab. No.1 Measurement Room
Report No.	10959367S-A
Date	October 9, 2015
Temperature / Humidity	25 deg. C / 40 % RH
Engineer	Yosuke Ishikawa
Mode	Tx BT LE

Sample : 90F0A39A

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-8.05	0.62	9.99	2.56	1.80	1.15	3.71	2.35
2440	-8.05	0.63	9.99	2.57	1.81	1.15	3.72	2.36
2480	-8.17	0.63	9.99	2.45	1.76	1.15	3.60	2.29

Sample : 90F0AF1C

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-8.21	0.62	9.99	2.40	1.74	1.15	3.55	2.26
2440	-8.20	0.63	9.99	2.42	1.75	1.15	3.57	2.28
2480	-8.30	0.63	9.99	2.32	1.71	1.15	3.47	2.22

Sample Calculation:

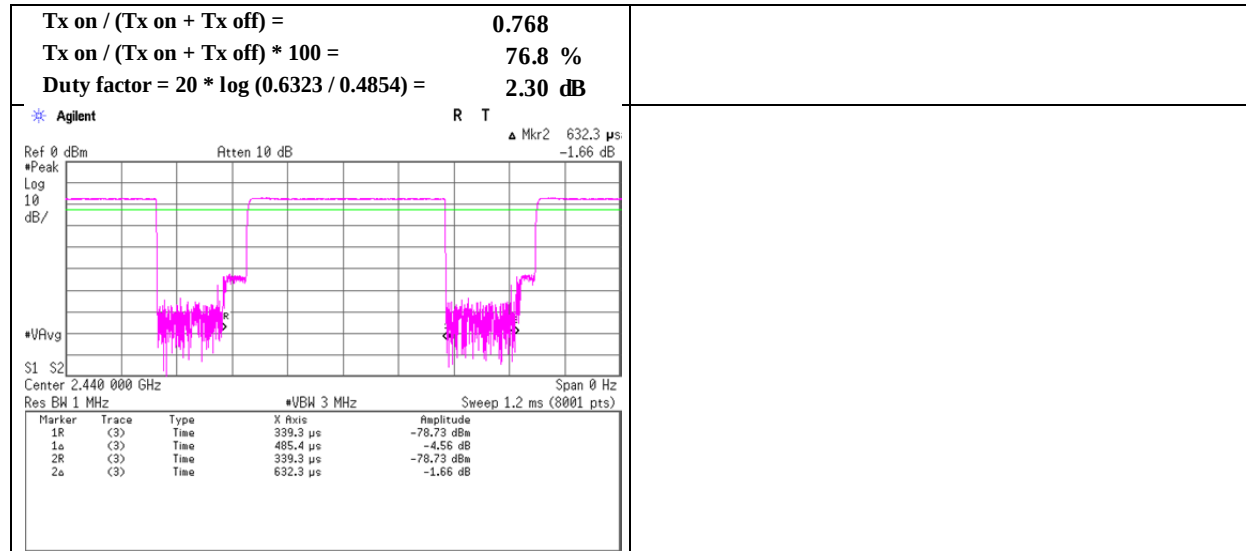
Result (Frame power) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Result (Burst power) = Frame power + Duty factor

*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10959367S-A
Date	October 3, 2015
Temperature / Humidity	24 deg. C / 56 % RH
Engineer	Hikaru Shirasawa
Mode	Tx BT LE



UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10959367S-A
Date : October 2, 2015 October 3, 2015
Temperature / Humidity : 23 deg. C / 37 % RH 24 deg. C / 56 % RH
Engineer : Hikaru Shirasawa Hikaru Shirasawa
(30-1000 MHz, (1-13 GHz)
13-26.5 GHz)
Mode : Tx BT LE 2402 MHz, Sample : 90F0A37B

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	335.900	QP	45.2	14.8	6.8	31.6	0.0	35.2	46.0	10.8	209	36	
Hori.	575.826	QP	36.0	18.6	8.2	31.6	0.0	31.2	46.0	14.8	120	42	
Hori.	2390.000	PK	48.0	27.7	13.7	40.7	2.5	51.2	73.9	22.7	174	355	
Hori.	2394.545	PK	55.1	27.7	13.7	40.7	2.5	58.3	73.9	15.6	100	353	
Hori.	4500.000	PK	49.8	30.3	5.8	41.9	2.5	46.5	73.9	27.4	100	202	
Hori.	4804.000	PK	47.2	31.4	6.1	41.7	2.5	45.5	73.9	28.4	100	0	
Hori.	7206.000	PK	47.8	36.9	7.5	41.2	2.5	53.5	73.9	20.4	100	359	
Hori.	9608.000	PK	46.4	38.0	8.7	40.1	2.5	55.5	73.9	18.4	100	0	
Hori.	12010.000	PK	47.1	39.7	9.2	39.4	2.5	59.1	73.9	14.8	100	359	
Hori.	4500.000	AV	41.2	30.3	5.8	41.9	2.5	37.9	53.9	16.0	100	202	
Vert.	48.092	QP	39.1	11.4	7.2	31.9	0.0	25.8	40.0	14.2	100	314	
Vert.	95.885	QP	45.9	9.3	8.1	31.9	0.0	31.4	43.5	12.1	100	233	
Vert.	143.993	QP	44.7	14.5	8.4	31.8	0.0	35.8	43.5	7.7	100	280	
Vert.	191.999	QP	38.4	16.2	8.7	31.8	0.0	31.5	43.5	12.0	100	186	
Vert.	240.136	QP	38.3	16.8	9.3	31.7	0.0	32.7	46.0	13.3	100	194	
Vert.	2390.000	PK	43.5	27.7	13.7	40.7	2.5	46.7	73.9	27.2	179	181	
Vert.	2394.480	PK	53.1	27.7	13.7	40.7	2.5	56.3	73.9	17.6	100	349	
Vert.	4500.000	PK	50.3	30.3	5.8	41.9	2.5	47.0	73.9	26.9	148	202	
Vert.	4804.000	PK	47.2	31.4	6.1	41.7	2.5	45.5	73.9	28.4	100	0	
Vert.	7206.000	PK	47.4	36.9	7.5	41.2	2.5	53.1	73.9	20.8	100	359	
Vert.	9608.000	PK	46.7	38.0	8.7	40.1	2.5	55.8	73.9	18.1	100	0	
Vert.	12010.000	PK	47.0	39.7	9.2	39.4	2.5	59.0	73.9	14.9	100	359	
Vert.	4500.000	AV	45.0	30.3	5.8	41.9	2.5	41.7	53.9	12.2	148	202	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	36.4	27.7	13.7	40.7	2.3	2.5	41.9	53.9	12.0	*1)
Hori.	2394.545	AV	36.2	27.7	13.7	40.7	2.3	2.5	41.7	53.9	12.2	*1)
Hori.	4804.000	AV	37.8	31.4	6.1	41.7	2.3	2.5	38.4	53.9	15.5	
Hori.	7206.000	AV	37.8	36.9	7.5	41.2	2.3	2.5	45.8	53.9	8.1	
Hori.	9608.000	AV	37.0	38.0	8.7	40.1	2.3	2.5	48.4	53.9	5.5	
Hori.	12010.000	AV	37.5	39.7	9.2	39.4	2.3	2.5	51.8	53.9	2.1	
Vert.	2390.000	AV	36.0	27.7	13.7	40.7	2.3	2.5	41.5	53.9	12.4	*1)
Vert.	2394.480	AV	37.0	27.7	13.7	40.7	2.3	2.5	42.5	53.9	11.4	*1)
Vert.	4804.000	AV	37.8	31.4	6.1	41.7	2.3	2.5	38.4	53.9	15.5	
Vert.	7206.000	AV	37.6	36.9	7.5	41.2	2.3	2.5	45.6	53.9	8.3	
Vert.	9608.000	AV	36.8	38.0	8.7	40.1	2.3	2.5	48.2	53.9	5.7	
Vert.	12010.000	AV	37.3	39.7	9.2	39.4	2.3	2.5	51.6	53.9	2.3	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	91.8	27.8	13.7	40.7	2.5	95.1	-	-	Carrier
Hori.	2400.000	PK	46.1	27.7	13.7	40.7	2.5	49.3	75.0	25.7	
Vert.	2402.000	PK	89.2	27.8	13.7	40.7	2.5	92.5	-	-	Carrier
Vert.	2400.000	PK	43.4	27.7	13.7	40.7	2.5	46.6	72.4	25.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

UL Japan, Inc.

Shonan EMC Lab.

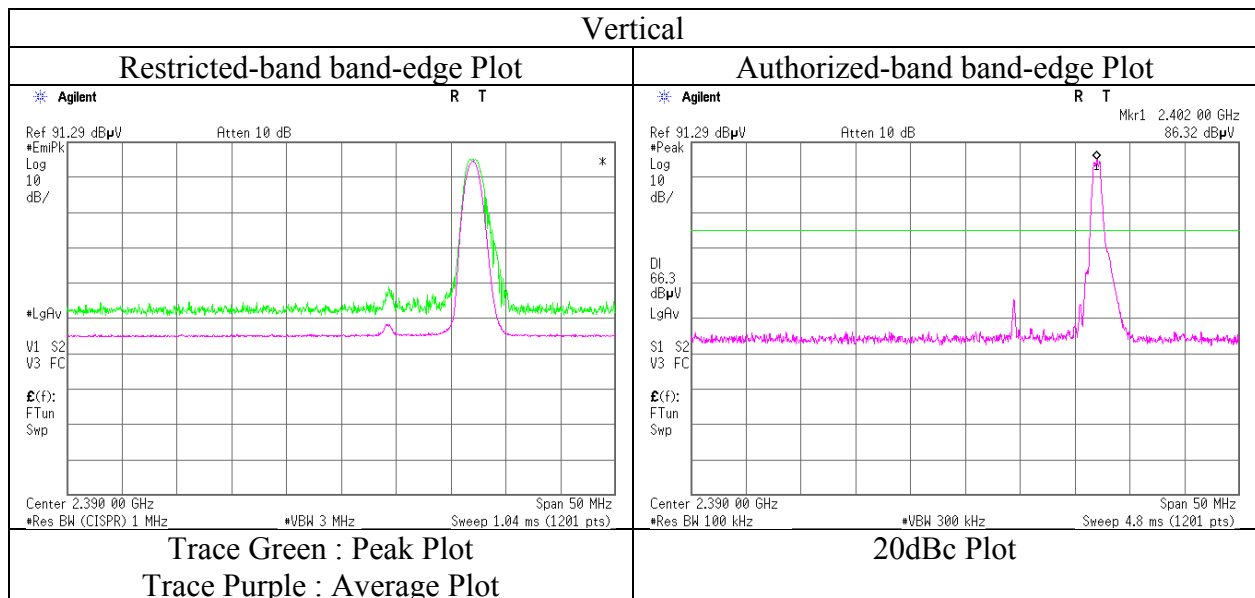
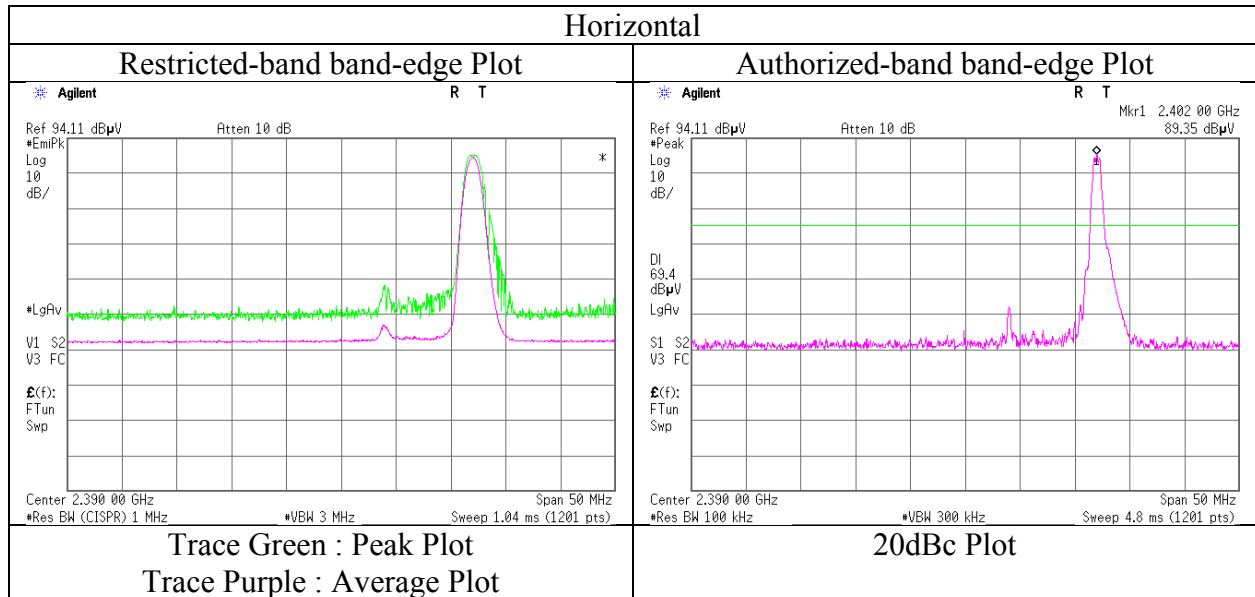
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	10959367S-A	
Date	October 2, 2015	October 3, 2015
Temperature / Humidity	23 deg. C / 37 % RH	24 deg. C / 56 % RH
Engineer	Hikaru Shirasawa (30-1000 MHz, 13-26.5 GHz)	Hikaru Shirasawa (1-13 GHz)
Mode	Tx BT LE 2402 MHz, Sample : 90F0A37B	



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10959367S-A
Date : October 2, 2015 October 3, 2015
Temperature / Humidity : 23 deg. C / 37 % RH 24 deg. C / 56 % RH
Engineer : Hikaru Shirasawa Hikaru Shirasawa
(30-1000 MHz, (1-13 GHz)
13-26.5 GHz)
Mode : Tx BT LE 2440 MHz, Sample : 90F0A37B

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	335.678	QP	45.1	14.8	6.8	31.6	0.0	35.1	46.0	10.9	217	54	
Hori.	575.885	QP	35.8	18.6	8.2	31.6	0.0	31.0	46.0	15.0	151	38	
Hori.	2394.567	PK	53.5	27.7	13.7	40.7	2.5	56.7	73.9	17.2	173	358	
Hori.	4880.000	PK	47.2	31.6	6.2	41.6	2.5	45.9	73.9	28.0	100	359	
Hori.	7320.000	PK	46.8	36.9	7.6	41.3	2.5	52.5	73.9	21.4	100	0	
Hori.	9760.000	PK	45.4	38.1	8.8	40.1	2.5	54.7	73.9	19.2	100	359	
Hori.	12200.000	PK	44.7	39.6	9.3	39.2	2.5	56.9	73.9	17.0	100	0	
Vert.	47.828	QP	40.0	11.5	7.2	31.9	0.0	26.8	40.0	13.2	100	67	
Vert.	95.880	QP	46.0	9.3	8.1	31.9	0.0	31.5	43.5	12.0	100	336	
Vert.	143.955	QP	45.0	14.5	8.4	31.8	0.0	36.1	43.5	7.4	100	145	
Vert.	192.020	QP	38.7	16.2	8.7	31.8	0.0	31.8	43.5	11.7	100	145	
Vert.	240.069	QP	38.4	16.8	9.3	31.7	0.0	32.8	46.0	13.2	100	199	
Vert.	2394.527	PK	53.2	27.7	13.7	40.7	2.5	56.4	73.9	17.5	100	255	
Vert.	4500.000	PK	50.0	30.3	5.8	41.9	2.5	46.7	73.9	27.2	100	131	
Vert.	4880.000	PK	46.8	31.6	6.2	41.6	2.5	45.5	73.9	28.4	100	0	
Vert.	7320.000	PK	46.7	36.9	7.6	41.3	2.5	52.4	73.9	21.5	100	0	
Vert.	9760.000	PK	45.6	38.1	8.8	40.1	2.5	54.9	73.9	19.0	100	359	
Vert.	12200.000	PK	44.9	39.6	9.3	39.2	2.5	57.1	73.9	16.8	100	0	
Vert.	4500.000	AV	42.9	30.3	5.8	41.9	2.5	39.6	53.9	14.3	100	131	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2394.567	AV	36.3	27.7	13.7	40.7	2.3	2.5	41.8	53.9	12.1	*1)
Hori.	4880.000	AV	37.4	31.6	6.2	41.6	2.3	2.5	38.4	53.9	15.5	
Hori.	7320.000	AV	37.3	36.9	7.6	41.3	2.3	2.5	45.3	53.9	8.6	
Hori.	9760.000	AV	36.4	38.1	8.8	40.1	2.3	2.5	48.0	53.9	5.9	
Hori.	12200.000	AV	35.3	39.6	9.3	39.2	2.3	2.5	49.8	53.9	4.1	
Vert.	2394.527	AV	36.4	27.7	13.7	40.7	2.3	2.5	41.9	53.9	12.0	*1)
Vert.	4880.000	AV	37.2	31.6	6.2	41.6	2.3	2.5	38.2	53.9	15.7	
Vert.	7320.000	AV	37.0	36.9	7.6	41.3	2.3	2.5	45.0	53.9	8.9	
Vert.	9760.000	AV	35.6	38.1	8.8	40.1	2.3	2.5	47.2	53.9	6.7	
Vert.	12200.000	AV	35.4	39.6	9.3	39.2	2.3	2.5	49.9	53.9	4.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10959367S-A
Date : October 2, 2015 October 3, 2015
Temperature / Humidity : 23 deg. C / 37 % RH 24 deg. C / 56 % RH
Engineer : Hikaru Shirasawa Hikaru Shirasawa
(30-1000 MHz, (1-13 GHz)
13-26.5 GHz)
Mode : Tx BT LE 2480 MHz, Sample : 90F0A37B

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	335.722	QP	45.2	14.8	6.8	31.6	0.0	35.2	46.0	10.8	215	34	
Hori.	575.908	QP	35.7	18.6	8.2	31.6	0.0	30.9	46.0	15.1	147	35	
Hori.	2483.500	PK	51.5	27.9	13.8	40.7	2.5	55.0	73.9	18.9	100	254	
Hori.	2518.867	PK	58.4	27.9	13.8	40.7	2.5	61.9	73.9	12.0	100	250	
Hori.	2589.350	PK	56.9	28.0	13.9	40.7	2.5	60.6	73.9	13.3	100	250	
Hori.	4960.000	PK	46.8	31.9	6.3	41.6	2.5	45.9	73.9	28.0	100	359	
Hori.	7440.000	PK	46.6	37.0	7.7	41.3	2.5	52.5	73.9	21.4	100	0	
Hori.	9920.000	PK	44.8	38.2	8.9	40.0	2.5	54.4	73.9	19.5	100	359	
Hori.	12400.000	PK	44.1	39.5	9.4	39.0	2.5	56.5	73.9	17.4	100	0	
Vert.	47.971	QP	39.9	11.5	7.2	31.9	0.0	26.7	40.0	13.3	100	142	
Vert.	95.869	QP	46.3	9.3	8.1	31.9	0.0	31.8	43.5	11.7	100	328	
Vert.	143.985	QP	45.0	14.5	8.4	31.8	0.0	36.1	43.5	7.4	100	2	
Vert.	192.104	QP	39.0	16.2	8.7	31.8	0.0	32.1	43.5	11.4	100	6	
Vert.	240.179	QP	38.3	16.8	9.3	31.7	0.0	32.7	46.0	13.3	100	248	
Vert.	2483.500	PK	51.1	27.9	13.8	40.7	2.5	54.6	73.9	19.3	100	36	
Vert.	2518.701	PK	57.6	27.9	13.8	40.7	2.5	61.1	73.9	12.8	100	42	
Vert.	2589.194	PK	58.3	28.0	13.9	40.7	2.5	62.0	73.9	11.9	100	5	
Vert.	4960.000	PK	47.2	31.9	6.3	41.6	2.5	46.3	73.9	27.6	100	0	
Vert.	7440.000	PK	45.7	37.0	7.7	41.3	2.5	51.6	73.9	22.3	100	359	
Vert.	9920.000	PK	44.8	38.2	8.9	40.0	2.5	54.4	73.9	19.5	100	0	
Vert.	12400.000	PK	44.8	39.5	9.4	39.0	2.5	57.2	73.9	16.7	100	359	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	37.4	27.9	13.8	40.7	2.3	2.5	43.2	53.9	10.7	*1)
Hori.	2518.867	AV	38.9	27.9	13.8	40.7	2.3	2.5	44.7	53.9	9.2	*1)
Hori.	2589.350	AV	37.6	28.0	13.9	40.7	2.3	2.5	43.6	53.9	10.3	*1)
Hori.	4960.000	AV	37.2	31.9	6.3	41.6	2.3	2.5	38.6	53.9	15.3	
Hori.	7440.000	AV	36.7	37.0	7.7	41.3	2.3	2.5	44.9	53.9	9.0	
Hori.	9920.000	AV	35.2	38.2	8.9	40.0	2.3	2.5	47.1	53.9	6.8	
Hori.	12400.000	AV	34.5	39.5	9.4	39.0	2.3	2.5	49.2	53.9	4.7	
Vert.	2483.500	AV	37.3	27.9	13.8	40.7	2.3	2.5	43.1	53.9	10.8	*1)
Vert.	2518.701	AV	37.8	27.9	13.8	40.7	2.3	2.5	43.6	53.9	10.3	*1)
Vert.	2589.194	AV	37.2	28.0	13.9	40.7	2.3	2.5	43.2	53.9	10.7	*1)
Vert.	4960.000	AV	36.8	31.9	6.3	41.6	2.3	2.5	38.2	53.9	15.7	
Vert.	7440.000	AV	36.7	37.0	7.7	41.3	2.3	2.5	44.9	53.9	9.0	
Vert.	9920.000	AV	35.0	38.2	8.9	40.0	2.3	2.5	46.9	53.9	7.0	
Vert.	12400.000	AV	34.4	39.5	9.4	39.0	2.3	2.5	49.1	53.9	4.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$

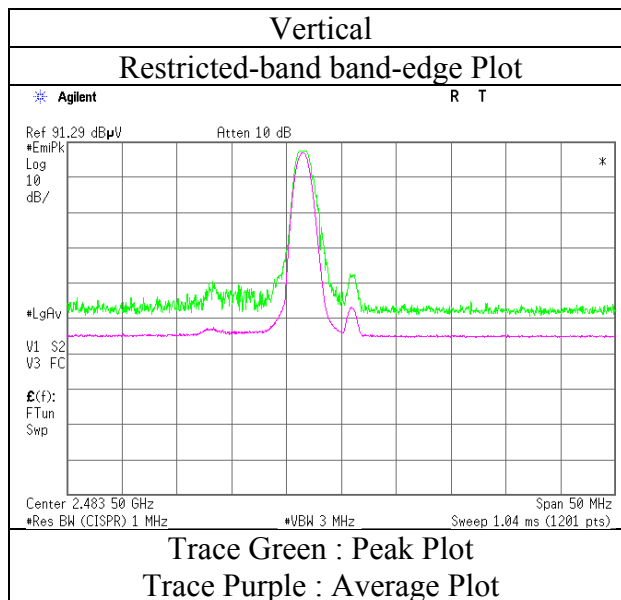
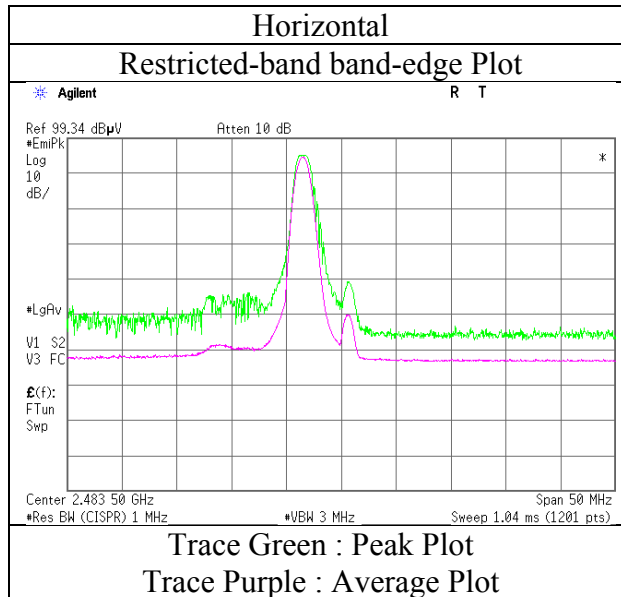
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber		
Report No.	10959367S-A		
Date	October 2, 2015	October 3, 2015	
Temperature / Humidity	23 deg. C / 37 % RH	24 deg. C / 56 % RH	
Engineer	Hikaru Shirasawa	Hikaru Shirasawa	
	(30-1000 MHz,	(1-13 GHz)	
	13-26.5 GHz)		
Mode	Tx BT LE 2480 MHz, Sample : 90F0A37B		



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10959367S-A
Date : October 2, 2015 October 3, 2015
Temperature / Humidity : 23 deg. C / 37 % RH 24 deg. C / 56 % RH
Engineer : Hikaru Shirasawa Hikaru Shirasawa
(30-1000 MHz, (1-13 GHz)
13-26.5 GHz)
Mode : Tx BT LE 2402 MHz, Sample : 90F0AF1D

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	335.714	QP	45.3	14.8	6.8	31.6	0.0	35.3	46.0	10.7	200	133	
Hori.	576.420	QP	33.8	18.6	8.2	31.6	0.0	29.0	46.0	17.0	100	190	
Hori.	2390.000	PK	47.8	27.7	13.7	40.7	2.5	51.0	73.9	22.9	162	110	
Hori.	2394.374	PK	53.0	27.7	13.7	40.7	2.5	56.2	73.9	17.7	162	110	
Hori.	4500.000	PK	48.4	30.3	5.8	41.9	2.5	45.1	73.9	28.8	100	203	
Hori.	4804.000	PK	47.1	31.4	6.1	41.7	2.5	45.4	73.9	28.5	100	0	
Hori.	7206.000	PK	47.3	36.9	7.5	41.2	2.5	53.0	73.9	20.9	100	359	
Hori.	9608.000	PK	46.4	38.0	8.7	40.1	2.5	55.5	73.9	18.4	100	0	
Hori.	12010.000	PK	47.0	39.7	9.2	39.4	2.5	59.0	73.9	14.9	100	359	
Hori.	4500.000	AV	41.8	30.3	5.8	41.9	2.5	38.5	53.9	15.4	100	203	
Vert.	48.107	QP	39.8	11.4	7.2	31.9	0.0	26.5	40.0	13.5	100	202	
Vert.	96.019	QP	44.0	9.3	8.1	31.9	0.0	29.5	43.5	14.0	100	205	
Vert.	143.940	QP	44.6	14.5	8.4	31.8	0.0	35.7	43.5	7.8	100	1	
Vert.	192.266	QP	40.6	16.2	8.7	31.8	0.0	33.7	43.5	9.8	100	250	
Vert.	239.988	QP	38.8	16.8	9.3	31.7	0.0	33.2	46.0	12.8	100	169	
Vert.	2390.000	PK	45.3	27.7	13.7	40.7	2.5	48.5	73.9	25.4	100	251	
Vert.	2394.790	PK	50.7	27.7	13.7	40.7	2.5	53.9	73.9	20.0	100	251	
Vert.	4500.000	PK	50.7	30.3	5.8	41.9	2.5	47.4	73.9	26.5	105	157	
Vert.	4804.000	PK	47.4	31.4	6.1	41.7	2.5	45.7	73.9	28.2	100	0	
Vert.	7206.000	PK	47.0	36.9	7.5	41.2	2.5	52.7	73.9	21.2	100	359	
Vert.	9608.000	PK	46.9	38.0	8.7	40.1	2.5	56.0	73.9	17.9	100	0	
Vert.	12010.000	PK	47.1	39.7	9.2	39.4	2.5	59.1	73.9	14.8	100	359	
Vert.	4500.000	AV	50.7	30.3	5.8	41.9	2.5	47.4	53.9	6.5	105	157	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log(3.98 m / 3.0 m) = 2.5 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	35.7	27.7	13.7	40.7	2.3	2.5	41.2	53.9	12.7	*1)
Hori.	2394.374	AV	36.0	27.7	13.7	40.7	2.3	2.5	41.5	53.9	12.4	*1)
Hori.	4804.000	AV	37.7	31.4	6.1	41.7	2.3	2.5	38.3	53.9	15.6	
Hori.	7206.000	AV	37.8	36.9	7.5	41.2	2.3	2.5	45.8	53.9	8.1	
Hori.	9608.000	AV	36.7	38.0	8.7	40.1	2.3	2.5	48.1	53.9	5.8	
Hori.	12010.000	AV	37.4	39.7	9.2	39.4	2.3	2.5	51.7	53.9	2.2	
Vert.	2390.000	AV	35.7	27.7	13.7	40.7	2.3	2.5	41.2	53.9	12.7	*1)
Vert.	2394.790	AV	37.5	27.7	13.7	40.7	2.3	2.5	43.0	53.9	10.9	*1)
Vert.	4804.000	AV	37.6	31.4	6.1	41.7	2.3	2.5	38.2	53.9	15.7	
Vert.	7206.000	AV	37.7	36.9	7.5	41.2	2.3	2.5	45.7	53.9	8.2	
Vert.	9608.000	AV	36.7	38.0	8.7	40.1	2.3	2.5	48.1	53.9	5.8	
Vert.	12010.000	AV	37.5	39.7	9.2	39.4	2.3	2.5	51.8	53.9	2.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log(3.98 m / 3.0 m) = 2.5 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	92.1	27.8	13.7	40.7	2.5	95.4	-	-	Carrier
Hori.	2400.000	PK	43.7	27.7	13.7	40.7	2.5	46.9	75.3	28.4	
Vert.	2402.000	PK	88.7	27.8	13.7	40.7	2.5	92.0	-	-	Carrier
Vert.	2400.000	PK	41.7	27.7	13.7	40.7	2.5	44.9	71.9	27.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log(3.98 m / 3.0 m) = 2.5 dB

13 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.5 dB

UL Japan, Inc.

Shonan EMC Lab.

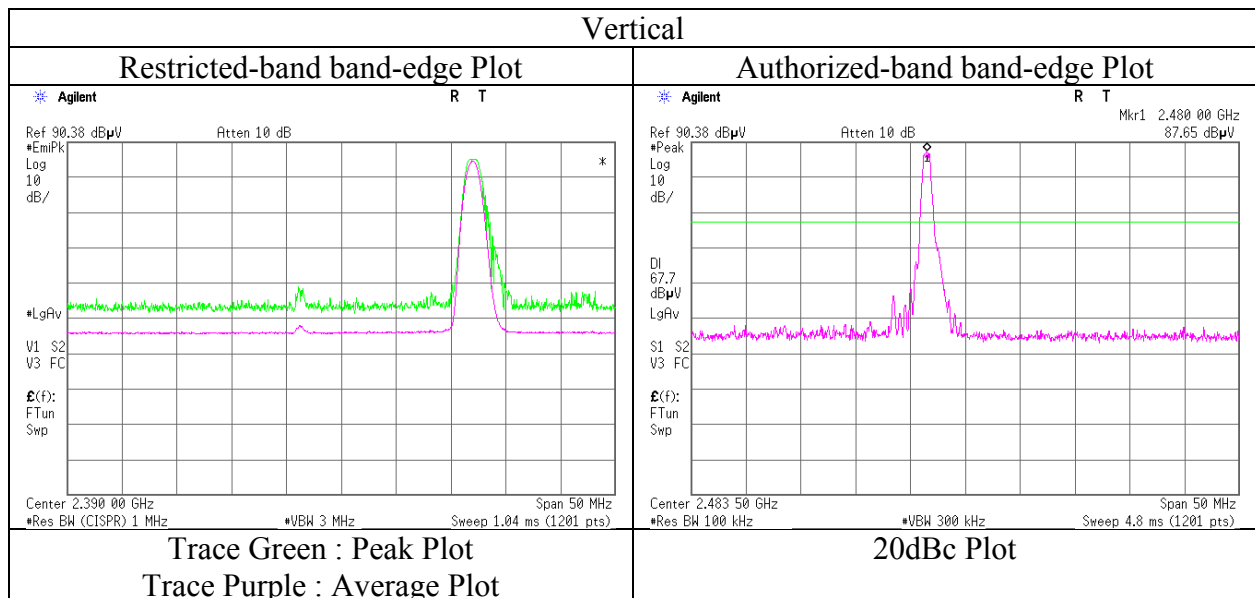
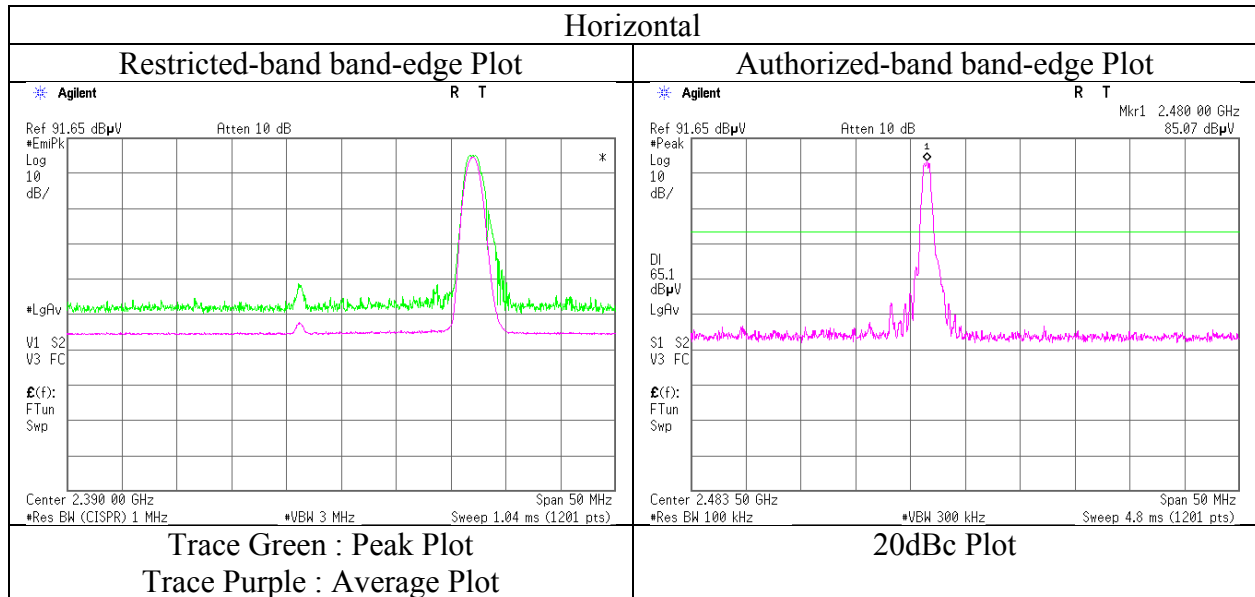
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	10959367S-A	
Date	October 2, 2015	October 3, 2015
Temperature / Humidity	23 deg. C / 37 % RH	24 deg. C / 56 % RH
Engineer	Hikaru Shirasawa (30-1000 MHz, 13-26.5 GHz)	Hikaru Shirasawa (1-13 GHz)
Mode	Tx BT LE 2402 MHz, Sample : 90F0AF1D	



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10959367S-A
Date : October 2, 2015 October 3, 2015
Temperature / Humidity : 23 deg. C / 37 % RH 24 deg. C / 56 % RH
Engineer : Hikaru Shirasawa Hikaru Shirasawa
(30-1000 MHz, (1-13 GHz)
13-26.5 GHz)
Mode : Tx BT LE 2440 MHz, Sample : 90F0AF1D

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	335.868	QP	45.2	14.8	6.8	31.6	0.0	35.2	46.0	10.8	211	28	
Hori.	575.824	QP	33.6	18.6	8.2	31.6	0.0	28.8	46.0	17.2	127	208	
Hori.	2394.577	PK	50.6	27.7	13.7	40.7	2.5	53.8	73.9	20.1	162	110	
Hori.	4880.000	PK	46.6	31.6	6.2	41.6	2.5	45.3	73.9	28.6	100	0	
Hori.	7320.000	PK	48.2	36.9	7.6	41.3	2.5	53.9	73.9	20.0	100	359	
Hori.	9760.000	PK	45.9	38.1	8.8	40.1	2.5	55.2	73.9	18.7	100	0	
Hori.	12200.000	PK	45.4	39.6	9.3	39.2	2.5	57.6	73.9	16.3	100	359	
Vert.	47.988	QP	39.5	11.5	7.2	31.9	0.0	26.3	40.0	13.7	100	34	
Vert.	95.995	QP	43.7	9.3	8.1	31.9	0.0	29.2	43.5	14.3	100	92	
Vert.	143.998	QP	44.9	14.5	8.4	31.8	0.0	36.0	43.5	7.5	100	169	
Vert.	191.996	QP	40.3	16.2	8.7	31.8	0.0	33.4	43.5	10.1	100	195	
Vert.	239.986	QP	37.9	16.8	9.3	31.7	0.0	32.3	46.0	13.7	100	197	
Vert.	2394.491	PK	51.8	27.7	13.7	40.7	2.5	55.0	73.9	18.9	100	0	
Vert.	4500.000	PK	48.4	30.3	5.8	41.9	2.5	45.1	73.9	28.8	105	157	
Vert.	4880.000	PK	47.5	31.6	6.2	41.6	2.5	46.2	73.9	27.7	100	0	
Vert.	7320.000	PK	46.8	36.9	7.6	41.3	2.5	52.5	73.9	21.4	100	359	
Vert.	9760.000	PK	45.0	38.1	8.8	40.1	2.5	54.3	73.9	19.6	100	0	
Vert.	12200.000	PK	51.8	39.6	9.3	39.2	2.5	64.0	73.9	9.9	100	359	
Vert.	4500.000	AV	46.9	30.3	5.8	41.9	2.5	43.6	53.9	10.3	105	157	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2394.577	AV	36.2	27.7	13.7	40.7	2.3	2.5	41.7	53.9	12.2	*1)
Hori.	4880.000	AV	37.5	31.6	6.2	41.6	2.3	2.5	38.5	53.9	15.4	
Hori.	7320.000	AV	37.2	36.9	7.6	41.3	2.3	2.5	45.2	53.9	8.7	
Hori.	9760.000	AV	36.1	38.1	8.8	40.1	2.3	2.5	47.7	53.9	6.2	
Hori.	12200.000	AV	35.9	39.6	9.3	39.2	2.3	2.5	50.4	53.9	3.5	
Vert.	2394.491	AV	35.9	27.7	13.7	40.7	2.3	2.5	41.4	53.9	12.5	*1)
Vert.	4880.000	AV	40.0	31.6	6.2	41.6	2.3	2.5	41.0	53.9	12.9	
Vert.	7320.000	AV	37.4	36.9	7.6	41.3	2.3	2.5	45.4	53.9	8.5	
Vert.	9760.000	AV	35.8	38.1	8.8	40.1	2.3	2.5	47.4	53.9	6.5	
Vert.	12200.000	AV	35.5	39.6	9.3	39.2	2.3	2.5	50.0	53.9	3.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10959367S-A
Date : October 2, 2015 October 3, 2015
Temperature / Humidity : 23 deg. C / 37 % RH 24 deg. C / 56 % RH
Engineer : Hikaru Shirasawa Hikaru Shirasawa
(30-1000 MHz, (1-13 GHz)
13-26.5 GHz)
Mode : Tx BT LE 2480 MHz, Sample : 90F0AF1D

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	335.878	QP	45.3	14.8	6.8	31.6	0.0	35.3	46.0	10.7	197	46	
Hori.	575.798	QP	33.9	18.6	8.2	31.6	0.0	29.1	46.0	16.9	133	207	
Hori.	2483.500	PK	50.1	27.9	13.8	40.7	2.5	53.6	73.9	20.3	100	264	
Hori.	2511.411	PK	55.8	27.9	13.8	40.7	2.5	59.3	73.9	14.6	100	255	
Hori.	2582.731	PK	58.9	28.0	13.9	40.7	2.5	62.6	73.9	11.3	116	112	
Hori.	4960.000	PK	47.1	31.9	6.3	41.6	2.5	46.2	73.9	27.7	100	0	
Hori.	7440.000	PK	47.4	37.0	7.7	41.3	2.5	53.3	73.9	20.6	100	359	
Hori.	9920.000	PK	45.9	38.2	8.9	40.0	2.5	55.5	73.9	18.4	100	0	
Hori.	12400.000	PK	44.1	39.5	9.4	39.0	2.5	56.5	73.9	17.4	100	359	
Vert.	48.023	QP	39.7	11.4	7.2	31.9	0.0	26.4	40.0	13.6	100	271	
Vert.	95.983	QP	43.8	9.3	8.1	31.9	0.0	29.3	43.5	14.2	100	24	
Vert.	144.168	QP	44.6	14.5	8.4	31.8	0.0	35.7	43.5	7.8	100	140	
Vert.	192.069	QP	40.6	16.2	8.7	31.8	0.0	33.7	43.5	9.8	100	293	
Vert.	239.995	QP	37.8	16.8	9.3	31.7	0.0	32.2	46.0	13.8	100	195	
Vert.	2483.500	PK	49.2	27.9	13.8	40.7	2.5	52.7	73.9	21.2	100	51	
Vert.	2511.322	PK	57.8	27.9	13.8	40.7	2.5	61.3	73.9	12.6	123	5	
Vert.	2582.425	PK	57.8	28.0	13.9	40.7	2.5	61.5	73.9	12.4	100	0	
Vert.	4960.000	PK	46.3	31.9	6.3	41.6	2.5	45.4	73.9	28.5	100	359	
Vert.	7440.000	PK	46.5	37.0	7.7	41.3	2.5	52.4	73.9	21.5	100	0	
Vert.	9920.000	PK	44.3	38.2	8.9	40.0	2.5	53.9	73.9	20.0	100	359	
Vert.	12400.000	PK	43.7	39.5	9.4	39.0	2.5	56.1	73.9	17.8	100	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	36.8	27.9	13.8	40.7	2.3	2.5	42.6	53.9	11.3	*1)
Hori.	2511.411	AV	37.6	27.9	13.8	40.7	2.3	2.5	43.4	53.9	10.5	*1)
Hori.	2582.731	AV	38.1	28.0	13.9	40.7	2.3	2.5	44.1	53.9	9.8	*1)
Hori.	4960.000	AV	37.2	31.9	6.3	41.6	2.3	2.5	38.6	53.9	15.3	
Hori.	7440.000	AV	36.7	37.0	7.7	41.3	2.3	2.5	44.9	53.9	9.0	
Hori.	9920.000	AV	36.8	38.2	8.9	40.0	2.3	2.5	48.7	53.9	5.2	
Hori.	12400.000	AV	34.8	39.5	9.4	39.0	2.3	2.5	49.5	53.9	4.4	
Vert.	2483.500	AV	36.3	27.9	13.8	40.7	2.3	2.5	42.1	53.9	11.8	*1)
Vert.	2511.322	AV	37.9	27.9	13.8	40.7	2.3	2.5	43.7	53.9	10.2	*1)
Vert.	2582.425	AV	37.0	28.0	13.9	40.7	2.3	2.5	43.0	53.9	10.9	*1)
Vert.	4960.000	AV	36.8	31.9	6.3	41.6	2.3	2.5	38.2	53.9	15.7	
Vert.	7440.000	AV	36.7	37.0	7.7	41.3	2.3	2.5	44.9	53.9	9.0	
Vert.	9920.000	AV	35.0	38.2	8.9	40.0	2.3	2.5	46.9	53.9	7.0	
Vert.	12400.000	AV	34.4	39.5	9.4	39.0	2.3	2.5	49.1	53.9	4.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$

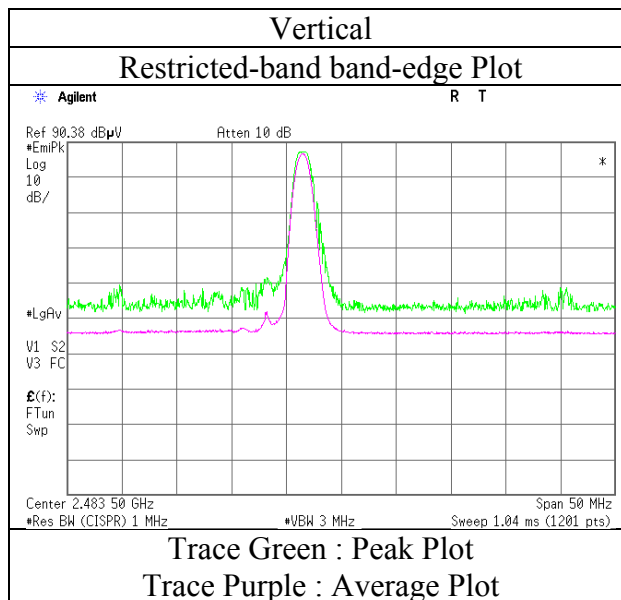
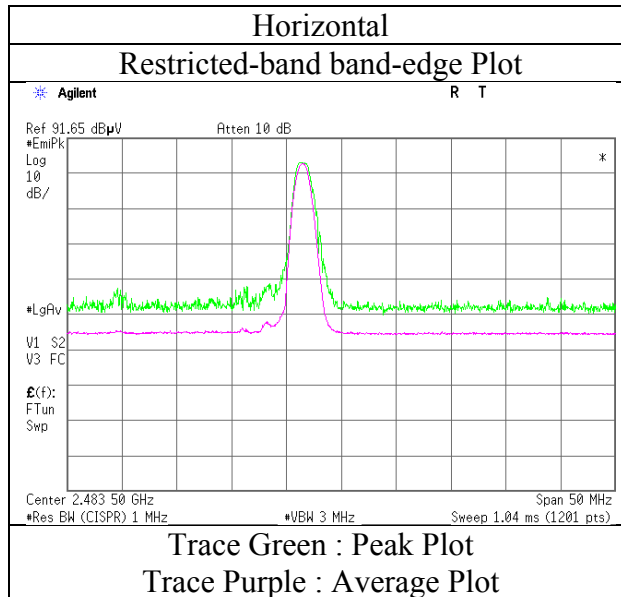
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

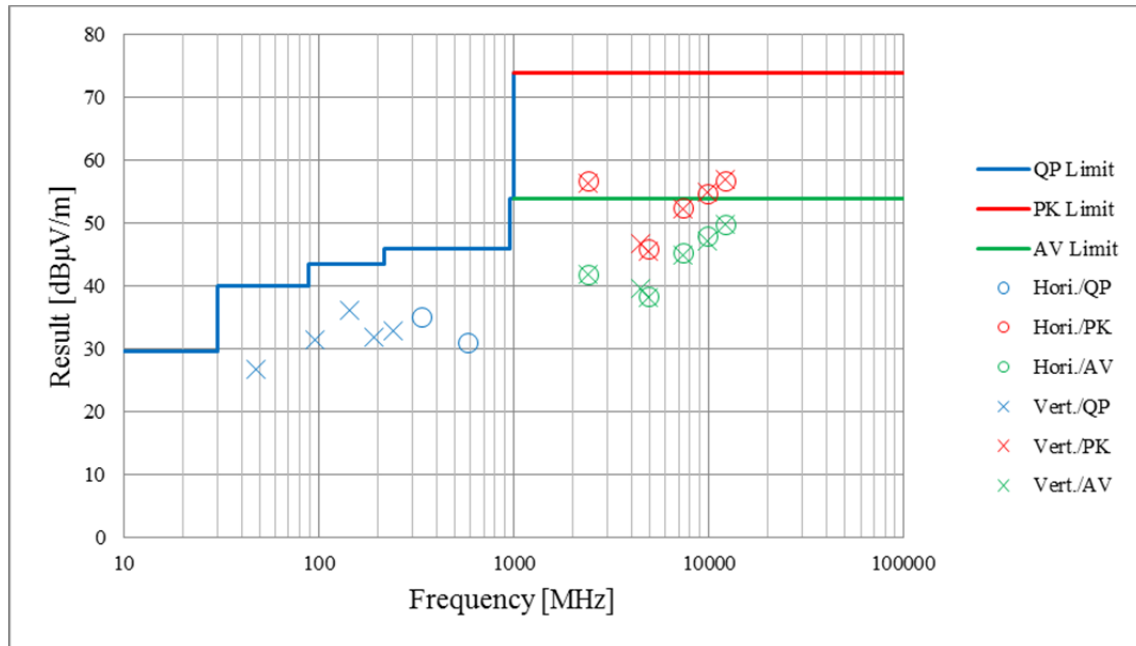
Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber		
Report No.	10959367S-A		
Date	October 2, 2015	October 3, 2015	
Temperature / Humidity	23 deg. C / 37 % RH	24 deg. C / 56 % RH	
Engineer	Hikaru Shirasawa	Hikaru Shirasawa	
	(30-1000 MHz,	(1-13 GHz)	
	13-26.5 GHz)		
Mode	Tx BT LE 2480 MHz, Sample : 90F0AF1D		



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission (Plot data, Worst case)

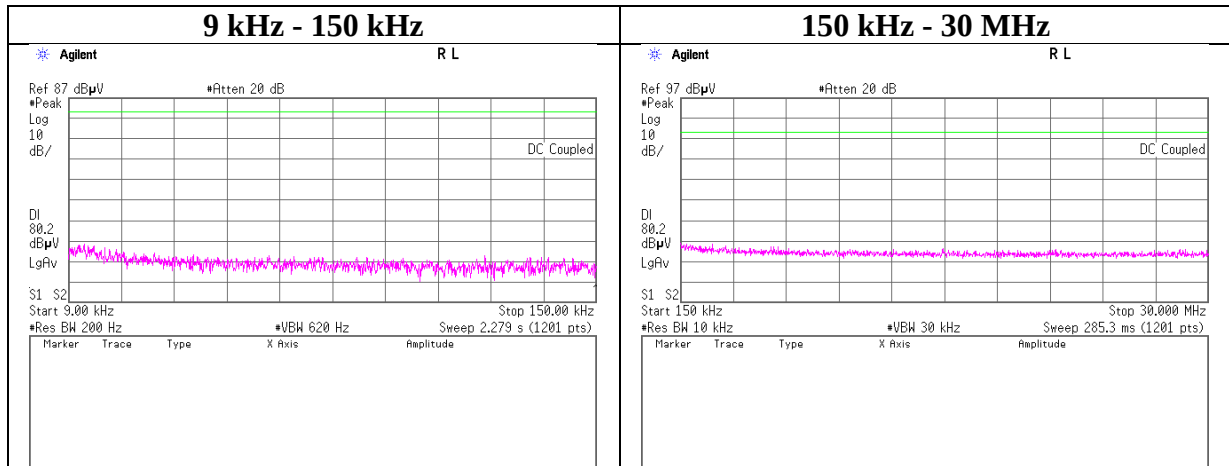
Test place	Shonan EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	10959367S-A	
Date	October 2, 2015	October 3, 2015
Temperature / Humidity	23 deg. C / 37 % RH	24 deg. C / 56 % RH
Engineer	Hikaru Shirasawa	Hikaru Shirasawa
	(30-1000 MHz,	(1-13 GHz)
	13-26.5 GHz)	
Mode	Tx BT LE 2440 MHz, Sample : 90F0A37B	



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place Shonan EMC Lab. No.1 Measurement Room
Report No. 10959367S-A
Date October 9, 2015
Temperature / Humidity 25 deg. C / 40 % RH
Engineer Yosuke Ishikawa
Mode Tx BT LE 2402 MHz ,Sample : 90F0A39A



Power Density

Test place Shonan EMC Lab. No.1 Measurement Room
Report No. 10959367S-A
Date October 9, 2015
Temperature / Humidity 25 deg. C / 40 % RH
Engineer Yosuke Ishikawa
Mode Tx BT LE

Sample : 90F0A39A

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-20.06	0.62	9.99	-9.45	8.00	17.45
2440.00	-19.73	0.63	9.99	-9.11	8.00	17.11
2480.00	-19.22	0.63	9.99	-8.60	8.00	16.60

Sample : 90F0AF1C

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402.00	-20.08	0.62	9.99	-9.47	8.00	17.47
2440.00	-19.38	0.63	9.99	-8.76	8.00	16.76
2480.00	-18.83	0.63	9.99	-8.21	8.00	16.21

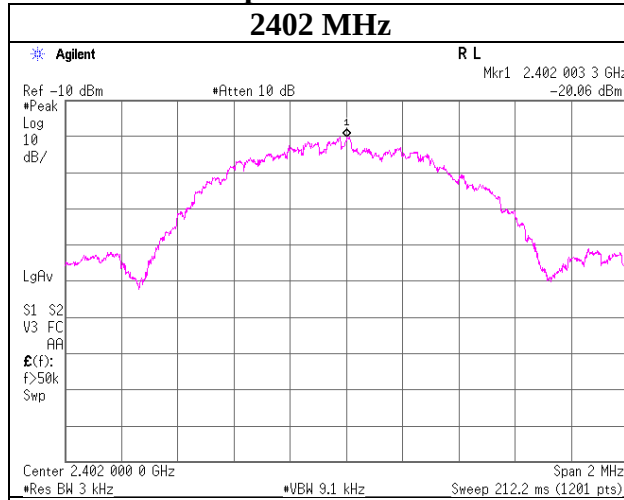
Sample Calculation:

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

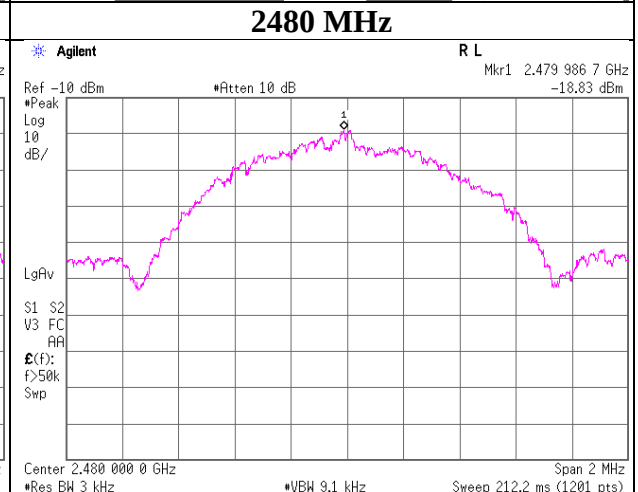
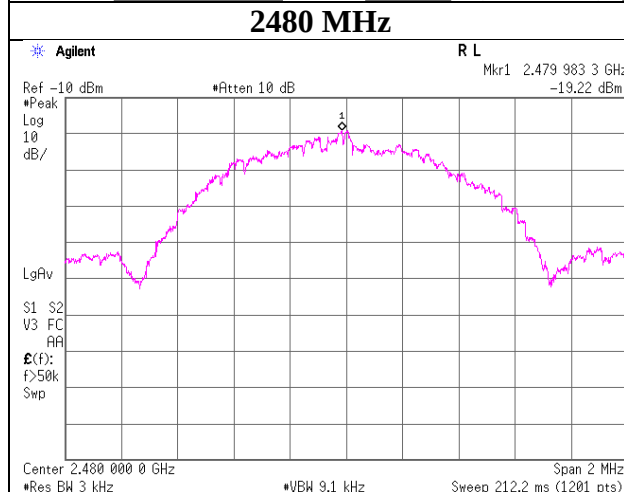
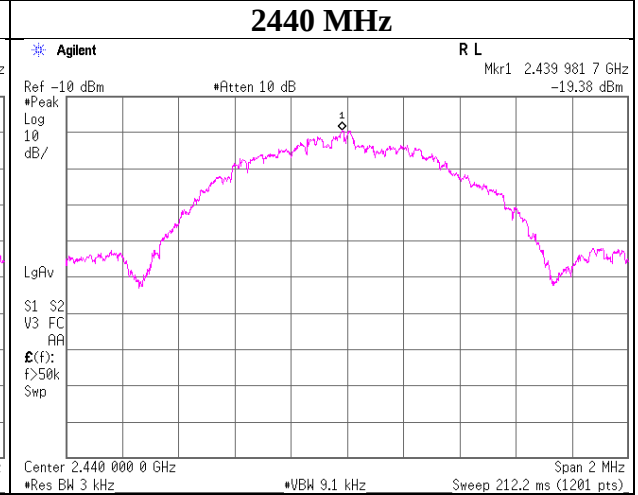
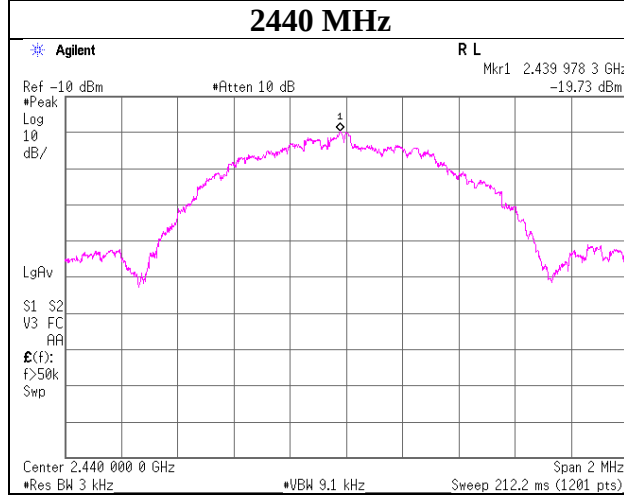
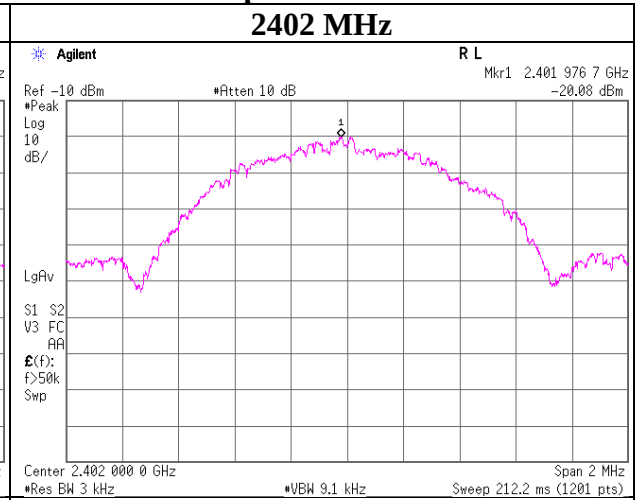
*The equipment and cables were not used for factor 0 dB of the data sheets.

Power Density

Sample : 90F0A39A



Sample : 90F0AF1C



UL Japan, Inc.

Shonan EMC Lab.

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

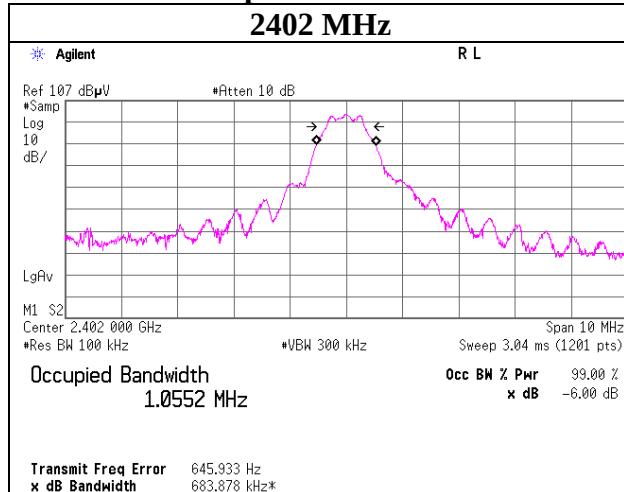
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

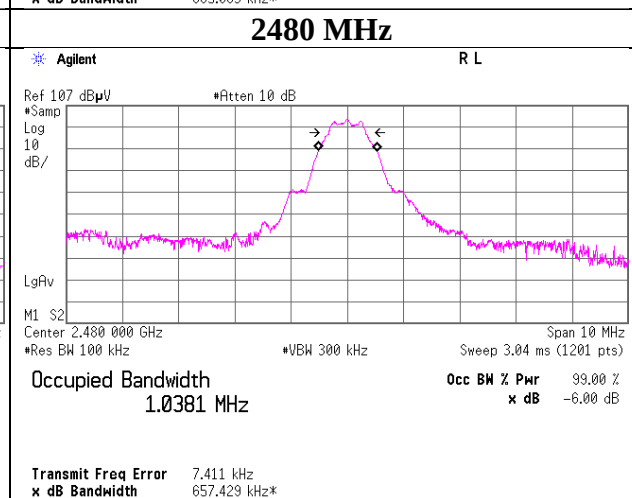
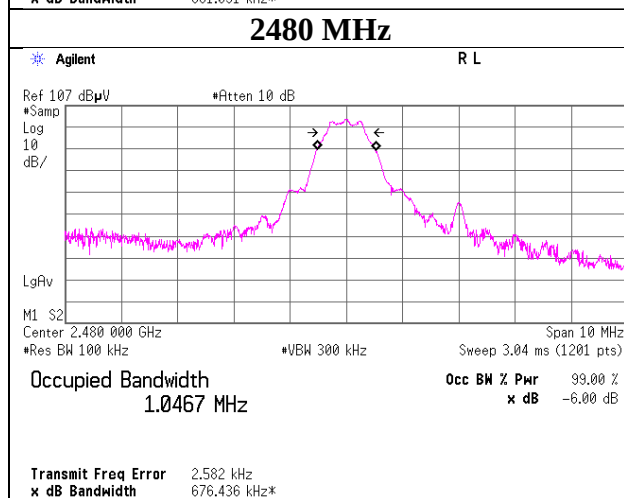
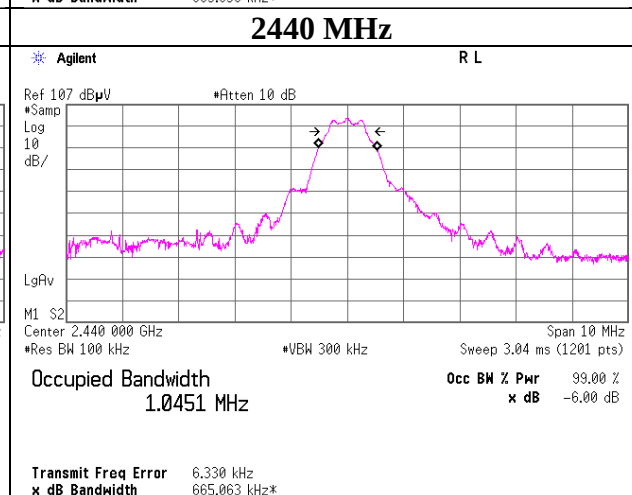
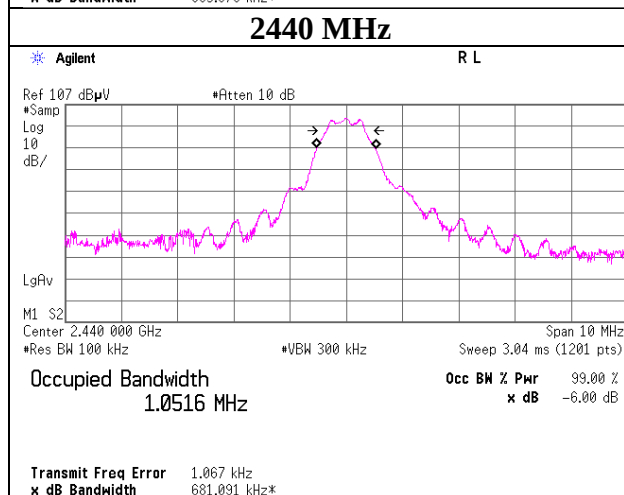
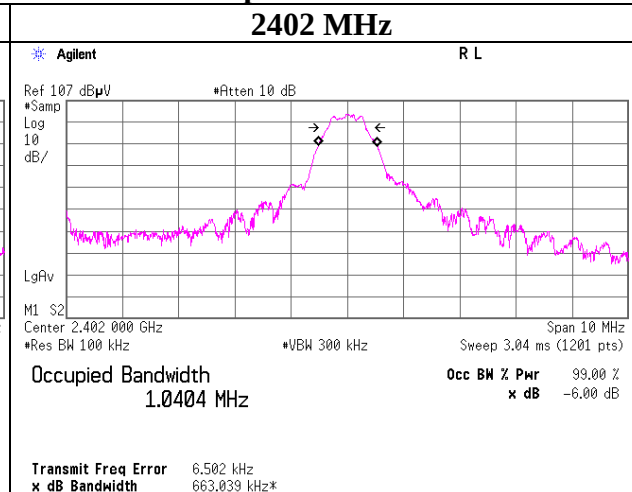
99% Occupied Bandwidth

Test place : Shonan EMC Lab. No.1 Measurement Room
Report No. : 10959367S-A
Date : October 9, 2015
Temperature / Humidity : 25 deg. C / 40 % RH
Engineer : Yosuke Ishikawa
Mode : Tx BT LE

Sample : 90F0A39A



Sample : 90F0AF1C



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2015/02/18 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2015/02/18 * 12
KAT3-11	Attenuator	JFW IND. INC.	50HF-003N	-	RE	2015/08/31 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2014/11/22 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12D SFA/141PE/141PE/141PE/141PE/NS 4906	-/0901-270 (RF Selector)	RE	2015/04/17 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12D SFA/141PE/141PE/141PE/141PE/NS 4906	-/0901-270 (RF Selector)	RE	2015/04/17 * 12
SLA-02	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0893	RE	2014/11/22 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2014/10/30 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2015/09/04 * 12
SJM-14	Measure	ASKUL	-	-	RE	-
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2015/07/15 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV (RE,CE,RFI, MF)	-	RE,CE	-
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26 W	00000019	RE	2015/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2015/03/11 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2015/03/17 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250 106	RE	2015/03/26 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2014/11/21 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2015/04/09 * 12
SAF-04	Pre Amplifier	TOYO Corporation	TPA0118-3 6	1440489	RE	2015/03/23 * 12
SCC-G05	Coaxial Cable	Junkosha	J12J102207-00	APR-30-1 5-037	RE	2015/05/11 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2015/05/19 * 12
SCC-05	Coaxial Cable	Fujikura	5D2W	-	CE	2015/04/17 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2015/02/24 * 12
SAT3-10	Attenuator	JFW	50HF-003N	-	CE	2015/08/31 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2014/12/24 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	CE	2014/11/11 * 12
SJM-15	Measure	ASKUL	-	-	CE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	CE	2014/11/11 * 12

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SRENT-05	Spectrum Analyzer	KEYSIGHT	E4440A	MY46187 752	AT	2015/10/05 * 12
SCC-G11	Coaxial Cable	Suhner	SUCOFLEX 102	31595/2	AT	2015/03/11 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	AT	2014/11/21 * 12
SPM-06	Power Meter	Anritsu	ML2495A	0850009	AT	2015/04/07 * 12
SPSS-03	Power sensor	Anritsu	MA2411B	0917063	AT	2015/04/07 * 12
SOS-13	Humidity Indicator	Custom	CTH-202	Q.C.17	AT	2015/04/28 * 12

The expiration date of the calibration is the end of the expired month.

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

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: **CE: Conducted Emission test**
 RE: Radiated Emission test
 AT: Antenna Terminal Conducted test