

# **FCC TEST REPORT**

**for**

**47 CFR, Part 15, Subpart C**

Equipment : Access Point

Model No. : PM-0301A

FCC ID : QU3PM0301A

Filing Type : Certification

Applicant : NEC Laboratories America  
4 Independence Way, Princeton, NJ, 08540, U.S.A.

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***SPORTON International Inc.***

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

## 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. Operation of Equipment under Test.....</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.....                                | 14        |
| 5.4. Power Spectral Density.....                           | 15        |
| 5.5. Test of Conducted Emission.....                       | 19        |
| 5.6. Test of Radiated Emission.....                        | 23        |
| 5.7. Band Edges Measurement.....                           | 32        |
| 5.8. Antenna Requirements .....                            | 35        |
| 5.9. RF Exposure.....                                      | 36        |
| <b>6. EMI Suppression Component List .....</b>             | <b>38</b> |
| <b>7. Antenna Factor &amp; Cable Loss .....</b>            | <b>38</b> |
| <b>8. List of Measuring Equipments Used.....</b>           | <b>40</b> |
| <b>9. Uncertainty of Test Site .....</b>                   | <b>41</b> |

## History of this test report

Original Report Issue Date: Jan. 15, 2003

■ No additional attachment.

☐ Additional attachment were issued as following record:

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

for

## 47 CFR, Part 15, Subpart C

Equipment : Access Point  
Model No. : PM-0301A  
FCC ID : QU3PM0301A  
Filing Type : Certification  
Applicant : NEC Laboratories America  
4 Independence Way, Princeton, NJ, 08540, U.S.A.

### I **HEREBY** CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 1992** 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 Dec. 13, 2002 at **SPORTON International Inc.** LAB.

 Jan. 16, 2003

K. J. Lin  
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**

NEC Laboratories America  
4 Independence Way, Princeton, NJ, 08540, U.S.A.

### **1.2. Manufacturer**

GIGA-BYTE TECHNOLOGY CO., LTD.  
No.6, Bau Chiang Road, Hsin-Tien, Taipei Hsien, Taiwan, R.O.C.

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

|                   |                           |
|-------------------|---------------------------|
| Equipment         | : Access Point            |
| Model No.         | : PM-0301A                |
| FCC ID            | : QU3PM0301A              |
| Trade Name        | : NEC                     |
| TP Cable          | : Non-Shielded, 1m        |
| Power Supply Type | : Switching               |
| AC Power Input    | : Wall-mount, 1.8m, 2 pin |

**1.4. Feature of Equipment under Test**

| Items                                | Contents                                                          |
|--------------------------------------|-------------------------------------------------------------------|
| 1. Modulation type                   | CCK,QPSK,BPSK                                                     |
| 2. How to move out the modulation    | Software Control                                                  |
| 3. Number of channels                | Default: 11,                                                      |
| 4. Carrier frequency of each channel | 2412, 2417, 2422, 2427, 2432, 2437, 2442, 2447, 2452, 2457, 2462, |
| 5. Bandwidth of each channel         | 20 MHz                                                            |
| 6. Transmitter or Transceiver        | Transceiver                                                       |
| 7. Power Rating (DC or AC, Volt)     | 5 VDC / 3.3A                                                      |
| 8. Maximum output power to Antenna   | 14 dBm                                                            |
| 9. Duty Cycle                        | 100%                                                              |
| 10. Basic function of product        | 802.11b Wireless LAN                                              |
| 11. Operation Temperature            | 0 40                                                              |
| 12. Antenna Connector Type           | MMCX                                                              |
| 13. Antenna Type                     | Dipole Antenna                                                    |
| 14. Antenna Gain                     | 2dBi                                                              |
| 15. Adapter                          | FAIRWAY / WN10A-050<br>I/P: 100-240V / 50-60HZ / 1.0A             |

## 2. Test Configuration of Equipment under Test

### 2.1. Test Manner

- a. The EUT has been associated with personal computer and peripherals pursuant to ANSI C63.4-1992 and configuration operated in a manner, which tended to maximize its emission characteristics in a typical application.
- b. The complete test system included local workstation and EUT for EMI test. The local workstation Included ASUS PC, REALsync Monitor, HP PS/2 Keyboard and LOGITECH PS/2 Mouse. HP Printer and ACEEX modem.
- 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: 2412MHz ( Channel 1 )  
Mode 2: 2437MHz ( Channel 6 )  
Mode 3: 2462MHz ( Channel 11 )
- d. Frequency range investigated: conduction 150 KHz to 30 MHz, radiation 30 MHz to 24000MHz.

### 2.2. Description of Test System

Support Unit 1. -- Personal Computer (ASUS) for local workstation

|                   |                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------|
| FCC ID            | : N/A                                                                                                           |
| Model No.         | : KTV133                                                                                                        |
| Power Supply Type | : Switching                                                                                                     |
| Power Cord        | : Non-Shielded                                                                                                  |
| Serial No.        | : SP0018                                                                                                        |
| Data Cable        | : Shielded, 360 degree via metal backshells                                                                     |
| Remark            | : This support device was tested to comply with FCC standards and authorized under a declaration of conformity. |

Support Unit 2. -- Monitor (REALsync) for local workstation

|                   |                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------|
| FCC ID            | : N/A                                                                                                           |
| Model No.         | : DJ72                                                                                                          |
| Power Supply Type | : Switching                                                                                                     |
| Power Cord        | : Non-Shielded                                                                                                  |
| Serial No.        | : SP0022                                                                                                        |
| 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 3. -- PS/2 Keyboard (HP) for remote workstation

FCC ID : N/A  
Model No. : SK-2502C  
Serial No. : SP0054  
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 4 -- PS/2 Mouse ( LOGITEC ) for local workstation

FCC ID : NZL211029  
Model No. : M-S34  
Serial No. : SP0045  
Data Cable : Non-Shielded, 1.7m

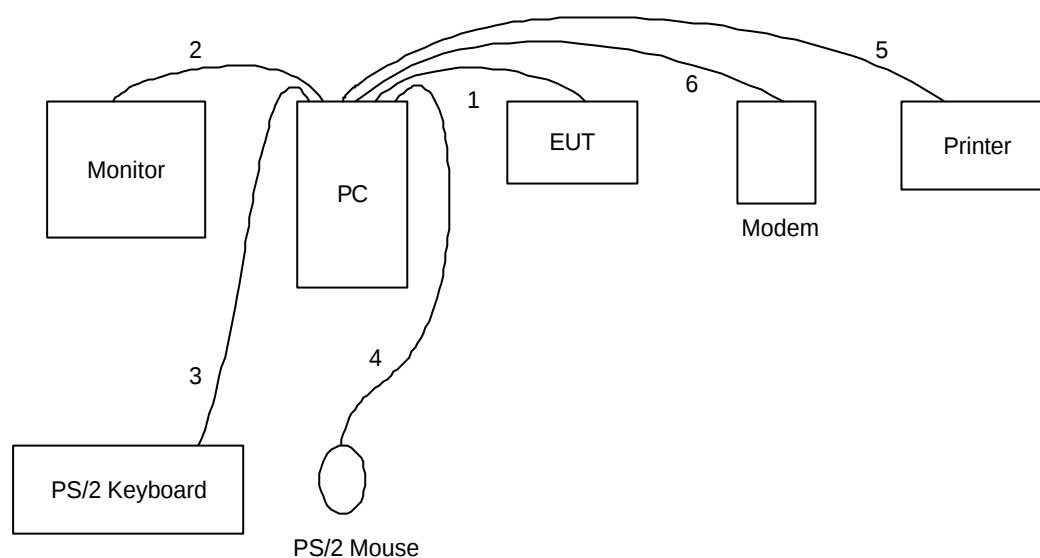
## Support Unit 5. -- Printer (HP) for local workstation

FCC ID : B94C2642X  
Model No. : DJ 400  
Serial No. : SP0051  
Data Cable : Shielded, 1.35m

## Support Unit 6. -- Modem ( ACEEX ) for local workstation

FCC ID : IFAXDM1414  
Model No. : DM1414  
Serial No. : SP0059  
Data Cable : Shielded, 1.15m

### 2.3. Connection Diagram of Test System



1. The TP cable is connected from PC to EUT
2. The I/O cable is connected from PC to the support unit 2
3. The I/O cable is connected from PC to the support unit 3
4. The I/O cable is connected from PC to the support unit 4.
5. The I/O cable is connected from PC to the support unit 5
6. The I/O cable is connected from PC to the support unit 6.

### **3. Operation of Equipment under Test**

During testing, the software provided by the applicant enable the EUT under transmission condition continuously.

## **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**

115V/60Hz

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

ANSI C63.4-1992

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

FCC Part 15, Subpart C

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

- a. Conduction: from 150 KHz to 30 MHz
- b. Radiation: from 30 MHz to 24620MHz

### **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

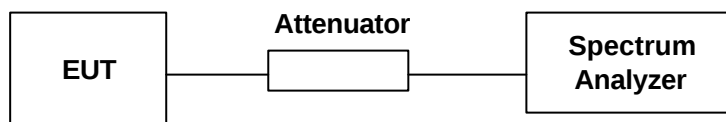
### 5.2.1. Measuring Instruments :

As described in chapter 6 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 :



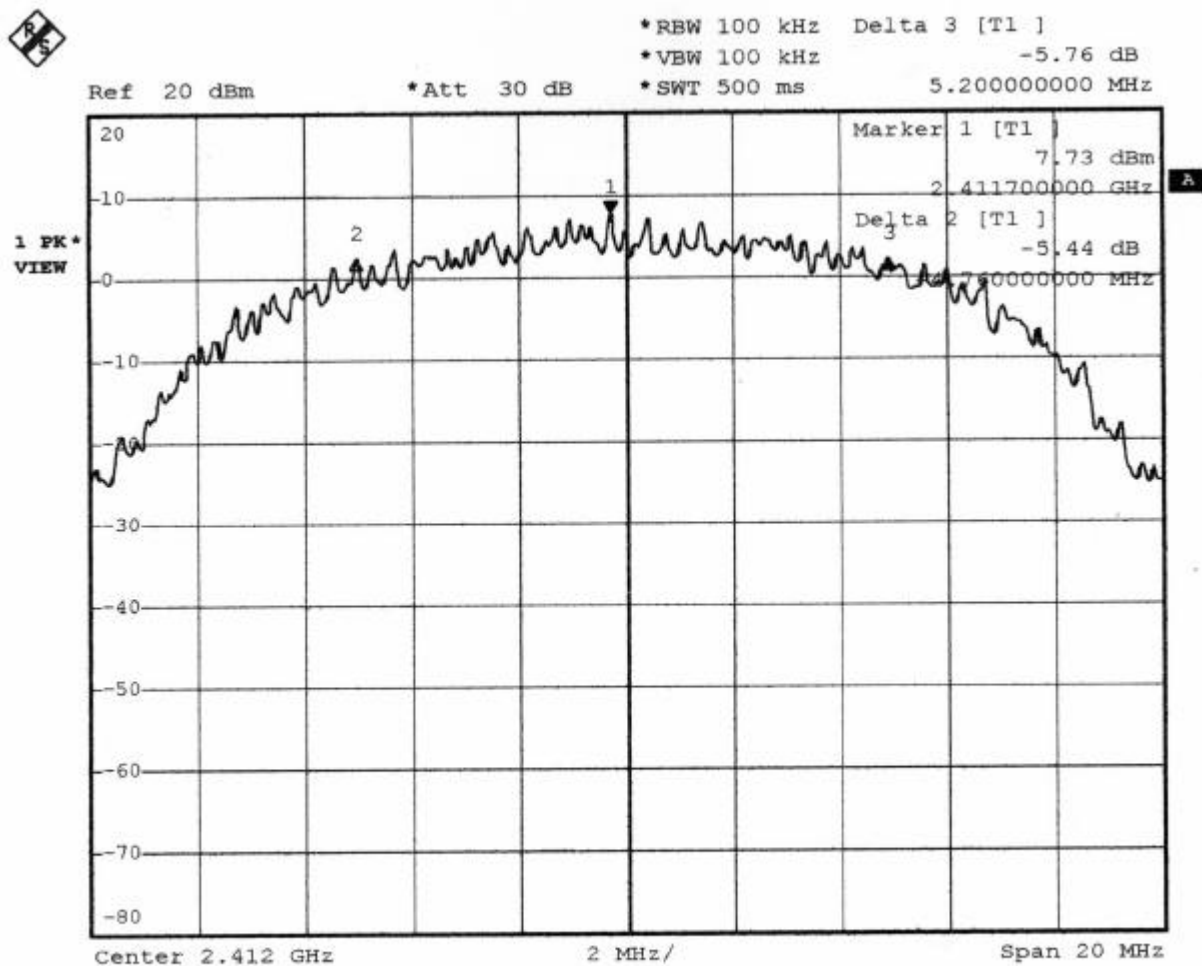
### 5.2.4. Test Result : The spectrum analyzer plots are attached as below

Temperature : 22.9 °C

Relative Humidity : 49 %

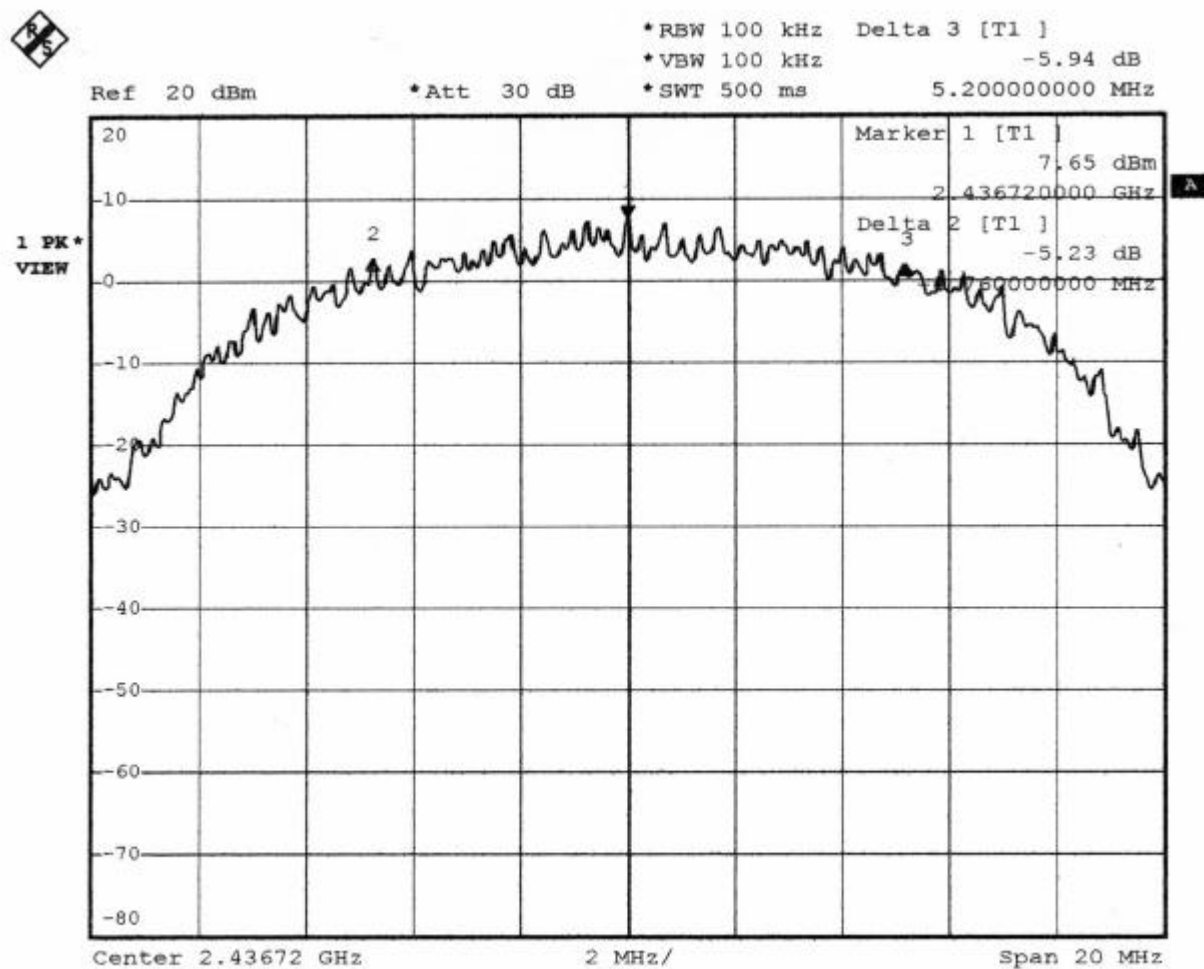
| Channel | Frequency<br>( MHz ) | 6dB Emission bandwidth<br>( MHz ) | Limits<br>( MHz ) | Plot<br>Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 1       | 2412                 | 9.96                              | 0.5               | 1                |
| 6       | 2437                 | 9.96                              | 0.5               | 2                |
| 11      | 2462                 | 9.52                              | 0.5               | 3                |

Plot1(Channel 1) :



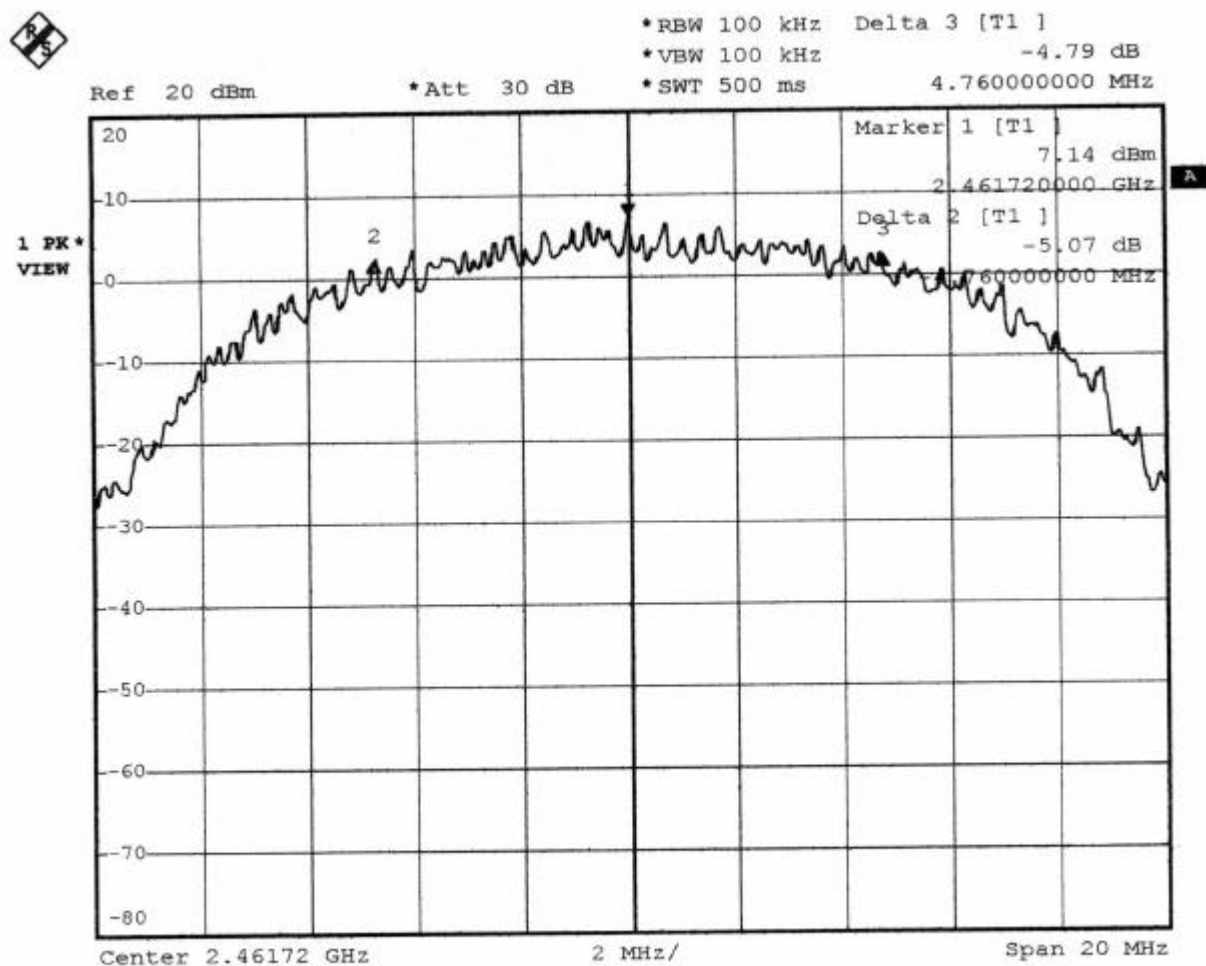
Date: 17.DEC.2002 09:06:24

Plot2(Channel 6) :



Date: 17.DEC.2002 09:26:25

Plot3(Channel 11) :



Date: 17.DEC.2002 09:38:54

Comments : 6dB Emission bandwidth&gt;500kHz

### 5.3. Peak Output Power

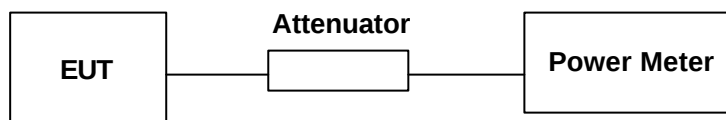
#### 5.3.1. Measuring Instruments :

As described in chapter 6 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 : 22.9 °C

Relative Humidity : 49 %

Antenna Gain: 2 dBi

| Channel | Frequency<br>(MHz) | Measured Output Power<br>(mWatt) | Measured Output Power<br>(dBm) | Limits<br>(Watt/dBm ) |
|---------|--------------------|----------------------------------|--------------------------------|-----------------------|
| 1       | 2412               | 47.97                            | 16.81                          | 1W/30 dBm             |
| 6       | 2437               | 47.00                            | 16.72                          | 1W/30 dBm             |
| 11      | 2462               | 41.78                            | 16.21                          | 1W/30 dBm             |

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

## 5.4. Power Spectral Density

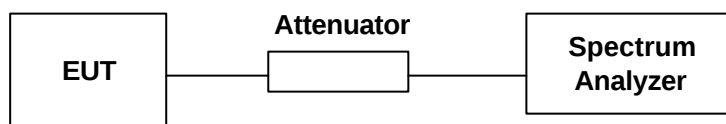
### 5.4.1. Measuring Instruments :

As described in chapter 6 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 :



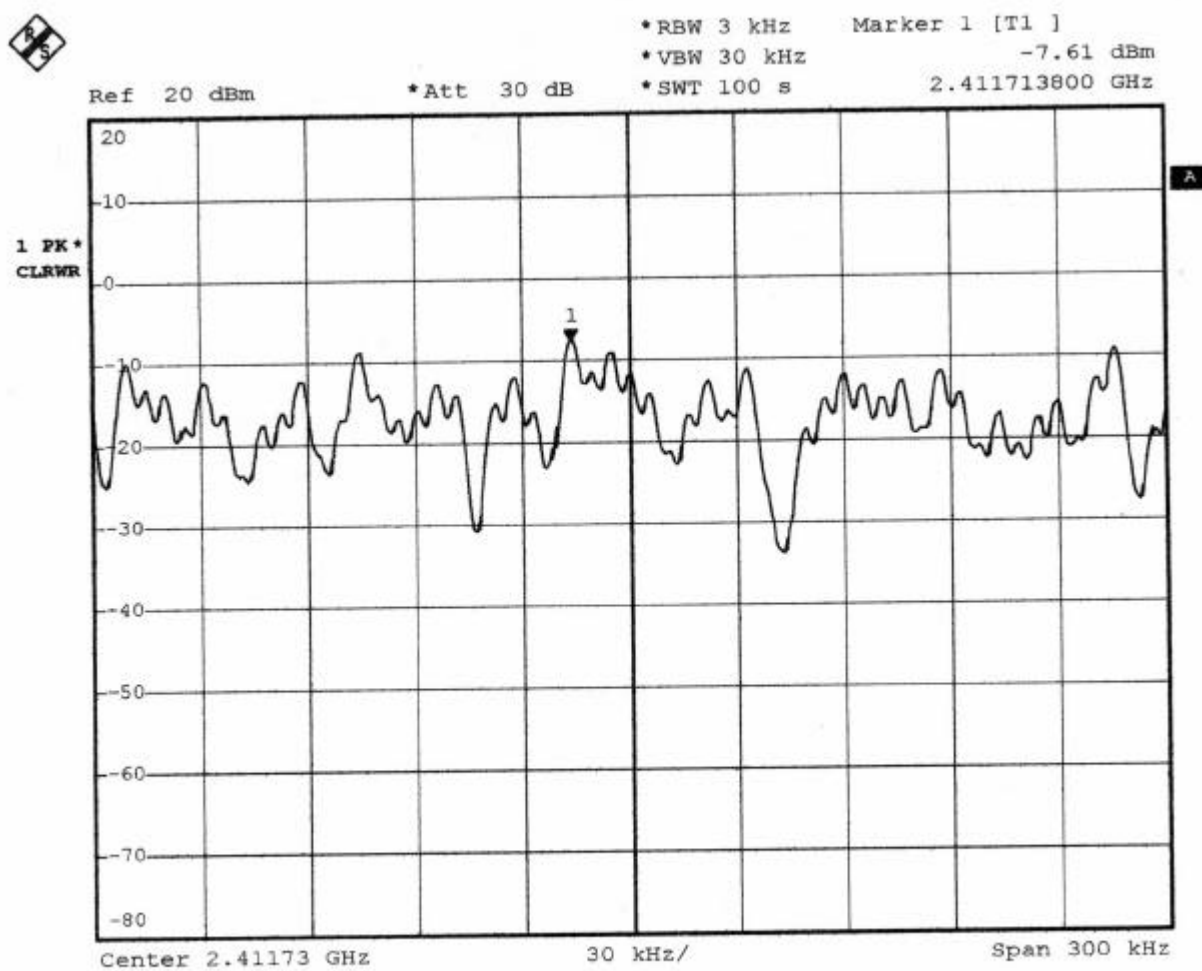
### 5.4.4. Test Result : See spectrum analyzer plots below

Temperature : 28.5°C

Relative Humidity : 59 %

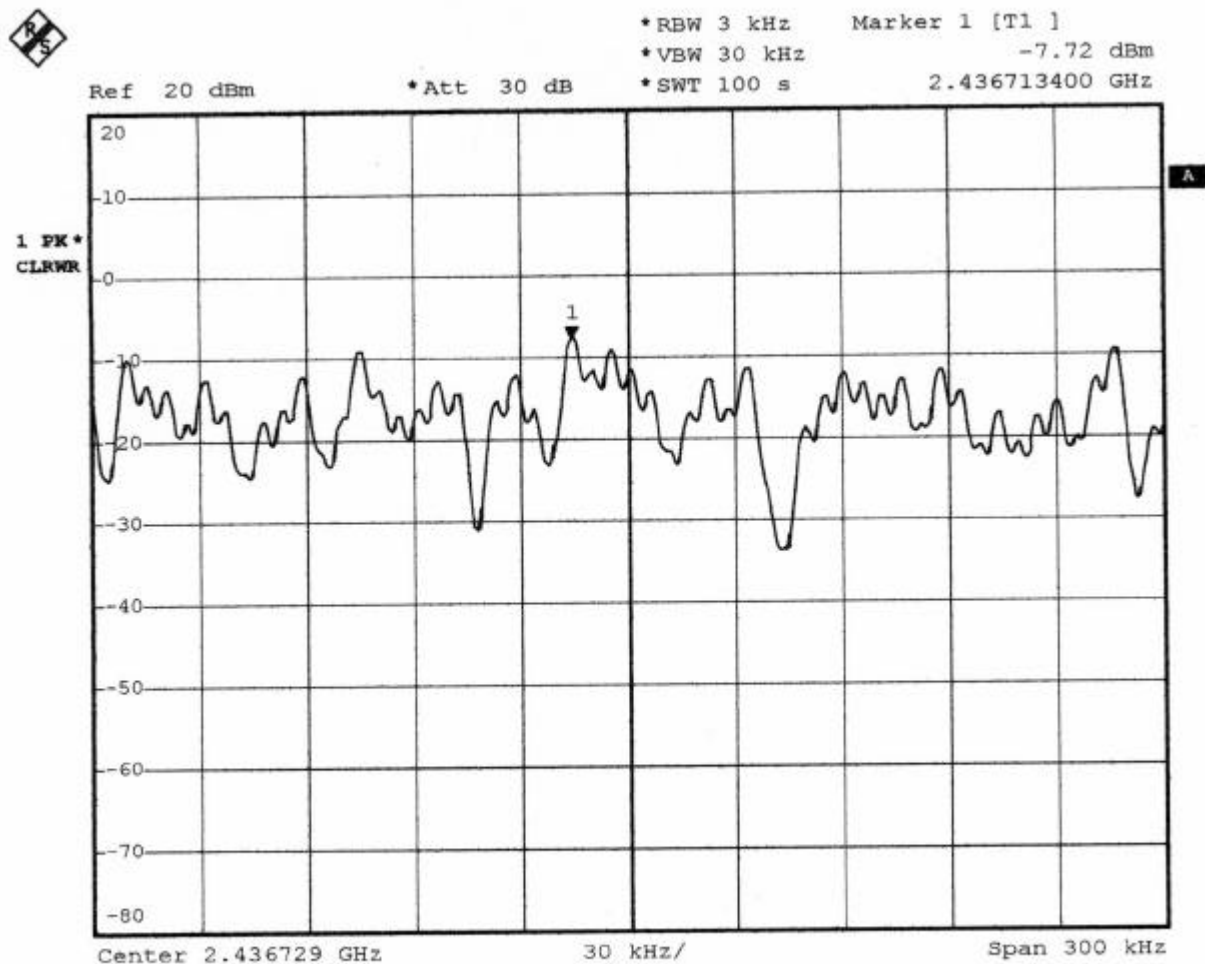
| Channel | Frequency<br>(MHz) | Power Spectral Density<br>(dBm) | Limits<br>(dBm) | Plot<br>Ref. No. |
|---------|--------------------|---------------------------------|-----------------|------------------|
| 1       | 2412               | -7.61                           | 8               | 1                |
| 6       | 2437               | -7.72                           | 8               | 2                |
| 11      | 2462               | -8.19                           | 8               | 3                |

Plot1(Channel 1):



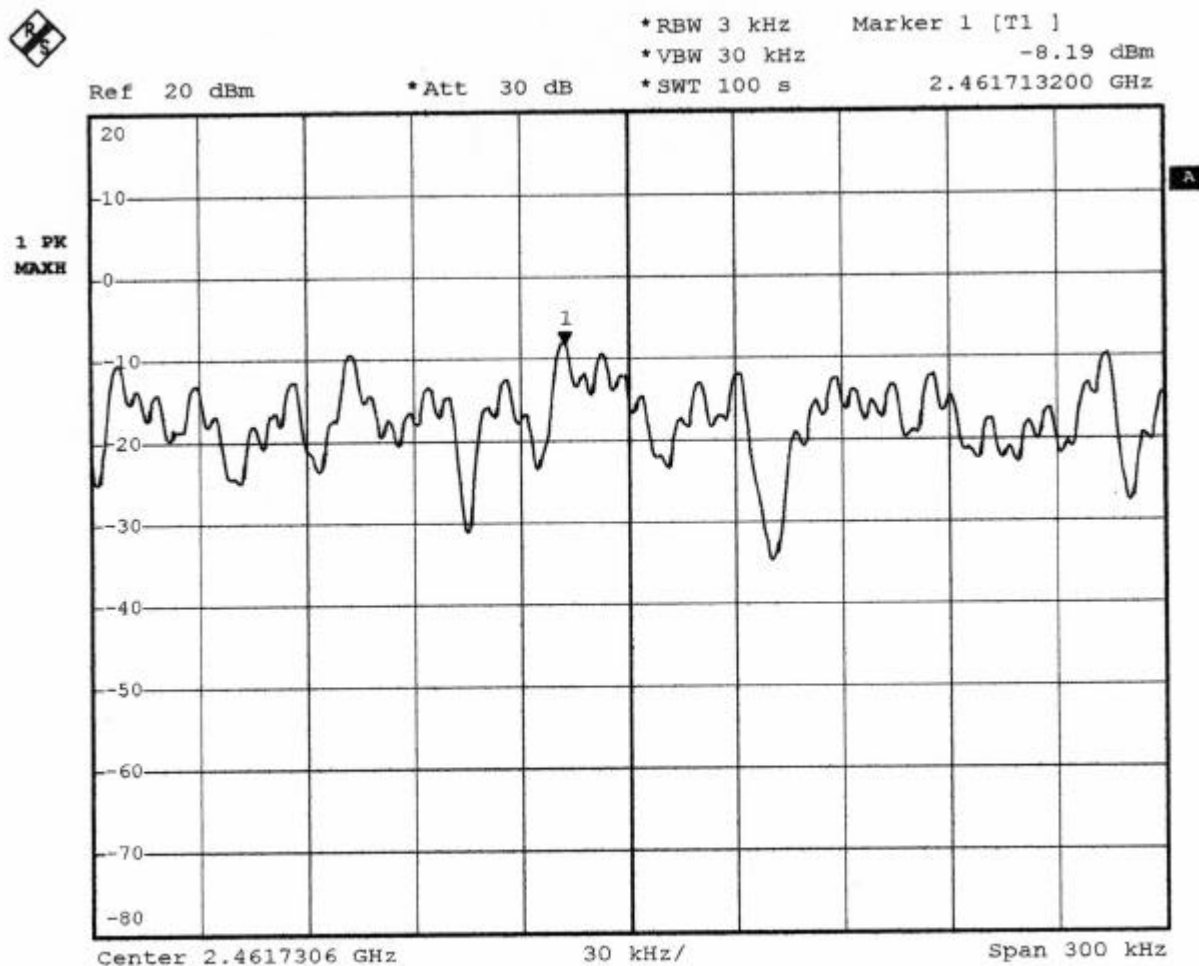
Date: 17.DEC.2002 09:14:30

Plot2(Channel 6):



Date: 17.DEC.2002 09:32:54

Plot3(Channel 11):



Date: 17.DEC.2002 09:50:55

## **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 C63.4-1992 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 :**

|                 |               |
|-----------------|---------------|
| • EMC Analyzer  | ( HP 8591EM ) |
| Attenuation     | 10 dB         |
| Start Frequency | 0.15 MHz      |
| Stop Frequency  | 30 MHz        |
| IF Bandwidth    | 9KHz          |

### **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

6dB Bandwidth: 9KHz

Temperature: 25°C

Relative Humidity: 43 %

Test Date: Dec.13, 2002

**The Conducted Emission test was passed at minimum margin NEUTRAL 0.409 MHz / 41.80 dBuV.**

| Frequency<br>( MHz ) | Line<br>or<br>Neutral | Meter Reading    |                  | Limits           |                  | Margin         |                |
|----------------------|-----------------------|------------------|------------------|------------------|------------------|----------------|----------------|
|                      |                       | Q.P.<br>( dBuV ) | A.V.<br>( dBuV ) | Q.P.<br>( dBuV ) | A.V.<br>( dBuV ) | Q.P.<br>( dB ) | A.V.<br>( dB ) |
| 0.410                | Line                  | 41.49            | 39.22            | 57.65            | 47.65            | -16.16         | -8.43          |
| 0.512                | Line                  | 39.72            | 36.45            | 56.00            | 46.00            | -16.28         | -9.55          |
| 0.716                | Line                  | 44.02            | 37.79            | 56.00            | 46.00            | -11.98         | -8.21          |
| 0.819                | Line                  | 41.02            | 34.48            | 56.00            | 46.00            | -14.98         | -11.52         |
| 0.920                | Line                  | 40.07            | 32.67            | 56.00            | 46.00            | -15.93         | -13.33         |
| 1.020                | Line                  | 43.58            | 35.52            | 56.00            | 46.00            | -12.42         | -10.48         |
| 0.409                | Neutral               | 43.58            | 41.80            | 57.67            | 47.67            | -14.09         | -5.87          |
| 0.511                | Neutral               | 40.66            | 37.55            | 56.00            | 46.00            | -15.34         | -8.45          |
| 0.614                | Neutral               | 39.90            | 35.59            | 56.00            | 46.00            | -16.10         | -10.41         |
| 0.715                | Neutral               | 44.88            | 38.84            | 56.00            | 46.00            | -11.12         | -7.16          |
| 1.021                | Neutral               | 42.89            | 34.45            | 56.00            | 46.00            | -13.11         | -11.55         |
| 1.221                | Neutral               | 42.33            | 32.72            | 56.00            | 46.00            | -13.67         | -13.28         |

Test Engineer: 

Andy Yang

Test Mode : Mode 2  
Temperature : 25°C  
Relative Humidity : 43 %  
Test Date: Dec. 13, 2002

**The Conducted Emission test was passed at minimum margin Neutral 0.513 MHz / 37.55 dBuV**

| Frequency<br>( MHz ) | Line<br>or<br>Neutral | Meter Reading    |                  | Limits           |                  | Margin         |                |
|----------------------|-----------------------|------------------|------------------|------------------|------------------|----------------|----------------|
|                      |                       | Q.P.<br>( dBuV ) | A.V.<br>( dBuV ) | Q.P.<br>( dBuV ) | A.V.<br>( dBuV ) | Q.P.<br>( dB ) | A.V.<br>( dB ) |
| 0.511                | Line                  | 40.32            | 36.85            | 56.00            | 46.00            | -15.68         | -9.15          |
| 0.614                | Line                  | 38.80            | 33.97            | 56.00            | 46.00            | -17.20         | -12.03         |
| 0.719                | Line                  | 43.21            | 37.50            | 56.00            | 46.00            | -12.79         | -8.50          |
| 0.820                | Line                  | 41.00            | 34.65            | 56.00            | 46.00            | -15.00         | -11.35         |
| 1.025                | Line                  | 43.48            | 35.50            | 56.00            | 46.00            | -12.52         | -10.50         |
| 1.227                | Line                  | 42.95            | 33.34            | 56.00            | 46.00            | -13.05         | -12.66         |
| 0.513                | Neutral               | 40.56            | 37.55            | 56.00            | 46.00            | -15.44         | -8.45          |
| 0.615                | Neutral               | 40.18            | 35.81            | 56.00            | 46.00            | -15.82         | -10.19         |
| 0.920                | Neutral               | 41.53            | 34.00            | 56.00            | 46.00            | -14.47         | -12.00         |
| 1.124                | Neutral               | 36.86            | 27.83            | 56.00            | 46.00            | -19.14         | -18.17         |
| 1.432                | Neutral               | 40.63            | 30.37            | 56.00            | 46.00            | -15.37         | -15.63         |
| 1.633                | Neutral               | 40.65            | 29.14            | 56.00            | 46.00            | -15.35         | -16.86         |

Test Engineer: \_\_\_\_\_

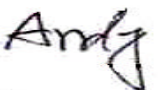


Andy Yang

Test Mode : Mode 3  
Temperature : 25°C  
Relative Humidity : 43 %  
Test Date: Dec. 13, 2002

The Conducted Emission test was passed at minimum margin **NEUTRAL 0.411 MHz / 42.02 dBuV.**

| Frequency<br>( MHz ) | Line<br>or<br>Neutral | Meter Reading    |                  | Limits           |                  | Margin         |                |
|----------------------|-----------------------|------------------|------------------|------------------|------------------|----------------|----------------|
|                      |                       | Q.P.<br>( dBuV ) | A.V.<br>( dBuV ) | Q.P.<br>( dBuV ) | A.V.<br>( dBuV ) | Q.P.<br>( dB ) | A.V.<br>( dB ) |
| 0.514                | Line                  | 40.02            | 36.85            | 56.00            | 46.00            | -15.98         | -9.15          |
| 0.617                | Line                  | 38.40            | 33.75            | 56.00            | 46.00            | -17.60         | -12.25         |
| 0.823                | Line                  | 41.12            | 34.65            | 56.00            | 46.00            | -14.88         | -11.35         |
| 1.029                | Line                  | 43.44            | 35.50            | 56.00            | 46.00            | -12.56         | -10.50         |
| 1.230                | Line                  | 42.93            | 33.24            | 56.00            | 46.00            | -13.07         | -12.76         |
| 1.434                | Line                  | 38.85            | 28.04            | 56.00            | 46.00            | -17.15         | -17.96         |
| 0.411                | Neutral               | 43.78            | 42.02            | 57.63            | 47.63            | -13.85         | -5.61          |
| 0.616                | Neutral               | 40.54            | 36.03            | 56.00            | 46.00            | -15.46         | -9.97          |
| 0.717                | Neutral               | 45.78            | 39.65            | 56.00            | 46.00            | -10.22         | -6.35          |
| 0.923                | Neutral               | 41.51            | 34.05            | 56.00            | 46.00            | -14.49         | -11.95         |
| 1.029                | Neutral               | 42.51            | 34.33            | 56.00            | 46.00            | -13.49         | -11.67         |
| 1.230                | Neutral               | 41.95            | 32.24            | 56.00            | 46.00            | -14.05         | -13.76         |

Test Engineer: 

Andy Yang

## 5.6. Test of Radiated Emission

Radiated emissions from 30 MHz to 24.62 GHz were measured according to the methods defines in ANSI C63.4-1992. The EUT was placed on a nonmetallic stand in the open-field site, 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

■ from 30MHz to 1GHz

- Amplifier ( HP 8447D )
  - RF Gain 25 dB
  - Signal Input 10MHz – 1.3GHz

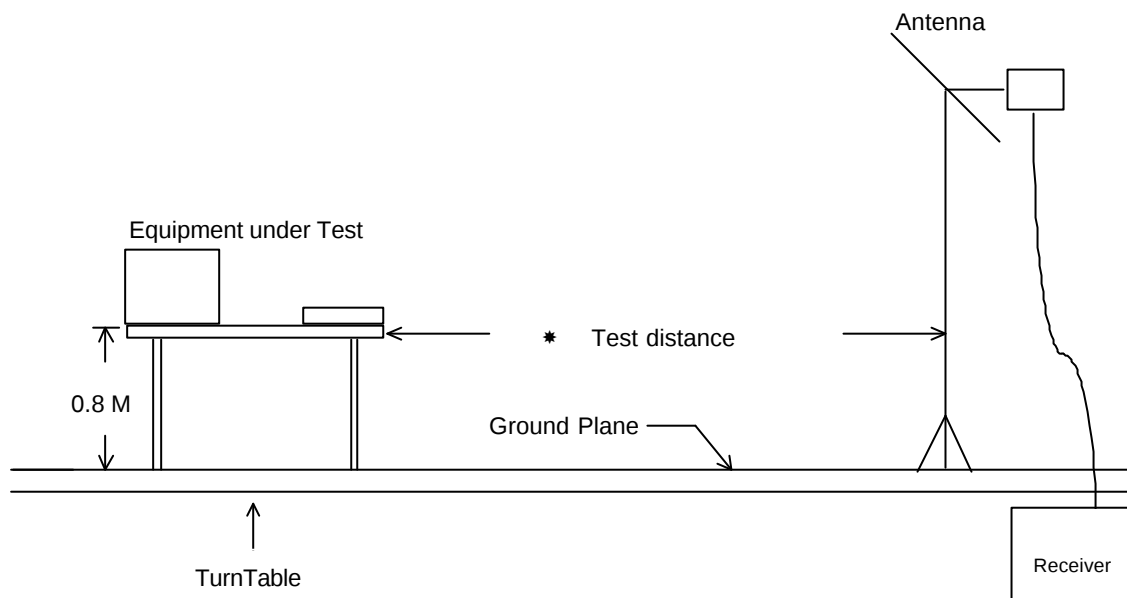
- Spectrum Analyzer (R&S FSP7 )
  - Attenuation 10 dB
  - Start Frequency 30 MHz
  - Stop Frequency 1 GHz
  - Resolution Bandwidth 120 kHz
  - Signal Input 9KHz – 7GHz

■ above 1GHz

- Spectrum ( R&S FSP30 )
  - Attenuation 10 dB
  - Start Frequency 1000 MHz
  - Stop Frequency 2462GHz
  - Resolution Bandwidth 1 MHz
  - Video Bandwidth For peak mode: 1MHz
  - Signal Input 30 MHz to 30 GHz
- Amplifier (MITEQ 805858)
  - Attenuation 0 dB
  - RF Gain 30 dB
  - Signal Input 100KHz – 26.5GHz

**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.

**5.6.3. Typical Test Setup Layout of Radiated Emission**

## 5.6.4. Test Result of Radiated Emission

Test Mode: Mode 1 (2412MHz)

Test Distance: 3 M

Temperature: 22.9°C

Relative Humidity: 49 %

Test Date: Dec. 12, 2002

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

**The Radiated Emission test was passed at minimum margin:****Horizontal 329.400 MHz / 43.25 dBuV/m Antenna Height 2 Meter, Turntable Degree 174 °**

■ For 30MHz to 1GHz

Corrected Reading: Antenna Factor + Cable Loss + Reading = Emission

Spurious Emission

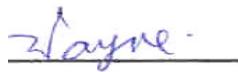
| Frequency | Antenna  | Cable  | Reading  | Limits     | Emission | Level      | Margin   | Detect |             |
|-----------|----------|--------|----------|------------|----------|------------|----------|--------|-------------|
| Polarity  | Factor   | Loss   |          |            |          |            |          |        |             |
| ( MHz )   | ( dB/m ) | ( dB ) | ( dBuV ) | ( dBuV/m ) | ( uV/m ) | ( dBuV/m ) | ( uV/m ) | ( dB ) | Mode        |
| 51.330    | H        | 7.50   | 1.23     | 51.86      | 40.00    | 100.00     | 33.49    | 47.26  | -6.51 Peak  |
| 106.410   | H        | 11.07  | 1.70     | 54.19      | 43.50    | 149.62     | 39.99    | 99.90  | -3.51 Q.P.  |
| 329.400   | H        | 13.70  | 3.09     | 53.24      | 46.00    | 199.53     | 43.25    | 131.07 | -2.75 Q.P.  |
| 363.000   | H        | 14.47  | 3.30     | 50.83      | 46.00    | 199.53     | 41.62    | 120.50 | -4.38 Peak  |
| 394.500   | H        | 15.55  | 3.40     | 50.53      | 46.00    | 199.53     | 42.31    | 130.47 | -3.69 Peak  |
| 1612.000  | H        | 27.05  | 4.18     | 52.46      | 74.00    | 5011.87    | 41.30    | 116.15 | -32.70 Peak |
| 2020.000  | H        | 31.05  | 4.74     | 58.17      | 74.00    | 5011.87    | 51.45    | 373.68 | -22.55 Peak |
| 2020.000  | H        | 31.05  | 4.74     | 55.78      | 54.00    | 501.20     | 49.06    | 283.80 | -4.94 A.V.  |
| 40.530    | V        | 12.56  | 1.10     | 45.43      | 40.00    | 100.00     | 31.99    | 39.77  | -8.01 Q.P.  |
| 98.580    | V        | 10.18  | 1.68     | 52.08      | 43.50    | 149.62     | 36.94    | 70.31  | -6.56 Peak  |
| 179.580   | V        | 8.61   | 2.29     | 56.05      | 43.50    | 149.62     | 40.27    | 103.16 | -3.23 Peak  |
| 363.000   | V        | 14.47  | 3.30     | 46.00      | 46.00    | 199.53     | 36.79    | 69.10  | -9.21 Peak  |
| 394.500   | V        | 15.55  | 3.40     | 45.33      | 46.00    | 199.53     | 37.11    | 71.70  | -8.89 Peak  |
| 2014.000  | V        | 31.06  | 4.73     | 54.53      | 74.00    | 5011.87    | 47.81    | 245.75 | -26.19 Peak |

## Field strength of fundamental and harmonics

| Frequency | Antenna  | Cable  | Reading                                                 | Limits | Emission | Level    | Margin Detect |
|-----------|----------|--------|---------------------------------------------------------|--------|----------|----------|---------------|
| Polarity  | Factor   | Loss   |                                                         |        |          |          |               |
| ( MHz )   | ( dB/m ) | ( dB ) | ( dBuV ) ( dBuV/m ) ( uV/m ) ( dBuV/m ) ( uV/m ) ( dB ) |        |          |          | Mode          |
| 2414.000  | H        | 30.17  | 5.20                                                    | 97.67  | 90.48    | 33419.50 | Peak          |
| 2414.000  | H        | 30.17  | 5.20                                                    | 88.85  | 81.57    | 11981.20 | A.V.          |
| 2412.000  | V        | 30.17  | 5.20                                                    | 107.16 | 99.88    | 98627.95 | Peak          |
| 2412.000  | V        | 30.17  | 5.20                                                    | 99.33  | 92.05    | 40040.55 | A.V.          |

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

Test Engineer :



Wayne Hsu

Test Mode: Mode 2 (2437 MHz)  
 Test Distance: 3 M  
 Temperature: 22.9°C  
 Relative Humidity: 49%  
 Test Date: Dec.12, 2002  
 Emission level (dBuV/m) = 20 log Emission level (uV/m)

**The Radiated Emission test was passed at minimum margin:**

**Horizontal 394.500 MHz / 42.84 dBuV/m Antenna Height 2 Meter , Turntable Degree 190 °**

■ For 30MHz to 1GHz

Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

Spurious Emission

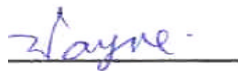
| Frequency | Antenna  | Cable  | Reading  | Limits     | Emission |            | Level    | Margin | Detect |      |
|-----------|----------|--------|----------|------------|----------|------------|----------|--------|--------|------|
| Polarity  | Factor   | Loss   |          |            |          |            |          |        |        |      |
| ( MHz )   | ( dB/m ) | ( dB ) | ( dBuV ) | ( dBuV/m ) | ( uV/m ) | ( dBuV/m ) | ( uV/m ) | ( dB ) | Mode   |      |
| 106.410   | H        | 11.07  | 1.70     | 51.68      | 43.50    | 149.62     | 37.48    | 74.82  | -6.02  | Q.P. |
| 297.300   | H        | 12.91  | 2.90     | 47.13      | 46.00    | 199.53     | 36.34    | 65.61  | -9.66  | Peak |
| 329.400   | H        | 13.70  | 3.09     | 51.89      | 46.00    | 199.53     | 41.90    | 124.45 | -4.10  | Peak |
| 394.500   | H        | 15.55  | 3.40     | 51.06      | 46.00    | 199.53     | 42.84    | 138.68 | -3.16  | Peak |
| 1614.000  | H        | 27.05  | 4.19     | 51.81      | 74.00    | 5011.87    | 40.66    | 107.90 | -33.34 | Peak |
| 2020.000  | H        | 31.05  | 4.74     | 57.25      | 74.00    | 5011.87    | 50.53    | 336.12 | -23.47 | Peak |
| 37.02     | V        | 14.48  | 1.00     | 43.74      | 40.00    | 100.00     | 32.12    | 40.37  | -7.88  | Q.P. |
| 51.06     | V        | 7.61   | 1.23     | 54.88      | 40.00    | 100.00     | 36.62    | 67.76  | -3.38  | Q.P. |
| 363.000   | V        | 14.47  | 3.30     | 45.68      | 46.00    | 199.53     | 36.74    | 68.71  | -9.53  | Peak |
| 494.600   | V        | 17.35  | 3.75     | 42.63      | 46.00    | 199.53     | 36.06    | 63.53  | -9.94  | Peak |
| 2020.000  | V        | 31.05  | 4.74     | 55.61      | 74.00    | 5011.87    | 48.89    | 278.30 | -25.11 | Peak |

## Field strength of fundamental and harmonics

| Frequency | Antenna  | Cable  | Reading  | Limits     | Emission | Level      | Margin   | Detect |      |
|-----------|----------|--------|----------|------------|----------|------------|----------|--------|------|
| Polarity  | Factor   | Loss   |          |            |          |            |          |        |      |
| ( MHz )   | ( dB/m ) | ( dB ) | ( dBuV ) | ( dBuV/m ) | ( uV/m ) | ( dBuV/m ) | ( uV/m ) | ( dB ) | Mode |
| 2438.000  | H        | 30.11  | 5.23     | 94.64      |          | 87.32      | 23227.37 |        | Peak |
| 2438.000  | H        | 30.11  | 5.23     | 86.46      |          | 79.14      | 9057.33  |        | A.V. |
| 2438.000  | V        | 30.11  | 5.23     | 107.05     |          | 99.73      | 96939.33 |        | Peak |
| 2438.000  | V        | 30.11  | 5.23     | 98.32      |          | 91.00      | 35481.34 |        | A.V. |

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

Test Engineer :



Wayne Hsu

Test Mode: Mode 3 ( 2462 MHz )  
 Test Distance: 3 M  
 Temperature: 22.9°C  
 Relative Humidity: 49 %  
 Test Date: Dec. 12, 2002  
 Emission level (dBuV/m) = 20 log Emission level (uV/m)  
 Corrected Reading: Antenna Factor + Cable Loss + Reading = Emission

**The Radiated Emission test was passed at minimum margin:**

**Vertical 31.620 MHz / 37.09 dBuV/m Antenna Height 1 Meter , Turntable Degree 190 °**

**Spurious Emission**

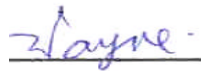
| Frequency | Antenna  | Cable  | Reading  | Limits     | Emission | Level      | Margin   | Detect  |        |      |
|-----------|----------|--------|----------|------------|----------|------------|----------|---------|--------|------|
| Polarity  | Factor   | Loss   |          |            |          |            |          |         |        |      |
| ( MHz )   | ( dB/m ) | ( dB ) | ( dBuV ) | ( dBuV/m ) | ( uV/m ) | ( dBuV/m ) | ( uV/m ) | ( dB )  | Mode   |      |
| 49.980    | H        | 8.00   | 1.21     | 51.16      | 40.00    | 100.00     | 33.27    | 46.08   | -6.73  | Peak |
| 106.410   | H        | 11.07  | 1.70     | 53.42      | 43.50    | 149.62     | 39.22    | 91.41   | -4.28  | Q.P. |
| 329.400   | H        | 13.70  | 3.09     | 52.14      | 46.00    | 199.53     | 42.15    | 128.09  | -3.85  | Peak |
| 363.000   | H        | 14.47  | 3.30     | 50.56      | 46.00    | 199.53     | 41.35    | 116.82  | -4.65  | Peak |
| 394.500   | H        | 15.55  | 3.40     | 50.50      | 46.00    | 199.53     | 42.28    | 130.02  | -3.72  | Peak |
| 1612.000  | H        | 27.05  | 4.18     | 52.52      | 74.00    | 5011.87    | 41.36    | 116.95  | -32.64 | Peak |
| 2020.000  | H        | 31.05  | 4.74     | 58.03      | 74.00    | 5011.87    | 51.31    | 367.71  | -22.69 | Peak |
| 2020.000  | H        | 31.05  | 4.74     | 55.49      | 54.00    | 502.00     | 48.77    | 274.47  | -5.23  | A.V. |
| 10526.000 | H        | 39.32  | 11.45    | 50.46      | 74.00    | 5011.87    | 60.19    | 1022.12 | -13.81 | Peak |
| 10526.000 | H        | 39.32  | 11.45    | 41.95      | 54.00    | 502.00     | 51.68    | 383.71  | -2.32  | A.V. |
| 31.620    | V        | 17.55  | 0.90     | 45.74      | 40.00    | 100.00     | 37.09    | 71.53   | -2.91  | Q.P. |
| 38.100    | V        | 13.90  | 1.04     | 48.59      | 40.00    | 100.00     | 36.43    | 66.30   | -3.57  | Q.P. |
| 47.820    | V        | 8.83   | 1.17     | 53.12      | 40.00    | 100.00     | 36.02    | 63.24   | -3.98  | Peak |
| 363.000   | V        | 14.47  | 3.30     | 46.55      | 46.00    | 100.00     | 37.44    | 74.47   | -8.56  | Peak |
| 394.500   | V        | 15.55  | 3.40     | 44.25      | 46.00    | 100.00     | 36.03    | 63.31   | -9.97  | Peak |
| 4926.000  | V        | 34.05  | 7.51     | 51.91      | 74.00    | 5011.87    | 49.94    | 314.05  | -24.06 | Peak |

## ■ Field strength of fundamental and harmonics

| Frequency | Antenna  | Cable  | Reading  | Limits     | Emission | Level      | Margin   | Detect |
|-----------|----------|--------|----------|------------|----------|------------|----------|--------|
| Polarity  | Factor   | Loss   |          |            |          |            |          |        |
| ( MHz )   | ( dB/m ) | ( dB ) | ( dBuV ) | ( dBuV/m ) | ( uV/m ) | ( dBuV/m ) | ( uV/m ) | ( dB ) |
|           |          |        |          |            |          |            |          | Mode   |
| 2462.000  | H        | 30.06  | 5.25     | 94.98      |          | 87.62      | 24043.63 | Peak   |
| 2462.000  | H        | 30.06  | 5.25     | 86.56      |          | 79.20      | 9120.11  | A.V.   |
| 2462.000  | V        | 30.06  | 5.25     | 98.39      |          | 91.03      | 35604.10 | Peak   |
| 2462.000  | V        | 30.06  | 5.25     | 96.87      |          | 89.51      | 29888.22 | A.V.   |

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

Test Engineer :

  
Wayne Hsu

## 5.7. Band Edges Measurement

### 5.7.1. Measuring Instruments :

As described in chapter 6 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

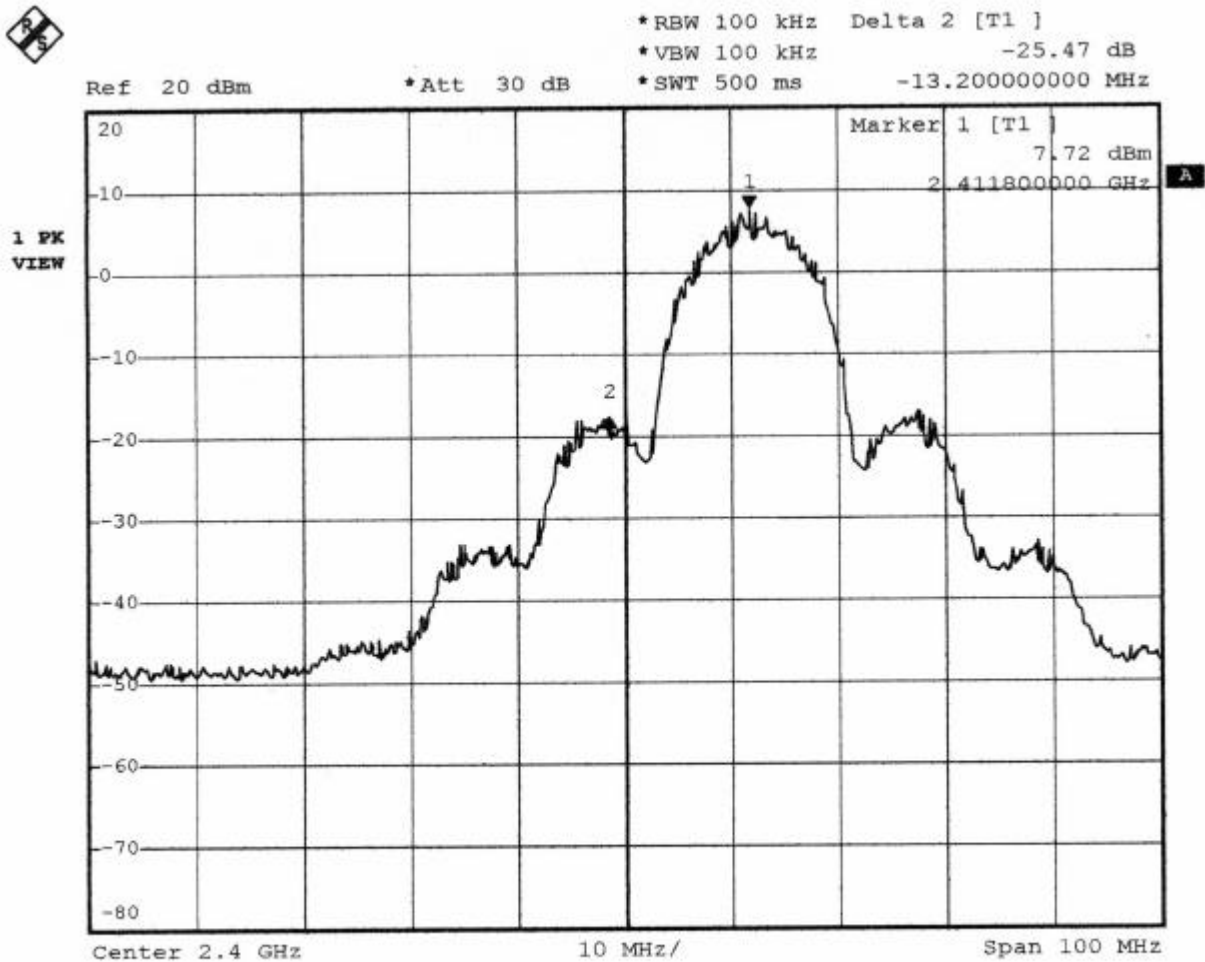
The band edge emission plot on page 37. shows 45.10dB delta between carrier maximum power and local maximum emission in the restricted band (2.4835GHz).

| Polarity | The emission of<br>carrier power<br>strength<br>(dB $\mu$ V/m) | The maximum<br>field strength in<br>restrict band<br>(dB $\mu$ V/m) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result  |
|----------|----------------------------------------------------------------|---------------------------------------------------------------------|-------------------------|----------------|---------|
| V        | 91.03                                                          | 49.22                                                               | 74.00                   | -24.78         | Peak    |
| V        | 89.51                                                          | 47.70                                                               | 54.00                   | -6.30          | Average |
| H        | 87.62                                                          | 45.81                                                               | 74.00                   | -28.19         | Peak    |
| H        | 79.20                                                          | 37.39                                                               | 54.00                   | -16.61         | 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.

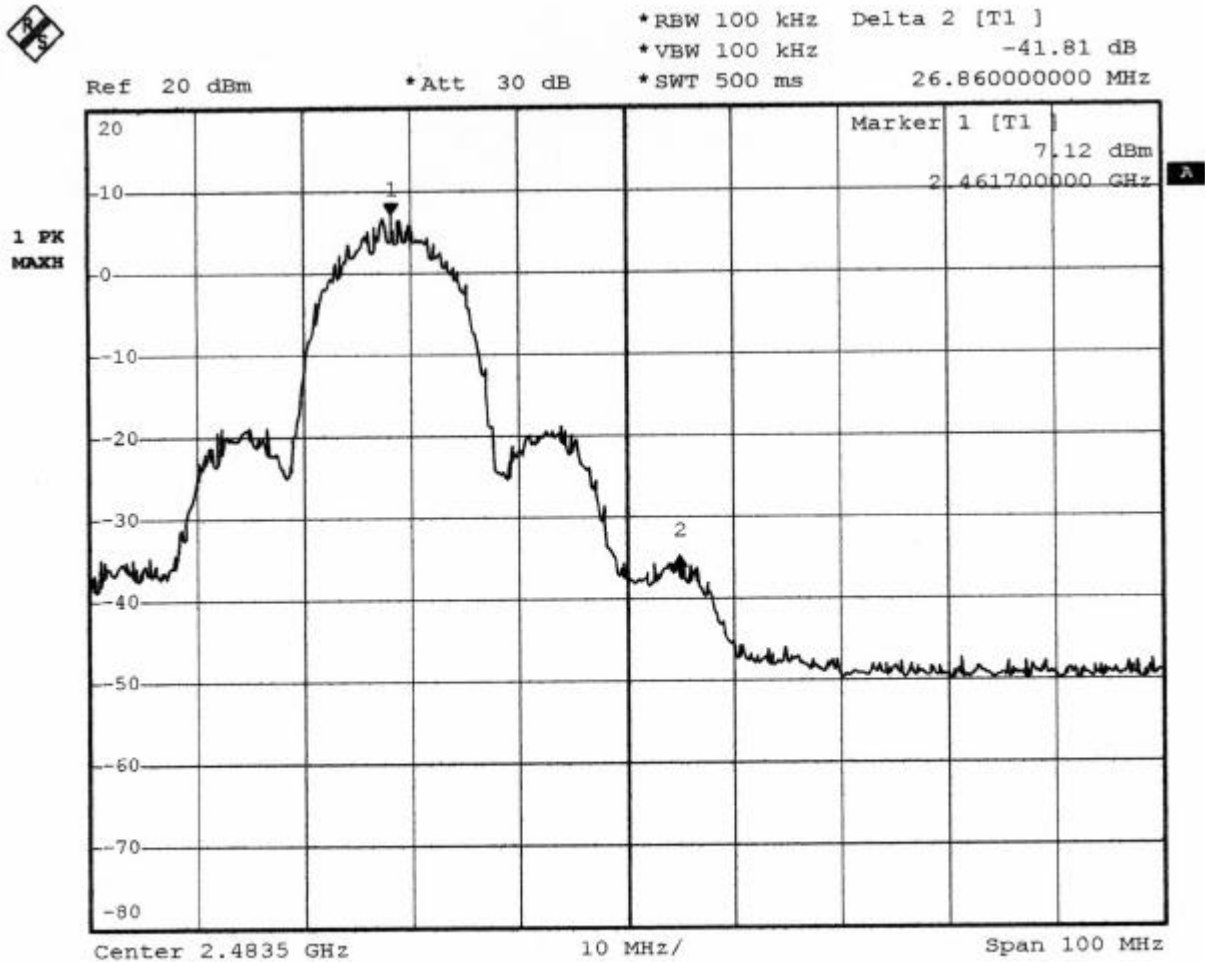
The spectrum analyzer plots are attached as below :

Plot1 (Channel 1) :



Date: 17.DEC.2002 09:17:51

Plot2 (Channel 11) :



Date: 17.DEC.2002 09:40:55

Comments : All emissions in any 100kHz bandwidth outside the band edge are attenuated more than 20dB from the carrier.

## **5.8. Antenna Requirements**

The EUT use a detachable antenna via **MMCX** 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 MMCX.

### **5.8.3. Notice**

This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter. End-users must be provided with specific operating instructions for satisfying RF exposure compliance.

## 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<br>(MHz) | Electric Field Strength<br>(E) (V/m) | Magnetic Field<br>Strength (H) (A/m) | Power Density (S)<br>(mW/ cm <sup>2</sup> ) | Averaging Time<br> E  <sup>2</sup>  H  <sup>2</sup> or S<br>(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<br>(MHz) | Electric Field Strength<br>(E) (V/m) | Magnetic Field<br>Strength (H) (A/m) | Power Density (S)<br>(mW/cm <sup>2</sup> ) | Averaging Time<br> E  <sup>2</sup>  H  <sup>2</sup> or S<br>( 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

$$E \text{ (V/m)} = \frac{\sqrt{30 \cdot P \cdot G}}{d} \quad \text{Power Density: } Pd \text{ (mW/cm}^2\text{)} = \frac{E^2}{3770}$$

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:

$$d = \sqrt{\frac{30 \cdot P \cdot G}{3770}}$$

| Channel No. | Gain<br>( dBi) | Gain Numeric | Peak Output<br>Power<br>( mW ) | Calculated RF<br>Exposure<br>Separation<br>Distance ( cm ) | Minimum RF<br>Exposure<br>Separation<br>Distance ( cm ) |
|-------------|----------------|--------------|--------------------------------|------------------------------------------------------------|---------------------------------------------------------|
| Channel 1   | 2              | 1.58         | 47.97                          | 0.777                                                      | 20                                                      |
| Channel 6   | 2              | 1.58         | 46.99                          | 0.769                                                      | 20                                                      |
| Channel 11  | 2              | 1.58         | 41.78                          | 0.725                                                      | 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 ferrite core on power output cable.  
(As the External photo No.3)

## 7. Antenna Factor & Cable Loss

| Frequency (MHz) | Antenna Factor (dB) | Cable Loss (dB) |
|-----------------|---------------------|-----------------|
| 30              | 18.10               | 0.90            |
| 35              | 16.00               | 0.90            |
| 40              | 13.19               | 1.09            |
| 45              | 10.57               | 1.10            |
| 50              | 8.00                | 1.21            |
| 55              | 6.30                | 1.30            |
| 60              | 5.30                | 1.30            |
| 65              | 4.95                | 1.40            |
| 70              | 5.19                | 1.40            |
| 75              | 6.05                | 1.49            |
| 80              | 6.86                | 1.50            |
| 85              | 7.94                | 1.60            |
| 90              | 8.60                | 1.60            |
| 95              | 9.70                | 1.60            |
| 100             | 10.26               | 1.69            |
| 110             | 11.19               | 1.70            |
| 120             | 11.60               | 1.81            |
| 130             | 11.42               | 1.90            |
| 140             | 10.92               | 1.99            |
| 150             | 10.20               | 2.00            |
| 160             | 9.20                | 2.11            |
| 170             | 9.00                | 2.20            |
| 180             | 8.60                | 2.29            |
| 190             | 8.70                | 2.30            |
| 200             | 8.10                | 2.40            |
| 220             | 8.86                | 2.51            |
| 240             | 10.70               | 2.60            |
| 260             | 13.10               | 2.71            |
| 280             | 12.50               | 2.80            |
| 300             | 13.00               | 2.90            |
| 320             | 13.51               | 3.00            |
| 340             | 13.90               | 3.10            |
| 360             | 14.43               | 3.30            |
| 380             | 14.79               | 3.30            |
| 400             | 15.80               | 3.40            |
| 450             | 16.37               | 3.59            |
| 500             | 17.40               | 3.80            |
| 550             | 18.57               | 3.90            |
| 600             | 18.50               | 4.20            |
| 650             | 18.93               | 4.40            |
| 700             | 19.03               | 4.40            |
| 750             | 19.84               | 4.71            |
| 800             | 19.82               | 4.90            |
| 850             | 20.30               | 5.00            |
| 900             | 20.32               | 5.11            |
| 950             | 20.82               | 5.60            |
| 1000            | 21.20               | 5.50            |

## 8. List of Measuring Equipments Used

| Instrument          | Manufacturer | Model No.  | Serial No. | Characteristics  | Calibration Date | Remark                |
|---------------------|--------------|------------|------------|------------------|------------------|-----------------------|
| EMC Receiver        | R&S          | ESCS 30    | 100132     | 9 KHz – 2.75 GHz | Jun. 03, 2002    | Conduction (CO01-HY)  |
| LISN                | MessTec      | NNB-2/16Z  | 2001-008   | 9 KHz – 30 MHz   | Apr. 30, 2002    | Conduction (CO01-HY)  |
| LISN (Support Unit) | MessTec      | NNB-2/16Z  | 2001-009   | 9 KHz – 30 MHz   | Apr. 30, 2002    | Conduction (CO01-HY)  |
| EMI Filter          | LINDGREN     | LRE-2060   | 1004       | < 450 Hz         | N/A              | Conduction (CO01-HY)  |
| EMI Filter          | LINDGREN     | N6006      | 201052     | 0 ~ 60 Hz        | N/A              | Conduction (CO01-HY)  |
| Spectrum analyzer   | R&S          | FSP30      | 100024     | 9KHZ-30GHZ       | Apr. 02, 2002    | Radiation (03CH03-HY) |
| Amplifier           | HP           | 8447D      | 2944A09072 | 100KHz – 1.3GHz  | Oct. 21, 2002    | Radiation (03CH03-HY) |
| Amplifier           | MITEQ        | NSP2650-NF | 805858     | 100KHz-26.5GHz   | Jul. 11, 2002    | Radiation (03CH03-HY) |
| Bilog Antenna       | SCHAFFNER    | CBL6112B   | 2687       | 30MHz –2GHz      | Dec. 23, 2001    | Radiation (03CH03-HY) |
| Horn Antenna        | COM-POWER    | AH-118     | 10094      | 1GHz – 18GHz     | Apr. 09, 2002    | Radiation (03CH03-HY) |
| Turn Table          | HD           | DS 420     | 420/650/00 | 0 ~ 360 degree   | N/A              | Radiation (03CH03-HY) |
| Antenna Mast        | HD           | MA 240     | 240/560/00 | 1 m - 4 m        | N/A              | Radiation (03CH03-HY) |
| Horn Antenna        | COM-POWER    | AH-118     | 10094      | 1GHz – 18GHz     | Apr. 09, 2002    | Radiation             |
| Spectrum analyzer   | R&S          | FSP40      | 100004/040 | 9KHZ-40GHZ       | Aug. 07, 2002    | Radiation             |
| Amplifier           | MITEQ        | AFS44      | 879981     | 100MHz-26.5GHz   | Aug. 12, 2002    | Radiation             |

Calibration Interval of instruments listed above is one year.

## 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%<br>$U=2U_e(y)$                                                   | normal (k=2)             | ±5.4  |

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

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

### 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%<br>$U=2U_e(y)$                                                | normal (k=2)             | ±3.32          |

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