



RADIO TEST REPORT

Test Report No. : 12931873H-A

Applicant : **Panasonic Avionics Corporation**
Type of Equipment : **Bluetooth v5 Dual-Mode USB Module**
Model No. : **R8U4FJ5168Z**
FCC ID : **U6YBT850**
Test regulation : **FCC Part 15 Subpart C: 2019
For Permissive Change
* Bluetooth Low Energy part
(Maximum Peak Output Power and Radiated Spurious Emission tests only)**

Test Result : **Complied (Refer to SECTION 3.2)**

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. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
8. The information provided from the customer for this report is identified in SECTION 1.

Date of test: June 28 and 29, 2019

Representative test engineer:

T. Shimada

Takumi Shimada
Engineer

Consumer Technology Division

Approved by:

Takayuki S.

Takayuki Shimada
Leader

Consumer Technology Division



This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://japan.ul.com/resources/emc_accredited/

- 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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Ise EMC Lab.

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REVISION HISTORY

Original Test Report No.: 12931873H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12931873H-A	July 12, 2019	-	-

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SECTION 1: Customer information

Company Name : Panasonic Avionics Corporation
Address : 26200 Enterprise Way Lake Forest, CA 92630 USA
Telephone Number : +1-949-672-2000
Facsimile Number : +1-949-462-7100
Contact Person : David O'Reilly

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., FCC ID on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment : Bluetooth v5 Dual-Mode USB Module
Model No. : R8U4FJ5168Z
Serial No. : Refer to SECTION 4.2
Rating : DC 3.3 V
Receipt Date of Sample : May 28, 2019
(Information from test lab.)
Country of Mass-production : Japan
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: R8U4FJ5168Z (referred to as the EUT in this report) is a Bluetooth v5 Dual-Mode USB Module.

Radio Specification

[Bluetooth (Classic Bluetooth and BLE)]

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : BT: FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
LE: GFSK
Channel spacing : BT: 1 MHz
LE: 2 MHz
Antenna type : Microstrip Antenna
Antenna Gain : -3.4 dBi
Clock frequency (Maximum) : 40 MHz

* This test report applies to Bluetooth Low Energy function (2402 MHz - 2480 MHz) except for Bluetooth with EDR.

<Contents of the change from original model>

Antenna of the EUT is new type.

The maximum output level of Bluetooth module is changed from +8dBm to +2dBm.

The radio specification except above is identical to the original.

Therefore only Radiated Spurious Emission test were performed in this report.

Additionally, only the information of modified antenna is described in this report.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 4, 2019 and effective July 5, 2019 except 15.258

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
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section 15.247(b)(3)	See data.	Complied a)	Conducted
	IC: RSS-Gen 6.12	IC: RSS-247 5.4(d)			
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02	FCC: Section15.247(d)	11.4 dB 909.004 MHz, QP, Horizontal	Complied b)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			
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 15.247 Meas Guidance v05r02 8.5 and 8.6. a) Refer to APPENDIX 1 (data of Maximum Peak Output Power) b) Refer to APPENDIX 1 (data of Radiated Spurious Emission) Symbols: Complied The data of this test item has enough margin, more than the measurement uncertainty. Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.					

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)

This EUT provides stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The antenna is not removable from the EUT.
Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.
Ise EMC Lab.

Antenna Terminal test

Test Item	Uncertainty (+/-)
Maximum Peak Output Power / Average Output Power	1.3 dB

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.9 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		5.0 dB
3 m	1 GHz to 6 GHz	5.0 dB
	6 GHz to 18 GHz	5.3 dB
1 m	10 GHz to 26.5 GHz	5.8 dB
	26.5 GHz to 40 GHz	5.8 dB
10 m	1 GHz to 18 GHz	5.2 dB

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-

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)

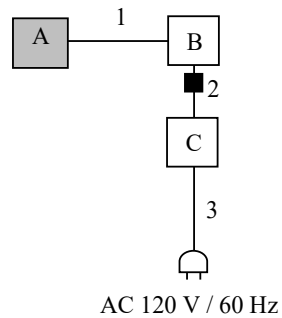
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
Bluetooth Low Energy (BT LE)	Maximum Packet Size, PRBS9
*Transmitting duty was 100 % on all tests. *The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 2 dBm Software: cybluetool ver Version 0.1.55.1	
*This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s) for BT LE

Test Item	Operating Mode	Tested frequency
Maximum Peak Output Power	Tx BT LE	2402 MHz
Radiated Spurious Emission		2440 MHz
(Below 1GHz/ Above 1GHz)		2480 MHz

4.2 Configuration and peripherals



■ : Standard Ferrite Core

* 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 v5 Dual-Mode USB Module	R8U4FD38302	U6YBT800	Panasonic Corporation	EUT
B	Laptop PC	CF-SZ5ADCVS	6JKSA17867	Panasonic Corporation	-
C	AC adaptor	CF-AA64L2C M1	64L2CM116904226A	Panasonic Corporation	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	0.90	Shielded	Shielded	-
2	DC Cable	0.90	Unshielded	Unshielded	-
3	AC Cable	0.70	Unshielded	Unshielded	-

SECTION 5: Radiated Spurious Emission

Test Procedure

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r02".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 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.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on 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.

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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 200 MHz	200 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.

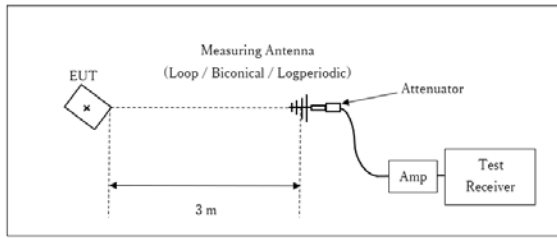
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	<u>11.12.2.5.1</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces <u>11.12.2.5.2</u> The duty cycle was less than 98% for detected noise, a duty factor was added to the 11.12.2.5.1 results.	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on ANSI C63.10-2013.

Figure 2: Test Setup

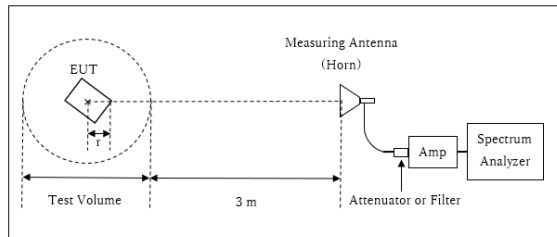
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

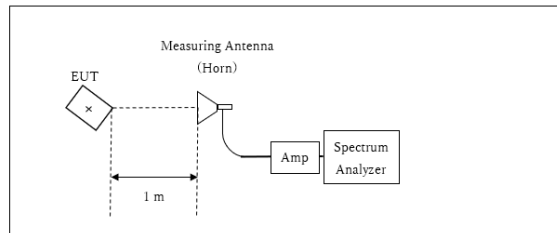


r : Radius of an outer periphery of EUT
 × : Center of turn table

Distance Factor: $20 \times \log(4.0 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$
 * Test Distance: $(3 + \text{Test Volume} / 2) - r = 4.0 \text{ m}$

Test Volume : 2.0 m
 (Test Volume has been calibrated based on CISPR 16-1-4.)
 r = 0.0 m

10 GHz - 26.5 GHz



× : Center of turn table

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

- 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 MHz - 26.5 GHz
Test data : APPENDIX
Test result : Pass

SECTION 6: 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
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *1)	-	Power Meter (Sensor: 50 MHz BW)
*1) Reference data							

The test results and limit are rounded off to two decimals place, so some differences might be observed.
The equipment and cables were not used for factor 0 dB of the data sheets.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Maximum Peak Output Power

Report No. 12931873H
 Test place Ise EMC Lab. No.8 Measurement Room
 Date June 28, 2019
 Temperature / Humidity 24 deg. C / 59 % RH
 Engineer Takumi Shimada
 Mode Tx BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dB]	[dBm]	[mW]	[dBm]	
2402	-8.91	0.03	10.09	1.21	1.32	30.00	1000	28.79	-3.40	-2.19	0.60	36.02	4000	38.21
2440	-9.24	0.03	10.09	0.88	1.22	30.00	1000	29.12	-3.40	-2.52	0.56	36.02	4000	38.54
2480	-9.68	0.03	10.09	0.44	1.11	30.00	1000	29.56	-3.40	-2.96	0.51	36.02	4000	38.98

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

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

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Average Output Power
(Reference data for RF Exposure)

Report No. 12931873H
Test place Ise EMC Lab. No.8 Measurement Room
Date June 28, 2019
Temperature / Humidity 24 deg. C / 59 % RH
Engineer Takumi Shimada
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-9.35	0.03	10.09	0.77	1.19	0.00	0.77	1.19
2440	-9.70	0.03	10.09	0.42	1.10	0.00	0.42	1.10
2480	-10.17	0.03	10.09	-0.05	0.99	0.00	-0.05	0.99

Sample Calculation:

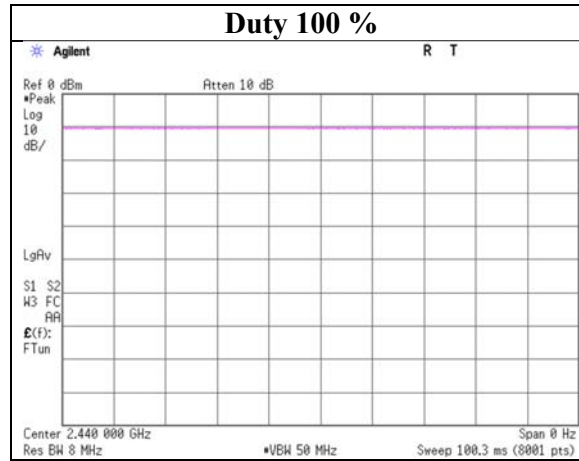
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

Result (Burst power average) = Time average + Duty factor

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

Burst rate confirmation

Report No. 12931873H
Test place Ise EMC Lab. No.8 Measurement Room
Date June 28, 2019
Temperature / Humidity 24 deg. C / 59 % RH
Engineer Takumi Shimada
Mode Tx BT LE



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

Report No. 12931873H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 29, 2019
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takumi Shimada
Mode Tx BT LE 2402 MHz

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.	31.463	QP	22.4	17.5	7.2	32.2	-	14.9	40.0	25.1	
Hori.	81.056	QP	32.3	6.7	8.0	32.2	-	14.8	40.0	25.2	
Hori.	174.082	QP	23.8	16.3	9.1	32.1	-	17.1	43.5	26.4	
Hori.	227.258	QP	32.5	11.3	9.6	32.0	-	21.3	46.0	24.7	
Hori.	480.000	QP	32.0	17.3	11.4	32.0	-	28.7	46.0	17.3	
Hori.	909.004	QP	29.6	22.1	13.8	30.9	-	34.6	46.0	11.4	
Hori.	2390.000	PK	41.8	27.8	5.5	32.8	-	42.4	73.9	31.5	
Hori.	4804.000	PK	40.2	31.7	7.7	31.8	-	47.7	73.9	26.2	Floor noise
Hori.	7206.000	PK	40.2	35.7	8.9	32.7	-	52.1	73.9	21.8	Floor noise
Hori.	9608.000	PK	40.8	38.6	9.4	33.3	-	55.6	73.9	18.4	Floor noise
Hori.	2390.000	AV	33.3	27.8	5.5	32.8	-	33.9	53.9	20.0	
Hori.	4804.000	AV	32.1	31.7	7.7	31.8	-	39.6	53.9	14.3	Floor noise
Hori.	7206.000	AV	32.8	35.7	8.9	32.7	-	44.7	53.9	9.2	Floor noise
Hori.	9608.000	AV	32.3	38.6	9.4	33.3	-	47.1	53.9	6.9	Floor noise
Vert.	36.463	QP	28.6	15.7	7.3	32.2	-	19.4	40.0	20.6	
Vert.	47.713	QP	34.1	11.7	7.5	32.2	-	21.1	40.0	18.9	
Vert.	79.992	QP	35.7	6.7	8.0	32.2	-	18.2	40.0	21.8	
Vert.	171.481	QP	25.6	15.9	9.0	32.1	-	18.4	43.5	25.1	
Vert.	303.008	QP	30.5	13.8	10.2	31.9	-	22.5	46.0	23.5	
Vert.	454.512	QP	31.5	16.6	11.2	32.0	-	27.4	46.0	18.6	
Vert.	2390.000	PK	41.1	27.8	5.5	32.8	-	41.7	73.9	32.2	
Vert.	4804.000	PK	38.8	31.7	7.7	31.8	-	46.3	73.9	27.6	Floor noise
Vert.	7206.000	PK	40.5	35.7	8.9	32.7	-	52.4	73.9	21.5	Floor noise
Vert.	9608.000	PK	40.8	38.6	9.4	33.3	-	55.6	73.9	18.4	Floor noise
Vert.	2390.000	AV	33.3	27.8	5.5	32.8	-	33.9	53.9	20.0	
Vert.	4804.000	AV	32.0	31.7	7.7	31.8	-	39.5	53.9	14.4	Floor noise
Vert.	7206.000	AV	32.8	35.7	8.9	32.7	-	44.7	53.9	9.2	Floor noise
Vert.	9608.000	AV	31.8	38.6	9.4	33.3	-	46.6	53.9	7.4	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (4 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

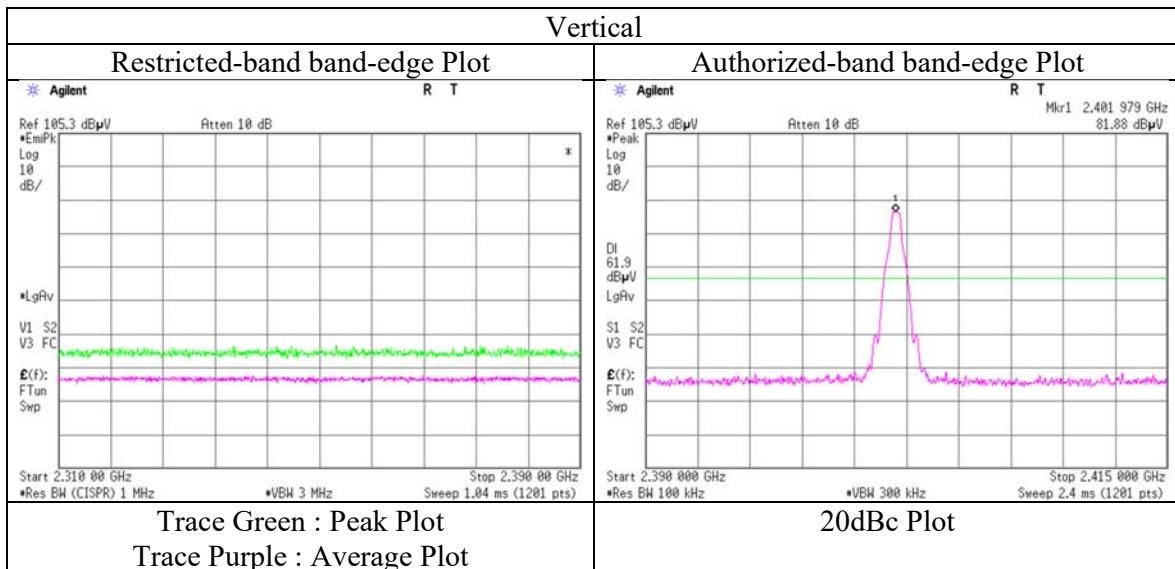
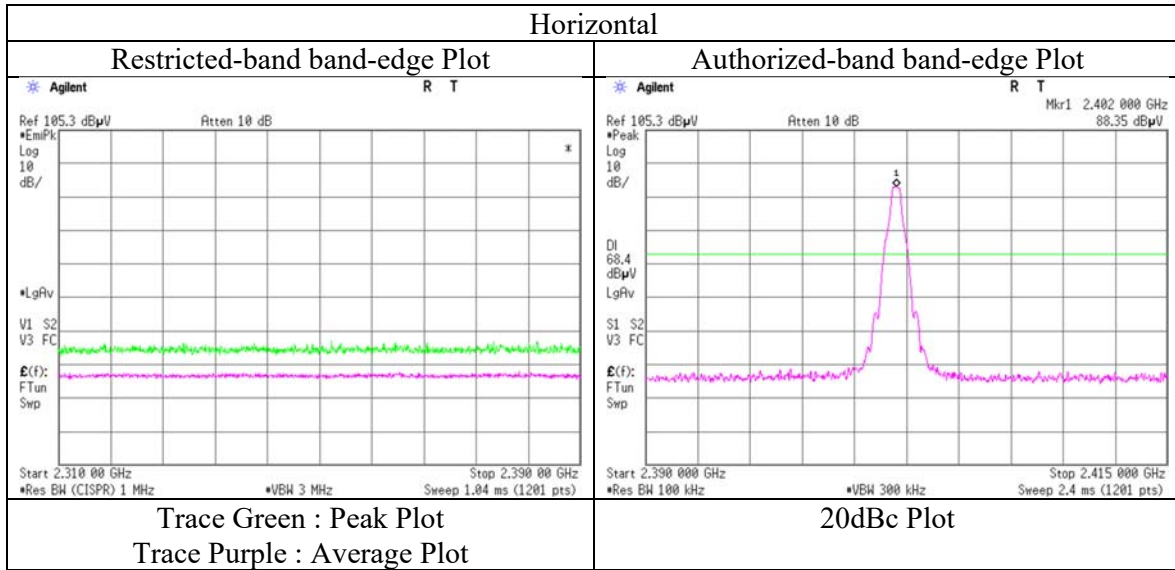
20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	88.4	27.8	5.6	32.7	89.0	-	-	Carrier
Hori.	2400.000	PK	34.6	27.8	5.6	32.7	35.2	69.0	33.8	
Vert.	2402.000	PK	81.9	27.8	5.6	32.7	82.5	-	-	Carrier
Vert.	2400.000	PK	30.4	27.8	5.6	32.7	31.0	62.5	31.5	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 12931873H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 29, 2019
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takumi Shimada
Mode Tx BT LE 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 12931873H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 29, 2019
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takumi Shimada
Mode Tx BT LE 2440 MHz

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.	32.334	QP	22.0	17.1	7.2	32.2	-	14.1	40.0	25.9	
Hori.	81.410	QP	30.5	6.8	8.0	32.2	-	13.1	40.0	26.9	
Hori.	152.844	QP	25.1	15.2	8.9	32.1	-	17.1	43.5	26.4	
Hori.	227.256	QP	32.4	11.3	9.6	32.0	-	21.2	46.0	24.8	
Hori.	606.010	QP	27.4	19.3	12.2	32.0	-	26.9	46.0	19.1	
Hori.	909.022	QP	28.9	22.1	13.8	30.9	-	33.9	46.0	12.1	
Hori.	4880.000	PK	40.5	31.7	7.7	31.8	-	48.1	73.9	25.8	Floor noise
Hori.	7320.000	PK	40.3	36.3	8.9	32.7	-	52.8	73.9	21.1	Floor noise
Hori.	9760.000	PK	40.6	39.1	9.4	33.4	-	55.7	73.9	18.2	Floor noise
Hori.	4880.000	AV	32.2	31.7	7.7	31.8	-	39.8	53.9	14.1	Floor noise
Hori.	7320.000	AV	32.5	36.3	8.9	32.7	-	45.0	53.9	8.9	Floor noise
Hori.	9760.000	AV	32.2	39.1	9.4	33.4	-	47.3	53.9	6.6	Floor noise
Vert.	35.937	QP	31.1	15.8	7.3	32.2	-	22.0	40.0	18.0	
Vert.	47.713	QP	34.0	11.7	7.5	32.2	-	21.0	40.0	19.0	
Vert.	80.799	QP	35.4	6.7	8.0	32.2	-	17.9	40.0	22.1	
Vert.	152.912	QP	27.5	15.2	8.9	32.1	-	19.5	43.5	24.0	
Vert.	303.008	QP	30.5	13.8	10.2	31.9	-	22.5	46.0	23.5	
Vert.	454.506	QP	31.6	16.6	11.2	32.0	-	27.5	46.0	18.5	
Vert.	4880.000	PK	38.5	31.7	7.7	31.8	-	46.1	73.9	27.8	Floor noise
Vert.	7320.000	PK	40.6	36.3	8.9	32.7	-	53.1	73.9	20.8	Floor noise
Vert.	9760.000	PK	40.7	39.1	9.4	33.4	-	55.8	73.9	18.1	Floor noise
Vert.	4880.000	AV	32.3	31.7	7.7	31.8	-	39.9	53.9	14.0	Floor noise
Vert.	7320.000	AV	32.4	36.3	8.9	32.7	-	44.9	53.9	9.0	Floor noise
Vert.	9760.000	AV	31.6	39.1	9.4	33.4	-	46.7	53.9	7.2	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (4 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 12931873H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 29, 2019
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takumi Shimada
Mode Tx BT LE 2480 MHz

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.	31.340	QP	22.4	17.5	7.2	32.2	-	14.9	40.0	25.1	
Hori.	82.285	QP	33.9	7.0	8.1	32.2	-	16.7	40.0	23.3	
Hori.	152.420	QP	25.6	15.3	8.9	32.1	-	17.6	43.5	25.9	
Hori.	227.256	QP	32.4	11.3	9.6	32.0	-	21.2	46.0	24.8	
Hori.	480.000	QP	31.7	17.3	11.4	32.0	-	28.4	46.0	17.6	
Hori.	909.024	QP	29.0	22.1	13.8	30.9	-	34.0	46.0	12.0	
Hori.	2483.500	PK	43.1	27.5	5.6	32.7	-	43.5	73.9	30.4	
Hori.	4960.000	PK	40.7	31.8	7.7	31.8	-	48.4	73.9	25.5	Floor noise
Hori.	7440.000	PK	40.5	36.6	8.9	32.7	-	53.3	73.9	20.6	Floor noise
Hori.	9920.000	PK	40.3	39.1	9.4	33.4	-	55.4	73.9	18.6	Floor noise
Hori.	2483.500	AV	32.2	27.5	5.6	32.7	-	32.6	53.9	21.3	
Hori.	4960.000	AV	32.5	31.8	7.7	31.8	-	40.2	53.9	13.7	Floor noise
Hori.	7440.000	AV	32.2	36.6	8.9	32.7	-	45.0	53.9	8.9	Floor noise
Hori.	9920.000	AV	31.7	39.1	9.4	33.4	-	46.8	53.9	7.2	Floor noise
Vert.	36.640	QP	30.2	15.6	7.3	32.2	-	20.9	40.0	19.1	
Vert.	48.195	QP	34.1	11.5	7.5	32.2	-	21.0	40.0	19.0	
Vert.	82.162	QP	35.3	6.9	8.1	32.2	-	18.1	40.0	21.9	
Vert.	152.804	QP	27.7	15.2	8.9	32.1	-	19.7	43.5	23.8	
Vert.	303.005	QP	30.6	13.8	10.2	31.9	-	22.6	46.0	23.4	
Vert.	454.502	QP	31.6	16.6	11.2	32.0	-	27.5	46.0	18.5	
Vert.	2483.500	PK	38.6	27.5	5.6	32.7	-	39.0	73.9	34.9	
Vert.	4960.000	PK	39.2	31.8	7.7	31.8	-	46.9	73.9	27.0	Floor noise
Vert.	7440.000	PK	40.5	36.6	8.9	32.7	-	53.3	73.9	20.6	Floor noise
Vert.	9920.000	PK	41.0	39.1	9.4	33.4	-	56.1	73.9	17.9	Floor noise
Vert.	2483.500	AV	32.3	27.5	5.6	32.7	-	32.7	53.9	21.2	
Vert.	4960.000	AV	32.5	31.8	7.7	31.8	-	40.2	53.9	13.7	Floor noise
Vert.	7440.000	AV	32.1	36.6	8.9	32.7	-	44.9	53.9	9.0	Floor noise
Vert.	9920.000	AV	31.7	39.1	9.4	33.4	-	46.8	53.9	7.2	Floor noise

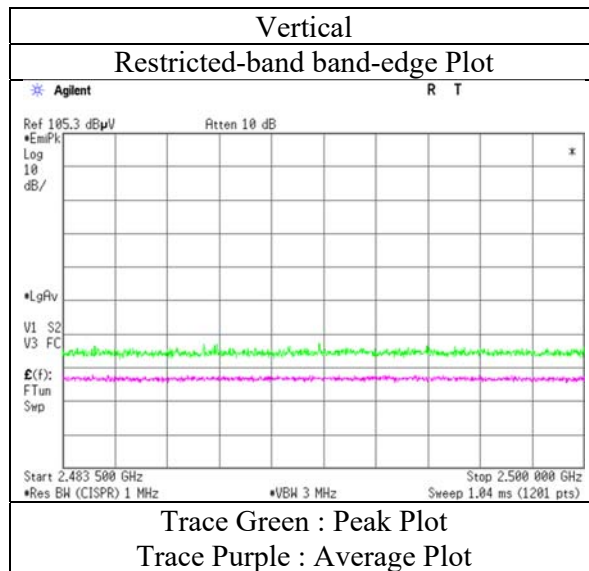
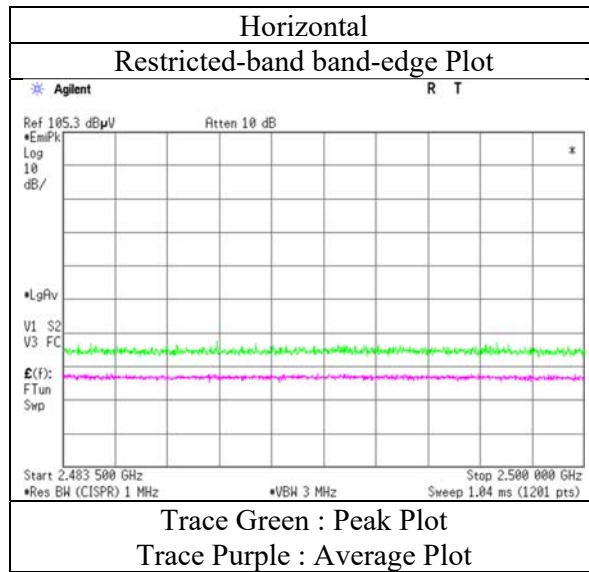
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (4 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

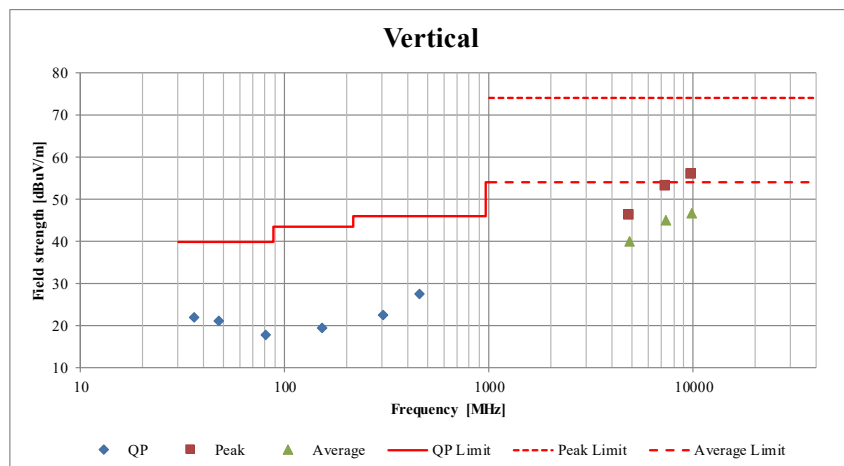
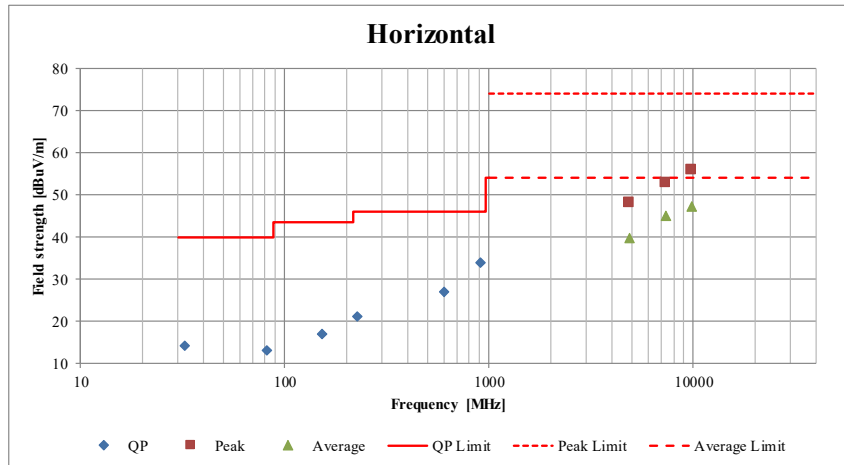
Report No. 12931873H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date June 29, 2019
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takumi Shimada
Mode Tx BT LE 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission (Plot data, Worst case)

Report No.	12931873H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	June 29, 2019
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Takumi Shimada
Mode	Tx BT LE 2440 MHz



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

APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
AT	141840	Power sensor	ANRITSU	MA2411B	11737	10/16/2018	10/31/2019	12
AT	141805	Power Meter	ANRITSU	ML2495A	6K00003338	10/16/2018	10/31/2019	12
AT	141173	Attenuator(10dB) (above1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	12/17/2018	12/31/2019	12
AT	141903	Spectrum Analyzer	AGILENT	E4440A	MY46186390	09/20/2018	09/30/2019	12
AT	141567	Thermo-Hygrometer	CUSTOM	CTH-201	0008	01/11/2019	01/31/2020	12
RE	142285	Antenna Tilt Jig	Intelligent System Engineering Co., Ltd	Antenna Tilt Jig	T-0003	-	-	-
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/06/2018	08/31/2019	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/08/2019	02/29/2020	12
RE	141323	Coaxial cable	UL Japan	-	-	07/03/2018	07/31/2019	12
RE	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2019	02/29/2020	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	05/24/2019	05/31/2020	12
RE	141266	Logperiodic Antenna(200- 1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	03/25/2019	03/31/2020	12
RE	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	01/29/2019	01/31/2020	12
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24
RE	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/08/2019	04/30/2021	24
RE	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/11/2019	01/31/2020	12
RE	141513	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	05/10/2019	05/31/2020	12
RE	141507	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	05/10/2019	05/31/2020	12
RE	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/ 1902S579(5m)	03/05/2019	03/31/2020	12
RE	141901	Spectrum Analyzer	AGILENT	E4440A	MY48250080	10/04/2018	10/31/2019	12
RE	141580	MicroWave System Amplifier	AGILENT	83017A	MY39500779	03/05/2019	03/31/2020	12
RE	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/19/2018	09/30/2019	12

***Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

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: RE: Radiated Emission test
AT: Antenna Terminal Conducted test**

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

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APPENDIX 3: Photographs of test setup

Radiated Spurious Emission

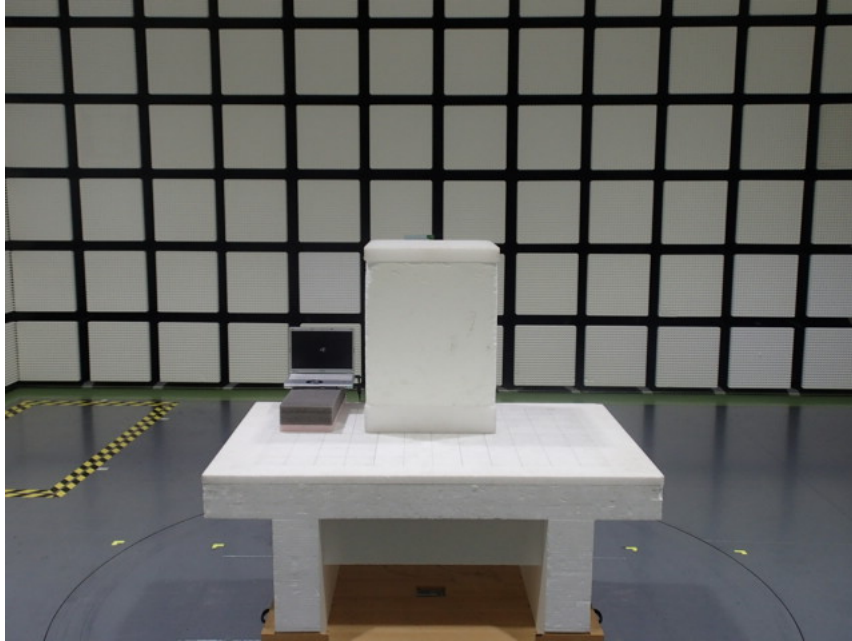


Photo 1

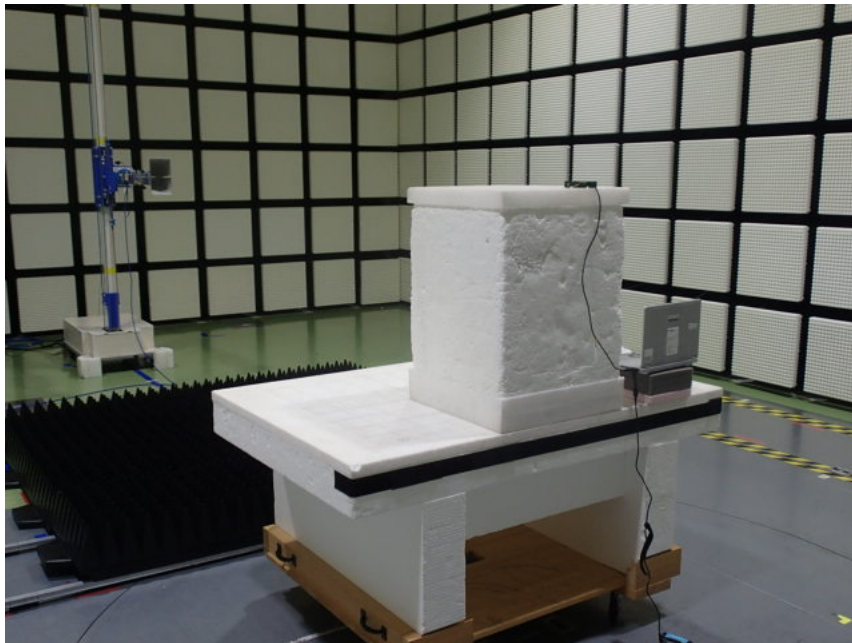


Photo 2

UL Japan, Inc.

Ise EMC Lab.

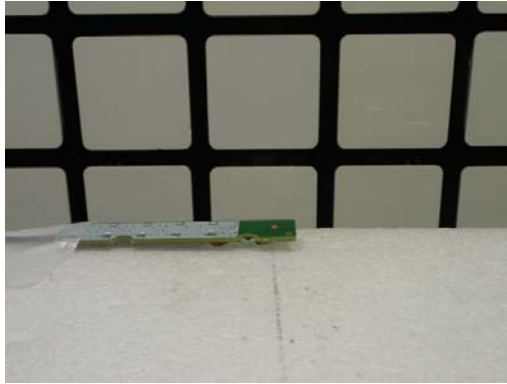
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

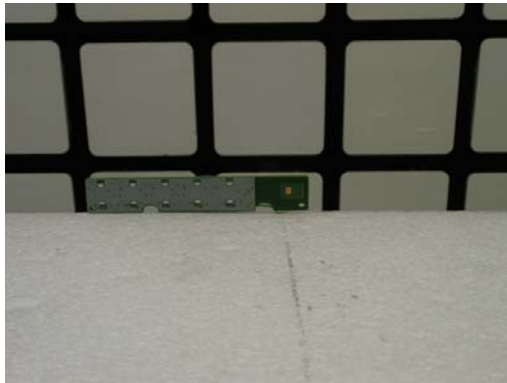
Facsimile : +81 596 24 8124

Worst Case Position
Below 1GHz (Horizontal: X-axis/ Vertical:X-axis)
Above 1GHz (Horizontal: X-axis/ Vertical:X-axis)

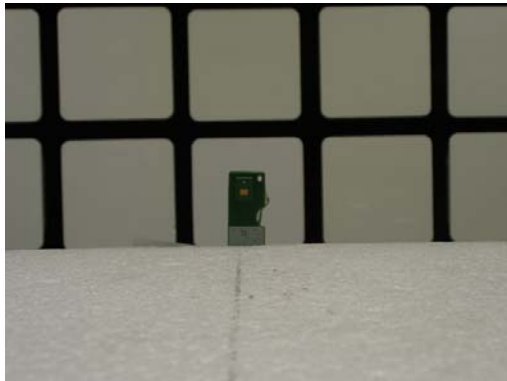
X-axis



Y-axis



Z-axis



End of Report