RADIO TEST REPORT

Test Report No. : 11184500H-A-R1

Applicant	:	**Renesas Electronics Corporation**
Type of Equipment	:	**RL78/G1D Module**
Model No.	:	**RY7011A0000DZ00**
FCC ID	:	**2AEMXY7011A00000**
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. 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.
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)
7. This report is a revised version of 11184500H-A. 11184500H-A is replaced with this report.

Date of test: March 2 to 4, 2016

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

Approved by:
Takayuki Shimada
Engineer
Consumer Technology Division

NVLAP LAB CODE: 200572-0

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/

REVISION HISTORY

Original Test Report No.: 11184500H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11184500H-A	March 28, 2016	-	-
1	11184500H-A-R1	March 31, 2016	P.21 and P.24	Collection of calculation

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	Renesas Electronics Corporation
Address	:	TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan
Telephone Number	:	+81-42-328-4133
Facsimile Number	:	+81-42-327-9293
Contact Person	:	Tomohiko Ohtsu

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

2.1 Identification of E.U.T.

Type of Equipment	:	RL78/G1D Module
Model No.	:	RY7011A0000DZ00
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.0 V
Receipt Date of Sample	:	March 2, 2016
Country of Mass-production	:	Japan
Condition of EUT	:	Engineering 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: RY7011A0000DZ00 (referred to as the EUT in this report) is a RL78/G1D Module.

General Specification

Clock frequency(ies) in the system	:	32 MHz

Radio Specification

Bluetooth Low Energy (Ver.4.1 + EDR/LE Dual mode)

Radio Type	:	Transceiver
Frequency of Operation	:	2402-2480MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.1 V
Antenna type	:	Mono-pole antenna
Antenna Gain	:	-0.3dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on November 23, 2015 *Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision does not affect the test specification applied to the EUT.
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 C63.10-2013 6. Standard test methods **IC:** RSS-Gen 8.8	**FCC:** Section 15.207 **IC:** RSS-Gen 8.8	**QP** 15.8 dB, 25.58904 MHz, L **AV** 9.4 dB, 25.58904 MHz, L	Complied	-
6dB Bandwidth	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r04 **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 v03r04 **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 v03r04 **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 v03r04 **IC:** RSS-Gen 6.13	**FCC:** Section15.247(d) **IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	8.8 dB 2483.500 MHz, AV, Horizontal	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 v03r04 12.2.7.
* 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(DC1.1V) 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

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

EMI

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 Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz -3 GHz	3 GHz -18 GHz	18 GHz -26.5 GHz	26.5 GHz -40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

Frequency range	Conducted emission using AMN(LISN) (±dB)
0.009 – 0.15MHz	3.5 dB
0.15 – 30MHz	2.9 dB

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(±dB)		(10 m*)(±dB)	
	30 – 300 MHz	300 – 1000MHz	30 – 300 MHz	300 – 1000MHz
Horizontal	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	4.5 dB	5.9 dB	4.8 dB	5.1 dB

Radiated emission				
(3 m*)(±dB)		(1 m*)(±dB)	(0.5 m*)(±dB)	(10 m*)(±dB)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.1 dB	5.3 dB	5.1 dB	5.1 dB	5.3 dB

*Measurement distance

Conducted Emission test

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

Radiated emission test

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

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	IC Registration Number	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	2973C-1	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	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	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	2973C-4	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.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	N/A	-	-
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 m x 2.0m 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.

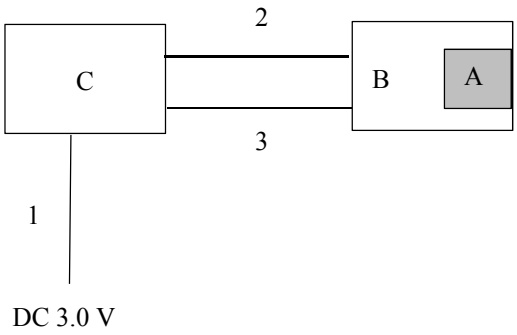
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Bluetooth (BT) Low Energy (LE): Transmitting (Tx)

Test Item	Operating Mode	Tested Frequency
Conducted Emission Spurious Emission 6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	Tx BT LE	2402MHz 2440MHz 2480MHz
*Power of the EUT was set by the software as follows; Power settings: 0dBm Software: rBLE_Mdm_CCRL_loco_alpha_rxsensitivity_20160204 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.		

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

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	RL78/G1D Module	RY7011A0000DZ00	482 *1) 101 *2)	Renesas Electronics Corporation	EUT
B	Jig board	Evaluation board	482 *1) 101 *2)	Renesas Electronics Corporation	*3)
C	Jig board	MBH-FUJI	001	FUJITSU COMPONENT LIMITED	-

*1) Used for Antenna Terminal conducted test
*2) Used for Radiated Emission test
*3) The test was performed with the module that as normal assumed implementation conditions (without a solid ground)

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.8	Unshielded	Unshielded	-
2	DC Cable	0.3	Unshielded	Unshielded	-
3	Signal Cable	0.3	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
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 80cm 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.

For the tests on EUT with other peripherals (as a whole system)
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. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.
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 v03r04".

[For below 1GHz]
EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 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.

[For above 1GHz]
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 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 *1)	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 (RMS) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz
Test Distance	3m	4.45 m *2) (1 GHz – 10GHz), 1 m *3) (10 GHz – 26.5 GHz)		4.45 m *2) (1 GHz – 10GHz), 1 m *3) (10 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r04
*2) Distance Factor: 20 x log (4.45 m / 3.0 m) = 3.43 dB
*3) Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.5 dB

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

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	2 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	Peak	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	10 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	9.1 kHz	27 kHz				

*1) Peak 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 v03r04".
*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 = 9.1 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

DATA OF CONDUCTED EMISSION TEST

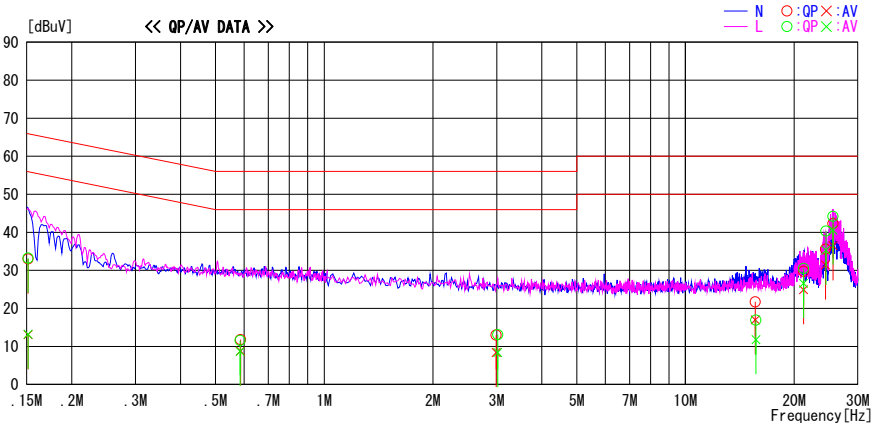
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2016/03/04

Report No. : 11184500H

Temp./Humi. : 20deg.C. / 38% RH
Engineer : Tomohisa Nakagawa

Mode / Remarks : BLE 2402MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



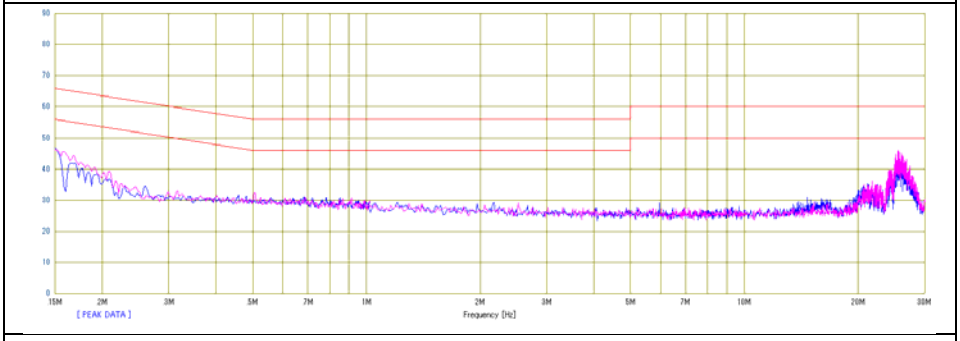
Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15145	19.8	-0.1	13.2	33.0	13.1	65.9	55.9	32.9	42.8	N	
0.58645	-1.5	-4.5	13.3	11.8	8.8	56.0	46.0	44.2	37.2	N	
2.99052	-0.6	-5.2	13.6	13.0	8.4	56.0	46.0	43.0	37.6	N	
15.59743	7.4	2.7	14.3	21.7	17.0	60.0	50.0	38.3	33.0	N	
21.21144	15.1	10.3	14.6	29.7	24.9	60.0	50.0	30.3	25.1	N	
24.41945	21.0	16.8	14.6	35.6	31.4	60.0	50.0	24.4	18.6	N	
25.58904	27.5	21.7	14.8	42.3	36.5	60.0	50.0	17.7	13.5	N	
0.15145	20.0	0.0	13.2	33.2	13.2	65.9	55.9	32.7	42.7	L	
0.58500	-1.7	-4.6	13.3	11.6	8.7	56.0	46.0	44.4	37.3	L	
3.02075	-0.5	-5.2	13.6	13.1	8.4	56.0	46.0	42.9	37.6	L	
15.66426	2.6	-2.5	14.3	16.9	11.8	60.0	50.0	43.1	38.2	L	
21.21144	15.9	12.0	14.6	30.5	26.6	60.0	50.0	29.5	23.4	L	
24.48628	25.7	20.7	14.6	40.3	35.3	60.0	50.0	19.7	14.7	L	
25.58904	29.4	25.8	14.8	44.2	40.6	60.0	50.0	15.8	9.4	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN. + CABLE)
Except for the above table : adequate margin data below the limits.

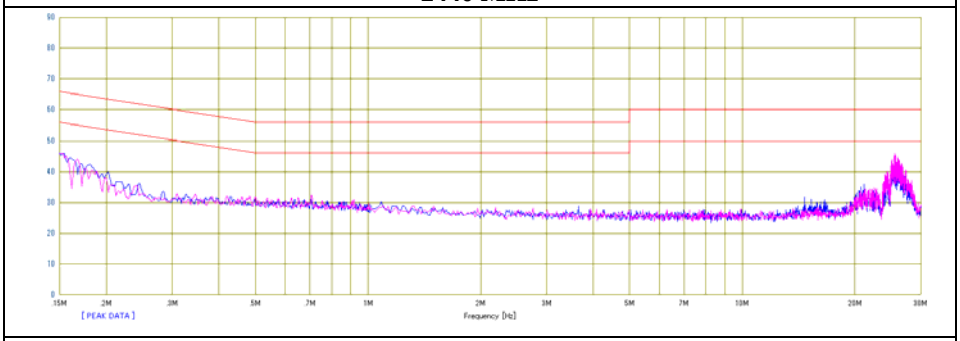
Conducted Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	23 deg. C / 37 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE

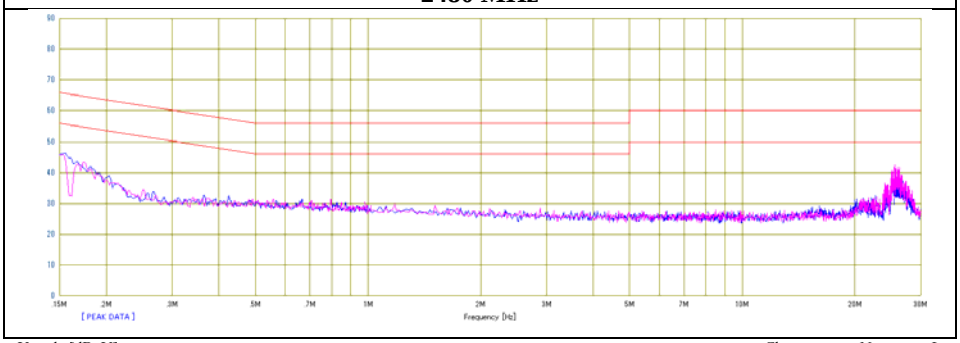
2402 MHz



2440 MHz



2480 MHz



Y scale [dBuV] Chart — N — L

6dB Bandwidth

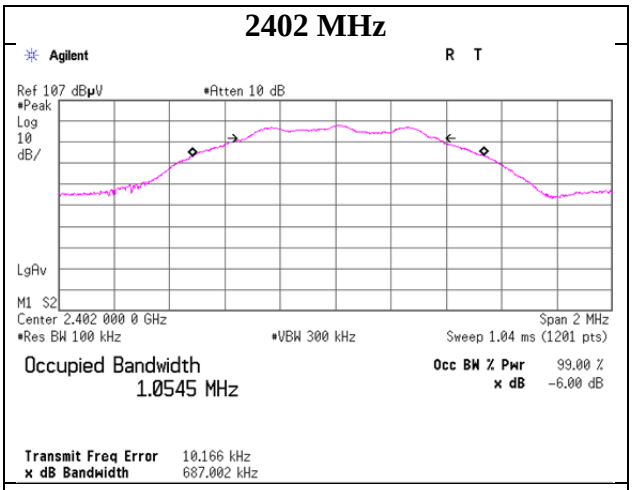
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BT LE	2402	0.687	> 500
	2440	0.691	> 500
	2480	0.683	> 500

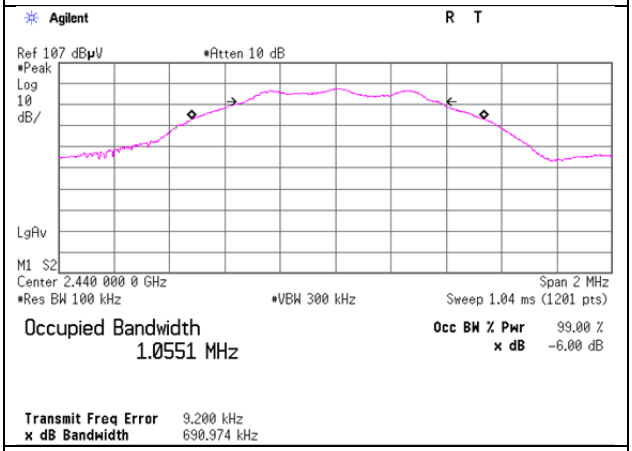
6dB Bandwidth

BT LE

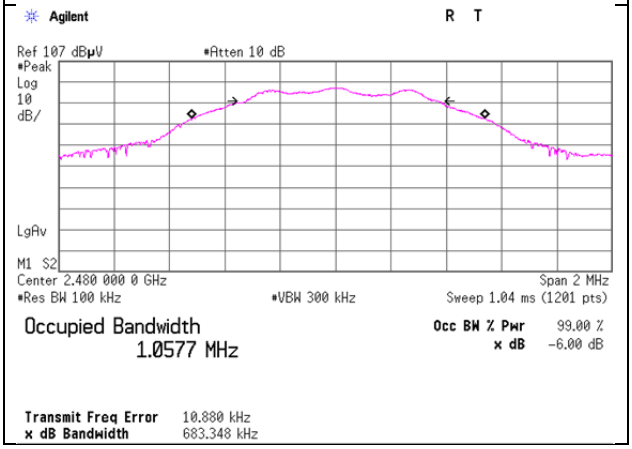
2402 MHz



2440 MHz



2480 MHz



Maximum Peak Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE

BLE

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-12.26	1.11	10.03	-1.12	0.77	30.00	1000	31.12
2440	-12.54	1.12	10.03	-1.39	0.73	30.00	1000	31.39
2480	-12.92	1.13	10.03	-1.76	0.67	30.00	1000	31.76

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 for RF Exposure / SAR testing)

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE

BLE

Freq.	Reading	Cable Loss	Atten. Loss	Result (Frame power)		Duty factor	Result (Burst power)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2402	-14.29	1.11	10.03	-3.15	0.48	1.45	-1.70	0.68
2440	-14.66	1.12	10.03	-3.51	0.45	1.45	-2.06	0.62
2480	-15.03	1.13	10.03	-3.87	0.41	1.45	-2.42	0.57

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

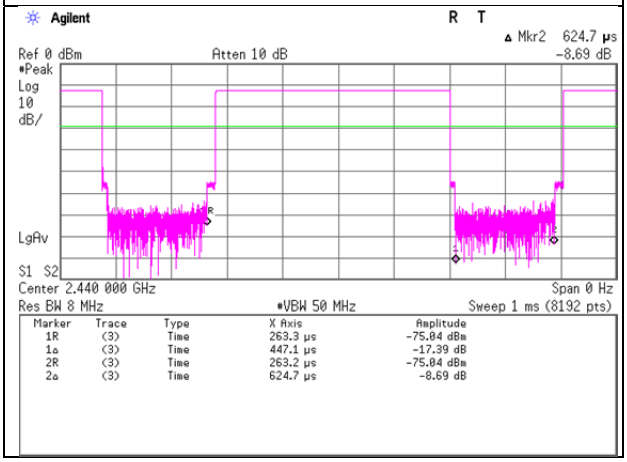
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst rate confirmation

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE

BLE

Tx on / (Tx on + Tx off) =	**0.716**
Tx on / (Tx on + Tx off) * 100 =	**71.6 %**
Duty factor = 10 * log (0.6247 / 0.447) =	**1.45 dB**



Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	11184500H	
Date	March 2, 2016	March 3, 2016
Temperature / Humidity	23 deg. C / 32 % RH	23 deg. C / 37 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
	above 1GHz	below 1GHz
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	37.800	QP	21.8	14.7	7.2	32.3	-	11.4	40.0	28.6	
Hori	70.000	QP	21.9	5.7	7.6	32.1	-	3.1	40.0	36.9	
Hori	250.000	QP	21.6	17.3	9.5	32.0	-	16.4	46.0	29.6	
Hori	325.000	QP	22.0	15.3	10.1	32.0	-	15.4	46.0	30.6	
Hori	560.000	QP	22.8	18.8	11.5	32.1	-	21.0	46.0	25.0	
Hori	920.000	QP	21.3	22.5	13.4	30.9	-	26.3	46.0	19.7	
Hori	2385.892	PK	57.2	26.9	6.7	32.0	-	58.8	73.9	15.1	
Hori	2390.000	PK	49.1	26.9	6.7	32.0	-	50.7	73.9	23.2	
Hori	4804.000	PK	41.3	31.8	8.1	31.3	-	49.9	73.9	24.0	
Hori	7206.000	PK	42.6	36.0	9.3	32.0	-	55.9	73.9	18.0	
Hori	9608.000	PK	42.9	38.2	10.3	32.4	-	59.0	73.9	14.9	
Hori	2385.892	AV	41.4	26.9	6.7	32.0	1.5	44.5	53.9	9.5	*1)
Hori	2390.000	AV	34.9	26.9	6.7	32.0	1.5	38.0	53.9	16.0	*1)
Hori	4804.000	AV	33.2	31.8	8.1	31.3	-	41.8	53.9	12.1	Floor noise
Hori	7206.000	AV	34.4	36.0	9.3	32.0	-	47.7	53.9	6.2	Floor noise
Hori	9608.000	AV	34.3	38.2	10.3	32.4	-	50.4	53.9	3.5	Floor noise
Vert	37.800	QP	22.0	14.7	7.2	32.3	-	11.6	40.0	28.4	
Vert	70.000	QP	22.2	5.7	7.6	32.1	-	3.4	40.0	36.6	
Vert	250.000	QP	21.5	17.3	9.5	32.0	-	16.3	46.0	29.7	
Vert	325.000	QP	22.0	15.3	10.1	32.0	-	15.4	46.0	30.6	
Vert	560.000	QP	22.8	18.8	11.5	32.1	-	21.0	46.0	25.0	
Vert	920.000	QP	21.3	22.5	13.4	30.9	-	26.3	46.0	19.7	
Vert	2385.892	PK	55.2	26.9	6.7	32.0	-	56.8	73.9	17.1	
Vert	2390.000	PK	47.4	26.9	6.7	32.0	-	49.0	73.9	24.9	
Vert	4804.000	PK	41.6	31.8	8.1	31.3	-	50.2	73.9	23.7	
Vert	7206.000	PK	43.0	36.0	9.3	32.0	-	56.3	73.9	17.6	
Vert	9608.000	PK	42.2	38.2	10.3	32.4	-	58.3	73.9	15.6	
Vert	2385.892	AV	39.4	26.9	6.7	32.0	1.5	42.5	53.9	11.5	*1)
Vert	2390.000	AV	32.0	26.9	6.7	32.0	1.5	35.1	53.9	18.9	*1)
Vert	4804.000	AV	30.8	31.8	8.1	31.3	-	39.4	53.9	14.5	Floor noise
Vert	7206.000	AV	32.1	36.0	9.3	32.0	-	45.4	53.9	8.5	Floor noise
Vert	9608.000	AV	32.2	38.2	10.3	32.4	-	48.3	53.9	5.6	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 (4.45m / 3.0 m) = 3.43 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

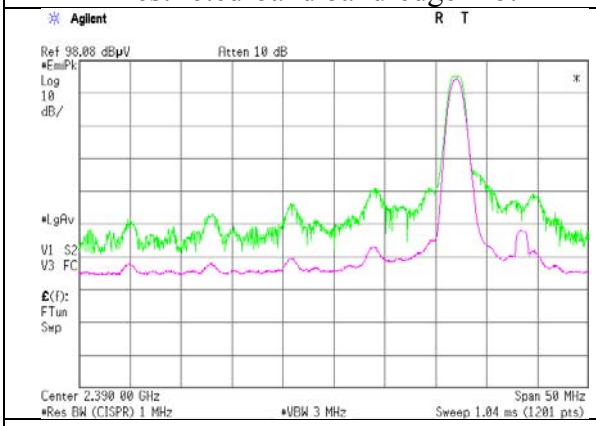
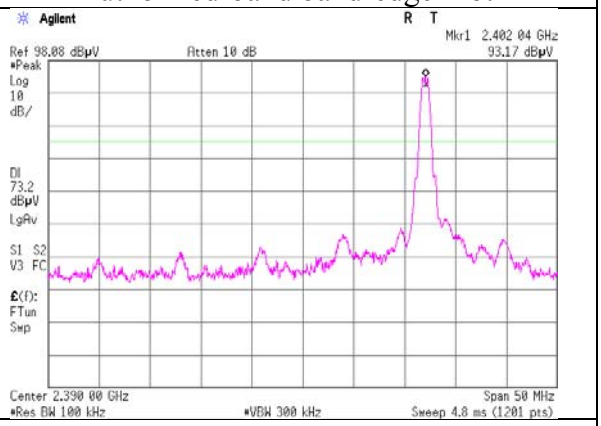
20dBc Data Sheet

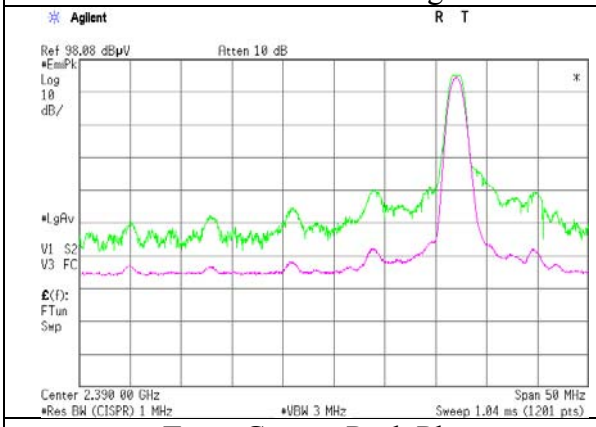
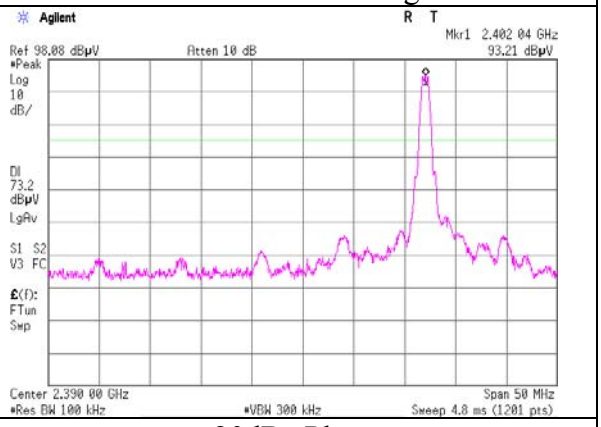
Polarity	Frequency	Detector	Reading	Ant.Fac.	Loss	Gain	Result	Limit	Margin	Remark
Hori	2402.000	PK	93.2	26.9	6.7	32.0	94.8	-	-	Carrier
Hori	2393.984	PK	44.7	26.9	6.7	32.0	46.3	74.8	28.5	
Hori	2399.897	PK	46.6	26.9	6.7	32.0	48.2	74.8	26.6	
Hori	2400.000	PK	44.3	26.9	6.7	32.0	45.9	74.8	28.9	
Vert	2402.000	PK	93.2	26.9	6.7	32.0	94.8	-	-	Carrier
Vert	2393.984	PK	43.4	26.9	6.7	32.0	45.0	74.8	29.8	
Vert	2399.897	PK	45.1	26.9	6.7	32.0	46.7	74.8	28.1	
Vert	2400.000	PK	44.4	26.9	6.7	32.0	46.0	74.8	28.8	

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

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11184500H
Date	March 2, 2016
Temperature / Humidity	23 deg. C / 32 % 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

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

Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	11184500H	
Date	March 2, 2016	March 3, 2016
Temperature / Humidity	23 deg. C / 32 % RH	23 deg. C / 37 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
	above 1GHz	below 1GHz
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	37.800	QP	21.8	14.7	7.2	32.3	-	11.4	40.0	28.6	
Hori	70.000	QP	21.9	5.7	7.6	32.1	-	3.1	40.0	36.9	
Hori	250.000	QP	21.6	17.3	9.5	32.0	-	16.4	46.0	29.6	
Hori	325.000	QP	22.0	15.3	10.1	32.0	-	15.4	46.0	30.6	
Hori	560.000	QP	22.8	18.8	11.5	32.1	-	21.0	46.0	25.0	
Hori	920.000	QP	21.3	22.5	13.4	30.9	-	26.3	46.0	19.7	
Hori	4880.000	PK	40.7	31.9	8.1	31.3	-	49.4	73.9	24.5	
Hori	7320.000	PK	40.9	36.0	9.4	32.0	-	54.3	73.9	19.6	
Hori	9760.000	PK	41.6	38.2	10.3	32.5	-	57.6	73.9	16.3	
Hori	4880.000	AV	30.9	31.9	8.1	31.3	-	39.6	53.9	14.3	Floor noise
Hori	7320.000	AV	31.6	36.0	9.4	32.0	-	45.0	53.9	8.9	Floor noise
Hori	9760.000	AV	31.2	38.2	10.3	32.5	-	47.2	53.9	6.7	Floor noise
Vert	37.800	QP	22.0	14.7	7.2	32.3	-	11.6	40.0	28.4	
Vert	70.000	QP	22.2	5.7	7.6	32.1	-	3.4	40.0	36.6	
Vert	250.000	QP	21.5	17.3	9.5	32.0	-	16.3	46.0	29.7	
Vert	325.000	QP	22.0	15.3	10.1	32.0	-	15.4	46.0	30.6	
Vert	560.000	QP	22.9	18.8	11.5	32.1	-	21.1	46.0	24.9	
Vert	920.000	QP	21.3	22.5	13.4	30.9	-	26.3	46.0	19.7	
Vert	4880.000	PK	40.7	31.9	8.1	31.3	-	49.4	73.9	24.5	
Vert	7320.000	PK	41.8	36.0	9.4	32.0	-	55.2	73.9	18.7	
Vert	9760.000	PK	40.9	38.2	10.3	32.5	-	56.9	73.9	17.0	
Vert	4880.000	AV	30.5	31.9	8.1	31.3	-	39.2	53.9	14.7	Floor noise
Vert	7320.000	AV	31.4	36.0	9.4	32.0	-	44.8	53.9	9.1	Floor noise
Vert	9760.000	AV	31.2	38.2	10.3	32.5	-	47.2	53.9	6.7	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 (4.45m / 3.0 m) = 3.43 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	11184500H	
Date	March 2, 2016	March 3, 2016
Temperature / Humidity	23 deg. C / 32 % RH	23 deg. C / 37 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
	above 1GHz	below 1GHz
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	37.800	QP	21.9	14.7	7.2	32.3	-	11.5	40.0	28.5	
Hori	70.000	QP	22.1	5.7	7.6	32.1	-	3.3	40.0	36.7	
Hori	250.000	QP	21.6	17.3	9.5	32.0	-	16.4	46.0	29.6	
Hori	325.000	QP	22.0	15.3	10.1	32.0	-	15.4	46.0	30.6	
Hori	560.000	QP	22.8	18.8	11.5	32.1	-	21.0	46.0	25.0	
Hori	920.000	QP	21.3	22.5	13.4	30.9	-	26.3	46.0	19.7	
Hori	2483.500	PK	55.8	26.9	6.7	32.0	-	57.4	73.9	16.5	
Hori	2487.657	PK	54.6	26.9	6.7	32.0	-	56.2	73.9	17.7	
Hori	4960.000	PK	41.7	32.1	8.1	31.2	-	50.7	73.9	23.2	
Hori	7440.000	PK	42.2	36.0	9.4	32.1	-	55.5	73.9	18.4	
Hori	9920.000	PK	42.5	38.2	10.5	32.5	-	58.7	73.9	15.2	
Hori	2483.500	AV	42.0	26.9	6.7	32.0	1.5	45.1	53.9	8.8	*1)
Hori	2487.657	AV	40.3	26.9	6.7	32.0	1.5	43.4	53.9	10.6	*1)
Hori	4960.000	AV	32.2	32.1	8.1	31.2	-	41.2	53.9	12.7	Floor noise
Hori	7440.000	AV	34.4	36.0	9.4	32.1	-	47.7	53.9	6.2	Floor noise
Hori	9920.000	AV	34.6	38.2	10.5	32.5	-	50.8	53.9	3.1	Floor noise
Vert	37.800	QP	21.9	14.7	7.2	32.3	-	11.5	40.0	28.5	
Vert	70.000	QP	22.2	5.7	7.6	32.1	-	3.4	40.0	36.6	
Vert	250.000	QP	21.4	17.3	9.5	32.0	-	16.2	46.0	29.8	
Vert	325.000	QP	22.0	15.3	10.1	32.0	-	15.4	46.0	30.6	
Vert	560.000	QP	22.8	18.8	11.5	32.1	-	21.0	46.0	25.0	
Vert	920.000	QP	21.3	22.5	13.4	30.9	-	26.3	46.0	19.7	
Vert	2483.500	PK	56.4	26.9	6.7	32.0	-	58.0	73.9	15.9	
Vert	2487.657	PK	55.2	26.9	6.7	32.0	-	56.8	73.9	17.1	
Vert	4960.000	PK	40.6	32.1	8.1	31.2	-	49.6	73.9	24.3	
Vert	7440.000	PK	42.8	36.0	9.4	32.1	-	56.1	73.9	17.8	
Vert	9920.000	PK	41.9	38.2	10.5	32.5	-	58.1	73.9	15.8	
Vert	2483.500	AV	41.2	26.9	6.7	32.0	1.5	44.3	53.9	9.7	*1)
Vert	2487.657	AV	38.6	26.9	6.7	32.0	1.5	41.7	53.9	12.3	*1)
Vert	4960.000	AV	34.3	32.1	8.1	31.2	-	43.3	53.9	10.6	Floor noise
Vert	7440.000	AV	35.0	36.0	9.4	32.1	-	48.3	53.9	5.6	Floor noise
Vert	9920.000	AV	34.5	38.2	10.5	32.5	-	50.7	53.9	3.2	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 (4.45m / 3.0 m) = 3.43 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

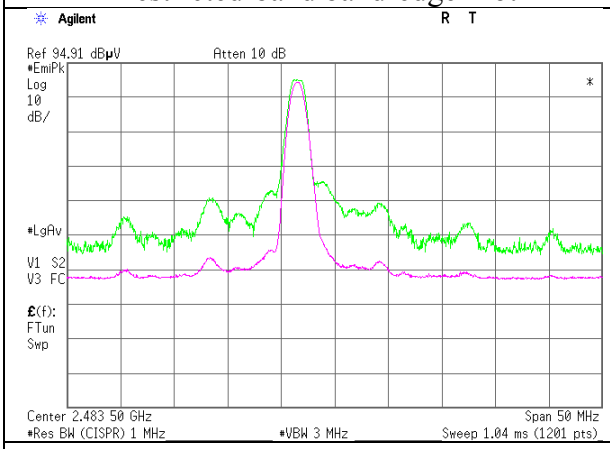
*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11184500H
Date	March 2, 2016
Temperature / Humidity	23 deg. C / 32 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx BT LE 2480 MHz

Horizontal

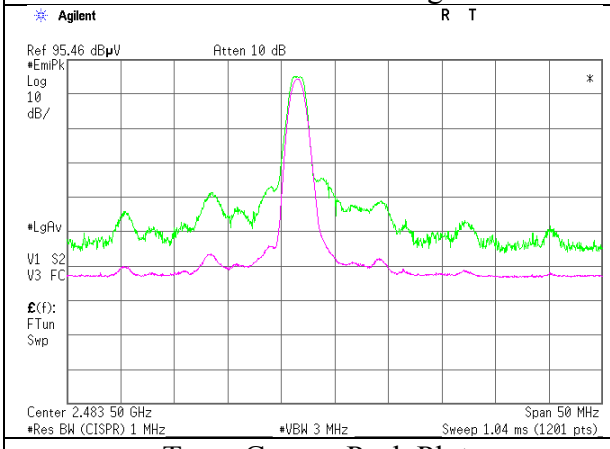
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

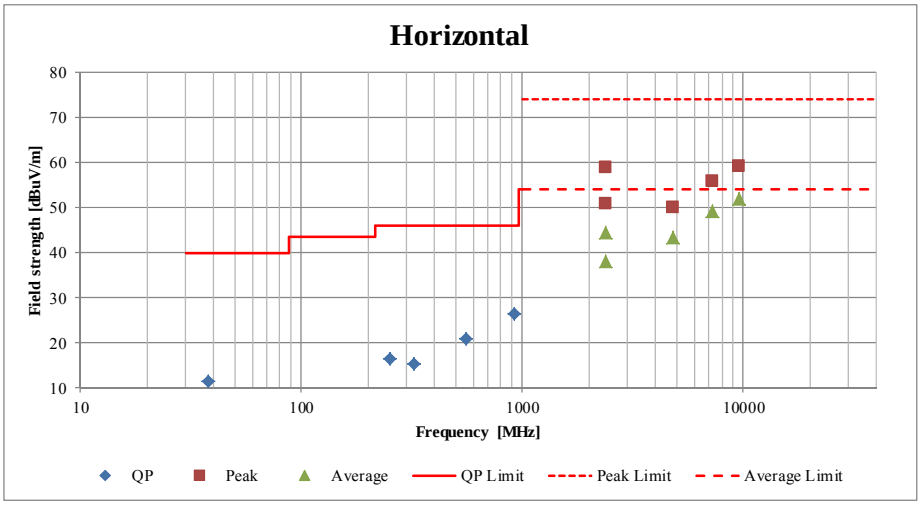


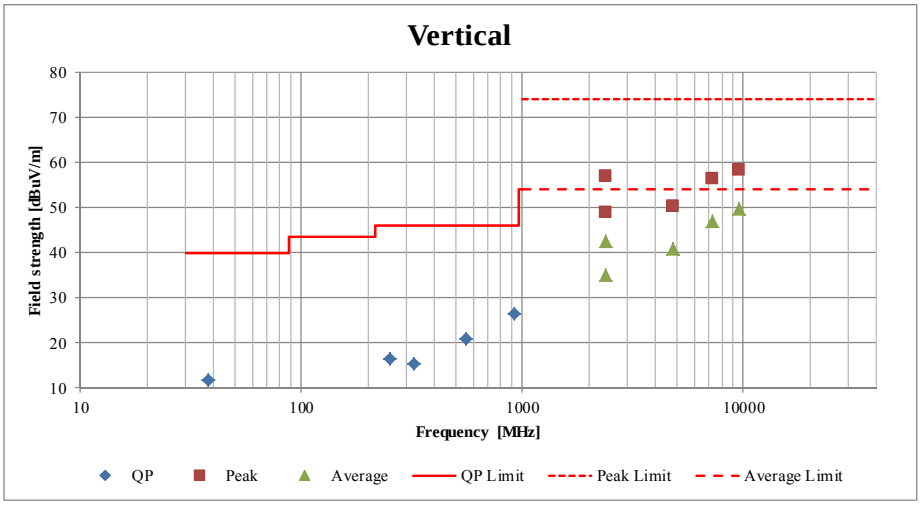
Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	11184500H	
Date	March 2, 2016	March 3, 2016
Temperature / Humidity	23 deg. C / 32 % RH	23 deg. C / 37 % RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa
	above 1GHz	below 1GHz
Mode	Tx BT LE 2402 MHz	



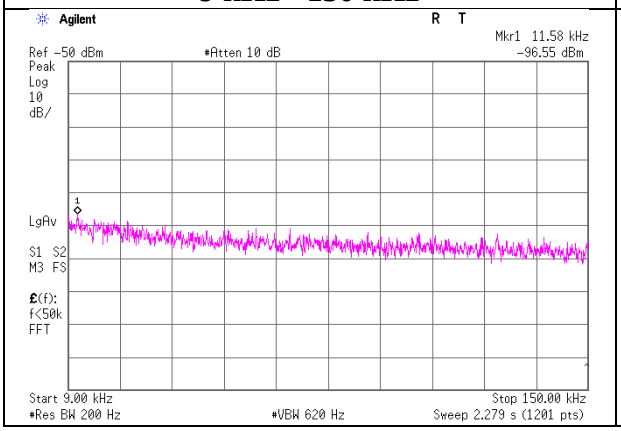


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

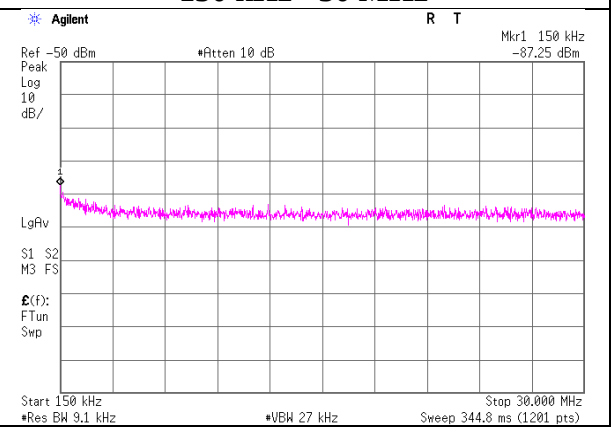
Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE 2402MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.58	-96.6	0.30	9.8	2.0	-84.4	300	6.0	-23.2	46.3	69.5	
150.00	-87.3	0.30	9.8	2.0	-75.1	300	6.0	-13.9	24.0	37.9	

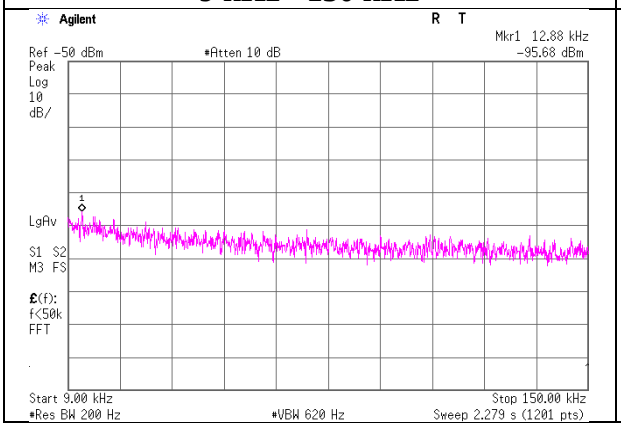
E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

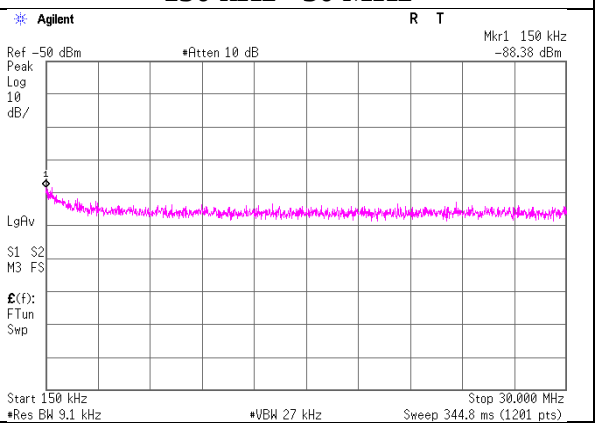
Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE 2440MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
12.88	-95.7	0.30	9.8	2.0	-83.6	300	6.0	-22.3	45.4	67.7	
150.00	-88.4	0.32	9.9	2.0	-76.1	300	6.0	-14.9	24.0	38.9	

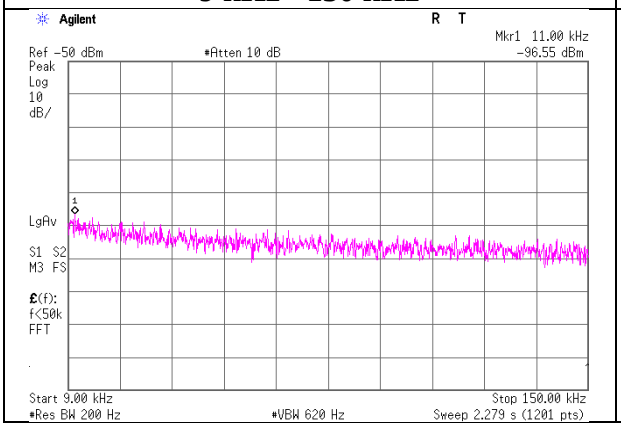
E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

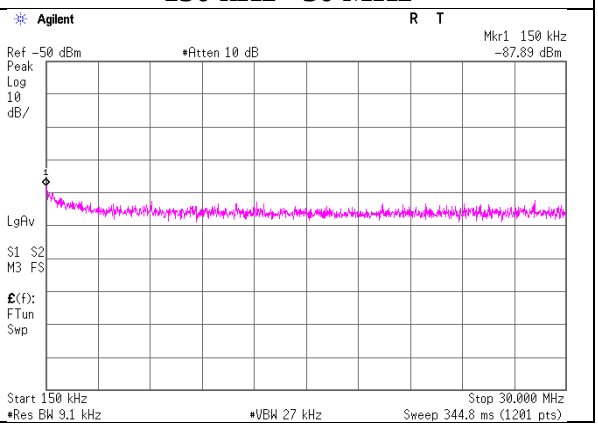
Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE 2480MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.00	-96.6	0.30	9.8	2.0	-84.4	300	6.0	-23.2	46.7	69.9	
150.00	-87.9	0.31	9.9	2.0	-75.7	300	6.0	-14.4	24.0	38.4	

E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss + Attenator Loss + Antenna Gain + 10 * log (N)

Power Density

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE

BLE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-24.01	1.11	10.03	-12.87	8.00	20.87
2440.00	-24.53	1.12	10.03	-13.38	8.00	21.38
2480.00	-25.74	1.13	10.03	-14.58	8.00	22.58

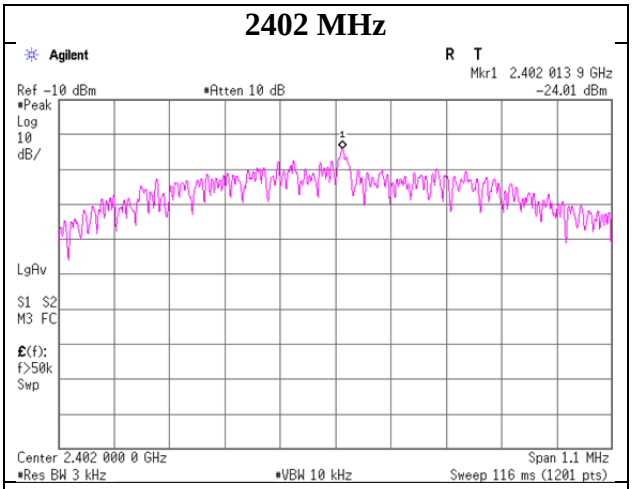
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

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

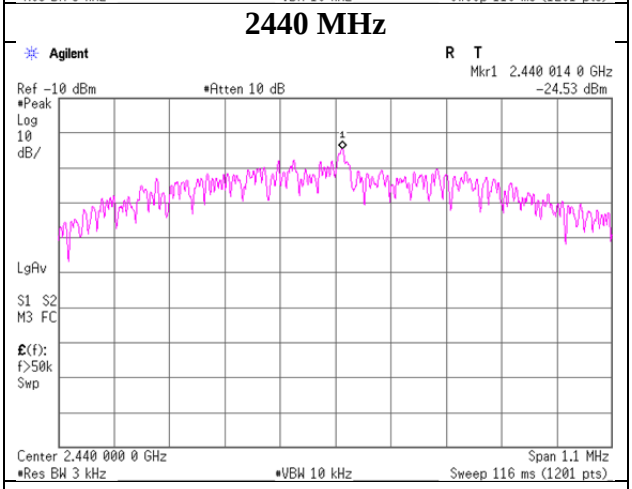
Power Density

BL TE

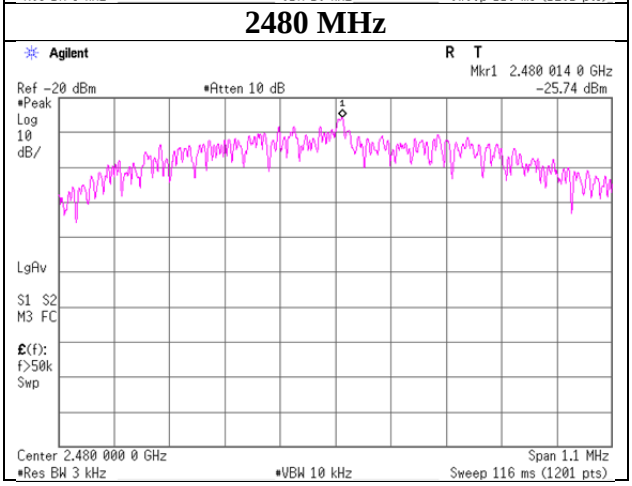
2402 MHz



2440 MHz



2480 MHz

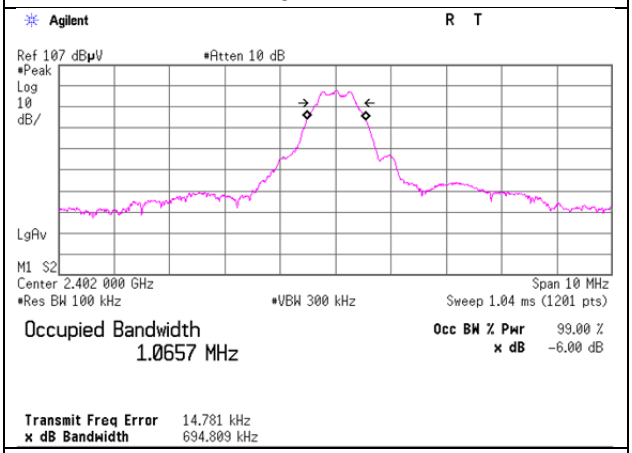


99%Occupied Bandwidth

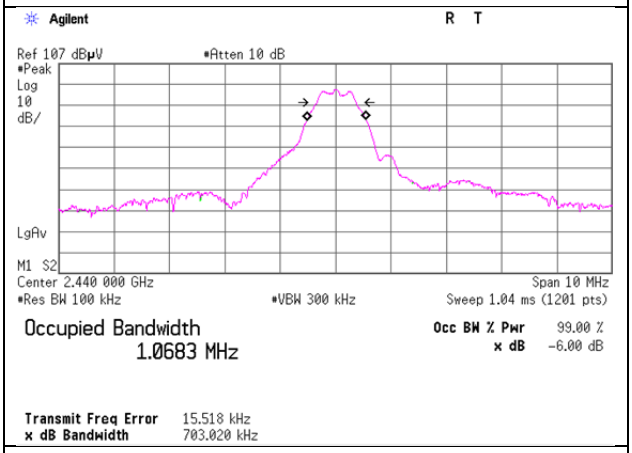
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11184500H
Date	March 3, 2016
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE

BT LE

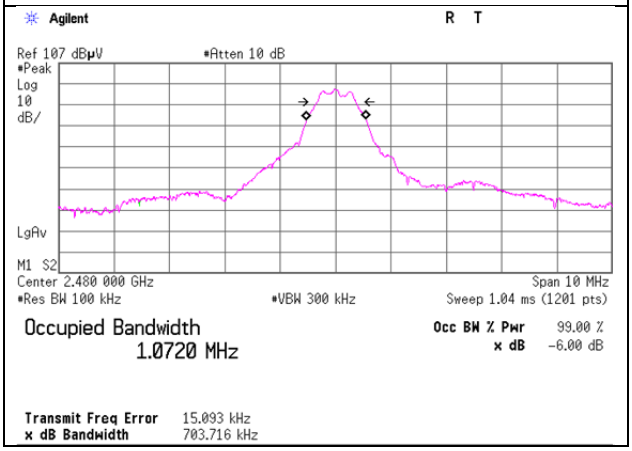
2402 MHz



2440 MHz



2480 MHz



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2015/10/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE/CE	2016/01/21 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2016/02/24 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2015/09/02 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2015/10/11 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2015/10/11 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2015/07/13 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2015/04/08 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2015/03/10 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE/CE	2016/01/13 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2015/07/10 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/sucoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher)	-/00640	CE	2015/07/02 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2015/05/18 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2015/05/21 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2015/03/19 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2015/05/19 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2015/06/09 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2015/06/09 * 12
MRENT-126	Spectrum Analyzer	KEYSIGHT	E4440A	MY46185516	AT	2015/07/31 * 12
MAT-57	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2016/01/18 * 12
MCC-170	Microwave Cable	Junkosha	MWX221	1409S493	AT	2015/03/04 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	AT	2015/12/07 * 12
MMM-17	DIGIITAL HiTESTER	Hioki	3805	070900530	AT	2016/01/13 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2015/12/08 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT	2015/11/06 * 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 disturbance voltage