

TEST REPORT

Report number: Z071C-09154

Issue Date: August 17, 2009

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

FCC Part15 Subpart C / IC RSS-210

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

Applicant	: HORI CO., LTD.
Equipment under test (EUT)	: WIRELESS MODULE
FCC ID	: RQZHP3-1500A
IC Certification Number	: 8406A-HP31500A
Model Number	: 1500#00-A
Serial Number	: N/A
EUT Condition	: Pre-production

Test procedure	: ANSI C63.4-2003
Date of test	: July 30, 31, 2009 August 17, 2009
Test place	: 3m Semi-anechoic chamber, Shielded room
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
Taiki Watanabe

Authorized by:


Jun Shimanuki
General Manager of Technical Division

NVLAP LAB CODE 200306-0

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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, RSS-210

1.3 Summary of test results

Table-A presents the list of the measurement items for Spread Spectrum, Frequency hopping devices under FCC Part 15 Subpart C and Industry Canada RSS-210 Issue 7.

Table-A: List of the measurements

Test Items Section	Test Items	Condition	Result
	Transmit mode [Tx]:		
15.247(a)(1) RSS-210 A8.1(a)	Occupied Bandwidth (20dB Bandwidth)	Conducted	Pass
RSS-Gen 4.6.1	99% Occupied bandwidth	Conducted	Pass
15.247(a)(1) RSS-210 A8.1(b)	Carrier Frequency Separation	Conducted	Pass
15.247(a)(1)(iii) RSS-210 A8.1(d)	Number of Hopping Frequencies	Conducted	Pass
15.247(a)(1)(iii) RSS-210 A8.1(d)	Time of Occupancy (Dwell Time)	Conducted	Pass
15.247(b)(1) 15.31(e) RSS-210 A8.4(2)	Maximum Peak Output Power - Conducted -	Conducted	Pass
15.247(d) RSS-210 A8.5	Band Edge Compliance of RF Conducted Emissions	Conducted	Pass
15.247(d) RSS-210 A8.5 RSS-Gen 4.9, 4.10	Spurious Emissions	Conducted Radiated	Pass
15.247(d) 15.205 15.209 RSS-210 2.2	Restricted Bands of Operation	Radiated	Pass
15.207 RSS-Gen 7.2.2	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

EUT is WIRELESS MODULE.

2.2 EUT information

Applicant : HORI CO., LTD.
640 Saedo-cho, Tsuzuki-ku Yokohama-shi, Kanagawa, 224-0054 Japan
Phone: + 81-45-933-9611 Fax: + 81-45-933-9617

Equipment under test (EUT) : WIRELESS MODULE

Trade name : HORI

Model number : 1500#00-A

Serial number : N/A

EUT condition : Pre-production

Max. frequency : 16MHz

Power ratings : DC 3.0V (Dry battery)

Size : (W) 30 x (D) 39 x (H) 12 mm

Environment : Indoor use

Thermal limitation : Operational temperature range : 0°C to 40°C
Storage temperature range : -25 °C to 60 °C

Operating mode : Tx mode / Rx mode

Variation of the family model(s) : N/A

[RF Specification]

Spread method : Frequency hopping spread spectrum (FHSS)

Frequency Range : 2405MHz - 2477MHz

Number of FR Channels : 25 Channels

Modulation Method/Data rate : GFSK/1Mbps

Nominal Bit Rates : 250hops/s

Channel Separation : 3MHz

Output power : 0.157mW

Antenna (Rx and Tx) : Pattern antenna

Antenna gain : -0.08dBi

RF type : Transceiver

Intended use : Data transmission

RF emission type designator : 1M47F1D

2.3 Operating channels and frequencies

Channel	Frequency[MHz]
1	2405
2	2408
3	2411
4	2414
5	2417
6	2420
7	2423
8	2426
9	2429
10	2432
11	2435
12	2438
13	2441
14	2444
15	2447
16	2450
17	2453
18	2456
19	2459
20	2462
21	2465
22	2468
23	2471
24	2474
25	2477

2.4 Operating mode

【Tx mode】

- i) WIRELESS MODULE set to Test jig
- ii) Select a test mode
 - Operating mode : No hopping , Hopping
 - Test frequency : CH.1, 12, 25
 - Power level : 0dBm
 - Transfer rate : 1Mbps
- iii) Start test mode

【Rx mode】

- i) WIRELESS MODULE set to Test jig
- ii) Select a test mode
 - Operating mode: Rx Test
 - Test frequency : CH.1, 12, 25
- iii) Start test mode

3. Configuration information

3.1 EUT and Peripheral(s) used

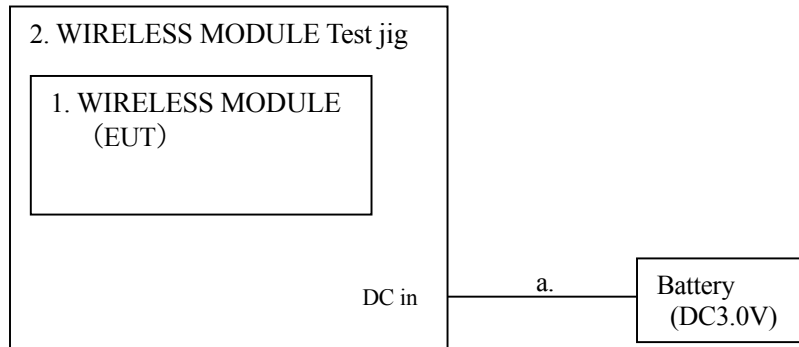
No.	Equipment	Company	Model No.	Serial No.	FCC ID/DoC	Comment
1	WIRELESS MODULE	HORI	1500#00-A	N/A	RQZHP3-1500A	EUT
2	WIRELESS MODULE Test jig	N/A	N/A	N/A	-	-
3	Power supply	Agilent Technologies	6236B	02140320	-	-

3.2 Cable(s) information

No.	Cable	Length [m]	Shield	Connector	Comment
a	DC cable	0.04	No	Plastic	-
b	DC cable	0.3	No	Metal	-
c	AC cable	2.0	No	Metal	-

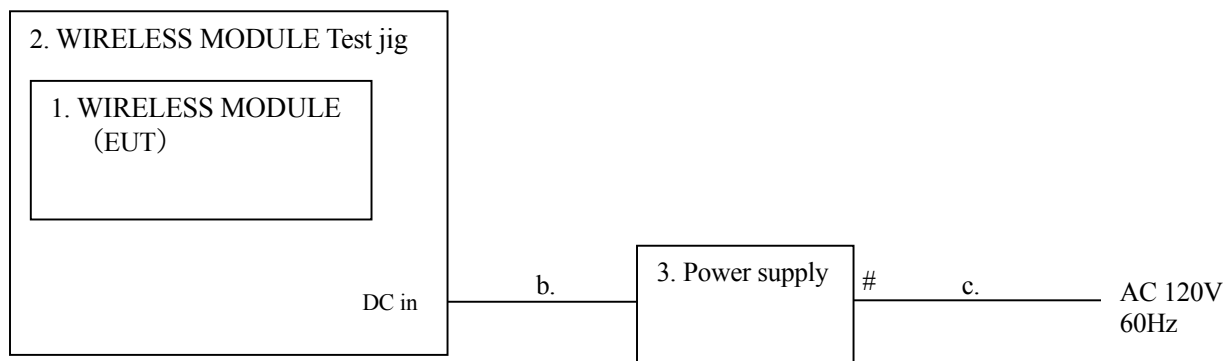
3.3 System configuration

[RF Conducted test / RF Radiated test]



Note1: Numbers assigned to equipment or cables on this diagram are corresponded to the list in “3.1 EUT and Peripheral(s) used” and “3.2 Cable(s) information”.

[AC Conducted emission test]



#: Un-detachable cable

Note1: Numbers assigned to equipment or cables on this diagram are corresponded to the list in “3.1 EUT and Peripheral(s) used” and “3.2 Cable(s) information”.

4. Test Type and Results

4.1 20dB Bandwidth / Occupied Bandwidth

4.1.1 Test Procedure [FCC 15.247(a)(1), IC RSS-210 A8.1(a)]

The bandwidth at 20 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=30kHz, VBW=300kHz, Span=5MHz, Sweep=auto

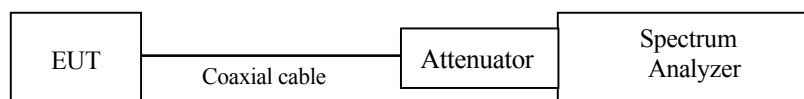
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 12 (mid) and ch 25 (high)]

The test mode of EUT is as follows.

- Tx mode

4.1.2 Measurement Setup



4.1.3 Limit of Bandwidth at 20 dB below

None

4.1.4 Measurement Result

Channel	Center Frequency (MHz)	Occupied Bandwidth (MHz)	20dB Bandwidth (MHz)
1	2405.00	1.3072	1.064
12	2438.00	1.4697	1.170
25	2477.00	1.4508	1.148

4.1.5 Trace Data

Test Personnel:

Tested by: Taiki Watanabe

Date : July. 31, 2009

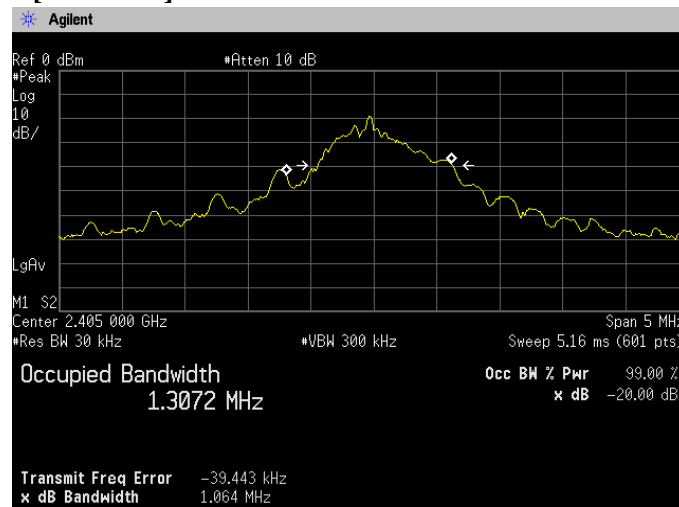
Temperature : 25.0 [°C]

Humidity : 65.0 [%]

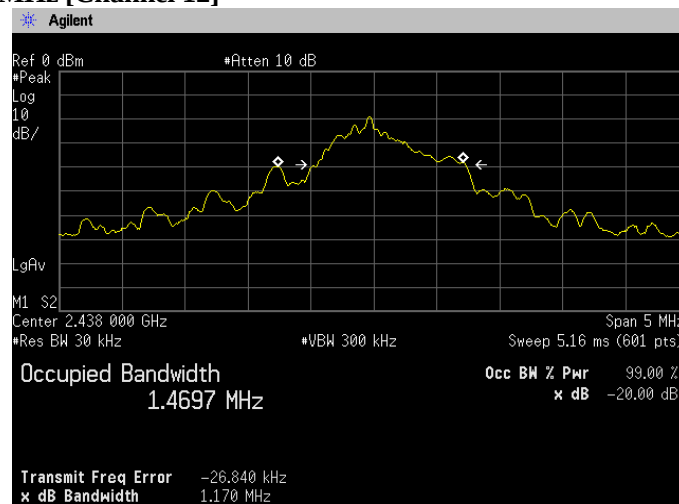
Test place : Shielded room

20dB Bandwidth/Occupied Bandwidth

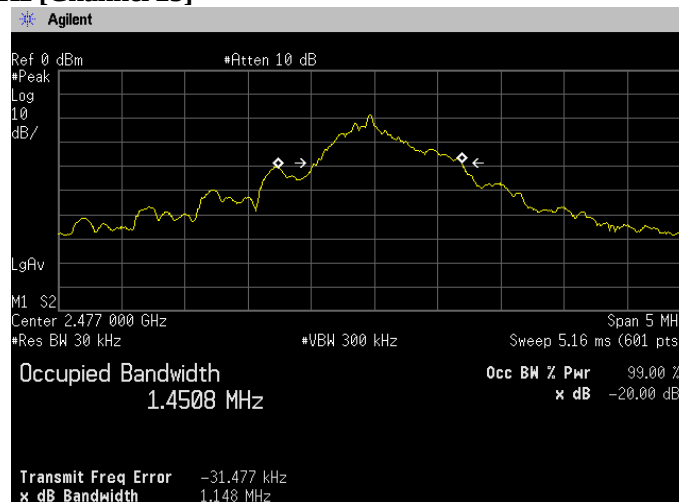
Channel Low: 2405.0MHz [Channel 1]



Channel Middle: 2438.0MHz [Channel 12]



Channel High: 2477.0MHz [Channel 25]



4.2 Carrier Frequency Separation

4.2.1 Test Procedure [FCC 15.247(a)(1), IC RSS-210 A8.1(b)]

The adjacent channel interval 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=30kHz, VBW=30kHz, Span=10MHz, Sweep=auto

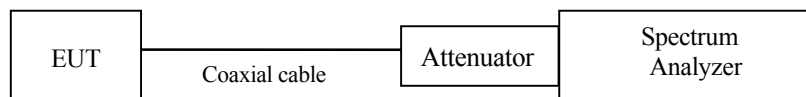
The EUT was set to operate with following conditions.

- Hopping [ch 12 (mid)]

The test mode of EUT is as follows.

- Tx mode

4.2.2 Measurement Setup



4.2.3 Limit of Carrier Frequency Separation

Systems shall have hopping channel carrier frequencies separated by a minimum of; 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

4.2.4 Measurement Result

Channel separation (MHz)	Limit (MHz)	Result
3	>two-thirds of the 20dB Bandwidth =780kHz	PASS

4.2.5 Trace Data

Test Personnel:

Tested by: Taiki Watanabe

Date : July. 31, 2009

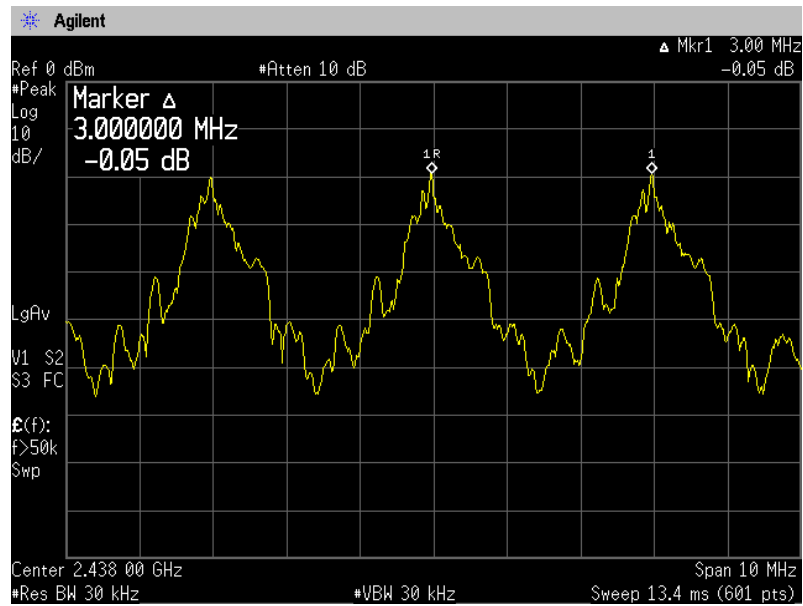
Temperature : 25.0 [°C]

Humidity : 65.0 [%]

Test place : Shielded room

Carrier Frequency Separation

Channel Middle: 2438.0MHz [Channel 12]



4.3 Number of Hopping Frequencies

4.3.1 Test Procedure [FCC 15.247(a)(1)(iii), IC RSS-210 A8.1(d)]

The number of hopping channels 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=Arbitrary setting, Sweep=auto

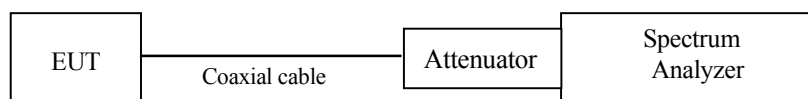
The EUT was set to operate with following conditions.

- Hopping

The test mode of EUT is as follows.

- Tx mode

4.3.2 Measurement Setup



4.3.3 Limit of Number of Hopping Frequencies

Shall have more than 15 channels.

4.3.4 Measurement Result

Number of channels	Limit	Result
25	≥15 channel	PASS

4.3.5 Trace Data

Test Personnel:

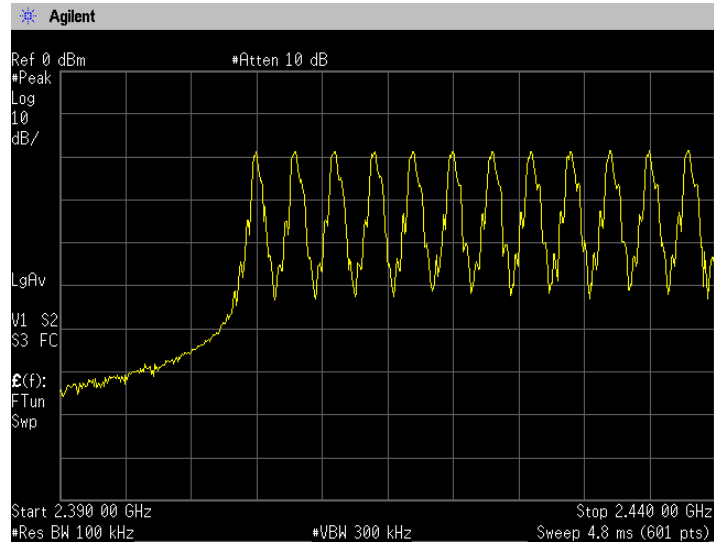
Tested by:

Taiki Watanabe

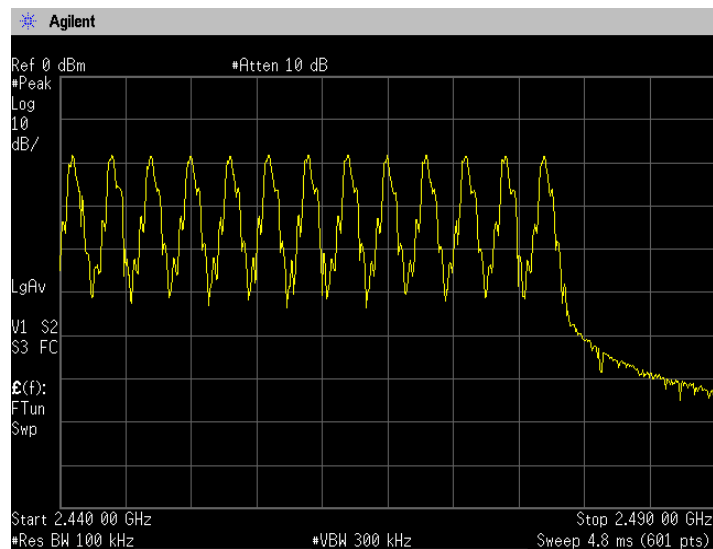
Date : July. 31, 2009
Temperature : 25.0 [°C]
Humidity : 65.0 [%]
Test place : Shielded room

Number of Hopping Frequencies

Low



High



4.4 Time of Occupancy (Dwell Time)

4.4.1 Test Procedure [FCC 15.247(a)(1)(iii), IC RSS-210 A8.1(d)]

The time occupancy of hopping channel 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=1MHz, Span=0MHz, Sweep=1.52ms

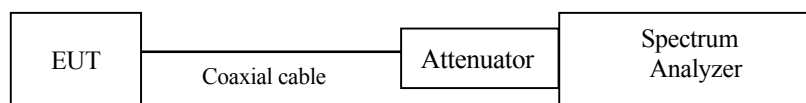
The EUT was set to operate with following conditions.

- Hopping [ch 1 (low), ch 12(mid) and ch 25 (high)]

The test mode of EUT is as follows.

- Tx mode

4.4.2 Measurement Setup



4.4.3 Limit of Time of Occupancy (Dwell Time)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

4.4.4 Measurement Result

Channel	Frequency (MHz)	Dwell time (ms)	Occupancy time of 10 seconds (s)	Limit	Result
1	2405.00	0.220	0.0055	<0.4s	PASS
12	2438.00	0.220	0.0055	<0.4s	PASS
25	2477.00	0.220	0.0055	<0.4s	PASS

The hopping rates of Bluetooth devices change with different types of payload. The longer the payload is, the slower the hopping rate. The hopping rate scenario is defined in Bluetooth core specification.

Calculation:

Occupancy time of 10.0 seconds * = time domain slot length x hop rate / number of hopper channel / 25 x 10
EX.) For Ch. 1 = 0.220 ms x 250 / 4 / 25 x 10 = 5.5 ms

4.4.5 Trace Data

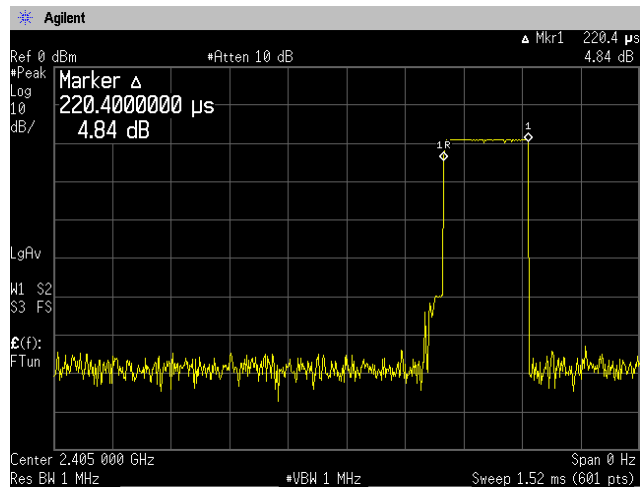
Test Personnel:

Tested by: Taiki Watanabe

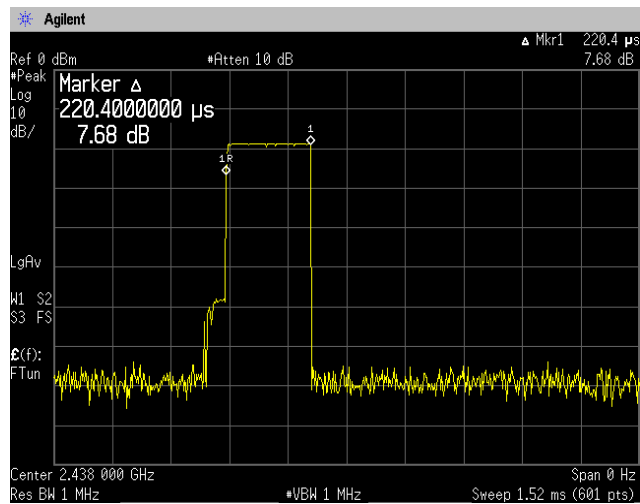
Date : July. 31, 2009
 Temperature : 25.0 [°C]
 Humidity : 65.0 [%]
 Test place : Shielded room

Dwell Time

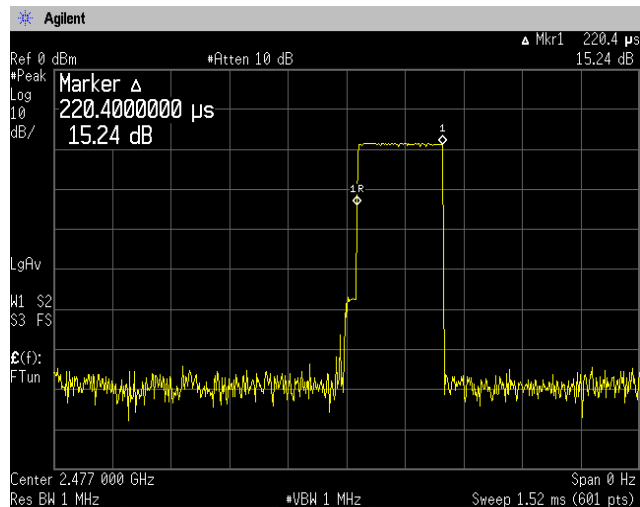
Channel Low: 2405.0MHz [Channel 1]



Channel Middle : 2438.0MHz [Channel 12]

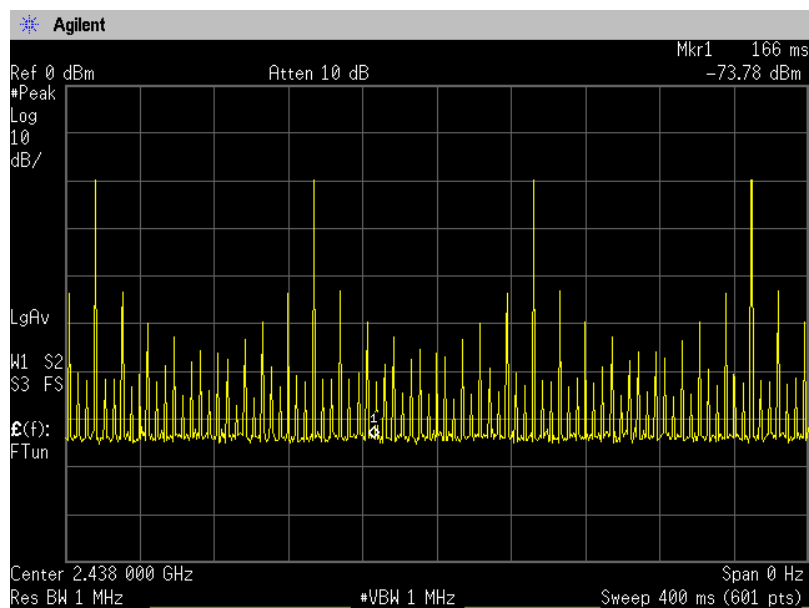


Channel High : 2477.0MHz [Channel 25]



Number of hopper channel

Channel Middle : 2438.0MHz [Channel 12]



4.5 Maximum Peak Output Power - Conducted -**4.5.1 Test Procedure [FCC 15.247(b)(1), 15.31(e), IC RSS-210 A8.4(2)]**

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:

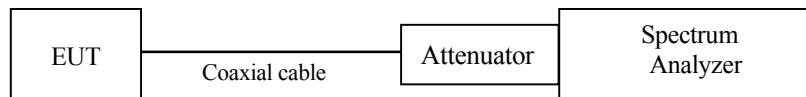
- RBW=3MHz, VBW=3MHz, Span=10MHz, Sweep=auto

The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 12 (mid) and ch 25 (high)]

The test mode of EUT is as follows.

- Tx mode in battery operation DC3.0V

4.5.2 Test Instruments and Measurement Setup**4.5.3 Limit of Maximum Peak Output Power**

0.125 watt or less.

4.5.4 Measurement Result

[Test mode in battery operation DC3.0V]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Antenna Gain (dBi)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
1	2405.00	-19.05	10.66	-0.08	-8.47	0.142	≤125	PASS
12	2438.00	-18.67	10.66	-0.08	-8.09	0.155	≤125	PASS
25	2477.00	-18.63	10.66	-0.08	-8.05	0.157	≤125	PASS

Calculation:

Reading (dBm) + Factor (dB) + Antenna Gain of EUT (dBi) = Level (dBm)

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

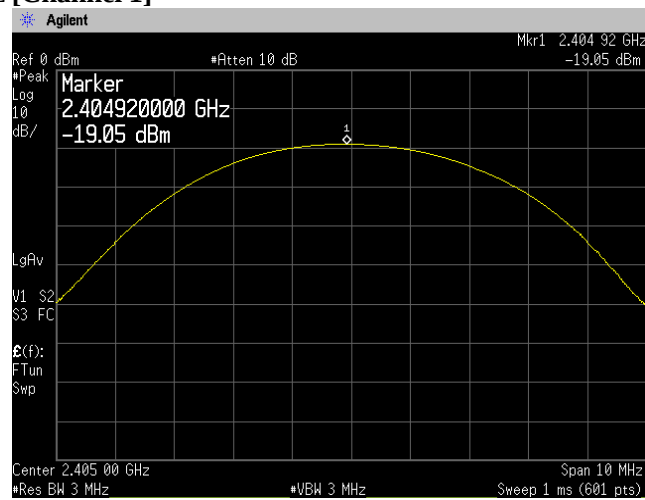
$P = 10^{(\text{Maximum Peak Output Power (dBm)} / 10)} (\text{mW})$

4.5.5 Trace Data**Test Personnel:**

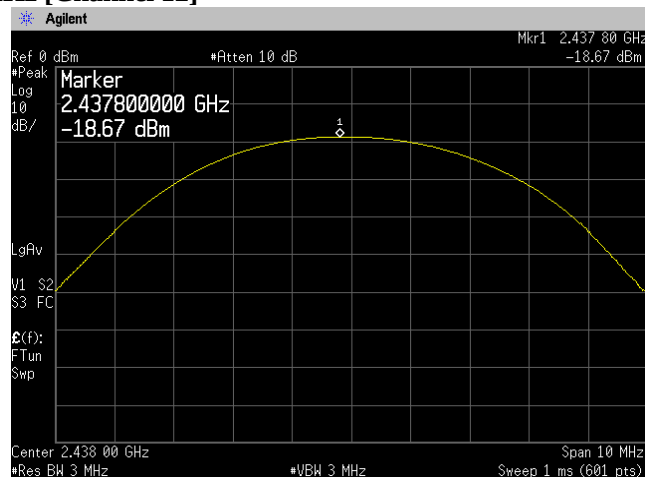
Tested by: Taiki Watanabe

Date : July. 31, 2009
 Temperature : 25.0 [°C]
 Humidity : 65.0 [%]
 Test place : Shielded room

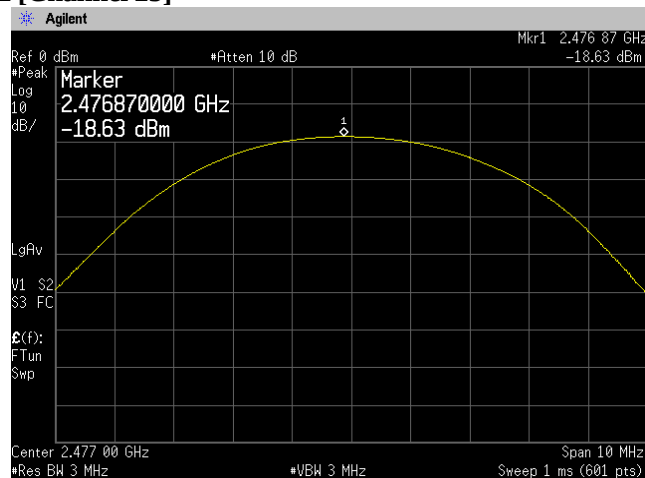
Maximum Peak Output Power - Conducted - [Battery operation DC3.0V]
Channel Low: 2405.0MHz [Channel 1]



Channel Middle: 2438.0MHz [Channel 12]



Channel High: 2477.0MHz [Channel 25]



4.6 Band Edge Compliance of RF Conducted Emissions

4.6.1 Test Procedure [FCC 15.247 (d), IC RSS-210 A8.5]

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=15MHz, Sweep=Auto

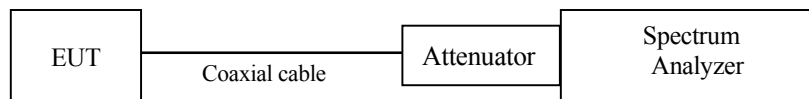
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low) and ch 25 (high)]

The test mode of EUT is as follows.

- Tx mode

4.6.2 Test Instruments and Measurement Setup



4.6.3 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.

4.6.4 Measurement Results of Band-edge

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Pass/Fail
1	2405.00	-18.76	2403.28	-51.64	32.88	At least 20dB below from peak of RF	PASS
25	2477.00	-18.38	2478.52	-49.40	31.02	At least 20dB below from peak of RF	PASS

4.6.5 Trace Data

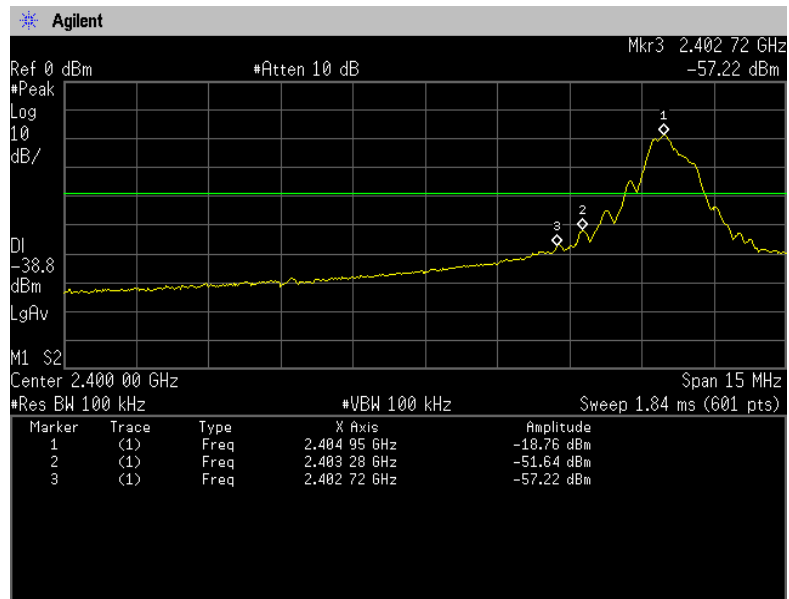
Test Personnel:

Tested by: Taiki Watanabe

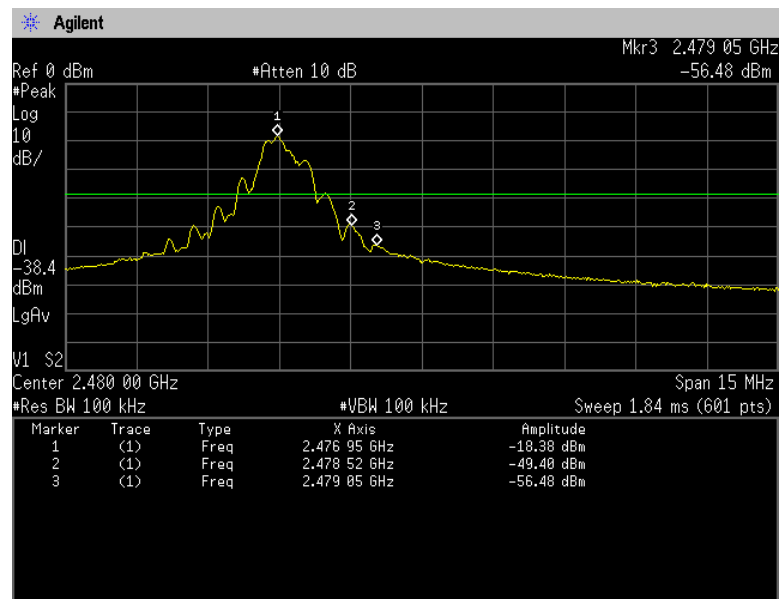
Date : July. 31, 2009
Temperature : 25.0 [°C]
Humidity : 65.0 [%]
Test place : Shielded room

Band Edge Compliance of RF Conducted Emissions

Channel Low: 2405.0MHz [Channel 1]



Channel High: 2477.0MHz [Channel 25]



4.7 Spurious Emissions - Conducted -

4.7.1 Test Procedure [FCC 15.247(d), IC RSS-210 A8.5, RSS-Gen 4.9&4.10]

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

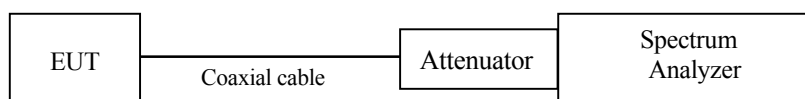
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 12 (mid) and ch 25 (high)]

The test mode of EUT is as follows.

- Tx mode

4.7.2 Measurement Setup



4.7.3 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.

4.7.4 Measurement Results of Spurious Emissions - Conducted -

Channel	Frequency [MHz]	Limit [dBm]	Results Chart	PASS / FAIL
1	2405.0	At least 20dB below from peak of RF.	See the Trace Data	PASS
12	2438.0	At least 20dB below from peak of RF.	See the Trace Data	PASS
25	2477.0	At least 20dB below from peak of RF.	See the Trace Data	PASS

4.7.5 Trace Data

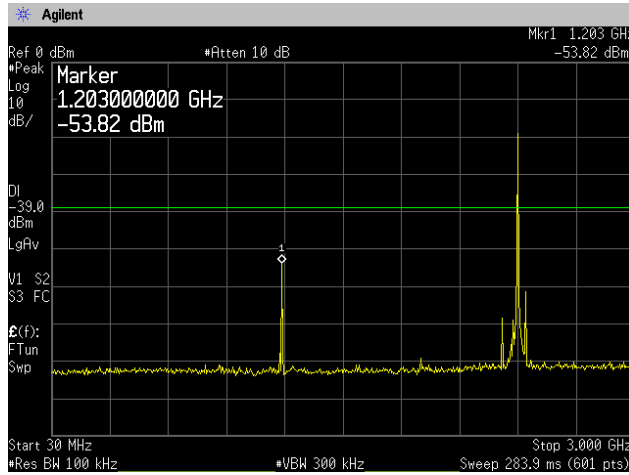
Test Personnel:

Tested by: Taiki Watanabe

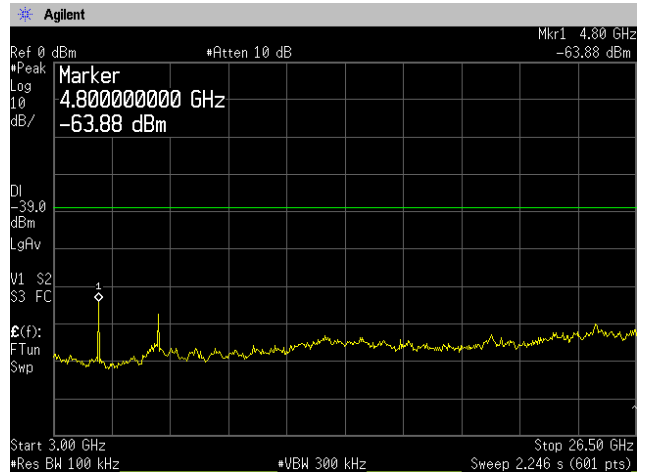
Date : July. 31, 2009
 Temperature : 25.0 [°C]
 Humidity : 65.0 [%]
 Test place : Shielded room

Spurious Emissions - Conducted -

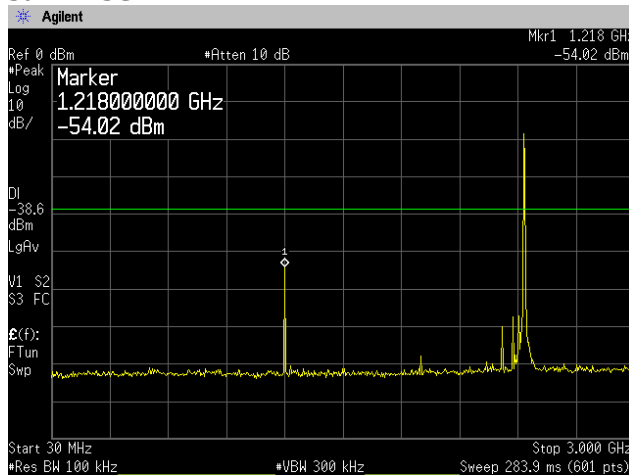
Channel Low: 2405.0MHz [Channel 1]
30MHz-3GHz



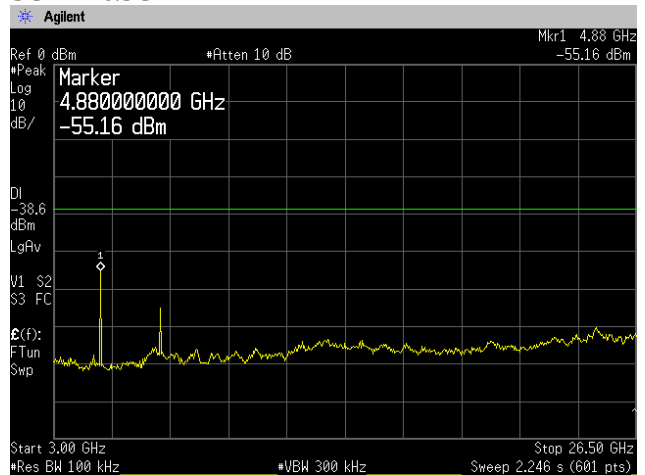
3GHz-26.5GHz



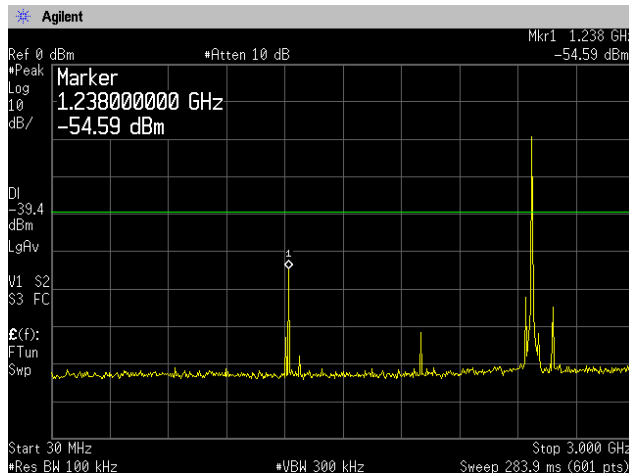
Channel Middle: 2438.0MHz [Channel 12]
30MHz-3GHz



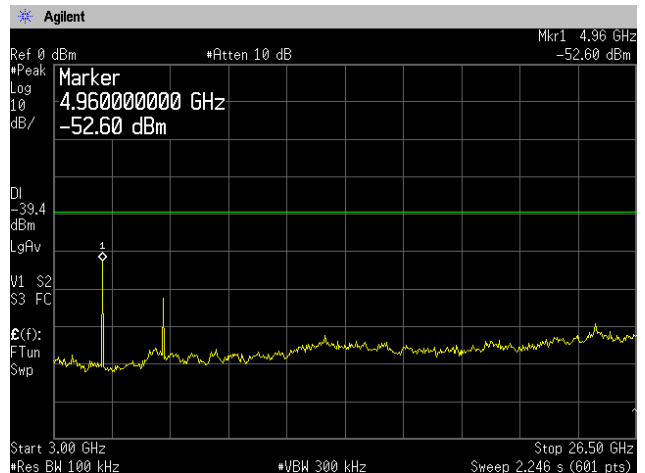
3GHz-26.5GHz



Channel High: 2477.0MHz [Channel 25]
30MHz-3GHz



3GHz-26.5GHz



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

4.8.1 Test Procedure [FCC 15.205/209/247(d), IC RSS-210 A8.5, RSS-Gen 4.9&4.10]

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 2402-2480MHz, 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.

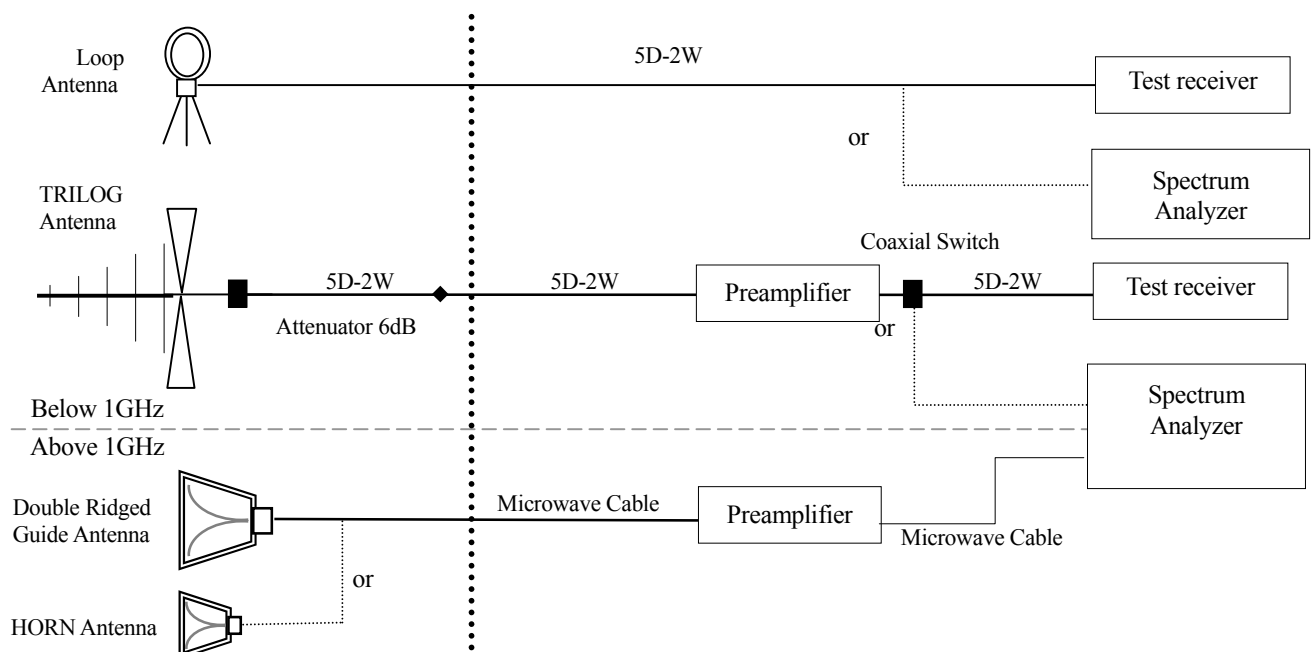
- No hopping [ch 1 (low), ch 12 (mid), ch 25 (high)]

The test mode of EUT is as follows.

- Tx mode, Rx mode

4.8.2 Measurement Setup

Test configuration for Spurious emissions



4.8.3 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.

4.8.4 Sample of field strength calculation

Spurious Emission

$$\text{dB}\mu\text{V/m} = 20\log_{10}(\mu\text{V/m})$$

Limit @ 147.6MHz = 150μV/m = 43.5dBμV/m
Reading = 42.8dBμV
Ant. Factor + Cable Loss - Amp. Gain = 14.2 + 3.0 - 30.0 = -12.8dB
Total = 42.8 - 12.8 = 30.0dBμV/m
Margin = 43.5 - 30.0 = <u>13.5dB</u>

4.8.5 Measurement Results

Test Personnel:

Tested by: Hiroaki Suzuki

Date : July. 30, 2009
Temperature : 21.1 [°C]
Humidity : 71.3 [%]
Test place : 3m Semi-anechoic chamber

Spurious Emissions - Radiated -

Below 1GHz

Tx Channel Low: 2405.0MHz [Channel 1]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	224.008	H	34.5	-10.3	24.2	46.0	21.8	143.0	298.0
2	304.004	H	34.6	-7.6	27.0	46.0	19.0	100.0	134.0

Tx Channel Middle: 2438.0MHz [Channel 12]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	224.005	H	34.7	-10.3	24.4	46.0	21.6	140.0	108.0
2	303.997	H	34.4	-7.6	26.8	46.0	19.2	100.0	118.0

Tx Channel High: 2477.0MHz [Channel 25]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	223.993	H	34.3	-10.3	24.0	46.0	22.0	145.0	105.0
2	304.007	H	34.5	-7.6	26.9	46.0	19.1	100.0	134.0

Rx Channel Low: 2405.0MHz [Channel 1]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	303.993	H	34.8	-7.6	27.2	46.0	18.8	100.0	124.0

Rx Channel Middle: 2438.0MHz [Channel 12]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	304.005	H	34.8	-7.6	27.2	46.0	18.8	100.0	115.0

Rx Channel High: 2480.0MHz [Channel 25]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	304.000	H	34.7	-7.6	27.1	46.0	18.9	100.0	116.0

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.

Spurious Emissions - Radiated -

Above 1GHz

Tx Channel Low: 2405.0MHz [Channel 1]

Peak Field Strength

(P)	Frequency [MHz]	Reading [dBuV/m]	c.f [dB(1/m)]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
H	1202.44	56.0	-9.1	46.9	74.0	27.1
H	4810.00	65.0	3.0	68.0	74.0	6.0
V	4810.00	67.1	3.0	70.1	74.0	3.9
H	7216.43	60.1	6.9	67.0	74.0	7.0
V	7216.43	57.9	6.9	64.8	74.0	9.2

Average Field Strength

(P)	Frequency [MHz]	Peak Result [dBuV/m]	Duty cycle factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
H	1202.44	46.9	20.0	26.9	54.0	27.1
H	4810.00	68.0	20.0	48.0	54.0	6.0
V	4810.00	70.1	20.0	50.1	54.0	3.9
H	7216.43	67.0	20.0	47.0	54.0	7.0
V	7216.43	64.8	20.0	44.8	54.0	9.2

Tx Channel Middle: 2438.0MHz [Channel 12]

Peak Field Strength

(P)	Frequency [MHz]	Reading [dBuV/m]	c.f [dB(1/m)]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
H	1218.98	55.4	-9.1	46.3	74.0	27.7
H	4876.00	64.0	3.2	67.2	74.0	6.8
V	4876.00	66.5	3.2	69.7	74.0	4.3
H	7316.12	56.9	7.3	64.2	74.0	9.8
V	7316.12	57.2	7.3	64.5	74.0	9.5

Average Field Strength

(P)	Frequency [MHz]	Peak Result [dBuV/m]	Duty cycle factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
H	1218.98	46.3	20.0	26.3	54.0	27.7
H	4876.00	67.2	20.0	47.2	54.0	6.8
V	4876.00	69.7	20.0	49.7	54.0	4.3
H	7316.12	64.2	20.0	44.2	54.0	9.8
V	7316.12	64.5	20.0	44.5	54.0	9.5

Spurious Emissions - Radiated

Tx Channel High: 2477.0MHz [Channel 25]

Peak Field Strength

(P)	Frequency [MHz]	Reading [dBuV/m]	c.f [dB(1/m)]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
H	1238.50	56.7	-8.9	47.8	74.0	26.2
H	4954.00	63.6	3.4	67.0	74.0	7.0
V	4954.00	65.2	3.4	68.6	74.0	5.4
H	7430.43	56.5	7.5	64.0	74.0	10.0
V	7430.43	56.7	7.5	64.2	74.0	9.8

Average Field Strength

(P)	Frequency [MHz]	Peak Result [dBuV/m]	Duty cycle factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
H	1238.50	47.8	20.0	27.8	54.0	26.2
H	4954.00	67.0	20.0	47.0	54.0	7.0
V	4954.00	68.6	20.0	48.6	54.0	5.4
H	7430.43	64.0	20.0	44.0	54.0	10.0
V	7430.43	64.2	20.0	44.2	54.0	9.8

Rx Channel Low: 2405.0MHz [Channel 1]

Peak Field Strength

(P)	Frequency [MHz]	Reading [dBuV/m]	c.f [dB(1/m)]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
V	1375.37	56.9	-8.7	48.2	74.0	25.8
H	1375.50	53.8	-8.7	45.1	74.0	28.9
H	2750.85	56.1	-3.6	52.5	74.0	21.5
V	2750.85	55.3	-3.6	51.7	74.0	22.3

Average Field Strength

(P)	Frequency [MHz]	Peak Result [dBuV/m]	Duty cycle factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
V	1375.37	48.2	20.0	28.2	54.0	25.8
H	1375.50	45.1	20.0	25.1	54.0	28.9
H	2750.85	52.5	20.0	32.5	54.0	21.5
V	2750.85	51.7	20.0	31.7	54.0	22.3

Spurious Emissions - Radiated –

Rx Channel Middle: 2438.0MHz [Channel 12]

Peak Field Strength

(P)	Frequency [MHz]	Reading [dBuV/m]	c.f [dB(1/m)]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
V	1394.33	53.9	-8.6	45.3	74.0	28.7
H	1394.30	55.8	-8.6	47.2	74.0	26.8
H	2788.48	56.3	-3.4	52.9	74.0	21.1
V	2788.50	54.4	-3.4	51.0	74.0	23.0

Average Field Strength

(P)	Frequency [MHz]	Peak Result [dBuV/m]	Duty cycle factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
V	1394.33	45.3	20.0	25.3	54.0	28.7
H	1394.30	47.2	20.0	27.2	54.0	26.8
H	2788.48	52.9	20.0	32.9	54.0	21.1
V	2788.50	51.0	20.0	31.0	54.0	23.0

Rx Channel High: 2477.0MHz [Channel 25]

Peak Field Strength

(P)	Frequency [MHz]	Reading [dBuV/m]	c.f [dB(1/m)]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
V	1416.53	53.7	-8.5	45.2	74.0	28.8
H	1416.55	55.7	-8.5	47.2	74.0	26.8
H	2833.03	54.1	-3.2	50.9	74.0	23.1
V	2833.07	55.1	-3.2	51.9	74.0	22.1

Average Field Strength

(P)	Frequency [MHz]	Peak Result [dBuV/m]	Duty cycle factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
V	1416.53	45.2	20.0	25.2	54.0	28.8
H	1416.55	47.2	20.0	27.2	54.0	26.8
H	2833.03	50.9	20.0	30.9	54.0	23.1
V	2833.07	51.9	20.0	31.9	54.0	22.1

Note:

1. Peak Field Strength : Emission Level (Margin) = Limit – [Reading + Factor (Antenna + Cable - Amp)]
2. Average Field Strength : Emission Level (Margin) = Limit – [Peak Result – Duty Cycle Factor].

4.8.6 Duty Cycle

Duty Cycle Factor Calculation

RF duty cycle factor: Calculation according to RF burst Para 15.35 (c)

Pulse width is 222us

There are 18 pulses in 100 mSec window

$222\mu\text{s} \times 18 = 3.996 \text{ ms}$

It is 3.996 ms in 100 ms

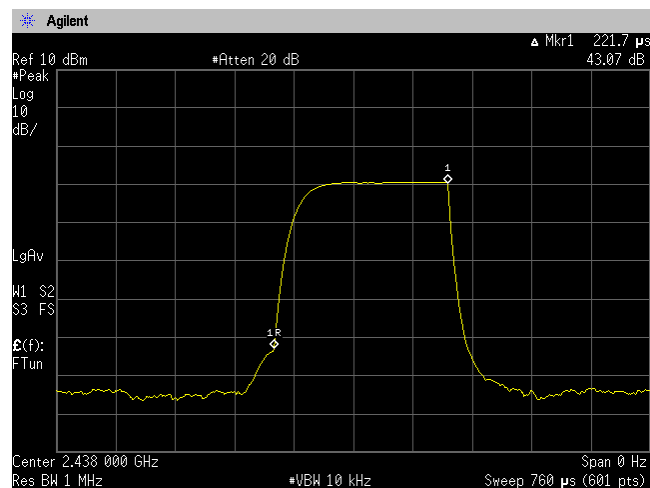
Duty cycle: $3.996/100 = 0.03996$

Duty cycle factor: $20\log(0.03996) = -27.97\text{dB}$

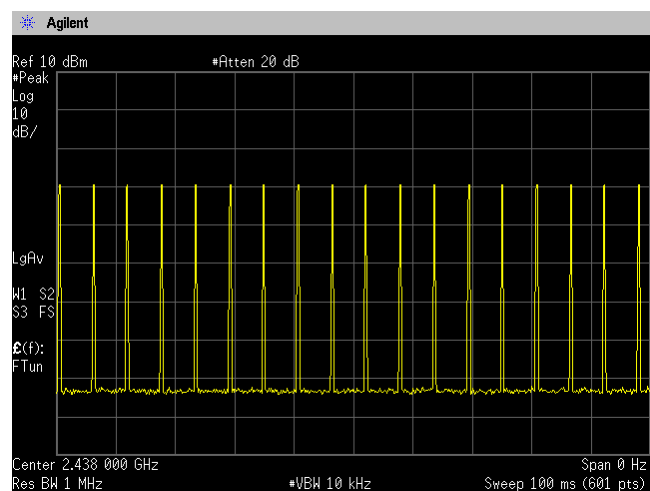
Maximum duty cycle according to Para 15.35 (b): 20dB

This value is used when measuring average field strength above 1GHz with Peak Detector function employed on Spectrum analyzer

Pulse width



100 ms window



4.9 Restricted Band of Operation

4.9.1 Test Procedure [FCC 15.205, 15.209, 15.247(d), IC RSS-210 2.2]

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=40MHz, Sweep=auto
- Average: RBW=1MHz, VBW=10Hz, Span=40MHz, Sweep=auto

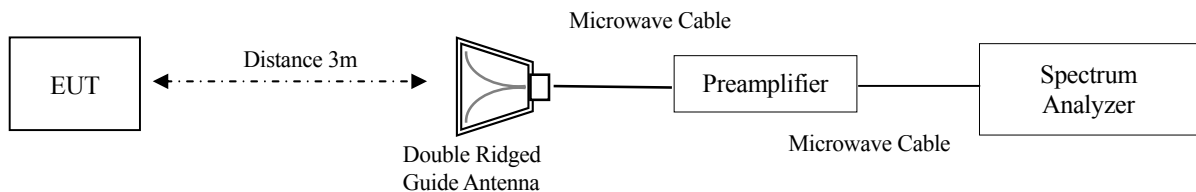
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 25 (high)]

The test mode of EUT is as follows.

- Tx mode

4.9.2 Measurement Setup



4.9.3 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.

4.9.4 Measurement Result

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c. f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]
1	2390.000	H		62.6	-4.2		58.4	74.0		15.6
2	2390.000	H	33.6		-4.2	29.4		54.0	24.6	
3	2390.000	V		53.7	-4.2		49.5	74.0		24.5
4	2390.000	V	33.5		-4.2	29.3		54.0	24.7	
5	2483.500	H		70.2	-3.9		66.3	74.0		7.7
6	2483.500	H	33.5		-3.9	29.6		54.0	24.4	
7	2483.500	V		57.6	-3.9		53.7	74.0		20.3
8	2483.500	V	33.3		-3.9	29.4		54.0	24.6	

4.9.5 Trace Data

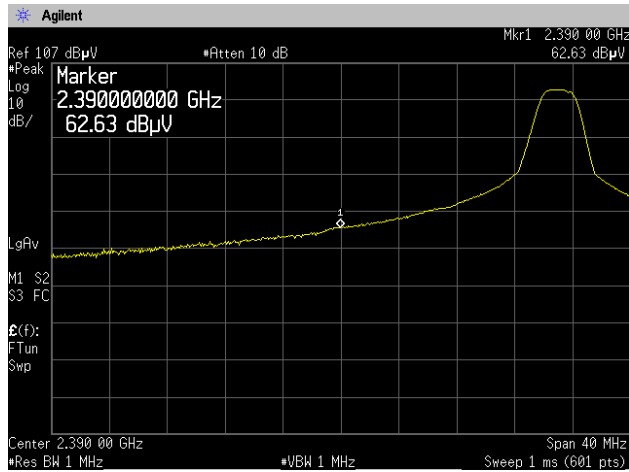
Test Personnel:

Tested by: Hiroaki Suzuki

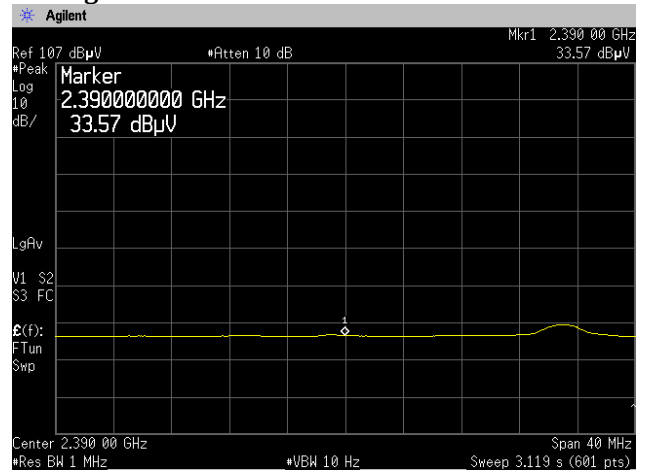
Date : July. 30, 2009
 Temperature : 21.1 [°C]
 Humidity : 71.3 [%]
 Test place : 3m Semi-anechoic chamber

Restricted Band of Operation

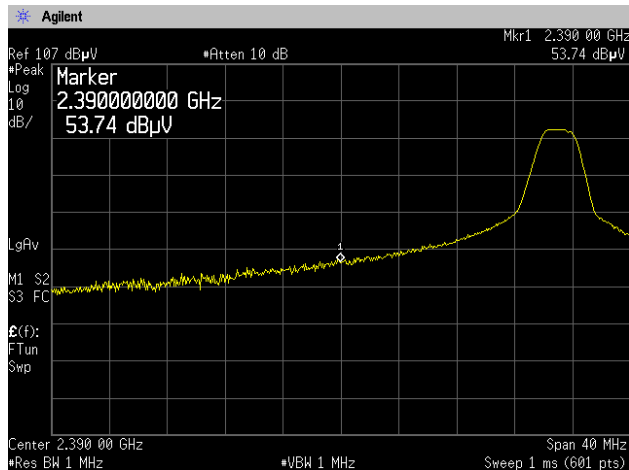
Frequency: 2390.0MHz -Horizontal-
Peak



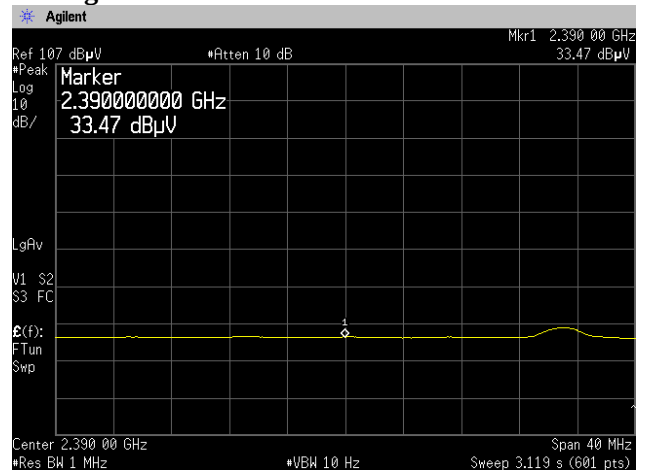
Average



Frequency: 2390.0MHz -Vertical-
Peak

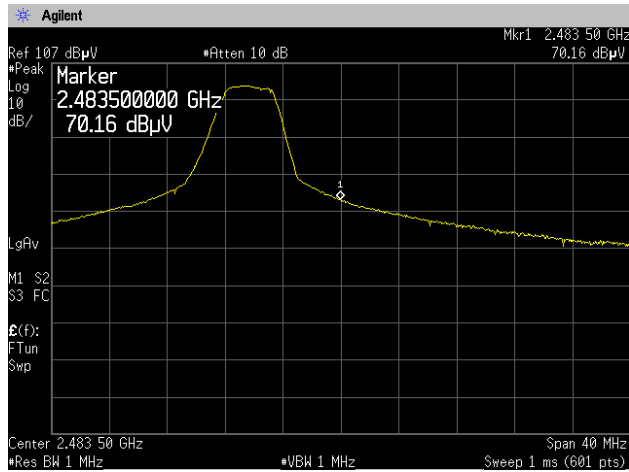


Average

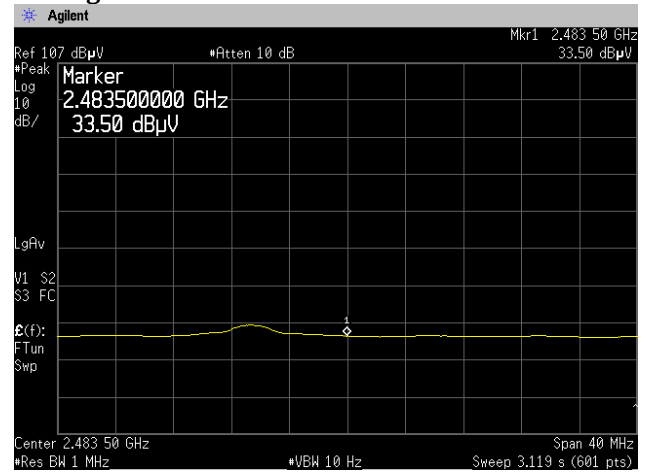


Restricted Band of Operation

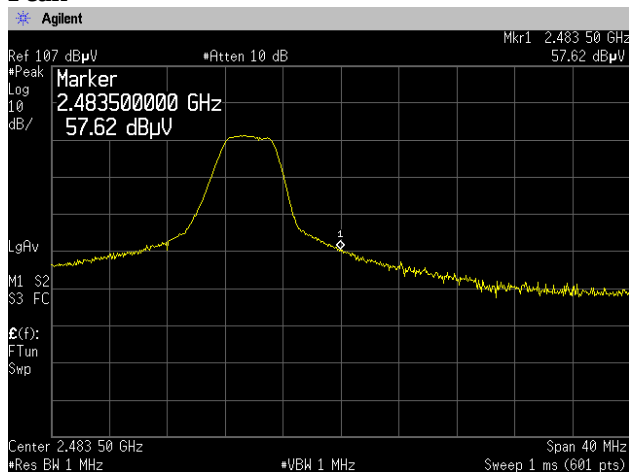
Frequency: 2483.5MHz -Horizontal-
Peak



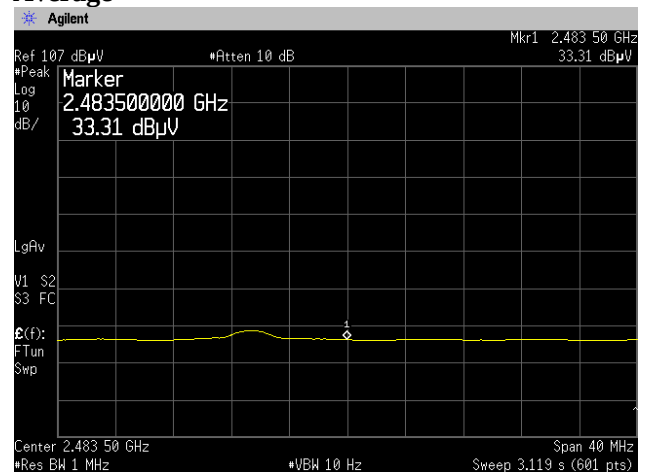
Average



Frequency: 2483.5MHz -Vertical-
Peak



Average



4.10 AC power line Conducted Emissions

4.10.1 Test Procedure [FCC 15.207, IC RSS-Gen 7.2.2]

Conducted emission 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:

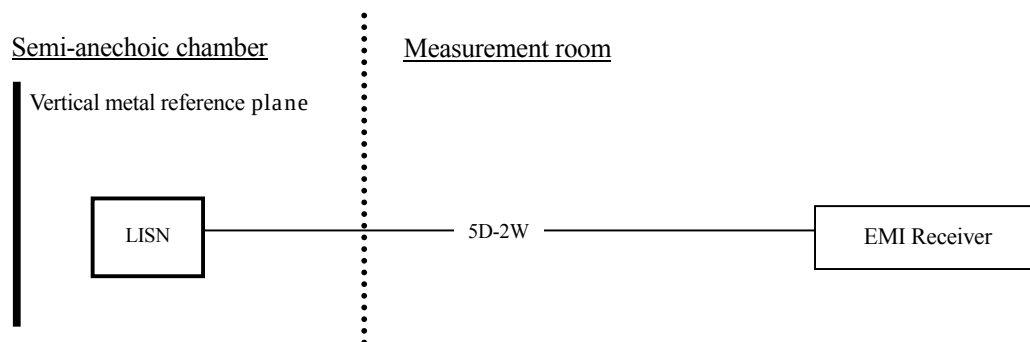
- 0.15MHz to 30MHz

The Test receiver is set to:

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

4.10.2 Measurement Setup

Test configuration for AC power line Conducted Emissions

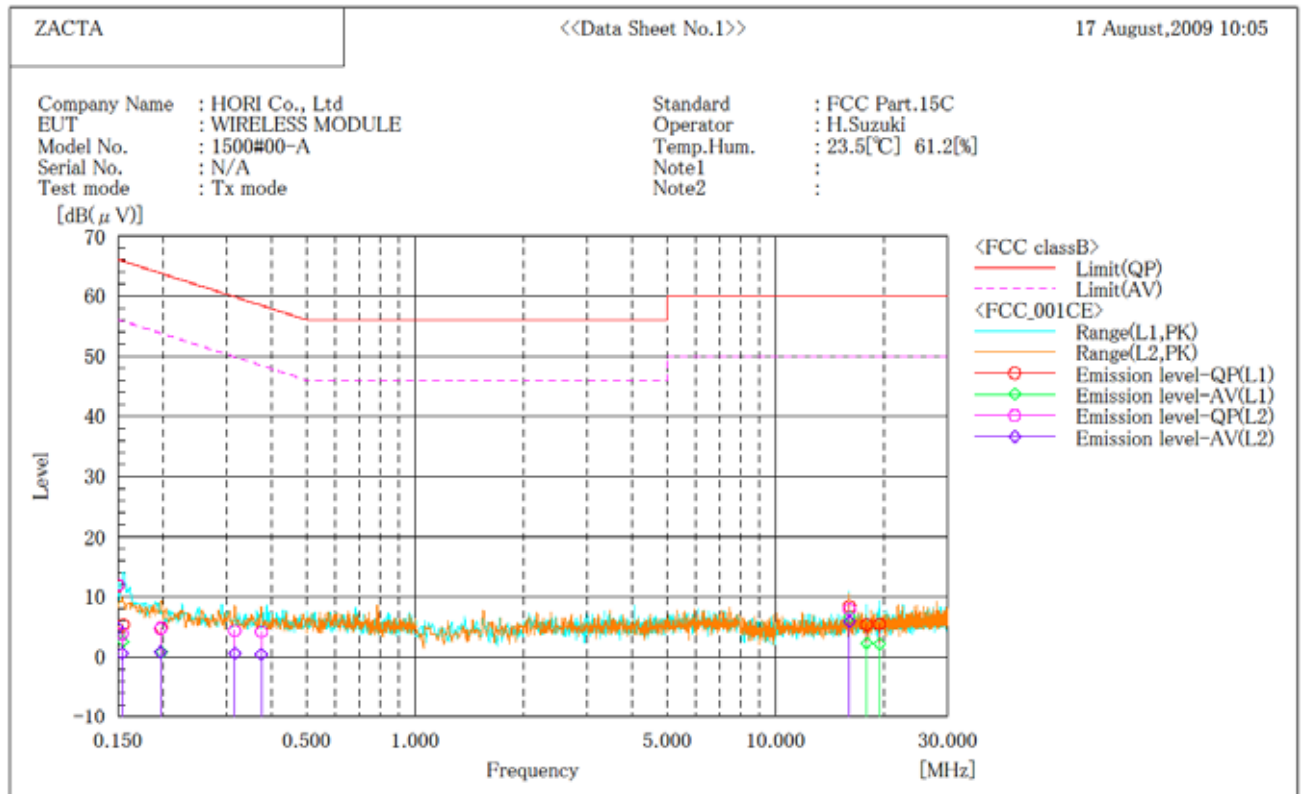


4.10.3 Limit of AC power line Conducted Emissions Measurement (Sample calculation)

Frequency	Limit		Sample of field strength calculation
	QP(dBμV)	AV(dBμV)	
0.15MHz to 0.5MHz	66 to 56*	56 to 46*	$\text{dB}\mu\text{V} = 20\log_{10}(\mu\text{V})$ Limit @ : 60.0dBμV(Quasi-peak) 6.770MHz : 50.0dBμV(Average) (Quasi peak) Reading = 51.2dBμV Cable loss + AMN factor = 0.3dB Total = 51.2 + 0.3 = 51.5dBμV Margin = 60.0 – 51.5 = 8.5dB
0.5MHz to 5MHz	56	46	
5MHz to 30MHz	60	50	(Average) Reading = 45.0dBμV Cable loss + AMN factor = 0.3dB Total = 45.0 + 0.3 = 45.3dBμV Margin = 50.0 – 45.3 = 4.7dB

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

4.10.4 Measurement Result



Final Result

— L1 Phase —

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c. f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.150	11.5	4.5	0.3	11.8	4.8	66.0	56.0	54.2	51.2
2	0.155	5.0	2.2	0.3	5.3	2.5	65.7	55.7	60.4	53.2
3	0.198	4.6	0.5	0.2	4.8	0.7	63.7	53.7	58.9	53.0
4	16.000	7.6	5.8	0.8	8.4	6.6	60.0	50.0	51.6	43.4
5	17.876	4.5	1.4	0.8	5.3	2.2	60.0	50.0	54.7	47.8
6	19.393	4.5	1.2	0.9	5.4	2.1	60.0	50.0	54.6	47.9

— L2 Phase —

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c. f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.150	11.6	4.5	0.3	11.9	4.8	66.0	56.0	54.1	51.2
2	0.154	3.5	0.3	0.3	3.8	0.6	65.8	55.8	62.0	55.2
3	0.197	4.5	0.5	0.2	4.7	0.7	63.7	53.7	59.0	53.0
4	0.316	4.2	0.5	0.1	4.3	0.6	59.8	49.8	55.5	49.2
5	0.375	4.0	0.3	0.1	4.1	0.4	58.4	48.4	54.3	48.0
6	16.000	7.0	5.0	0.8	7.8	5.8	60.0	50.0	52.2	44.2

4.11 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 chip 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)	$\pm 2.9\text{dB}$
Radiated emission (9kHz - 30MHz)	$\pm 4.4\text{dB}$
Radiated emission (30MHz – 1000MHz)	$\pm 5.2\text{dB}$
Radiated emission (1000MHz – 26GHz)	$\pm 3.6\text{dB}$

6. Laboratory description

6.1 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

6.2 Facility filing information:

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

2) FCC filing:

Site name	Registration Number	Expiry Date
Site 2, Site3	91065	November 16, 2011
3m Semi-anechoic chamber 10m Semi-anechoic chamber	540072	March 12, 2010

3) Industry Canada Oats site filing:

Site name	Sites on file: Oats 3m/10m	Expiry Date
Site 2	4224A-2	January 24, 2010
Site 3	4224A-3	January 24, 2010
3m Semi-anechoic chamber	4224A-4	January 24, 2010
10m Semi-anechoic chamber	4224A-5	January 24, 2010

4) 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, 2011	T-1477	Oct. 8, 2011
Site 3	R-138	C-134	Nov. 16, 2011	T-1478	Oct. 8, 2011
10m Semi-anechoic chamber	R-2480	C-2722	Dec. 19, 2009	T-1474	Oct. 8, 2011
3m Semi-anechoic chamber	R-2481	C-2723	Dec. 19, 2009	T-1475	Oct. 8, 2011
Shielded room No.1	R-137	C-2724	Dec. 19, 2009	T-1476	Oct. 8, 2011

5) ETL SEMKO authorization:

Authorized as an EMC test laboratory.

6) TUV Rheinland authorization:

Authorized as an EMC test laboratory.

7) BUREAU VERITAS certification:

Certified as an EMC test laboratory.

Appendix A: Test equipment

List of Measuring Instruments

Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
Spectrum Analyzer (3Hz – 42.98GHz)	Agilent Technologies	E4447A	MY46180188	Feb. 2010	Feb. 27, 2009
Preamplifier (100kHz-1.2GHz)	ANRITSU	MH648A	M08067	Jun. 2010	Jun. 13, 2009
Preamplifier (1GHz-26.5GHz)	Agilent Technologies	8449B	3008A01008	Dec. 2009	Dec. 11, 2007
EMI Receiver	ROHDE&SCHWARZ	ESCI	100765	May. 2010	May. 27, 2009
Loop antenna	ROHDE&SCHWARZ	HFH2-Z2	891847/17	Feb.2010	Feb. 12, 2009
Coaxial cable	N/A	RG213	N/A	Feb. 2010	Feb. 12, 2009
TRILOG Antenna	Schwarzbeck	VULB9160	9160-3221	Apr. 2010	Apr. 13, 2009
Attenuator (6dB)	TDC	TAT-43B-06	N/A	Aug. 2009	Aug. 8, 2008
Double Ridged Guide Antenna	EMCO	3115	4328	Dec. 2010	Dec. 10, 2008
Broad-Band Horn antenna	Schwarzbeck	BBHA9170	BBHA9170189	Mar. 2010	Mar. 23, 2007
Preamplifier	TSJ	MLA-1840-B03-35	1240332	Mar. 2010	Mar. 23, 2007
Microwave cable	SUHNER	SUCOFLEX 106	60929/6 (15m)	Nov. 2009	Nov. 12, 2008
	SUHNER	SUCOFLEX 106	60959/6 (1m)	Nov. 2009	Nov. 12, 2008
Coaxial cable	Fujikura	5D-2W/1.5m	#AEC3R-003	Feb. 2010	Feb. 5, 2009
		5D-2W/1m	#AEC3R-004	Feb. 2010	Feb. 5, 2009
		5D-2W/4m	#AEC3C-001	Feb. 2010	Feb. 5, 2009
	SUHNER	RG214/U/10m	#AEC3C-002	Feb. 2010	Feb. 5, 2009
Microwave cable	SUHNER	SUCOFLEX104	199511/4	Nov. 2009	Nov. 12, 2008
Attenuator	Weinschel	56-10	J4180	Nov. 2009	Nov. 12, 2008
Line impedance stabilization network for EUT	Kyoritsu Electrical Works, Ltd.	KNW-407F	8-2003-1	May. 2010	May. 29, 2009
PC	DELL	DIMENSION E521	85465BX	N/A	N/A
Software	TOYO Corporation	EP5/RE-AJ	0611193/V3.4	N/A	N/A
Site attenuation	ZACTA Technology	3m Semi-anechoic chamber	5192Z	May. 2010	May. 18, 2009

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