RADIO TEST REPORT

Test Report No. : 13074034H-A

Applicant	:	**Panasonic Avionics Corporation**
Type of Equipment	:	**BTv4.0 Dual Mode USB HCI Module**
Model No.	:	**R8U2FW6810Z**
FCC ID	:	**U6YBT800**
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)**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the 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: October 19 and 20, 2019

Representative test engineer: T. Nakagawa
Tomohisa Nakagawa
Engineer
Consumer Technology Division

Approved by: Takayuki. S
Takayuki Shimada
Leader
Consumer Technology Division

NVLAP TESTING NVLAP LAB CODE 200572-0 ilac-MRA

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REVISION HISTORY

Original Test Report No.: 13074034H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13074034H-A	November 11, 2019	-	-

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation
AC	Alternating Current
AFH	Adaptive Frequency Hopping
AM	Amplitude Modulation
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
Cal Int	Calibration Interval
CCK	Complementary Code Keying
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
D-factor	Distance factor
DFS	Dynamic Frequency Selection
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
EDR	Enhanced Data Rate
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EN	European Norm
ERP, e.r.p.	Effective Radiated Power
EU	European Union
EUT	Equipment Under Test
Fac.	Factor
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
Freq.	Frequency
FSK	Frequency Shift Keying
GFSK	Gaussian Frequency-Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Hori.	Horizontal
ICES	Interference-Causing Equipment Standard
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
ILAC	International Laboratory Accreditation Conference
ISED	Innovation, Science and Economic Development Canada
ISO	International Organization for Standardization
JAB	Japan Accreditation Board
LAN	Local Area Network
LIMS	Laboratory Information Management System
MCS	Modulation and Coding Scheme
MRA	Mutual Recognition Arrangement
N/A	Not Applicable
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
NVLAP	National Voluntary Laboratory Accreditation Program
OBW	Occupied Band Width
OFDM	Orthogonal Frequency Division Multiplexing
P/M	Power meter
PCB	Printed Circuit Board
PER	Packet Error Rate
PHY	Physical Layer
PK	Peak
PN	Pseudo random Noise
PRBS	Pseudo-Random Bit Sequence
PSD	Power Spectral Density
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadri-Phase Shift Keying
RBW	Resolution Band Width
RDS	Radio Data System
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RSS	Radio Standards Specifications
Rx	Receiving
SA, S/A	Spectrum Analyzer
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
TR	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN

CONTENTS **PAGE**

SECTION 1: Customer information....5
SECTION 2: Equipment under test (E.U.T.)....5
SECTION 3: Test specification, procedures & results....6
SECTION 4: Operation of E.U.T. during testing....9
SECTION 5: Radiated Spurious Emission....11
SECTION 6: Antenna Terminal Conducted Tests....13
APPENDIX 1: Test data....14
Maximum Peak Output Power....14
Average Output Power....15
Radiated Spurious Emission....17
APPENDIX 2: Test instruments....23
APPENDIX 3: Photographs of test setup....24
Radiated Spurious Emission....24
Worst Case Position....25

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
- Operating/Test Mode(s) (Mode(s)) on all the 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	:	BTv4.0 Dual Mode USB HCI Module
Model No.	:	R8U2FW6810Z
Serial No.	:	Refer to SECTION 4.2
Rating	:	DC 5 V
Receipt Date of Sample (Information from test lab.)	:	October 16, 2019
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: R8U2FW6810Z (referred to as the EUT in this report) is a BTv4.0 Dual Mode USB HCI Module.

Radio Specification

[Bluetooth (Dual mode (Classic Bluetooth and BT LE)]

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	BT: FHSS (GFSK, π/4DQPSK, 8DPSK) LE: GFSK
Channel spacing	:	BT: 1 MHz LE: 2 MHz
Power Supply (radio part input)	:	DC 3.3 V / DC 1.8 V
Antenna type	:	Pattern Antenna
Antenna Gain	:	2.5 dBi
Clock frequency (Maximum)	:	48 MHz

*This test report applies to Bluetooth with EDR function (LE part: 2402 MHz - 2480 MHz).

<Contents of the change from original model>
Antenna gain is larger than original model and output power settings are lower than original model.
Therefore only Maximum Peak Output Power and Radiated Spurious Emission tests were performed in this report.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on July 19, 2019 and effective August 19, 2019 except 15.258

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

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
	ISED: RSS-Gen 6.12	**ISED:** RSS-247 5.4(d)			
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	3.9 dB 4960.00 MHz, AV, Horizontal	Complied# b)	Radiated (above 30 MHz) *1)
	ISED: RSS-Gen 6.13	**ISED:** 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 (DC 3.3 V) 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 (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.4 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.6 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)	4.8 dB
	(Vertical)	5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
	(Vertical)	6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
	(Vertical)	4.8 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
	(Vertical)	5.0 dB
3 m	1 GHz to 6 GHz	4.9 dB
	6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB
	26.5 GHz to 40 GHz	5.5 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
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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	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

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 (BT LE)	Maximum Packet Size, PRBS9

*EUT has the power settings by the software as follows (setting value might be different from product specification value);

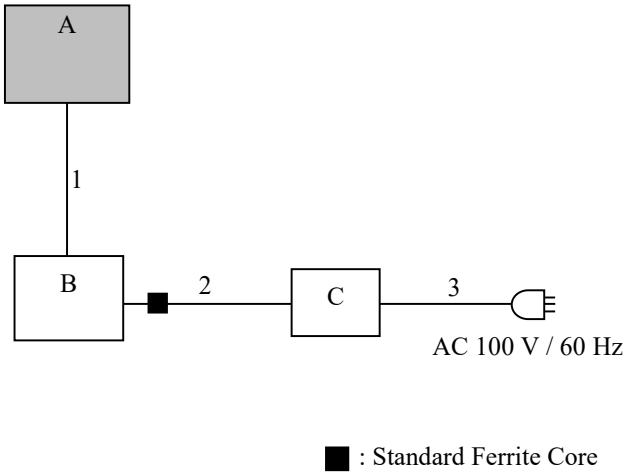
Power settings: : -4 dBm
Software: Blue test 3, Version 2.5.0.93

*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)

Test Item	Operating Mode	Tested frequency
Spurious Emission, Maximum Peak Output Power	BT LE	2402 MHz 2440 MHz 2480 MHz

4.2 Configuration and peripherals



* 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	BluetootBTv4.0 Dual Mode USB HCI Module	R8U2FW6810Z	527FC2 for AT* 527FF1 for RE*	Panasonic Corporation	EUT
B	Laptop PC	CF-SX2	4KKSA78923	Panasonic Corporation	-
C	AC Adapter	CF-AA5773A	5713AM110209115A	Panasonic Corporation	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	3.3	Shielded	Shielded	-
2	DC Cable	1.8	Unshielded	Unshielded	-
3	AC Cable	1.5	Unshielded	Unshielded	-

*AT: Antenna Terminal conducted test, RE: Radiated Spurious Emission test

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.

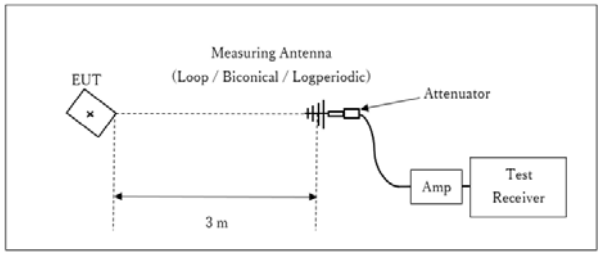
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	11.12.2.5.1 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces 11.12.2.5.2 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

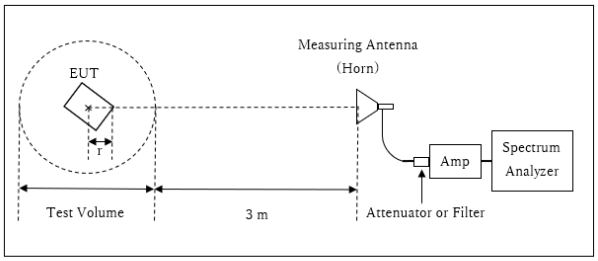
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

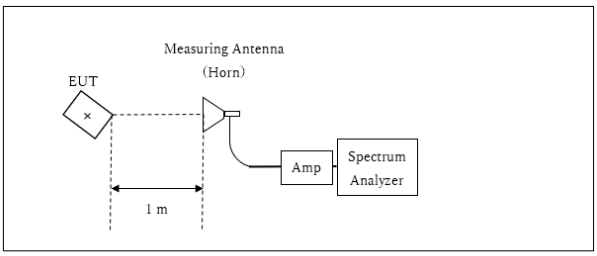


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (4.0 m / 3.0 m) = 2.5 dB
* Test Distance: (3 + Test Volume /2) - r = 4.0 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 x log (1.0 m / 3.0 m) = -9.5 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.	13074034H
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Date	October 19, 2019
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-17.01	0.23	9.49	-7.29	0.19	30.00	1000	37.29
2440	-15.10	0.23	9.49	-5.38	0.29	30.00	1000	35.38
2480	-12.81	0.23	9.49	-3.09	0.49	30.00	1000	33.09

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

Average Output Power
(Reference data for RF Exposure)

Report No.	13074034H
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Date	October 19, 2019
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2402	-20.48	0.23	9.49	-10.76	0.08	1.66	-9.10	0.12
2440	-18.07	0.23	9.49	-8.35	0.15	1.66	-6.69	0.21
2480	-15.58	0.23	9.49	-5.86	0.26	1.66	-4.20	0.38

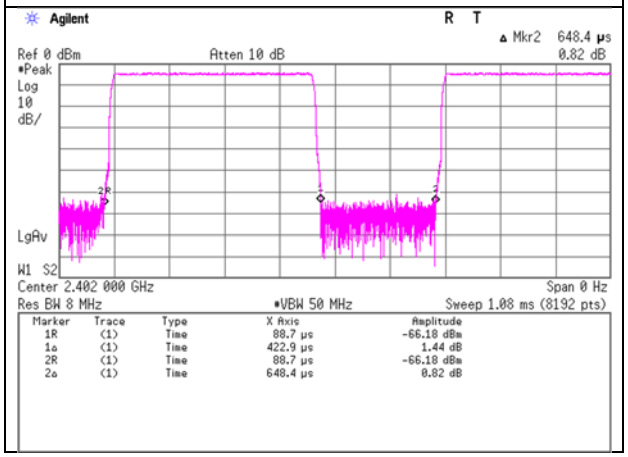
Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

Burst rate confirmation

Report No.	13074034H
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Date	October 19, 2019
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE

BT LE

Tx on / (Tx on + Tx off) =	**0.683**
Tx on / (Tx on + Tx off) * 100 =	**68.3 %**
Duty factor = 10 * log (0.6484 / 0.4429) =	**1.66 dB**



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

Radiated Spurious Emission

Report No.	13074034H	
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber	
Date	October 19, 2019	October 20, 2019
Temperature / Humidity	23 deg. C / 68 % RH	22 deg. C / 65 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
Mode	Tx BT LE 2402MHz	

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.	57.625	QP	21.9	8.5	7.9	32.2	-	6.2	40.0	33.9	
Hori.	70.673	QP	30.3	6.3	8.1	32.1	-	12.6	40.0	27.4	
Hori.	141.648	QP	22.5	14.6	8.9	32.1	-	13.9	43.5	29.6	
Hori.	399.600	QP	23.6	15.8	10.8	32.0	-	18.2	46.0	27.8	
Hori.	450.200	QP	34.4	16.7	11.1	32.0	-	30.2	46.0	15.8	
Hori.	498.000	QP	28.0	17.7	11.4	32.0	-	25.1	46.0	21.0	
Hori.	2390.000	PK	41.2	27.9	5.9	31.9	-	43.1	73.9	30.8	
Hori.	4804.000	PK	45.3	31.7	8.1	31.3	-	53.8	73.9	20.1	
Hori.	7206.000	PK	42.6	36.2	8.7	32.4	-	55.1	73.9	18.8	Floor noise
Hori.	9608.000	PK	43.2	38.0	9.7	32.8	-	58.1	73.9	15.9	Floor noise
Hori.	2390.000	AV	33.6	27.9	5.9	31.9	1.7	37.1	53.9	16.8	*1)
Hori.	4804.000	AV	38.6	31.7	8.1	31.3	1.7	48.7	53.9	5.2	
Hori.	7206.000	AV	34.7	36.2	8.7	32.4	-	47.2	53.9	6.7	Floor noise
Hori.	9608.000	AV	35.7	38.0	9.7	32.8	-	50.6	53.9	3.3	Floor noise
Vert.	56.860	QP	29.0	8.8	7.9	32.2	-	13.5	40.0	26.5	
Vert.	71.948	QP	38.9	6.3	8.1	32.1	-	21.1	40.0	18.9	
Vert.	128.558	QP	31.8	13.7	8.7	32.1	-	22.2	43.5	21.3	
Vert.	399.400	QP	31.1	15.7	10.8	32.0	-	25.7	46.0	20.3	
Vert.	450.400	QP	34.8	16.7	11.1	32.0	-	30.6	46.0	15.4	
Vert.	601.000	QP	29.5	19.4	12.0	32.1	-	28.7	46.0	17.3	
Vert.	2390.000	PK	41.5	27.9	5.9	31.9	-	43.4	73.9	30.5	
Vert.	4804.000	PK	43.7	31.7	8.1	31.3	-	52.1	73.9	21.8	
Vert.	7206.000	PK	42.1	36.2	8.7	32.4	-	54.6	73.9	19.3	Floor noise
Vert.	9608.000	PK	43.2	38.0	9.7	32.8	-	58.1	73.9	15.8	Floor noise
Vert.	2390.000	AV	30.7	27.9	5.9	31.9	1.7	34.3	53.9	19.6	*1)
Vert.	4804.000	AV	37.9	31.7	8.1	31.3	1.7	48.1	53.9	5.8	
Vert.	7206.000	AV	36.4	36.2	8.7	32.4	-	48.9	53.9	5.0	Floor noise
Vert.	9608.000	AV	36.0	38.0	9.7	32.8	-	50.9	53.9	3.0	Floor noise

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

*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 (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

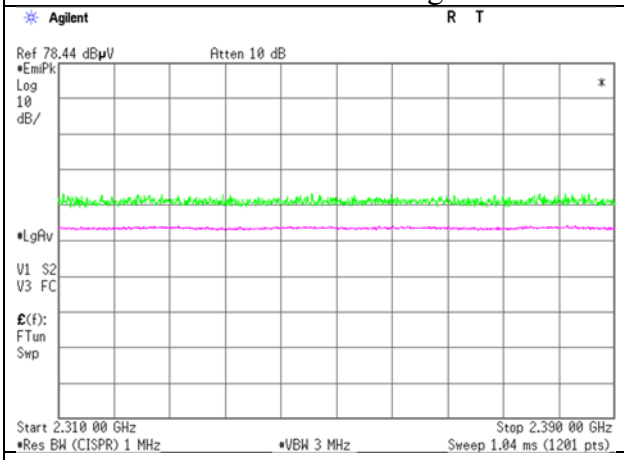
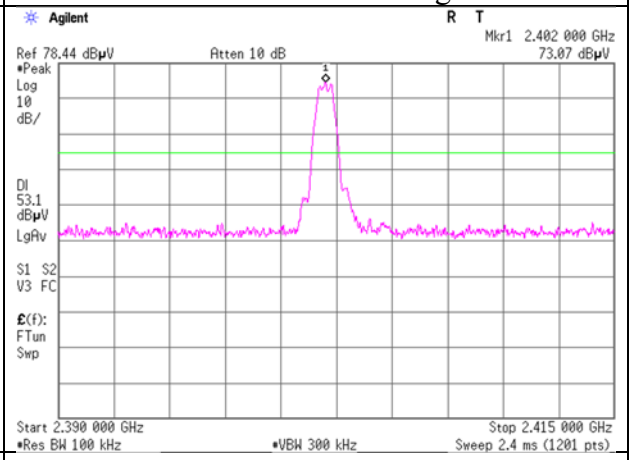
20dBc Data Sheet

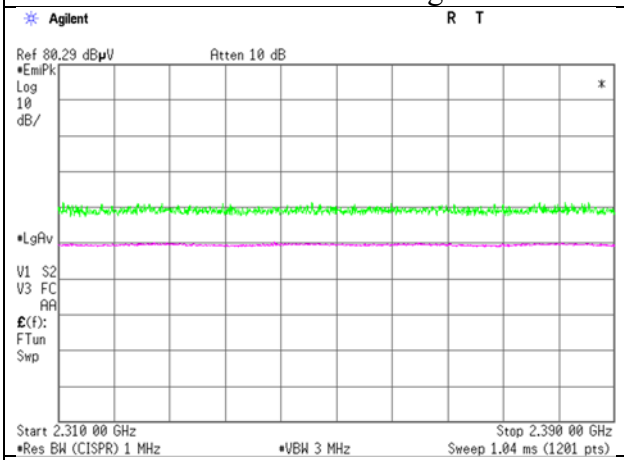
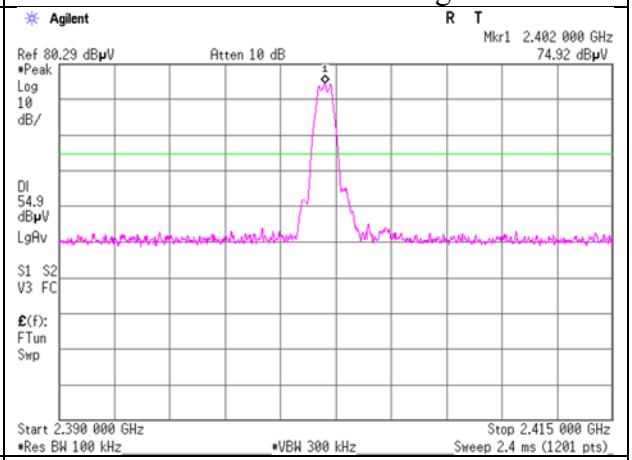
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	73.1	27.9	5.9	31.9	75.0	-	-	Carrier
Hori.	2400.000	PK	33.2	27.9	5.9	31.9	35.1	55.0	19.9	
Vert.	2402.000	PK	74.9	27.9	5.9	31.9	76.8	-	-	Carrier
Vert.	2400.000	PK	32.9	27.9	5.9	31.9	34.9	56.8	22.0	

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13074034H
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Date	October 19, 2019
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE 2402MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

* 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.	13074034H	
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber	
Date	October 19, 2019	October 20, 2019
Temperature / Humidity	23 deg. C / 68 % RH	22 deg. C / 65 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
Mode	Tx BT LE 2440MHz	

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.	52.185	QP	22.1	10.4	7.8	32.2	-	8.1	40.0	31.9	
Hori.	72.075	QP	31.3	6.3	8.1	32.1	-	13.5	40.0	26.5	
Hori.	135.740	QP	25.3	14.3	8.8	32.1	-	16.3	43.5	27.2	
Hori.	399.420	QP	23.3	15.7	10.8	32.0	-	17.9	46.0	28.1	
Hori.	451.800	QP	34.5	16.7	11.1	32.0	-	30.4	46.0	15.6	
Hori.	498.000	QP	26.4	17.7	11.4	32.0	-	23.5	46.0	22.6	
Hori.	4880.000	PK	46.0	31.6	8.1	31.2	-	54.4	73.9	19.5	
Hori.	7320.000	PK	42.6	36.5	8.7	32.5	-	55.4	73.9	18.5	Floor noise
Hori.	9760.000	PK	44.0	38.3	9.7	32.9	-	59.1	73.9	14.8	Floor noise
Hori.	4880.000	AV	39.0	31.6	8.1	31.2	1.7	49.1	53.9	4.8	
Hori.	7320.000	AV	34.3	36.5	8.7	32.5	-	47.1	53.9	6.8	Floor noise
Hori.	9760.000	AV	35.8	38.3	9.7	32.9	-	50.9	53.9	3.0	Floor noise
Vert.	57.583	QP	33.4	8.5	7.9	32.2	-	17.7	40.0	22.3	
Vert.	72.075	QP	38.8	6.3	8.1	32.1	-	21.0	40.0	19.0	
Vert.	130.428	QP	31.8	13.8	8.7	32.1	-	22.3	43.5	21.3	
Vert.	399.870	QP	30.5	15.8	10.8	32.0	-	25.1	46.0	20.9	
Vert.	451.400	QP	36.0	16.7	11.1	32.0	-	31.9	46.0	14.1	
Vert.	600.087	QP	30.0	19.3	11.9	32.1	-	29.2	46.0	16.8	
Vert.	4880.000	PK	44.7	31.6	8.1	31.2	-	53.2	73.9	20.7	
Vert.	7320.000	PK	42.9	36.5	8.7	32.5	-	55.7	73.9	18.2	Floor noise
Vert.	9760.000	PK	44.0	38.3	9.7	32.9	-	59.1	73.9	14.8	Floor noise
Vert.	4880.000	AV	37.6	31.6	8.1	31.2	1.7	47.8	53.9	6.1	
Vert.	7320.000	AV	34.2	36.5	8.7	32.5	-	47.0	53.9	6.9	Floor noise
Vert.	9760.000	AV	35.5	38.3	9.7	32.9	-	50.7	53.9	3.3	Floor noise

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

*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 (4.0 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.	13074034H	
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber	
Date	October 19, 2019	October 20, 2019
Temperature / Humidity	23 deg. C / 68 % RH	22 deg. C / 65 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
Mode	Tx BT LE 2480MHz	

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.	54.480	QP	22.0	9.5	7.9	32.2	-	7.2	40.0	32.8	
Hori.	68.888	QP	32.0	6.4	8.1	32.1	-	14.3	40.0	25.7	
Hori.	128.303	QP	25.3	13.7	8.7	32.1	-	15.6	43.5	27.9	
Hori.	407.000	QP	24.9	15.9	10.8	32.0	-	19.7	46.0	26.3	
Hori.	450.000	QP	35.3	16.7	11.1	32.0	-	31.1	46.0	14.9	
Hori.	498.000	QP	26.7	17.7	11.4	32.0	-	23.8	46.0	22.3	
Hori.	2483.500	PK	41.1	27.7	6.0	31.8	-	43.0	73.9	30.9	
Hori.	4960.000	PK	46.2	31.6	8.1	31.2	-	54.7	73.9	19.2	
Hori.	7440.000	PK	42.9	36.6	8.8	32.5	-	55.8	73.9	18.2	Floor noise
Hori.	9920.000	PK	43.3	38.5	9.8	33.0	-	58.6	73.9	15.3	Floor noise
Hori.	2483.500	AV	33.0	27.7	6.0	31.8	1.7	36.5	53.9	17.4	*1)
Hori.	4960.000	AV	39.8	31.6	8.1	31.2	1.7	50.0	53.9	3.9	
Hori.	7440.000	AV	33.5	36.6	8.8	32.5	-	46.3	53.9	7.6	Floor noise
Hori.	9920.000	AV	35.5	38.5	9.8	33.0	-	50.8	53.9	3.1	Floor noise
Vert.	56.733	QP	32.1	8.8	7.9	32.2	-	16.7	40.0	23.4	
Vert.	71.055	QP	36.7	6.3	8.1	32.1	-	18.9	40.0	21.1	
Vert.	130.768	QP	31.0	13.8	8.7	32.1	-	21.5	43.5	22.0	
Vert.	399.600	QP	32.3	15.8	10.8	32.0	-	26.9	46.0	19.1	
Vert.	449.800	QP	36.3	16.7	11.1	32.0	-	32.1	46.0	13.9	
Vert.	600.400	QP	28.3	19.3	11.9	32.1	-	27.5	46.0	18.5	
Vert.	2483.500	PK	41.5	27.7	6.0	31.8	-	43.3	73.9	30.6	
Vert.	4960.000	PK	43.9	31.6	8.1	31.2	-	52.5	73.9	21.5	
Vert.	7440.000	PK	42.7	36.6	8.8	32.5	-	55.5	73.9	18.4	Floor noise
Vert.	9920.000	PK	43.9	38.5	9.8	33.0	-	59.2	73.9	14.7	Floor noise
Vert.	2483.500	AV	31.1	27.7	6.0	31.8	1.7	34.6	53.9	19.3	*1)
Vert.	4960.000	AV	37.3	31.6	8.1	31.2	1.7	47.5	53.9	6.5	
Vert.	7440.000	AV	34.2	36.6	8.8	32.5	-	47.0	53.9	6.9	Floor noise
Vert.	9920.000	AV	36.4	38.5	9.8	33.0	-	51.7	53.9	2.2	Floor noise

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

*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 (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

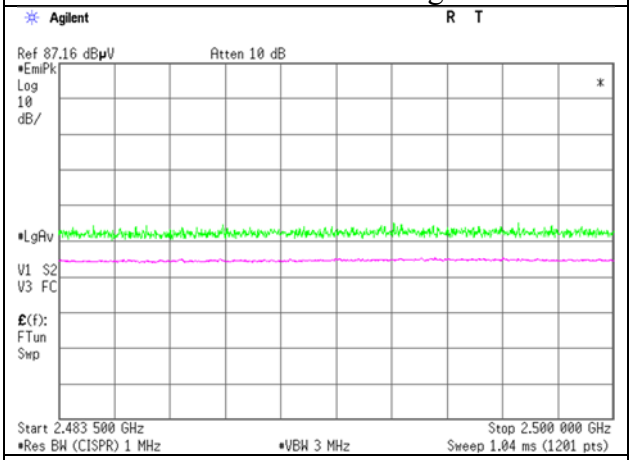
*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13074034H
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Date	October 19, 2019
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE 2480MHz

Horizontal

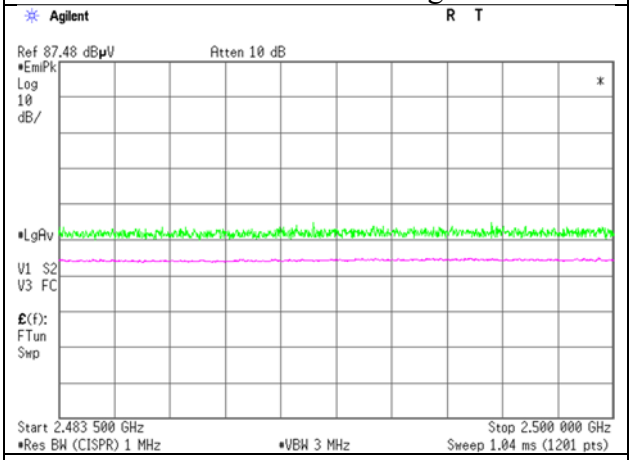
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

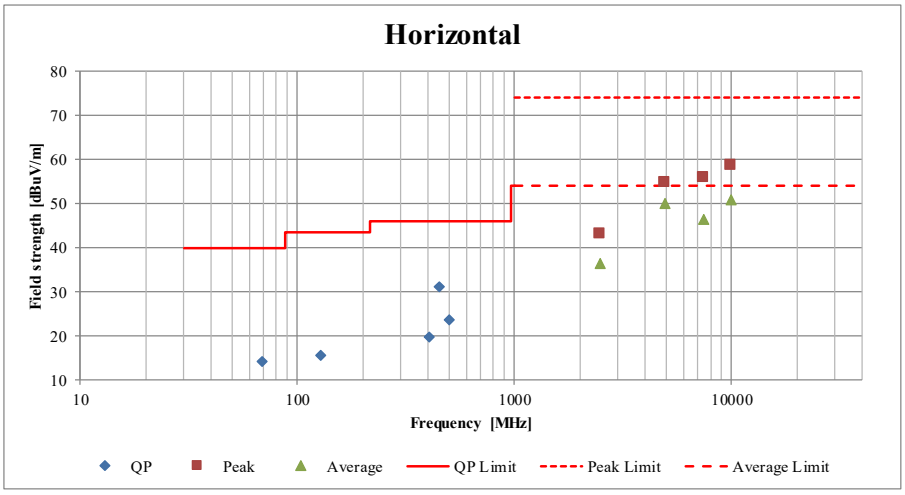


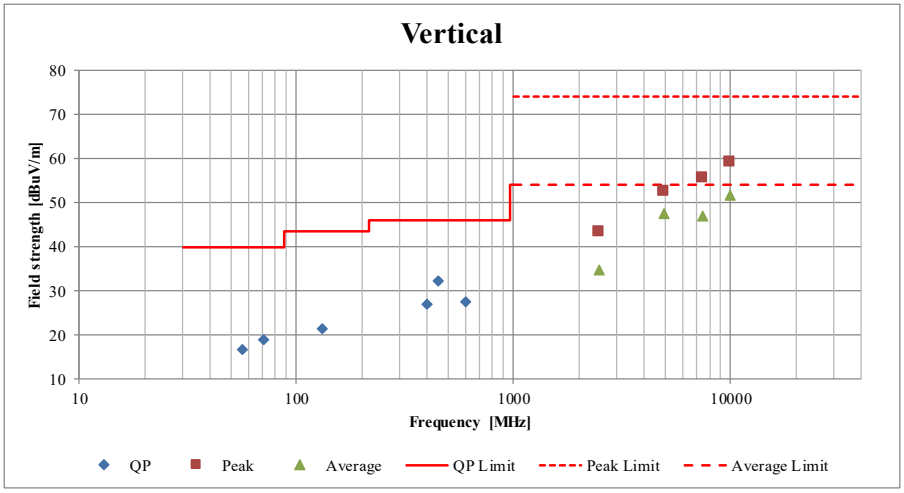
Trace Green : Peak Plot
Trace Purple : Average Plot

* 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.	13074034H
Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Date	October 19, 2019
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE 2480MHz





*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
RE	148898	Attenuator	EMC Instruments Corporation	8491A	MY52462282	10/03/2018	10/31/2019	12
RE	142227	Measure	KOMELON	KMC-36	-	-	-	-
RE	141397	Coaxial Cable	UL Japan	-	-	06/18/2019	06/30/2020	12
RE/AT	141545	DIGITAL HiTESTER	HIOKI	3805	51201148	01/29/2019	01/31/2020	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/02/2019	08/31/2020	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	141267	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	9111B-192	08/24/2019	08/31/2020	12
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/08/2019	02/29/2020	12
RE	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/28/2018	06/30/2020	24
RE/AT	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/11/2019	01/31/2020	12
RE	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/04/2019	04/30/2021	24
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	09/26/2019	09/30/2020	12
RE	141506	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	10/08/2019	10/31/2020	12
RE	141581	MicroWave System Amplifier	AGILENT	83017A	650	10/16/2019	10/31/2020	12
RE	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	06/17/2019	06/30/2020	12
AT	141223	Attenuator	Weinschel Associates	WA56-10	56100306	05/17/2019	05/31/2020	12
AT	141805	Power Meter	ANRITSU	ML2495A	6K00003338	10/03/2019	10/31/2020	12
AT	141840	Power sensor	ANRITSU	MA2411B	11737	10/03/2019	10/31/2020	12
RE	141425	Biconical Antenna	Schwarzbeck	VHA9103 +BBA9106	1302	08/24/2019	08/31/2020	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

APPENDIX 3: Photographs of test setup

Radiated Spurious Emission

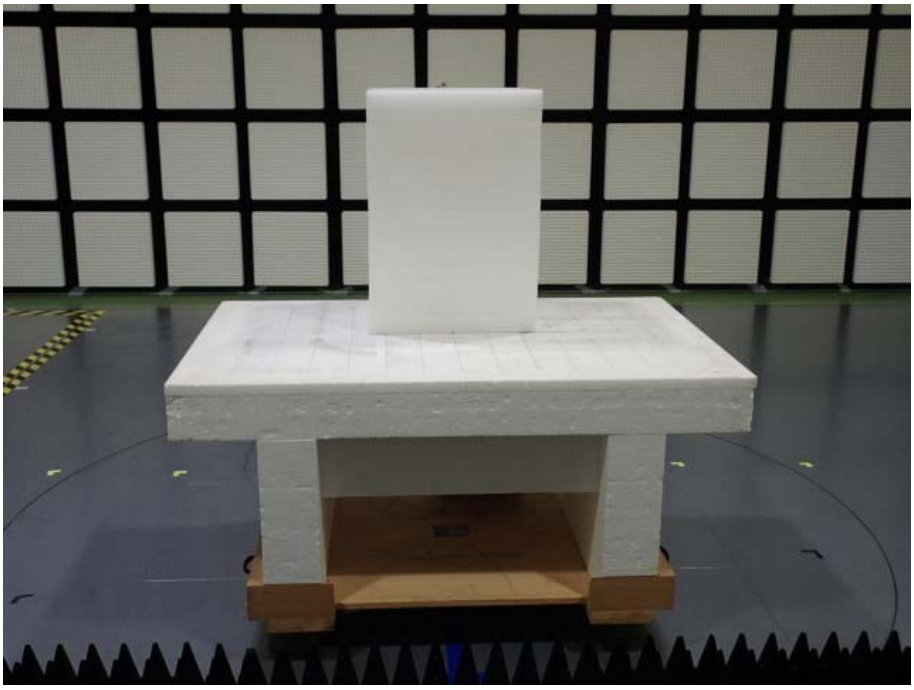


Photo 1

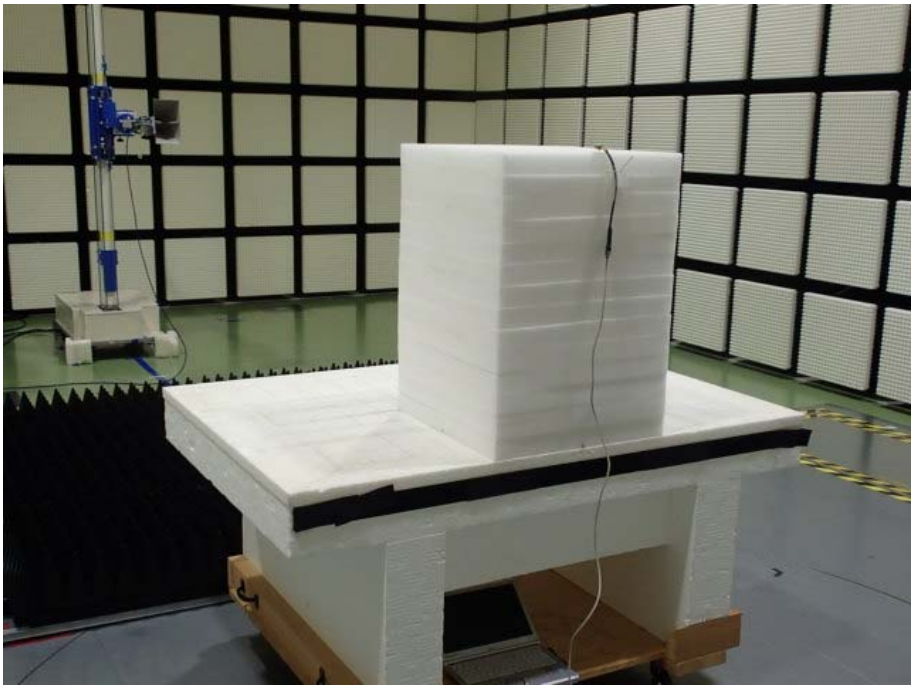


Photo 2

UL Japan, Inc.
Ise EMC Lab.
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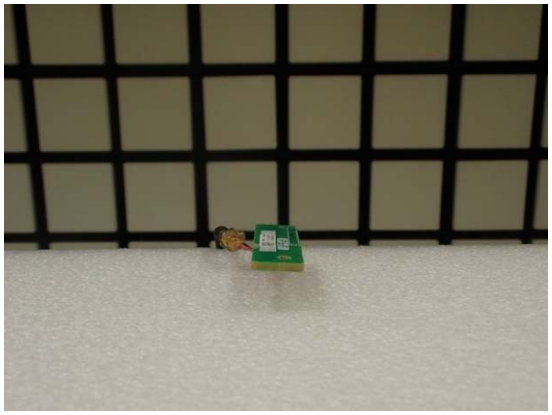
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

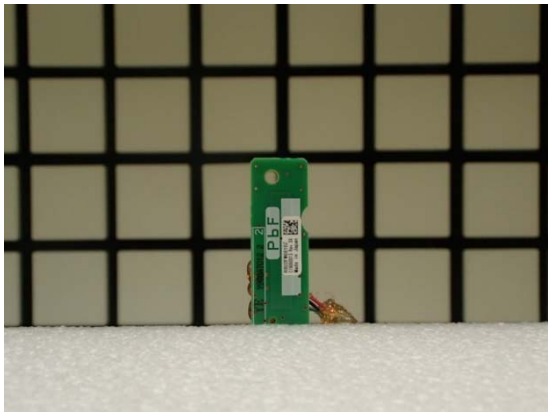
Worst Case Position

	Horizontal	Vertical
Spurious emission band edge compliance	X-axis	Y-axis
Spurious emission above 1GHz	X-axis	X-axis
Spurious emission below 1GHz	X-axis	Y-axis

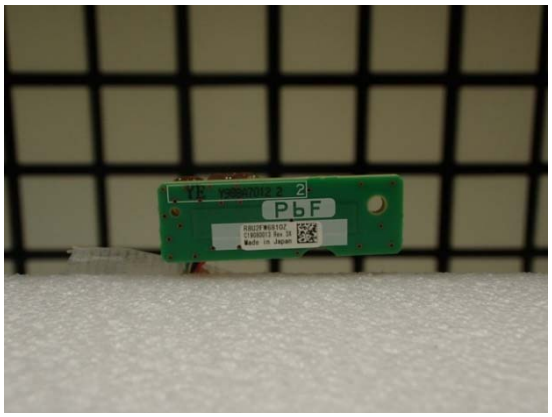
X-axis



Y-axis



Z-axis



End of Report

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