

TEST REPORT

Report number: Z071C-13079

Issue Date: March 22, 2013

The device, as described herewith, was tested pursuant to applicable test procedure indicated below and complies with the requirements of;

FCC Part15 Subpart C

The test results are traceable to the international or national standards.

Applicant	:	MITSUMI ELECTRIC CO., LTD.
Equipment under test (EUT)	:	Bluetooth LE Module
Model Number	:	WML-C69
Serial Number	:	19, 23
FCC ID	:	POO-WC69


Test procedure	:	ANSI C63.4-2003
Date of test	:	March 11, 12, 15, 2013
Test place	:	ZACTA Technology Corporation Yonezawa Testing Center 4149-7 Hachimanpara 5-chome Yonezawa-shi Yamagata 992-1128 Japan Phone: +81-238-28-2880 Fax: +81-238-28-2888
Test results	:	Complied

Zacta Technology Corporation certifies that no party to the application is subject to a denial of federal benefits that include FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

The results in this report are applicable only to the samples tested.
This report shall not be re-produced except in full without the written approval of ZACTA Technology Corporation.

This test report must not be used by client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Tested by:


Hiroaki Suzuki

Authorized by:


Eiji Akiba

Deputy General Manager of Technical Division



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1. Summary of Test

1.1 Purpose of test

It is the original test in order to verify conformance to standards listed in section 1.2.

1.2 Standards

CFR47 FCC Part 15 Subpart C

1.3 Summary of test results

Table-A presents the list of the measurement items for intentional radiators operated 2.4GHz band devices under FCC Part 15 Subpart C.

Table-A: List of the measurements

Test Items Section	Test Items	Condition	Result
15.247(a)(2)	6dB Bandwidth	Conducted	Pass
15.247(b)(3)	Maximum Peak Output Power	Conducted	Pass
15.247(d)	Band Edge Compliance of RF Conducted Emissions	Conducted	Pass
15.247(d) 15.205 15.209	Restricted Bands of Operation	Radiated	Pass
15.247(d) 15.205 15.209	Spurious Emissions	Conducted Radiated	Pass
15.247(e)	Transmitter Power Spectral Density	Conducted	Pass
15.207	AC Power Line Conducted Emissions 150kHz – 30MHz	Conducted	Pass

1.4 Deviation from the standard

None

1.5 Modification to the EUT by laboratory

None

2. Equipment description

2.1 General Description of equipment

This device is a Bluetooth LE Module which operates in 2.4GHz band.

2.2 EUT information

Applicant	: MITSUMI ELECTRIC CO., LTD. 2-11-2, TSURUMAKI, TAMA-SHI, TOKYO, JAPAN 206-8567 Phone: +81-42-310-4823 Fax: +81-42-310-5582
Equipment under test (EUT)	: Bluetooth LE Module
Trade name	: MITSUMI
Model number	: WML-C69
Serial number	: 19 (Antenna port Conducted Test) 23 (Radiated Emission, Conducted Emission Test)
EUT condition	: Pre-production
Max. frequency	: 16MHz
Power ratings	: DC 3.0V
Size	: (W) 10.8 x (H) 19.9 x (D) 2.3 mm
Environment	: Indoor and Outdoor use
Thermal limitation	: -30°C to 85°C
Operating mode	: Tx mode, Rx mode
Variation of model(s)	: N/A
[RF Specification]	
Protocol	: Bluetooth 4.0 LE
Frequency Range	: 2402MHz - 2480MHz
Number of FR Channels	: 40 Channels
Modulation Method/Data rate	: GFSK (1Mbps)
Channel Separation	: 2MHz
Output Power	: 8.356mW
Antenna (Rx and Tx)	: PCB antenna
Antenna gain	: -0.2dBi
RF type	: Transceiver
Intended use	: Data transmission

2.3 Operating channels and frequencies

Channel	Frequency [MHz]	Channel	Frequency [MHz]
0	2402	21	2444
1	2404	22	2446
2	2406	23	2448
3	2408	24	2450
4	2410	25	2452
5	2412	26	2454
6	2414	27	2456
7	2416	28	2458
8	2418	29	2460
9	2420	30	2462
10	2422	31	2464
11	2424	32	2466
12	2426	33	2468
13	2428	34	2470
14	2430	35	2472
15	2432	36	2474
16	2434	37	2476
17	2436	38	2478
18	2438	39	2480
19	2440		
20	2442		

2.4 Description of Test modes

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Tested Channel	Frequency (MHz)
Low	2402
Middle	2440
High	2480

The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

Following channel(s) was (were) selected for the final test as listed below.

Tested Channel	Modulation Type	Data Rate
Low, Middle, High	GFSK	1Mbps

The field strength of spurious emission was measured at each position of all three axis X, Y and Z to compare the level, and the maximum noise.

The worst emission was found in X axis and the worst case recorded.

2.5 Operating mode

Software : uEnergy_Tools-2.1.0.163

【Tx mode】

i) RF test program set up

ii) Select a PACKET TRANSMIT

Operating frequency: Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

iii) Start test mode

【Rx mode】

i) RF test program set up

ii) Select a RECEIVE

Operating frequency: Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

iii) Start test mode

3. Configuration information

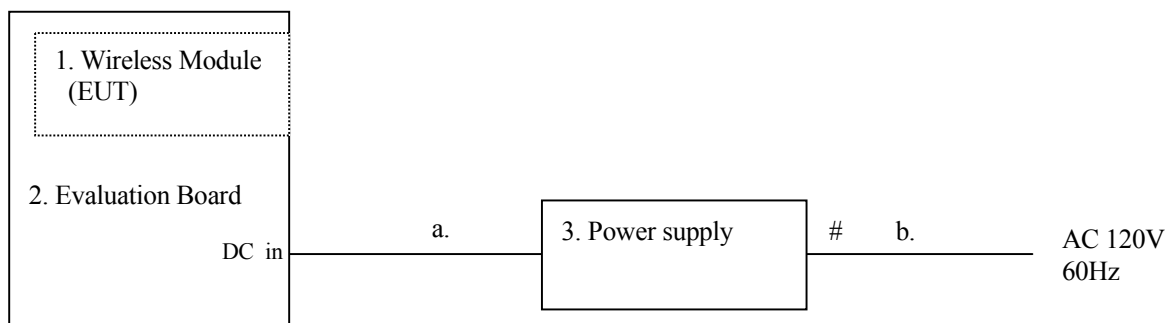
3.1 Peripheral(s) used

No.	Equipment	Company	Model No.	Serial No.	FCC ID/DoC	Comment
1	Bluetooth LE Module	MITSUMI	WML-C69	19 , 23	FCC ID:POO-WC69	EUT
2	Evaluation Board	MITSUMI	N/A	N/A	-	Test jig
3	Power supply	KIKUSUI	PAB	N/A	-	-

3.2 Cable(s) information

No.	Cable	Length [m]	Shield	Connector	Comment
a	DC cable	1.5	No	-	-
b	AC power cord for Power supply	2.0	No	Plastic	-

3.3 System configuration



#: Un-detachable cable

Note 1: Numbers assigned to equipment or cables on this diagram are corresponded to the list in “3.1 EUT and Peripheral(s) used”, “3.2 Cable(s) information”.

4. Test Type and Results

4.1 6dB Bandwidth

4.1.1 Test Procedure [FCC 15.247(a)(2)]

The bandwidth at 6 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=100kHz, VBW=300kHz, Span=3MHz, Sweep=auto

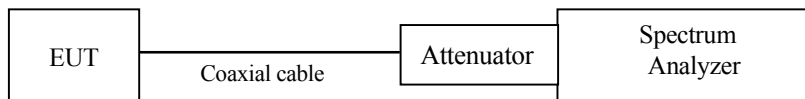
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

4.1.2 Measurement Setup



4.1.3 Limit of Bandwidth at 6 dB below

500kHz or more

4.1.4 Measurement Result

Channel	Center Frequency [MHz]	6dB Bandwidth [MHz]
Low	2402	0.680
Middle	2440	0.689
High	2480	0.694

4.1.5 Trace Data

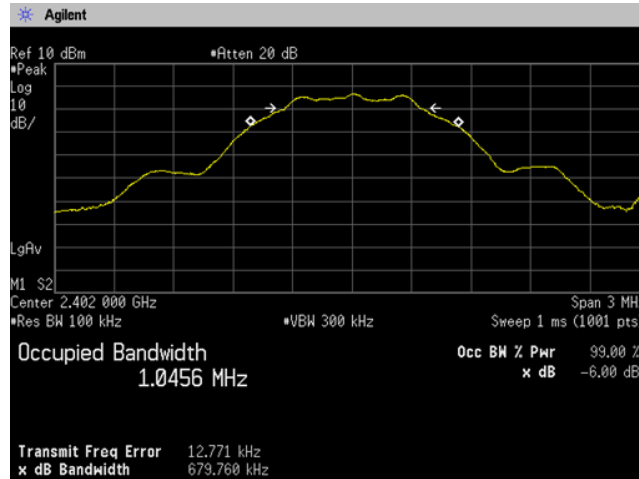
Test Personnel:

Tested by: Hiroaki Suzuki

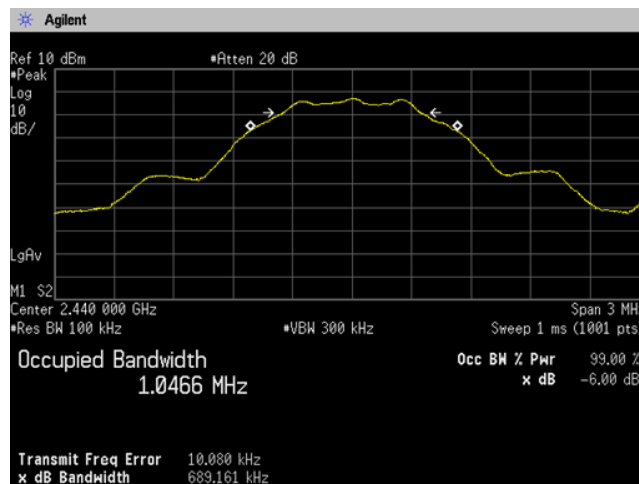
Date : Mar. 11, 2013
 Temperature : 20.0 [°C]
 Humidity : 45.0 [%]
 Test place : Shielded room

6dB Bandwidth

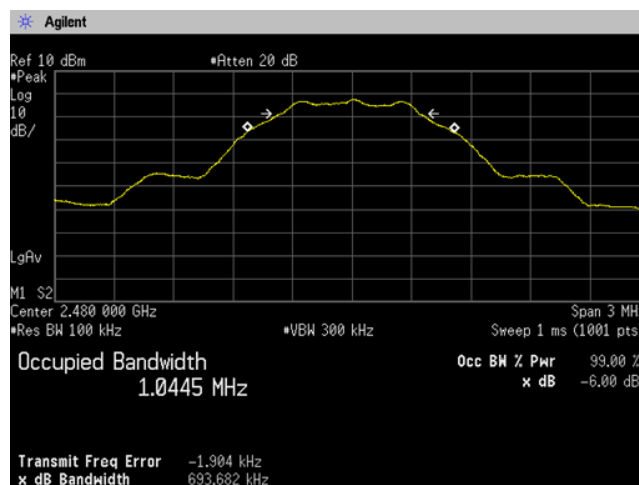
Channel Low: 2402MHz



Channel Middle: 2440MHz



Channel High: 2480MHz



4.2 Maximum Peak Output Power – Conducted -

4.2.1 Test Procedure [FCC 15.247(b)(3)]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=1MHz, VBW=3MHz, Span=5MHz, Sweep=auto

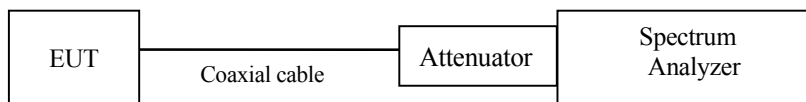
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

4.4.2 Measurement Setup



4.2.3 Limit of Maximum Peak Output Power

1W (1000mW) or less

4.2.4 Measurement Result

[DC 2.55V]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2402.00	-2.71	10.37	7.66	5.834	≤ 1000	PASS
Middle	2440.00	-2.32	10.37	8.05	6.383	≤ 1000	PASS
High	2480.00	-1.95	10.37	8.42	6.950	≤ 1000	PASS

[DC 3V]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2402	-2.20	10.37	8.17	6.561	≤ 1000	PASS
Middle	2440	-1.60	10.37	8.77	7.534	≤ 1000	PASS
High	2480	-1.15	10.37	9.22	8.356	≤ 1000	PASS

[DC 3.45V]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2402.00	-2.76	10.37	7.61	5.768	≤ 1000	PASS
Middle	2440.00	-2.32	10.37	8.05	6.383	≤ 1000	PASS
High	2480.00	-1.93	10.37	8.44	6.982	≤ 1000	PASS

Calculation:

$$\text{Reading (dBm)} + \text{Factor (dB)} = \text{Level (dBm)}$$

$$10 \log P = \text{Level (dBm)}$$

$$P = 10^{(\text{Maximum Peak Output Power (dBm)} / 10)} \text{ (mW)}$$

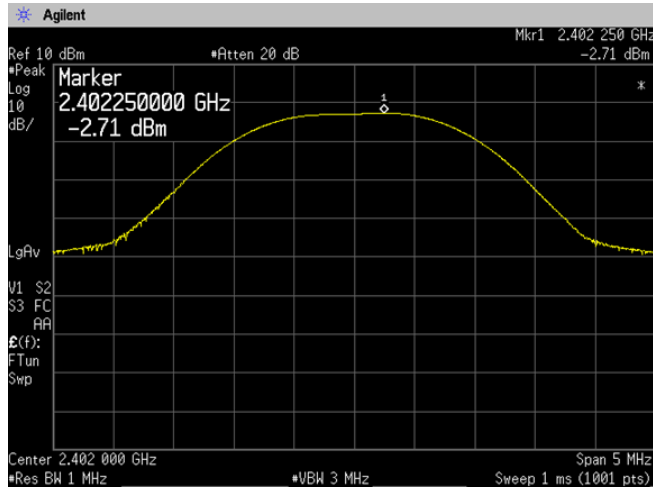
4.2.5 Trace Data

Test Personnel:

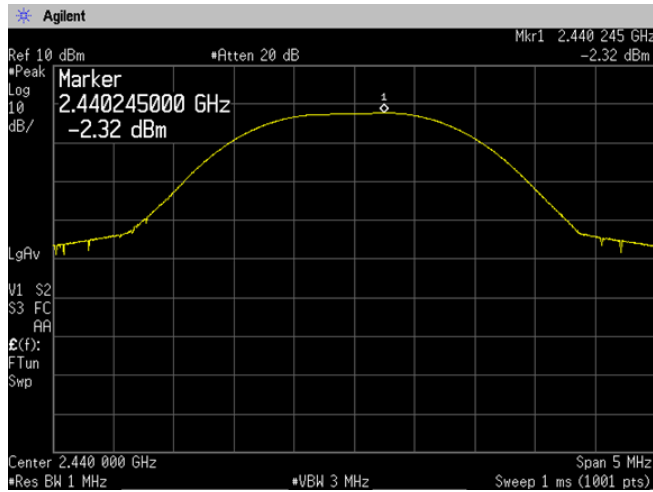
Tested by: Hiroaki Suzuki

Date : Mar. 11, 2013
Temperature : 20.0 [°C]
Humidity : 45.0 [%]
Test place : Shielded room

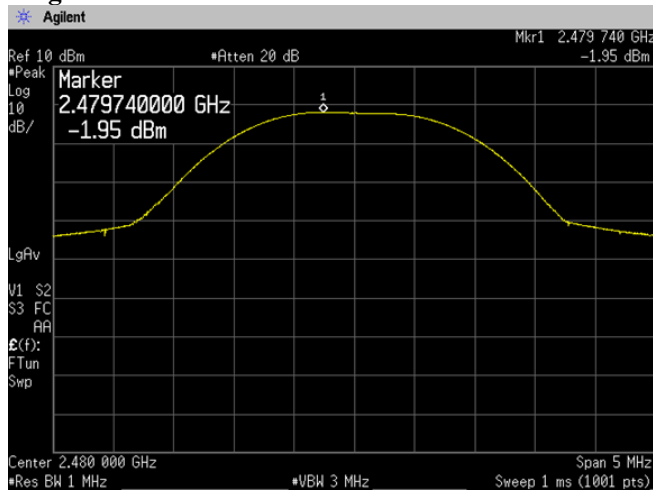
Maximum Peak Output Power - Conducted -
[DC 2.55V] Channel Low: 2402MHz



Channel Middle: 2440MHz

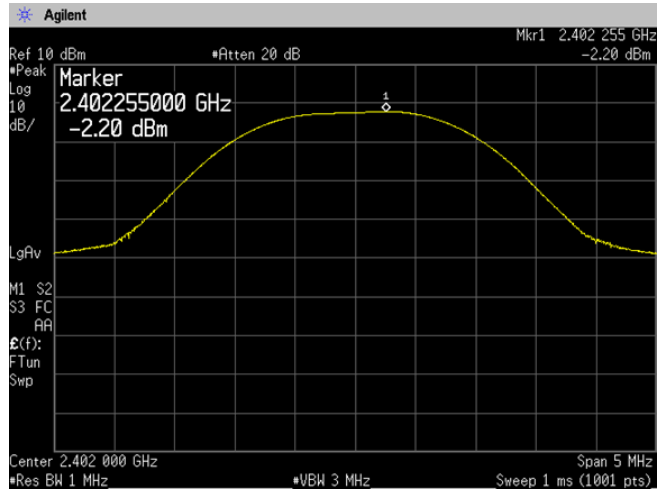


Channel High: 2480MHz

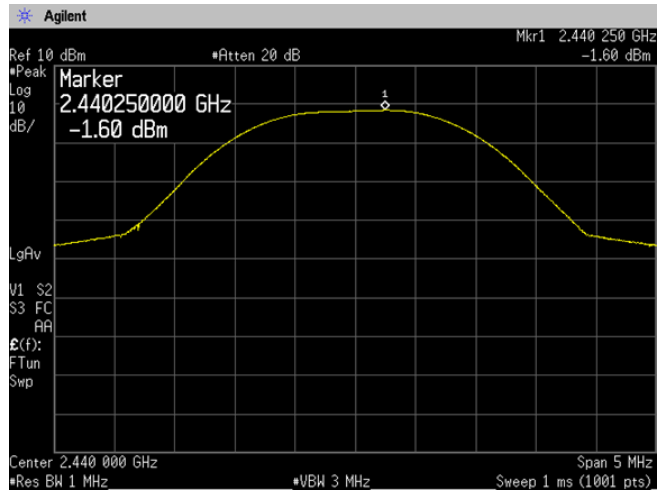


[DC 3V]

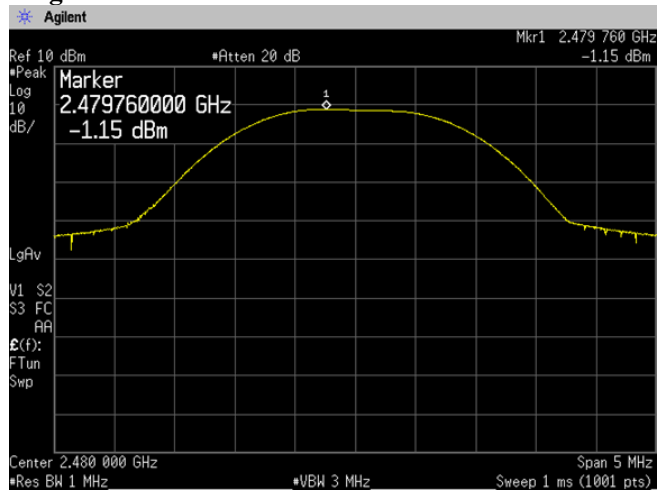
Channel Low: 2402MHz



Channel Middle: 2440MHz

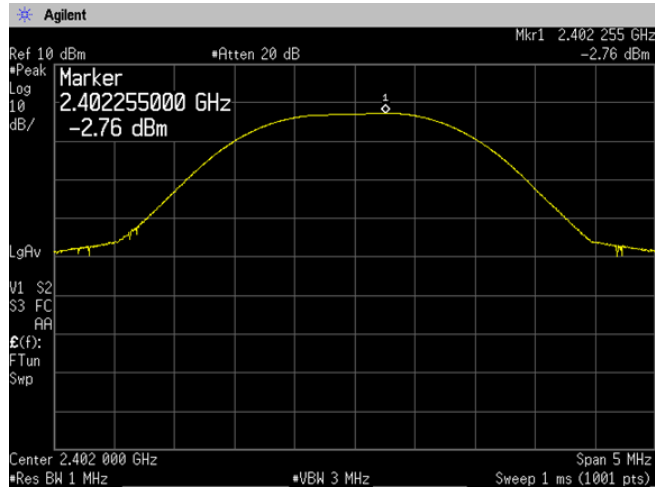


Channel High: 2480MHz

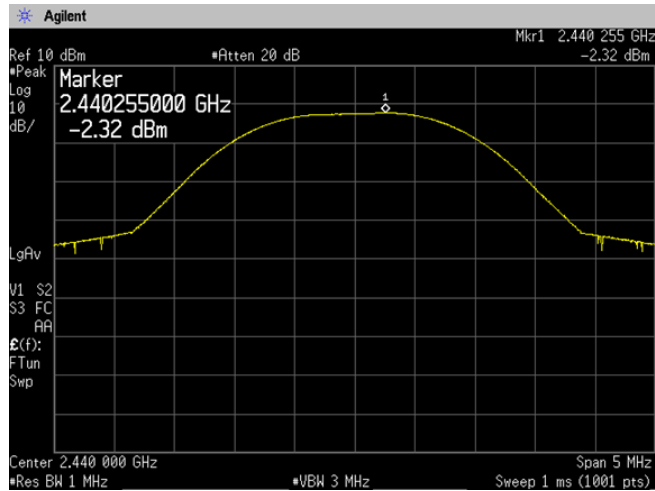


[DC 3.45V]

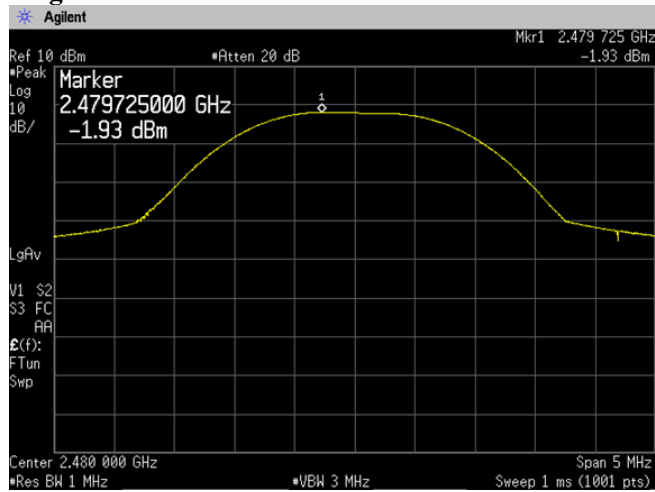
Channel Low: 2402MHz



Channel Middle: 2440MHz



Channel High: 2480MHz



4.3 Band Edge Compliance of RF Conducted Emissions

4.3.1 Test Procedure [FCC 15.247(d)]

The Band Edge is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=100kHz, VBW=100kHz, Span=Arbitrary setting, Sweep=Auto

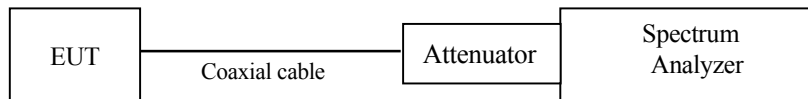
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

4.3.2 Measurement Setup



4.3.3 Limit of Band Edge Compliance of RF Conducted Emissions

In any 100kHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

4.3.4 Measurement Results

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2402	-2.42	2370.07	-56.05	53.63	At least 20dB below from peak of RF	PASS
High	2480	-1.40	2495.99	-58.21	56.81	At least 20dB below from peak of RF	PASS

4.3.5 Trace Data

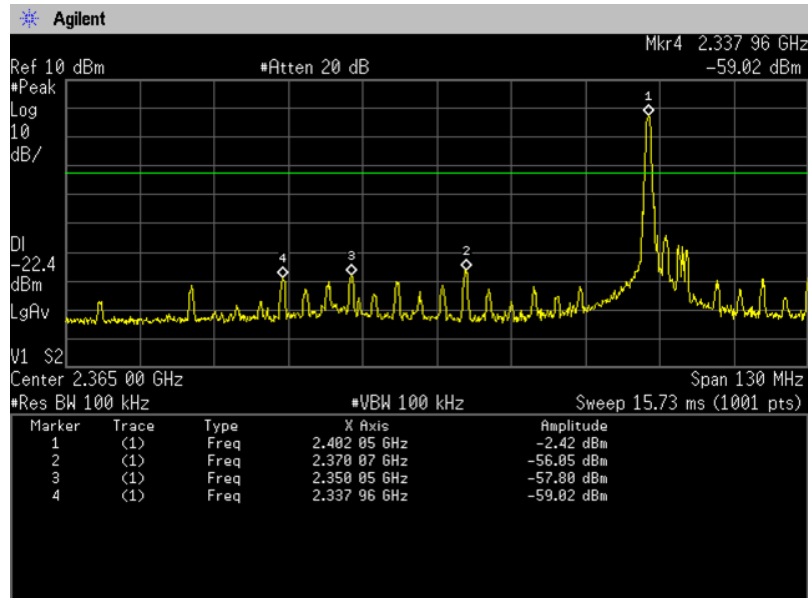
Test Personnel:

Tested by: Hiroaki Suzuki

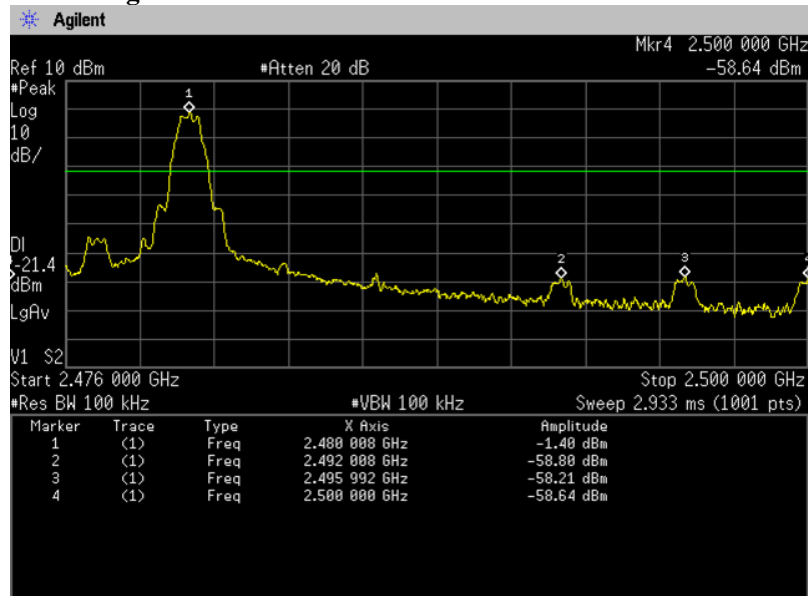
Date : Mar. 11, 2013
 Temperature : 20.0 [°C]
 Humidity : 45.0 [%]
 Test place : Shielded room

Band Edge Compliance of RF Conducted Emissions

Channel Low: 2402MHz



Channel High: 2480MHz



4.4 Spurious Emissions - Conducted -

4.4.1 Test Procedure [FCC 15.247(d)]

The spurious emissions (Conducted) are measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=100kHz, VBW=300kHz, Span=Arbitrary setting, Sweep=Auto

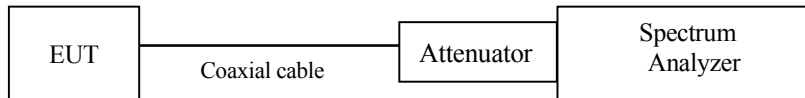
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

4.4.2 Measurement Setup



4.4.3 Limit of Spurious Emissions - Conducted -

In any 100KHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power.

4.4.4 Measurement Results

Channel	Frequency [MHz]	Limit [dBm]	Results Chart	Result
Low	2402	At least 20dB below from peak of RF.	See the Trace Data	PASS
Middle	2440	At least 20dB below from peak of RF.	See the Trace Data	PASS
High	2480	At least 20dB below from peak of RF.	See the Trace Data	PASS

4.4.5 Trace Data

Test Personnel:

Tested by: Hiroki Suzuki

Date : Mar. 11, 2013

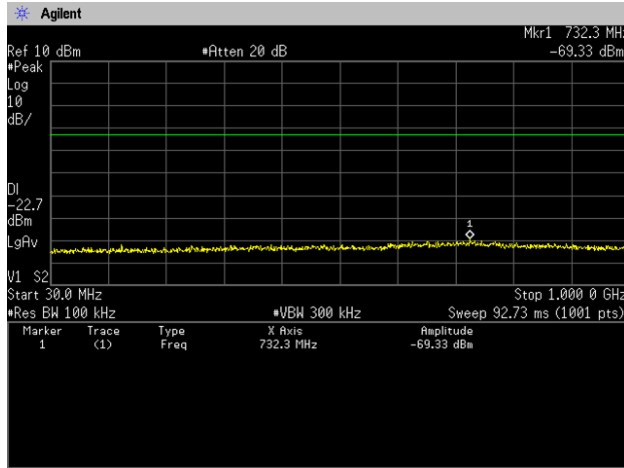
Temperature : 20.0 [°C]

Humidity : 45.0 [%]

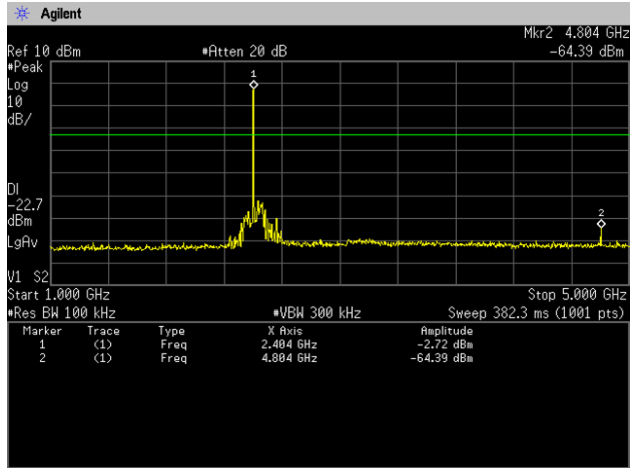
Test place : Shielded room

Spurious Emissions - Conducted

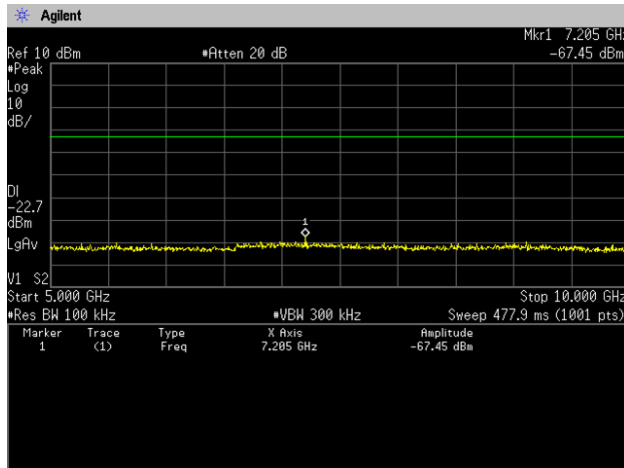
**Channel Low: 2402MHz
30MHz-1GHz**



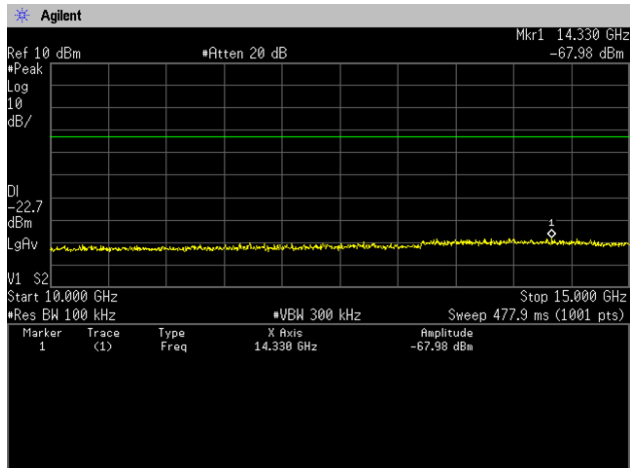
1GHz-5GHz



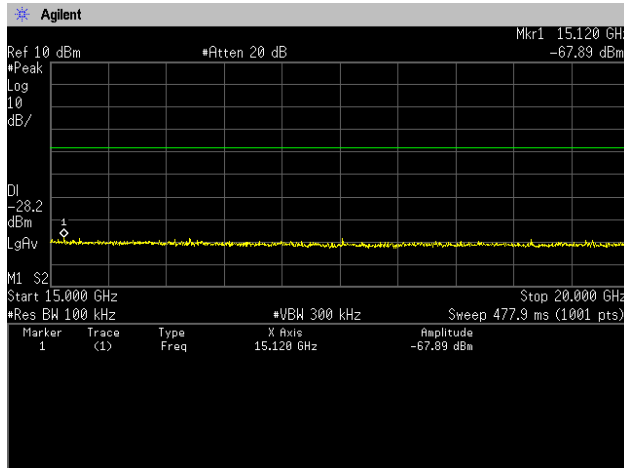
5GHz-10GHz



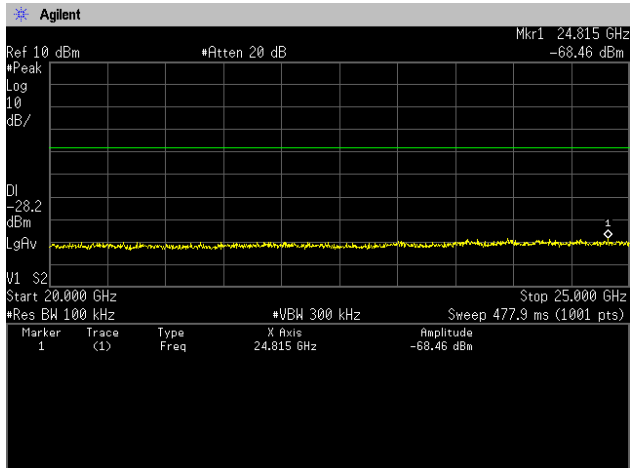
10GHz-15GHz



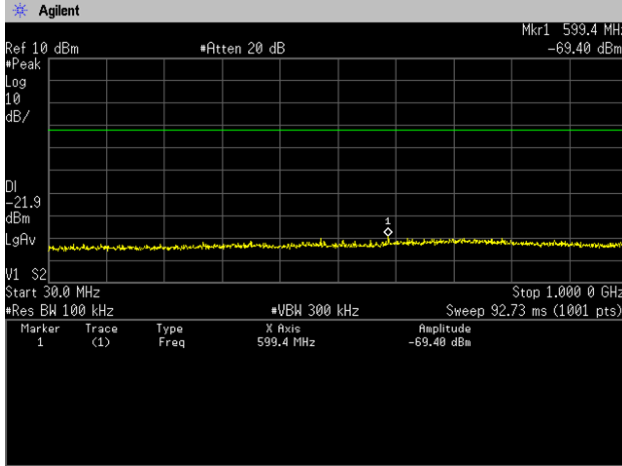
15GHz-20GHz



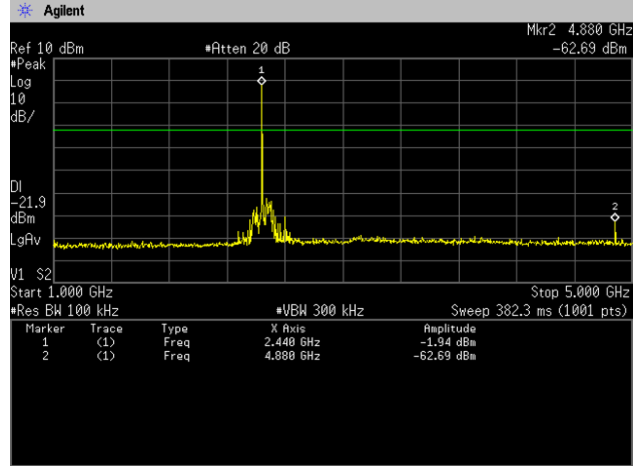
20GHz-25GHz



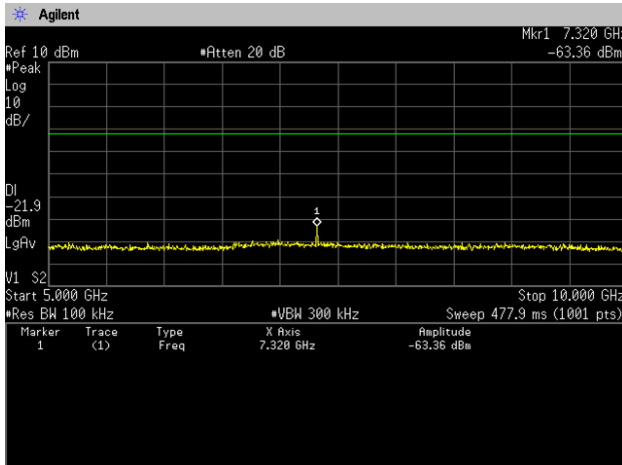
**Channel Middle: 2440MHz
30MHz-1GHz**



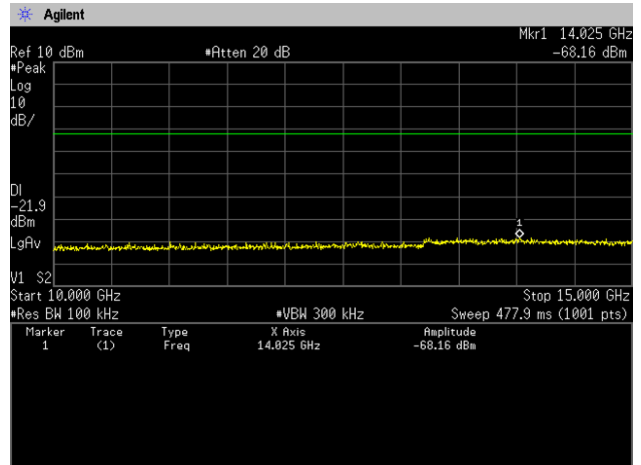
1GHz-5GHz



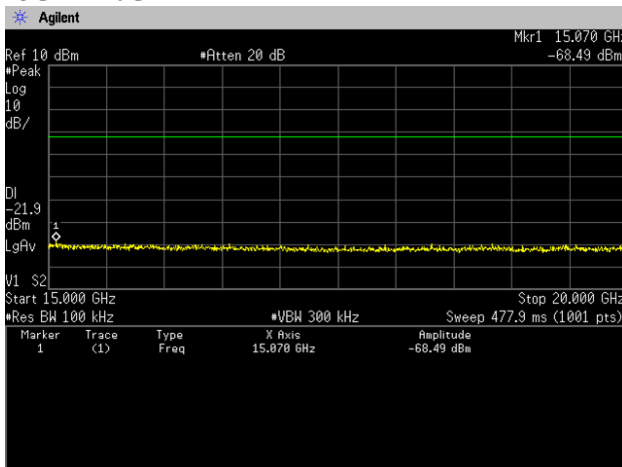
5GHz -10GHz



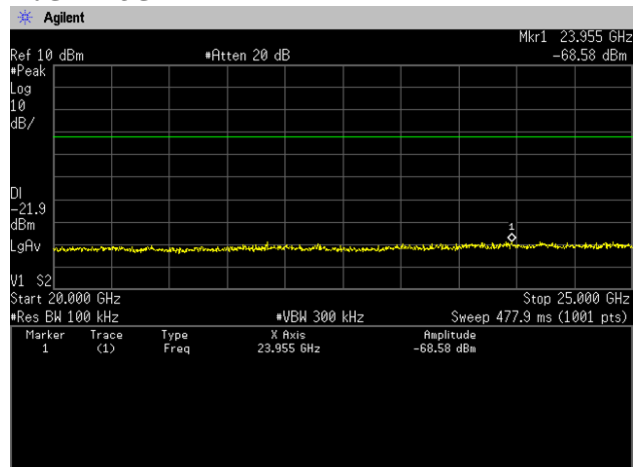
10GHz -15GHz



15GHz -20GHz

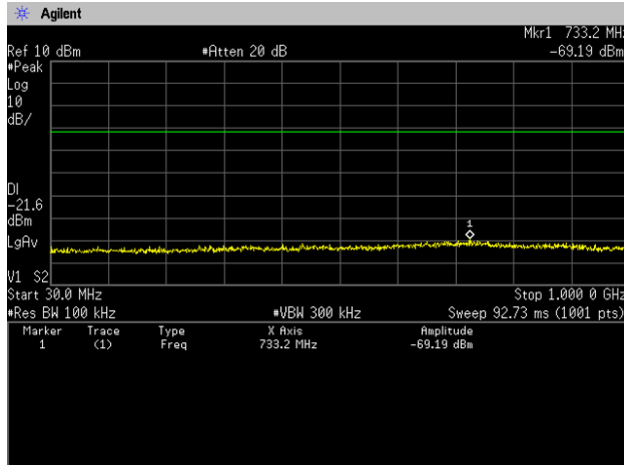


20GHz-25GHz

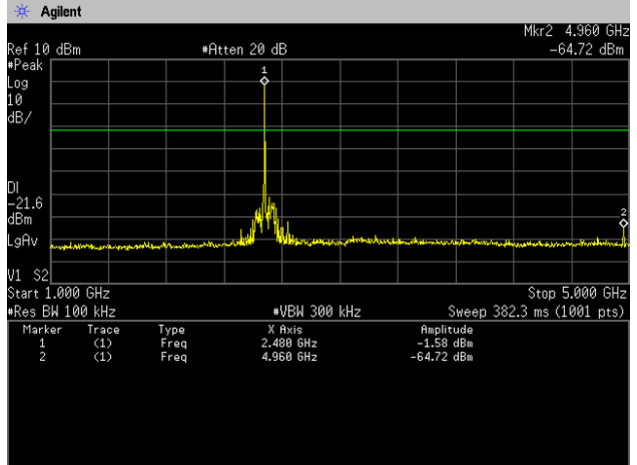


Spurious Emissions - Conducted

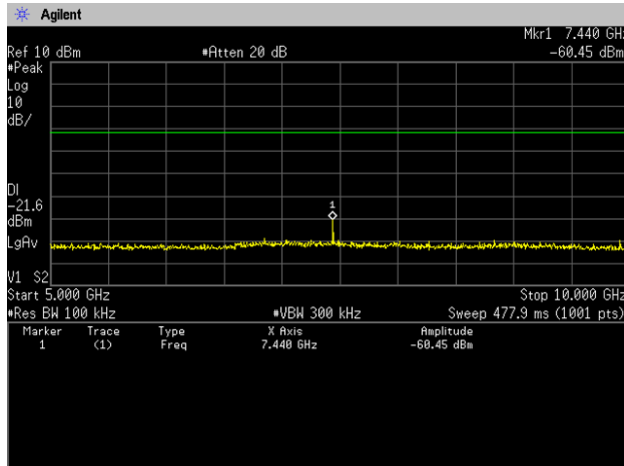
**Channel High: 2480MHz
30MHz-1GHz**



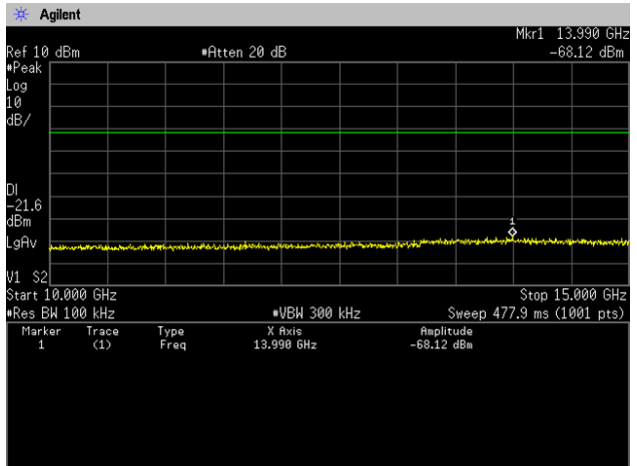
1GHz-5GHz



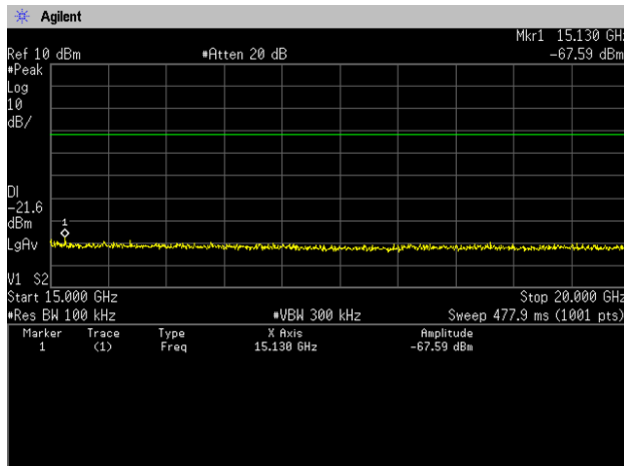
5GHz -10GHz



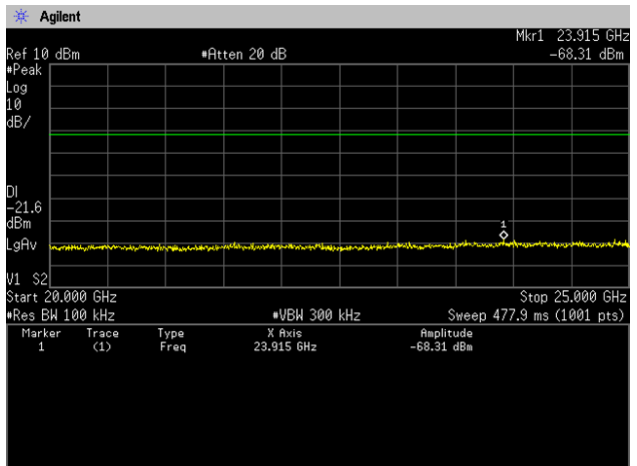
10GHz -15GHz



15GHz -20GHz



20GHz-25GHz



4.5 Restricted Band of Operation

4.5.1 Test Procedure [FCC 15.205, 15.209, 15.247(d)]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- Peak: RBW=1MHz, VBW=1MHz, Span=Arbitrary setting, Sweep=auto
- Average: RBW=1MHz, VBW=10kHz, Span= Arbitrary setting , Sweep=auto

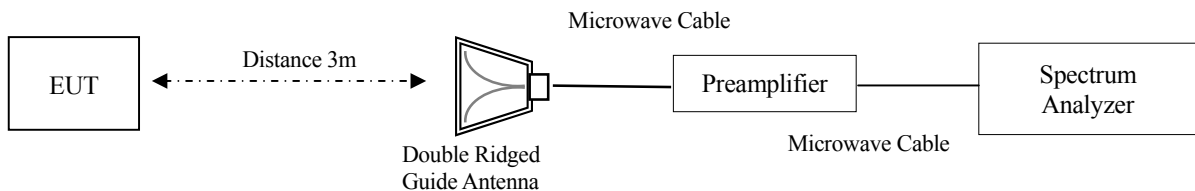
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

4.5.2 Measurement Setup



4.5.3 Limit of Restricted Band of Operation

Emission at the boundary of the restricted band provided by 15.205 shall be lower than 15.209 limit.

4.5.4 Measurement Result

Channel	Frequency[MHz]	Results Chart	Result
Low	2402	See the Trace Data	PASS
High	2480	See the Trace Data	PASS

4.5.5 Trace Data

Test Personnel:

Tested by: Hiroaki Suzuki

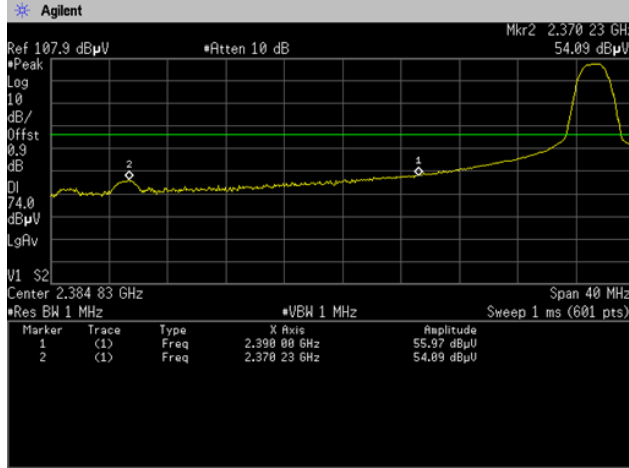
Date : Mar. 12, 2013
 Temperature : 19.0 [°C]
 Humidity : 22.8 [%]
 Test place : 3m Semi-anechoic chamber

Restricted Band of Operation

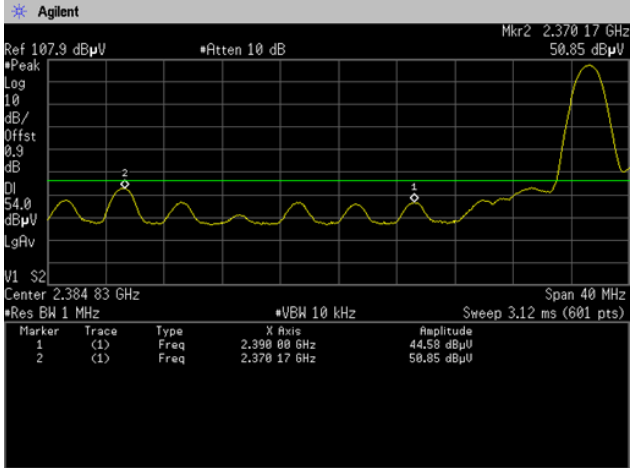
Channel Low: 2402MHz

-Horizontal-

Peak

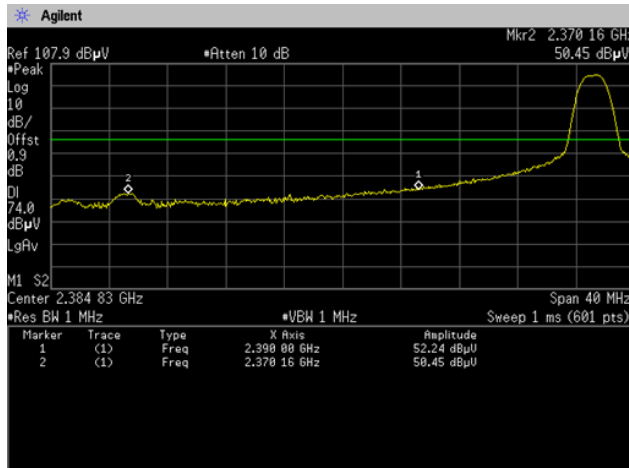


Average

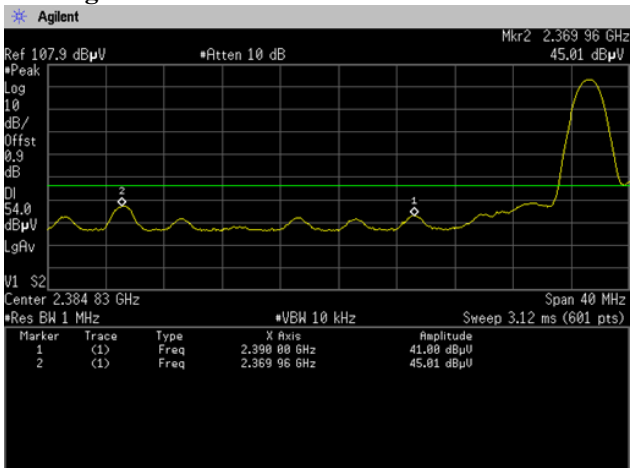


-Vertical-

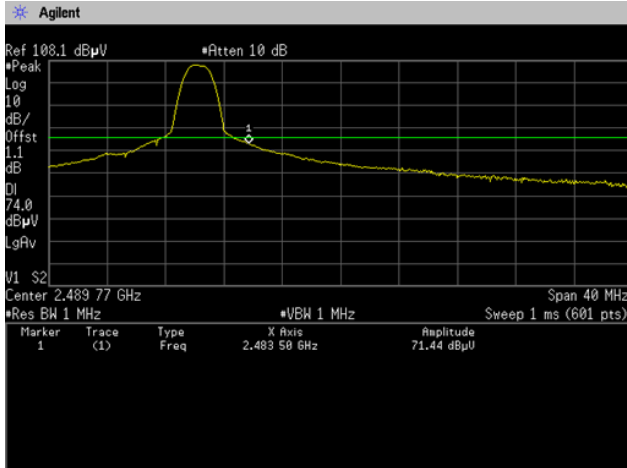
Peak



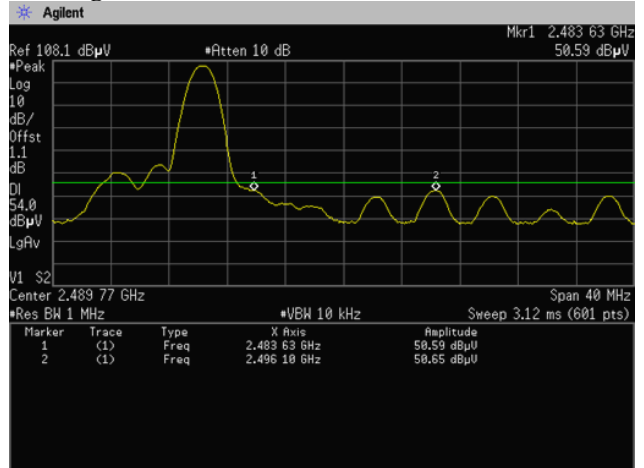
Average



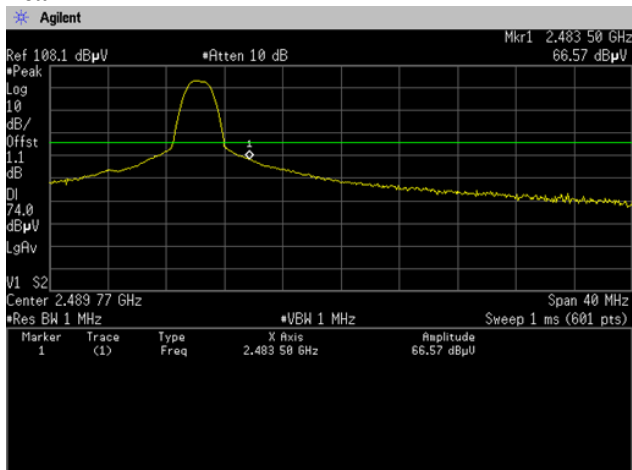
Channel Low: 2480MHz
-Horizontal-
Peak



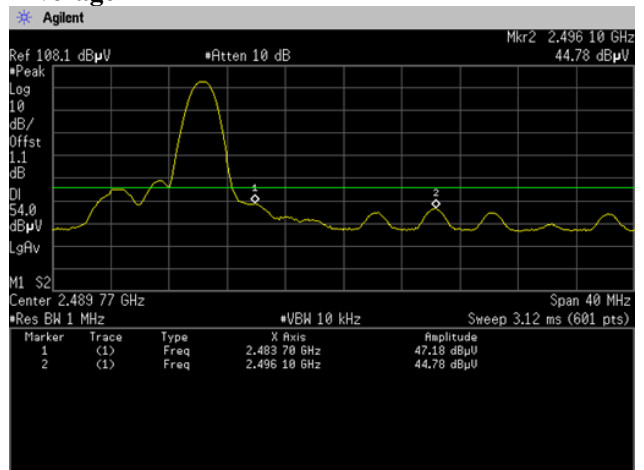
Average



-Vertical-
Peak



Average



4.6 Spurious Emissions - Radiated - (9kHz - 25GHz)

4.6.1 Test Procedure [FCC 15.205/209/247(d)]

Radiated emission measurements are performed at 3m distance with the broadband antenna (Loop antenna, TRILOG antenna, and double-ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1 to 4 meters and stopped at height producing the maximum emission. As for the Loop antenna, it is positioned with its plane vertical, and the center of the Loop is 1.0meter above the ground plane. Frequency Range: 9kHz –1GHz is scanned and investigated with the test receiver, and above 1GHz, with the spectrum analyzer. The detector function of the test receiver is set to CISPR Quasi-peak mode and the bandwidth is set to 120kHz. Peak and average detectors are used for measurements above 1GHz. The bandwidth of the spectrum analyzer is set to 1MHz.

The EUT and support equipment are placed on a 1meter x 2meter surface, 0.8meter height FRP table. The turntable is rotated by 360 degrees and stopped at azimuth of producing the maximum emission.

Interconnecting cables, which hanging closer than 40cm to the horizontal metal ground plane are bundled its excess in center. The highest fundamental frequency generated in the EUT is 2404-2480MHz, therefore the frequency was investigated up to 25GHz, as specified in CFR section 15.33, and at least six highest emissions are reported. The test results represent the worst-case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation.

Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

The spectrum analyzer is set to:

- Peak: RBW=1MHz, VBW=1MHz, Span=0Hz, Sweep=auto
- Average: RBW=1MHz, VBW=10Hz, Span=0Hz, Sweep=auto

The EUT was set to operate with following conditions.

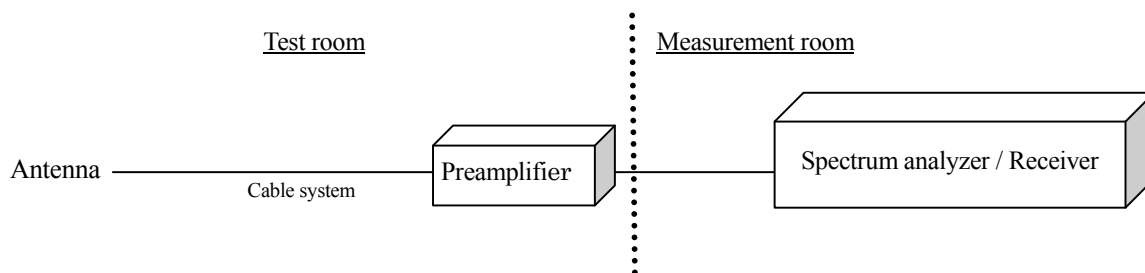
- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode, Rx mode

4.6.2 Measurement Setup

Test configuration for Spurious Emissions



4.6.3 Limit of Spurious Emission Measurement

Frequency [MHz]	Field Strength	
	[uV/m]	[dBuV/m]
0.009 – 0.490	2400 / F [kHz]	20logE [uV/m]
0.490 – 1.705	24000 / F [kHz]	20logE [uV/m]
1.705-30	30	29.5
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level [dBuV/m] = 20 log Emission [uV/m]
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.6.4 Measurement Results

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Mar. 12, 2013
 Temperature : 19.0 [°C]
 Humidity : 22.8 [%]
 Test place : 3m Semi-anechoic chamber

Spurious Emissions - Radiated -

Tx Channel Low: 2402MHz

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	336.000	H	35.8	-6.6	29.2	46.0	16.8	100.0	176.0
2	344.000	H	38.0	-6.5	31.5	46.0	14.5	100.0	171.0
3	352.000	H	37.5	-6.3	31.2	46.0	14.8	100.0	171.0

No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c. f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]
1	4804.500	H	43.1	31.4	9.0	52.1	40.4	74.0	54.0	21.9	13.6	115.0	294.0
2	4804.500	V	46.4	34.2	9.0	55.4	43.2	74.0	54.0	18.6	10.8	110.0	256.0
3	7206.700	H	43.9	30.7	13.7	57.6	44.4	74.0	54.0	16.4	9.6	100.0	52.0
4	7206.710	V	46.9	33.9	13.7	60.6	47.6	74.0	54.0	13.4	6.4	120.0	340.0

Tx Channel Middle: 2440MHz

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	336.000	H	35.0	-6.6	28.4	46.0	17.6	100.0	187.0
2	344.000	H	37.7	-6.5	31.2	46.0	14.8	100.0	183.0
3	352.000	H	37.4	-6.3	31.1	46.0	14.9	100.0	191.0

No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c. f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]
1	4880.520	H	45.8	32.2	9.4	55.2	41.6	74.0	54.0	18.8	12.4	100.0	182.0
2	4880.460	V	47.8	35.7	9.4	57.2	45.1	74.0	54.0	16.8	8.9	100.0	206.0
3	7320.660	H	44.8	31.4	14.4	59.2	45.8	74.0	54.0	14.8	8.2	100.0	7.0
4	7320.660	V	47.8	35.1	14.4	62.2	49.5	74.0	54.0	11.8	4.5	124.0	325.0

Tx Channel High: 2480MHz

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	336.000	H	33.9	-6.6	27.3	46.0	18.7	100.0	181.0
2	344.000	H	36.4	-6.5	29.9	46.0	16.1	100.0	184.0
3	352.000	H	37.0	-6.3	30.7	46.0	15.3	100.0	191.0

No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c. f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]
1	4959.200	H	43.8	30.9	9.7	53.5	40.6	74.0	54.0	20.5	13.4	100.0	176.0
2	4959.500	V	45.7	33.6	9.7	55.4	43.3	74.0	54.0	18.6	10.7	104.0	33.6
3	7439.240	H	45.6	32.6	14.6	60.2	47.2	74.0	54.0	13.8	6.8	100.0	3.0
4	7439.240	V	48.7	37.1	14.6	63.3	51.7	74.0	54.0	10.7	2.3	112.0	316.0

Note:

1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable - Amp)]
2. No emissions were detected in frequency range 9KHz to 30MHz at the 3 meters distance.
3. Rx mode was Emission from the EUT has more than 20dB margin below the limit.

4.7 Transmitter Power Spectral Density

4.7.1 Test Procedure [FCC 15.247(d)]

The peak power density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=3kHz, VBW=10kHz, Span=300kHz, Sweep=100s

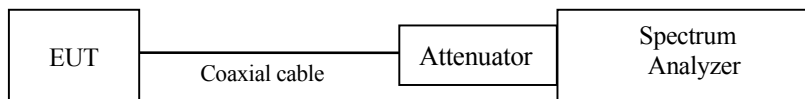
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

4.7.2 Measurement Setup



4.7.3 Limit of Transmitter Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band.

4.7.4 Measurement Results

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2402	-18.45	10.37	-8.08	8.00	16.08	PASS
Middle	2440	-17.30	10.37	-6.93	8.00	14.93	PASS
High	2480	-16.61	10.37	-6.24	8.00	14.24	PASS

Note: Transmitter Power Spectral Density Level (Margin) = Limit – [Reading + Factor (Cable)]

4.7.5 Trace Data

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Mar. 12, 2013

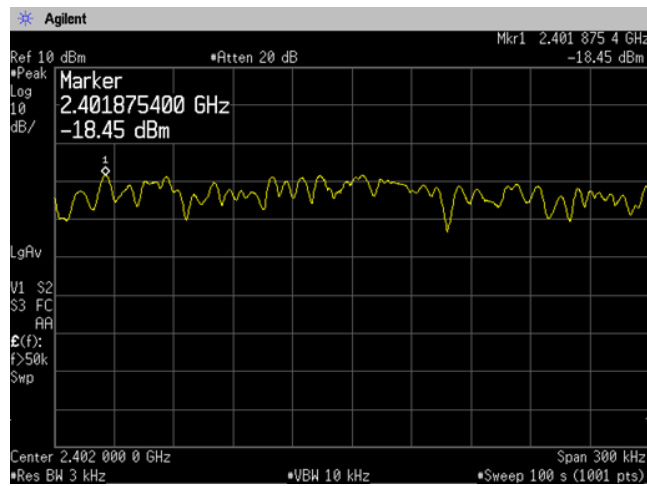
Temperature : 19.0 [°C]

Humidity : 22.8 [%]

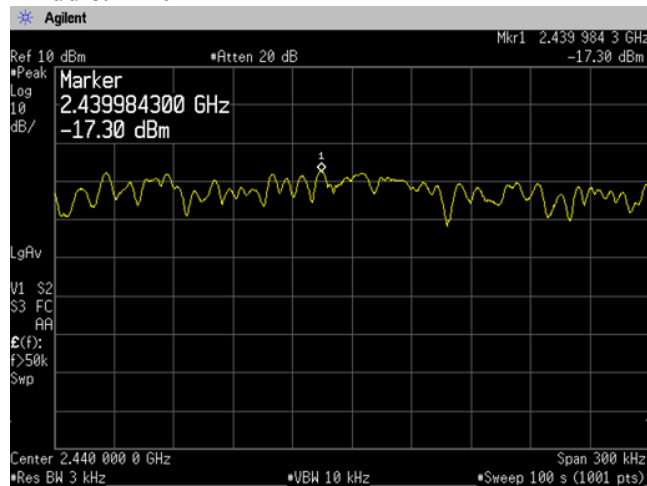
Test place : Shielded room

Transmitter Power Spectral Density

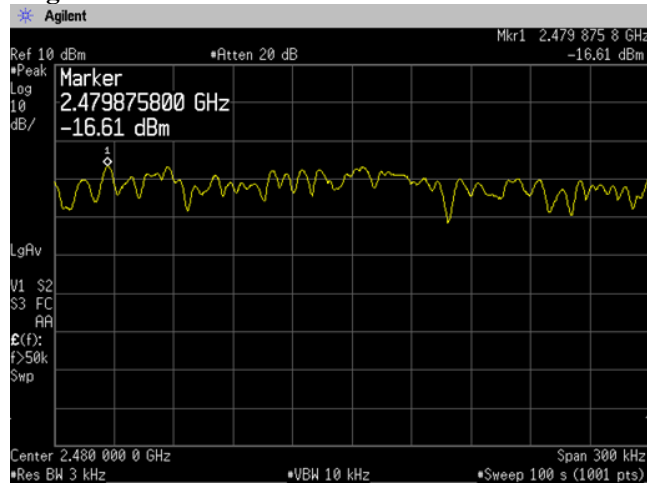
Channel Low: 2402MHz



Channel Middle: 2440MHz



Channel High: 2480MHz



4.8 AC power line Conducted Emissions

4.8.1 Test Procedure [FCC 15.207]

Conducted emissions at AC mains port measurements are performed at open area test site according to ANSI C63.4 section 7.

EUT and support equipment are placed on FRP table of 2.0m(W) × 1.0m(D) × 0.8m(H) in size. EUT is connected to 50Ω/50μH Line Impedance Stabilization Network (LISN) which is placed on reference ground plane, and was placed 80cm away from EUT. Excess of AC power cable is bundled in center. Vertical Metal Reference Plane 2.0m (W) × 2.0m (H) in size is placed 0.4m away from EUT. LISN for peripheral is terminated in 50Ω.

EUT operating mode is selected to emit the maximum noise. Overall frequency range is investigated with spectrum analyzer using peak detector. Maximum emission configuration is determined by manipulating the EUT, support equipment, interconnecting cables. Then, emission measurements are performed with test receiver in above setting to each current-carrying conductor of the mains port. Sufficient time for EUT, support equipment and test equipment are provided in order for them to warm up to their normal operating condition.

Frequency range:

- 0.15MHz to 30MHz

The Test receiver is set to:

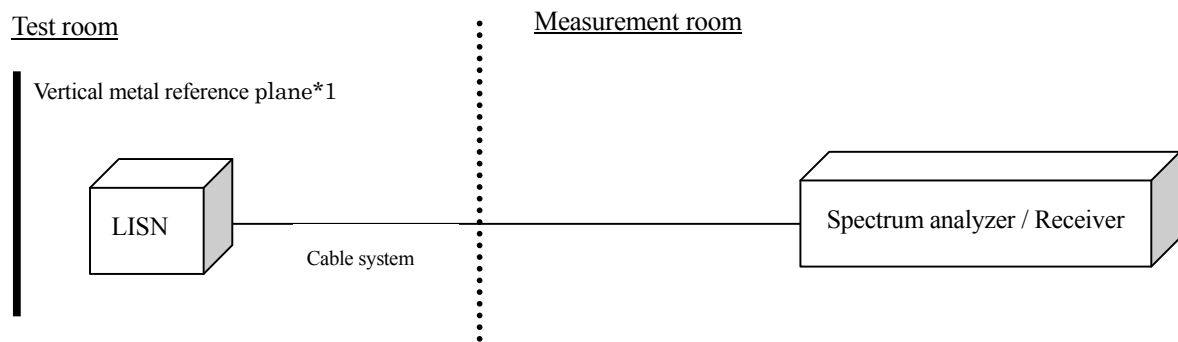
- Detector: Quasi-peak, Average
- Bandwidth: 9kHz

The test mode of EUT is as follows.

- Tx mode (Conducted emissions were measured the AC mains port of the DC power supply.)

4.4.2 Measurement Setup

Test configuration for AC power line Conducted Emissions



*1: Used it for Table-top only

4.8.3 Limit of AC power line Conducted Emissions Measurement

Frequency	Limit	
	QP(dB μ V)	AV(dB μ V)
0.15MHz to 0.5MHz	66 to 56*	56 to 46*
0.5MHz to 5MHz	56	46
5MHz to 30MHz	60	50

*: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

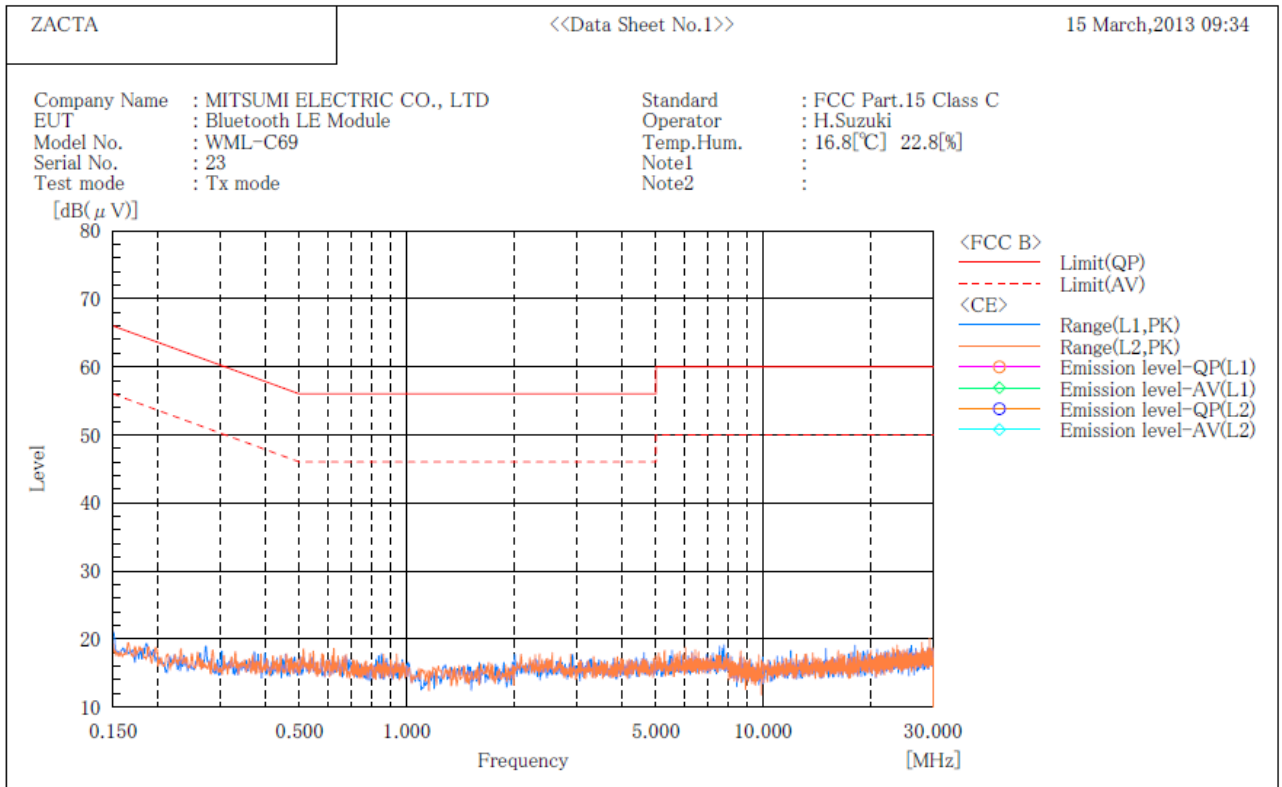
4.8.4 Calculation method

Emission level = Reading + (LISN. Factor + Cable system loss)

Margin = Limit – Emission level

4.8.5 Measurement Result

***** CONDUCTED EMISSION at MAINS PORT *****
<< 3m Semi-anechoic chamber >>



Note: No emissions were observed during Conducted Emission testing.

4.9 Antenna requirement

According to FCC section 15.203., an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The antenna is a PCB antenna mounted inside of the EUT. Therefore, the EUT complies with the antenna requirement of FCC section 15.203.

5. Uncertainty of measurement

Expanded uncertainties stated were calculated with a coverage Factor $k=2$.

Please note that these results are not taken into account when determining compliance or non-compliance with test result.

Test item	Measurement uncertainty
Conducted emission at mains port (150kHz - 30MHz)	$\pm 3.0\text{dB}$
Radiated emission (9kHz - 30MHz)	$\pm 4.4\text{dB}$
Radiated emission (30MHz – 1000MHz)	$\pm 4.5\text{dB}$
Radiated emission (1000MHz – 26GHz)	$\pm 3.9\text{dB}$

6. Laboratory description

1. Location: ZACTA Technology Corporation Yonezawa Testing Center
4149-7 Hachimanpara 5-chome Yonezawa-shi Yamagata 992-1128 Japan
Phone: +81-238-28-2880 Fax: +81-238-28-2888

2. Facility filing information:

1) NVLAP accreditation: NVLAP Lab. code: 200306-0

2)VLAC accreditation: Lab. code: VLAC-013

Site name	Radiated emission	Conducted emission for mains port	Conducted emission for telecom port	Radiated emission (CMAD)	Expiry Date
10m Semi-anechoic chamber	VLAC-013			VLAC-013	Jul. 3, 2013
3m Semi-anechoic chamber				-	
Shielded room No.1	-	VLAC-013		-	

3) FCC filing:

Site name	Registration Number	Expiry Date
Site 2	91065	Oct.31, 2014
Site 3		
10m Semi-anechoic chamber	540072	Jan. 9, 2016
3m Semi-anechoic chamber		
Shielded room No.1		

4) Industry Canada Oats site filing:

Site name	Sites on file: Oats 3m/10m	Expiry Date
Site 2	4224A-2	Jan. 23, 2015
Site 3	4224A-3	
3m Semi-anechoic chamber	4224A-4	
10m Semi-anechoic chamber	4224A-5	

5) VCCI site filing:

Site name	Radiated emission	Conducted emission for mains port	Expiry Date	Conducted emission for telecom port	Expiry Date
Site 2	R-137	C-133	Nov. 16, 2014	T-1221	Nov. 28, 2014
Site 3	R-138	C-134		T-1222	
10m Semi-anechoic chamber	R-2480	C-2722	Jul. 3, 2013	T-1474	Jul. 3, 2013
	G-81	-		-	-
3m Semi-anechoic chamber	R-2481	C-2723		T-1475	Jul. 3, 2013
	G-82	-		-	-
Shielded room No.1	-	C-2724		T-1476	Jul. 3, 2013

- 6) TÜV SÜD PS authorization:
Authorized as an EMC test laboratory
- 7) Intertek authorization:
Authorized as an EMC test laboratory
- 8) TÜV Rheinland authorization:
Authorized as an EMC test laboratory
- 9) BUREAU VERITAS certification:
Certified as an EMC test laboratory

Appendix A: Test equipment

Antenna port Conducted Test

Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
Spectrum Analyzer	Agilent Technologies	E4440A	US40420937	Oct. 2013	Oct. 19, 2012
Microwave cable	SUHNER	SUCOFLEX104	199511/4	Nov. 2013	Nov. 12, 2012
Attenuator	Weinschel	56-10	J4180	Nov. 2013	Nov. 12, 2012

*The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.

Radiated Emission

Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
Spectrum Analyzer	Agilent Technologies	E4447A	MY46180188	Mar. 2014	Mar. 8, 2013
Preamplifier	ANRITSU	MH648A	M96057	Jun. 2013	Jun. 12, 2012
Preamplifier	Agilent Technologies	8449B	3008A01008	Dec. 2013	Dec. 9, 2012
Preamplifier	TSJ	MLA-1840-B03-35	1040332	Apr. 2013	Apr. 20, 2010
EMI Receiver	ROHDE&SCHWARZ	ESCI	100764	Jul. 2013	Jul. 6, 2012
Loop antenna	ROHDE&SCHWARZ	HFH2-Z2	891847/010	Sep.2013	Sep. 14, 2012
TRILOG Antenna	Schwarzbeck	VULB9160	9160-3218	May 2014	May 2, 2012
Attenuator(6dB)	TME	CFA-01NPJ-6	N/A (S274)	Jun. 2013	Jun. 12, 2012
Double Ridged Guide Antenna	EMCO	3115	4328	Jan. 2014	Jan. 21, 2013
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170189	Apr. 2013	Apr. 20, 2010
Microwave cable	SUHNER	SUCOFLEX104/9m	346314/4	Oct. 2013	Oct. 6, 2012
		SUCOFLEX104/1m	322084/4	Oct. 2013	Oct. 6, 2012
		SUCOFLEX104/1.5m	317226/4	Oct. 2013	Oct. 6, 2012
		SUCOFLEX106/7m	41625/6	Oct. 2013	Oct. 6, 2012
Notch Filter	Micro-Tronics	BRM50702	045	Nov. 2013	Nov. 12, 2012
PC	DELL	DIMENSION E521	75465BX	N/A	N/A
Software	TOYO Corporation	EP5/RE-AJ	0611193/V5.3.61	N/A	N/A
3m Semi-anechoic chamber	TOKIN	N/A	N/A (9002-NSA)	May 2013	May 19, 2012

*The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.

Conducted Emission

Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
EMI Receiver	ROHDE&SCHWARZ	ESCI	100764	Jul. 2013	Jul. 6, 2012
Coaxial cable	FUJIKURA	5D-2W/4m	N/A (S350)	Feb. 2014	Feb. 4, 2013
	FUJIKURA	5D-2W/1m	N/A (S193)	Feb. 2014	Feb. 4, 2013
	SUHNER	RG214/U/10m	N/A (S194)	Feb. 2014	Feb. 4, 2013
Line impedance Stabilization network for EUT	Kyoritsu Electrical Works, Ltd.	KNW-407F	8-2003-1	Mar. 2014	Mar. 12, 2013
Attenuator	HUBER+SUHNER	6810.01.A	N/A (S411)	Jun. 2013	Jun. 25, 2012
PC	DELL	DIMENSION E521	75465BX	N/A	N/A
Software	TOYO Corporation	EP5/CE-AJ	0611193/V5.2.41	N/A	N/A

*The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.