

# FCC TEST REPORT

for

## 47 CFR, Part 15, Subpart C

Equipment : Wireless AP

Model No. : F5D7130

FCC ID : K7SF5D7130

Filing Type : Certification

Applicant : **Belkin Corporation**  
501 West Walnut Street, Compton, CA, 90220-5221 USA

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### ***SPORTON International Inc.***

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

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***SPORTON International Inc.***

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## Table of Contents

|  |           |
|--|-----------|
| <b>History of this test report .....</b>                   | <b>ii</b> |
| <b>CERTIFICATE OF COMPLIANCE.....</b>                      | <b>1</b>  |
| <b>1. General Description of Equipment under Test.....</b> | <b>2</b>  |
| 1.1. Applicant.....  | 2         |
| 1.2. Manufacturer .....                                    | 2         |
| 1.3. Basic Description of Equipment under Test .....       | 2         |
| 1.4. Feature of Equipment under Test .....                 | 3         |
| <b>2. Test Configuration of Equipment under Test.....</b>  | <b>4</b>  |
| 2.1. Test Manner .....                                     | 4         |
| 2.2. Description of Test System .....                      | 4         |
| 2.3. Connection Diagram of Test System .....               | 6         |
| <b>3. Test Software .....</b>                              | <b>7</b>  |
| <b>4. General Information of Test.....</b>                 | <b>8</b>  |
| 4.1. Test Voltage .....                                    | 8         |
| 4.2. Standard for Methods of Measurement.....              | 8         |
| 4.3. Test in Compliance with .....                         | 8         |
| 4.4. Frequency Range Investigated .....                    | 8         |
| 4.5. Test Distance .....                                   | 8         |
| <b>5. Report of Measurements and Examinations .....</b>    | <b>9</b>  |
| 5.1. List of Measurements and Examinations .....           | 9         |
| 5.2. 6dB Bandwidth .....                                   | 10        |
| 5.3. Peak Output Power .....                               | 11        |
| 5.4. Power Spectral Density .....                          | 12        |
| 5.5. Test of Conducted Emission .....                      | 13        |
| 5.6. Test of Radiated Emission .....                       | 20        |
| 5.7. Band Edges Measurement.....                           | 29        |
| 5.8. Antenna Requirements .....                            | 30        |
| 5.9. RF Exposure .....                                     | 31        |
| <b>6. EMI Suppression Component List.....</b>              | <b>33</b> |
| <b>7. Antenna Factor &amp; Cable Loss .....</b>            | <b>34</b> |
| <b>8. List of Measuring Equipments Used .....</b>          | <b>36</b> |
| <b>9. Uncertainty of Test Site .....</b>                   | <b>38</b> |



# CERTIFICATE OF COMPLIANCE

for

## 47 CFR, Part 15, Subpart C

Equipment : Wireless AP  
Model No. : F5D7130  
FCC ID : K7SF5D7130  
Filing Type : Certification  
Applicant : **Belkin Corporation**  
501 West Walnut Street, Compton, CA, 90220-5221 USA

I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 2001** and the equipment under test was **passed** all test items required in FCC Part 15 subpart C, relative to the equipment under test. Testing was carried out on Nov. 11, 2003 at **SPORTON International Inc.** LAB.



Alex Chen  
Manager

**SPORTON International Inc.**

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

## **1. General Description of Equipment under Test**

### **1.1. Applicant**

Belkin Corporation  
501 West Walnut Street, Compton, CA, 90220-5221 USA

### **1.2. Manufacturer**

Same as 1.1

### **1.3. Basic Description of Equipment under Test**

Equipment : Wireless AP  
Model No. : F5D7130  
FCC ID : K7SF5D7130  
Trade Name : Belkin  
TP Cable : Non-Shielded, 1m  
Power Supply Type : Switching  
AC Power Input : Wall-Mount, 2 pin  
DC Power Cable : Non-Shielded, 1.8m, 2 pin

**1.4. Feature of Equipment under Test**

| Product Feature & Specification                                      |  |
|--|--|
| 1. Host/Radio Interface  | DSSS   |
| 2. Type of Modulation  | CCK, DQPSK, DBPSK  |
| 3. Number of Channels  | 11   |
| 4. Frequency Band  | 2400MHz~2483.5MHz  |
| 5. Carrier Frequency of each channel                                 | 2412MHz+(n-1)5MHz, n=Channel NO.                         |
| 6. Bandwidth of each channel   | 11 MHz   |
| 7. Maximum Output Power to Antenna                                   | 18.75 dBm  |
| 8. IF & L.O. frequency   | IF: 374 MHz, L.O.: 2036MHz                               |
| 9. Type of Antenna Connector<br>(Ex: SMA, TNC, MCX, MMCX, UFC...etc) | Outside: Undetachable, Inside: U.FL                      |
| 10. Antenna Type/ Class and Gain                                     | Dipole Antenna, 2dBi                                     |
| 11. Function Type  | Transceiver  |
| 12. Power Rating (DC/AC, Voltage)                                    | Input: AC 100V-240V, 0.4A, 50-60Hz<br>Output: DC 5 V, 2A |
| 13. Duty Cycle   | 100%   |
| 14. Basic function of product  | Wireless router  |

**2. Test Configuration of Equipment under Test**

**2.1. Test Manner**

- a. The EUT has been associated with notebook and peripherals pursuant to ANSI C63.4-2001 and configuration operated in a manner, which tended to maximize its emission characteristics in a typical application.
- b. The complete test system included remote DELL Notebook, COMPAQ Notebook, VIEWSONIC Monitor, LOGITECH PS/2 Keyboard, LOGITECH USB Mouse, EPSON Printer and EUT for EMI test.
- c. The EUT can operate on eleven channels from 2412.0MHz to 2462.0MHz. (as listed in section 1.4). According to 15.31(m), three channels (one near top, one near middle and one near bottom) were performed as following:
  - Mode 1: CH01 ( 2412MHz )
  - Mode 2: CH06 ( 2437MHz )
  - Mode 3: CH11 ( 2462MHz )
- d. Frequency range investigated: conduction 150 KHz to 30 MHz, radiation 30 MHz to 25000MHz.

**2.2. Description of Test System**

Support Unit 1. -- Notebook (COMPAQ) – for local workstation

FCC ID : N/A  
Model No. : PRESARIO 1500  
Power Supply Type : Switching  
Power Cord : Non-Shielded  
Serial No. : SP0127  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

Support Unit 2. -- Monitor (VIEWSONIC) – for local workstation

FCC ID : N/A  
Model No. : VCDTS21553-3P  
Power Supply Type : Switching  
Power Cord : Non-Shielded  
Serial No. : SP0051  
Data Cable : Shielded, 1.7m  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

## Support Unit 3. – PS/2 Keyboard (LOGITECH) – for local workstation

FCC ID : N/A  
Model No. : Y-SJ17  
Serial No. : SP0054  
Data Cable : Shielded, 360 degree via metal backshells, 1.7m  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

## Support Unit 4. – USB Mouse (LOGITECH) – for local workstation

FCC ID : N/A  
Model No. : M-BE58  
Serial No. : SP0041  
Data Cable : Shielded, 1.7m  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

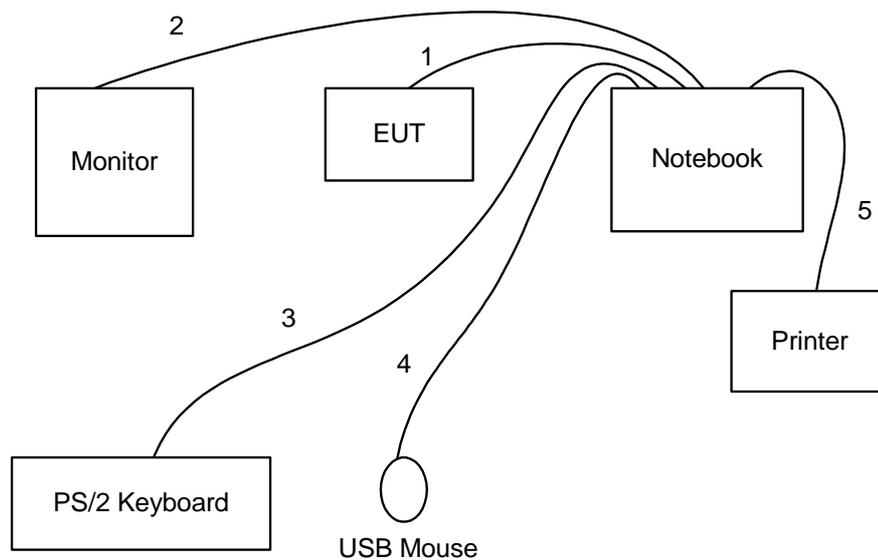
## Support Unit 5. -- Printer (EPSON) – for local workstation

FCC ID : N/A  
Model No. : STYLUS COLOR 680  
Power Supply Type : Linear  
Power Cord : Non-Shielded  
Serial No. : SP0048  
Data Cable : Shielded, 1.35m  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

## Support Unit 6. -- Notebook (DELL) – for remote workstation

FCC ID : N/A  
Model No. : PP01L  
Power Supply Type : Switching  
Power Cord : Non-Shielded  
Serial No. : SP0131  
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

### 2.3. Connection Diagram of Test System



1. The TP cable is connected from Notebook to the EUT
2. The I/O cable is connected from Notebook to the support unit 2
3. The I/O cable is connected from Notebook to the support unit 3.
4. The I/O cable is connected from Notebook to the support unit 4
5. The I/O cable is connected from Notebook to the support unit 5

### **3. Test Software**

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 program was executed as follows:

- a. Turn on the power of all equipment.
- b. The PC reads the test program from the hard disk drive and runs it.
- c. The PC sends " H" messages to the monitor, and the monitor displays " H" patterns on the screen.
- d. The PC sends " H" messages to the printer, then the printer prints them on the paper.
- e. The PC sends " H" messages to the internal Hard Disk, and the Hard Disk reads and writes the message.
- f. Repeat the steps from c to e.

At the same time, the following programs were executed:

- Executed "MFGTEST.EXE" to keep transmitting signals at fixed frequency.
- Executed "EXPLOR.EXE" to link with the remote workstation to receive and transmit data by wireless.

## **4. General Information of Test**

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,  
Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C.  
TEL : 886-3-327-3456  
FAX : 886-3-318-0055

Test Site No : CO01-HY, 03CH03-HY

### **4.1. Test Voltage**

110V/60Hz

### **4.2. Standard for Methods of Measurement**

ANSI C63.4-2001 for conducted power line test and radiated emission test,  
“Guidance on Measurements for Direct Sequence Spread Spectrum Systems” for test of 6dB Bandwidth  
“Guidance on Measurements for Direct Sequence Spread Spectrum Systems” for test of Maximum Peak Output Power  
“Guidance on Measurements for Direct Sequence Spread Spectrum Systems” for test of 100kHz Bandwidth of Frequency Band Edges  
“Guidance on Measurements for Direct Sequence Spread Spectrum Systems” for test of Power Spectral Density

### **4.3. Test in Compliance with**

FCC Part 15, Subpart C, 15.247

### **4.4. Frequency Range Investigated**

- a. Conduction: from 150 kHz to 30 MHz
- b. Radiation: from 30 MHz to 25000MHz

### **4.5. Test Distance**

The test distance of radiated emission from antenna to EUT is 3 M.

## 5. Report of Measurements and Examinations

### 5.1. List of Measurements and Examinations

| FCC Rule                             | Description of Test                      | Result |
|--------------------------------------|--|--------|
| 15.207                               | Conducted Emission                       | Pass   |
| <u>15.247(a)(2)</u>                  | 6dB Bandwidth                            | Pass   |
| <u>15.247(b)</u>                     | Maximum Peak Output Power                | Pass   |
| 15.209                               | Radiated Emission                        | Pass   |
| <u>15.247(c)</u>                     | 100kHz Bandwidth of Frequency Band Edges | Pass   |
| <u>15.247(d)</u>                     | Power Spectral Density                   | Pass   |
| <u>15.203</u>                        | Antenna Requirement                      | Pass   |
| 1.1307<br>1.1310<br>2.1091<br>2.1093 | RF Exposure Compliance                   | Pass   |

**5.2. 6dB Bandwidth**

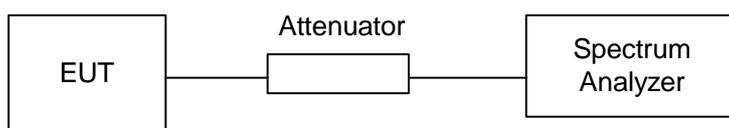
5.2.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.2.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

5.2.3. Test Setup Layout :



5.2.4. Test Result : The spectrum analyzer plots are attached as below

- Temperature : 25°C
- Relative Humidity : 65 %

| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 1       | 2412                 | 11.12                             | 0.5               | 1                |
| 6       | 2437                 | 9.52                              | 0.5               | 2                |
| 11      | 2462                 | 11.04                             | 0.5               | 3                |

**5.3. Peak Output Power**

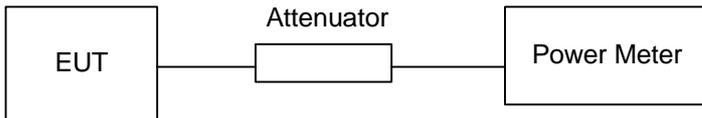
5.3.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.3.2. Test Procedure :

The antenna port ( RF output ) of the EUT was connected to the input ( RF input ) of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

5.3.3. Test Setup Layout :



5.3.4. Test Result : See spectrum analyzer plots below

- Temperature : 25°C
- Relative Humidity : 65 %

| Channel | Frequency (MHz) | Measured Output Power (mWatt) | Measured Output Power (dBm) | Limits (Watt/dBm ) |
|---------|-----------------|-------------------------------|-----------------------------|--------------------|
| 1       | 2412            | 65.464                        | 18.16                       | 1W/30 dBm          |
| 6       | 2437            | 60.117                        | 17.79                       | 1W/30 dBm          |
| 11      | 2462            | 74.989                        | 18.75                       | 1W/30 dBm          |

- 
- Comments : Maximum Peak Output Power < 30dBm ( 1Watt)

**5.4. Power Spectral Density**

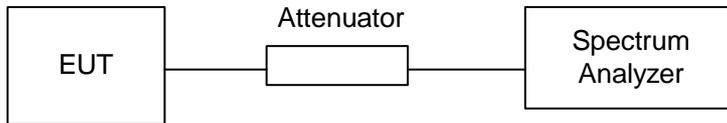
5.4.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.4.2. Test Procedure :

1. The transmitter output was connected to spectrum analyzer through an attenuator.
2. The spectrum analyzer's resolution bandwidth were set at 3KHz RBW and 30KHz VBW as that of the fundamental frequency. Set the sweep time=span/3KHz.
3. The power spectral density was measured and recorded.
4. The Sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

5.4.3. Test Setup Layout :



5.4.4. Test Result : See spectrum analyzer plots below

- Temperature : 25°C
- Relative Humidity : 65 %

| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|-----------------|------------------|
| 1       | 2412               | -11.56                          | 8               | 1                |
| 6       | 2437               | -11.69                          | 8               | 2                |
| 11      | 2462               | -11.88                          | 8               | 3                |

## 5.5. Test of Conducted Emission

Conducted Emissions were measured from 150 KHz to 30 MHz with a bandwidth of 9 KHz and return leads of the EUT according to the methods defined in ANSI C63.4-2001 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

### 5.5.1. Major Measuring Instruments :

|                 |               |
|-----------------|---------------|
| ● Test Receiver | (R&S ESCS 30) |
| Attenuation     | 10 dB         |
| Start Frequency | 0.15 MHz      |
| Stop Frequency  | 30 MHz        |
| IF Bandwidth    | 9 KHz         |

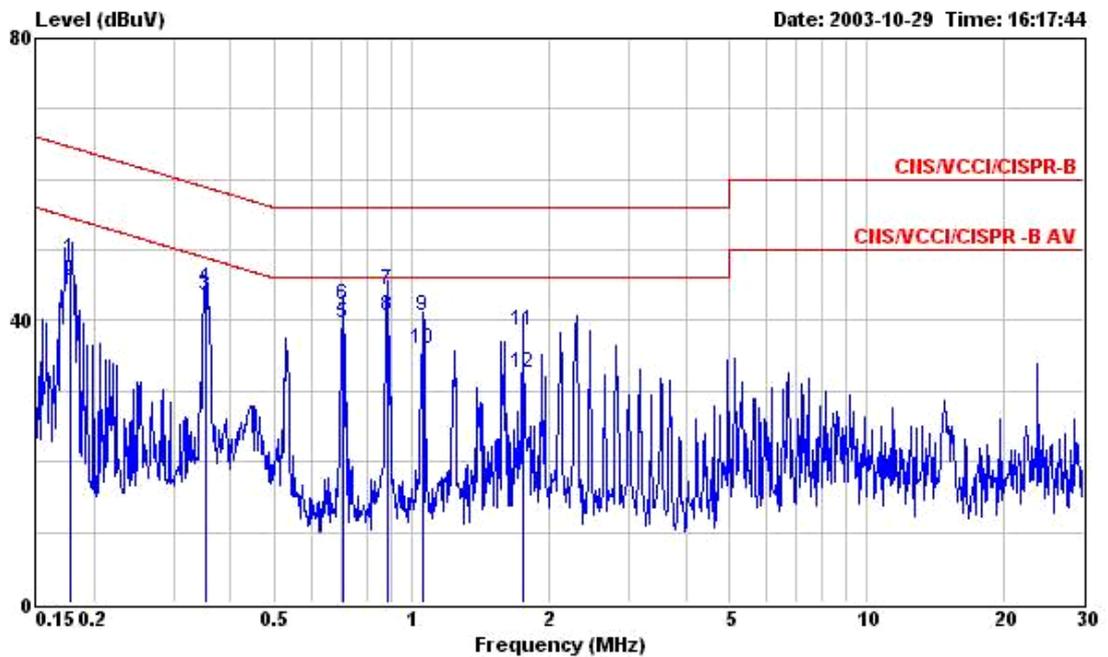
### 5.5.2. Test Procedures :

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connect to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 KHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5.5.3. Test Result of Conducted Emission :

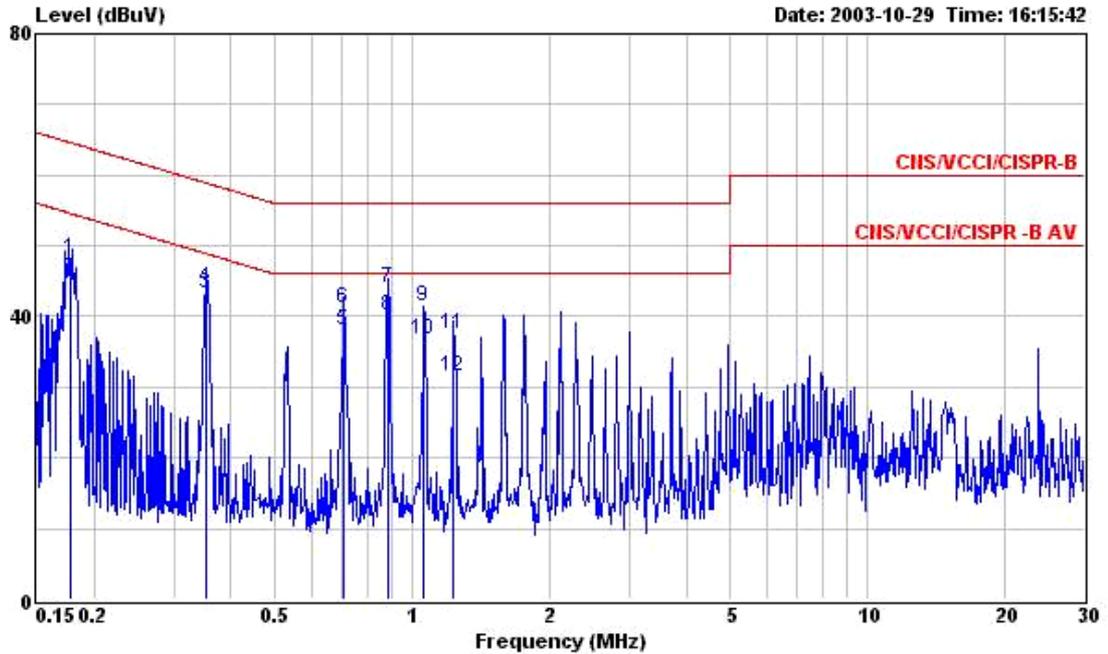
- Test Mode: Mode 1
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 25.9°C
- Relative Humidity: 60 %

The test was passed at the minimum margin that marked by the frame in the following table.



Site : C001-HY  
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE  
 EUT : Wireless AP  
 Power : 110V/60Hz  
 Model :  
 Memo : TX CH01

|    | Freq  | Level | Over   | Limit | Read  | Probe  | Cable |         |
|----|-------|-------|--------|-------|-------|--------|-------|---------|
|    | MHz   | dBuV  | Limit  | Line  | Level | Factor | Loss  | Remark  |
|    |       |       | dB     | dBuV  | dBuV  | dB     | dB    |         |
| 1  | 0.178 | 48.85 | -15.74 | 64.59 | 48.69 | 0.10   | 0.06  | QP      |
| 2  | 0.178 | 45.63 | -8.96  | 54.59 | 45.47 | 0.10   | 0.06  | Average |
| 3  | 0.354 | 43.58 | -5.29  | 48.87 | 43.40 | 0.10   | 0.08  | Average |
| 4  | 0.354 | 44.46 | -14.41 | 58.87 | 44.28 | 0.10   | 0.08  | QP      |
| 5  | 0.707 | 39.72 | -6.28  | 46.00 | 39.53 | 0.10   | 0.09  | Average |
| 6  | 0.707 | 42.25 | -13.75 | 56.00 | 42.06 | 0.10   | 0.09  | QP      |
| 7  | 0.882 | 44.32 | -11.68 | 56.00 | 44.12 | 0.10   | 0.10  | QP      |
| 8  | 0.882 | 40.69 | -5.31  | 46.00 | 40.49 | 0.10   | 0.10  | Average |
| 9  | 1.060 | 40.59 | -15.41 | 56.00 | 40.39 | 0.10   | 0.10  | QP      |
| 10 | 1.060 | 35.87 | -10.13 | 46.00 | 35.67 | 0.10   | 0.10  | Average |
| 11 | 1.758 | 38.57 | -17.43 | 56.00 | 38.35 | 0.10   | 0.12  | QP      |
| 12 | 1.758 | 32.52 | -13.48 | 46.00 | 32.30 | 0.10   | 0.12  | Average |



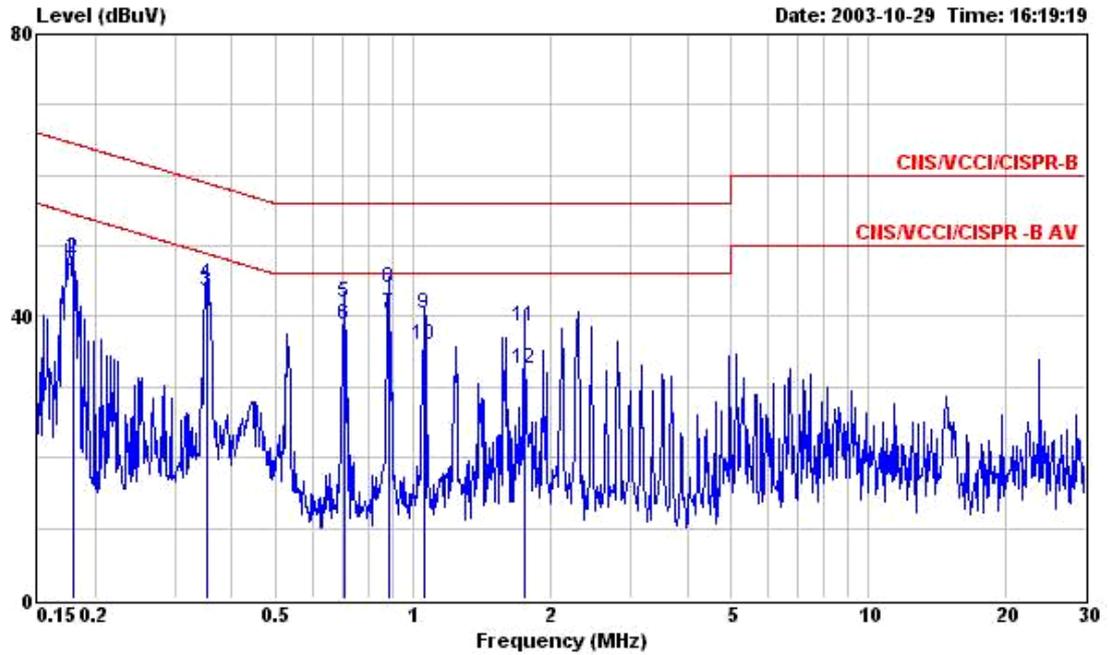
Site : C001-HY  
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 NEUTRAL  
 EUT : Wireless AP  
 Power : 110V/60Hz  
 Model :  
 Memo : TX CH01

|    | Freq  | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Remark  |
|----|-------|-------|------------|------------|------------|--------------|------------|---------|
|    | MHz   | dBuV  | dB         | dBuV       | dBuV       | dB           | dB         |         |
| 1  | 0.177 | 48.31 | -16.32     | 64.63      | 48.15      | 0.10         | 0.06       | QP      |
| 2  | 0.177 | 45.32 | -9.31      | 54.63      | 45.16      | 0.10         | 0.06       | Average |
| 3  | 0.352 | 43.38 | -5.54      | 48.92      | 43.20      | 0.10         | 0.08       | Average |
| 4  | 0.352 | 44.14 | -14.78     | 58.92      | 43.96      | 0.10         | 0.08       | QP      |
| 5  | 0.708 | 37.93 | -8.07      | 46.00      | 37.74      | 0.10         | 0.09       | Average |
| 6  | 0.708 | 41.12 | -14.88     | 56.00      | 40.93      | 0.10         | 0.09       | QP      |
| 7  | 0.884 | 44.10 | -11.90     | 56.00      | 43.90      | 0.10         | 0.10       | QP      |
| 8  | 0.884 | 40.07 | -5.93      | 46.00      | 39.87      | 0.10         | 0.10       | Average |
| 9  | 1.060 | 41.49 | -14.51     | 56.00      | 41.29      | 0.10         | 0.10       | QP      |
| 10 | 1.060 | 36.79 | -9.21      | 46.00      | 36.59      | 0.10         | 0.10       | Average |
| 11 | 1.232 | 37.56 | -18.44     | 56.00      | 37.35      | 0.10         | 0.11       | QP      |
| 12 | 1.232 | 31.43 | -14.57     | 46.00      | 31.22      | 0.10         | 0.11       | Average |

Test Engineer : John  
 John Huang

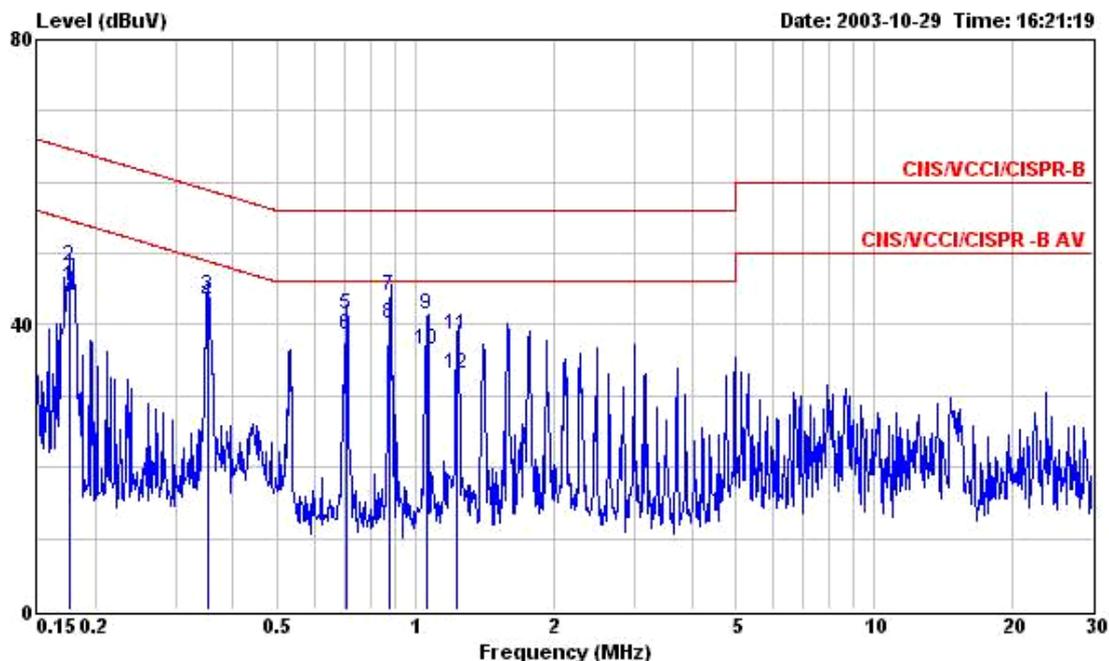
- Test Mode: Mode 2
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 25.9°C
- Relative Humidity: 60 %

The test was passed at the minimum margin that marked by the frame in the following table.



Site : C001-HY  
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE  
 EUT : Wireless AP  
 Power : 110V/60Hz  
 Model :  
 Memo : TX CH06

|    | Freq  | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Remark  |
|----|-------|-------|------------|------------|------------|--------------|------------|---------|
|    | MHz   | dBuV  | dB         | dBuV       | dBuV       | dB           | dB         |         |
| 1  | 0.179 | 44.91 | -9.63      | 54.54      | 44.75      | 0.10         | 0.06       | Average |
| 2  | 0.179 | 48.33 | -16.21     | 64.54      | 48.17      | 0.10         | 0.06       | QP      |
| 3  | 0.354 | 43.50 | -5.37      | 48.87      | 43.32      | 0.10         | 0.08       | Average |
| 4  | 0.354 | 44.55 | -14.32     | 58.87      | 44.37      | 0.10         | 0.08       | QP      |
| 5  | 0.708 | 41.91 | -14.09     | 56.00      | 41.72      | 0.10         | 0.09       | QP      |
| 6  | 0.708 | 38.77 | -7.23      | 46.00      | 38.58      | 0.10         | 0.09       | Average |
| 7  | 0.884 | 40.52 | -5.48      | 46.00      | 40.32      | 0.10         | 0.10       | Average |
| 8  | 0.884 | 44.16 | -11.84     | 56.00      | 43.96      | 0.10         | 0.10       | QP      |
| 9  | 1.060 | 40.50 | -15.50     | 56.00      | 40.30      | 0.10         | 0.10       | QP      |
| 10 | 1.060 | 35.87 | -10.13     | 46.00      | 35.67      | 0.10         | 0.10       | Average |
| 11 | 1.758 | 38.64 | -17.36     | 56.00      | 38.42      | 0.10         | 0.12       | QP      |
| 12 | 1.758 | 32.68 | -13.32     | 46.00      | 32.46      | 0.10         | 0.12       | Average |



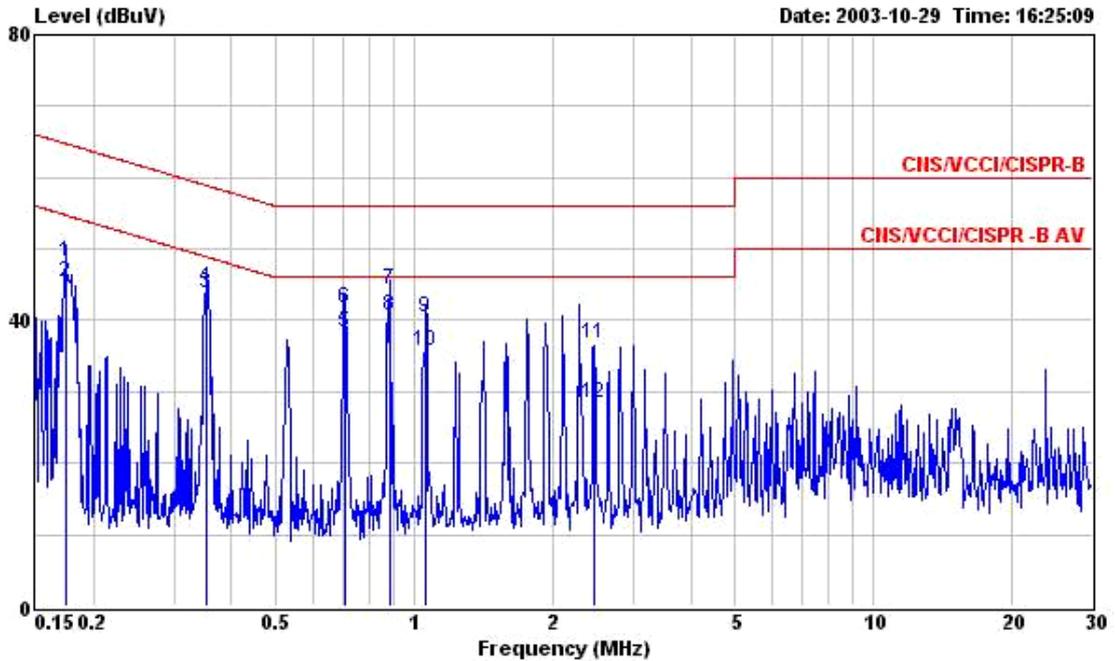
Site : C001-HY  
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 NEUTRAL  
 EUT : Wireless AP  
 Power : 110V/60Hz  
 Model :  
 Memo : TX CH06

|    | Freq  | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Remark  |
|----|-------|-------|------------|------------|------------|--------------|------------|---------|
|    | MHz   | dBuV  | dB         | dBuV       | dBuV       | dB           | dB         |         |
| 1  | 0.176 | 45.42 | -9.24      | 54.66      | 45.26      | 0.10         | 0.06       | Average |
| 2  | 0.176 | 48.27 | -16.39     | 64.66      | 48.11      | 0.10         | 0.06       | QP      |
| 3  | 0.354 | 43.92 | -14.95     | 58.87      | 43.74      | 0.10         | 0.08       | QP      |
| 4  | 0.354 | 43.12 | -5.75      | 48.87      | 42.94      | 0.10         | 0.08       | Average |
| 5  | 0.705 | 41.50 | -14.50     | 56.00      | 41.31      | 0.10         | 0.09       | QP      |
| 6  | 0.705 | 38.61 | -7.39      | 46.00      | 38.42      | 0.10         | 0.09       | Average |
| 7  | 0.881 | 44.16 | -11.84     | 56.00      | 43.96      | 0.10         | 0.10       | QP      |
| 8  | 0.881 | 40.20 | -5.80      | 46.00      | 40.00      | 0.10         | 0.10       | Average |
| 9  | 1.060 | 41.39 | -14.61     | 56.00      | 41.19      | 0.10         | 0.10       | QP      |
| 10 | 1.060 | 36.59 | -9.41      | 46.00      | 36.39      | 0.10         | 0.10       | Average |
| 11 | 1.235 | 38.51 | -17.49     | 56.00      | 38.30      | 0.10         | 0.11       | QP      |
| 12 | 1.235 | 33.21 | -12.79     | 46.00      | 33.00      | 0.10         | 0.11       | Average |

Test Engineer : John  
 John Huang

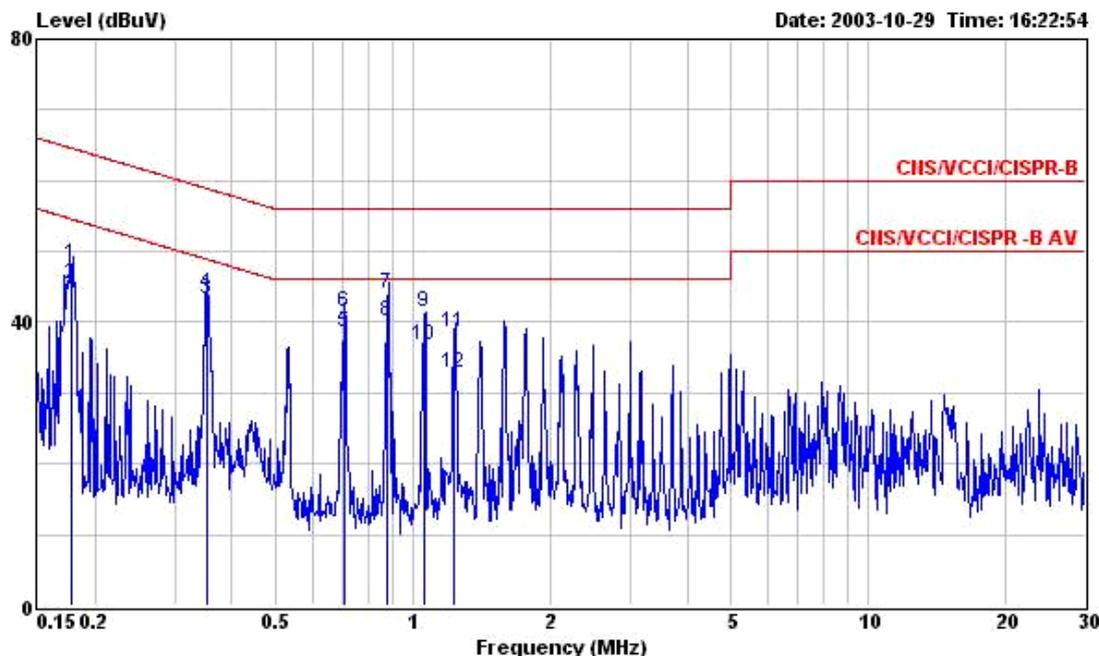
- Test Mode: Mode 3
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 25.9°C
- Relative Humidity: 60 %

The test was passed at the minimum margin that marked by the frame in the following table.



Site : C001-HY  
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE  
 EUT : Wireless AP  
 Power : 110V/60Hz  
 Model :  
 Memo : TX CH11

|    | Freq  | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Remark  |
|----|-------|-------|------------|------------|------------|--------------|------------|---------|
|    | MHz   | dBuV  | dB         | dBuV       | dBuV       | dB           | dB         |         |
| 1  | 0.174 | 48.15 | -16.62     | 64.77      | 47.99      | 0.10         | 0.06       | QP      |
| 2  | 0.174 | 45.33 | -9.44      | 54.77      | 45.17      | 0.10         | 0.06       | Average |
| 3  | 0.352 | 43.83 | -5.09      | 48.92      | 43.65      | 0.10         | 0.08       | Average |
| 4  | 0.352 | 44.67 | -14.25     | 58.92      | 44.49      | 0.10         | 0.08       | QP      |
| 5  | 0.708 | 38.39 | -7.61      | 46.00      | 38.20      | 0.10         | 0.09       | Average |
| 6  | 0.708 | 41.78 | -14.22     | 56.00      | 41.59      | 0.10         | 0.09       | QP      |
| 7  | 0.882 | 44.30 | -11.70     | 56.00      | 44.10      | 0.10         | 0.10       | QP      |
| 8  | 0.882 | 40.69 | -5.31      | 46.00      | 40.49      | 0.10         | 0.10       | Average |
| 9  | 1.060 | 40.42 | -15.58     | 56.00      | 40.22      | 0.10         | 0.10       | QP      |
| 10 | 1.060 | 35.73 | -10.27     | 46.00      | 35.53      | 0.10         | 0.10       | Average |
| 11 | 2.475 | 36.65 | -19.35     | 56.00      | 36.41      | 0.10         | 0.14       | QP      |
| 12 | 2.475 | 28.47 | -17.53     | 46.00      | 28.23      | 0.10         | 0.14       | Average |



Site : C001-HY  
 Condition : CIS/VCCI/CISPR-B 2003 2001/008 NEUTRAL  
 EUT : Wireless AP  
 Power : 110V/60Hz  
 Model :  
 Memo : TX CH11

|    | Freq  | Level | Over Limit | Limit Line | Read Level | Probe Factor | Cable Loss | Remark  |
|----|-------|-------|------------|------------|------------|--------------|------------|---------|
|    | MHz   | dBuV  | dB         | dBuV       | dBuV       | dB           | dB         |         |
| 1  | 0.177 | 48.23 | -16.40     | 64.63      | 48.07      | 0.10         | 0.06       | QP      |
| 2  | 0.177 | 45.22 | -9.41      | 54.63      | 45.06      | 0.10         | 0.06       | Average |
| 3  | 0.353 | 43.38 | -5.52      | 48.90      | 43.20      | 0.10         | 0.08       | Average |
| 4  | 0.353 | 44.10 | -14.80     | 58.90      | 43.92      | 0.10         | 0.08       | QP      |
| 5  | 0.705 | 38.61 | -7.39      | 46.00      | 38.42      | 0.10         | 0.09       | Average |
| 6  | 0.705 | 41.54 | -14.46     | 56.00      | 41.35      | 0.10         | 0.09       | QP      |
| 7  | 0.881 | 44.14 | -11.86     | 56.00      | 43.94      | 0.10         | 0.10       | QP      |
| 8  | 0.881 | 40.20 | -5.80      | 46.00      | 40.00      | 0.10         | 0.10       | Average |
| 9  | 1.059 | 41.43 | -14.57     | 56.00      | 41.23      | 0.10         | 0.10       | QP      |
| 10 | 1.059 | 36.86 | -9.14      | 46.00      | 36.66      | 0.10         | 0.10       | Average |
| 11 | 1.234 | 38.57 | -17.43     | 56.00      | 38.36      | 0.10         | 0.11       | QP      |
| 12 | 1.234 | 32.90 | -13.10     | 46.00      | 32.69      | 0.10         | 0.11       | Average |

Test Engineer : John  
 John Huang

## 5.6. Test of Radiated Emission

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.4-2001. The EUT was placed on a nonmetallic stand, 0.8 meter above the ground plane, as shown in section 4.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

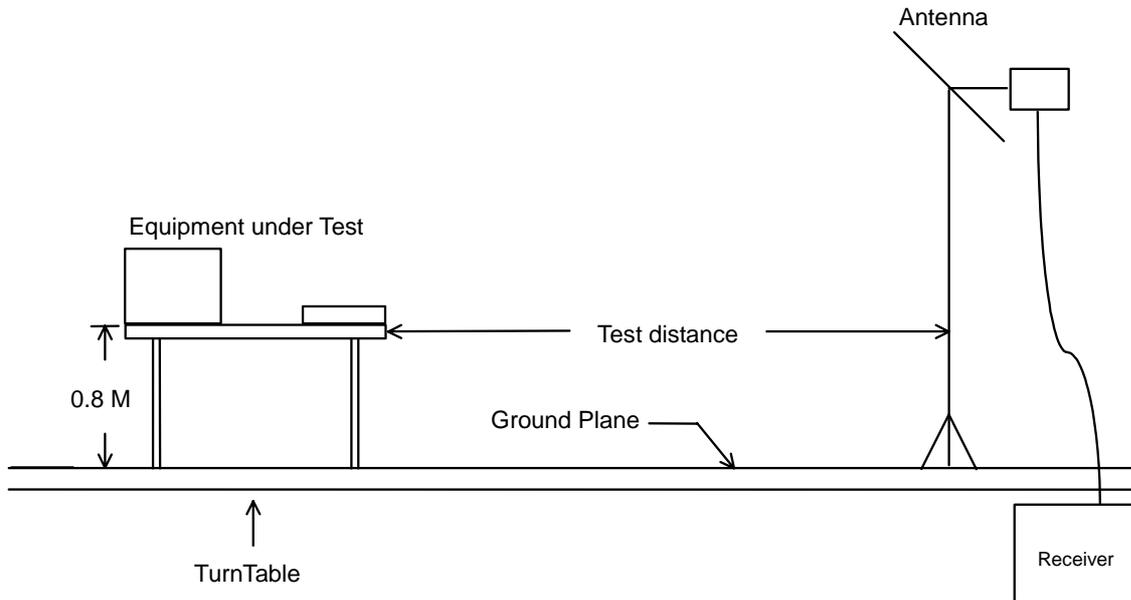
### 5.6.1. Major Measuring Instruments

- Amplifier (HP 8447D)
  - RF Gain 30 dB
  - Signal Input 100 KHz to 1.3 GHz
  
- Amplifier (MITEQ AFS44)
  - RF Gain 40 dB
  - Signal Input 100 MHz to 26.5 GHz
  
- Spectrum analyzer (R&S FSEK30)
  - Attenuation 10 dB
  - Start Frequency 1 GHz
  - Stop Frequency 25 GHz
  - Resolution Bandwidth 1 MHz
  - Video Bandwidth 1 MHz
  - Signal Input 20 Hz to 40 GHz
  
- Test Receiver (SCHAFFNER SCR3501)
  - Resolution Bandwidth 120 KHz
  - Frequency Band 9 K – 1 GHz
  - Quasi-Peak Detector ON for Quasi-Peak Mode  
OFF for Peak Mode

**5.6.2. Test Procedures**

1. The EUT was placed on a rotatable table top 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
5. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 3 dB lower than the 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 and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission 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.

5.6.3. Typical Test Setup Layout of Radiated Emission



5.6.4. Test Result of Radiated Emission

- Test Mode: Mode 1
- Test Distance: 3 M
- Temperature: 22 °C
- Relative Humidity: 56 %
- Test Date: Feb. 25, 2003
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

**The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 1 m, turn table degree is 133°**

■ Spurious Emission

- For 30MHz to 1GHz

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor<br>( dB/m ) | Loss<br>( dB ) | Reading<br>( dBuV ) | Limits<br>( dBuV/m ) ( uV/m ) | Emission<br>( dBuV/m ) ( uV/m ) | Level<br>( dB ) | Margin<br>( dB ) | Detect<br>Mode |
|----------------------|---------------------|-----------------------------|----------------|---------------------|-------------------------------|---------------------------------|-----------------|------------------|----------------|
| 47.820               | H                   | 8.01                        | 1.27           | 26.46               | 40.00 100                     | 35.74 61.24                     | -4.26           | Peak             |                |
| 358.100              | H                   | 13.28                       | 3.99           | 24.66               | 46.00 200                     | 41.93 124.88                    | -4.07           | Peak             |                |
| 264.090              | V                   | 11.71                       | 3.26           | 27.88               | 46.00 200                     | 42.85 138.84                    | -3.15           | Peak             |                |
| 357.400              | V                   | 13.26                       | 3.98           | 24.38               | 46.00 200                     | 41.62 120.50                    | -4.38           | Peak             |                |
| 624.100              | V                   | 17.46                       | 5.62           | 18.76               | 46.00 200                     | 41.84 123.59                    | -4.16           | Peak             |                |
| 662.600              | V                   | 17.73                       | 5.89           | 18.61               | 46.00 200                     | 42.23 129.27                    | -3.77           | Peak             |                |

- For above 1GHz

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor<br>( dB/m ) | Loss<br>( dB ) | Reading<br>( dBuV ) | Limits<br>( dBuV/m ) ( uV/m ) | Emission<br>( dBuV/m ) ( uV/m ) | Level<br>( dB ) | Margin<br>( dB ) | Detect<br>Mode |
|----------------------|---------------------|-----------------------------|----------------|---------------------|-------------------------------|---------------------------------|-----------------|------------------|----------------|
| 1590.000             | H                   | 28.15                       | 4.13           | 10.83               | 74.00 5012                    | 43.11 143.05                    | -30.89          | Peak             |                |
| 1476.000             | V                   | 27.36                       | 3.92           | 15.64               | 74.00 5012                    | 46.92 221.82                    | -27.08          | Peak             |                |
| 1590.000             | V                   | 28.15                       | 4.13           | 14.75               | 74.00 5012                    | 47.03 224.65                    | -26.97          | Peak             |                |
| 1750.000             | V                   | 29.27                       | 4.41           | 13.38               | 74.00 5012                    | 47.06 225.42                    | -26.94          | Peak             |                |
| 2318.000             | V                   | 30.67                       | 5.44           | 12.73               | 74.00 5012                    | 48.84 276.69                    | -25.16          | Peak             |                |
| 2462.000             | V                   | 30.53                       | 5.72           | 14.30               | 74.00 5012                    | 50.55 336.90                    | -23.45          | Peak             |                |
| 3214.000             | V                   | 30.34                       | 7.06           | 11.38               | 74.00 5012                    | 48.78 274.79                    | -25.22          | Peak             |                |

■ Field strength of fundamental and harmonics

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor | Reading<br>Loss | Limits<br>( dBuV ) | Emission<br>( dBuV/m ) | Level<br>( uV/m ) | Margin<br>( dB ) | Detect<br>Mode |   |               |
|----------------------|---------------------|-----------------|-----------------|--------------------|------------------------|-------------------|------------------|----------------|---|---------------|
| 2412.000             | H                   | 30.58           | 5.62            | 54.02              | -                      | -                 | 90.22            | 32433.96       | - | Peak          |
| 2412.000             | H                   | 30.58           | 5.62            | 51.44              | -                      | -                 | 87.64            | 24099.05       | - | A.V.          |
| 2412.000             | V                   | 30.58           | 5.62            | 60.44              | -                      | -                 | 96.64            | 67920.36       | - | Peak          |
| 2412.000             | V                   | 30.58           | 5.62            | 56.15              | -                      | -                 | 92.35            | 41447.66       | - | A.V.          |
| 4824.000             | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 7236.000             | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 9648.000             | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 12060.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 14472.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 16884.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 19296.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 21708.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 24120.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above

Test Engineer : Jay  
Jay Zhong

- Test Mode: Mode 2
- Test Distance: 3 M
- Temperature: 25 °C
- Relative Humidity: 65 %
- Test Date: Nov. 07, 2003
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

**The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 1 m, turn table degree is 105°**

■ Spurious Emission

- For 30MHz to 1GHz

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor<br>( dB/m ) | Cable<br>Loss<br>( dB ) | Reading<br>( dBuV ) | Limits<br>( dBuV/m ) | Emission<br>( uV/m ) | Level<br>( dBuV/m ) | Margin<br>( uV/m ) | Detect<br>( dB ) | Mode |
|----------------------|---------------------|-----------------------------|-------------------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|------|
| 85.620               | H                   | 7.70                        | 1.59                    | 20.93               | 40.00                | 100.00               | 30.22               | 32.43              | -9.78            | Peak |
| 398.000              | H                   | 14.57                       | 3.51                    | 15.65               | 46.00                | 199.53               | 33.73               | 48.58              | -12.27           | Peak |
| 430.200              | H                   | 15.06                       | 3.54                    | 16.53               | 46.00                | 199.53               | 35.13               | 57.08              | -10.87           | Peak |
| 441.400              | H                   | 15.21                       | 3.54                    | 13.94               | 46.00                | 199.53               | 32.69               | 43.10              | -13.31           | Peak |
| 64.290               | V                   | 4.84                        | 1.42                    | 24.38               | 40.00                | 100.00               | 30.64               | 34.04              | -9.36            | Peak |
| 131.790              | V                   | 10.46                       | 1.96                    | 18.66               | 43.50                | 149.62               | 31.08               | 35.81              | -12.42           | Peak |

- For above 1GHz

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor<br>( dB/m ) | Cable<br>Loss<br>( dB ) | Reading<br>( dBuV ) | Limits<br>( dBuV/m ) | Emission<br>( uV/m ) | Level<br>( dBuV/m ) | Margin<br>( uV/m ) | Detect<br>( dB ) | Mode |
|----------------------|---------------------|-----------------------------|-------------------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|------|
| 1596.000             | H                   | 25.75                       | 4.89                    | 11.75               | 74.00                | 5011.87              | 42.39               | 131.67             | -31.61           | Peak |
| 1596.000             | H                   | 25.75                       | 4.89                    | -0.47               | 54.00                | 501.19               | 30.17               | 32.25              | -23.83           | A.V. |
| 1324.000             | V                   | 24.91                       | 4.43                    | 15.54               | 74.00                | 5011.87              | 44.88               | 175.39             | -29.12           | Peak |
| 1324.000             | V                   | 24.91                       | 4.43                    | -0.33               | 54.00                | 501.19               | 29.01               | 28.22              | -24.99           | A.V. |
| 1454.000             | V                   | 25.22                       | 4.63                    | 10.69               | 74.00                | 5011.87              | 40.54               | 106.41             | -33.46           | Peak |
| 1454.000             | V                   | 25.22                       | 4.63                    | -1.81               | 54.00                | 501.19               | 28.04               | 25.23              | -25.96           | A.V. |
| 1596.000             | V                   | 25.75                       | 4.89                    | 15.32               | 74.00                | 5011.87              | 45.96               | 198.61             | -28.04           | Peak |
| 1596.000             | V                   | 25.75                       | 4.89                    | 0.90                | 54.00                | 501.19               | 31.54               | 37.76              | -22.46           | A.V. |

■ Field strength of fundamental and harmonics

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor | Reading<br>Loss | Limits<br>( dBuV ) | Emission<br>( dBuV/m ) | Level<br>( uV/m ) | Margin<br>( dB ) | Detect<br>Mode |   |               |
|----------------------|---------------------|-----------------|-----------------|--------------------|------------------------|-------------------|------------------|----------------|---|---------------|
| 2436.000             | H                   | 28.29           | 6.26            | 47.13              | -                      | -                 | 81.68            | 12133.89       | - | Peak          |
| 2436.000             | H                   | 28.29           | 6.26            | 43.85              | -                      | -                 | 78.40            | 8317.64        | - | A.V.          |
| 2430.000             | V                   | 28.28           | 6.25            | 55.86              | -                      | -                 | 90.39            | 33075.01       | - | Peak          |
| 2430.000             | V                   | 28.28           | 6.25            | 52.68              | -                      | -                 | 87.21            | 22935.07       | - | A.V.          |
| 4874.000             | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 7311.000             | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 9748.000             | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 12185.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 14622.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 17059.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 19496.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 21933.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |
| 24370.000            | V/H                 |                 |                 |                    |                        |                   | -                |                |   | Peak,<br>A.V. |

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above

Test Engineer : Steve  
Steve Chen

- Test Mode: Mode 3
- Test Distance: 3 M
- Temperature: 22 °C
- Relative Humidity: 56 %
- Test Date: Feb. 25, 2003
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

**The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 2 m, turn table degree is 54 °**

■ Spurious Emission

- For 30MHz to 1GHz

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor | Cable<br>Loss | Reading<br>( dBuV ) | Limits<br>( dBuV/m ) | Emission<br>( uV/m ) | Level<br>( dBuV/m ) | Margin<br>( uV/m ) | Detect<br>( dB ) | Mode |
|----------------------|---------------------|-----------------|---------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|------|
| 47.820               | H                   | 8.01            | 1.27          | 26.39               | 40.00                | 100                  | 35.67               | 60.74              | -4.33            | Peak |
| 355.300              | H                   | 13.19           | 3.94          | 24.65               | 46.00                | 200                  | 41.78               | 122.74             | -4.22            | Peak |
| 396.600              | H                   | 14.53           | 4.07          | 24.08               | 46.00                | 200                  | 42.68               | 136.14             | -3.32            | Peak |
| 31.890               | V                   | 14.55           | 1.04          | 20.45               | 40.00                | 100                  | 36.04               | 63.39              | -3.96            | Peak |
| 623.400              | V                   | 17.46           | 5.61          | 18.67               | 46.00                | 200                  | 41.74               | 122.18             | -4.26            | Peak |
| 662.600              | V                   | 17.73           | 5.89          | 17.89               | 46.00                | 200                  | 41.51               | 118.99             | -4.49            | Peak |

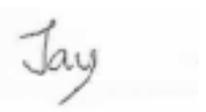
- For above 1GHz

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor | Cable<br>Loss | Reading<br>( dBuV ) | Limits<br>( dBuV/m ) | Emission<br>( uV/m ) | Level<br>( dBuV/m ) | Margin<br>( uV/m ) | Detect<br>( dB ) | Mode |
|----------------------|---------------------|-----------------|---------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|------|
| 1590.000             | V                   | 28.15           | 4.13          | 15.21               | 74.00                | 5012                 | 47.49               | 236.86             | -26.51           | Peak |
| 2318.000             | V                   | 30.67           | 5.44          | 15.49               | 74.00                | 5012                 | 51.60               | 380.19             | -22.40           | Peak |
| 2558.000             | V                   | 30.47           | 5.91          | 12.61               | 74.00                | 5012                 | 48.99               | 281.51             | -25.01           | Peak |

■ Field strength of fundamental and harmonics

| Frequency<br>( MHz ) | Antenna<br>Polarity | Cable<br>Factor<br>( dB/m ) | Reading<br>Loss<br>( dB ) | Limits<br>( dBuV ) | ( dBuV/m ) | Emission<br>( uV/m ) | Level<br>( dBuV/m ) | Margin<br>( uV/m ) | Detect<br>( dB ) | Mode          |
|----------------------|---------------------|-----------------------------|---------------------------|--------------------|------------|----------------------|---------------------|--------------------|------------------|---------------|
| 2462.000             | H                   | 30.53                       | 5.72                      | 52.28              | -          | -                    | 88.53               | 26699.31           | -                | Peak          |
| 2462.000             | H                   | 30.53                       | 5.72                      | 48.70              | -          | -                    | 84.95               | 17680.72           | -                | A.V.          |
| 2462.000             | V                   | 30.53                       | 5.72                      | 62.42              | -          | -                    | 98.67               | 85802.51           | -                | Peak          |
| 2462.000             | V                   | 30.53                       | 5.72                      | 59.42              | -          | -                    | 95.67               | 60743.53           | -                | A.V.          |
| 4924.000             | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |
| 7386.000             | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |
| 9848.000             | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |
| 12310.000            | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |
| 14772.000            | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |
| 17234.000            | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |
| 18696.000            | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |
| 22158.000            | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |
| 24620.000            | V/H                 |                             |                           |                    |            |                      | -                   |                    |                  | Peak,<br>A.V. |

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above

Test Engineer :   
Jay Zhong

**5.7. Band Edges Measurement**

5.7.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.7.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer via a low lose cable.
2. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100 KHz bandwidth from band edge.
3. The band edges was measured and recorded.

5.7.3. Test Result :

- Test Result in lower band (Channel 1) : PASS
- Test Result in higher band(Channel 11) : PASS

5.7.4. Note on Band edge Emission

The band edge emission plot on appendix B page B8. shows 44.49dB delta between carrier maximum power and local maximum emission in the restricted band (2.4835GHz).

| Polarity | The emission of carrier power strength (dB μ V/m) | The maximum field strength in restrict band (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) | Result  |
|----------|---|--|------------------|-------------|---------|
| H        | 88.53   | 44.04  | 74.00            | -29.96      | Peak    |
| H        | 84.95   | 40.46  | 54.00            | -13.54      | Average |
| V        | 98.67   | 54.18  | 74.00            | -19.82      | Peak    |
| V        | 95.67   | 51.18  | 54.00            | -2.82       | Average |

\* The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

## **5.8. Antenna Requirements**

The EUT use a undetachable Dipole antenna. (antenna via U.FL external connector). It is considered meet antenna requirement of FCC.

### **5.8.1. Standard Applicable**

For intentional device, according to FCC 47 CFR 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### **5.8.2. Antenna Connected Construction**

The maximum Gain antenna used in this product is dipole antenna. The antenna connector type is U.FL. The coaxial cable of the antenna is fixed to the antenna.

**5.9. RF Exposure**

FCC Rules and Regulations Part 1.1307,1.1310,2.1091,2.1093:

RF Exposure Compliance

5.9.1. Limit For Maximum Permissible Exposure (MPE)

(A) Limits for Occupational / Controlled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|--|--|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                   | 6  |
| 3.0-30                | 1842/f                            | 4.89/f                            | (900/f)*                                 | 6  |
| 30-300                | 61.4                              | 0.163                             | 1.0                                      | 6  |
| 300-1500              |                                   |                                   | F/300                                    | 6  |
| 1500-100,000          |                                   |                                   | 5  | 6  |

(B) Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S ( minutes ) |
|-----------------------|-----------------------------------|-----------------------------------|---|--|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                  | 30   |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f)*                                | 30   |
| 30-300                | 27.5                              | 0.073                             | 0.2                                     | 30   |
| 300-1500              |                                   |                                   | F/1500                                  | 30   |
| 1500-100,000          |                                   |                                   | 1.0                                     | 30   |

F=frequency in MHz

\*Plane-wave equivalent power density

5.9.2. MPE Calculations

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (mW/cm}^2\text{)} = \frac{E^2}{377}$$

- E = Electric field (V/m)
- P = Peak output power (mW)
- G = Antenna numeric gain (numeric)
- d = Separation distance (m)

Because the EUT is belong to General Population/ Uncontrolled Exposure. So the Limit of Power Density is 1.0 mW/cm<sup>2</sup>. We can change the formula to:

$$d = \sqrt{\frac{30 \times P \times G}{377}}$$

| Channel NO. | Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power (mW) | Calculated RF Exposure Separation Distance ( cm ) | Minimum RF Exposure Separation Distance ( cm ) |
|-------------|--------------------|------------------------|-------------------------|------------------------|---|--|
| Channel 1   | 2.00               | 1.58                   | 18.16                   | 65.46                  | 2.87  | 20   |
| Channel 6   | 2.00               | 1.58                   | 17.79                   | 60.12                  | 2.75  | 20   |
| Channel 11  | 2.00               | 1.58                   | 18.75                   | 74.99                  | 3.07  | 20   |

5.9.3. FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation. Proposed RF exposure safety information to include in User's Manual.

## **6. EMI Suppression Component List**

1. Add a gasket on rear side of daughter board.  
(As the Internal photo No.7)

### 7. Antenna Factor & Cable Loss

<Mode 1, 3>

| Frequency (MHz) | Antenna Factor (dB) | Cable Loss (dB) | Frequency (MHz) | Antenna Factor (dB) | Cable Loss (dB) |
|-----------------|---------------------|-----------------|-----------------|---------------------|-----------------|
| 30              | 15.35               | 1.00            | 1000            | 24.30               | 3.89            |
| 35              | 13.63               | 1.08            | 2000            | 31.10               | 5.41            |
| 40              | 11.11               | 1.18            | 3000            | 29.60               | 6.92            |
| 45              | 10.59               | 1.24            | 4000            | 30.80               | 8.24            |
| 50              | 6.47                | 1.30            | 5000            | 34.20               | 9.22            |
| 55              | 5.83                | 1.38            | 6000            | 33.30               | 10.25           |
| 60              | 5.18                | 1.44            | 7000            | 37.80               | 11.61           |
| 65              | 4.81                | 1.52            | 8000            | 39.40               | 11.78           |
| 70              | 4.43                | 1.59            | 9000            | 38.40               | 12.59           |
| 75              | 5.10                | 1.68            | 10000           | 38.90               | 13.84           |
| 80              | 5.91                | 1.75            | 11000           | 41.10               | 14.64           |
| 85              | 7.33                | 1.77            | 12000           | 42.70               | 14.12           |
| 90              | 8.74                | 1.83            | 13000           | 43.90               | 16.01           |
| 100             | 9.36                | 1.90            | 14000           | 43.70               | 13.76           |
| 110             | 9.65                | 2.01            | 15000           | 43.40               | 14.30           |
| 120             | 9.97                | 2.06            | 16000           | 40.90               | 15.16           |
| 130             | 10.51               | 2.16            | 17000           | 44.40               | 15.88           |
| 140             | 10.32               | 2.24            | 18000           | 47.10               | 16.09           |
| 150             | 9.42                | 2.34            | 19000           | 37.60               | 16.98           |
| 160             | 8.09                | 2.42            | 20000           | 37.30               | 16.21           |
| 170             | 7.43                | 2.56            | 21000           | 37.00               | 20.13           |
| 180             | 7.60                | 2.62            | 22000           | 38.00               | 19.24           |
| 190             | 7.43                | 2.67            | 23000           | 38.70               | 19.64           |
| 200             | 7.26                | 2.76            | 24000           | 38.60               | 20.54           |
| 220             | 9.11                | 2.92            | 25000           | 38.90               | 20.14           |
| 240             | 10.88               | 3.09            |                 |                     |                 |
| 260             | 11.75               | 3.23            |                 |                     |                 |
| 280             | 11.55               | 3.38            |                 |                     |                 |
| 300             | 11.36               | 3.51            |                 |                     |                 |
| 320             | 12.03               | 3.63            |                 |                     |                 |
| 340             | 12.69               | 3.73            |                 |                     |                 |
| 360             | 13.33               | 4.03            |                 |                     |                 |
| 380             | 14.00               | 4.00            |                 |                     |                 |
| 400             | 14.63               | 4.09            |                 |                     |                 |
| 450             | 15.33               | 4.31            |                 |                     |                 |
| 500             | 16.03               | 4.64            |                 |                     |                 |
| 550             | 16.65               | 5.09            |                 |                     |                 |
| 600             | 17.29               | 5.49            |                 |                     |                 |
| 650             | 17.64               | 5.82            |                 |                     |                 |
| 700             | 18.00               | 5.94            |                 |                     |                 |
| 750             | 18.39               | 6.16            |                 |                     |                 |
| 800             | 18.79               | 6.58            |                 |                     |                 |
| 850             | 19.10               | 6.72            |                 |                     |                 |
| 900             | 19.42               | 6.81            |                 |                     |                 |
| 950             | 19.58               | 7.10            |                 |                     |                 |
| 1000            | 19.75               | 7.41            |                 |                     |                 |

**<Mode 2>**

| Frequency (MHz) | Antenna Factor (dB) | Cable Loss (dB) | Frequency (MHz) | Antenna Factor (dB) | Cable Loss (dB) |
|-----------------|---------------------|-----------------|-----------------|---------------------|-----------------|
| 30              | 15.35               | 1.01            | 1000            | 24.30               | 3.89            |
| 35              | 13.63               | 1.04            | 2000            | 31.10               | 5.41            |
| 40              | 11.11               | 1.09            | 3000            | 29.60               | 6.92            |
| 45              | 10.59               | 1.24            | 4000            | 30.80               | 8.24            |
| 50              | 6.47                | 1.43            | 5000            | 34.20               | 9.22            |
| 55              | 5.83                | 1.39            | 6000            | 33.30               | 10.25           |
| 60              | 5.18                | 1.59            | 7000            | 37.80               | 11.61           |
| 65              | 4.81                | 1.41            | 8000            | 39.40               | 11.78           |
| 70              | 4.43                | 1.43            | 9000            | 38.40               | 12.59           |
| 75              | 5.10                | 1.55            | 10000           | 38.90               | 13.84           |
| 80              | 5.91                | 1.56            | 11000           | 41.10               | 14.64           |
| 85              | 7.33                | 1.62            | 12000           | 42.70               | 14.12           |
| 90              | 8.74                | 1.41            | 13000           | 43.90               | 16.01           |
| 95              | 9.05                | 1.81            | 14000           | 43.70               | 13.76           |
| 100             | 9.36                | 1.68            | 15000           | 43.40               | 14.30           |
| 110             | 9.65                | 1.73            | 16000           | 40.90               | 15.16           |
| 120             | 9.97                | 1.79            | 17000           | 44.40               | 15.88           |
| 130             | 10.51               | 1.93            | 18000           | 47.10               | 16.09           |
| 140             | 10.32               | 2.06            | 19000           | 37.60               | 16.98           |
| 150             | 9.42                | 2.09            | 20000           | 37.30               | 16.21           |
| 160             | 8.09                | 2.12            | 21000           | 37.00               | 20.13           |
| 170             | 7.43                | 2.12            | 22000           | 38.00               | 19.24           |
| 180             | 7.60                | 2.12            | 23000           | 38.70               | 19.64           |
| 190             | 7.43                | 2.21            | 24000           | 38.60               | 20.54           |
| 200             | 7.26                | 2.29            | 25000           | 38.90               | 20.14           |
| 220             | 9.11                | 2.42            |                 |                     |                 |
| 240             | 10.88               | 2.54            |                 |                     |                 |
| 260             | 11.75               | 2.66            |                 |                     |                 |
| 280             | 11.55               | 2.76            |                 |                     |                 |
| 300             | 11.36               | 2.85            |                 |                     |                 |
| 320             | 12.03               | 3.10            |                 |                     |                 |
| 340             | 12.69               | 3.36            |                 |                     |                 |
| 360             | 13.33               | 3.49            |                 |                     |                 |
| 380             | 14.00               | 3.50            |                 |                     |                 |
| 400             | 14.63               | 3.51            |                 |                     |                 |
| 450             | 15.33               | 3.55            |                 |                     |                 |
| 500             | 16.03               | 3.81            |                 |                     |                 |
| 550             | 16.65               | 4.05            |                 |                     |                 |
| 600             | 17.29               | 4.23            |                 |                     |                 |
| 650             | 17.64               | 4.63            |                 |                     |                 |
| 700             | 18.00               | 4.74            |                 |                     |                 |
| 750             | 18.39               | 4.95            |                 |                     |                 |
| 800             | 18.79               | 5.06            |                 |                     |                 |
| 850             | 19.10               | 5.18            |                 |                     |                 |
| 900             | 19.42               | 5.40            |                 |                     |                 |
| 950             | 19.58               | 5.91            |                 |                     |                 |
| 1000            | 19.75               | 5.58            |                 |                     |                 |

**8. List of Measuring Equipments Used**

**<Conduction & Conducted>**

| Instrument                    | Manufacturer       | Model No. | Serial No.  | Characteristics  | Calibration Date | Remark    |
|-------------------------------|--------------------|-----------|-------------|------------------|------------------|-----------|
| EMC Receiver                  | R&S                | ESCS 30   | 100132      | 9 KHz – 2.75 GHz | Jun. 12, 2003    | (CO01-HY) |
| LISN                          | MessTec            | NNB-2/16Z | 2001-008    | 9 KHz – 30 MHz   | Apr. 29, 2003    | (CO01-HY) |
| LISN<br>(Support Unit)        | MessTec            | NNB-2/16Z | 2001-009    | 9 KHz – 30 MHz   | Apr. 29, 2003    | (CO01-HY) |
| EMI Filter                    | LINDGREN           | LRE-2060  | 1004        | < 450 Hz         | N/A              | (CO01-HY) |
| EMI Filter                    | LINDGREN           | N6006     | 201052      | 0 ~ 60 Hz        | N/A              | (CO01-HY) |
| RF Cable-CON                  | Suhner Switzerland | RG223/U   | CB029       | 9KHz~30MHz       | Jan. 07, 2003    | (CO01-HY) |
| 50 ohm BNC type<br>Terminal   | NOBLE              | 50ohm     | TM013       | 50 ohm           | Apr. 24, 2003    | (CO01-HY) |
| Power meter                   | R&S                | NRVS      | 100444      | DC~40GHz         | May 28, 2002     | Conducted |
| Power sensor                  | R&S                | NRV-Z55   | 100049      | DC~40GHz         | May 28, 2002     | Conducted |
| Power Sensor                  | R&S                | NRV-Z32   | 100057      | 30MHz-6GHz       | May 28, 2002     | Conducted |
| AC power source               | HPC                | HPA-500W  | HPA-9100024 | AC 0~300V        | May 27, 2002     | Conducted |
| Temp. and Humidity<br>Chamber | KSON               | THS-C3L   | 612         | N/A              | Oct. 02, 2002    | Conducted |

**< Radiation >**

| Instrument               | Manufacturer   | Model No.    | Serial No.           | Characteristics  | Calibration Date | Remark                         |
|--------------------------|----------------|--------------|----------------------|------------------|------------------|--------------------------------|
| Receiver                 | R&S            | ESCS30       | 100174               | 9KHz~2.75GHz     | Dec. 12, 2002    | (03CH03-HY)<br>(for Mode 1, 3) |
| Horn Antenna             | Schwarzbeck    | BBHA9170     | BBHA9170154          | 15GHz~40GHz      | May 09, 2001     | (03CH03-HY)<br>(for Mode 1, 3) |
| Amplifier                | HP             | 8447D        | 2944A09072           | 100KHz – 1.3GHz  | Oct. 21, 2002    | (03CH03-HY)<br>(for Mode 1, 3) |
| Bilog Antenna            | SCHAFFNER      | CBL6112B     | 2687                 | 30MHz –2GHz      | Dec. 21, 2002    | (03CH03-HY)<br>(for Mode 1, 3) |
| Turn Table               | HD             | DS 420       | 420/650/00           | 0 ~ 360 degree   | N/A              | (03CH03-HY)<br>(for Mode 1, 3) |
| Antenna Mast             | HD             | MA 240       | 240/560/00           | 1 m - 4 m        | N/A              | (03CH03-HY)<br>(for Mode 1, 3) |
| Half-wave dipole antenna | R&S            | HZ12<br>HZ13 | 83924403<br>83924503 | 30MHz - 1GHz     | Sep. 23, 2002    | (03CH03-HY)<br>(for Mode 1, 3) |
| Horn Antenna             | COM-POWER      | AH-118       | 10094                | 1GHz – 18GHz     | Apr. 09, 2002    | (03CH03-HY)<br>(for Mode 1, 3) |
| Spectrum analyzer        | R&S            | FSP40        | 100004/040           | 9KHZ~40GHZ       | Aug. 07, 2002    | (03CH03-HY)<br>(for Mode 1, 3) |
| Amplifier                | MITEQ          | AFS44        | 879981               | 100MHz~26.5GHz   | Aug. 12, 2002    | (03CH03-HY)<br>(for Mode 1, 3) |
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M       | 03CH03-HY            | 30MHz~1GHz<br>3m | Jun. 21, 2003    | (03CH03-HY)<br>(for Mode 2)    |
| Spectrum analyzer        | R&S            | FSEK30       | 100189               | 20Hz~40GHz       | Aug. 04, 2003    | (03CH03-HY)<br>(for Mode 2)    |
| Receiver                 | SCHAFFNER      | SCR 3501     | 417                  | 9 KHz –1GHz      | Feb. 20, 2003    | (03CH03-HY)<br>(for Mode 2)    |
| Amplifier                | HP             | 8447D        | 2944A09072           | 100KHz – 1.3GHz  | Feb. 19, 2003    | (03CH03-HY)<br>(for Mode 2)    |
| Bilog Antenna            | SCHAFFNER      | CBL6112B     | 2687                 | 30MHz –2GHz      | Dec. 21, 2002    | (03CH03-HY)<br>(for Mode 2)    |
| RF Cable-R03m            | Jye Bao        | RG142        | CB021                | 30MHz~1GHz       | Jan. 02, 2003    | (03CH03-HY)<br>(for Mode 2)    |
| Amplifier                | MITEQ          | NSP2650-NF   | 805858               | 100MHz~26.5GHz   | Jul. 10, 2003    | (03CH03-HY)<br>(for Mode 2)    |
| Horn Antenna             | COM-POWER      | AH-118       | 10094                | 1GHz – 18GHz     | Apr. 10, 2003    | (03CH03-HY)<br>(for Mode 2)    |
| Turn Table               | HD             | DS 420       | 420/650/00           | 0 ~ 360 degree   | N/A              | (03CH03-HY)<br>(for Mode 2)    |
| Antenna Mast             | HD             | MA 240       | 240/560/00           | 1 m - 4 m        | N/A              | (03CH03-HY)<br>(for Mode 2)    |
| Horn Antenna             | Schwarzbeck    | BBHA9170     | BBHA9170154          | 15GHz~40GHz      | Jun. 02, 2003    | (03CH03-HY)<br>(for Mode 2)    |
| RF Cable-HIGH            | Jye Bao        | RG142        | CB030-HIGH           | 1GHz~29.5GHz     | Mar. 14, 2003    | (03CH03-HY)<br>(for Mode 2)    |

Calibration Interval of instruments listed above is one year, except for Horn Antenna, BBHA9170.

### 9. Uncertainty of Test Site

Uncertainty of Radiated Emission Measurement

| Contribution  | Probability Distribution | 3m    |
|---|--------------------------|-------|
| Antenna factor calibration  | normal(k=2)              | ±1    |
| cable loss calibration  | normal(k=2)              | ±0.3  |
| RCV/SPA specification   | rectangular              | ±2    |
| Antenna Directivity   | rectangular              | ±3    |
| Antenna Factor V.S. Height  | rectangular              | ±2    |
| Antenna Factor Interpolation for Frequency  | rectangular              | ±0.25 |
| site imperfection   | rectangular              | ±2    |
| Mismatch<br>Receiver VSWR $\Gamma_1=0.09$<br>Antenna VSWR $\Gamma_2=0.67$<br>Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$ | U-shaped                 | ±0.54 |
| combined standard uncertainty $U_e(y)$  | normal                   | ±2.7  |
| Measuring uncertainty for a level of confidence of 95% $U=2U_e(y)$  | normal (k=2)             | ±5.4  |

$U = \{((1/2)^2+(0.3/2)^2+(2^2+0.5^2+2^2+0.25^2+2^2)/3+(0.54)^2/2)\}^{1/2}=2.2$  for 10m test distance

$U = \{((1/2)^2+(0.3/2)^2+(2^2+3^2+2^2+0.25^2+2^2)/3+(0.54)^2/2)\}^{1/2}=2.7$  for 3m test distance

Uncertainty of Conducted Emission Measurement

| Contribution   | Probability Distribution | 150KHz – 30MHz |
|--|--------------------------|----------------|
| Cable and I/P attenuator calibration   | normal(k=2)              | ±0.3           |
| RCV/SPA specification  | rectangular              | ±2             |
| LISN coupling specification  | rectangular              | ±1.5           |
| Transducer factor frequency interpolation  | rectangular              | ±0.2           |
| Mismatch<br>Receiver VSWR $\Gamma_1=0.09$<br>LISN VSWR $\Gamma_2=0.33$<br>Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$ | U-shaped                 | 0.2            |
| combined standard uncertainty $U_e(y)$   | normal                   | ±1.66          |
| Measuring uncertainty for a level of confidence of 95% $U=2U_e(y)$   | normal (k=2)             | ±3.32          |

$U = \{(0.3/2)^2 + (2^2+1.5^2+0.2^2)/3+(0.2)^2/2\}^{1/2}=1.66$