RADIO TEST REPORT

Test Report No. : 10767588H-B

Applicant	:	**TOUA CORPORATION**
Type of Equipment	:	**Wireless Module**
Model No.	:	**RFM24N1C-05-B**
Test regulation	:	**FCC Part 15 Subpart C: 2015**
FCC ID	:	**2AFXHN1C05B**
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)

Date of test: May 27 to July 4, 2015

Representative test engineer: Koji Yamamoto
Koji Yamamoto
Engineer
Consumer Technology Division

Approved by: M. Imura
Motoya Imura
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,
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REVISION HISTORY

Original Test Report No.: 10767588H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10767588H-B	November 17, 2015	-	-

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
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SECTION 1: Customer information

Company Name	:	TOUA CORPORATION
Address	:	2-4-12 Ookubo Sinjuku-ku Tokyo 169-0072 Japan
Telephone Number	:	+81-3-6205-5591
Facsimile Number	:	+81-3-5155-6551
Contact Person	:	Makoto Kondou

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

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless Module
Model No.	:	RFM24N1C-05-B
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.0 V
Receipt Date of Sample	:	May 18, 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: RFM24N1C-05-B (referred to as the EUT in this report) is a Wireless Module.

General Specification

Clock frequency(ies) in the system	:	16 MHz, 32.768 kHz

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2470 MHz
Modulation	:	GFSK
Power Supply (radio part input)	:	DC 1.2 / 1.7 V
Antenna type	:	Pattern antenna
Antenna Gain	:	-5.88 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

* The EUT complies with FCC Part 15 Subpart B: 2015, final revised on June 12, 2015 and effective July 13, 2015.

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** 18.0 dB, 0.44528 MHz, N **AV** 23.1 dB, 0.44528 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:** Section15.247(d) **IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	0.2 dB 4872.000 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)
The RF Module has its own regulator.
The RF Module is constantly provided voltage (DC 1.2 / 1.7 V) through the regulator 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.

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	5.5 dB	6.3 dB	5.5 dB	5.8 dB	5.8 dB	4.3 dB
No. 2	4.2 dB	5.4 dB	6.3 dB	5.4 dB	5.7 dB	5.9 dB	5.6 dB
No. 3	4.4 dB	5.4 dB	6.4 dB	5.2 dB	5.5 dB	5.8 dB	5.5 dB
No. 4	4.7 dB	5.6 dB	6.4 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	2.6 dB

Conducted Emission test

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

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

UL Japan, Inc. 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

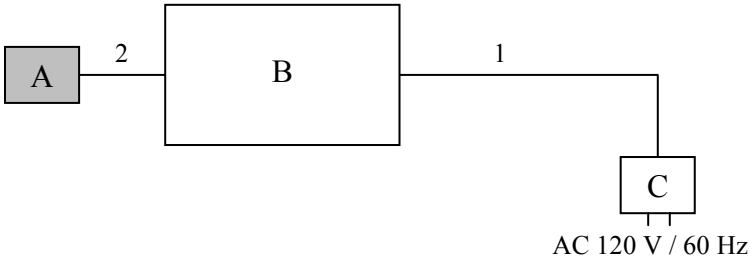
4.1 Operating Mode(s)

Mode	Remarks*
Transmitting mode (Tx)	-
*Power of the EUT was set by the software as follows; - Power Setting: 0dBm - Software: RfSkillInspector Ver. 0,10,916,1 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission, Spurious Emission, 6dB Bandwidth, Maximum Peak Output Power, Power Density, 99% Occupied Bandwidth	Tx	2402 MHz 2436 MHz 2470 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	Wireless Module	RFM24N1C-05-B	A3789	TOUA CORPORATION	EUT
B	Jig	-	-	-	-
C	AC Adapter	UN110-3320	A04-0268627	UNIFIVE	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.60	Unshielded	Unshielded	-
2	Signal Cable	0.25	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

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 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	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	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 x log (3.0 m / 1.0 m) = 9.5 dB

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT (Module and Antenna) 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	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	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				
Band Edge confirmation	40 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)

*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

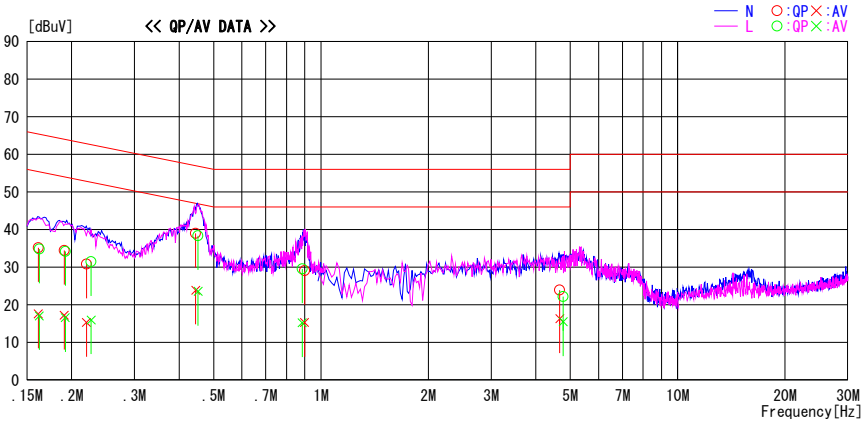
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/07/04

Report No. : 10767588H

Temp./Humi. : 22deg. C / 58% RH
Engineer : Koji Yamamoto

Mode / Remarks : Tx 2470MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



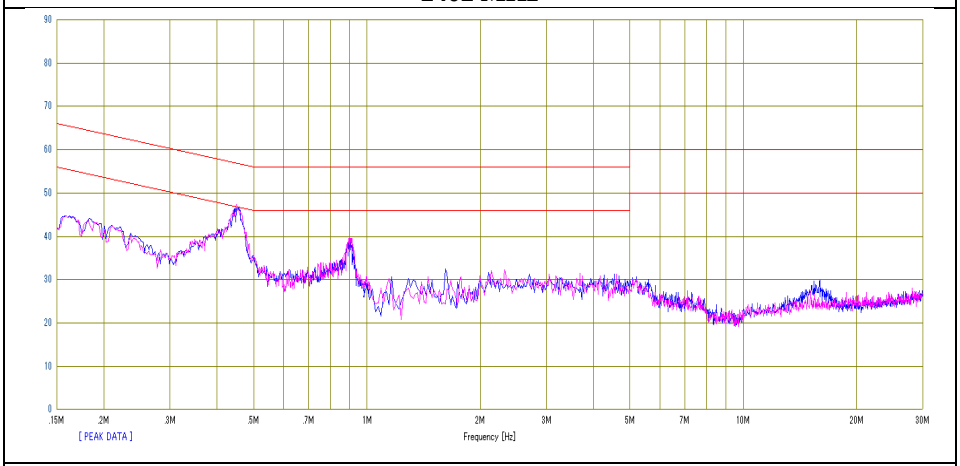
Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.16119	21.9	4.3	13.3	35.2	17.6	65.4	55.4	30.2	37.8	N	
0.19059	21.2	3.9	13.3	34.5	17.2	64.0	54.0	29.5	36.8	N	
0.22013	17.5	2.0	13.3	30.8	15.3	62.8	52.8	32.0	37.5	N	
0.44528	25.7	10.6	13.3	39.0	23.9	57.0	47.0	18.0	23.1	N	
0.89900	15.7	1.9	13.4	29.1	15.3	56.0	46.0	26.9	30.7	N	
4.66985	9.9	2.3	14.0	23.9	16.3	56.0	46.0	32.1	29.7	N	
0.16223	21.5	3.8	13.3	34.8	17.1	65.3	55.3	30.5	38.2	L	
0.19184	20.9	3.3	13.3	34.2	16.6	64.0	54.0	29.8	37.4	L	
0.22671	18.2	2.7	13.3	31.5	16.0	62.6	52.6	31.1	36.6	L	
0.45238	25.1	10.3	13.3	38.4	23.6	56.8	46.8	18.4	23.2	L	
0.88575	16.2	1.8	13.4	29.6	15.2	56.0	46.0	26.4	30.8	L	
4.77261	8.2	1.5	14.0	22.2	15.5	56.0	46.0	33.8	30.5	L	

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

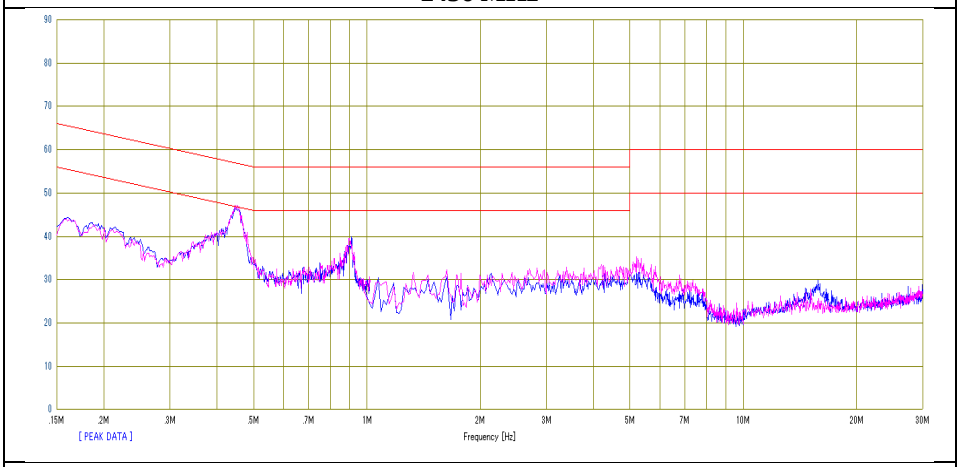
Conducted Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10767588H
Date	July 4, 2015
Temperature / Humidity	22 deg. C / 58 % RH
Engineer	Koji Yamamoto
Mode	Tx

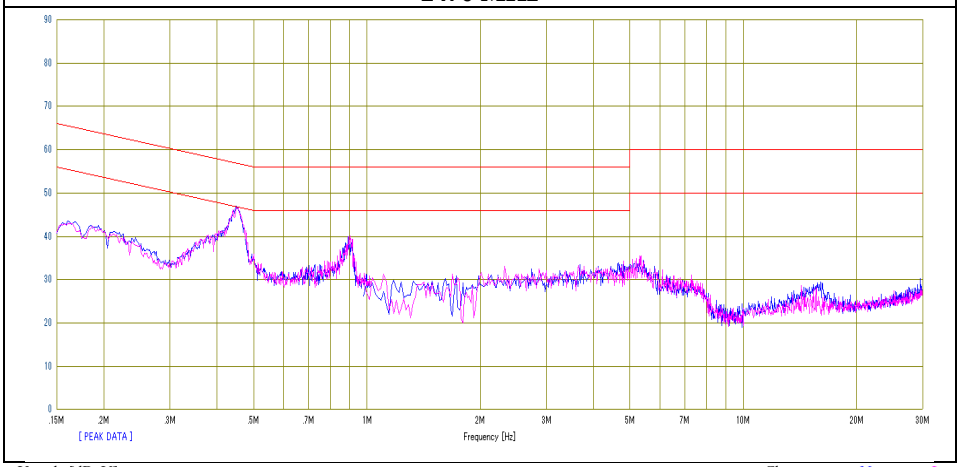
2402 MHz



2436 MHz



2470 MHz



Y scale [dBuV] Chart — N — L

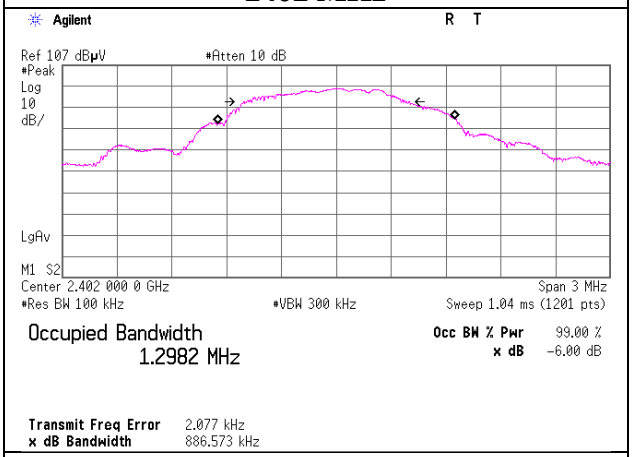
6dB Bandwidth

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx

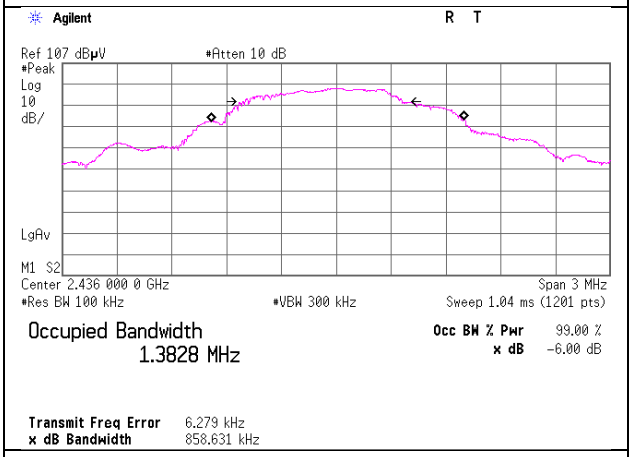
Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2402	0.887	> 500
2436	0.859	> 500
2470	0.947	> 500

6dB Bandwidth

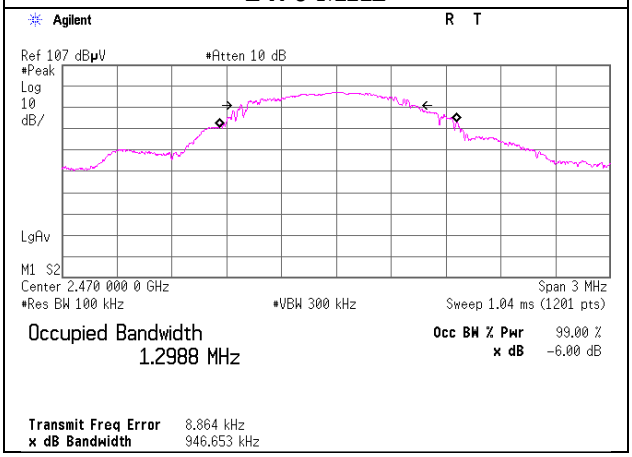
2402 MHz



2436 MHz



2470 MHz



Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-11.15	1.90	10.02	0.77	1.19	30.00	1000	29.23
2436	-11.82	1.92	10.02	0.12	1.03	30.00	1000	29.88
2470	-12.64	1.94	10.02	-0.68	0.86	30.00	1000	30.68

Sample Calculation:
Result = Reading + Cable Loss + Attenuator Loss

Average Output Power
(Reference data for RF Exposure)

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx

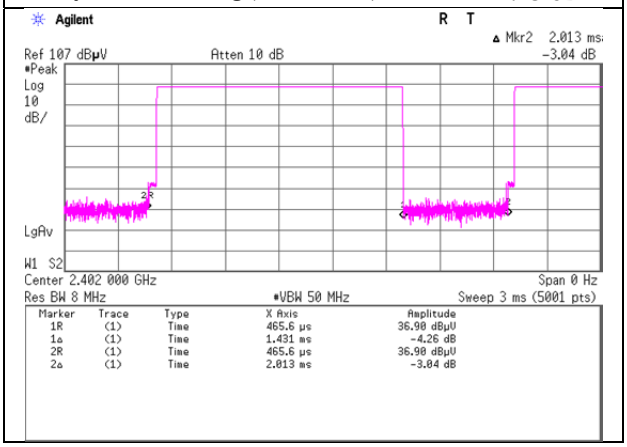
Freq.	Reading	Cable Loss	Atten. Loss	Result (Frame power)		Duty factor	Result (Burst power)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
2402	-13.00	1.90	10.02	-1.08	0.78	1.48	0.40	1.10
2436	-13.72	1.92	10.02	-1.78	0.66	1.48	-0.30	0.93
2470	-14.63	1.94	10.02	-2.67	0.54	1.48	-1.19	0.76

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

Burst rate confirmation

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx

Tx on / (Tx on + Tx off) =	**0.711**
Tx on / (Tx on + Tx off) * 100 =	**71.1 %**
Duty factor = 10 * log (2.013 / 1.431) =	**1.48 dB**



Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10767588H
Date	July 3, 2015
Temperature / Humidity	20 deg. C / 57 % RH
Engineer	Takafumi Noguchi
Mode	Tx 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	31.800	QP	27.7	16.7	6.8	28.5	-	22.7	40.0	17.3	
Hori	45.982	QP	23.0	12.1	6.9	28.5	-	13.5	40.0	26.5	
Hori	53.850	QP	22.9	9.3	7.0	28.5	-	10.7	40.0	29.3	
Hori	80.381	QP	34.9	6.9	7.3	28.4	-	20.7	40.0	19.3	
Hori	93.761	QP	30.1	9.1	7.4	28.3	-	18.3	43.5	25.2	
Hori	351.998	QP	25.7	16.2	9.2	27.9	-	23.2	46.0	22.8	
Hori	2390.000	PK	54.5	29.3	3.5	35.0	-	52.3	73.9	21.6	
Hori	4804.000	PK	51.1	32.7	5.8	34.2	-	55.4	73.9	18.5	
Hori	7206.000	PK	47.5	36.8	7.2	34.1	-	57.4	73.9	16.5	
Hori	9608.000	PK	46.8	38.9	8.1	34.7	-	59.1	73.9	14.8	Floor Noise
Hori	2390.000	AV	37.0	29.3	3.5	35.0	1.5	36.3	53.9	17.6	*1)
Hori	4804.000	AV	45.5	32.7	5.8	34.2	1.5	51.3	53.9	2.6	
Hori	7206.000	AV	38.8	36.8	7.2	34.1	1.5	50.2	53.9	3.7	
Hori	9608.000	AV	35.8	38.9	8.1	34.7	-	48.1	53.9	5.8	Floor Noise
Vert	31.800	QP	29.2	16.7	6.8	28.5	-	24.2	40.0	15.8	
Vert	45.982	QP	33.0	12.1	6.9	28.5	-	23.5	40.0	16.5	
Vert	55.914	QP	41.6	8.7	7.0	28.5	-	28.8	40.0	11.2	
Vert	80.574	QP	53.0	6.9	7.3	28.4	-	38.8	40.0	1.2	
Vert	92.068	QP	47.1	8.8	7.4	28.3	-	35.0	43.5	8.5	
Vert	351.998	QP	28.5	16.2	9.2	27.9	-	26.0	46.0	20.0	
Vert	2390.000	PK	52.5	29.3	3.5	35.0	-	50.3	73.9	23.6	
Vert	4804.000	PK	50.9	32.7	5.8	34.2	-	55.2	73.9	18.7	
Vert	7206.000	PK	47.3	36.8	7.2	34.1	-	57.2	73.9	16.7	
Vert	9608.000	PK	44.0	38.9	8.1	34.7	-	56.3	73.9	17.6	Floor Noise
Vert	2390.000	AV	36.3	29.3	3.5	35.0	1.5	35.6	53.9	18.3	*1)
Vert	4804.000	AV	45.3	32.7	5.8	34.2	1.5	51.1	53.9	2.8	
Vert	7206.000	AV	38.4	36.8	7.2	34.1	1.5	49.8	53.9	4.1	
Vert	9608.000	AV	35.1	38.9	8.1	34.7	-	47.4	53.9	6.5	Floor Noise

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

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

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

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

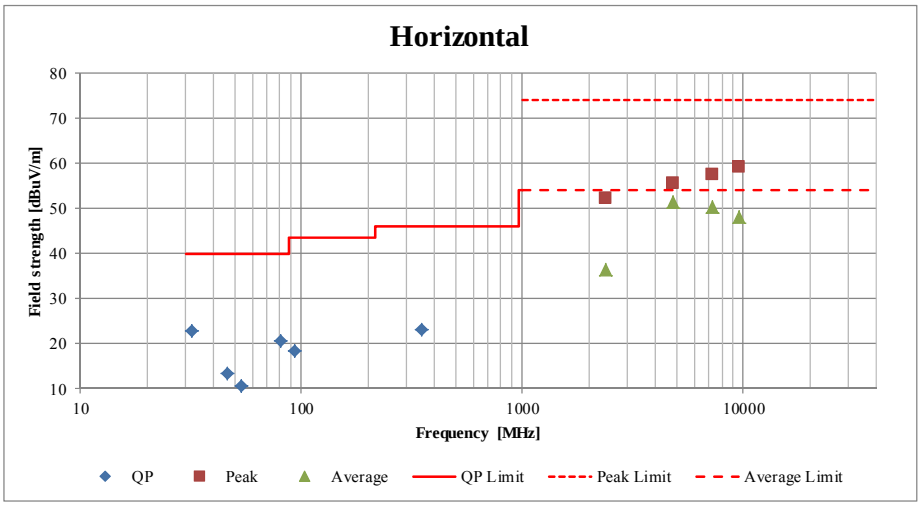
20dBc Data Sheet

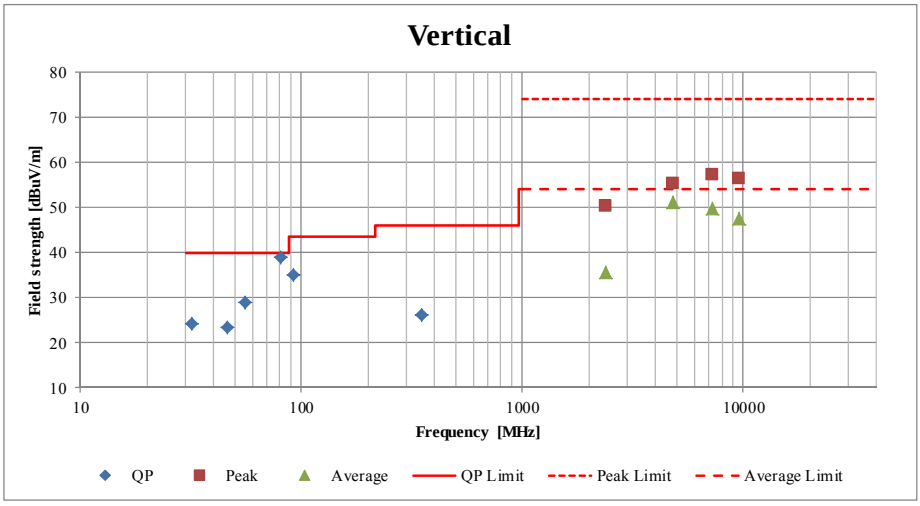
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	91.4	29.3	3.5	35.0	89.2	-	-	Carrier
Hori	2400.000	PK	52.7	29.3	3.5	35.0	50.5	69.2	18.7	
Vert	2402.000	PK	89.2	29.3	3.5	35.0	87.0	-	-	Carrier
Vert	2400.000	PK	50.4	29.3	3.5	35.0	48.2	67.0	18.8	

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

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10767588H
Date	July 3, 2015
Temperature / Humidity	20 deg. C / 57 % RH
Engineer	Takafumi Noguchi
Mode	Tx 2402 MHz





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

Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10767588H
Date	July 3, 2015
Temperature / Humidity	20 deg. C / 57 % RH
Engineer	Takafumi Noguchi
Mode	Tx 2436 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	31.800	QP	27.0	16.7	6.8	28.5	-	22.0	40.0	18.0	
Hori	45.981	QP	23.0	12.1	6.9	28.5	-	13.5	40.0	26.5	
Hori	53.850	QP	22.8	9.3	7.0	28.5	-	10.6	40.0	29.4	
Hori	81.274	QP	37.5	7.0	7.3	28.4	-	23.4	40.0	16.6	
Hori	93.766	QP	30.1	9.1	7.4	28.3	-	18.3	43.5	25.2	
Hori	351.998	QP	25.5	16.2	9.2	27.9	-	23.0	46.0	23.0	
Hori	4872.000	PK	52.3	32.8	5.9	34.2	-	56.8	73.9	17.1	
Hori	7308.000	PK	46.8	36.8	7.1	34.1	-	56.6	73.9	17.3	
Hori	9744.000	PK	43.8	39.0	8.1	34.7	-	56.2	73.9	17.7	Floor Noise
Hori	4872.000	AV	47.7	32.8	5.9	34.2	1.5	53.7	53.9	0.2	
Hori	7308.000	AV	38.5	36.8	7.1	34.1	1.5	49.8	53.9	4.1	
Hori	9744.000	AV	34.5	39.0	8.1	34.7	-	46.9	53.9	7.0	Floor Noise
Vert	31.800	QP	29.7	16.7	6.8	28.5	-	24.7	40.0	15.3	
Vert	45.981	QP	34.0	12.1	6.9	28.5	-	24.5	40.0	15.5	
Vert	53.474	QP	41.3	9.5	7.0	28.5	-	29.3	40.0	10.7	
Vert	80.661	QP	52.9	6.9	7.3	28.4	-	38.7	40.0	1.3	
Vert	92.068	QP	47.0	8.8	7.4	28.3	-	34.9	43.5	8.6	
Vert	351.998	QP	28.6	16.2	9.2	27.9	-	26.1	46.0	19.9	
Vert	4872.000	PK	50.7	32.8	5.9	34.2	-	55.2	73.9	18.7	
Vert	7308.000	PK	46.7	36.8	7.1	34.1	-	56.5	73.9	17.4	
Vert	9744.000	PK	44.0	39.0	8.1	34.7	-	56.4	73.9	17.5	Floor Noise
Vert	4872.000	AV	45.1	32.8	5.9	34.2	1.5	51.1	53.9	2.8	
Vert	7308.000	AV	38.3	36.8	7.1	34.1	1.5	49.6	53.9	4.3	
Vert	9744.000	AV	34.7	39.0	8.1	34.7	-	47.1	53.9	6.8	Floor Noise

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

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

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

Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10767588H
Date July 3, 2015
Temperature / Humidity 20 deg. C / 57 % RH
Engineer Takafumi Noguchi
Mode Tx 2470 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	31.800	QP	27.1	16.7	6.8	28.5	-	22.1	40.0	17.9	
Hori	45.981	QP	22.8	12.1	6.9	28.5	-	13.3	40.0	26.7	
Hori	53.850	QP	23.0	9.3	7.0	28.5	-	10.8	40.0	29.2	
Hori	81.274	QP	37.9	7.0	7.3	28.4	-	23.8	40.0	16.2	
Hori	93.762	QP	30.2	9.1	7.4	28.3	-	18.4	43.5	25.1	
Hori	351.999	QP	25.6	16.2	9.2	27.9	-	23.1	46.0	22.9	
Hori	2483.500	PK	56.7	29.3	3.5	34.9	-	54.6	73.9	19.3	
Hori	4940.000	PK	51.9	32.9	5.9	34.2	-	56.5	73.9	17.4	
Hori	7410.000	PK	46.0	36.8	7.1	34.2	-	55.7	73.9	18.2	
Hori	9880.000	PK	42.8	39.0	8.2	34.7	-	55.3	73.9	18.6	Floor Noise
Hori	2483.500	AV	38.4	29.3	3.5	34.9	1.5	37.8	53.9	16.1	*1)
Hori	4940.000	AV	46.3	32.9	5.9	34.2	1.5	52.4	53.9	1.5	
Hori	7410.000	AV	37.6	36.8	7.1	34.2	1.5	48.8	53.9	5.1	
Hori	9880.000	AV	33.6	39.0	8.2	34.7	-	46.1	53.9	7.8	Floor Noise
Vert	31.800	QP	29.8	16.7	6.8	28.5	-	24.8	40.0	15.2	
Vert	45.981	QP	33.9	12.1	6.9	28.5	-	24.4	40.0	15.6	
Vert	53.477	QP	41.4	9.5	7.0	28.5	-	29.4	40.0	10.6	
Vert	80.421	QP	52.7	6.9	7.3	28.4	-	38.5	40.0	1.5	
Vert	92.066	QP	46.8	8.8	7.4	28.3	-	34.7	43.5	8.8	
Vert	351.998	QP	28.5	16.2	9.2	27.9	-	26.0	46.0	20.0	
Vert	2483.500	PK	55.7	29.3	3.5	34.9	-	53.6	73.9	20.3	
Vert	4940.000	PK	49.3	32.9	5.9	34.2	-	53.9	73.9	20.0	
Vert	7410.000	PK	45.6	36.8	7.1	34.2	-	55.3	73.9	18.6	
Vert	9880.000	PK	41.9	39.0	8.2	34.7	-	54.4	73.9	19.5	Floor Noise
Vert	2483.500	AV	36.3	29.3	3.5	34.9	1.5	35.7	53.9	18.2	*1)
Vert	4940.000	AV	43.1	32.9	5.9	34.2	1.5	49.2	53.9	4.7	
Vert	7410.000	AV	37.1	36.8	7.1	34.2	1.5	48.3	53.9	5.6	
Vert	9880.000	AV	33.8	39.0	8.2	34.7	-	46.3	53.9	7.6	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB

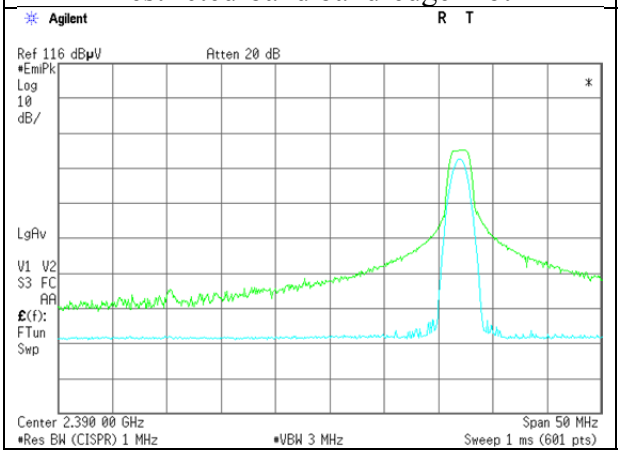
*1) Not Out of Band emission (Leakage Power)

Band Edge confirmation

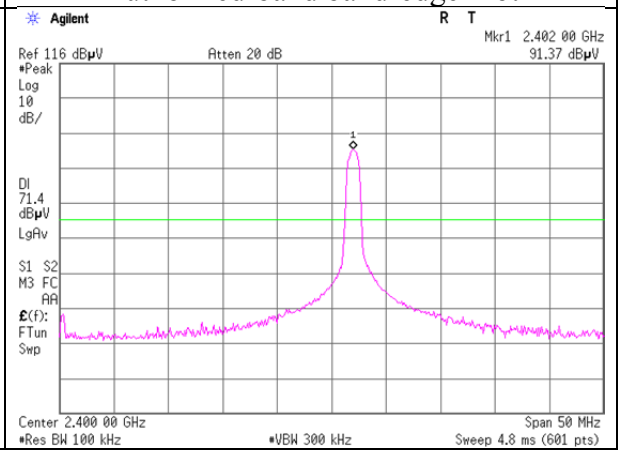
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10767588H
Date	July 3, 2015
Temperature / Humidity	20 deg. C / 57 % RH
Engineer	Takafumi Noguchi
Mode	Tx 2402 MHz

Horizontal

Restricted-band band-edge Plot

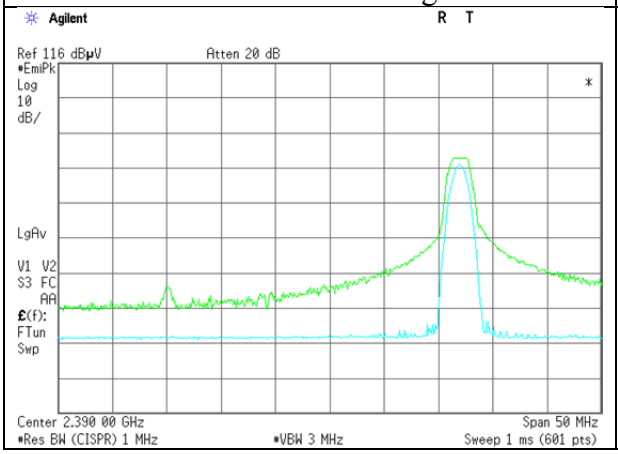


Authorized-band band-edge Plot

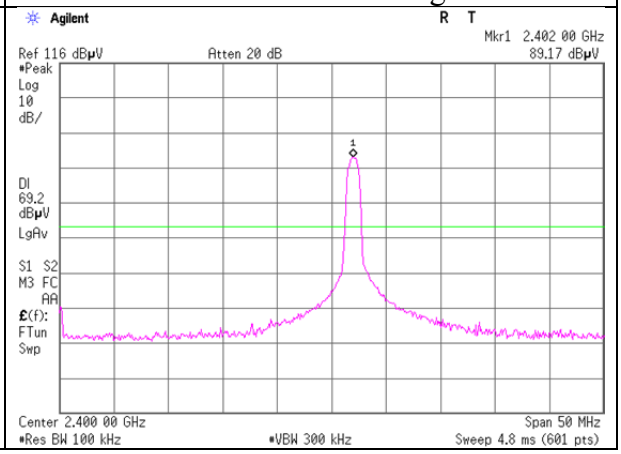


Vertical

Restricted-band band-edge Plot



Authorized-band band-edge Plot

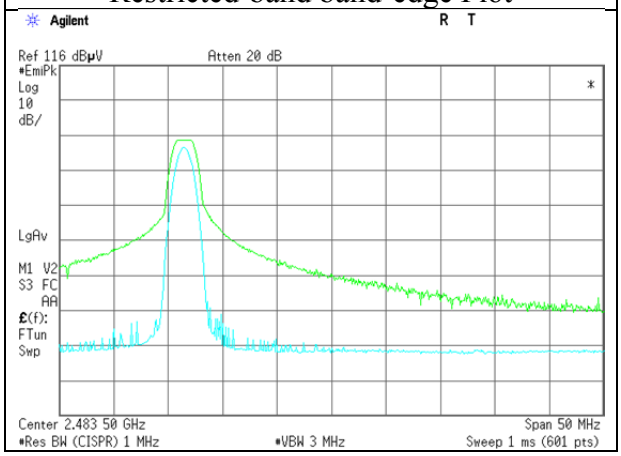


Band Edge confirmation

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10767588H
Date	July 3, 2015
Temperature / Humidity	20 deg. C / 57 % RH
Engineer	Takafumi Noguchi
Mode	Tx 2470 MHz

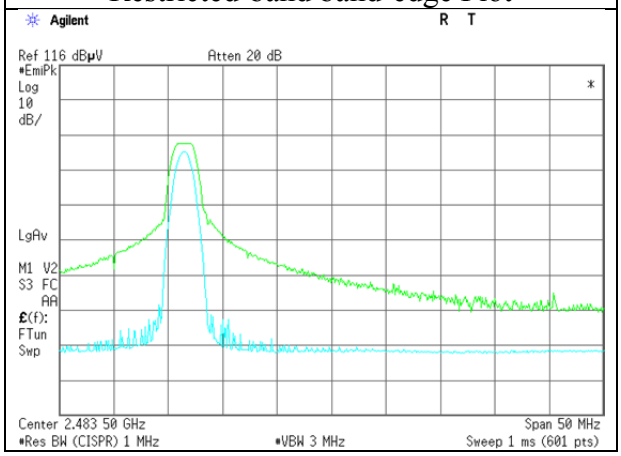
Horizontal

Restricted-band band-edge Plot



Vertical

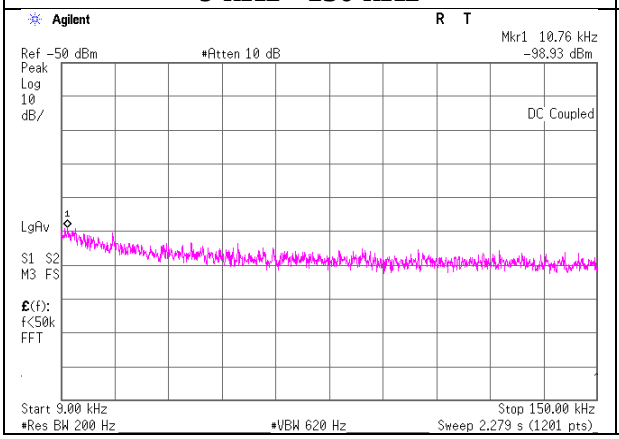
Restricted-band band-edge Plot



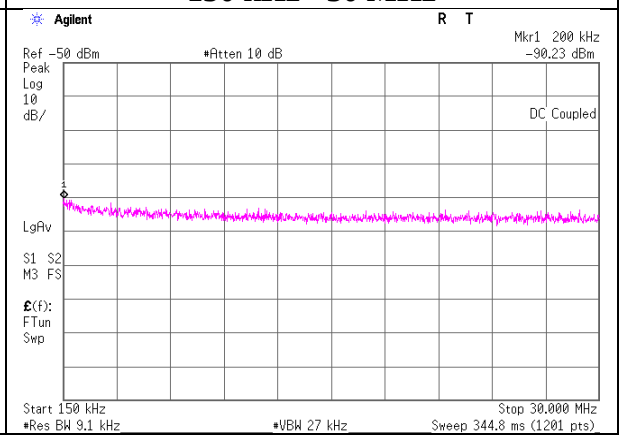
Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx 2402 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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
10.76	-98.9	0.12	9.8	-5.9	1	-94.9	300	6.0	-33.6	46.9	80.5	
200.00	-90.2	0.12	9.8	-5.9	1	-86.2	300	6.0	-24.9	21.5	46.4	

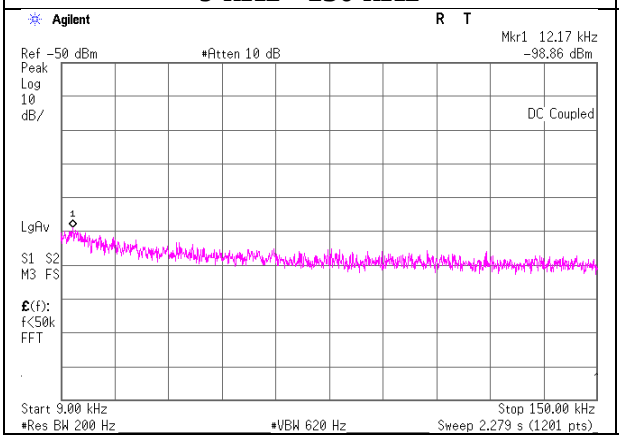
E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

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

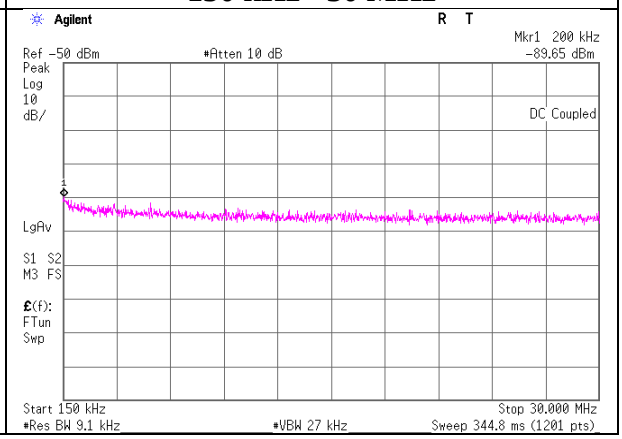
Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx 2436 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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	-98.9	0.12	9.8	-5.9	1	-94.8	300	6.0	-33.5	45.8	79.3	
200.00	-89.7	0.12	9.8	-5.9	1	-85.6	300	6.0	-24.3	21.5	45.8	

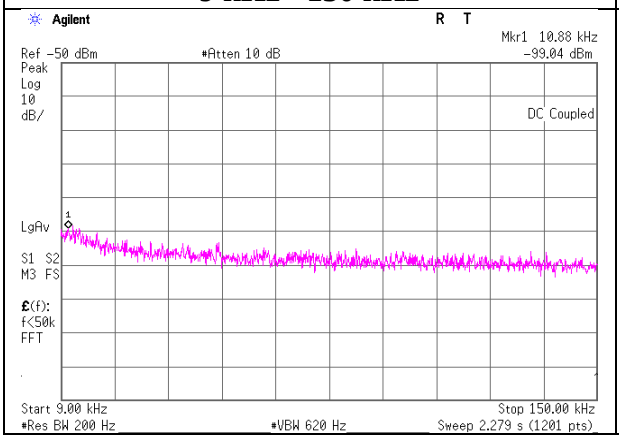
E = EIRP - 20 log (D) + Ground bounce + 104.8 [dBuV/m]

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

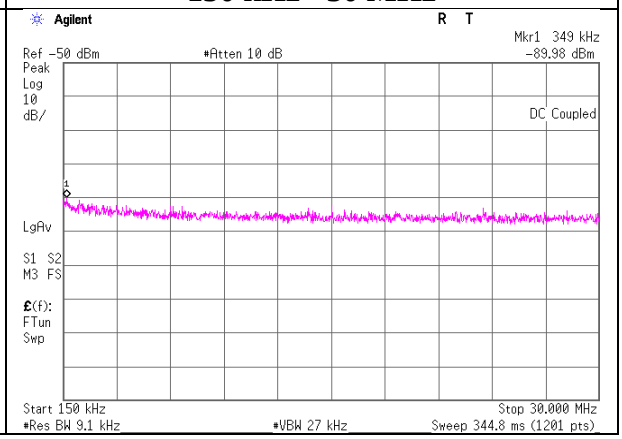
Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx 2470 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator 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
10.88	-99.0	0.12	9.8	-5.9	1	-95.0	300	6.0	-33.7	46.8	80.5	
349.00	-90.0	0.12	9.8	-5.9	1	-85.9	300	6.0	-24.7	16.7	41.4	

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

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

Power Density

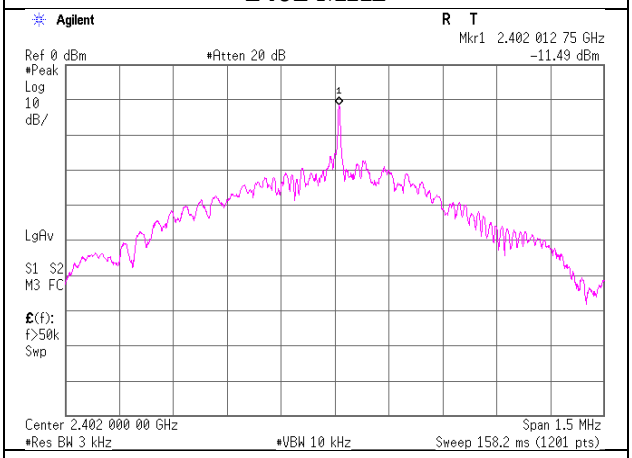
Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-11.49	1.90	10.02	0.43	8.00	7.57
2436.00	-12.19	1.92	10.02	-0.25	8.00	8.25
2470.00	-13.13	1.94	10.02	-1.17	8.00	9.17

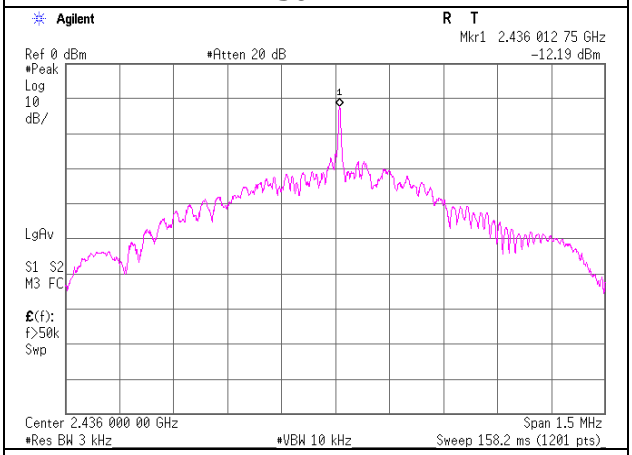
Sample Calculation:
Result = Reading + Cable Loss + Attenuator

Power Density

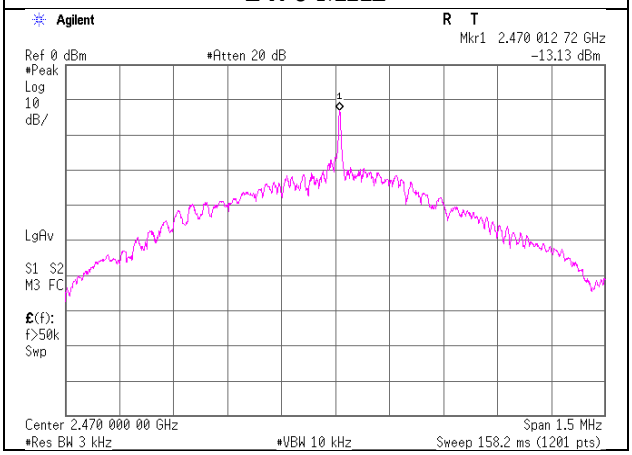
2402 MHz



2436 MHz



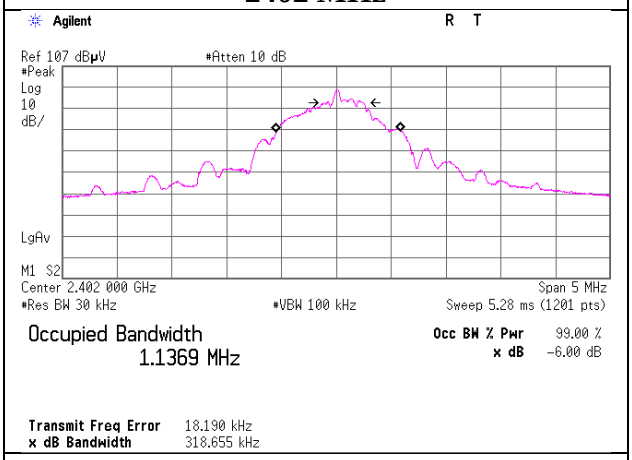
2470 MHz



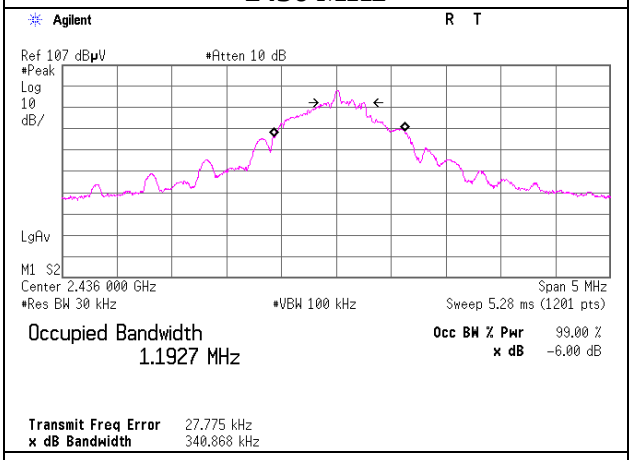
99%Occupied Bandwidth

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10767588H
Date	May 27, 2015
Temperature / Humidity	23 deg. C / 55 % RH
Engineer	Koji Yamamoto
Mode	Tx

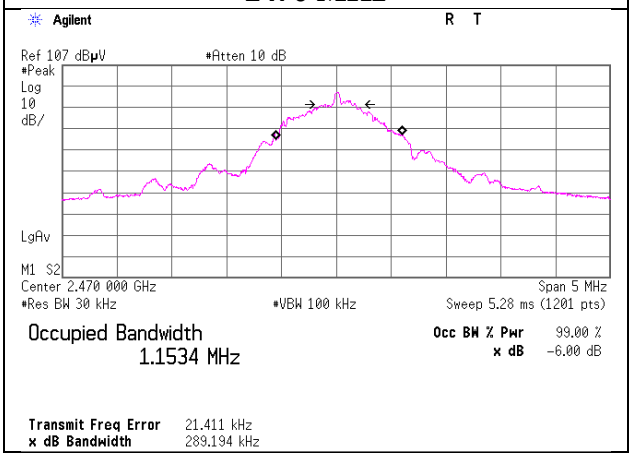
2402 MHz



2436 MHz



2470 MHz



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOS-24	Thermo-Hygrometer	Custom	CTH-201	0005	AT	2015/01/13 * 12
MRENT-116	Spectrum Analyzer	Agilent	E4440A	MY46187620	AT	
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2014/10/06 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2014/10/06 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2014/11/19 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2015/03/18 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	AT	2014/12/02 * 12
MCC-45	Microwave Cable	Murata	MXGS83RK3000	-	AT	2014/07/31 * 12
MCC-173	Microwave Cable	Junkosha	MWX221	1409S496	AT	2015/03/04 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2014/09/24 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2015/07/01 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2015/01/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE/CE	2015/06/08 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2014/10/18 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2014/10/18 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2015/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2014/11/11 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2014/09/26 * 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
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2015/02/05 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE/CE	2015/05/18 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(EUT)	2014/07/10 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2015/02/06 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 12

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

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