



RADIO TEST REPORT

Test Report No. : 10863245H-A-R1

Applicant : FUJITSU COMPONENT LIMITED
Type of Equipment : Bluetooth Smart Module
Model No. : MBH7BLZ07
FCC ID : SQK-7BLZ07
Test regulation : FCC Part 15 Subpart C: 2015
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the 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 10863245H-A. 10863245H-A is replaced with this report.

Date of test: July 30 to August 25, 2015

Representative test engineer:


Yuta Moriya

Engineer

Consumer Technology Division

Approved by:



Takayuki Shimada

Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10863245H-A

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SECTION 1: Customer information

Company Name	:	FUJITSU COMPONENT LIMITED
Address	:	Shinagawa Seaside Park Tower, 12-4, Higashi-shinagawa 4-chome, Shinagawa-ku, Tokyo, 140-8586, Japan
Telephone Number	:	+81-3-3450-1639
Facsimile Number	:	+81-3-3474-2372
Contact Person	:	Takeshi Wakui

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

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth Smart Module
Model No.	:	MBH7BLZ07
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.3 V / DC 1.8 V
Receipt Date of Sample	:	July 29, 2015
Country of Mass-production	:	Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: MBH7BLZ07 (referred to as the EUT in this report) is a Bluetooth Smart Module.

General Specification

Clock frequency(ies) in the system	:	32 MHz
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Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402-2480MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.6 V
Antenna type	:	Mono-pole Antenna
Antenna Gain	:	-3.1dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on September 8, 2015

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

* The revision on September 8, 2015 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4-2009 7. AC powerline Conducted Emission measurements IC: RSS-Gen 8.8	FCC: Section 15.207 IC: RSS-Gen 8.8	QP 12.6 dB, 0.27180 MHz, L AV 15.4 dB, 0.46103 MHz, N	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	8.9 dB 2487.673 MHz, Horizontal, AV	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

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

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

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

FCC 15.31 (e)

This EUT provides stable voltage (DC 1.6 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

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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 $k = 2$.
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Test site (semi anechoic chamber)	Conducted emission Uncertainty (+/-)			
	No. 1	No. 2	No. 3	No. 4
150 kHz - 30 MHz	3.5 dB	3.5 dB	3.4 dB	3.5 dB

Test site (semi anechoic chamber)	Radiated emission Uncertainty (+/-)						
	Measurement distance: 3 m				1 m		0.5 m
	9 kHz - 30 MHz	30 MHz - 300 MHz	300 MHz - 1 GHz	1 GHz - 10 GHz	10 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz
No. 1	4.3 dB	5.1 dB	6.2 dB	5.5 dB	5.8 dB	5.8 dB	4.3 dB
No. 2	4.2 dB	5.1 dB	6.2 dB	5.4 dB	5.7 dB	5.9 dB	5.6 dB
No. 3	4.4 dB	5.1 dB	6.3 dB	5.2 dB	5.5 dB	5.8 dB	5.5 dB
No. 4	4.7 dB	5.3 dB	6.3 dB	5.3 dB	5.7 dB	5.9 dB	5.5 dB

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	
0.7 dB	1.5 dB	1.5 dB	1.7 dB	2.8 dB	2.8 dB	2.9 dB	

Conducted Emission test

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

Radiated emission test

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

3.5 Test Location

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 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

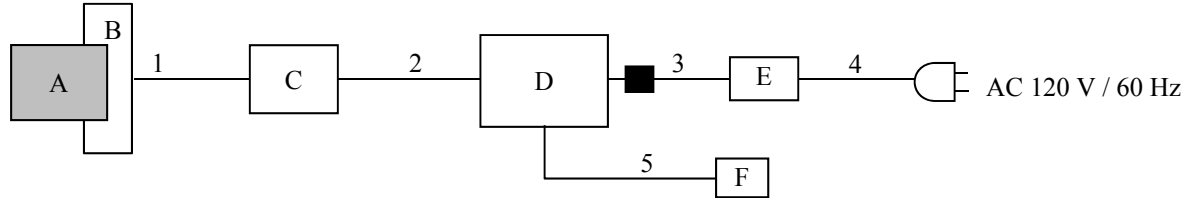
4.1 Operating Mode(s)

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

Details of Operating Mode(s)

Test Item	Operating Mode	Tested Frequency
Conducted Emission Spurious Emission 6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	Tx BT LE	2402MHz 2440MHz 2480MHz
*Power of the EUT was set by the software as follows; Power settings: 4 dBm Software: fdcp_v2.04 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. *This EUT has two ratings: DC 3.3 V or DC 1.8 V. However this EUT has own regulator. After the comparison between above ratings (DC 3.3 V and DC 1.8 V), the tests were performed with rating that had worst case (DC 3.3 V) as a representative.		

4.2 Configuration and peripherals



■ : Standard Ferrite Core

* Cabling and setup 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	Remark
A	Bluetooth Smart Module	MBH7BLZ07	No.1 for AT No.3 for RE	FUJITSU COMPONENT LIMITED	EUT
B	Jig	-	-	FUJITSU COMPONENT LIMITED	-
C	Jig	-	-	FUJITSU COMPONENT LIMITED	-
D	Laptop PC	PC-VY25AFZ77	99023031A	NEC	-
E	AC Adapter	PA-1750-07	9518834LB	NEC	-
F	Mouse	TK-MSUK	060801039	SANWA SUPPLY INC.	*1)

AT: Antenna terminal conducted tests

RE: Spurious emission test

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Signal Cable	0.25	Unshielded	Unshielded	-
2	USB Cable	1.50	Shielded	Shielded	-
3	DC Cable	1.80	Unshielded	Unshielded	-
4	AC Cable	1.80	Unshielded	Unshielded	-
5	USB Cable	1.50	Shielded	Shielded	*1)

*1) Used for Conducted Emission test only.

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 v03r03".

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.

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

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

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

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

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

Test Antennas are used as below;

Frequency	Below 30 MHz	30 MHz to 300 MHz	300 MHz to 1 GHz	Above 1 GHz
Antenna Type	Loop	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: <u>12.2.5.2</u> 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	3 m (below 10 GHz), 1 m *2) (above 10 GHz)		3 m (below 10 GHz), 1 m *2) (above 10 GHz)

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

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

- 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

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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	3 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	100 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 v03r03".

*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.

(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 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

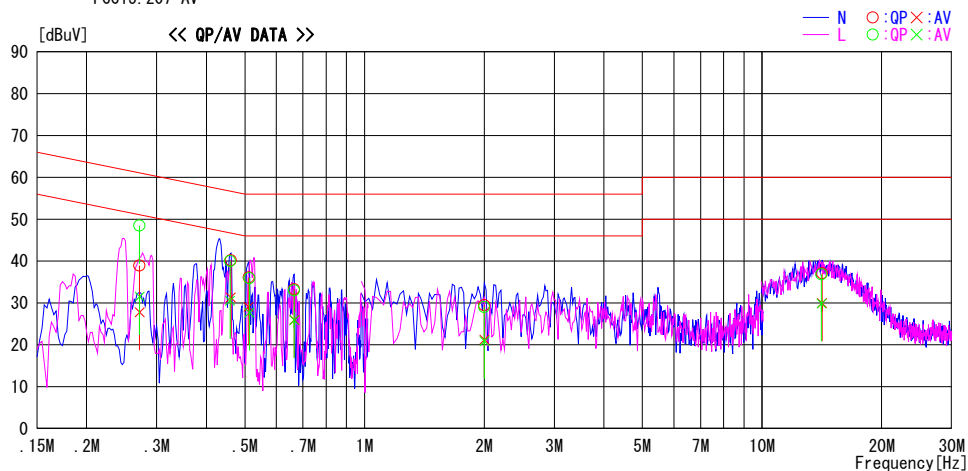
UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2015/08/20

Report No. : 10863245H

Temp./Humi. : 23deg. C / 52% RH
Engineer : Ken Fujita

Mode / Remarks : Tx 2440 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.27180	25.5	14.4	13.4	38.9	27.8	61.1	51.1	22.2	23.3	N	
0.46103	26.8	17.9	13.4	40.2	31.3	56.7	46.7	16.5	15.4	N	
0.51105	22.7	15.7	13.4	36.1	29.1	56.0	46.0	19.9	16.9	N	
0.66547	19.9	12.6	13.4	33.3	26.0	56.0	46.0	22.7	20.0	N	
2.00038	16.0	7.7	13.5	29.5	21.2	56.0	46.0	26.5	24.8	N	
14.16051	22.8	15.7	14.3	37.1	30.0	60.0	50.0	22.9	20.0	N	
0.27180	35.1	18.1	13.4	48.5	31.5	61.1	51.1	12.6	19.6	L	
0.45885	26.6	17.1	13.4	40.0	30.5	56.7	46.7	16.7	16.2	L	
0.51323	22.5	14.3	13.4	35.9	27.7	56.0	46.0	20.1	18.3	L	
0.66547	19.6	12.5	13.4	33.0	25.9	56.0	46.0	23.0	20.1	L	
2.00038	15.5	7.4	13.5	29.0	20.9	56.0	46.0	27.0	25.1	L	
14.11038	22.6	15.6	14.3	36.9	29.9	60.0	50.0	23.1	20.1	L	

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

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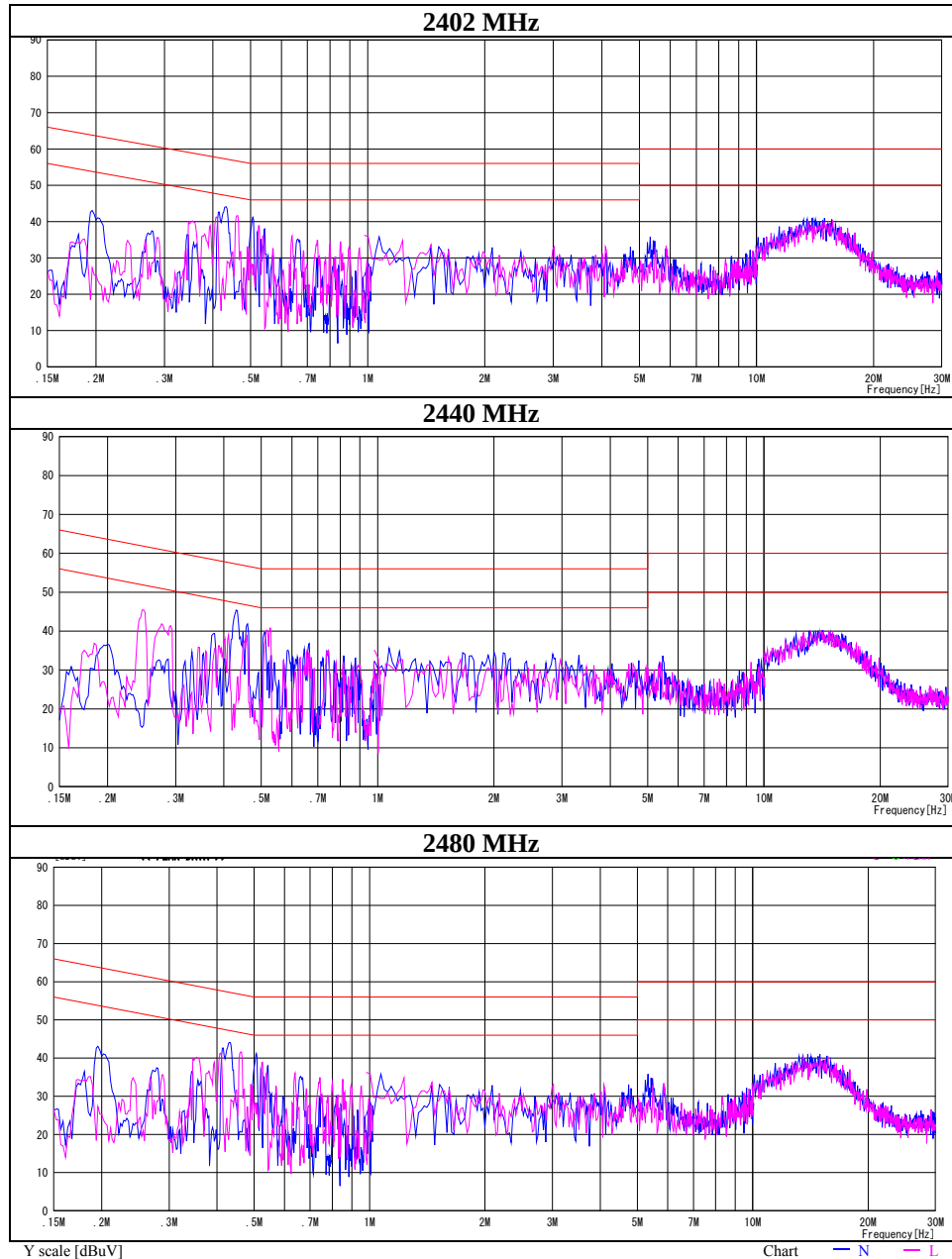
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Conducted Emission

Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10863245H
Date	August 20, 2015
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Ken Fujita
Mode	Tx BT LE



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6dB Bandwidth

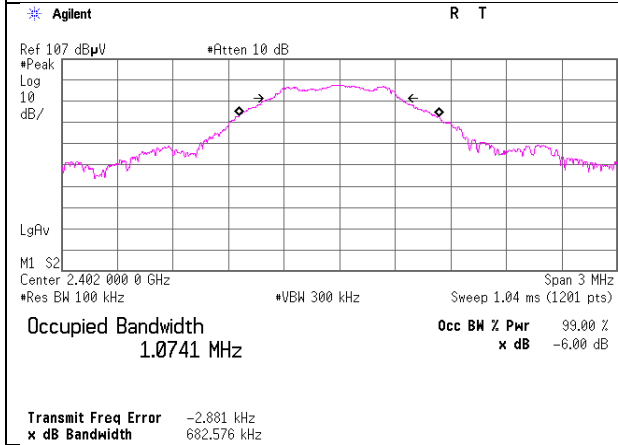
Test place Ise EMC Lab. No.11 Measurement Room
Report No. 10863245H
Date July 30, 2015
Temperature / Humidity 24 deg. C / 40 % RH
Engineer Yuta Moriya
Mode Tx BT LE

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
BT LE	2402	0.683	> 500
	2440	0.669	> 500
	2480	0.674	> 500

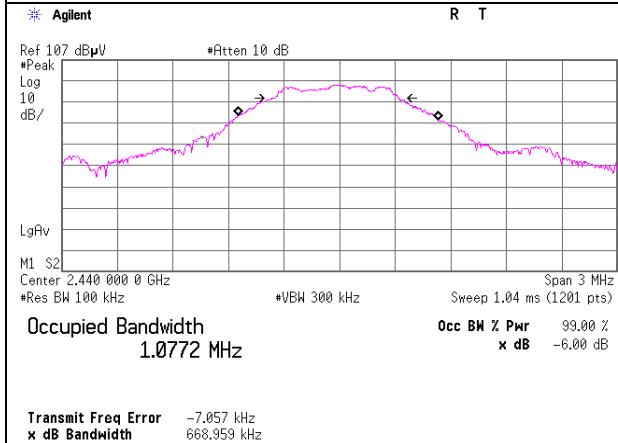
6dB Bandwidth

BT LE

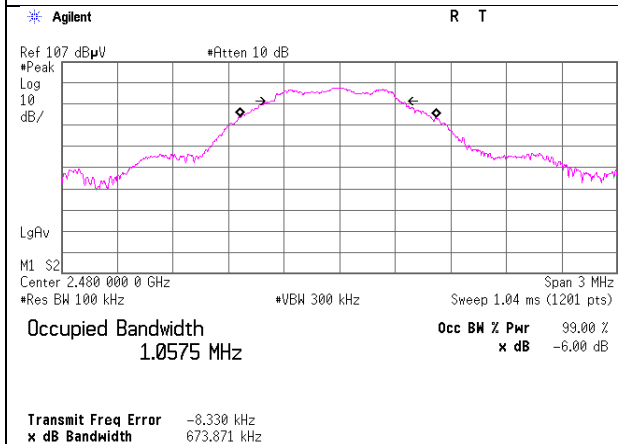
2402 MHz



2440 MHz



2480 MHz



Maximum Peak Output Power

Test place : Ise EMC Lab. No.2 Measurement Room
Report No. : 10863245H
Date : August 20, 2015
Temperature / Humidity : 23 deg. C / 68 % RH
Engineer : Shinichi Miyazono
Mode : Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-8.21	0.30	9.96	2.05	1.60	30.00	1000	27.95
2440	-8.19	0.30	9.96	2.07	1.61	30.00	1000	27.93
2480	-8.26	0.30	9.96	2.00	1.58	30.00	1000	28.00

Sample Calculation:

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

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10863245H
Date	August 20, 2015
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE

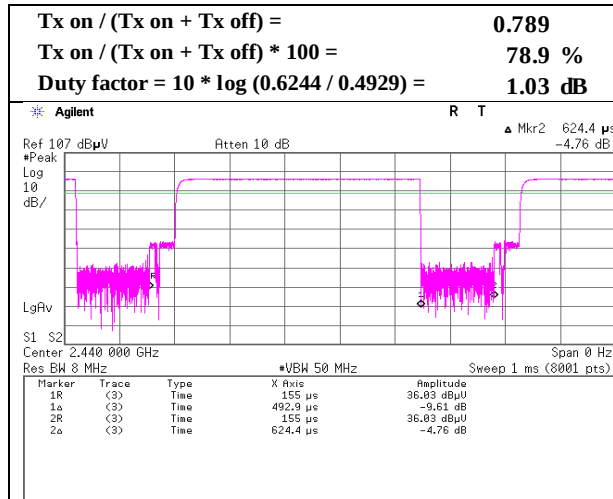
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)	
				[dBm]	[mW]
2402	-9.97	0.30	9.96	0.29	1.07
2440	-9.91	0.30	9.96	0.35	1.08
2480	-10.11	0.30	9.96	0.15	1.04

Sample Calculation:

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

Burst rate confirmation

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10863245H
Date August 25, 2015
Temperature / Humidity 23 deg. C / 52 % RH
Engineer Yuta Moriya
Mode Tx BT LE



Radiated Spurious Emission

Report No.	10863245H	No.4	No.2
Semi Anechoic Chamber	No.4	No.4	No.2
Date	August 20, 2015	August 20, 2015	August 25, 2015
Temperature / Humidity	23 deg. C / 62 % RH	22 deg. C / 61 % RH	23 deg. C / 52 % RH
Engineer	Takafumi Noguchi (Above 10GHz)	Ken Fujita (Below 1GHz)	Yuta Moriya (1-10GHz)
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	50.000	QP	22.9	10.8	7.3	32.2	-	8.8	40.0	31.2	
Hori	75.000	QP	22.6	6.4	7.7	32.0	-	4.7	40.0	35.3	
Hori	100.000	QP	22.6	10.1	8.0	32.3	-	8.4	43.5	35.1	
Hori	250.000	QP	22.2	17.2	9.5	32.0	-	16.9	46.0	29.1	
Hori	500.000	QP	22.0	18.2	11.3	32.1	-	19.4	46.0	26.6	
Hori	610.000	QP	21.9	19.6	11.8	32.1	-	21.2	46.0	24.8	
Hori	2382.900	PK	58.6	29.3	3.5	35.0	-	56.4	73.9	17.5	
Hori	2390.000	PK	51.9	29.3	3.5	35.0	-	49.7	73.9	24.2	
Hori	4804.000	PK	42.2	32.7	5.8	34.2	-	46.5	73.9	27.4	No signal detect
Hori	7206.000	PK	42.3	36.8	7.2	34.1	-	52.2	73.9	21.7	No signal detect
Hori	9608.000	PK	42.7	38.9	8.1	34.7	-	55.0	73.9	18.9	No signal detect
Hori	2382.900	AV	43.7	29.3	3.5	35.0	1.0	42.5	53.9	11.4	*1)
Hori	2390.000	AV	37.9	29.3	3.5	35.0	1.0	36.7	53.9	17.2	*1)
Hori	4804.000	AV	34.1	32.7	5.8	34.2	-	38.4	53.9	15.5	No signal detect
Hori	7206.000	AV	32.8	36.8	7.2	34.1	-	42.7	53.9	11.2	No signal detect
Hori	9608.000	AV	32.9	38.9	8.1	34.7	-	45.2	53.9	8.7	No signal detect
Vert	50.000	QP	22.9	10.8	7.3	32.2	-	8.8	40.0	31.2	
Vert	75.000	QP	22.6	6.4	7.7	32.0	-	4.7	40.0	35.3	
Vert	100.000	QP	22.6	10.1	8.0	32.3	-	8.4	43.5	35.1	
Vert	250.000	QP	22.2	17.2	9.5	32.0	-	16.9	46.0	29.1	
Vert	500.000	QP	22.1	18.2	11.3	32.1	-	19.5	46.0	26.5	
Vert	610.000	QP	22.0	19.6	11.8	32.1	-	21.3	46.0	24.7	
Vert	2382.900	PK	58.8	29.3	3.5	35.0	-	56.6	73.9	17.3	
Vert	2390.000	PK	52.5	29.3	3.5	35.0	-	50.3	73.9	23.6	
Vert	4804.000	PK	42.5	32.7	5.8	34.2	-	46.8	73.9	27.1	No signal detect
Vert	7206.000	PK	42.9	36.8	7.2	34.1	-	52.8	73.9	21.1	No signal detect
Vert	9608.000	PK	43.0	38.9	8.1	34.7	-	55.3	73.9	18.6	No signal detect
Vert	2382.900	AV	40.9	29.3	3.5	35.0	1.0	39.7	53.9	14.2	*1)
Vert	2390.000	AV	38.7	29.3	3.5	35.0	1.0	37.5	53.9	16.4	*1)
Vert	4804.000	AV	34.1	32.7	5.8	34.2	-	38.4	53.9	15.5	No signal detect
Vert	7206.000	AV	32.6	36.8	7.2	34.1	-	42.5	53.9	11.4	No signal detect
Vert	9608.000	AV	32.6	38.9	8.1	34.7	-	44.9	53.9	9.0	No signal detect

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 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: 10 GHz - 26.5 GHz 20log (3.0 m / 1.0 m) = 9.5 dB

26.5 GHz - 40 GHz 20log (3.0 m / 0.5 m) = 15.6 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	100.0	29.3	3.5	35.0	97.8	-	-	Carrier
Hori	2400.000	PK	56.9	29.3	3.5	35.0	54.7	77.8	23.1	
Vert	2402.000	PK	99.9	29.3	3.5	35.0	97.7	-	-	Carrier
Vert	2400.000	PK	56.7	29.3	3.5	35.0	54.5	77.7	23.2	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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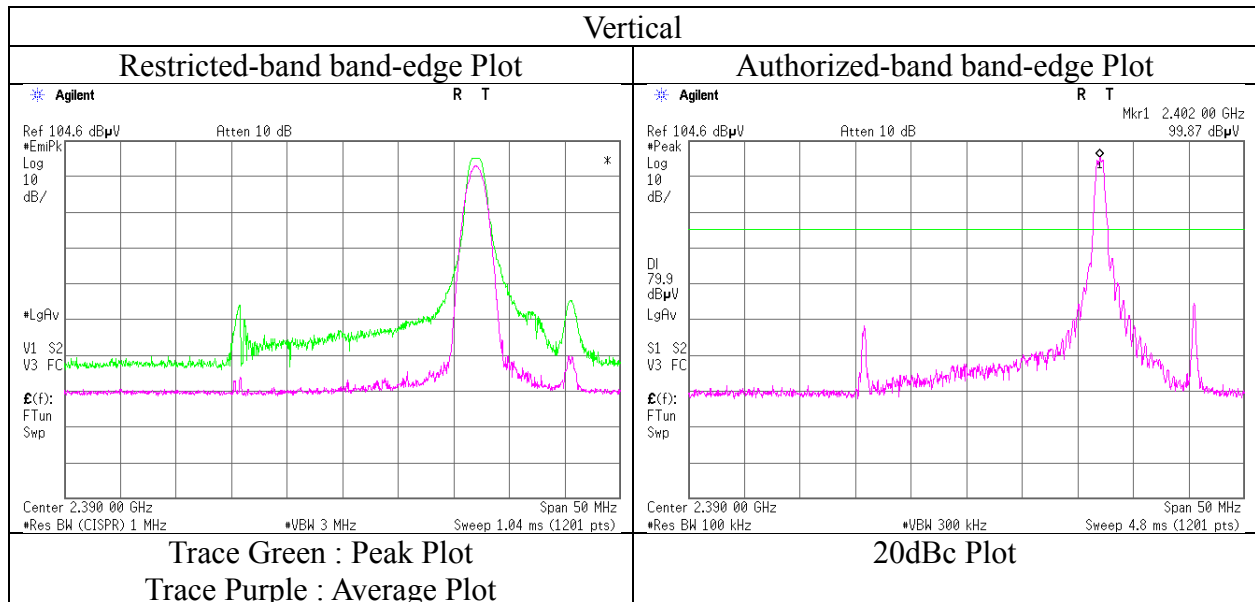
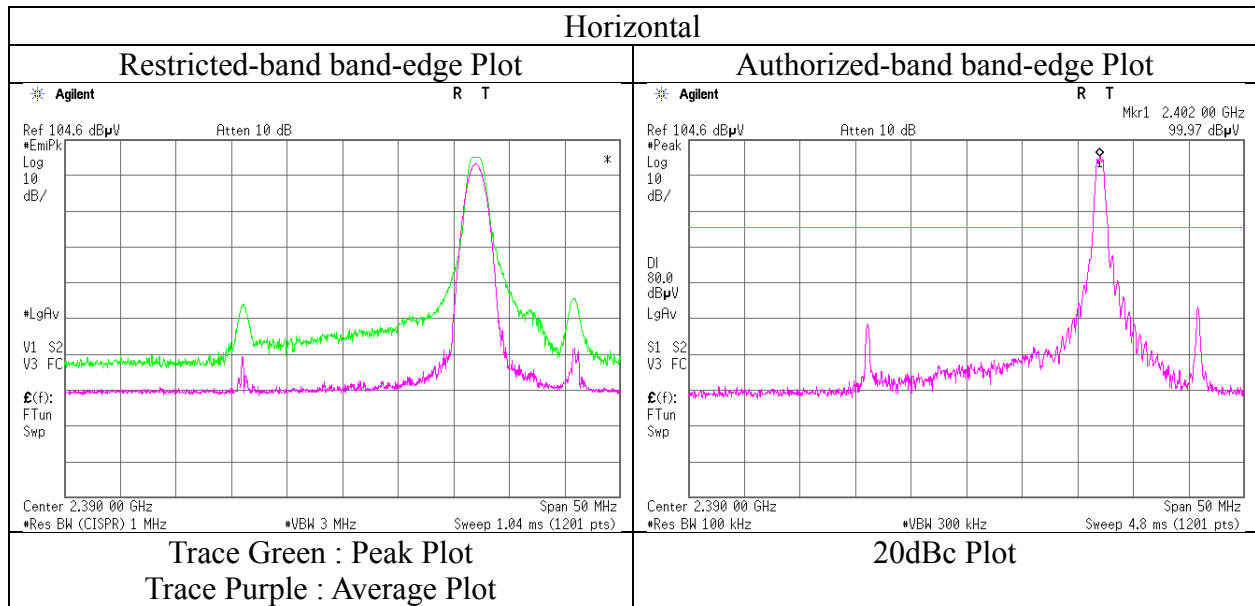
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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10863245H
Date	August 25, 2015
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx BT LE

BT LE 2402 MHz



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

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Radiated Spurious Emission

Report No.	10863245H	No.4	No.2
Semi Anechoic Chamber	No.4	No.4	No.2
Date	August 20, 2015	August 20, 2015	August 25, 2015
Temperature / Humidity	23 deg. C / 62 % RH	22 deg. C / 61 % RH	23 deg. C / 52 % RH
Engineer	Takafumi Noguchi (Above 10GHz)	Ken Fujita (Below 1GHz)	Yuta Moriya (1-10GHz)
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	50.000	QP	22.9	10.8	7.3	32.2	-	8.8	40.0	31.2	
Hori	75.000	QP	22.6	6.4	7.7	32.0	-	4.7	40.0	35.3	
Hori	100.000	QP	22.6	10.1	8.0	32.3	-	8.4	43.5	35.1	
Hori	250.000	QP	22.2	17.2	9.5	32.0	-	16.9	46.0	29.1	
Hori	500.000	QP	22.0	18.2	11.3	32.1	-	19.4	46.0	26.6	
Hori	610.000	QP	22.0	19.6	11.8	32.1	-	21.3	46.0	24.7	
Hori	4880.000	PK	42.2	32.8	5.9	34.2	-	46.7	73.9	27.2	No signal detect
Hori	7320.000	PK	42.3	36.8	7.1	34.1	-	52.1	73.9	21.8	No signal detect
Hori	9760.000	PK	42.7	39.0	8.1	34.7	-	55.1	73.9	18.8	No signal detect
Hori	4880.000	AV	34.1	32.8	5.9	34.2	-	38.6	53.9	15.3	No signal detect
Hori	7320.000	AV	32.8	36.8	7.1	34.1	-	42.6	53.9	11.3	No signal detect
Hori	9760.000	AV	32.9	39.0	8.1	34.7	-	45.3	53.9	8.6	No signal detect
Vert	50.000	QP	22.9	10.8	7.3	32.2	-	8.8	40.0	31.2	
Vert	75.000	QP	22.6	6.4	7.7	32.0	-	4.7	40.0	35.3	
Vert	100.000	QP	22.6	10.1	8.0	32.3	-	8.4	43.5	35.1	
Vert	250.000	QP	22.2	17.2	9.5	32.0	-	16.9	46.0	29.1	
Vert	500.000	QP	22.0	18.2	11.3	32.1	-	19.4	46.0	26.6	
Vert	610.000	QP	22.0	19.6	11.8	32.1	-	21.3	46.0	24.7	
Vert	4880.000	PK	43.9	32.8	5.9	34.2	-	48.4	73.9	25.5	No signal detect
Vert	7320.000	PK	42.0	36.8	7.1	34.1	-	51.8	73.9	22.1	No signal detect
Vert	9760.000	PK	43.1	39.0	8.1	34.7	-	55.5	73.9	18.4	No signal detect
Vert	4880.000	AV	34.3	32.8	5.9	34.2	-	38.8	53.9	15.1	No signal detect
Vert	7320.000	AV	34.6	36.8	7.1	34.1	-	44.4	53.9	9.5	No signal detect
Vert	9760.000	AV	34.4	39.0	8.1	34.7	-	46.8	53.9	7.1	No signal detect

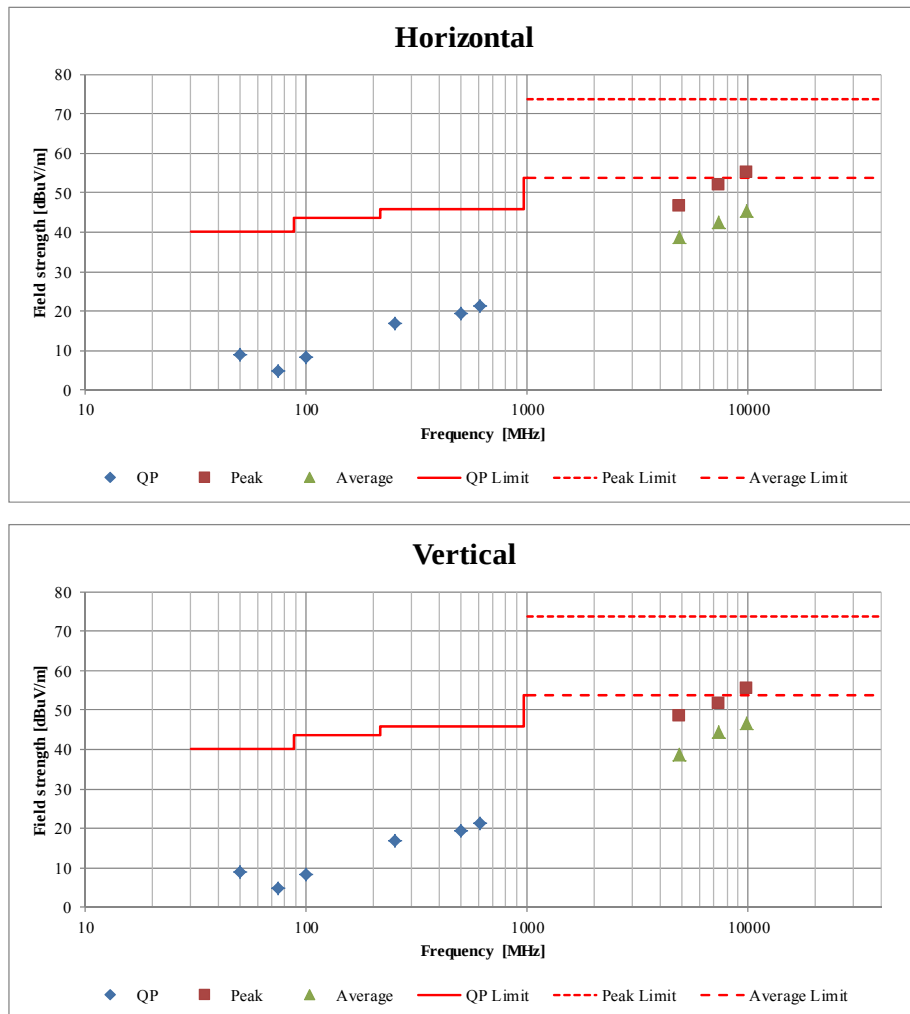
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 GHz)) - Gain(Amplifier)

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

Distance factor: 10 GHz - 26.5 GHz $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$
26.5 GHz - 40 GHz $20\log(3.0\text{ m} / 0.5\text{ m}) = 15.6\text{ dB}$

Radiated Spurious Emission (Plot data, Worst case)

Report No.	10863245H	No.4	No.2
Semi Anechoic Chamber	No.4	No.4	No.2
Date	August 20, 2015	August 20, 2015	August 25, 2015
Temperature / Humidity	23 deg. C / 62 % RH	22 deg. C / 61 % RH	23 deg. C / 52 % RH
Engineer	Takafumi Noguchi (Above 10GHz)	Ken Fujita (Below 1GHz)	Yuta Moriya (1-10GHz)
Mode	Tx BT LE 2440 MHz		



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

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Radiated Spurious Emission

Report No.	10863245H	No.4	No.2
Semi Anechoic Chamber	No.4	No.4	No.2
Date	August 20, 2015	August 20, 2015	August 25, 2015
Temperature / Humidity	23 deg. C / 62 % RH	22 deg. C / 61 % RH	23 deg. C / 52 % RH
Engineer	Takafumi Noguchi (Above 10GHz)	Ken Fujita (Below 1GHz)	Yuta Moriya (1-10GHz)
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	50.000	QP	22.9	10.8	7.3	32.2	-	8.8	40.0	31.2	
Hori	75.000	QP	22.6	6.4	7.7	32.0	-	4.7	40.0	35.3	
Hori	100.000	QP	22.6	10.1	8.0	32.3	-	8.4	43.5	35.1	
Hori	250.000	QP	22.2	17.2	9.5	32.0	-	16.9	46.0	29.1	
Hori	500.000	QP	22.0	18.2	11.3	32.1	-	19.4	46.0	26.6	
Hori	610.000	QP	22.0	19.6	11.8	32.1	-	21.3	46.0	24.7	
Hori	2483.500	PK	57.3	29.3	3.5	34.9	-	55.2	73.9	18.7	
Hori	2487.673	PK	63.5	29.3	3.5	34.9	-	61.4	73.9	12.5	
Hori	4960.000	PK	42.3	33.0	5.9	34.3	-	46.9	73.9	27.0	No signal detect
Hori	7440.000	PK	42.2	36.8	7.0	34.2	-	51.8	73.9	22.1	No signal detect
Hori	9920.000	PK	43.1	39.0	8.2	34.7	-	55.6	73.9	18.3	No signal detect
Hori	2483.500	AV	44.6	29.3	3.5	34.9	1.0	43.5	53.9	10.4	*1)
Hori	2487.673	AV	46.1	29.3	3.5	34.9	1.0	45.0	53.9	8.9	*1)
Hori	4960.000	AV	34.4	33.0	5.9	34.3	-	39.0	53.9	14.9	No signal detect
Hori	7440.000	AV	32.3	36.8	7.0	34.2	-	41.9	53.9	12.0	No signal detect
Hori	9920.000	AV	32.7	39.0	8.2	34.7	-	45.2	53.9	8.7	No signal detect
Vert	50.000	QP	22.9	10.8	7.3	32.2	-	8.8	40.0	31.2	
Vert	75.000	QP	22.6	6.4	7.7	32.0	-	4.7	40.0	35.3	
Vert	100.000	QP	22.7	10.1	8.0	32.3	-	8.5	43.5	35.0	
Vert	250.000	QP	22.2	17.2	9.5	32.0	-	16.9	46.0	29.1	
Vert	500.000	QP	22.0	18.2	11.3	32.1	-	19.4	46.0	26.6	
Vert	610.000	QP	22.0	19.6	11.8	32.1	-	21.3	46.0	24.7	
Vert	2483.500	PK	56.0	29.3	3.5	34.9	-	53.9	73.9	20.0	
Vert	2487.673	PK	61.3	29.3	3.5	34.9	-	59.2	73.9	14.7	
Vert	4960.000	PK	42.6	33.0	5.9	34.3	-	47.2	73.9	26.7	No signal detect
Vert	7440.000	PK	43.1	36.8	7.0	34.2	-	52.7	73.9	21.2	No signal detect
Vert	9920.000	PK	42.9	39.0	8.2	34.7	-	55.4	73.9	18.5	No signal detect
Vert	2483.500	AV	42.8	29.3	3.5	34.9	1.0	41.7	53.9	12.2	*1)
Vert	2487.673	AV	44.2	29.3	3.5	34.9	1.0	43.1	53.9	10.8	*1)
Vert	4960.000	AV	34.1	33.0	5.9	34.3	-	38.7	53.9	15.2	No signal detect
Vert	7440.000	AV	32.4	36.8	7.0	34.2	-	42.0	53.9	11.9	No signal detect
Vert	9920.000	AV	32.5	39.0	8.2	34.7	-	45.0	53.9	8.9	No signal detect

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10 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: 10 GHz - 26.5 GHz $20\log(3.0\text{ m} / 1.0\text{ m}) = 9.5\text{ dB}$

26.5 GHz - 40 GHz $20\log(3.0\text{ m} / 0.5\text{ m}) = 15.6\text{ dB}$

*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	2480.000	PK	103.4	29.3	3.5	34.9	101.3	-	-	Carrier
Hori	2500.278	PK	62.6	29.3	3.5	34.9	60.5	81.3	20.8	
Vert	2480.000	PK	101.8	29.3	3.5	34.9	99.7	-	-	Carrier
Vert	2500.278	PK	60.5	29.3	3.5	34.9	58.4	79.7	21.3	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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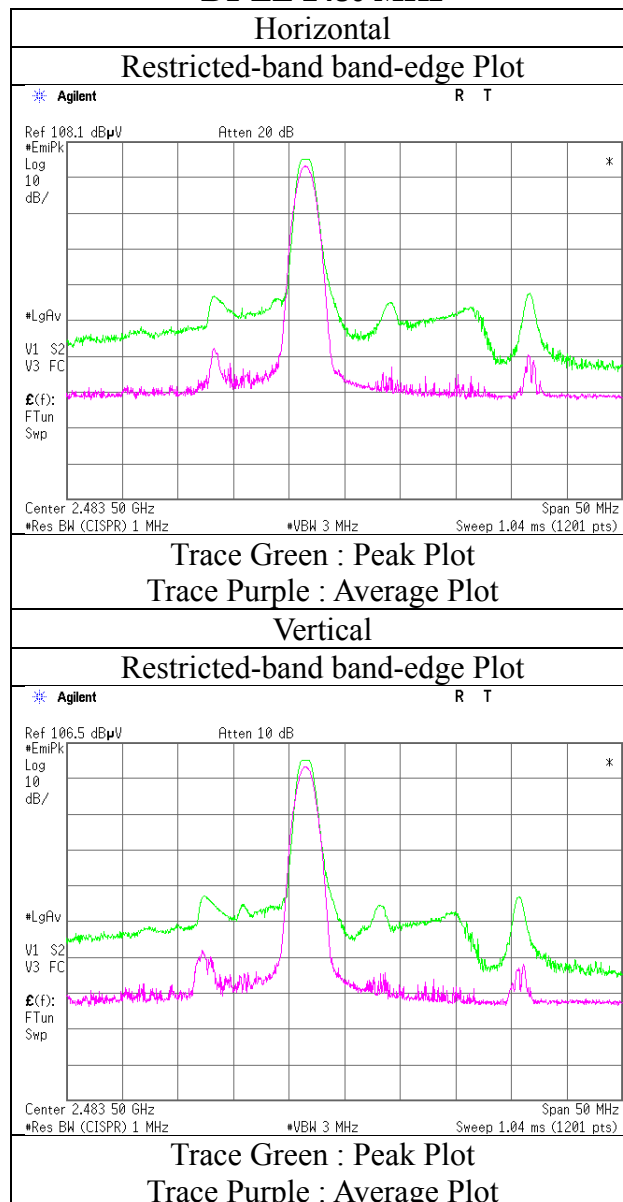
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Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10863245H
Date	August 25, 2015
Temperature / Humidity	23 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx BT LE

BT LE 2480 MHz



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

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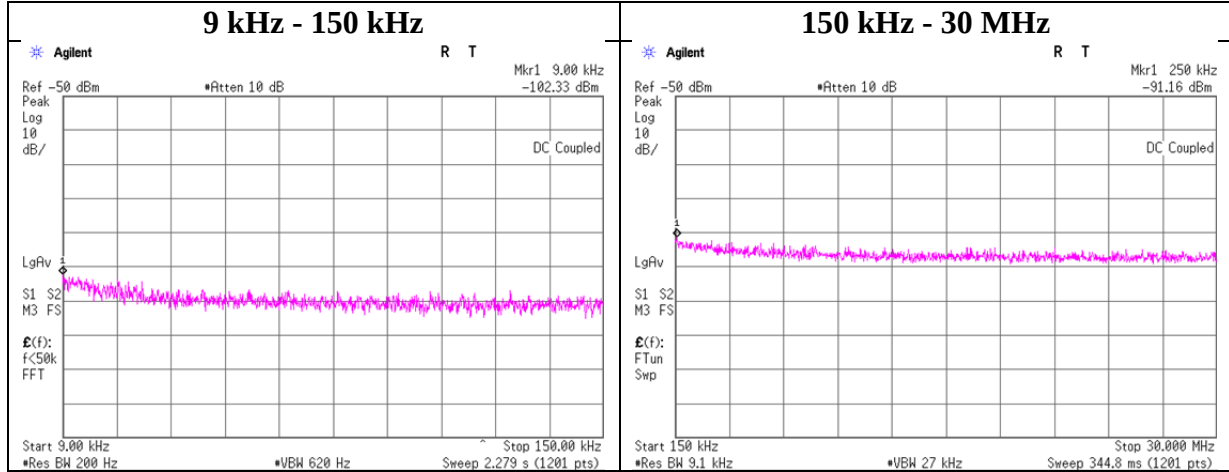
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 10863245H
Date : August 20, 2015
Temperature / Humidity : 23 deg. C / 68 % RH
Engineer : Shinichi Miyazono
Mode : Tx BT LE 2402 MHz



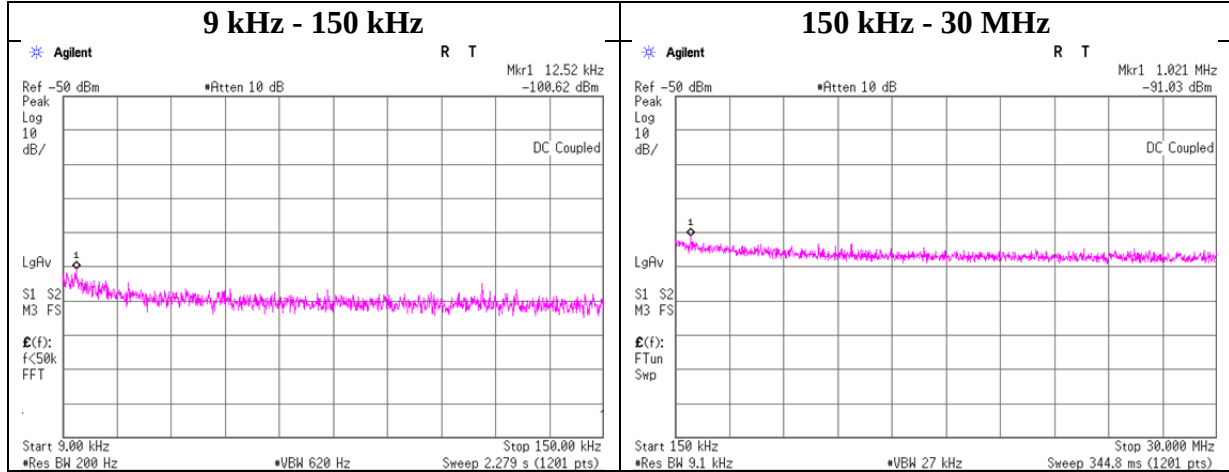
Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.00	-102.33	0.31	9.83	2.0	1	-90.2	300	6.0	-28.9	48.5	77.4	
250.00	-91.16	0.31	9.82	2.0	1	-79.0	300	6.0	-17.8	19.6	37.4	

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

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

Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10863245H
Date	August 20, 2015
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
12.52	-100.62	0.31	9.83	2.0	1	-88.5	300	6.0	-27.2	45.6	72.8	
1021.00	-91.03	0.31	9.82	2.0	1	-78.9	30	6.0	2.4	27.4	25.0	

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

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Ise EMC Lab.

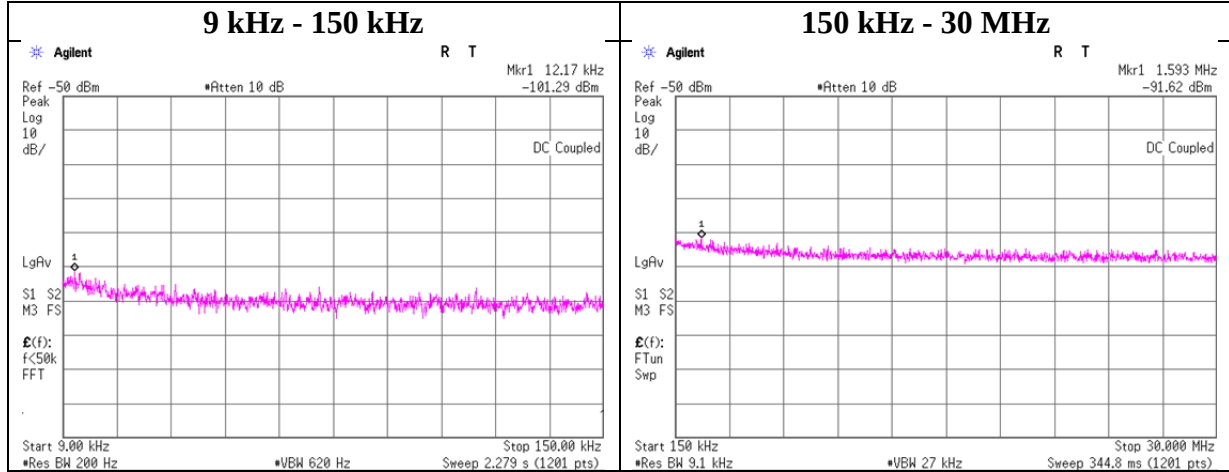
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Telephone : +81 596 24 8999

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Conducted Spurious Emission

Test place	Ise EMC Lab. No.2 Measurement Room
Report No.	10863245H
Date	August 20, 2015
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Shinichi Miyazono
Mode	Tx BT LE 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
12.17	-101.29	0.31	9.83	2.0	1	-89.2	300	6.0	-27.9	45.8	73.7	
1593.00	-91.62	0.32	9.82	2.0	1	-79.5	30	6.0	1.8	23.5	21.7	

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss} + \text{Antenna Gain} + 10 * \log(N)$

Power Density

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 10863245H
Date August 20, 2015
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Shinichi Miyazono
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-21.62	1.17	9.96	-10.49	8.00	18.49
2440.00	-20.93	1.17	9.96	-9.80	8.00	17.80
2480.00	-20.22	1.18	9.96	-9.08	8.00	17.08

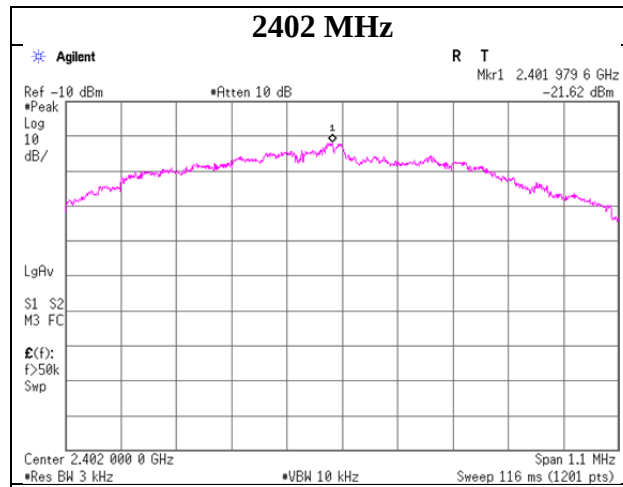
Sample Calculation:

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

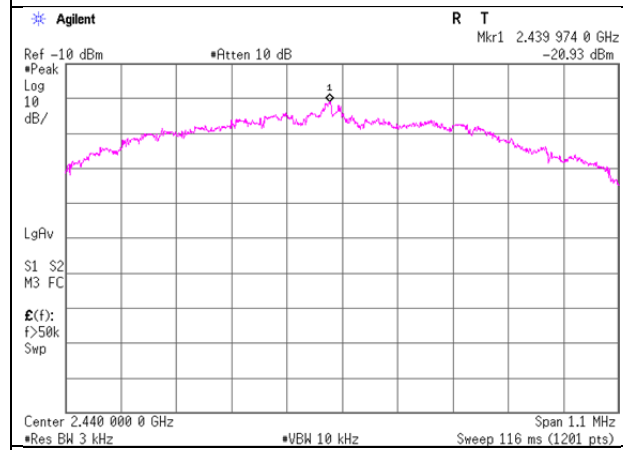
Power Density

BT LE

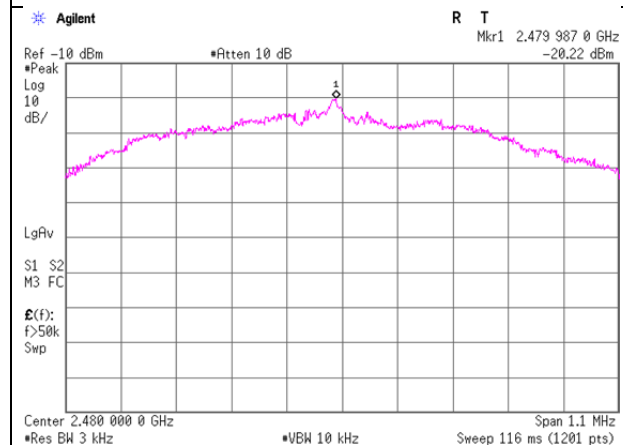
2402 MHz



2440 MHz



2480 MHz



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Ise EMC Lab.

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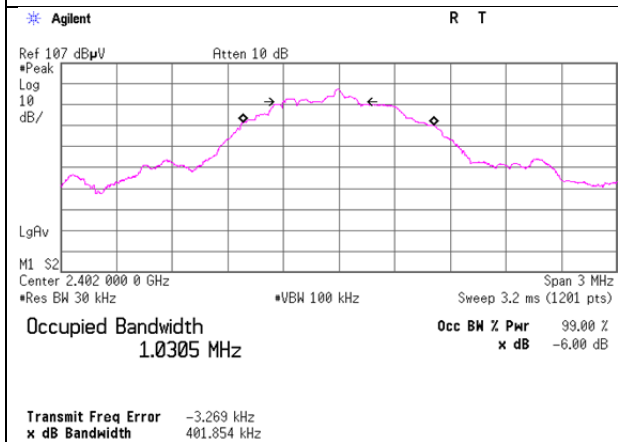
Facsimile : +81 596 24 8124

99%Occupied Bandwidth

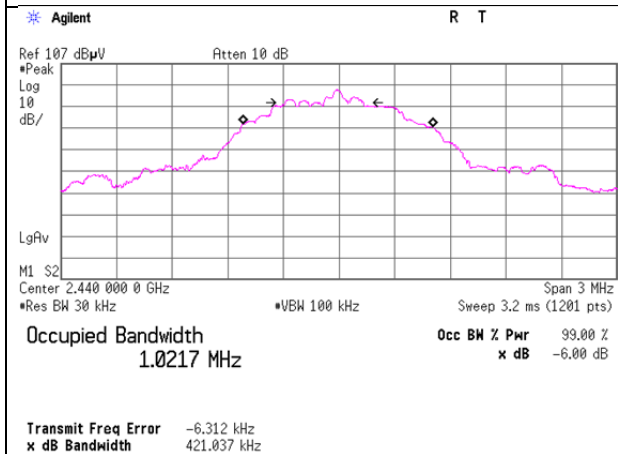
Test place Ise EMC Lab. No.11 Measurement Room
Report No. 10863245H
Date July 30, 2015
Temperature / Humidity 24 deg. C / 40 % RH
Engineer Yuta Moriya
Mode Tx BT LE

BT LE

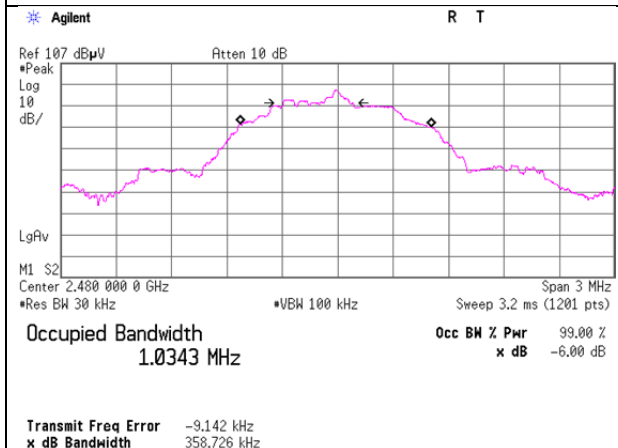
2402 MHz



2440 MHz



2480 MHz



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APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE/RE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	AT	2014/10/17 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	AT	2015/05/18 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2015/03/18 * 12
MCC-144	Microwave Cable	Junkosha	MWX221	1207S407	AT	2015/08/06 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2014/12/22 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	CE	2014/08/19 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	CE	2015/02/19 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	CE	2015/01/13 * 12
MJM-16	Measure	KOMELON	KMC-36	-	CE	-
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE	2015/07/10 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(3m)/sucoform141-PE(1m)/421-010(1.5m)/R FM-E321(Switcher)	-/00640	CE	2015/07/02 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	AT/RE	2015/01/13 * 12
MPM-16	Power Meter	Agilent	8990B	MY51000271	AT	2015/04/01 * 12
MPSE-22	Power sensor	Agilent	N1923A	MY54070003	AT	2015/04/01 * 12
MAT-24	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71389	AT	2015/06/18 * 12
MCC-171	Microwave Cable	Junkosha	MWX221	1409S494	AT	2015/03/04 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2014/11/19 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2015/03/06 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2015/01/16 * 12
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	CE	2015/06/02 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2015/07/01 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2014/11/12 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2015/02/05 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2014/09/24 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2015/01/28 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/02/26 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2015/02/26 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2015/06/22 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2015/03/12 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2015/06/06 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2014/08/12 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2014/11/10 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2014/11/22 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2014/11/22 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2015/06/19 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2014/11/11 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2015/03/09 * 12

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

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

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

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