

TEST REPORT

Report number: Z071C-09012

Issue Date: April 22, 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 | : | Wacom Co., Ltd. 2-510-1, Toyonodai, Otone-machi, Kitasaitama-gun, Saitama 349-1148, Japan Phone: +81-480-78-1211 Fax: +81-480-78-1404 |
| Equipment under test (EUT) | : | RF Module |
| FCC ID | : | HV4RY24TL |
| IC Certification Number | : | 6888A-RY24TL |
| Model Number | : | RY24TL-01DT |
| Serial Number | : | N/A |
| EUT Condition | : | Pre-production |

| | | |
|----------------|---|---|
| Test procedure | : | ANSI C63.4-2003 |
| Date of test | : | March 25, 26, 31, 2009 April 9, 10, 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

Authorized by:


Katsumi Sumiyoshi
Manager of Quality Control 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, RSS-210

1.3 Summary of test results

Table-A presents the list of the measurement items 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 |
|--|---|------------------|---------------|
| RSS-Gen 4.6.1 | Occupied Bandwidth (20dB Bandwidth) | Conducted | Pass |
| 15.249(c), (d) RSS-210 A2.9(b) | Restricted Bands of Operation | Radiated | Pass |
| 15.249(a), (b), (c), (d), (e) RSS-210 A2.9(a), (b) RSS-Gen 4.9, 4.10 | Spurious Emissions (Field Strength of Fundamental and Harmonics) | 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

This device is a wireless module which operates in 2.4GHz band.

2.2 EUT information

| No. | EUT | Company | Model No. | Serial No. | FCC ID/DoC | Comment |
|------------|------------|---------------------------|------------------|-------------------|-------------------|----------------|
| 1 | RF module | Ryoyo Electro Corporation | RY24TL-01DT | N/A | HV4RY24TL | EUT |

Max. frequency : 18.432MHz
Power ratings : DC 3.3V
Size : (W) 76 x (L) 20 x (H) 5.7 mm
Type of equipment : Stand-alone
Environment : Indoor and Outdoor use
Thermal limitation : 0°C to 60°C
Operating mode : Tx mode, Rx mode
Variation of model(s) : None

[RF Specification]

Frequency Range : 2404MHz - 2480MHz
Number of FR Channels : 9 Channels
Modulation Method/Data rate : GFSK (1Mbps)
Channel Separation : 5MHz
Antenna (Rx and Tx) : PCB antenna
Antenna gain : 0.08dBi
RF type : Transceiver
Intended use : Data transmission
RF emission type designator : 1M42F1D

2.3 Operating channels and frequencies

| Channel | Frequency [MHz] |
|----------------|----------------------------|
| 1 | 2404 |
| 2 | 2409 |
| 3 | 2414 |
| 4 | 2437 |
| 5 | 2442 |
| 6 | 2447 |
| 7 | 2470 |
| 8 | 2475 |
| 9 | 2480 |

2.4 Operating mode

【Tx mode】

- i) RF test program set up
- ii) Select a test mode
 Operating frequency: CH.1, 5, 9
- iii) Start test mode

【Rx mode】

- i) RF test program set up
- ii) Select a Receiver mode
- iii) Start test mode

3. Configuration information

3.1 Peripheral(s) used

| No. | Equipment | Company | Model No. | Serial No. | FCC ID/DoC | Comment |
|-----|--------------------|---------------------------|---------------|------------|------------|---------|
| 2 | Interface board | Ryoyo Electro Corporation | N/A | N/A | - | - |
| 3 | I.T.E POWER SUPPLY | N/A | N/A | N/A | - | - |
| 4 | Personal Computer | hp | Compaq nx6320 | CNU7071H4D | DoC | - |
| 5 | AC adapter for PC | hp | PA-1650-02HC | 7108054501 | - | - |
| 6 | Printer | Canon | BJF200 | ETN02300 | DoC | * |

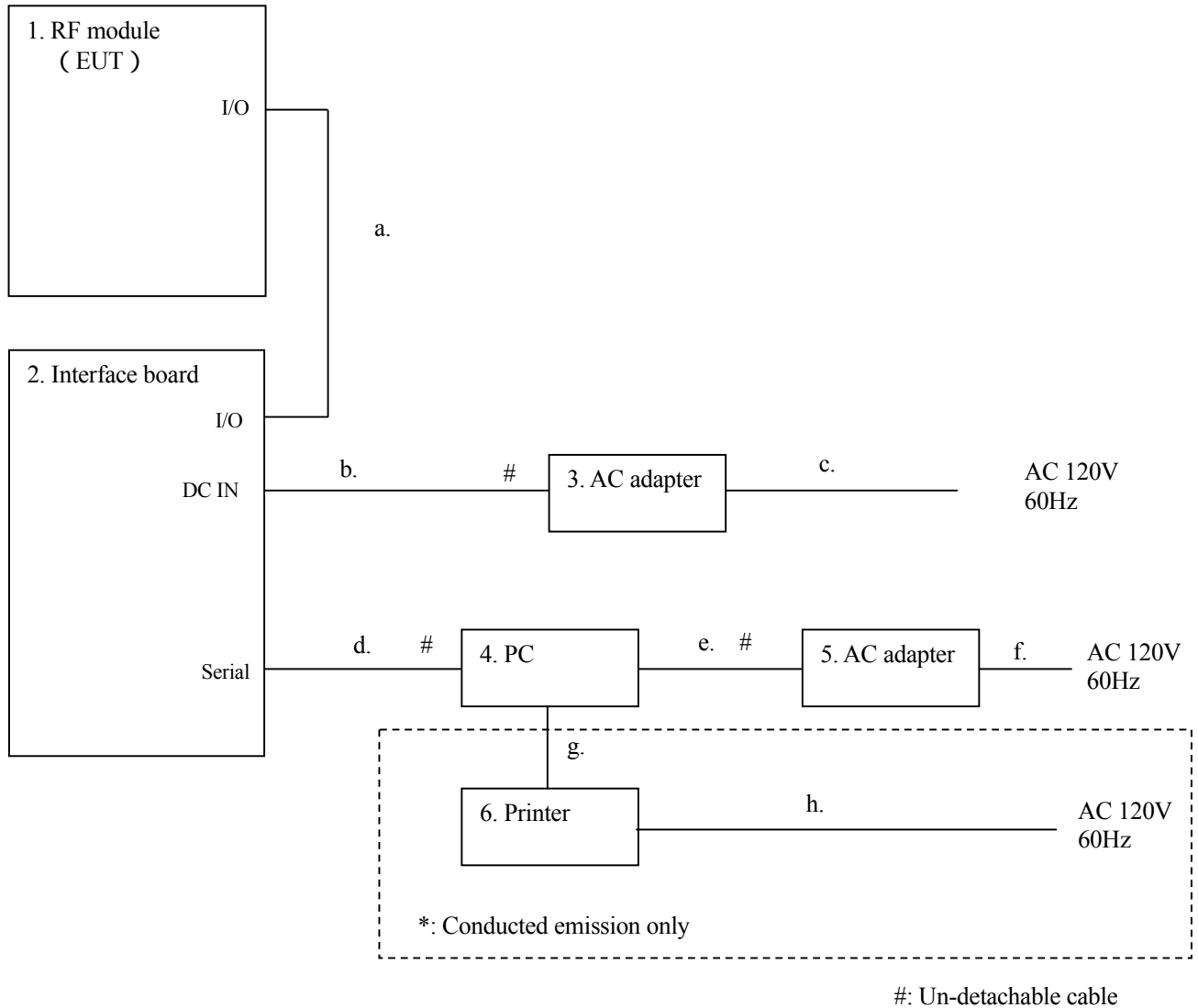
*: Conducted emission only.

3.2 Cable(s) information

| No. | Cable | Length [m] | Shield | Connector | Comment |
|-----|---------------------------------|------------|--------|-----------|---------|
| a | I/O cable | 0.15 | No | Plastic | - |
| b | DC cable | 1.9 | No | Plastic | - |
| c | AC cable | 0.7 | No | Plastic | - |
| d | Serial cable | 2.0 | Yes | Metal | - |
| e | DC cable for PC AC adapter | 1.8 | No | Plastic | - |
| f | AC Power cord for PC AC adapter | 1.7 | No | Plastic | - |
| g | Parallel cable | 2.1 | Yes | Metal | * |
| h | AC power cord | 2.0 | No | Plastic | * |

*: Conducted emission only.

3.3 System configuration



Note 1: Numbers assigned to equipment or cables on this diagram are corresponded to the list in “2.1 EUT information”, “3.1 Peripheral(s) used and “3.2 Cable(s) information”.

4. Test Instruments

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 | M96057 | Jun. 2009 | Jun. 14, 2008 |
| Preamplifier (1GHz-26.5GHz) | Agilent Technologies | 8449B | 3008A01008 | Dec. 2009 | Dec. 11, 2007 |
| Preamplifier (18GHz-40GHz) | TSJ | MLA-1840-B03-35 | 1040332 | Mar. 2009 | Mar. 28, 2007 |
| EMI Receiver | ROHDE&SCHWARZ | ESCI | 100764 | May. 2009 | May. 30, 2008 |
| Loop antenna | ROHDE&SCHWARZ | HFH2-Z2 | 891847/17 | Feb.2010 | Feb. 12, 2009 |
| TRILOG Antenna | Schwarzbeck | VULB9160 | 9160-3218 | Apr. 2009 | Apr. 23, 2008 |
| Attenuator(6dB) | TDC | TAT-43B-06 | N/A | Aug. 2009 | Aug. 8, 2008 |
| Double Ridged Guide Antenna | EMCO | 3115 | 5205 | Sep. 2009 | Sep. 26, 2007 |
| Broad-Band Horn Antenna | Schwarzbeck | BBHA9170 | BBHA9170189 | Mar. 2009 | Mar. 28, 2007 |
| Microwave cable | SUHNER | SUCOFLEX 106 15m | 60929/6 | Nov. 2009 | Nov. 12, 2008 |
| | SUHNER | SUCOFLEX 106 1m | 60959/6 | Nov. 2009 | Nov. 12, 2008 |
| Coaxial cable | Fujikura | 5D-2W/10m | #AEC3R-001 | Feb. 2010 | Feb. 5, 2009 |
| | | 5D-2W/1.5m | #AEC3RC-001 | Feb. 2010 | Feb. 5, 2009 |
| | | 5D-2W/1m | #AEC3RC-002 | Feb. 2010 | Feb. 5, 2009 |
| | | SUCOFLEX_106/7m | #AEC3R-003 | 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 | Apr. 2009 | Apr. 28, 2008 |
| Line impedance Stabilization network for EUT | Kyoritsu Electrical Works, Ltd. | KNW-242F | 8-1973-1 | Apr. 2009 | Apr. 15, 2008 |
| PC | DELL | DIMENSION E521 | 85465BX | N/A | N/A |
| PC | IBM | 6892-44J | 97-42089 | 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 | Apr. 2009 | Apr. 26, 2008 |

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

5. Test Type and Results

5.1 20dB Bandwidth / Occupied Bandwidth

5.1.1 Test Procedure [RSS-Gen 4.6.1]

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=100kHz, VBW=100kHz, Span=5MHz, Sweep=auto

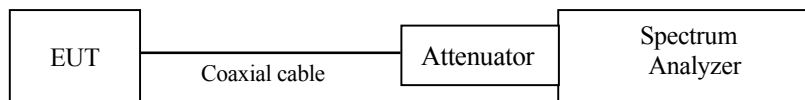
The EUT was set to operate with following conditions.

- ch 1 (low), ch 5 (mid) and ch 9 (high)

The test mode of EUT is as follows.

- Tx mode

5.1.2 Measurement Setup



5.1.3 Limit of Bandwidth at 20 dB below

None

5.1.4 Measurement Result

| Channel | Center Frequency [MHz] | 20dB Bandwidth [MHz] | Occupied Bandwidth [MHz] |
|---------|------------------------|----------------------|--------------------------|
| 1 | 2404.0 | 1.508 | 1.4185 |
| 5 | 2442.0 | 1.400 | 1.2831 |
| 9 | 2480.0 | 1.207 | 1.0440 |

5.1.5 Trace Data

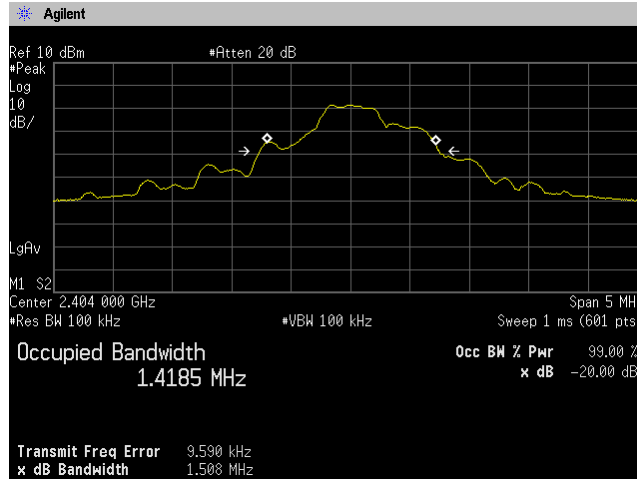
Test Personnel:

Tested by: Hiroaki Suzuki

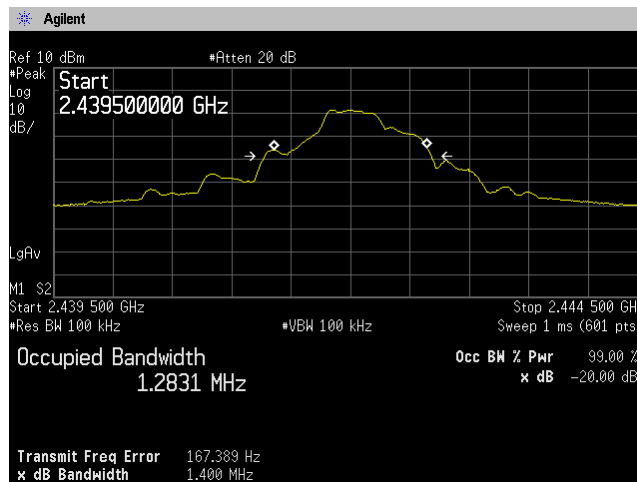
Date : Mar. 31, 2009
 Temperature : 20.0 [°C]
 Humidity : 52.0 [%]
 Test place : Shielded room

20dB Bandwidth/Occupied Bandwidth

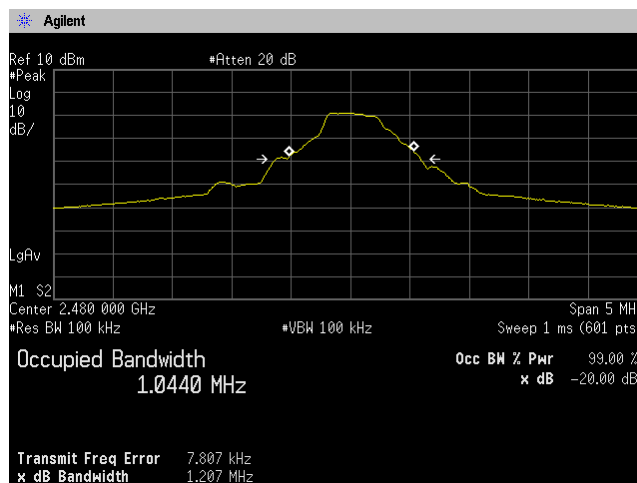
Channel Low: 2404.0MHz [Channel 1]



Channel Middle: 2442.0MHz [Channel 5]



Channel High: 2480.0MHz [Channel 9]



5.2 Restricted Band of Operation

5.2.1 Test Procedure [FCC 15.205, 15.209, 15.249(c),(d), IC RSS-210 A2.9(b)]

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=5MHz, Sweep=auto
- Marker Delta: RBW=300kHz, VBW=300kHz, Span=40MHz, Sweep=auto
- Average: RBW=1MHz, VBW=10Hz, Span=40MHz, Sweep=auto

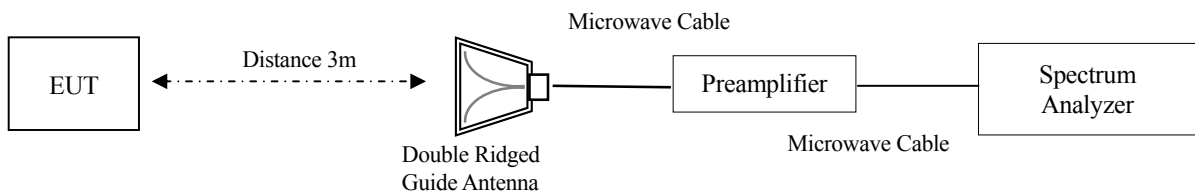
The EUT was set to operate with following conditions.

- ch 1 (low), ch 9 (high)

The test mode of EUT is as follows.

- Tx mode

5.2.2 Measurement Setup



5.2.3 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.

5.2.4 Measurement Result

Peak Field Strength

| (P) | Frequency [MHz] | Reading [dBuV/m] | c.f [dB(1/m)] | Marker Delta [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|------------------|---------------|-------------------|-----------------|----------------|-------------|
| H | 2390.0 | 110.3 | -5.4 | 47.1 | 57.8 | 74.0 | 16.2 |
| V | 2390.0 | 102.8 | -5.4 | 46.8 | 50.6 | 74.0 | 23.4 |
| H | 2483.5 | 108.5 | -5.1 | 35.8 | 67.6 | 74.0 | 6.4 |
| V | 2483.5 | 102.4 | -5.1 | 35.6 | 61.7 | 74.0 | 12.3 |

Average Field Strength

| (P) | Frequency [MHz] | Reading [dBuV/m] | c.f [dB(1/m)] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|------------------|---------------|-----------------|----------------|-------------|
| H | 2390.0 | 38.2 | -5.4 | 32.8 | 54.0 | 21.2 |
| V | 2390.0 | 37.7 | -5.4 | 32.3 | 54.0 | 21.7 |
| H | 2483.5 | 49.7 | -5.1 | 44.6 | 54.0 | 9.4 |
| V | 2483.5 | 44.1 | -5.1 | 39.0 | 54.0 | 15.0 |

Note:

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

5.2.5 Trace Data

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Apr. 9, 2009
 Temperature : 20.1 [°C]
 Humidity : 23.9 [%]
 Test place : 3m Semi-anechoic chamber

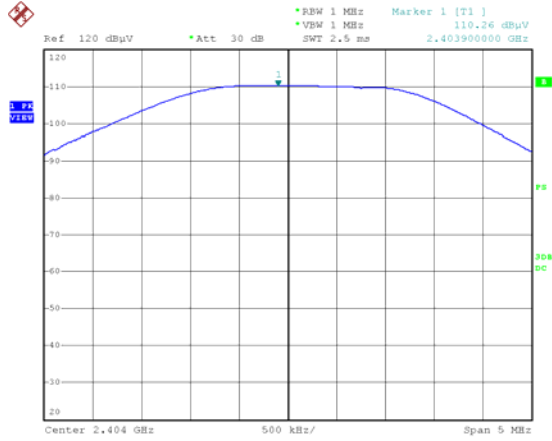
Test Personnel:

Tested by: Hiroaki Suzuki

Date : Apr. 10, 2009
 Temperature : 21.5 [°C]
 Humidity : 23.2 [%]
 Test place : 3m Semi-anechoic chamber

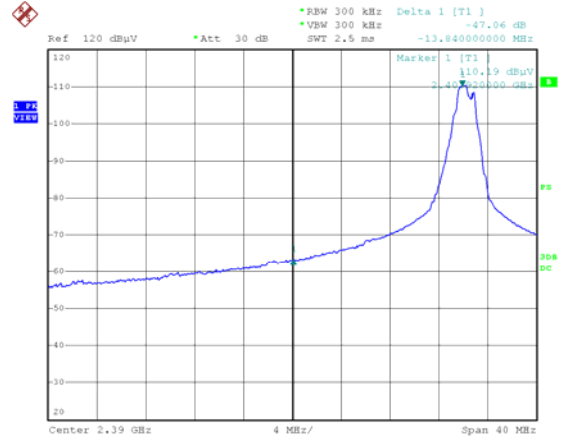
Restricted Band of Operation

Frequency: 2390.0MHz -Horizontal-Peak



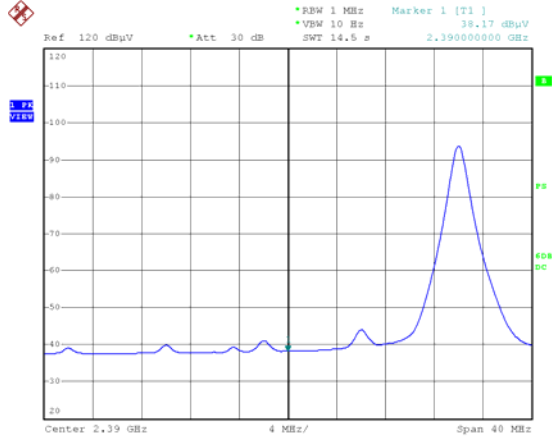
Date: 9.APR.2009 17:58:57

Marker Delta



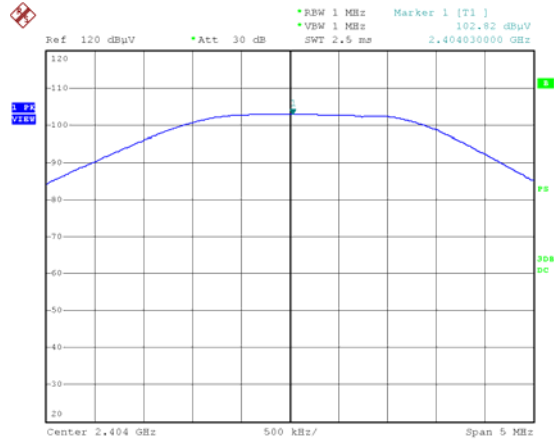
Date: 9.APR.2009 18:00:54

Average



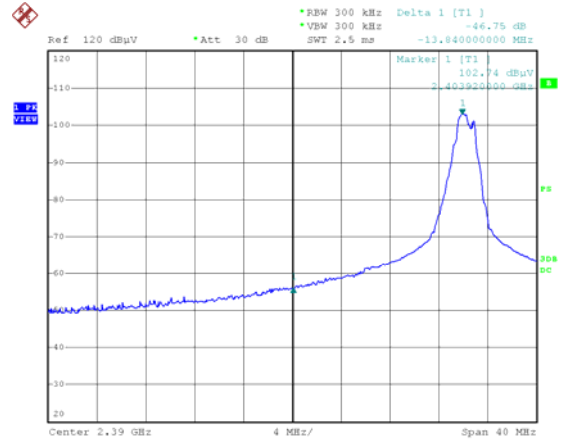
Date: 10.APR.2009 12:18:04

Frequency: 2390.0MHz -Vertical-Peak



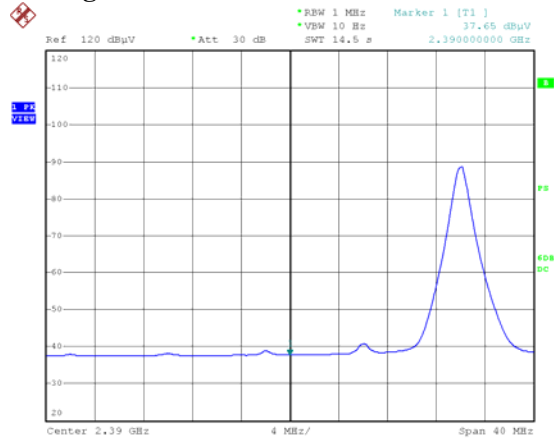
Date: 9.APR.2009 17:46:34

Marker Delta



Date: 9.APR.2009 17:54:24

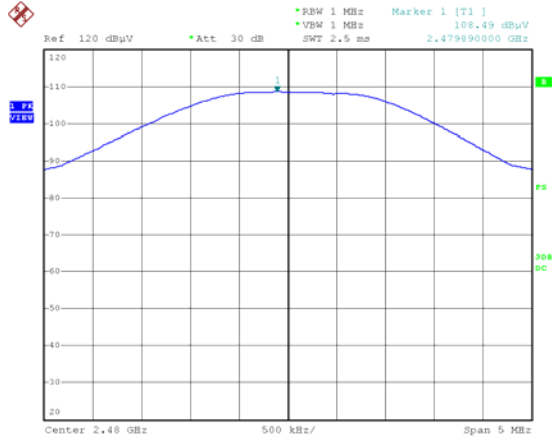
Average



Date: 10.APR.2009 12:13:40

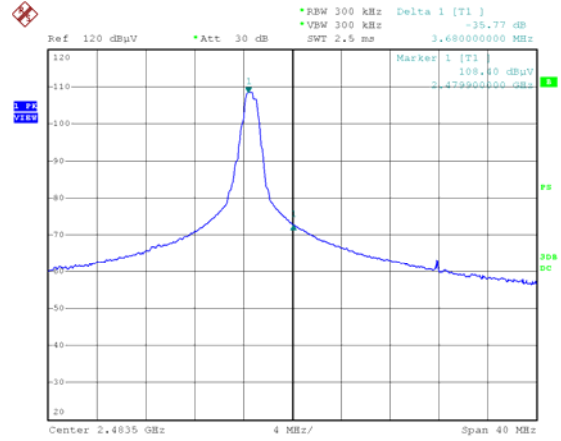
Restricted Band of Operation

Frequency: 2483.5MHz -Horizontal-Peak



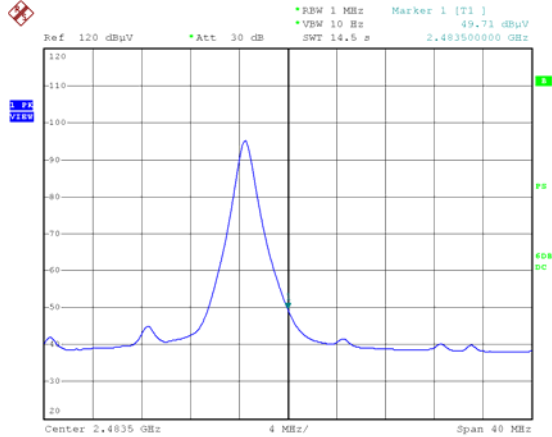
Date: 9.APR.2009 18:09:20

Marker Delta



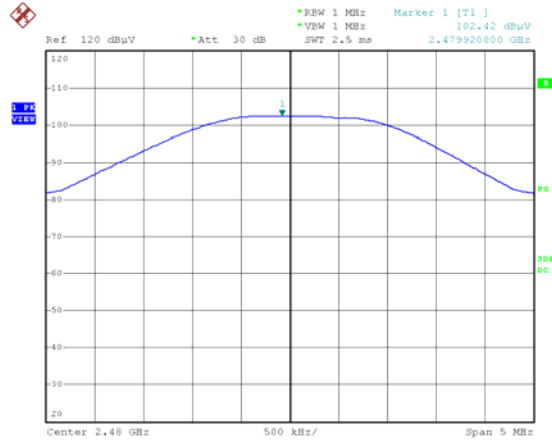
Date: 9.APR.2009 18:28:45

Average



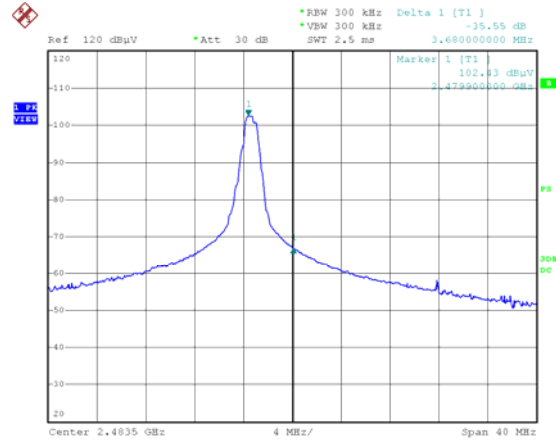
Date: 10.APR.2009 11:58:18

Frequency: 2483.5MHz -Vertical-Peak



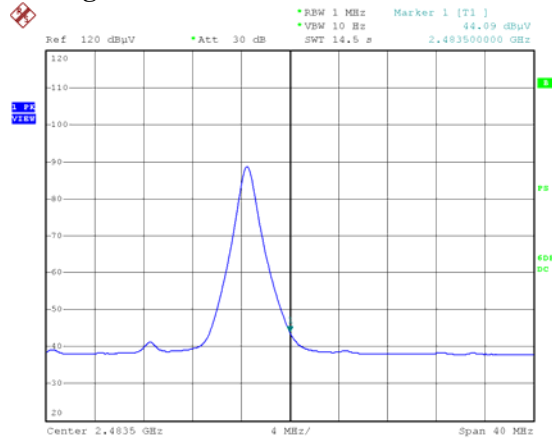
Date: 9.APR.2009 18:32:57

Marker Delta



Date: 9.APR.2009 18:35:11

Average



Date: 10.APR.2009 12:04:40

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

5.3.1 Test Procedure [FCC 15.205/209/249(a), (b), (c), (d), (e), 15.35(b), IC RSS-210 A2.9(a), (b), 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.

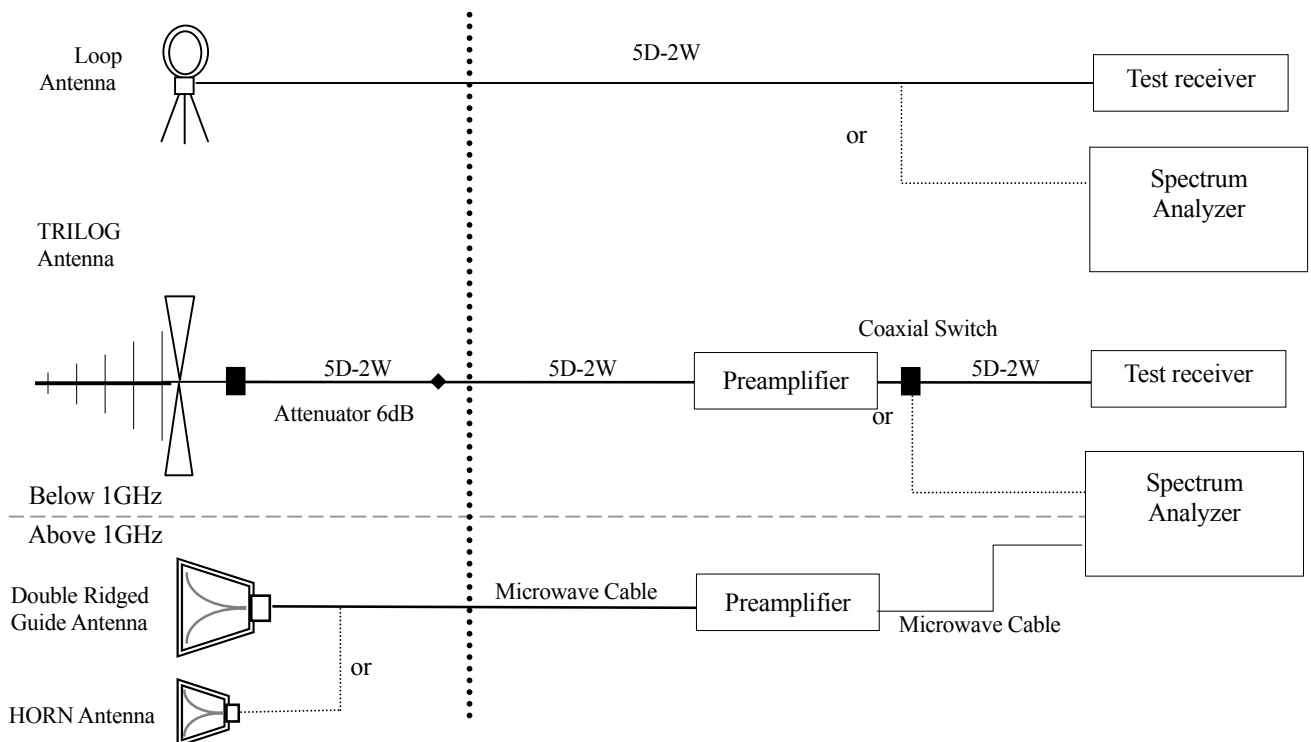
The EUT and support equipment are placed on a 1meter x 2meter surface, 0.8meter height FRP table. The turntable is rotated by 360 degrees and stopped at azimuth of producing the maximum emission.

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 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.

5.3.2 Measurement Setup

Test configuration for Spurious emissions



5.3.3 Limit of Spurious Emission Measurement

Field Strength of Fundamental and Harmonics

| Fundamental Frequency [MHz] | Field Strength of Fundamental | | Field Strength of Harmonics | |
|--------------------------------|-------------------------------|----------|-----------------------------|----------|
| | [mV/m] | [dBuV/m] | [uV/m] | [dBuV/m] |
| 902 – 928 | 50 | 94.0 | 500 | 54.0 |
| 2400 – 2483.5 | 50 | 94.0 | 500 | 54.0 |
| 5725 – 5875 | 50 | 94.0 | 500 | 54.0 |
| 24000 - 24250 | 250 | 108.0 | 2500 | 68.0 |

Spurious Emissions

| 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.

5.3.4 Sample of field strength calculation

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

| |
|--|
| 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> |

5.3.5 Measurement Results

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Mar. 25, 2009
Temperature : 19.7 [°C]
Humidity : 29.4 [%]
Test place : 3m Semi-anechoic chamber

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Mar. 26, 2009
Temperature : 21.0 [°C]
Humidity : 28.5 [%]
Test place : 3m Semi-anechoic chamber

**Spurious Emissions - Radiated -
Below 1GHz**

Tx Channel Low: 2404.0MHz [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 | 33.575 | V | 24.1 | -11.1 | 13.0 | 40.0 | 27.0 | 100.0 | 177.0 |
| 2 | 250.000 | H | 35.1 | -9.6 | 25.5 | 46.0 | 20.5 | 107.0 | 243.0 |
| 3 | 250.010 | V | 33.8 | -9.6 | 24.2 | 46.0 | 21.8 | 156.0 | 173.0 |
| 4 | 432.030 | H | 35.1 | -4.8 | 30.3 | 46.0 | 15.7 | 174.0 | 237.0 |
| 5 | 528.050 | V | 32.6 | -2.7 | 29.9 | 46.0 | 16.1 | 100.0 | 323.0 |
| 6 | 834.686 | H | 33.8 | 2.4 | 36.2 | 46.0 | 9.8 | 133.0 | 27.0 |
| 7 | 858.488 | H | 32.3 | 2.8 | 35.1 | 46.0 | 10.9 | 132.0 | 34.0 |

Tx Channel Middle: 2442.0MHz [Channel 5]

| 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 | 80.000 | H | 22.8 | -14.1 | 8.7 | 40.0 | 31.3 | 400.0 | 21.0 |
| 2 | 250.010 | H | 35.9 | -9.6 | 26.3 | 46.0 | 19.7 | 100.0 | 247.0 |
| 3 | 388.315 | H | 31.8 | -5.9 | 25.9 | 46.0 | 20.1 | 100.0 | 117.0 |
| 4 | 528.060 | V | 35.2 | -2.7 | 32.5 | 46.0 | 13.5 | 100.0 | 113.0 |
| 5 | 858.450 | H | 32.0 | 2.8 | 34.8 | 46.0 | 11.2 | 154.0 | 33.0 |

Tx Channel High: 2480.0MHz [Channel 9]

| 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 | 47.316 | V | 34.4 | -9.8 | 24.6 | 40.0 | 15.4 | 100.0 | 0.0 |
| 2 | 250.010 | V | 37.2 | -9.6 | 27.6 | 46.0 | 18.4 | 150.0 | 184.0 |
| 3 | 432.050 | V | 38.9 | -4.8 | 34.1 | 46.0 | 11.9 | 100.0 | 51.0 |
| 4 | 528.057 | V | 35.5 | -2.7 | 32.8 | 46.0 | 13.2 | 100.0 | 110.0 |
| 5 | 858.480 | H | 32.3 | 2.8 | 35.1 | 46.0 | 10.9 | 100.0 | 30.0 |

Rx mode

| 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 | 250.020 | V | 35.9 | -9.6 | 26.3 | 46.0 | 19.7 | 100.0 | 177.0 |
| 2 | 432.040 | V | 38.4 | -4.8 | 33.6 | 46.0 | 12.4 | 100.0 | 83.0 |
| 3 | 528.047 | V | 35.7 | -2.7 | 33.0 | 46.0 | 13.0 | 100.0 | 113.0 |
| 4 | 858.470 | H | 32.3 | 2.8 | 35.1 | 46.0 | 10.9 | 100.0 | 29.0 |

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.

Above 1GHz

Tx Channel Low: 2404.0MHz [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 | 2404.01 | 111.2 | -5.4 | 105.8 | 114.0 | 8.2 |
| V | 2404.13 | 102.4 | -5.4 | 97.0 | 114.0 | 17.0 |
| H | 4807.71 | 57.2 | 2.0 | 59.2 | 74.0 | 14.8 |
| V | 4807.47 | 52.2 | 2.0 | 54.2 | 74.0 | 19.8 |
| V | 7213.08 | 50.2 | 6.5 | 56.7 | 74.0 | 17.3 |
| V | 9616.42 | 47.9 | 9.2 | 57.1 | 74.0 | 16.9 |

Average Field Strength

| (P) | Frequency [MHz] | Peak Result [dBuV/m] | Duty cycle factor [dB(1/m)] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|----------------------|-----------------------------|-----------------|----------------|-------------|
| H | 2404.01 | 105.8 | 20.0 | 85.8 | 94.0 | 8.2 |
| V | 2404.13 | 97.0 | 20.0 | 77.0 | 94.0 | 17.0 |
| H | 4807.71 | 59.2 | 20.0 | 39.2 | 54.0 | 14.8 |
| V | 4807.47 | 54.2 | 20.0 | 34.2 | 54.0 | 19.8 |
| V | 7213.08 | 56.7 | 20.0 | 36.7 | 54.0 | 17.3 |
| V | 9616.42 | 57.1 | 20.0 | 37.1 | 54.0 | 16.9 |

Tx Channel Middle: 2442.0MHz [Channel 5]

Peak Field Strength

| (P) | Frequency [MHz] | Reading [dBuV/m] | c.f [dB(1/m)] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|------------------|---------------|-----------------|----------------|-------------|
| H | 2441.99 | 110.5 | -5.3 | 105.2 | 114.0 | 8.8 |
| V | 2441.99 | 102.3 | -5.3 | 97.0 | 114.0 | 17.0 |
| H | 4883.73 | 57.7 | 1.9 | 59.6 | 74.0 | 14.4 |
| V | 4883.71 | 52.6 | 1.9 | 54.5 | 74.0 | 19.5 |
| H | 7326.05 | 52.9 | 7.2 | 60.1 | 74.0 | 13.9 |
| V | 7325.60 | 54.2 | 7.2 | 61.4 | 74.0 | 12.6 |
| V | 9767.75 | 49.1 | 8.9 | 58.0 | 74.0 | 16.0 |

Average Field Strength

| (P) | Frequency [MHz] | Peak Result [dBuV/m] | Duty cycle factor [dB(1/m)] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|----------------------|-----------------------------|-----------------|----------------|-------------|
| H | 2441.99 | 105.2 | 20.0 | 85.2 | 94.0 | 8.8 |
| V | 2441.99 | 97.0 | 20.0 | 77.0 | 94.0 | 17.0 |
| H | 4884.73 | 59.6 | 20.0 | 39.6 | 54.0 | 14.4 |
| V | 4883.71 | 54.5 | 20.0 | 34.5 | 54.0 | 19.5 |
| H | 7326.05 | 60.1 | 20.0 | 40.1 | 54.0 | 13.9 |
| V | 7325.60 | 61.4 | 20.0 | 41.4 | 54.0 | 12.6 |
| V | 9767.75 | 58.0 | 20.0 | 38.0 | 54.0 | 16.0 |

Tx Channel High: 2480.0MHz [Channel 9]

Peak Field Strength

| (P) | Frequency [MHz] | Reading [dBuV/m] | c.f [dB(1/m)] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|------------------|---------------|-----------------|----------------|-------------|
| H | 2479.96 | 104.7 | -5.1 | 99.6 | 114.0 | 14.4 |
| V | 2479.91 | 102.9 | -5.1 | 97.8 | 114.0 | 16.2 |
| V | 4960.32 | 53.9 | 2.1 | 56.0 | 74.0 | 18.0 |
| H | 7439.63 | 56.6 | 7.3 | 63.9 | 74.0 | 10.1 |
| V | 7440.66 | 60.6 | 7.3 | 53.3 | 74.0 | 20.7 |
| V | 9919.41 | 49.2 | 9.0 | 58.2 | 74.0 | 15.8 |

Average Field Strength

| (P) | Frequency [MHz] | Peak Result [dBuV/m] | Duty cycle factor [dB(1/m)] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|----------------------|-----------------------------|-----------------|----------------|-------------|
| H | 2479.96 | 99.6 | 20.0 | 79.6 | 94.0 | 14.4 |
| V | 2479.91 | 97.8 | 20.0 | 77.8 | 94.0 | 16.2 |
| V | 4960.32 | 56.0 | 20.0 | 36.0 | 54.0 | 18.0 |
| H | 7439.63 | 63.9 | 20.0 | 43.9 | 54.0 | 10.1 |
| V | 7440.66 | 53.3 | 20.0 | 33.3 | 54.0 | 20.7 |
| V | 9919.41 | 58.2 | 20.0 | 38.2 | 54.0 | 15.8 |

Rx mode

Peak Field Strength

| (P) | Frequency [MHz] | Reading [dBuV/m] | c.f [dB(1/m)] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|------------------|---------------|-----------------|----------------|-------------|
| V | 2832.20 | 49.5 | -3.8 | 45.7 | 74.0 | 28.3 |

Average Field Strength

| (P) | Frequency [MHz] | Peak Result [dBuV/m] | Duty cycle factor [dB(1/m)] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] |
|-----|-----------------|----------------------|-----------------------------|-----------------|----------------|-------------|
| V | 2836.20 | 45.7 | 20.0 | 25.7 | 54.0 | 28.3 |

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]

5.3.6 Duty Cycle

Duty Cycle Factor Calculation

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

Pulse width is 200us

There are 45 pulses in 100mSec window

$200\mu\text{s} \times 45 = 9\text{ms}$

It is 9ms in 100ms

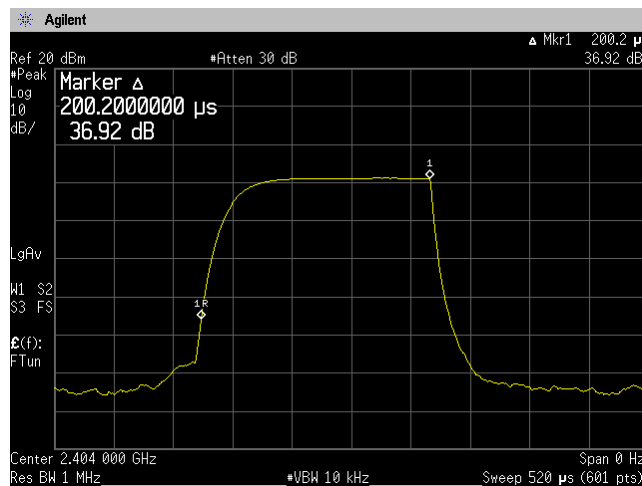
Duty cycle: $9/100 = 0.09$

Duty cycle factor: $20\log(0.09) = -20.9\text{dB}$

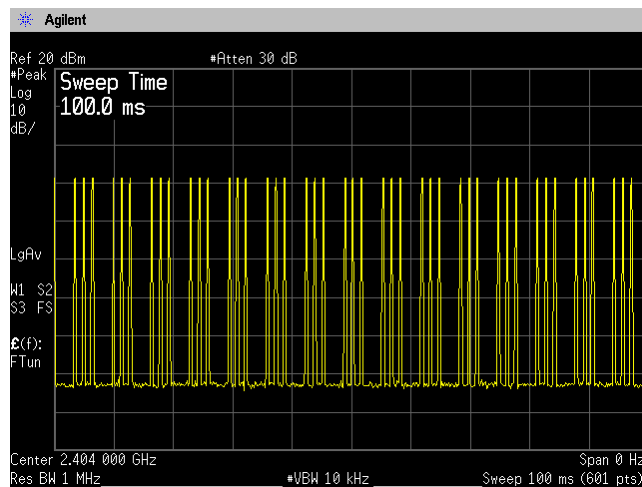
Maximum duty cycle according to Para 15.35 (b): 20dB

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

Pulse width



100ms window



5.4 AC power line Conducted Emissions

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

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 wooden table of 2.3m(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 2.4m (W) × 2.7m (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:

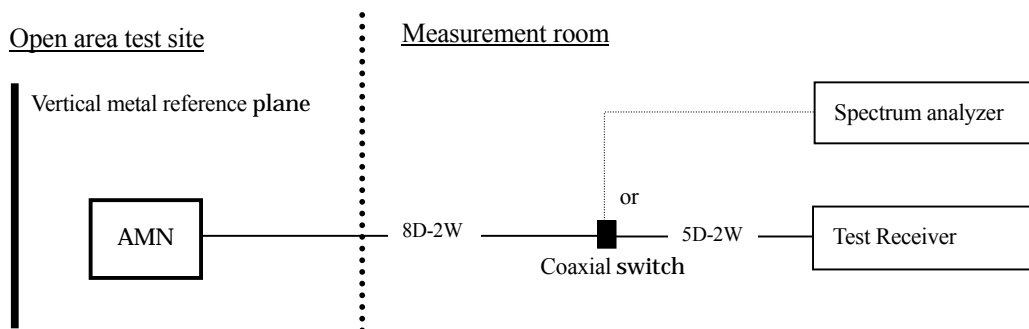
- 0.15MHz to 30MHz

The Test receiver is set to:

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

5.4.2 Measurement Setup

Test configuration for AC power line Conducted Emissions

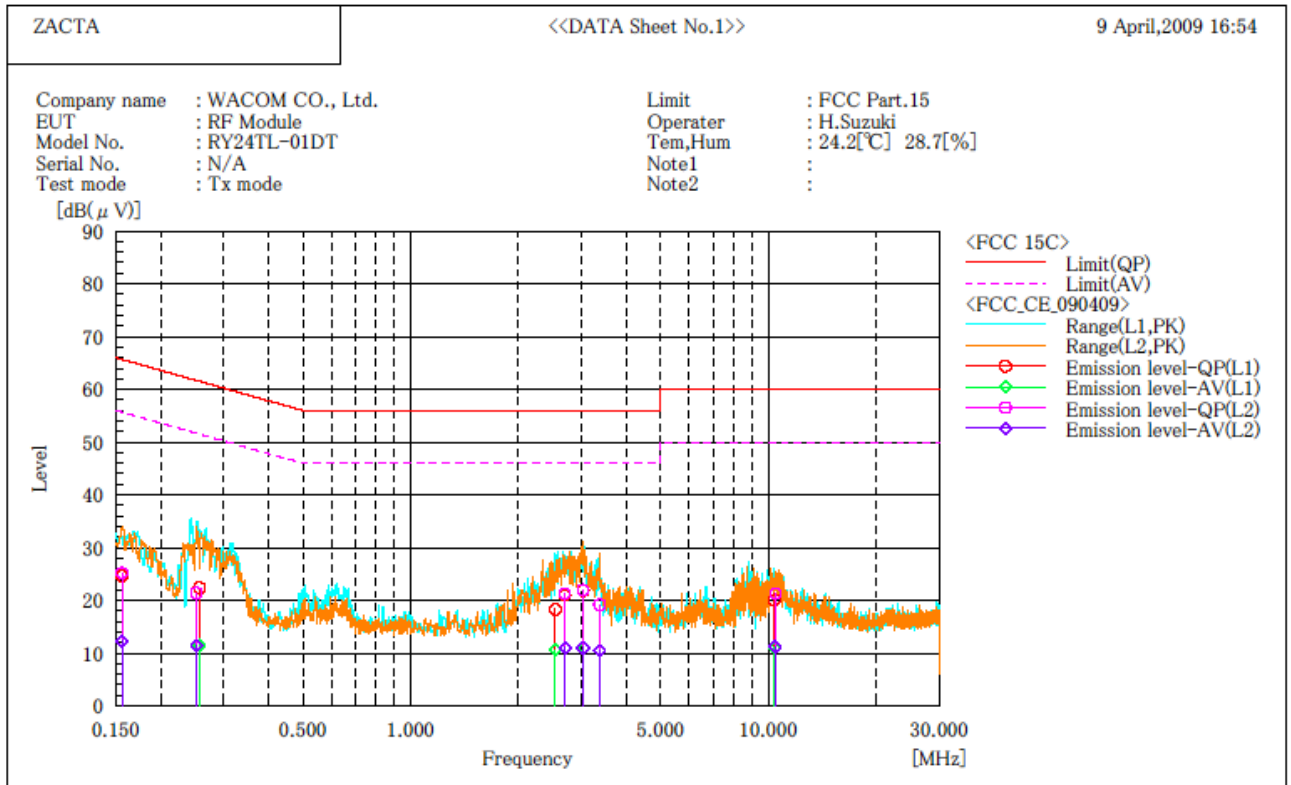


5.4.3 Limit of AC power line Conducted Emissions Measurement (Sample calculation)

| 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) |
| 0.5MHz to 5MHz | 56 | 46 | (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 |
| 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.

5.4.4 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 | 0.156 | 13.6 | 1.3 | 11.1 | 24.7 | 12.4 | 65.7 | 55.7 | 41.0 | 43.3 |
| 2 | 0.257 | 12.0 | 1.1 | 10.4 | 22.4 | 11.5 | 61.5 | 51.5 | 39.1 | 40.0 |
| 3 | 2.535 | 8.5 | 0.8 | 9.8 | 18.3 | 10.6 | 56.0 | 46.0 | 37.7 | 35.4 |
| 4 | 2.700 | 11.2 | 1.2 | 9.8 | 21.0 | 11.0 | 56.0 | 46.0 | 35.0 | 35.0 |
| 5 | 3.035 | 12.1 | 1.2 | 9.8 | 21.9 | 11.0 | 56.0 | 46.0 | 34.1 | 35.0 |
| 6 | 10.400 | 10.0 | 1.0 | 10.1 | 20.1 | 11.1 | 60.0 | 50.0 | 39.9 | 38.9 |

--- 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 | 0.156 | 14.1 | 1.3 | 11.1 | 25.2 | 12.4 | 65.7 | 55.7 | 40.5 | 43.3 |
| 2 | 0.252 | 11.0 | 1.0 | 10.4 | 21.4 | 11.4 | 61.7 | 51.7 | 40.3 | 40.3 |
| 3 | 2.695 | 11.5 | 1.2 | 9.8 | 21.3 | 11.0 | 56.0 | 46.0 | 34.7 | 35.0 |
| 4 | 3.034 | 12.2 | 1.2 | 9.8 | 22.0 | 11.0 | 56.0 | 46.0 | 34.0 | 35.0 |
| 5 | 3.375 | 9.4 | 0.6 | 9.8 | 19.2 | 10.4 | 56.0 | 46.0 | 36.8 | 35.6 |
| 6 | 10.468 | 11.2 | 1.2 | 10.1 | 21.3 | 11.3 | 60.0 | 50.0 | 38.7 | 38.7 |

5.5 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.

6. 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) | $\pm 3.6\text{dB}$ |

7. Laboratory description

7.1 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

7.2 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:

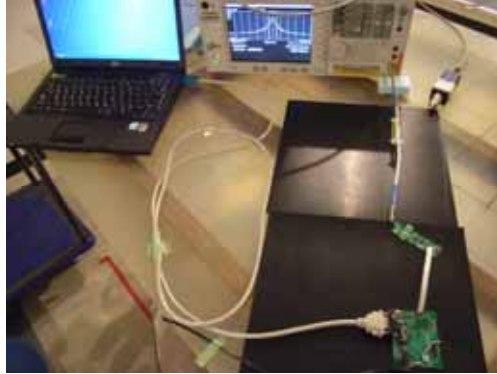
Authorized as an EMC test laboratory.

7) BUREAU VERITAS certification:

Certified as an EMC test laboratory.

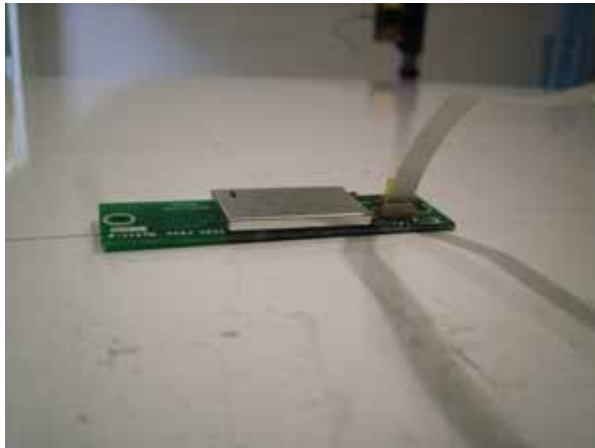
8. Test photographs

System configuration (RF Conducted test)

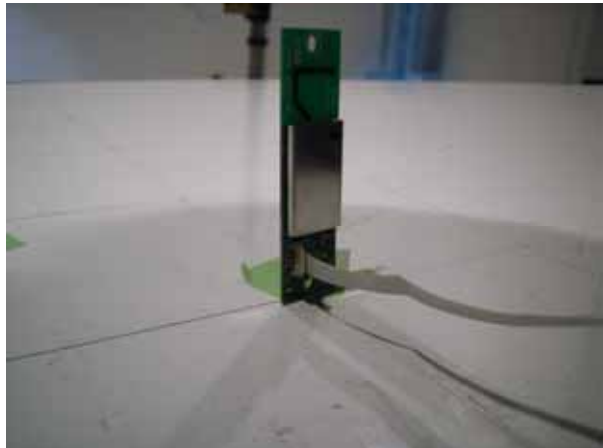


Transmitter Radiated Spurious Emissions (RF Radiated test)

Case 1



Case 2



Case 3



Note: Case 3 generates the maximum emission .

Conducted emission at mains port



The photographs show maximized emission configuration.