# FCC RADIO TEST REPORT

according to

47 CFR FCC Part 15 Subpart C § 15.247

| | | |
|---|---|---|
| **Equipment** | : | **150N Wireless LAN Access Point** |
| **Model No.** | : | **EW-7215APn, EW-7215PDn, GAP-215N, GAP-PD215N** |
| **Brand Name** | : | **EDIMAX** |
| **Filing Type** | : | **New Application** |
| **Applicant** | : | **EDIMAX TECHNOLOGY CO., LTD.**<br>No.3, Wu Chuan 3RD Road, Wu-Ku Industrial Park, Taipei Hsien, Taiwan |
| **FCC ID** | : | **NDD9572150901** |
| **Manufacturer** | : | **EDIMAX TECHNOLOGY CO., LTD.**<br>No.3, Wu Chuan 3RD Road, Wu-Ku Industrial Park, Taipei Hsien, Taiwan |
| **Received Date** | : | Sep. 01, 2009 |
| **Final Test Date** | : | Oct. 20, 2009 |
| **Multiple Listing** | : | Please refer to section 2.6 |

## Statement

**Test result included is only for the 802.11n of the product.**

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.4-2003** and **47 CFR FCC Part 15 Subpart C**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.



***SPORTON International Inc.***

*6F, No. 106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.*

# Table of Contents

# History of This Test Report

Original Issue Date: Oct. 29, 2009

Report No.: FR921312AI

■ No additional attachment.

□ Additional attachment were issued as following record:

| Attachment No. | Issue Date | Description |
|---|---|---|
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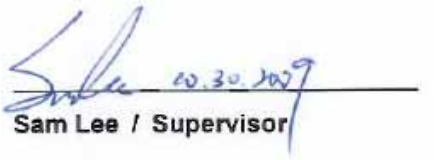
# CERTIFICATE OF COMPLIANCE

according to

47 CFR FCC Part 15 Subpart C § 15.247

| | | |
|---|---|---|
| Equipment | : | 150N Wireless LAN Access Point |
| Model No. | : | EW-7215APn, EW-7215PDn, GAP-215N, GAP-PD215N |
| Brand Name | : | EDIMAX |
| Applicant | : | EDIMAX TECHNOLOGY CO., LTD.<br>No.3, Wu Chuan 3RD Road, Wu-Ku Industrial Park, Taipei Hsien, Taiwan |

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Sep. 01, 2009 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

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# 1 SUMMARY OF THE TEST RESULT

| Applied Standard: 47 CFR FCC Part 15 Subpart C | | | | |
|---|---|---|---|---|
| **Part** | **Rule Section** | **Description of Test** | **Result** | **Under Limit** |
| 3.1 | 15.207 | AC Power Line Conducted Emissions | Complies | 10.23 dB |
| 3.2 | 15.247(b)(3) | Maximum Conducted Output Power | Complies | 15.41 dB |
| 3.3 | 15.247(e) | Power Spectral Density | Complies | 15.31 dB |
| 3.4 | 15.247(a)(2) | 6dB Spectrum Bandwidth | Complies | - |
| 3.5 | 15.247(d) | Radiated Emissions | Complies | 0.94 dB |
| 3.6 | 15.247(d) | Band Edge Emissions | Complies | 1.06 dB |
| 3.7 | 15.203 | Antenna Requirements | Complies | - |

| Test Items | Uncertainty | Remark |
|---|---|---|
| AC Power Line Conducted Emissions | ±2.3dB | Confidence levels of 95% |
| Maximum Peak Conducted Output Power | ±0.8dB | Confidence levels of 95% |
| Power Spectral Density | ±0.5dB | Confidence levels of 95% |
| 6dB Spectrum Bandwidth | $\pm 8.5\times10^{-8}$ | Confidence levels of 95% |
| Radiated Emissions (9kHz~30MHz) | ±0.8dB | Confidence levels of 95% |
| Radiated Emissions (30MHz~1000MHz) | ±1.9dB | Confidence levels of 95% |
| Radiated / Band Edge Emissions (1GHz~18GHz) | ±1.9dB | Confidence levels of 95% |
| Radiated Emissions (18GHz~40GHz) | ±1.9dB | Confidence levels of 95% |
| Temperature | ±0.7℃ | Confidence levels of 95% |
| Humidity | ±3.2% | Confidence levels of 95% |
| DC / AC Power Source | ±1.4% | Confidence levels of 95% |

# 2 GENERAL INFORMATION

## 2.1 Product Details

There are two difference appearance of product. The white appearance power type is only adapter and the black appearance power type has adapter or POE. Only the radio detail of IEEE 802.11n is shown in the table below. For more detailed features description, please refer to the manufacturer's specifications or user's manual.

| Items | Description |
|---|---|
| Power Type | +5V from adapter |
| Modulation | See the below table for IEEE 802.11n |
| Data Modulation | OFDM (BPSK / QPSK / 16QAM / 64QAM) |
| Data Rate (Mbps) | See the below table for IEEE 802.11n |
| Frequency Range | 2400 ~ 2483.5MHz |
| Channel Number | 11 for 20MHz bandwidth ; 7 for 40MHz bandwidth |
| Channel Band Width (99%) | MCS 0 (20MHz) : 17.4038 MHz ; MCS 0 (40MHz) : 35.641 MHz |
| Conducted Output Power | MCS 0 (20MHz) : 23.63 dBm ; MCS 0 (40MHz) : 18.31 dBm |

## 2.2 Accessories

| Power | Brand | Model | Rating |
|---|---|---|---|
| Switching power supply | PHIHONG | PSAC05R-050 | INPUT : 100-240V~300mA 50-60Hz<br>OUTPUT : +5V 1A MAX |

## 2.3 Table for Filed Antenna

**Antenna & Bandwidth**

| Antenna | Single (TX) | |
|---|---|---|
| Bandwidth Mode | 20 MHz | 40 MHz |
| 802.11b | V | X |
| 802.11g | V | X |
| 802.11n (2.4GHz) | V | V |

| Ant. | Antenna Type | Connector | Gain (dBi) | Remark |
|---|---|---|---|---|
| A | Dipole Antenna | Reversed-SMA | 3.00 | TX / RX |

**Antenna: 3dBi Detachable Dipole Antenna x 1 (1T1R Spatial Multiplexing MIMO configuration).**

**IEEE 802.11n Modulation Scheme**

| MCS Index | Nss | Modulation | R | NBPSC | NCBPS | | NDBPS | | Data rate(Mbps) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 800nsGI | |
| | | | | | 20MHz | 40MHz | 20MHz | 40MHz | 20MHz | 40MHz |
| 0 | 1 | BPSK | 1/2 | 1 | 52 | 108 | 26 | 54 | 6.5 | 13.5 |
| 1 | 1 | QPSK | 1/2 | 2 | 104 | 216 | 52 | 108 | 13.0 | 27.0 |
| 2 | 1 | QPSK | 3/4 | 2 | 104 | 216 | 78 | 162 | 19.5 | 40.5 |
| 3 | 1 | 16-QAM | 1/2 | 4 | 208 | 432 | 104 | 216 | 26.0 | 54.0 |
| 4 | 1 | 16-QAM | 3/4 | 4 | 208 | 432 | 156 | 324 | 39.0 | 81.0 |
| 5 | 1 | 64-QAM | 2/3 | 6 | 312 | 648 | 208 | 432 | 52.0 | 108.0 |
| 6 | 1 | 64-QAM | 3/4 | 6 | 312 | 648 | 234 | 486 | 58.5 | 121.5 |
| 7 | 1 | 64-QAM | 5/6 | 6 | 312 | 648 | 260 | 540 | 65.0 | 135.0 |

| Symbol | Explanation |
|---|---|
| NSS | Number of spatial streams |
| R | Code rate |
| NBPSC | Number of coded bits per single carrier |
| NCBPS | Number of coded bits per symbol |
| NDBPS | Number of data bits per symbol |
| GI | guard interval |

## 2.4 Table for Carrier Frequencies

There are two bandwidth systems for IEEE 802.11n.

For 20MHz bandwidth systems, use Channel 1~Channel 11.

For 40MHz bandwidth systems, use Channel 3~Channel 9.

| Frequency Band | Channel No. | Frequency | Channel No. | Frequency |
|---|---|---|---|---|
| 2400~2483.5MHz | 1 | 2412 MHz | 7 | 2442 MHz |
| | 2 | 2417 MHz | 8 | 2447 MHz |
| | 3 | 2422 MHz | 9 | 2452 MHz |
| | 4 | 2427 MHz | 10 | 2457 MHz |
| | 5 | 2432 MHz | 11 | 2462 MHz |
| | 6 | 2437 MHz | - | - |

## 2.5 Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on the entire possible configuration for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items | Mode | Data Rate | Channel |
|---|---|---|---|
| AC Power Line Conducted Emissions | See the Note | Auto | - |
| Maximum Conducted Output Power<br>Power Spectral Density<br>6dB Spectrum Bandwidth<br>Radiated Emissions 1GHz~10$^{th}$ Harmonic<br>Band Edge Emissions | MCS 0 (20MHz) | 6.5 Mbps | 1/6/11 |
| | MCS 0 (40MHz) | 13.5 Mbps | 3/6/9 |
| Radiated Emissions 9kHz~1GHz | See the Note | Auto | - |

Note: For the all test, the following modes were tested:

Mode 1. white appearance + Adapter

Mode 2. black appearance + POE

In the Radiated Emissions (1GHz~12.75GHz): Because the EUT RF module is same, so use the Mode 2 is tested in this report.

## 2.6 Table for Multiple Listing

| No. | Brand Name | Model Name |
|---|---|---|
| 1 | Edimax | EW-7215APn,EW-7215PDn,GAP-215N,GAP-PD215N |
| 2 | Conceptronic | C150APM |

## 2.7 Table for Testing Locations

| Test Site No. | Site Category | Location | FCC Reg. No. | IC File No. | VCCI Reg. No |
|---|---|---|---|---|---|
| CO04-HY | Conduction | Hwa Ya | 643075 | IC 4086B-1 | - |
| TH01-HY | OVEN Room | Hwa Ya | - | - | - |
| 03CH02-HY | SAC | Hwa Ya | 643075 | IC 4086B-1 | - |

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC); Fully Anechoic Chamber (FAC).

## 2.8 Table for Supporting Units

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| Notebook | DELL | D400 | N/A |
| Modem | ACEEX | DM1414 | IFAXDM1414 |
| Mouse (USB) | Microsoft | 1004 | N/A |
| Notebook (Remote Workstation) | DELL | D400 | N/A |
| POE (Remote Workstation) | D-Link | DEL-P200 | N/A |

## 2.9 Table for Parameters of Test Software Setting

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

**Power Parameters of IEEE 802.11n**

| Test Software Version | RT3052 | | |
|---|---|---|---|
| Frequency | 2412 MHz | 2437 MHz | 2462 MHz |
| IEEE 802.11n(20MHz) | 0e | 1f | 13 |
| Frequency | 2422 MHz | 2437 MHz | 2452 MHz |
| IEEE 802.11n(40MHz) | 0c | 1f | 0f |

## 2.10 EUT Operation during Test

An executive program, EMCTEST.EXE under WIN XP, which generates a complete line of continuously repeating “H“ pattern was used as the test software.

The NB sends “H“ messages to the panel, and the panel displays “H“ patterns on the screen.

Executed "ping.exe" to link with the remote workstation to receive and transmit data by LAN and WLAN.

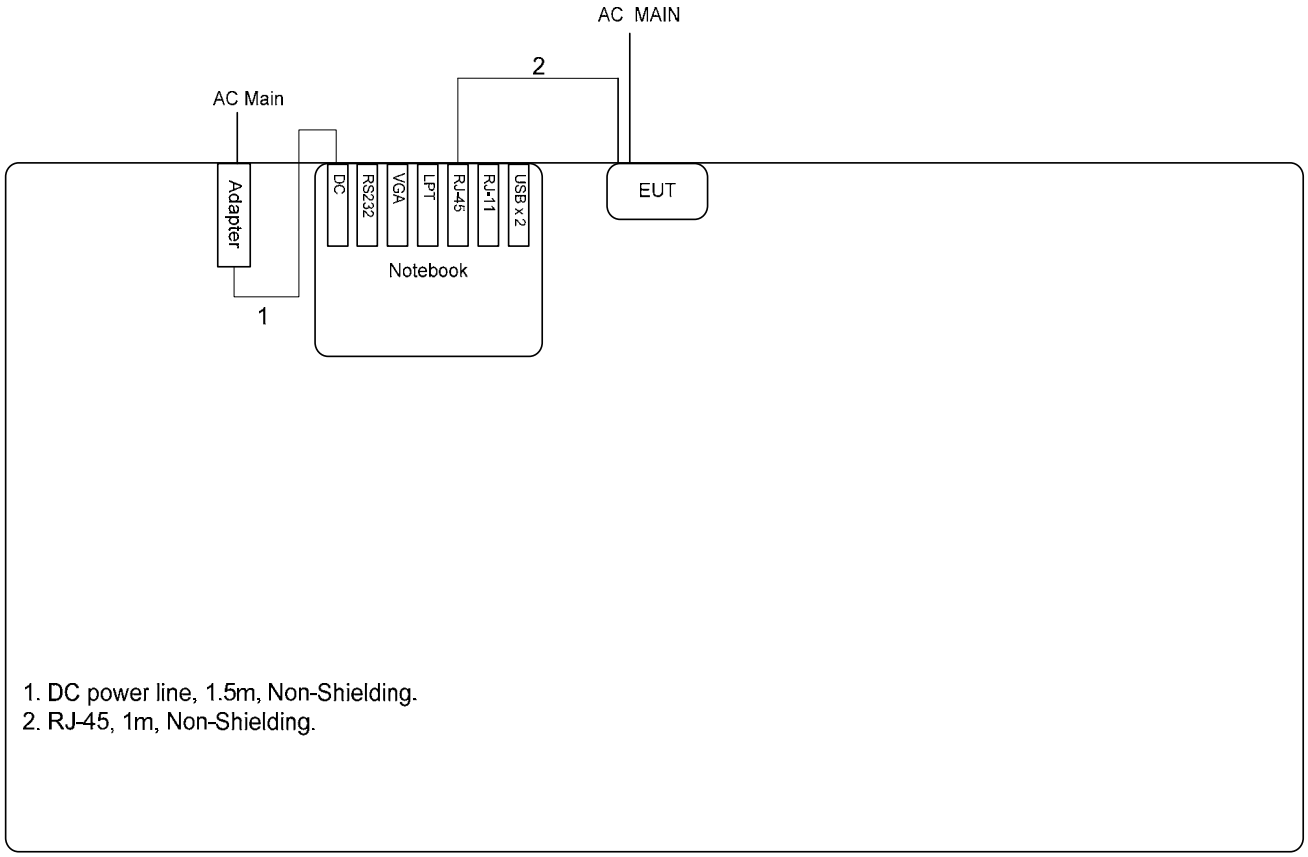
Executed “RT3052” to keep transmitting signals at fixed frequency.

## 2.11 Test Configuration

### 2.11.1 Radiation Emissions Test Configuration

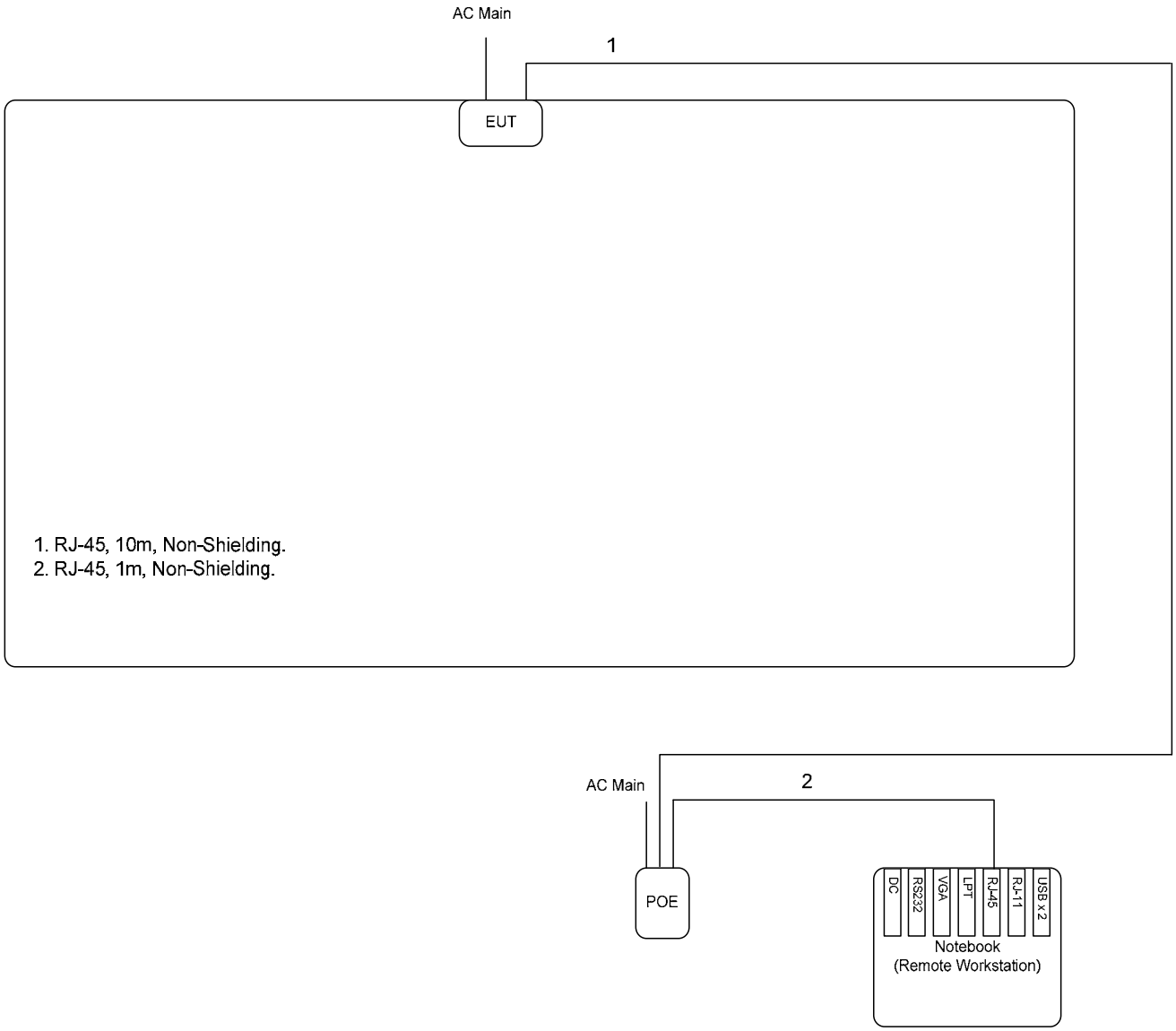
**For radiated emissions 9kHz~1GHz**

**Mode 1**



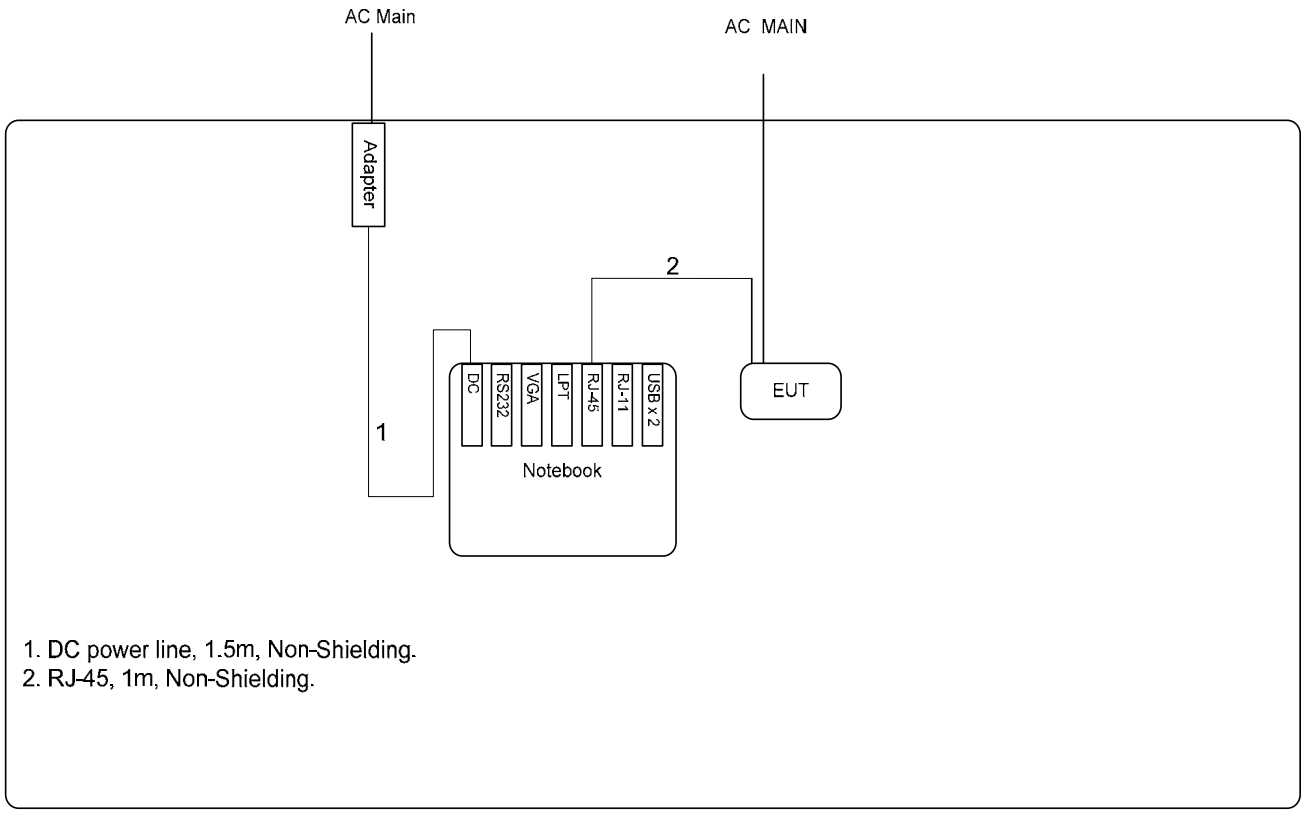

1. DC power line, 1.5m, Non-Shielding.
2. RJ-45, 1m, Non-Shielding.

**Mode 2**


AC Main
1
EUT
1. RJ-45, 10m, Non-Shielding.
2. RJ-45, 1m, Non-Shielding.
AC Main
2
POE
DC
RS232
VGA
LPT
RJ-45
RJ-11
USB x2
Notebook
(Remote Workstation)

**For radiated emissions above 1GHz**

**Mode 1**




1. DC power line, 1.5m, Non-Shielding.
2. RJ-45, 1m, Non-Shielding.

# 3 TEST RESULT

## 3.1 AC Power Line Conducted Emissions Measurement

### 3.1.1 Limit

For this product which is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

**Class B**

| Frequency (MHz) | QP Limit (dBuV) | AV Limit (dBuV) |
|---|---|---|
| 0.15~0.5 | 66~56 | 56~46 |
| 0.5~5 | 56 | 46 |
| 5~30 | 60 | 50 |

### 3.1.2 Measuring Instruments and Setting

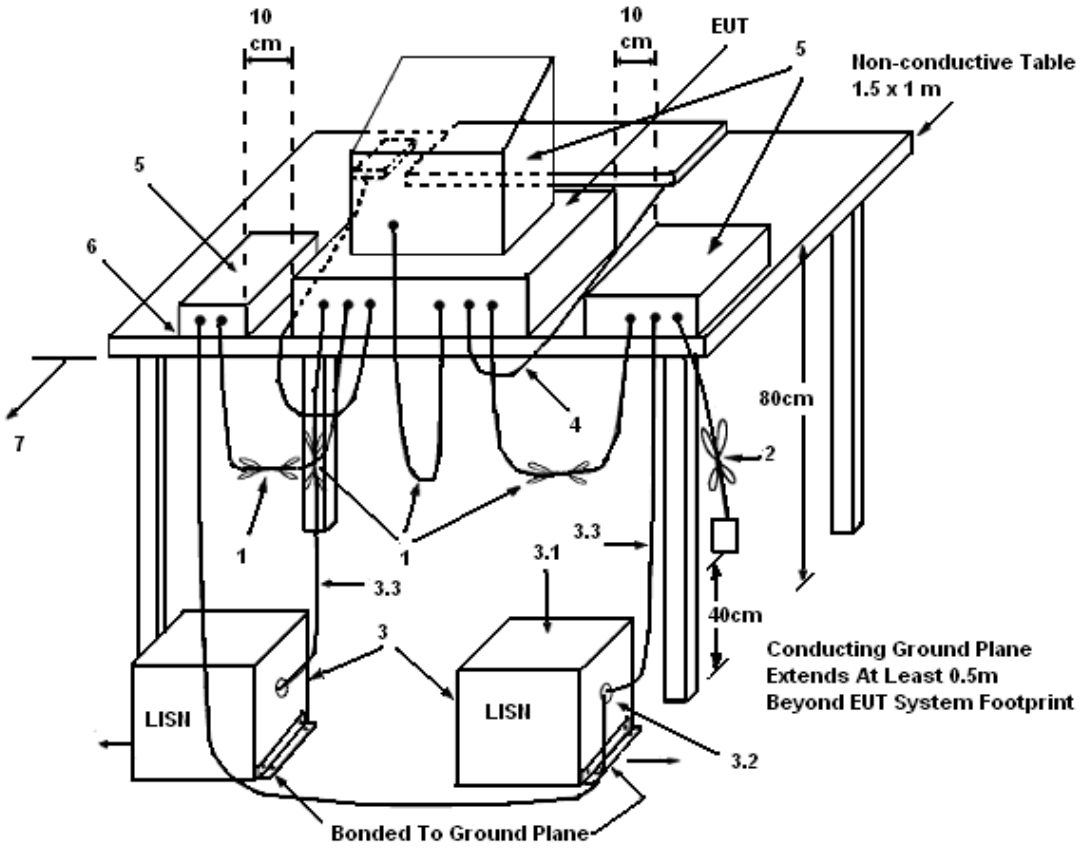
Please refer to section 4 of equipments list in this report. The following table is the setting of the receiver.

| Receiver Parameters | Setting |
|---|---|
| Attenuation | 10 dB |
| Start Frequency | 0.15 MHz |
| Stop Frequency | 30 MHz |
| IF Bandwidth | 9 KHz |

### 3.1.3 Test Procedures

1. Configure the EUT according to ANSI C63.4. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 KHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

### 3.1.4 Test Setup Layout




LEGEND:

(1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

(2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

(3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference ground plane.

(3.1) All other equipment powered from additional LISN(s).

(3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

(3.3) LISN at least 80 cm from nearest part of EUT chassis.

(4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.

(5) Non-EUT components of EUT system being tested.

(6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

(7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

### 3.1.5 Test Deviation

There is no deviation with the original standard.

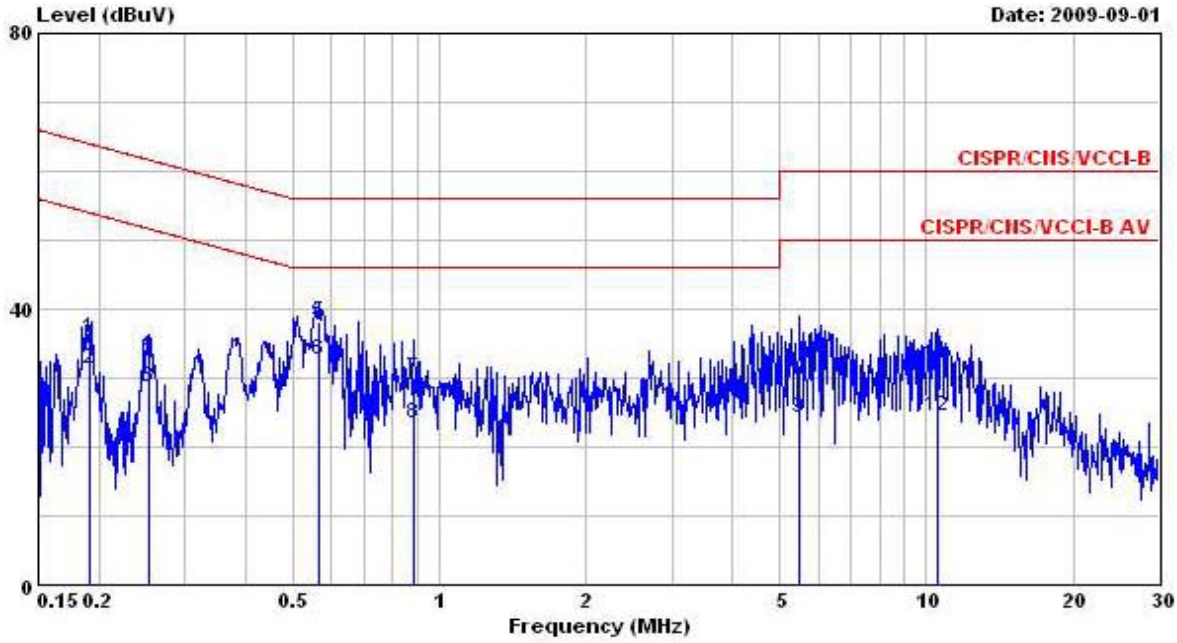
### 3.1.6 EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

### 3.1.7 Results of AC Power Line Conducted Emissions Measurement

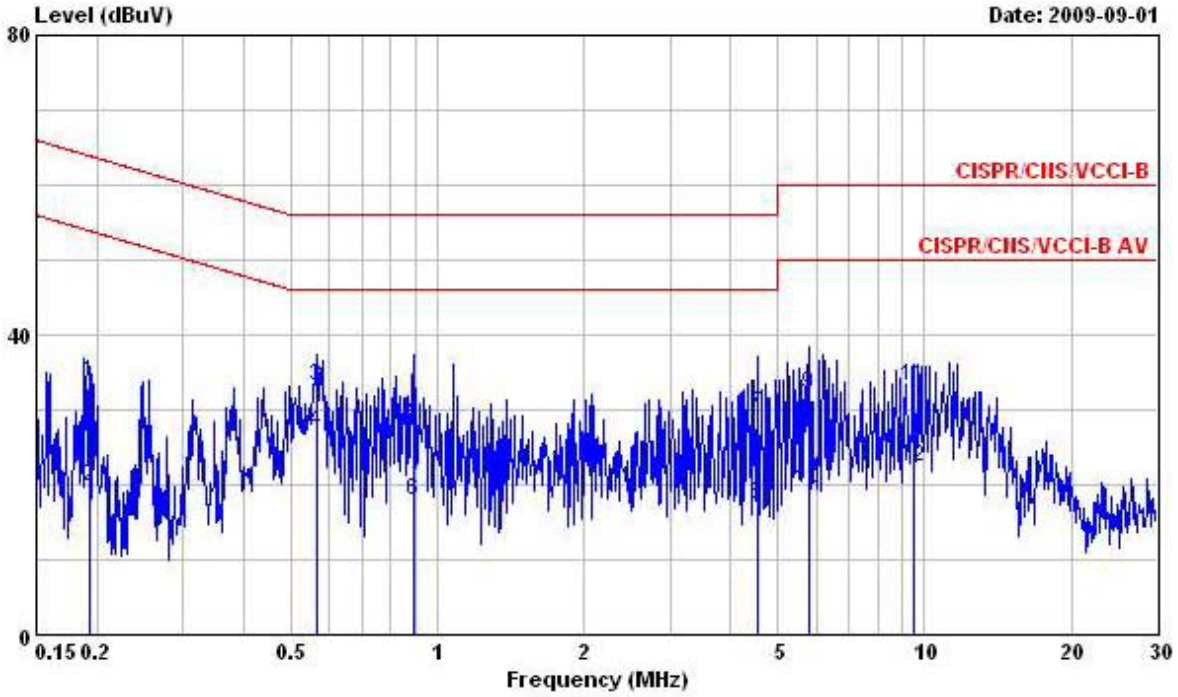
| | | | |
|---|---|---|---|
| **Final Test date** | Sep. 01, 2009 | **Test Site No.** | CO04-HY |
| **Temperature** | 25℃ | **Humidity** | 55% |
| **Test Engineer** | Chris | **Configuration** | Mode 1 |

***Line***




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | 0.1906880 | 35.85 | -28.16 | 64.01 | 35.73 | 0.08 | 0.04 | QP |
| 2 | 0.1906880 | 31.37 | -22.64 | 54.01 | 31.25 | 0.08 | 0.04 | Average |
| 3 | 0.2533290 | 28.80 | -22.85 | 51.65 | 28.69 | 0.08 | 0.03 | Average |
| 4 | 0.2533290 | 33.42 | -28.23 | 61.65 | 33.31 | 0.08 | 0.03 | QP |
| 5 | 0.5640910 | 38.07 | -17.93 | 56.00 | 37.90 | 0.10 | 0.07 | QP |
| 6 | 0.5640910 | 32.65 | -13.35 | 46.00 | 32.48 | 0.10 | 0.07 | Average |
| 7 | 0.8849860 | 30.02 | -25.98 | 56.00 | 29.82 | 0.11 | 0.09 | QP |
| 8 | 0.8849860 | 23.55 | -22.45 | 46.00 | 23.35 | 0.11 | 0.09 | Average |
| 9 | 5.480 | 24.14 | -25.86 | 50.00 | 23.69 | 0.20 | 0.25 | Average |
| 10 | 5.480 | 31.96 | -28.04 | 60.00 | 31.51 | 0.20 | 0.25 | QP |
| 11 | 10.510 | 32.00 | -28.00 | 60.00 | 31.37 | 0.28 | 0.35 | QP |
| 12 | 10.510 | 24.59 | -25.41 | 50.00 | 23.96 | 0.28 | 0.35 | Average |

***Neutral***



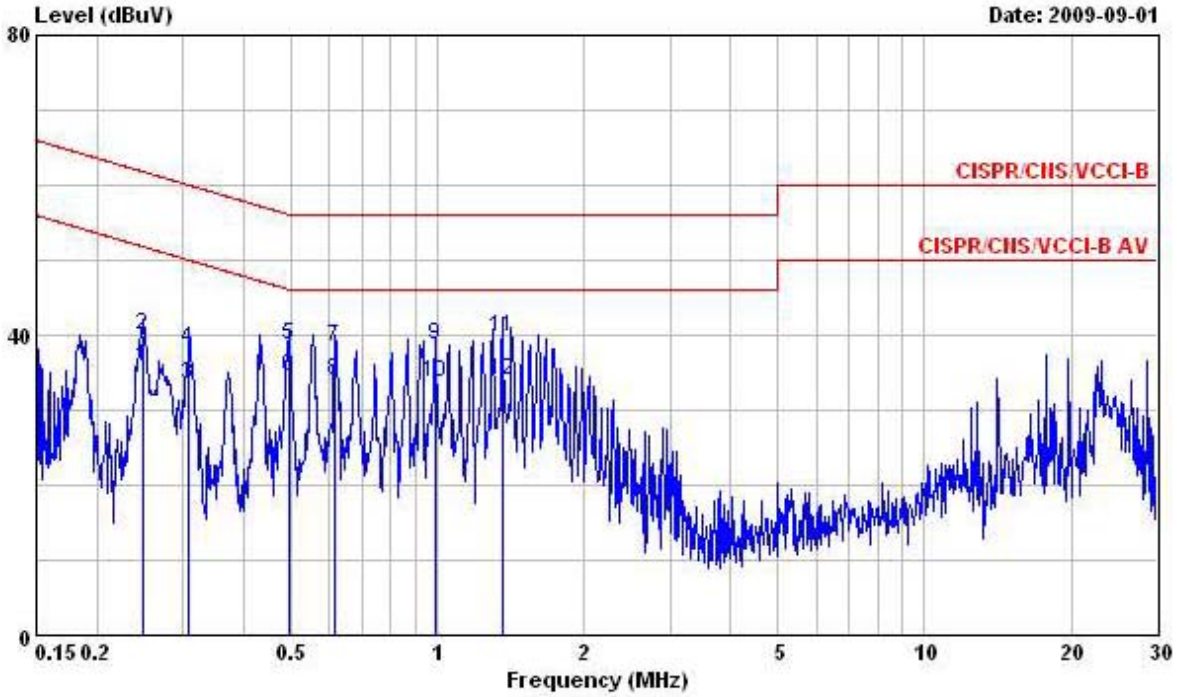

| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | 0.1924750 | 33.71 | -30.22 | 63.93 | 33.60 | 0.08 | 0.03 | QP |
| 2 | 0.1924750 | 19.81 | -34.12 | 53.93 | 19.70 | 0.08 | 0.03 | Average |
| 3 | 0.5640910 | 33.21 | -22.79 | 56.00 | 33.05 | 0.09 | 0.07 | QP |
| 4 | 0.5640910 | 27.20 | -18.80 | 46.00 | 27.04 | 0.09 | 0.07 | Average |
| 5 | 0.8896870 | 27.83 | -28.17 | 56.00 | 27.64 | 0.10 | 0.09 | QP |
| 6 | 0.8896870 | 17.83 | -28.17 | 46.00 | 17.64 | 0.10 | 0.09 | Average |
| 7 | 4.530 | 29.39 | -26.61 | 56.00 | 29.00 | 0.17 | 0.22 | QP |
| 8 | 4.530 | 17.28 | -28.72 | 46.00 | 16.89 | 0.17 | 0.22 | Average |
| 9 | 5.800 | 32.20 | -27.80 | 60.00 | 31.75 | 0.19 | 0.26 | QP |
| 10 | 5.800 | 19.35 | -30.65 | 50.00 | 18.90 | 0.19 | 0.26 | Average |
| 11 | 9.500 | 33.15 | -26.85 | 60.00 | 32.57 | 0.25 | 0.33 | QP |
| 12 | 9.500 | 22.38 | -27.62 | 50.00 | 21.80 | 0.25 | 0.33 | Average |

Note:

Level = Read Level + LISN Factor + Cable Loss.

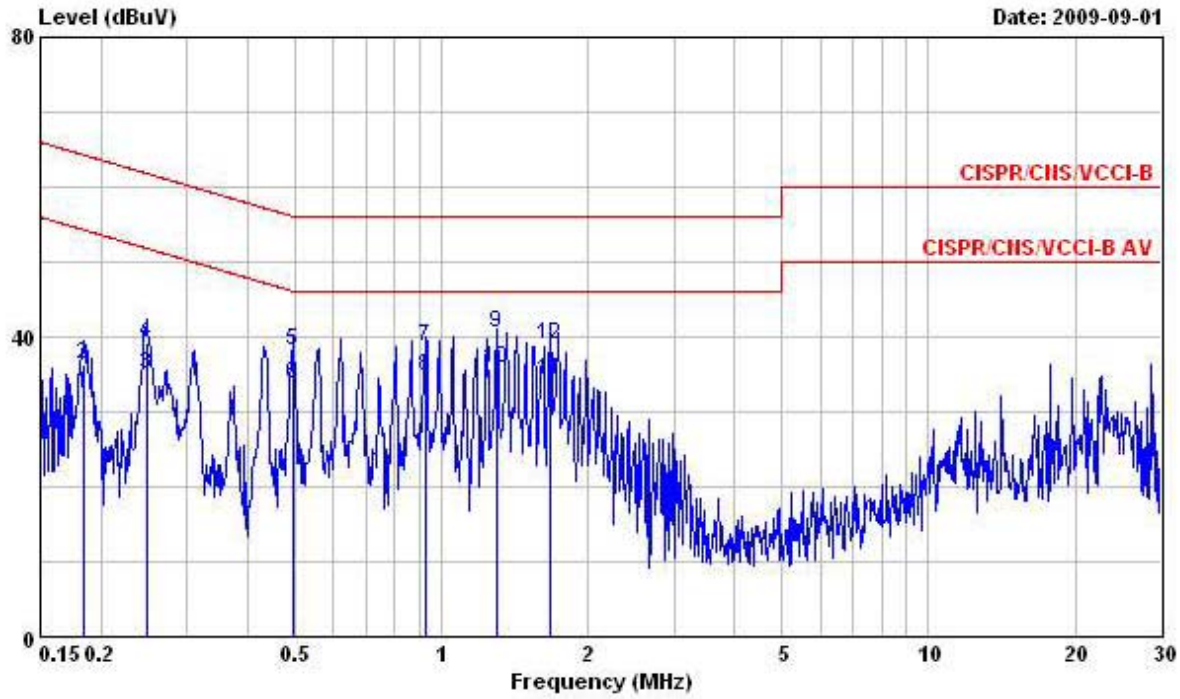
| Final Test date | Sep. 01, 2009 | Test Site No. | CO04-HY |
|---|---|---|---|
| Temperature | 25℃ | Humidity | 55% |
| Test Engineer | Chris | Configuration | Mode 2 |

***Line***




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | 0.2481740 | 35.86 | -15.96 | 51.82 | 35.75 | 0.08 | 0.03 | Average |
| 2 | 0.2481740 | 40.09 | -21.73 | 61.82 | 39.98 | 0.08 | 0.03 | QP |
| 3 | 0.3085760 | 33.55 | -16.46 | 50.01 | 33.42 | 0.09 | 0.04 | Average |
| 4 | 0.3085760 | 38.10 | -21.91 | 60.01 | 37.97 | 0.09 | 0.04 | QP |
| 5 | 0.4941090 | 38.79 | -17.31 | 56.10 | 38.63 | 0.09 | 0.07 | QP |
| 6 | 0.4941090 | 34.45 | -11.65 | 46.10 | 34.29 | 0.09 | 0.07 | Average |
| 7 | 0.6172570 | 38.38 | -17.62 | 56.00 | 38.20 | 0.10 | 0.08 | QP |
| 8 | 0.6172570 | 33.98 | -12.02 | 46.00 | 33.80 | 0.10 | 0.08 | Average |
| 9 | 0.9878600 | 38.66 | -17.34 | 56.00 | 38.45 | 0.11 | 0.10 | QP |
| 10 | 0.9878600 | 33.72 | -12.28 | 46.00 | 33.51 | 0.11 | 0.10 | Average |
| 11 | 1.359 | 39.61 | -16.39 | 56.00 | 39.37 | 0.12 | 0.12 | QP |
| 12 | 1.359 | 34.01 | -11.99 | 46.00 | 33.77 | 0.12 | 0.12 | Average |

***Neutral***




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | 0.1847350 | 32.30 | -21.97 | 54.27 | 32.17 | 0.08 | 0.05 | Average |
| 2 | 0.1847350 | 36.41 | -27.86 | 64.27 | 36.28 | 0.08 | 0.05 | QP |
| 3 | 0.2494160 | 35.01 | -16.77 | 51.78 | 34.90 | 0.08 | 0.03 | Average |
| 4 | 0.2494160 | 39.19 | -22.59 | 61.78 | 39.08 | 0.08 | 0.03 | QP |
| 5 | 0.4941090 | 38.17 | -17.93 | 56.10 | 38.02 | 0.08 | 0.07 | QP |
| 6 | 0.4941090 | 33.70 | -12.40 | 46.10 | 33.55 | 0.08 | 0.07 | Average |
| 7 | 0.9238890 | 38.75 | -17.25 | 56.00 | 38.55 | 0.10 | 0.10 | QP |
| 8 | @0.9238890 | 34.69 | -11.31 | 46.00 | 34.49 | 0.10 | 0.10 | Average |
| 9 | 1.296 | 40.59 | -15.41 | 56.00 | 40.38 | 0.10 | 0.11 | QP |
| 10 | @ 1.296 | 35.77 | -10.23 | 46.00 | 35.56 | 0.10 | 0.11 | Average |
| 11 | 1.666 | 34.33 | -11.67 | 46.00 | 34.09 | 0.11 | 0.13 | Average |
| 12 | 1.666 | 39.05 | -16.95 | 56.00 | 38.81 | 0.11 | 0.13 | QP |

Note:

Level = Read Level + LISN Factor + Cable Loss.

## 3.2 Maximum Conducted Output Power Measurement

### 3.2.1 Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

### 3.2.2 Measuring Instruments and Setting

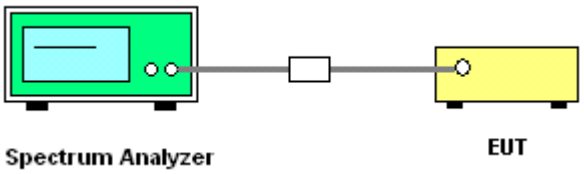
Please refer to section 4 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Power Meter Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 0.135 s ~ 26 s |
| RB | 1000 kHz |
| VB | 3000 kHz |
| Detector | rms |
| Trace | Max Hold |
| Sweep Time | Auto |

### 3.2.3 Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Test was performed in accordance with Measurement of Digital Transmission Systems Operating under Section 15.247.

### 3.2.4 Test Setup Layout




### 3.2.5 Test Deviation

There is no deviation with the original standard.

### 3.2.6 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 3.2.7 Test Result of Maximum Conducted Output Power

| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 22, 2009 | **Test Site No.** | TH01-HY |
| **Temperature** | 26℃ | **Humidity** | 56% |
| **Test Engineer** | Sam | **Configuration** | 802.11n |

**Configuration of IEEE 802.11n (20MHz)**

| Channel | Frequency | Conducted Power (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 1 | 2412 MHz | 15.95 | 30.00 | **Complies** |
| 6 | 2437 MHz | 23.63 | 30.00 | **Complies** |
| 11 | 2462 MHz | 17.17 | 30.00 | **Complies** |

**Configuration of IEEE 802.11n (40MHz)**

| Channel | Frequency | Conducted Power (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 3 | 2422 MHz | 9.47 | 30.00 | **Complies** |
| 6 | 2437 MHz | 18.31 | 30.00 | **Complies** |
| 9 | 2452 MHz | 10.03 | 30.00 | **Complies** |

## 3.3 Power Spectral Density Measurement

### 3.3.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 3.3.2 Measuring Instruments and Setting

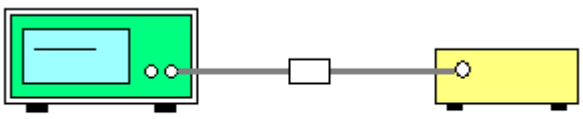
Please refer to section 4 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 1.5MHz |
| RB | 3 kHz |
| VB | 30 kHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | 500s |

### 3.3.3 Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Set RBW of spectrum analyzer to 3kHz and VBW to 30kHz. Set Detector to Peak, Trace to Max Hold.
3. Mark the frequency with maximum peak power as the center of the display of the spectrum.
4. Set the span to 1.5MHz and the sweep time to 500s and record the maximum peak value.

### 3.3.4 Test Setup Layout




### 3.3.5 Test Deviation

There is no deviation with the original standard.

### 3.3.6 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 3.3.7 Test Result of Power Spectral Density

| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 22, 2009 | **Test Site No.** | TH01-HY |
| **Temperature** | 26℃ | **Humidity** | 56% |
| **Test Engineer** | Sam | **Configuration** | 802.11n |

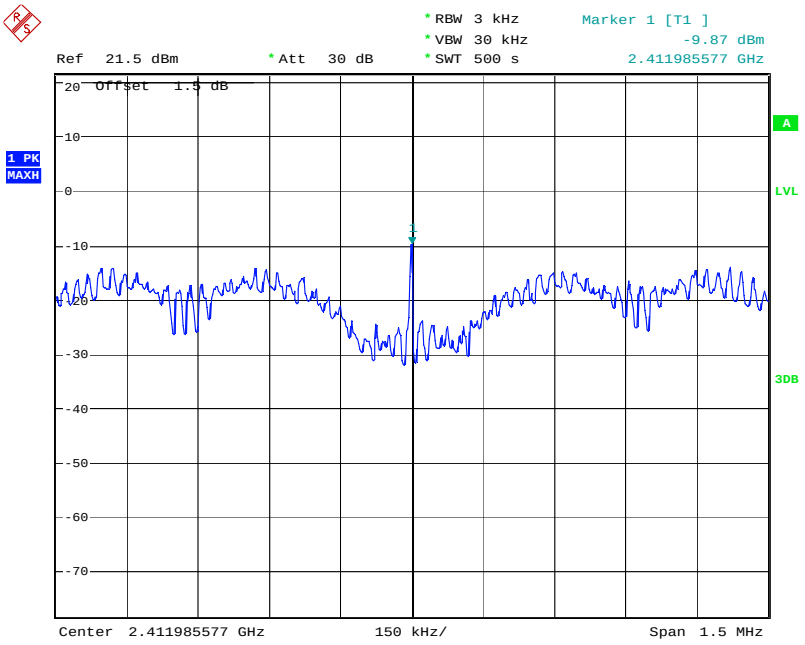
**Configuration of IEEE 802.11n (20MHz)**

| Channel | Frequency | Power Density (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 1 | 2412 MHz | -9.87 | 8.00 | **Complies** |
| 6 | 2437 MHz | -2.72 | 8.00 | **Complies** |
| 11 | 2462 MHz | -8.75 | 8.00 | **Complies** |

**Configuration of IEEE 802.11n (40MHz)**

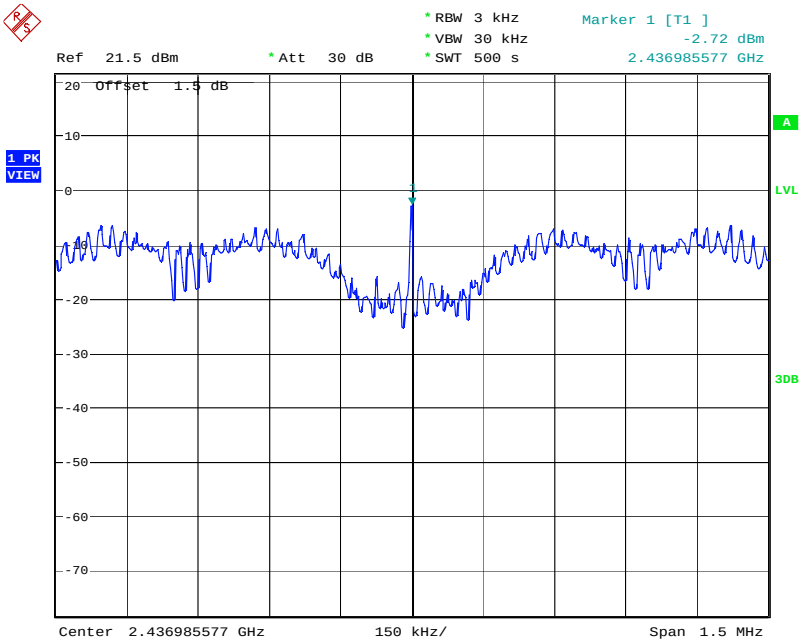
| Channel | Frequency | Power Density (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 3 | 2422 MHz | -11.67 | 8.00 | **Complies** |
| 6 | 2437 MHz | -3.24 | 8.00 | **Complies** |
| 9 | 2452 MHz | -11.64 | 8.00 | **Complies** |

## Power Density Plot on Configuration of IEEE 802.11n (20MHz) / 2412 MHz



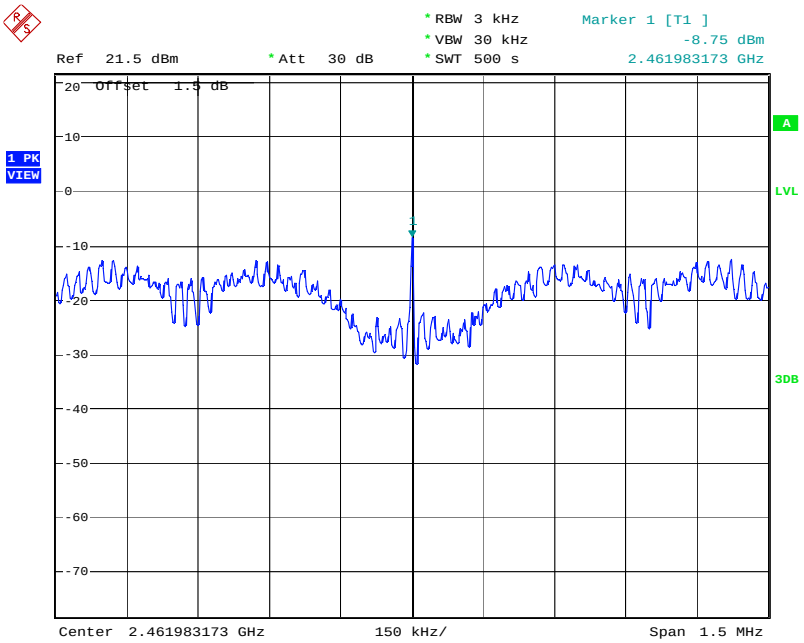

Date: 22.OCT.2009 19:30:00

## Power Density Plot on Configuration of IEEE 802.11n (20MHz) / 2437 MHz



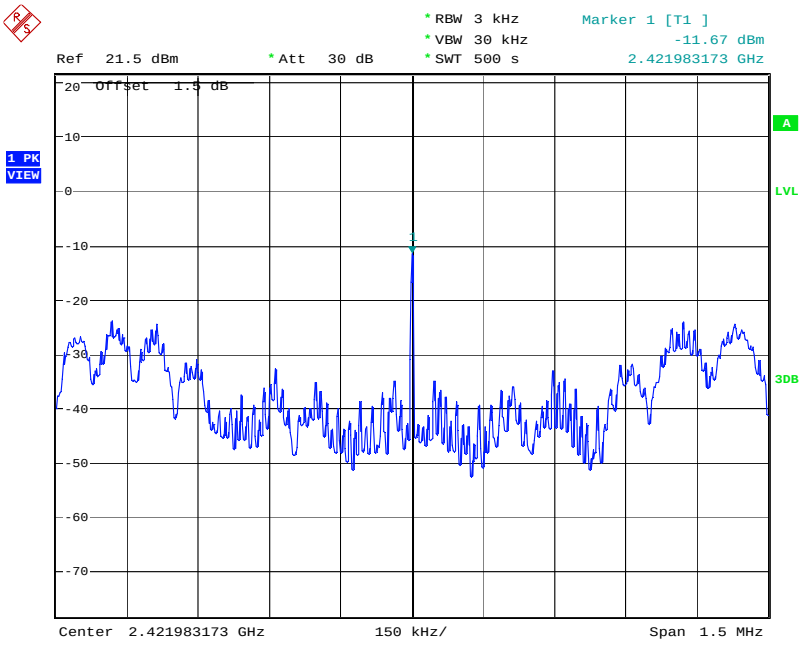

Date: 22.OCT.2009 19:30:31

## Power Density Plot on Configuration of IEEE 802.11n (20MHz) / 2462 MHz



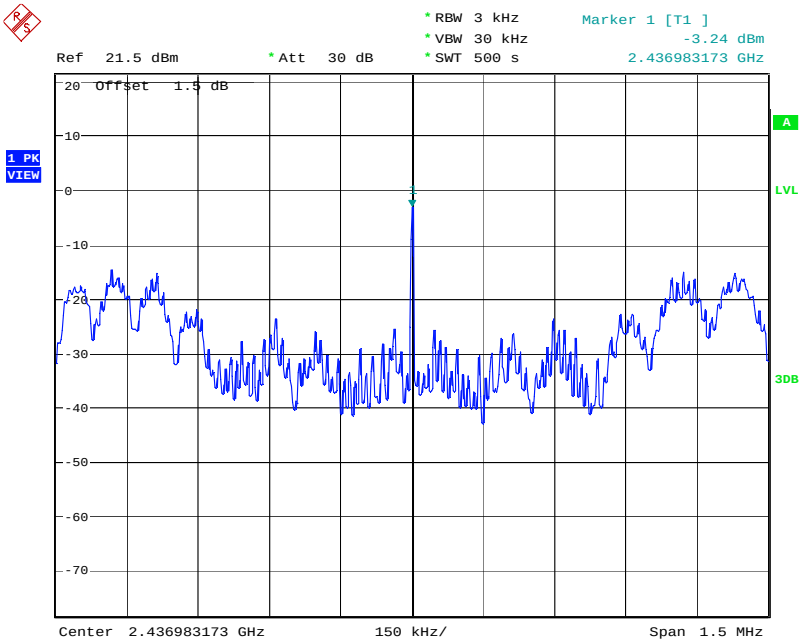

Date: 22.OCT.2009 19:31:02

### Power Density Plot on Configuration of IEEE 802.11n (40MHz) / 2422 MHz



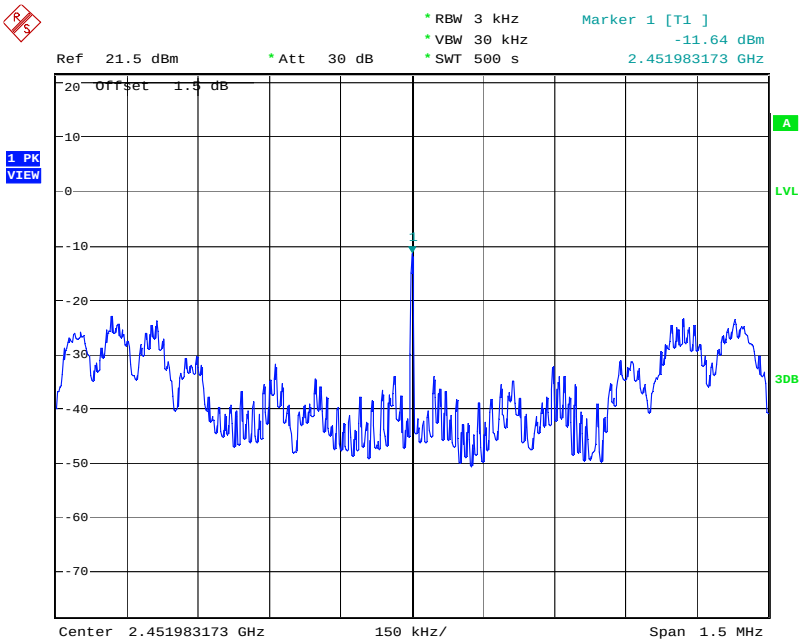

Date: 22.OCT.2009 20:00:38

### Power Density Plot on Configuration of IEEE 802.11n (40MHz) / 2437 MHz




Date: 22.OCT.2009 20:05:17

## Power Density Plot on Configuration of IEEE 802.11n (40MHz) / 2452 MHz




Date: 22.OCT.2009 20:05:46

## 3.4 6dB Spectrum Bandwidth Measurement

### 3.4.1 Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

### 3.4.2 Measuring Instruments and Setting

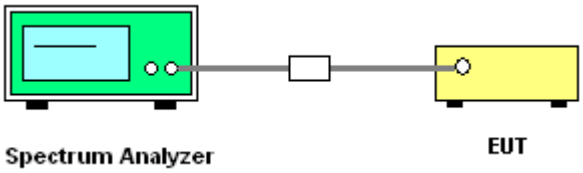
Please refer to section 4 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameters | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | > 6dB Bandwidth |
| RB | 100 kHz |
| VB | 100 kHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

### 3.4.3 Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were used.
3. Measured the spectrum width with power higher than 6dB below carrier.

### 3.4.4 Test Setup Layout




### 3.4.5 Test Deviation

There is no deviation with the original standard.

### 3.4.6 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 3.4.7 Test Result of 6dB Spectrum Bandwidth

| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 22, 2009 | **Test Site No.** | TH01-HY |
| **Temperature** | 26℃ | **Humidity** | 56% |
| **Test Engineer** | Sam | **Configuration** | 802.11n |

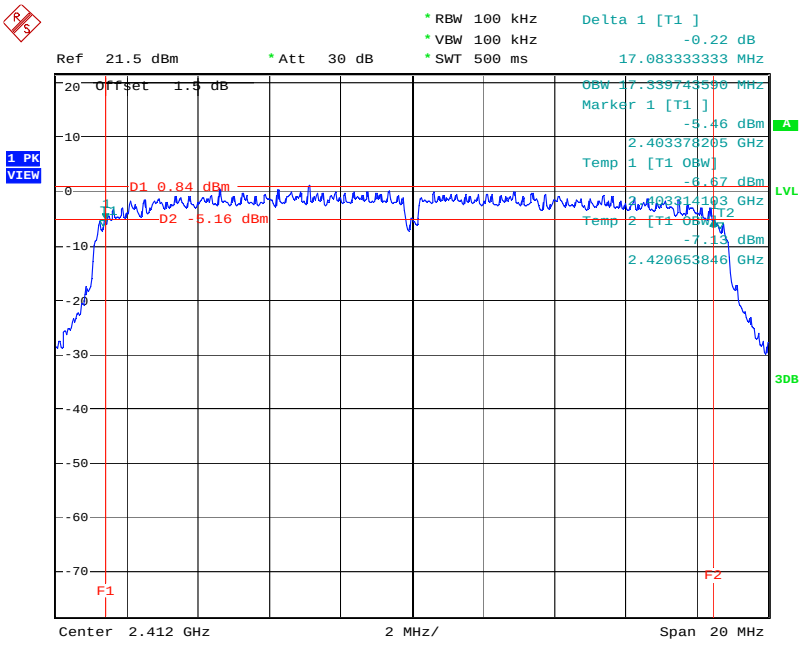
**Configuration of IEEE 802.11n (20MHz)**

| Channel | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| 1 | 2412 MHz | 17.0833 | 17.3397 | 500 | **Complies** |
| 6 | 2437 MHz | 16.9871 | 17.4038 | 500 | **Complies** |
| 11 | 2462 MHz | 16.9871 | 17.3076 | 500 | **Complies** |

**Configuration of IEEE 802.11n (40MHz)**

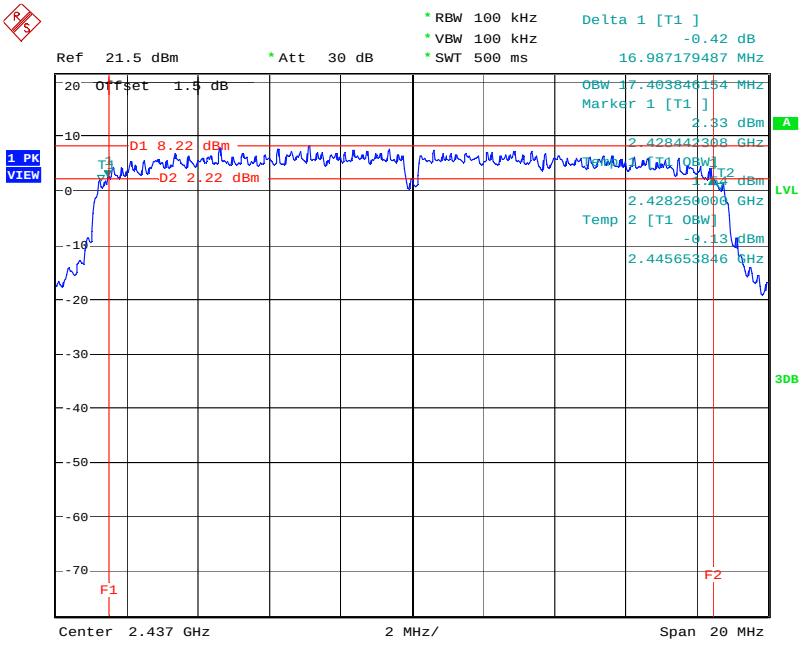
| Channel | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| 3 | 2422 MHz | 35.5769 | 35.6410 | 500 | **Complies** |
| 6 | 2437 MHz | 35.7051 | 35.6410 | 500 | **Complies** |
| 9 | 2452 MHz | 35.6410 | 35.5769 | 500 | **Complies** |

### 6 dB Bandwidth Plot on Configuration of IEEE 802.11n (20MHz) / 2412 MHz



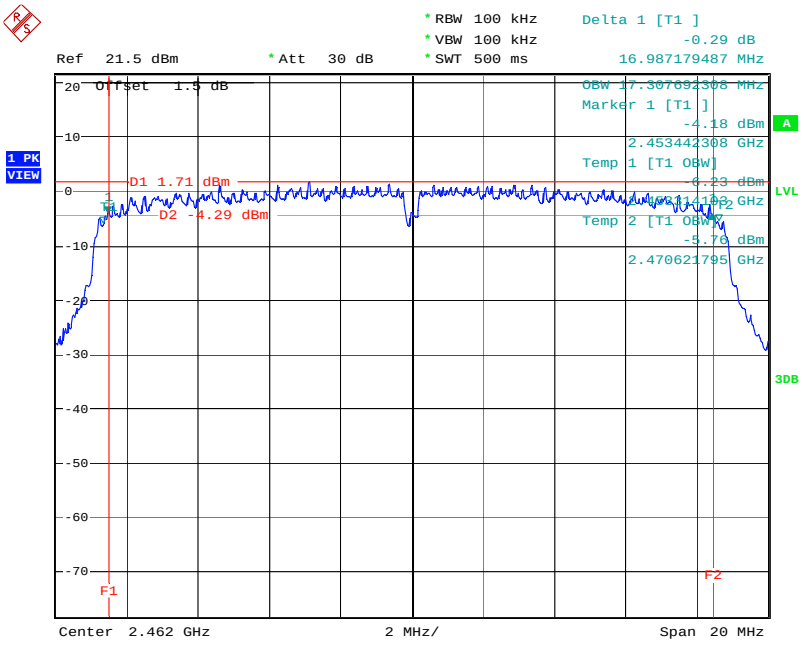

Date: 22.OCT.2009 19:28:21

### 6 dB Bandwidth Plot on Configuration of IEEE 802.11n (20MHz) / 2437 MHz

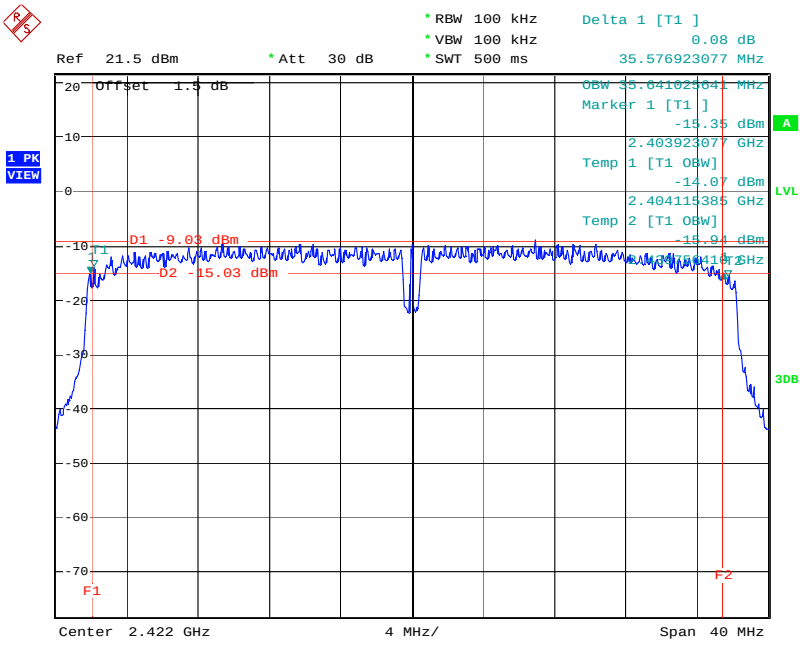



Date: 22.OCT.2009 19:34:10

## 6 dB Bandwidth Plot on Configuration of IEEE 802.11n (20MHz) / 2462 MHz

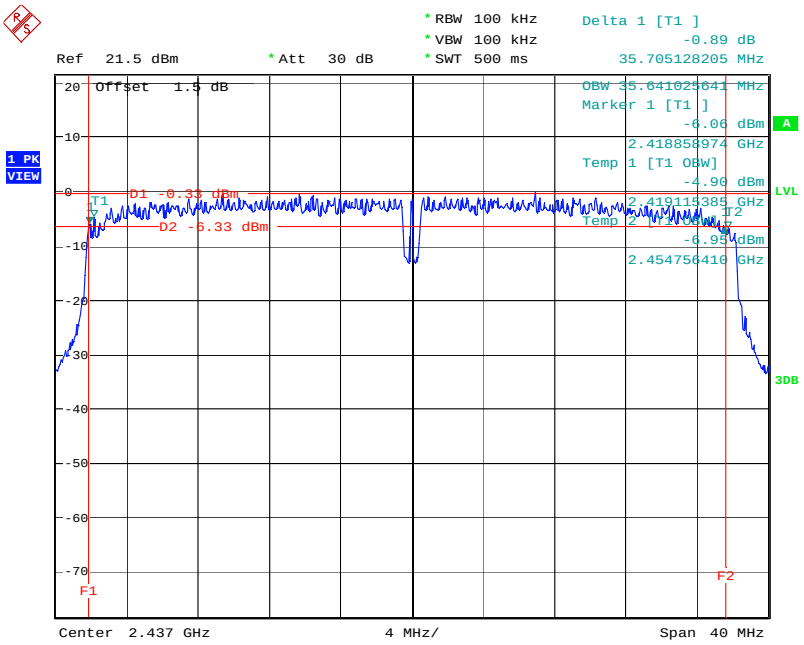


## 6 dB Bandwidth Plot on Configuration of IEEE 802.11n (40MHz) / 2422 MHz



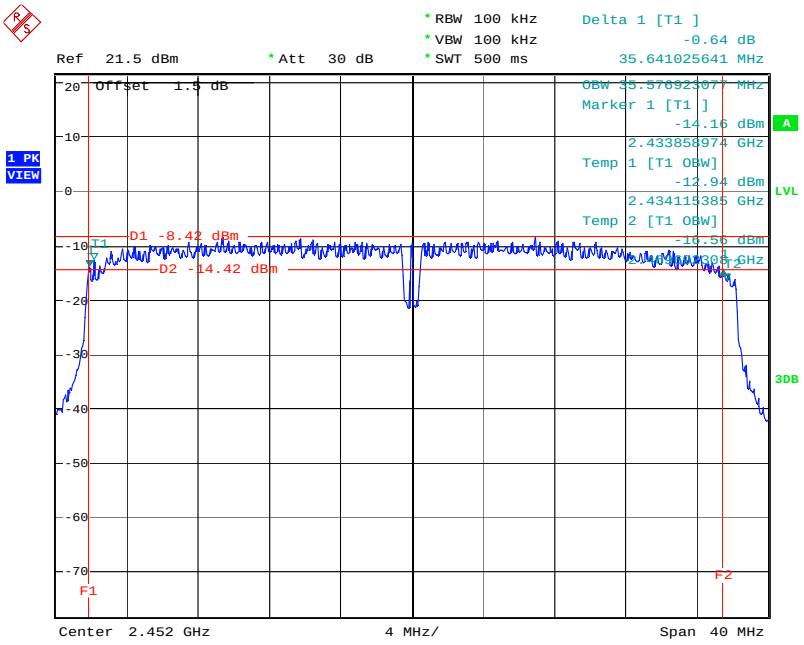

Date: 22.OCT.2009 19:58:52

## 6 dB Bandwidth Plot on Configuration of IEEE 802.11n (40MHz) / 2437 MHz




Date: 22.OCT.2009 19:57:46

## 6 dB Bandwidth Plot on Configuration of IEEE 802.11n (40MHz) / 2452 MHz



## 3.5 Radiated Emissions Measurement

### 3.5.1 Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (microvolt/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 3.5.2 Measuring Instruments and Setting

Please refer to section 4 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | 10th carrier harmonic |
| RB / VB (Emission in restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average |
| RB / VB (Emission in non-restricted band) | 1MHz / 1MHz for peak |

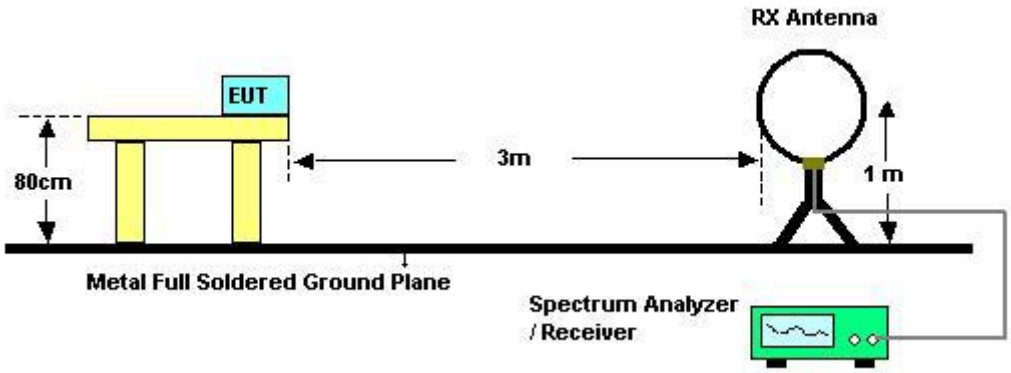
| Receiver Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |

### 3.5.3 Test Procedures

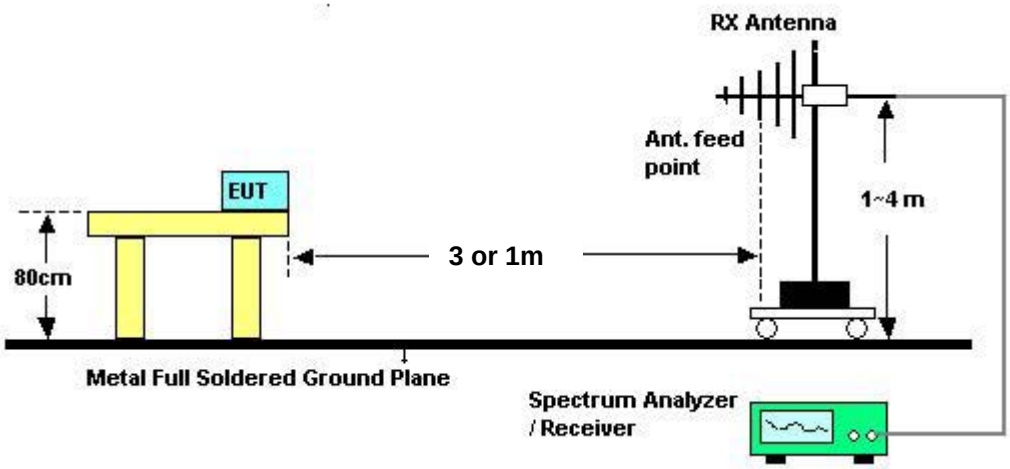
1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

### 3.5.4 Test Setup Layout

**For radiated emissions below 30MHz**




**For radiated emissions above 30MHz**




Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [9.54 dB].

### 3.5.5 Test Deviation

There is no deviation with the original standard.

### 3.5.6 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 3.5.7 Results of Radiated Emissions (9kHz~30MHz)

| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 21, 2009 | **Test Site No.** | 03CH02-HY |
| **Temperature** | 26℃ | **Humidity** | 54% |
| **Test Engineer** | Kobe | | |

| Freq. (MHz) | Level (dBuV) | Over Limit (dB) | Limit Line (dBuV) | Remark |
|---|---|---|---|---|
| - | - | - | - | See Note |

Note:

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

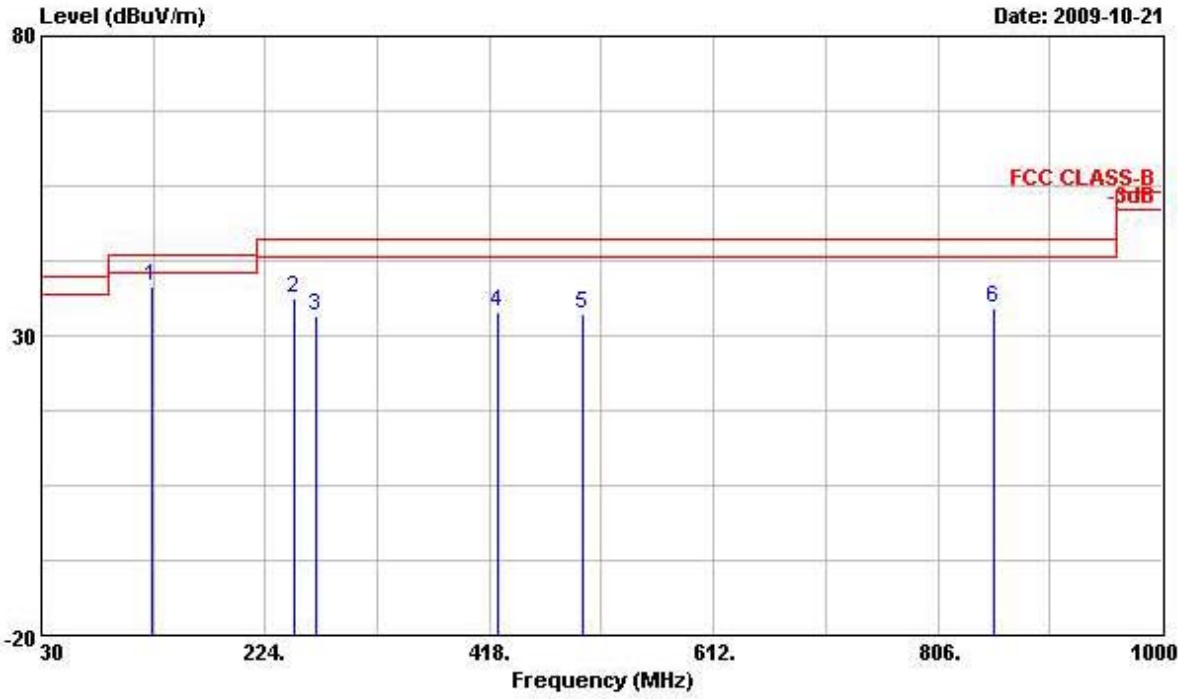
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

### 3.5.8 Results of Radiated Emissions (30MHz~1GHz)

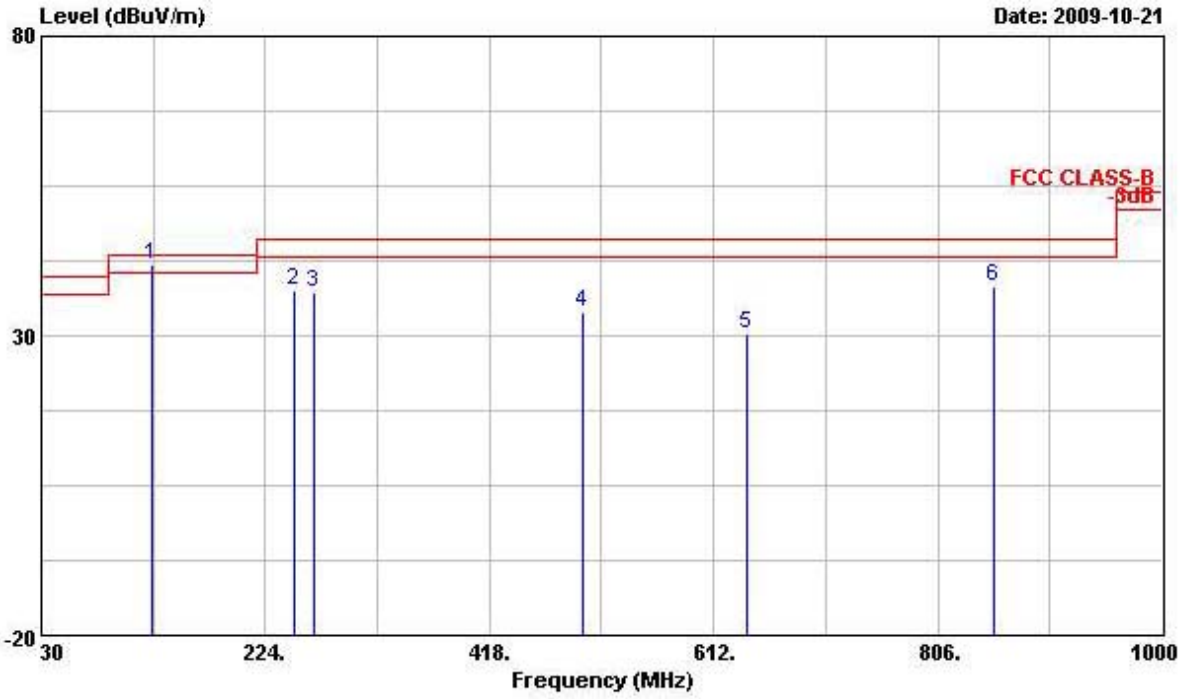
| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 21, 2009 | **Test Site No.** | 03CH02-HY |
| **Temperature** | 26℃ | **Humidity** | 54% |
| **Test Engineer** | Kobe | **Configuration** | Mode 1 |

***Horizontal***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 125.060 | 38.20 | -5.30 | 43.50 | 53.55 | 13.18 | 2.22 | 30.75 | Peak |
| 2 | 249.220 | 36.17 | -9.83 | 46.00 | 50.60 | 12.97 | 3.10 | 30.50 | Peak |
| 3 | 268.620 | 33.17 | -12.83 | 46.00 | 47.12 | 13.26 | 3.25 | 30.46 | Peak |
| 4 | 424.790 | 34.00 | -12.00 | 46.00 | 44.42 | 15.76 | 3.95 | 30.13 | Peak |
| 5 | 498.510 | 33.56 | -12.44 | 46.00 | 41.94 | 17.26 | 4.26 | 29.90 | Peak |
| 6 | 854.500 | 34.54 | -11.46 | 46.00 | 37.68 | 20.14 | 5.56 | 28.84 | Peak |

***Vertical***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 125.060 | 41.74 | -1.76 | 43.50 | 57.09 | 13.18 | 2.22 | 30.75 | Peak |
| 2 @ | 249.220 | 37.54 | -8.46 | 46.00 | 51.97 | 12.97 | 3.10 | 30.50 | Peak |
| 3 @ | 265.710 | 37.10 | -8.90 | 46.00 | 51.12 | 13.22 | 3.23 | 30.47 | Peak |
| 4 | 498.510 | 33.90 | -12.10 | 46.00 | 42.28 | 17.26 | 4.26 | 29.90 | Peak |
| 5 | 641.100 | 30.44 | -15.56 | 46.00 | 35.15 | 19.63 | 5.10 | 29.44 | Peak |
| 6 @ | 854.500 | 38.07 | -7.93 | 46.00 | 41.21 | 20.14 | 5.56 | 28.84 | Peak |

Note:

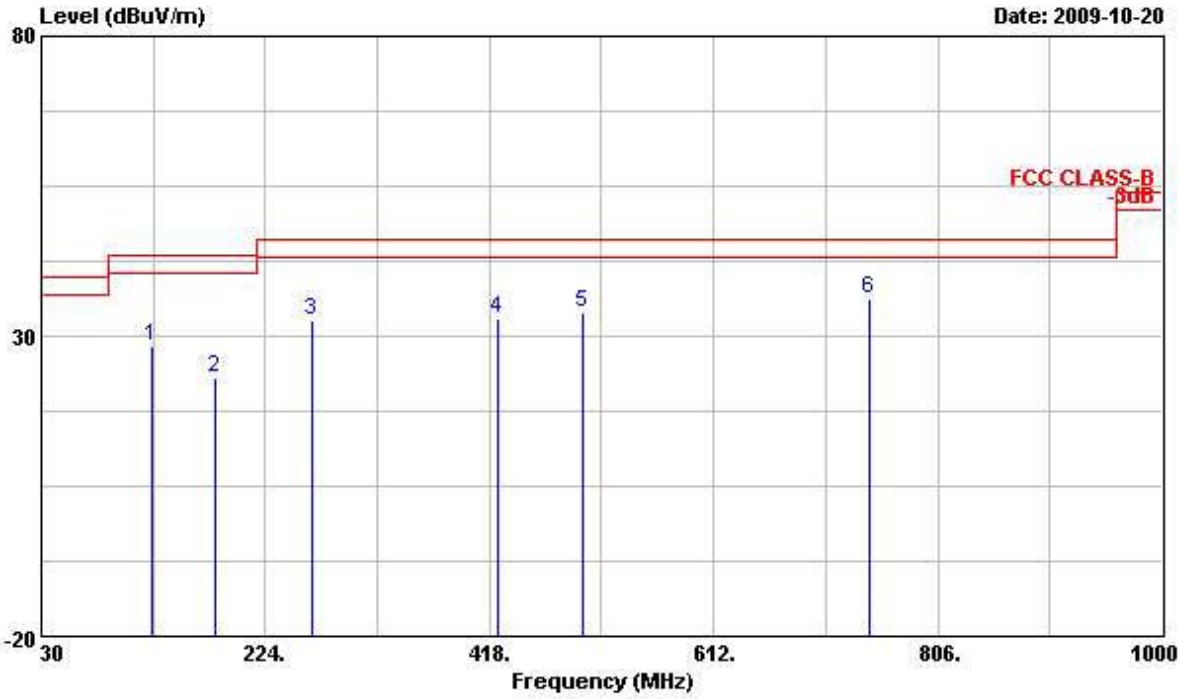
The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

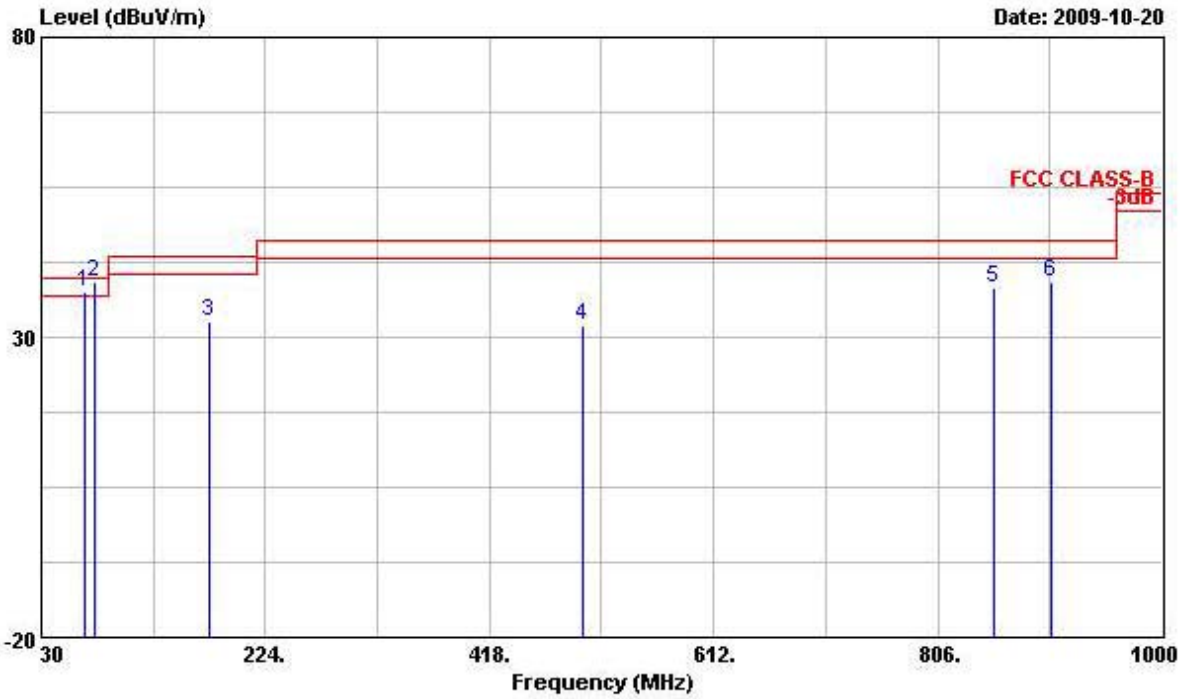
| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 20, 2009 | **Test Site No.** | 03CH02-HY |
| **Temperature** | 26℃ | **Humidity** | 54% |
| **Test Engineer** | Kobe | **Configuration** | Mode 2 |

***Horizontal***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 | 125.060 | 28.29 | -15.21 | 43.50 | 43.64 | 13.18 | 2.22 | 30.75 | Peak |
| 2 | 180.350 | 23.24 | -20.26 | 43.50 | 41.38 | 9.90 | 2.60 | 30.64 | Peak |
| 3 | 264.740 | 32.51 | -13.49 | 46.00 | 46.55 | 13.21 | 3.22 | 30.47 | Peak |
| 4 | 424.790 | 32.96 | -13.04 | 46.00 | 43.38 | 15.76 | 3.95 | 30.13 | Peak |
| 5 | 498.510 | 34.03 | -11.97 | 46.00 | 42.41 | 17.26 | 4.26 | 29.90 | Peak |
| 6 @ | 746.830 | 36.35 | -9.65 | 46.00 | 40.63 | 19.51 | 5.32 | 29.11 | Peak |

***Vertical***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 67.830 | 37.56 | -2.44 | 40.00 | 59.84 | 6.81 | 1.71 | 30.80 | Peak |
| 2 @ | 75.590 | 39.06 | -0.94 | 40.00 | 60.98 | 7.11 | 1.77 | 30.80 | Peak |
| 3 | 175.500 | 32.68 | -10.82 | 43.50 | 50.87 | 9.88 | 2.58 | 30.65 | Peak |
| 4 | 498.510 | 31.81 | -14.19 | 46.00 | 40.19 | 17.26 | 4.26 | 29.90 | Peak |
| 5 @ | 854.500 | 38.37 | -7.63 | 46.00 | 41.51 | 20.14 | 5.56 | 28.84 | Peak |
| 6 @ | 904.940 | 39.16 | -6.84 | 46.00 | 41.72 | 20.17 | 5.95 | 28.68 | Peak |

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

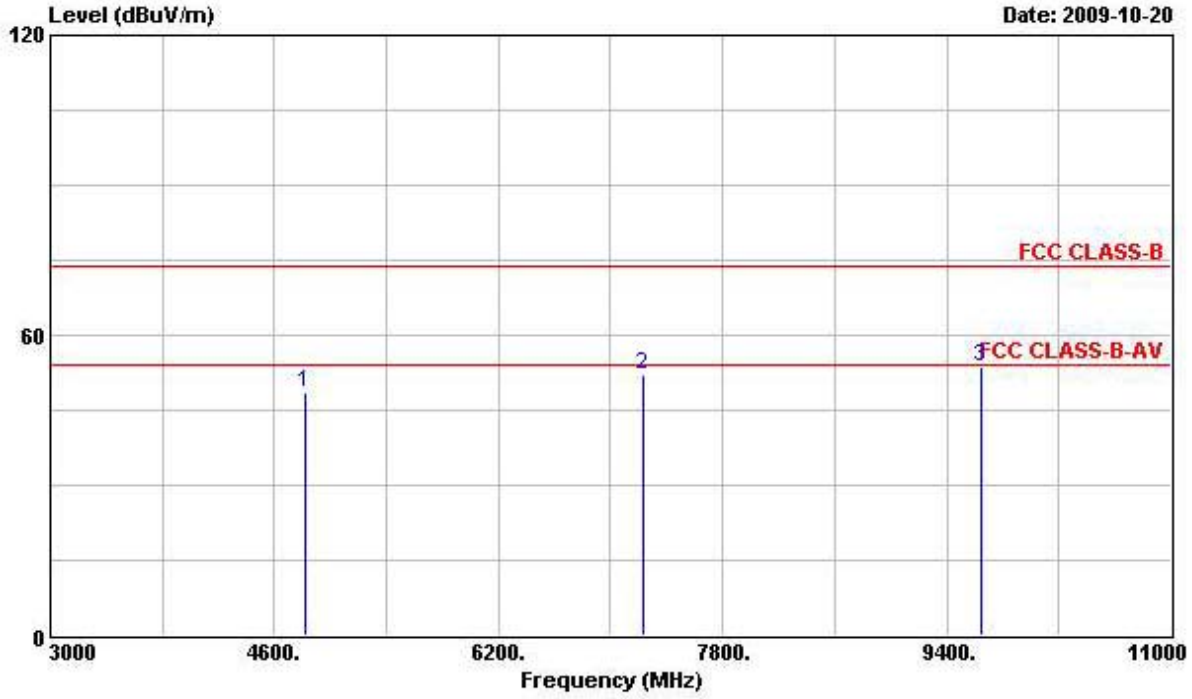
Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

### 3.5.9 Results for Radiated Emissions (1GHz~10th Harmonic)

| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 20, 2009 | **Test Site No.** | 03CH02-HY |
| **Temperature** | 26℃ | **Humidity** | 54% |
| **Test Engineer** | Kobe | **Configuration** | 802.11n CH 1 (20MHz) |

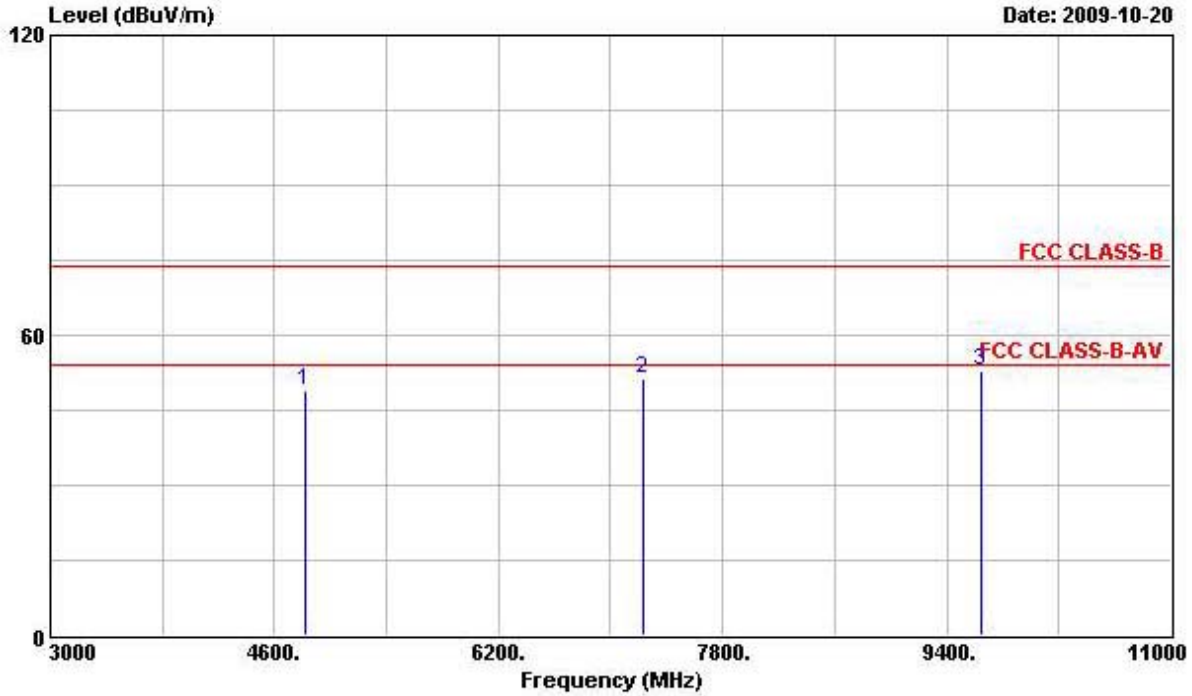
***Horizontal***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4824.000 | 48.43 | -5.57 | 54.00 | 42.60 | 35.76 | 4.58 | 34.51 | PK |
| 2 | 7236.000 | 51.91 | | | 42.72 | 37.85 | 5.63 | 34.29 | Peak |
| 3 | 9648.000 | 53.83 | | | 42.73 | 39.39 | 6.34 | 34.63 | Peak |

Note: An item 2 and 3 are on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

***Vertical***

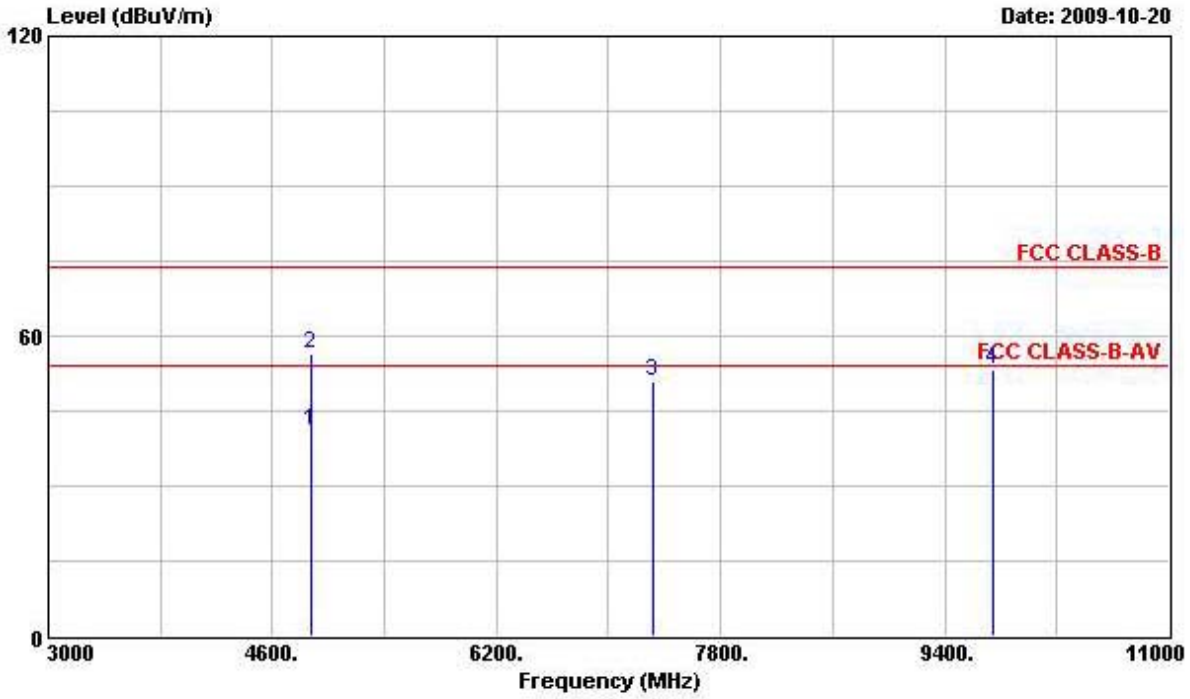



| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4824.000 | 48.78 | -5.22 | 54.00 | 43.58 | 35.13 | 4.58 | 34.51 | PK |
| 2 | 7236.000 | 51.27 | | | 43.03 | 36.90 | 5.63 | 34.29 | Peak |
| 3 | 9648.000 | 53.04 | | | 42.74 | 38.59 | 6.34 | 34.63 | Peak |

Note: An item 2 and 3 are on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

| Final Test date | Oct. 20, 2009 | Test Site No. | 03CH02-HY |
|---|---|---|---|
| Temperature | 26℃ | Humidity | 54% |
| Test Engineer | Kobe | Configuration | 802.11n CH 6 (20MHz) |

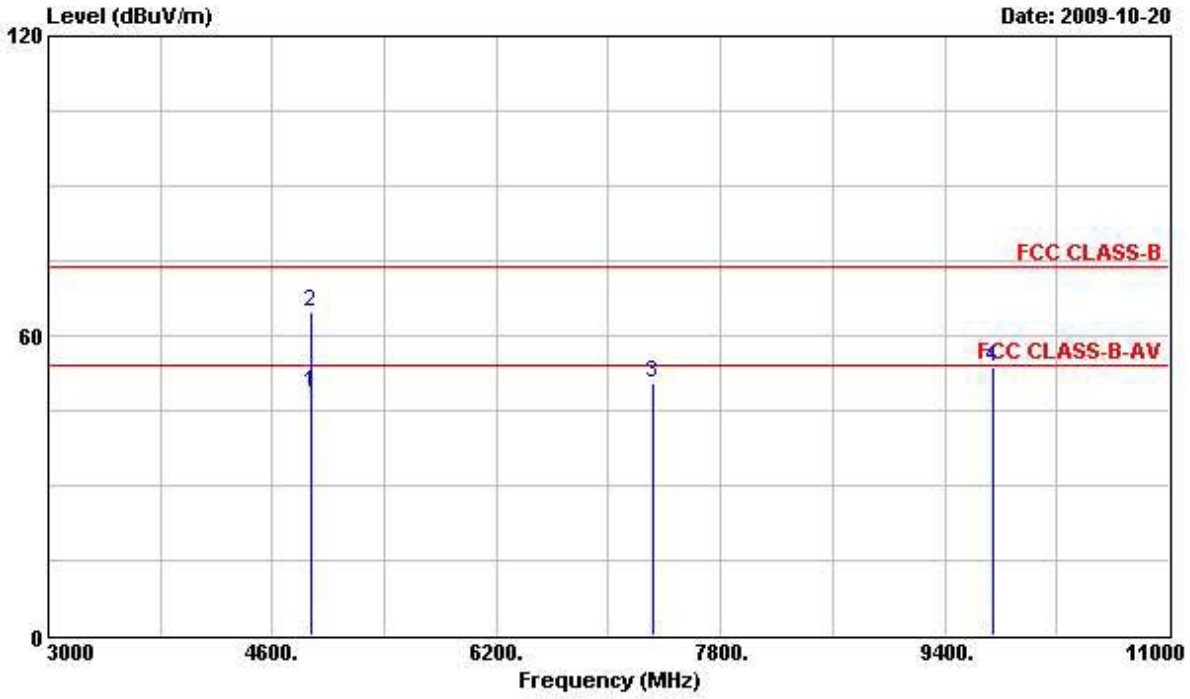
***Horizontal***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 | 4874.000 | 41.10 | -12.90 | 54.00 | 35.11 | 35.83 | 4.61 | 34.45 | Average |
| 2 | 4874.000 | 56.26 | -17.74 | 74.00 | 50.27 | 35.83 | 4.61 | 34.45 | Peak |
| 3 @ | 7311.000 | 50.90 | -3.10 | 54.00 | 41.69 | 37.86 | 5.64 | 34.29 | PK |
| 4 | 9748.000 | 53.23 | | | 41.94 | 39.51 | 6.36 | 34.58 | Peak |

Note: An item 4 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

***Vertical***

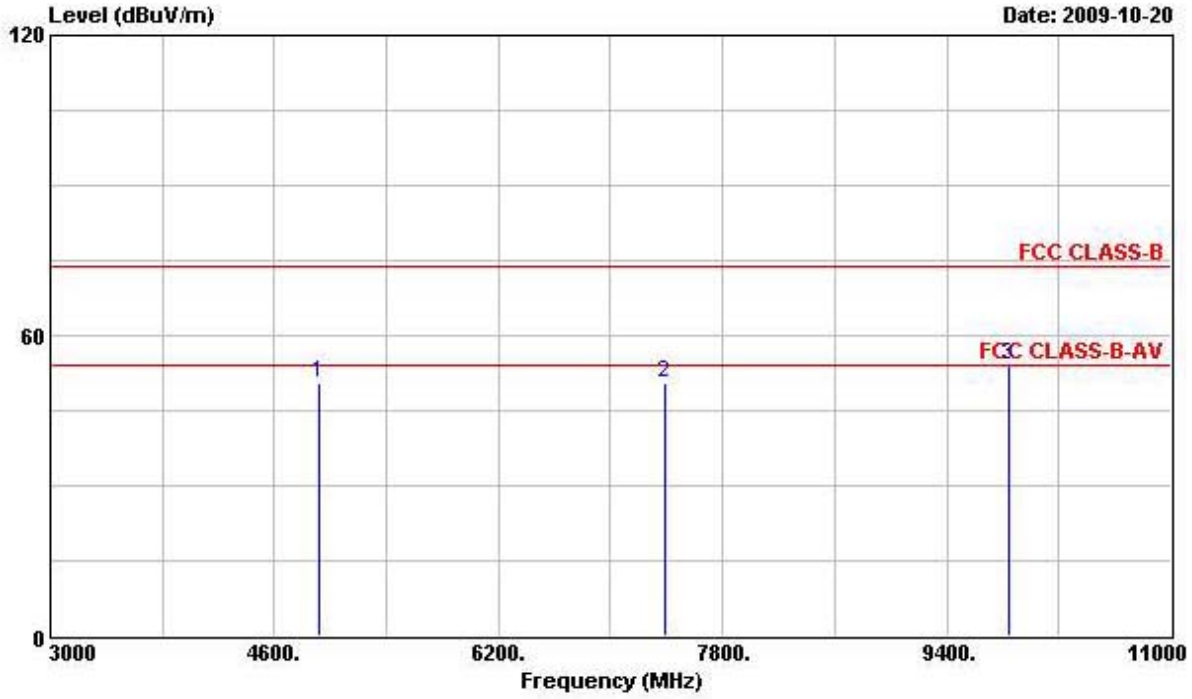



| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4874.000 | 48.67 | -5.33 | 54.00 | 43.33 | 35.18 | 4.61 | 34.45 | Average |
| 2 @ | 4874.000 | 64.83 | -9.17 | 74.00 | 59.49 | 35.18 | 4.61 | 34.45 | Peak |
| 3 @ | 7311.000 | 50.52 | -3.48 | 54.00 | 42.25 | 36.92 | 5.64 | 34.29 | PK |
| 4 | 9748.000 | 53.62 | | | 43.13 | 38.71 | 6.36 | 34.58 | Peak |

Note: An item 4 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

| Final Test date | Oct. 20, 2009 | Test Site No. | 03CH02-HY |
|---|---|---|---|
| Temperature | 26℃ | Humidity | 54% |
| Test Engineer | Kobe | Configuration | 802.11n CH 11 (20MHz) |

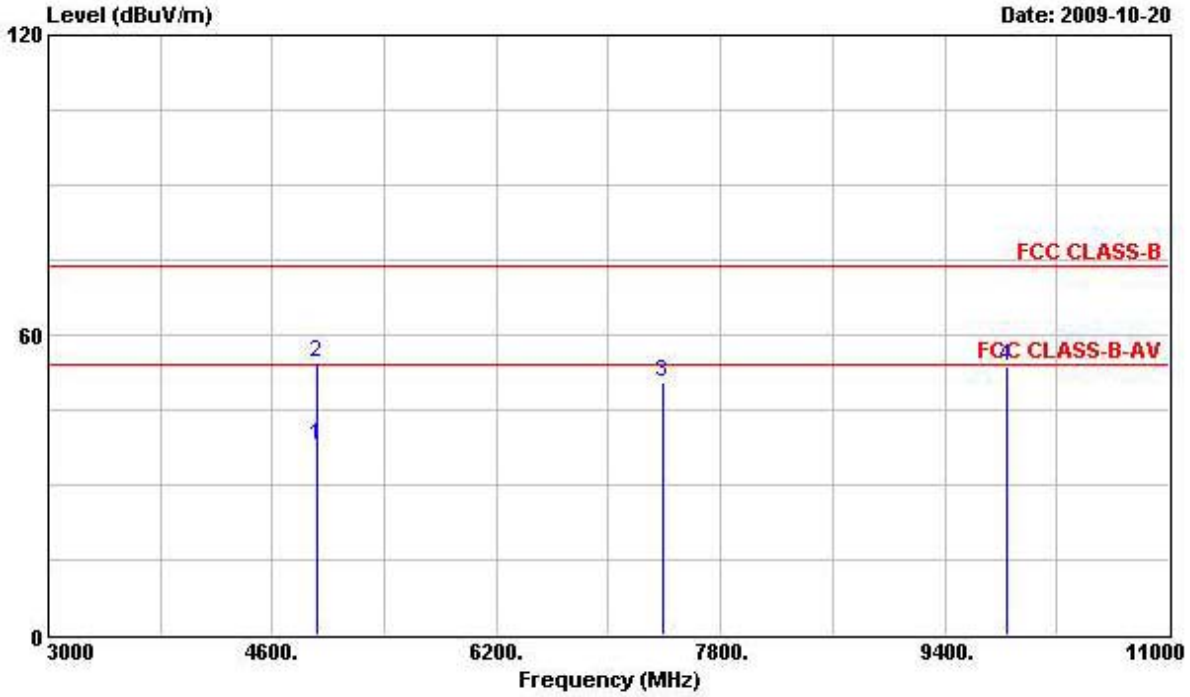
***Horizontal***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4924.000 | 50.45 | -3.55 | 54.00 | 44.25 | 35.90 | 4.68 | 34.38 | PK |
| 2 @ | 7386.000 | 50.60 | -3.40 | 54.00 | 41.36 | 37.88 | 5.65 | 34.29 | PK |
| 3 | 9848.000 | 53.99 | | | 42.54 | 39.61 | 6.38 | 34.54 | Peak |

Note: An item 3 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

***Vertical***

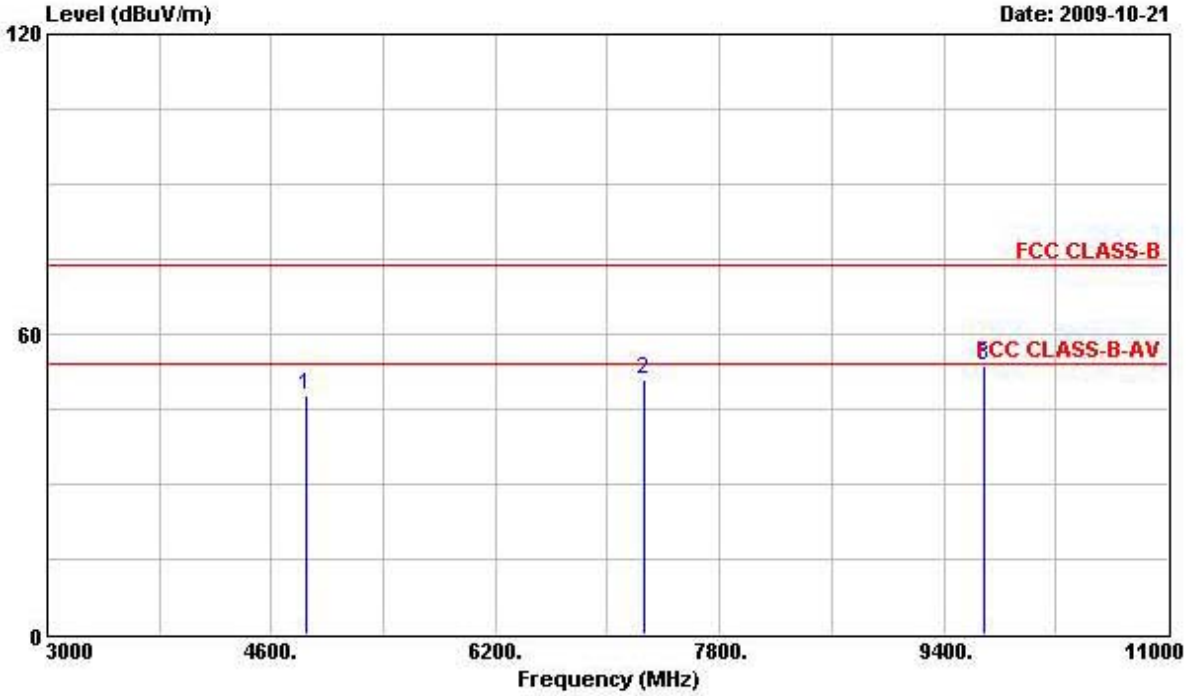



| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 | 4924.000 | 38.02 | -15.98 | 54.00 | 32.49 | 35.23 | 4.68 | 34.38 | Average |
| 2 | 4924.000 | 54.64 | -19.36 | 74.00 | 49.11 | 35.23 | 4.68 | 34.38 | Peak |
| 3 @ | 7386.000 | 50.51 | -3.49 | 54.00 | 42.19 | 36.96 | 5.65 | 34.29 | PK |
| 4 | 9848.000 | 53.68 | | | 43.03 | 38.81 | 6.38 | 34.54 | Peak |

Note: An item 4 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

| Final Test date | Oct. 21, 2009 | Test Site No. | 03CH02-HY |
|---|---|---|---|
| Temperature | 26℃ | Humidity | 54% |
| Test Engineer | Kobe | Configuration | 802.11n CH 3 (40MHz) |

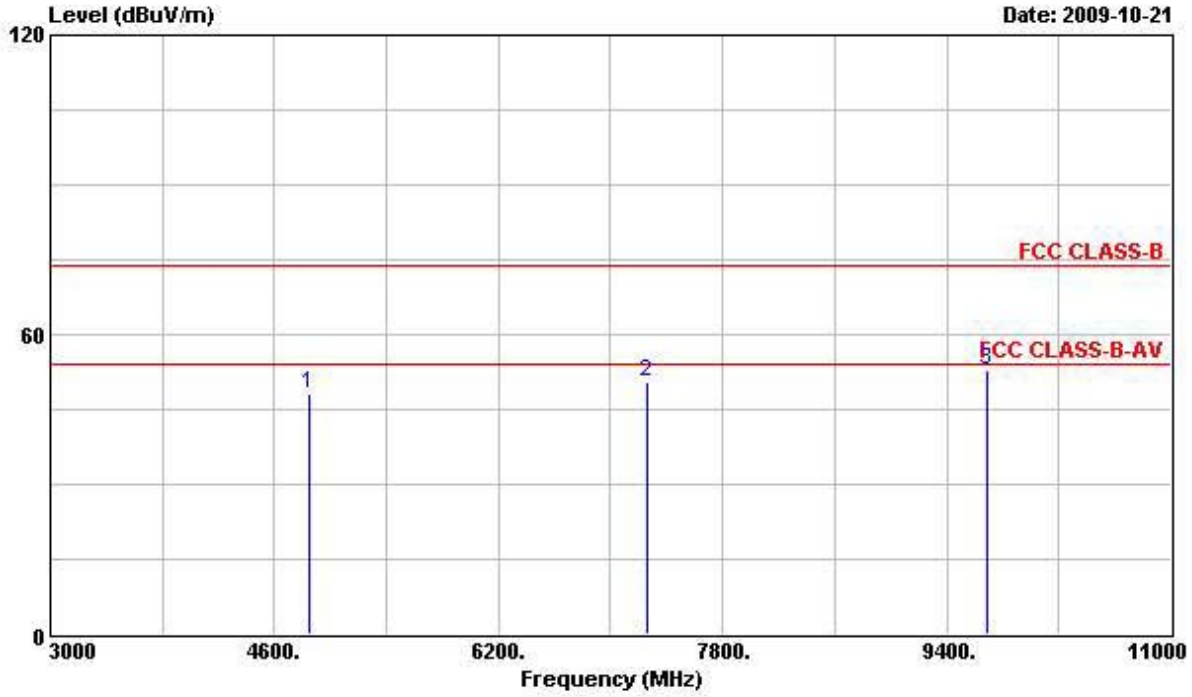
***Horizontal***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4844.000 | 47.91 | -6.09 | 54.00 | 42.00 | 35.78 | 4.61 | 34.48 | PK |
| 2 @ | 7266.000 | 50.96 | -3.04 | 54.00 | 41.76 | 37.86 | 5.63 | 34.29 | PK |
| 3 | 9688.000 | 53.68 | | | 42.50 | 39.43 | 6.35 | 34.60 | Peak |

Note: An item 3 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

***Vertical***

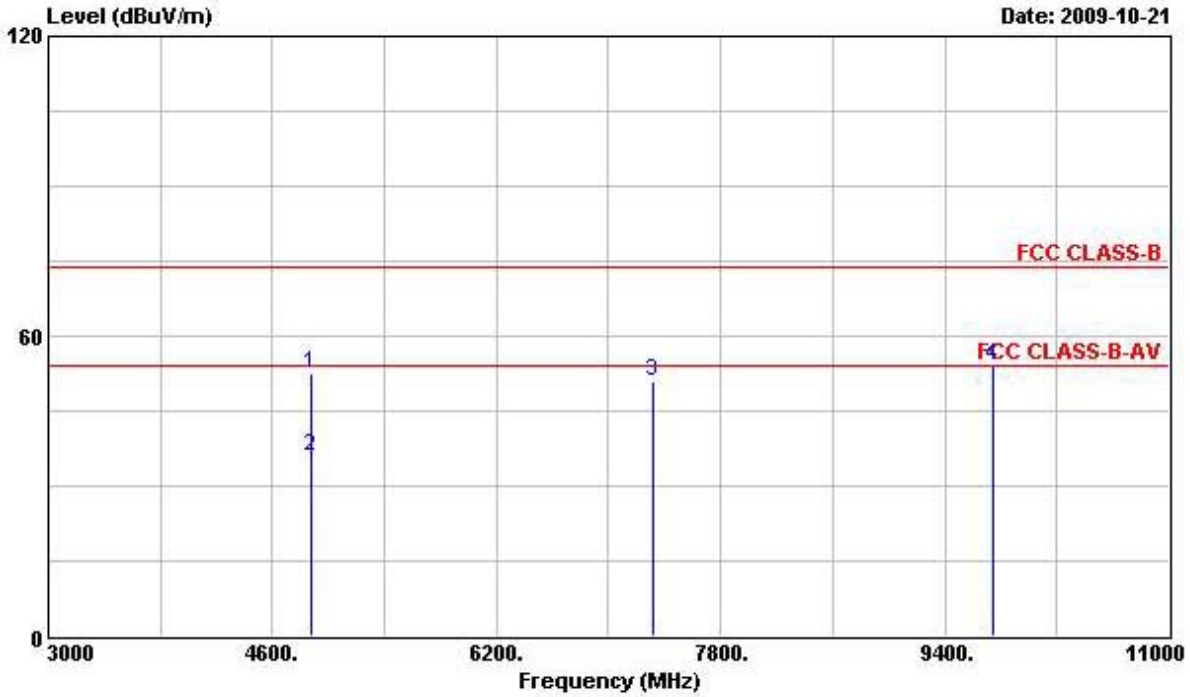



| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4844.000 | 48.15 | -5.85 | 54.00 | 42.88 | 35.14 | 4.61 | 34.48 | PK |
| 2 @ | 7266.000 | 50.50 | -3.50 | 54.00 | 42.25 | 36.91 | 5.63 | 34.29 | PK |
| 3 | 9688.000 | 52.70 | | | 42.32 | 38.63 | 6.35 | 34.60 | Peak |

Note: An item 3 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

| Final Test date | Oct. 21, 2009 | Test Site No. | 03CH02-HY |
|---|---|---|---|
| Temperature | 26℃ | Humidity | 54% |
| Test Engineer | Kobe | Configuration | 802.11n CH 6 (40MHz) |

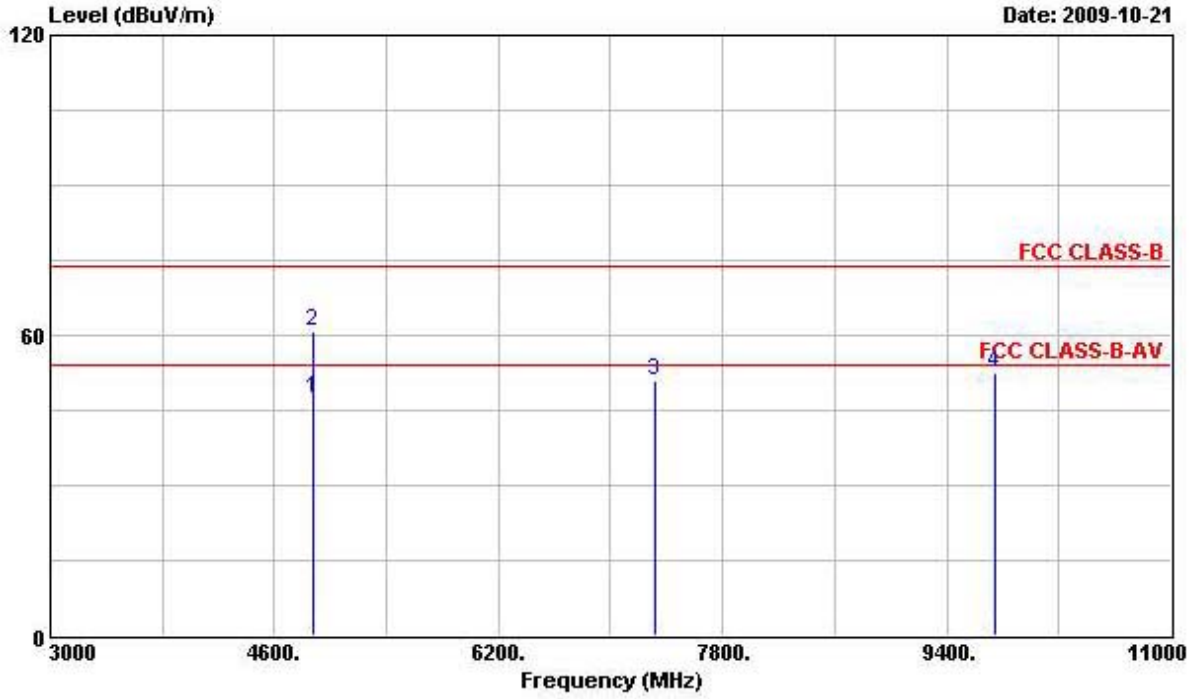
***Horizontal***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 | 4874.000 | 52.41 | -21.59 | 74.00 | 46.42 | 35.83 | 4.61 | 34.45 | Peak |
| 2 | 4874.000 | 36.11 | -17.89 | 54.00 | 30.12 | 35.83 | 4.61 | 34.45 | Average |
| 3 @ | 7311.000 | 50.99 | -3.01 | 54.00 | 41.78 | 37.86 | 5.64 | 34.29 | PK |
| 4 | 9748.000 | 54.02 | | | 42.73 | 39.51 | 6.36 | 34.58 | Peak |

Note: An item 4 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

***Vertical***

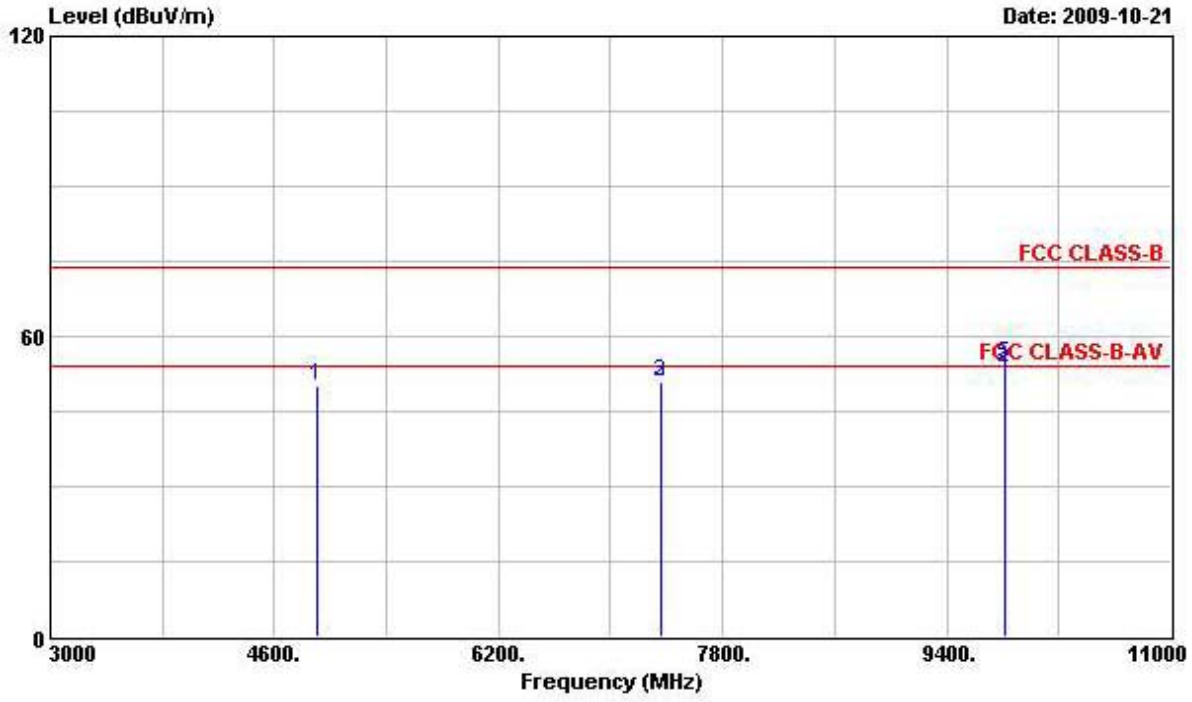



| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4874.000 | 47.30 | -6.70 | 54.00 | 41.96 | 35.18 | 4.61 | 34.45 | Average |
| 2 | 4874.000 | 60.96 | -13.04 | 74.00 | 55.62 | 35.18 | 4.61 | 34.45 | Peak |
| 3 @ | 7311.000 | 50.86 | -3.14 | 54.00 | 42.59 | 36.92 | 5.64 | 34.29 | PK |
| 4 | 9748.000 | 52.63 | | | 42.14 | 38.71 | 6.36 | 34.58 | Peak |

Note: An item 4 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

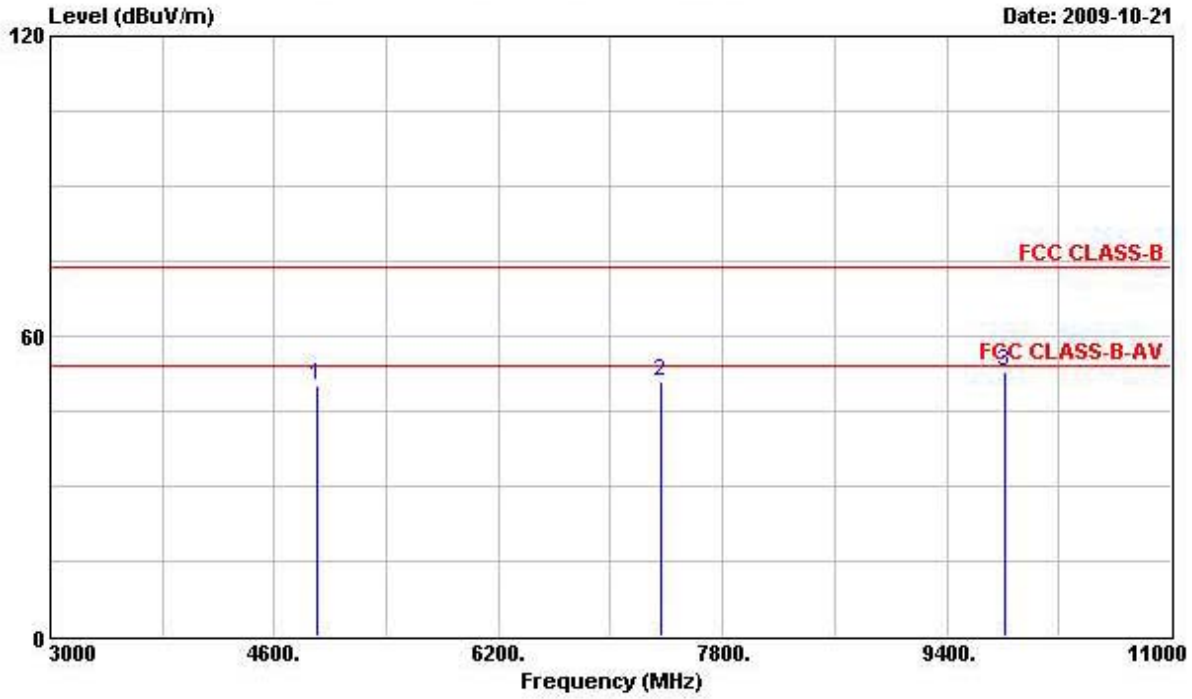
| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 21, 2009 | **Test Site No.** | 03CH02-HY |
| **Temperature** | 26℃ | **Humidity** | 54% |
| **Test Engineer** | Kobe | **Configuration** | 802.11n CH 9 (40MHz) |

***Horizontal***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4904.000 | 50.05 | -3.95 | 54.00 | 44.62 | 35.21 | 4.64 | 34.42 | PK |
| 2 | 7356.000 | 50.86 | -23.14 | 74.00 | 42.57 | 36.94 | 5.64 | 34.29 | Peak |
| 3 | 7356.000 | 50.77 | -23.23 | 74.00 | 41.55 | 37.87 | 5.64 | 34.29 | Peak |
| 4 | 9808.000 | 52.87 | -21.13 | 74.00 | 42.29 | 38.77 | 6.37 | 34.56 | Peak |
| 5 | 9808.000 | 54.52 | -19.48 | 74.00 | 43.14 | 39.57 | 6.37 | 34.56 | Peak |

***Vertical***




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 4904.000 | 50.05 | -3.95 | 54.00 | 44.62 | 35.21 | 4.64 | 34.42 | PK |
| 2 @ | 7356.000 | 50.86 | -3.14 | 54.00 | 42.57 | 36.94 | 5.64 | 34.29 | PK |
| 3 | 9808.000 | 52.87 | | | 42.29 | 38.77 | 6.37 | 34.56 | Peak |

Note: An item 3 is on un-restricted band, so the limit is -20dB for the field strength of the fundamental emissions (see section 3.6.7).

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

## 3.6 Band Edge and Fundamental Emissions Measurement

### 3.6.1 Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (micorvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 3.6.2 Measuring Instruments and Setting

Please refer to section 4 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 100 MHz |
| RB / VB (Emission in restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average |
| RB / VB (Emission in non-restricted band) | 1MHz / 1MHz for Peak |

### 3.6.3 Test Procedures

1. The test procedure is the same as section 3.5.3; only the frequency range investigated is limited to 100MHz around band edges.
2. In case the emission is fail due to the used RB/VB is too wide, marker-delta method of FCC Public Notice DA00-705 will be followed.

### 3.6.4 Test Setup Layout

This test setup layout is the same as that shown in section 3.5.4.

### 3.6.5 Test Deviation

There is no deviation with the original standard.

### 3.6.6 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 3.6.7 Test Result of Band Edge and Fundamental Emissions

| | | | |
|---|---|---|---|
| **Final Test date** | Oct. 26, 2009 | **Test Site No.** | 03CH02-HY |
| **Temperature** | 26℃ | **Humidity** | 54% |
| **Test Engineer** | Kobe | **Configuration** | 802.11n CH 1, 6, 11 (20MHz) |

***Channel 1***

| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 2387.140 | 66.45 | -7.55 | 74.00 | 31.40 | 32.03 | 3.02 | 0.00 | Peak |
| 2 @ | 2408.420 | 114.59 | | | 79.48 | 32.09 | 3.02 | 0.00 | Peak |
| 1 @ | 2390.000 | 52.60 | -1.40 | 54.00 | 17.55 | 32.03 | 3.02 | 0.00 | Average |
| 2 @ | 2408.610 | 104.07 | | | 68.96 | 32.09 | 3.02 | 0.00 | Average |

An item 2 is Fundamental Emissions.

***Channel 6***

| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 2440.340 | 119.75 | | | 88.30 | 28.40 | 3.05 | 0.00 | Peak |
| 1 @ | 2439.580 | 109.31 | | | 77.86 | 28.40 | 3.05 | 0.00 | Peak |

An item 1 is Fundamental Emissions.

***Channel 11***

| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 @ | 2460.100 | 114.53 | | | 79.20 | 32.28 | 3.05 | 0.00 | Peak |
| 2 @ | 2483.500 | 68.44 | -5.56 | 74.00 | 33.02 | 32.34 | 3.08 | 0.00 | Peak |
| 1 @ | 2458.770 | 104.01 | | | 68.68 | 32.28 | 3.05 | 0.00 | Average |
| 2 @ | 2483.500 | 52.80 | -1.20 | 54.00 | 17.38 | 32.34 | 3.08 | 0.00 | Average |

An item 1 is Fundamental Emissions.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

| **Final Test date** | Oct. 26, 2009 | **Test Site No.** | 03CH02-HY |
|---|---|---|---|
| **Temperature** | 26℃ | **Humidity** | 54% |
| **Test Engineer** | Kobe | **Configuration** | 802.11n CH 3, 6, 9 (40MHz) |

***Channel 3***

| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 | @ 2382.580 | 65.50 | -8.50 | 74.00 | 30.54 | 31.97 | 2.99 | 0.00 | Peak |
| 2 | @ 2409.180 | 109.45 | | | 74.34 | 32.09 | 3.02 | 0.00 | Peak |
| 1 | @ 2390.000 | 52.94 | -1.06 | 54.00 | 17.89 | 32.03 | 3.02 | 0.00 | Average |
| 2 | @ 2409.370 | 98.66 | | | 63.55 | 32.09 | 3.02 | 0.00 | Average |

An item 2 is Fundamental Emissions.

***Channel 6***

| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 | @ 2439.770 | 117.01 | | | 85.56 | 28.40 | 3.05 | 0.00 | Peak |
| 1 | @ 2440.530 | 106.29 | | | 74.84 | 28.40 | 3.05 | 0.00 | Peak |

An item 1 is Fundamental Emissions.

***Channel 9***

| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | |
| 1 | @ 2454.970 | 110.60 | | | 75.27 | 32.28 | 3.05 | 0.00 | Peak |
| 2 | @ 2483.850 | 66.57 | -7.43 | 74.00 | 31.15 | 32.34 | 3.08 | 0.00 | Peak |
| 1 | @ 2447.940 | 98.79 | | | 63.53 | 32.21 | 3.05 | 0.00 | Average |
| 2 | @ 2483.500 | 52.46 | -1.54 | 54.00 | 17.04 | 32.34 | 3.08 | 0.00 | Average |

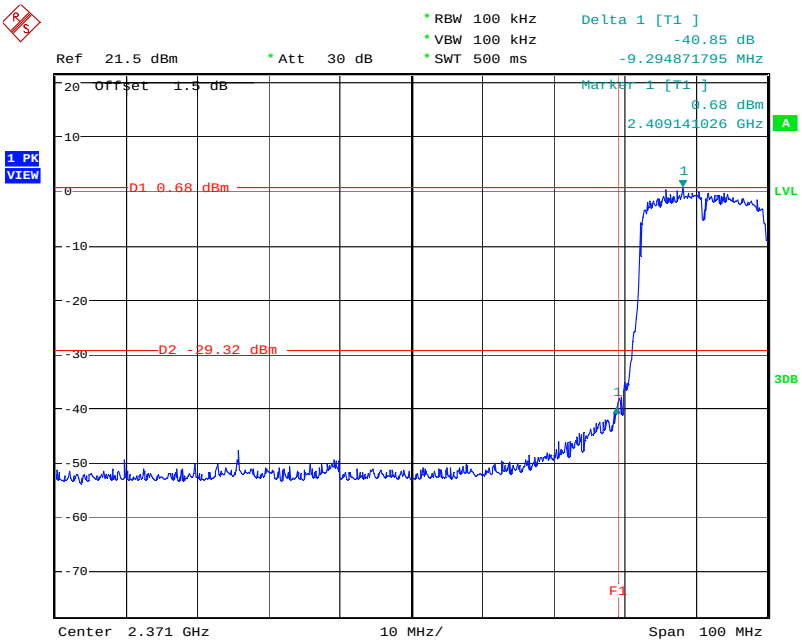
An item 1 is Fundamental Emissions.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

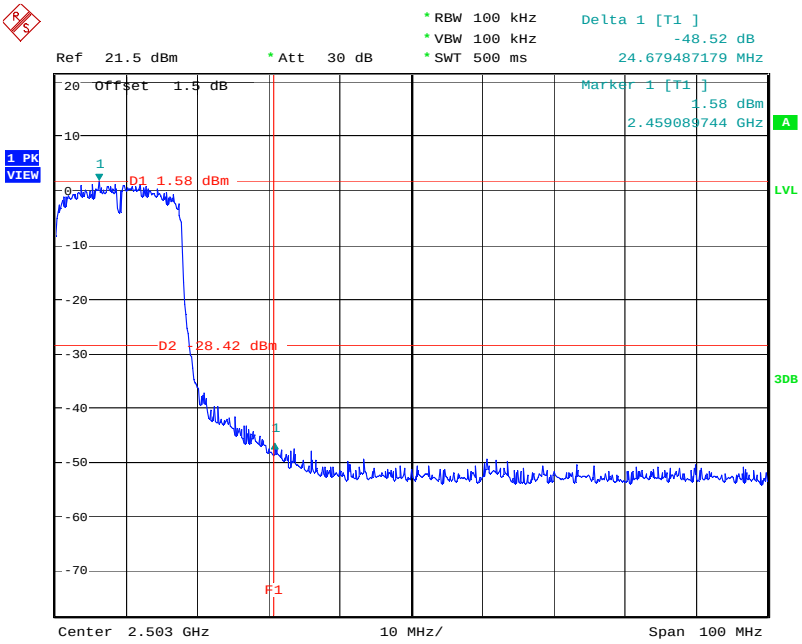
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

### Low Band Edge Plot on Configuration of IEEE 802.11n (20MHz) / 2412 MHz



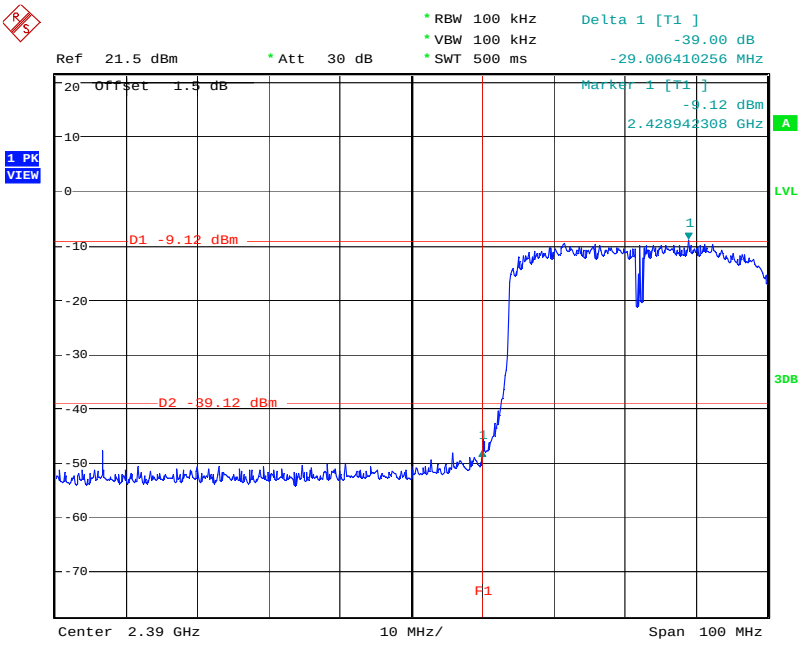

Date: 22.OCT.2009 19:29:12

### High Band Edge Plot on Configuration of IEEE 802.11n (20MHz) / 2462 MHz



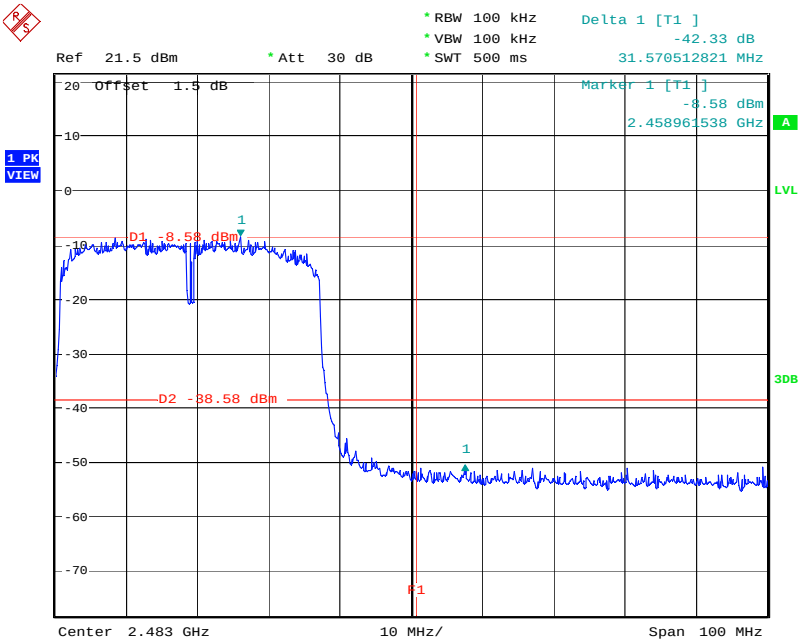

Date: 22.OCT.2009 19:33:02

### Low Band Edge Plot on Configuration of IEEE 802.11n (40MHz) / 2422 MHz




Date: 22.OCT.2009 19:59:46

### High Band Edge Plot on Configuration of IEEE 802.11n (40MHz) / 2452 MHz




Date: 22.OCT.2009 19:53:49

## 3.7 Antenna Requirements

### 3.7.1 Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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 use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

### 3.7.2 Antenna Connector Construction

Please refer to section 2.3 in this test report; antenna connector complied with the requirements.

# 4 LIST OF MEASURING EQUIPMENTS

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| EMC Receiver | R&S | ESCS 30 | 100174 | 9kHz – 2.75GHz | Apr. 15, 2009 | Conduction (CO04-HY) |
| LISN | MessTec | NNB-2/16Z | 99079 | 9kHz – 30MHz | Mar. 23, 2009 | Conduction (CO04-HY) |
| LISN (Support Unit) | EMCO | 3810/2NM | 9703-1839 | 9kHz – 30MHz | Mar. 22, 2009 | Conduction (CO04-HY) |
| RF Cable-CON | UTIFLEX | 3102-26886-4 | CB049 | 9kHz – 30MHz | Apr. 20, 2009 | Conduction (CO04-HY) |

Note: Calibration Interval of instruments listed above is one year.

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSU26.5 | 100015 | 20Hz ~ 26.5GHz | Oct. 28, 2008 | Conducted (TH01-HY) |
| Power Meter | R&S | NRVS | 100444 | DC ~ 40GHz | Jul. 31, 2009 | Conducted (TH01-HY) |
| Power Sensor | R&S | NRV-Z51 | 100666 | DC ~ 30GHz | Aug. 05, 2009 | Conducted (TH01-HY) |
| Power Sensor | R&S | NRV-Z32 | 100057 | 30MHz ~ 6GHz | Jul. 31, 2009 | Conducted (TH01-HY) |
| DC Power Source | G.W. | GPC-6030D | C671845 | DC 1V ~ 60V | Mar. 13, 2009 | Conducted (TH01-HY) |
| Temp. and Humidity Chamber | Giant Force | GTH-225-20-S | MAB0103-001 | N/A | Aug. 06, 2009 | Conducted (TH01-HY) |
| RF CABLE-1m | Jye Bao | RG142 | CB034-1m | 20MHz ~ 7GHz | Dec. 01, 2008 | Conducted (TH01-HY) |
| RF CABLE-2m | Jye Bao | RG142 | CB035-2m | 20MHz ~ 1GHz | Dec. 01, 2008 | Conducted (TH01-HY) |

Note: Calibration Interval of instruments listed above is one year.

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| AC Power Source | HPC | HPA-500W | HPA-9100024 | AC 0 ~ 300V | Jul. 12, 2009* | Conducted (TH01-HY) |

Note: Calibration Interval of instruments listed above is two year.

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| Horn Antenna | EMCO | 3115 | 6741 | 1GHz ~ 18GHz | Apr. 28, 2009 | Radiation (03CH02-HY) |
| Bilog Antenna | SCHAFFNER | CBL61128 | 2723 | 30 MHz - 2 GHz | Nov. 30, 2008 | Radiation (03CH02-HY) |
| RF Cable-R03m | Jye Bao | RG142 | CB020 | 30 MHz - 1 GHz | Dec. 17, 2008 | Radiation (03CH02-HY) |
| RF Cable-HIGH | SUHNER | SUCOFLEX106 | 03CH02-HY | 1GHz~40GHz | Dec. 17, 2008 | Radiation (03CH02-HY) |
| Spectrum Analyzer | R&S | FSP40 | 100305/040 | 9 kHz - 40GHz | Feb. 04, 2009 | Radiation (03CH02-HY) |
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH02-HY | 30 MHz - 1 GHz 3m | May 11, 2009 | Radiation (03CH02-HY) |
| Amplifier | Agilent | 8447D | 2944A11146 | 100 kHz – 1.3 GHz | Jul. 07, 2009 | Radiation (03CH02-HY) |
| Amplifier | Agilent | 8449B | 3008A02373 | 1GHz – 26.5 GHz | Jul. 16, 2009 | Radiation (03CH02-HY) |
| Turn Table | HD | DS 420 | 420/649/00 | 0 - 360 degree | N/A | Radiation (03CH02-HY) |
| Antenna Mast | HD | MA 240 | 240/559/00 | 1 m - 4 m | N/A | Radiation (03CH02-HY) |

Note: Calibration Interval of instruments listed above is one year.

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| Loop Antenna | R&S | HFH2-Z2 | 860004/001 | 9 kHz - 30 MHz | Jul 28, 2008* | Radiation (03CH02-HY) |

Note: Calibration Interval of instruments listed above is two year.

# 5 TEST LOCATION

| | | | |
|---|---|---|---|
| SHIJR | ADD | : | 6Fl., No. 106, Sec. 1, Shintai 5th Rd., Shijr City, Taipei, Taiwan 221, R.O.C. |
| | TEL | : | 886-2-2696-2468 |
| | FAX | : | 886-2-2696-2255 |
| HWA YA | ADD | : | No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. |
| | TEL | : | 886-3-327-3456 |
| | FAX | : | 886-3-318-0055 |
| LINKOU | ADD | : | No. 30-2, Dingfu Tsuen, Linkou Shiang, Taipei, Taiwan 244, R.O.C |
| | TEL | : | 886-2-2601-1640 |
| | FAX | : | 886-2-2601-1695 |
| DUNGHU | ADD | : | No. 3, Lane 238, Kangle St., Neihu Chiu, Taipei, Taiwan 114, R.O.C. |
| | TEL | : | 886-2-2631-4739 |
| | FAX | : | 886-2-2631-9740 |
| JUNGHE | ADD | : | 7Fl., No. 758, Jungjeng Rd., Junghe City, Taipei, Taiwan 235, R.O.C. |
| | TEL | : | 886-2-8227-2020 |
| | FAX | : | 886-2-8227-2626 |
| NEIHU | ADD | : | 4Fl., No. 339, Hsin Hu 2nd Rd., Taipei 114, Taiwan, R.O.C. |
| | TEL | : | 886-2-2794-8886 |
| | FAX | : | 886-2-2794-9777 |
| JHUBEI | ADD | : | No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. |
| | TEL | : | 886-3-656-9065 |
| | FAX | : | 886-3-656-9085 |

# 6 TAF CERTIFICATE OF ACCREDITATION

Certificate No. : L1190-090318

財團法人全國認證基金會
Taiwan Accreditation Foundation

## Certificate of Accreditation

This is to certify that

**Sporton International Inc.**
**EMC & Wireless Communications Laboratory**
No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

**is accredited in respect of laboratory**

| | | |
|---|---|---|
| **Accreditation Criteria** | : | ISO/IEC 17025:2005 |
| **Accreditation Number** | : | 1190 |
| **Originally Accredited** | : | December 15, 2003 |
| **Effective Period** | : | January 10, 2007 to January 09, 2010 |
| **Accredited Scope** | : | Testing Field, see described in the Appendix |
| **Specific Accreditation Program** | : | Accreditation Program for Designated Testing Laboratory for Commodities Inspection<br>Accreditation Program for Telecommunication Equipment Testing Laboratory<br>Accreditation Program for BSMI Mutual Recognition Arrangment with Foreign Authorities |

Jay-San Chen
President, Taiwan Accreditation Foundation
Date : March 18, 2009

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The Appendix forms an integral part of this Certificate, which shall be invalid when use without the Appendix