

FCC TEST REPORT

for

47 CFR, Part 15, Subpart C

Equipment : 802.11b Access Point

Model No. : ME103

FCC ID : PY3ME103

Filing Type : Certification

Applicant : NETGEAR Inc.
4500 Great America Parkwar, Santa Clara, CA 95054

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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

| | |
|--|-----------|
| History of this test report..... | ii |
| CERTIFICATE OF COMPLIANCE..... | 1 |
| 1. General Description of Equipment under Test..... | 2 |
| 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 |
| 2. Test Configuration of Equipment under Test..... | 4 |
| 2.1. Test Manner | 4 |
| 2.2. Description of Test System | 4 |
| 2.3. Connection Diagram of Test System | 6 |
| 3. Operation of Equipment under Test | 7 |
| 4. General Information of Test..... | 8 |
| 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 |
| 5. Report of Measurements and Examinations | 9 |
| 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 |
| 6. EMI Suppression Component List..... | 38 |
| 7. Antenna Factor & Cable Loss | 39 |
| 8. List of Measuring Equipments Used | 41 |
| 9. Uncertainty of Test Site | 42 |

CERTIFICATE OF COMPLIANCE

for

47 CFR, Part 15, Subpart C

Equipment : 802.11b Access Point

Model No. : ME103

FCC ID : PY3ME103

Filing Type : Certification

Applicant : **NETGEAR Inc.**

4500 Great America Parkwar, Santa Clara, CA 95054

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 Feb. 18, 2003 at **SPORTON International Inc.** LAB.



K. J. Lin
Manager

SPORTON International Inc.

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

SPORTON International Inc.

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FCC ID : PY3ME103

Page No. : 1 of 42

Issued Date : Feb. 25, 2003

1. General Description of Equipment under Test

1.1. Applicant

NETGEAR Inc.
4500 Great America Parkwar, Santa Clara, CA 95054

1.2. Manufacturer

Sercomm Corporation
10th F1., No. 19-13, Sanchung Road, Nankang, Taipei City, Taiwan 115, R.O.C.
(Nankang Software Park, Bldg. #E)

1.3. Basic Description of Equipment under Test

Equipment : 802.11b Access Point
Model No. : NE103
FCC ID : PY3ME103
Trade Name : NETGEAR
UTP Data Cable : Non-Shielded, 1m
Power Supply Type : Linear
AC Power Cord : Wall-mount, 2 pin
DC Power Cable : Non-Shielded, 1.8m, 2 pin

1.4. Feature of Equipment under Test

| | Description | Comments |
|------------------------------|---------------------------|---|
| Chipset | TI ACX100 | Mac + BB |
| Power | 12V DC/5V DC | Must interoperate with POE101 |
| Ethernet port | Single 10/100, RJ45 | Auto-MDIX |
| Wireless | 802.11b | 2.4GHz, 11 Mbps |
| Antennae | 2x2dBi detachable | |
| Ext. Antenna(e) Average gain | Min.+1dBI (+3dBi desired) | mounted with the housing, if applicable |
| Ext. Antenna(e) Average gain | Min.+2dBI (+5dBi desired) | |
| Maximum Output Power | 18dBm | |
| Antenna Type | Reverse SMA | |

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 LOGITECH PS/2 Keyboard, LOGITECH USB Mouse, ViewSonic Monitor, EPSON Printer, COMPAQ Notebook 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: 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 25000MHz.

2.2. Description of Test System

Support Unit 1. -- PS/2 Keyboard (LOGITECH)

| | |
|------------|---|
| 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 2. -- USB Mouse (LOGITECH)

| | |
|------------|---|
| 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 3. -- Monitor (VIEWSONIC)

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.

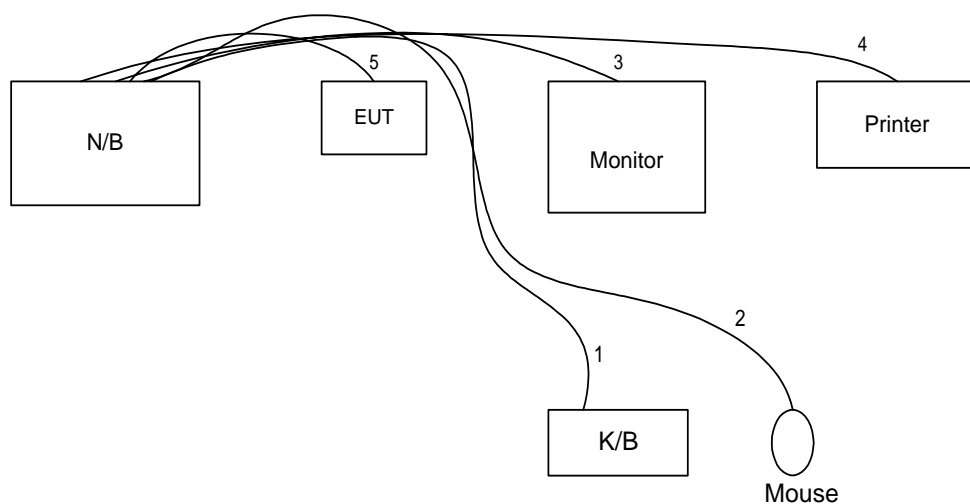
Support Unit 4. -- Printer (EPSON)

FCC ID : N/A
Model No. : STYLUS COLOR S680
Power Supply Type : Linear
Power Cord : Non-Shielded
Serial No. : SP0048
Data Cable : Braided-Shielded, 360 degree via metal backshells, 1.35m

Support Unit 5. -- Notebook (COMPAQ)

FCC ID : N/A
Model No. : Presario 1500
Power Supply Type : Switching
Power Cord : Non-Shielded
Serial No. : SP0037
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 I/O cable is connected from Notebook to the support unit 1
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 EUT to the support unit 5

3. Operation of Equipment under Test

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

The 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 modem.
- f. The PC sends " H " messages to the internal Hard Disk, and the Hard Disk reads and writes the message.
- g. Repeat the steps from **c** to **f**.

At the same time, Executed "EMI706ST" to keep transmitting signals at fixed frequency.

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 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 1.1310 2.1091 2.1093 | RF Exposure Compliance | Pass |

5.2. 6dB Bandwidth

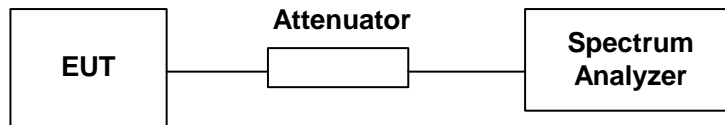
5.2.1. Measuring Instruments :

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 :

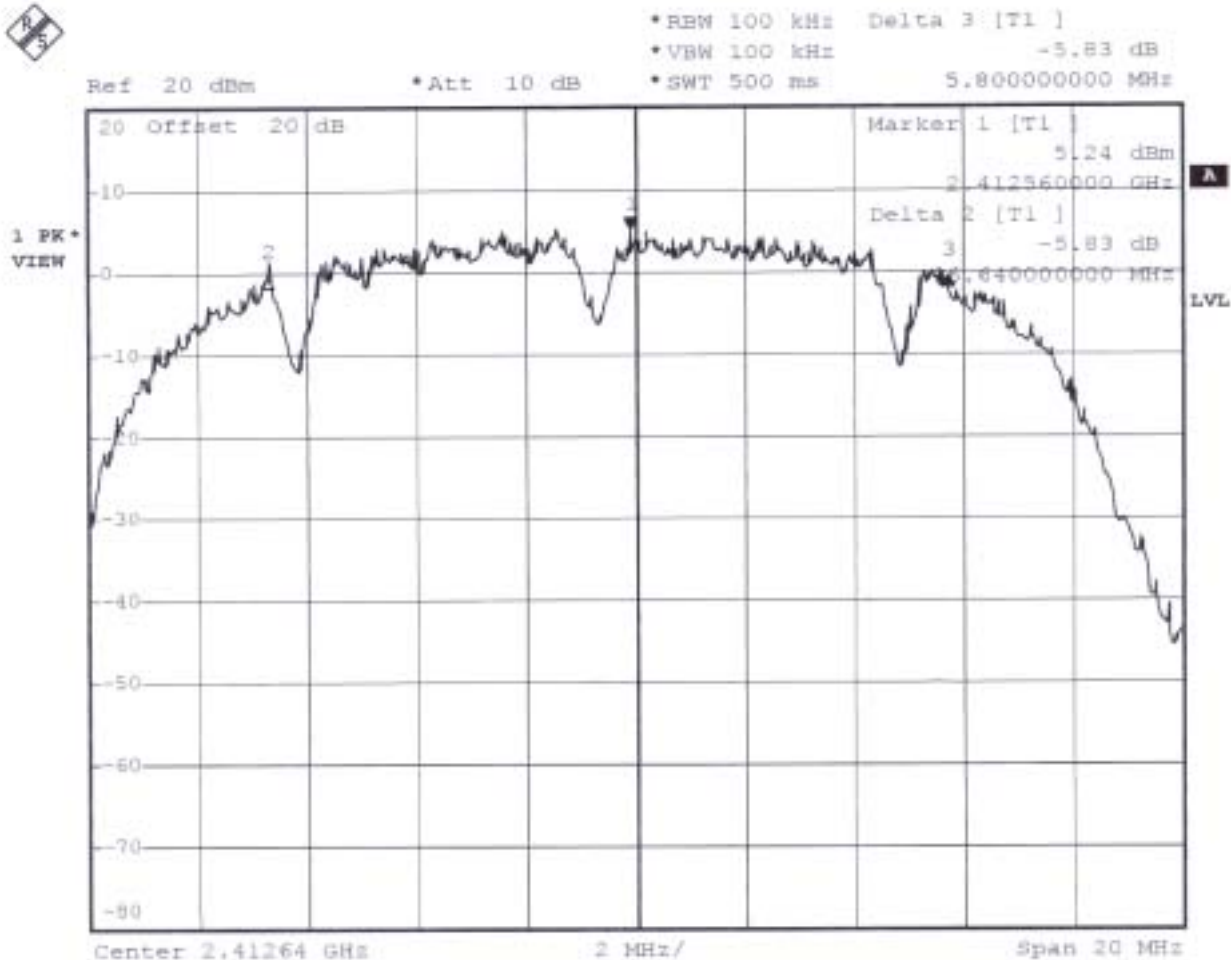


5.2.4. Test Result : The spectrum analyzer plots are attached as below

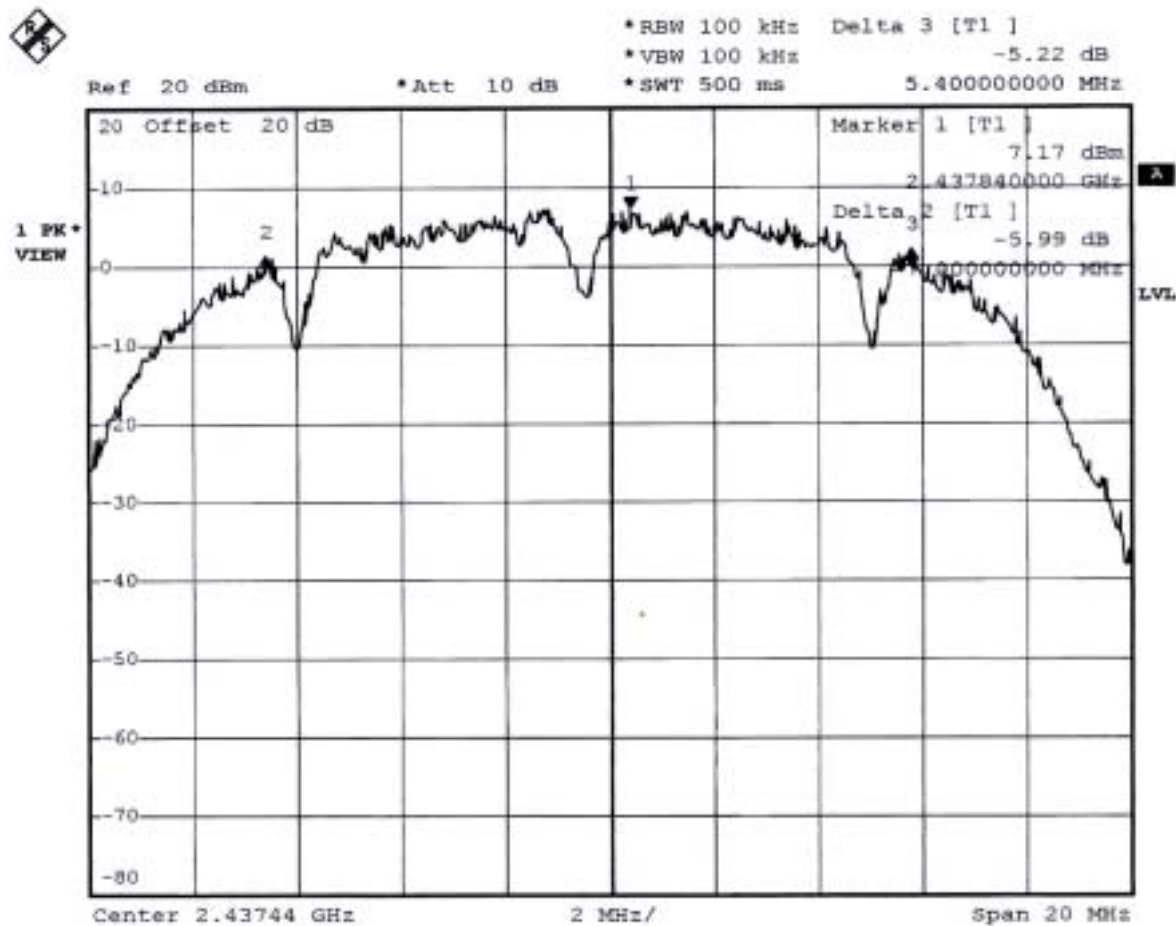
- Temperature : 25.4°C
- Relative Humidity : 56 %

| Channel | Frequency (MHz) | 6dB Emission bandwidth (MHz) | Limits (MHz) | Plot Ref. No. |
|---------|----------------------|-----------------------------------|-------------------|------------------|
| 1 | 2412 | 12.44 | 0.5 | 1 |
| 6 | 2437 | 12.40 | 0.5 | 2 |
| 11 | 2462 | 10.16 | 0.5 | 3 |

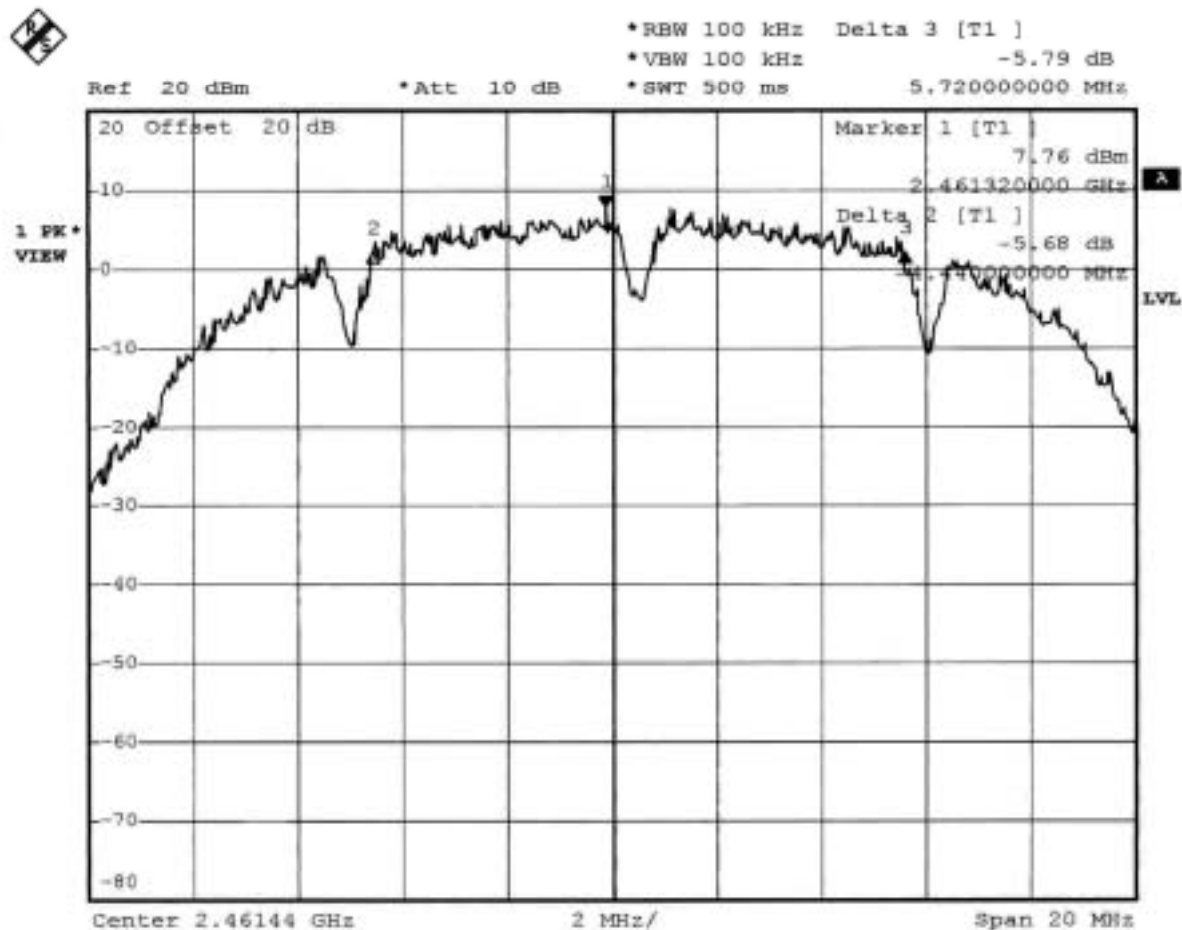
Plot1(Channel 1) :



Plot2(Channel 6) :



Plot3(Channel 11) :



Comments : 6dB Emission bandwidth>500kHz

5.3. Peak Output Power

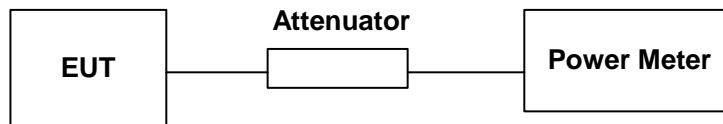
5.3.1. Measuring Instruments :

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 : 25.4 °C
- Relative Humidity : 56 %
- Antenna Gain: 2 dBi

| Channel | Frequency (MHz) | Measured Output Power (mWatt) | Measured Output Power (dBm) | Limits (Watt/dBm) |
|---------|-----------------|-------------------------------|-----------------------------|--------------------|
| 1 | 2412 | 54.20 | 17.34 | 1W/30 dBm |
| 6 | 2437 | 57.28 | 17.58 | 1W/30 dBm |
| 11 | 2462 | 59.43 | 17.74 | 1W/30 dBm |

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

5.4. Power Spectral Density

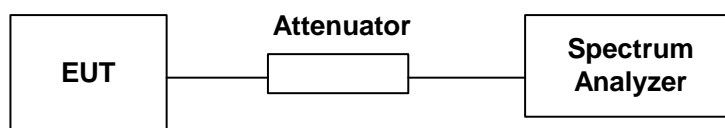
5.4.1. Measuring Instruments :

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 :

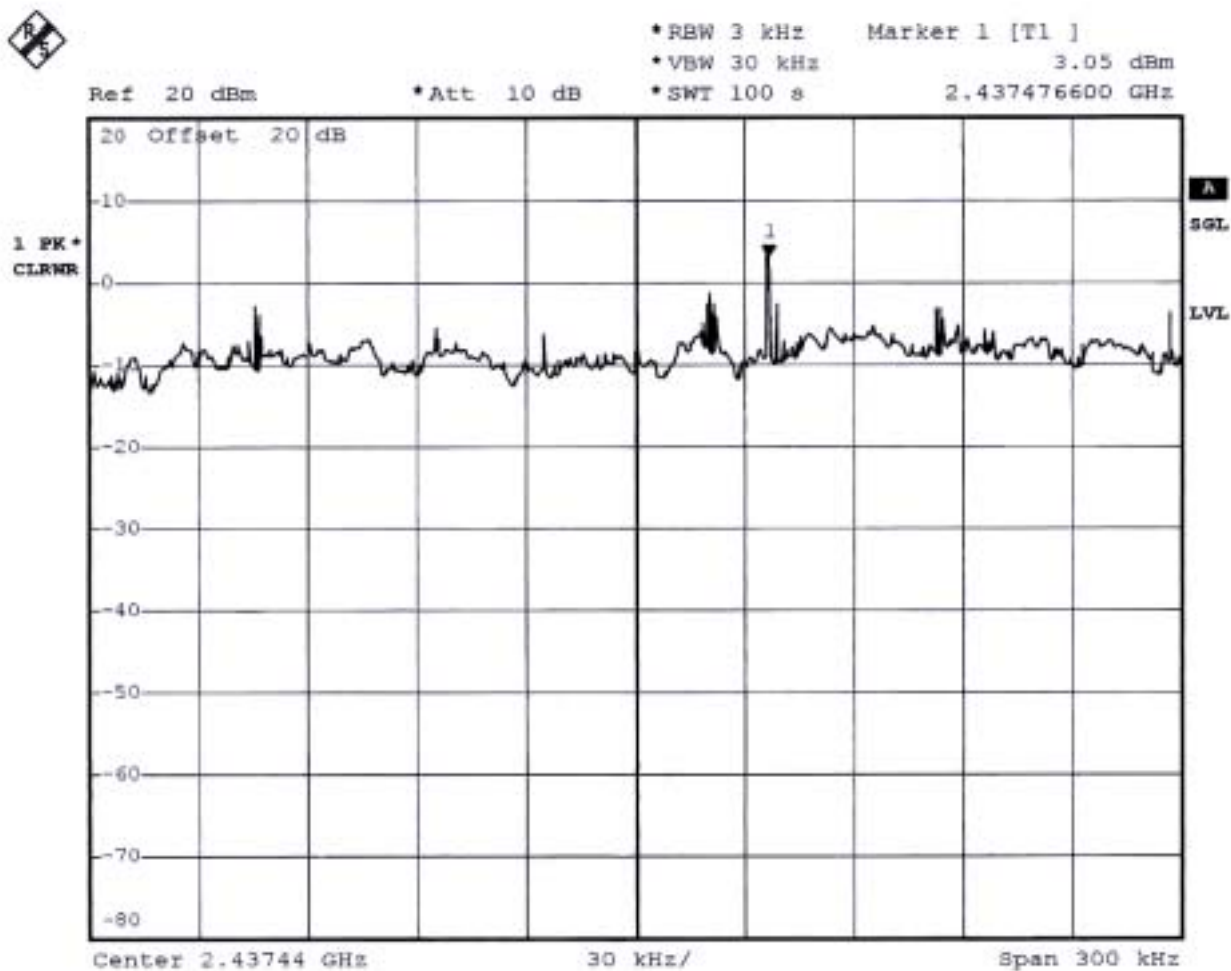


5.4.4. Test Result : See spectrum analyzer plots below

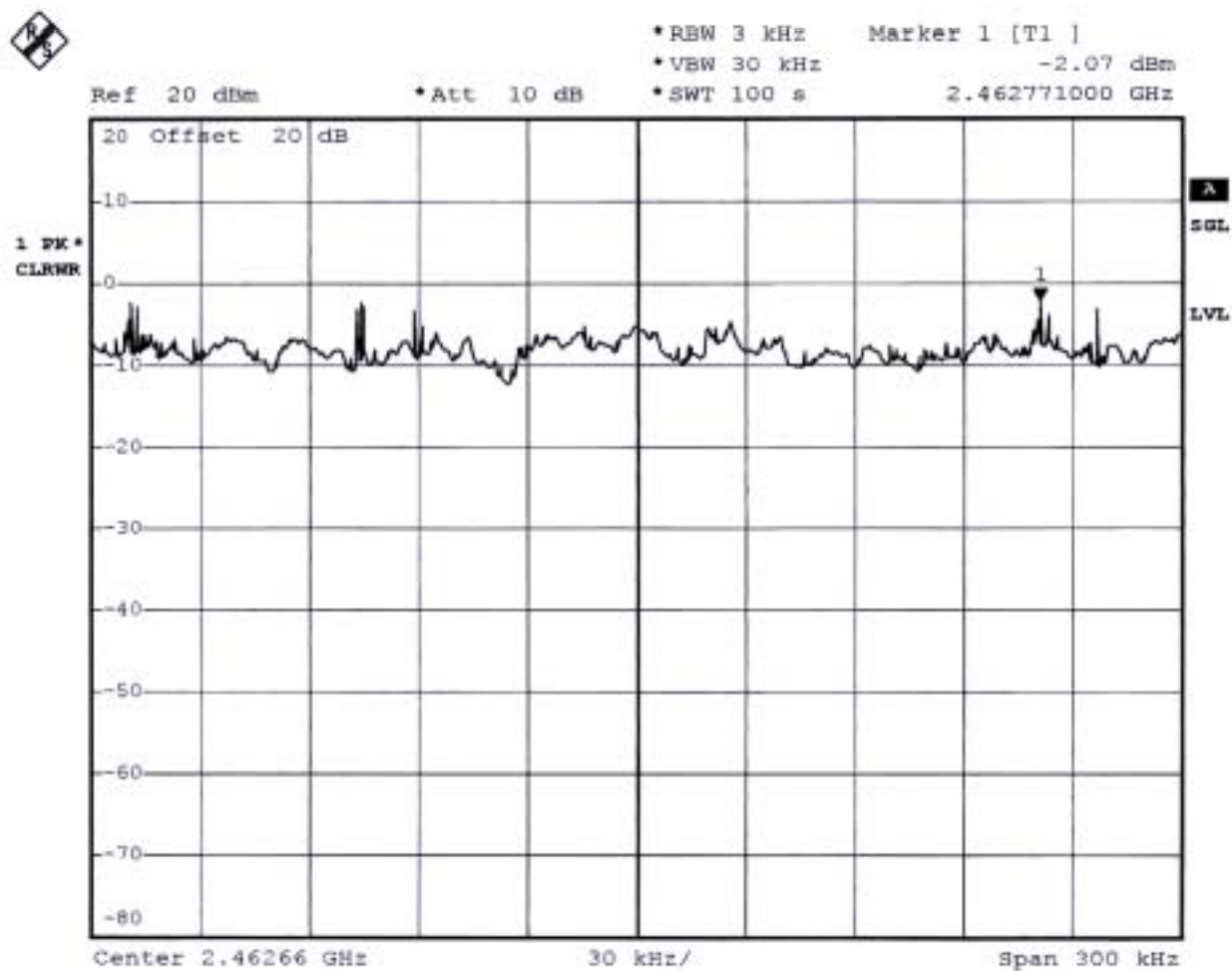
- Temperature : 25.4°C
- Relative Humidity : 56 %

| Channel | Frequency (MHz) | Power Spectral Density (dBm) | Limits (dBm) | Plot Ref. No. |
|---------|--------------------|---------------------------------|-----------------|------------------|
| 1 | 2412 | -4.29 | 8 | 1 |
| 6 | 2437 | 3.05 | 8 | 2 |
| 11 | 2462 | -2.07 | 8 | 3 |

Plot2(Channel 6):



Plot3(Channel 11):



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 :

| | |
|-----------------|---------------|
| ● 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 :

Frequency Range of Test : from 150KHz to 30 MHz

6dB Bandwidth : 9KHz

- Test Mode : Mode 1
- Temperature : 25.4°C
- Relative Humidity : 56 %
- Test Date: Feb. 18, 2003

The test was passed at the minimum margin that marked under gray area in the following table

| Frequency (MHz) | Line or Neutral | Meter Reading | | Limits | | Margin | |
|----------------------|-----------------------|------------------|------------------|------------------|------------------|----------------|----------------|
| | | Q.P. (dBuV) | A.V. (dBuV) | Q.P. (dBuV) | A.V. (dBuV) | Q.P. (dB) | A.V. (dB) |
| 0.162 | L | 45.89 | 21.55 | 65.36 | 55.36 | -19.47 | -33.81 |
| 0.187 | L | 45.62 | 18.16 | 64.17 | 54.17 | -18.55 | -36.01 |
| 0.232 | L | 42.78 | 15.72 | 62.38 | 52.38 | -19.60 | -36.66 |
| 0.299 | L | 40.64 | 14.09 | 60.27 | 50.27 | -19.63 | -36.18 |
| 0.433 | L | 39.20 | 14.02 | 57.19 | 47.19 | -17.99 | -33.17 |
| 7.610 | L | 28.34 | 23.22 | 60.00 | 50.00 | -31.66 | -26.78 |
| 0.160 | N | 45.87 | 21.24 | 65.46 | 55.46 | -19.59 | -34.22 |
| 0.184 | N | 45.80 | 17.91 | 64.30 | 54.30 | -18.50 | -36.39 |
| 0.461 | N | 38.76 | 14.82 | 56.67 | 46.67 | -17.91 | -31.85 |
| 0.486 | N | 38.36 | 13.32 | 56.24 | 46.24 | -17.88 | -32.92 |
| 0.899 | N | 29.02 | 8.31 | 56.00 | 46.00 | -26.98 | -37.69 |
| 7.770 | N | 31.41 | 25.81 | 60.00 | 50.00 | -28.59 | -24.19 |

Test Engineer :



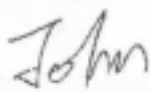
John Huang

- Test Mode : Mode 2
- Temperature : 25.4°C
- Relative Humidity : 56 %
- Test Date: Feb. 18, 2003

The test was passed at the minimum margin that marked under gray area in the following table

| Frequency (MHz) | Line or Neutral | Meter Reading | | Limits | | Margin | |
|----------------------|-----------------------|------------------|------------------|------------------|------------------|----------------|----------------|
| | | Q.P. (dBuV) | A.V. (dBuV) | Q.P. (dBuV) | A.V. (dBuV) | Q.P. (dB) | A.V. (dB) |
| 0.161 | L | 45.73 | 21.65 | 65.41 | 55.41 | -19.68 | -33.76 |
| 0.197 | L | 44.94 | 18.37 | 63.74 | 53.74 | -18.80 | -35.37 |
| 0.251 | L | 41.81 | 15.76 | 61.72 | 51.72 | -19.91 | -35.96 |
| 0.358 | L | 39.69 | 13.94 | 58.77 | 48.77 | -19.08 | -34.83 |
| 0.413 | L | 39.02 | 13.53 | 57.59 | 47.59 | -18.57 | -34.06 |
| 7.450 | L | 30.27 | 24.96 | 60.00 | 50.00 | -29.73 | -25.04 |
| 0.162 | N | 45.77 | 21.18 | 65.36 | 55.36 | -19.59 | -34.18 |
| 0.193 | N | 45.20 | 17.83 | 63.91 | 53.91 | -18.71 | -36.08 |
| 0.327 | N | 40.15 | 14.62 | 59.53 | 49.53 | -19.38 | -34.91 |
| 0.421 | N | 39.15 | 14.82 | 57.43 | 47.43 | -18.28 | -32.61 |
| 0.933 | N | 29.13 | 9.36 | 56.00 | 46.00 | -26.87 | -36.64 |
| 7.850 | N | 32.17 | 26.88 | 60.00 | 50.00 | -27.83 | -23.12 |

Test Engineer :




John Huang

- Test Mode : Mode 3
- Temperature : 25.4°C
- Relative Humidity : 56 %
- Test Date: Feb. 18, 2003

The test was passed at the minimum margin that marked under gray area in the following table

| Frequency (MHz) | Line or Neutral | Meter Reading | | Limits | | Margin | |
|----------------------|-----------------------|------------------|------------------|------------------|------------------|----------------|----------------|
| | | Q.P. (dBuV) | A.V. (dBuV) | Q.P. (dBuV) | A.V. (dBuV) | Q.P. (dB) | A.V. (dB) |
| 0.160 | L | 45.69 | 21.55 | 65.46 | 55.46 | -19.77 | -33.91 |
| 0.279 | L | 40.96 | 14.56 | 60.85 | 50.85 | -19.89 | -36.29 |
| 0.336 | L | 39.96 | 13.97 | 59.30 | 49.30 | -19.34 | -35.33 |
| 0.421 | L | 38.90 | 13.70 | 57.43 | 47.43 | -18.53 | -33.73 |
| 7.890 | L | 30.66 | 25.27 | 60.00 | 50.00 | -29.34 | -24.73 |
| 19.703 | L | 29.98 | 29.47 | 60.00 | 50.00 | -30.02 | -20.53 |
| 0.161 | N | 45.77 | 21.24 | 65.41 | 55.41 | -19.64 | -34.17 |
| 0.195 | N | 45.08 | 17.98 | 63.82 | 53.82 | -18.74 | -35.84 |
| 0.393 | N | 39.40 | 14.28 | 58.00 | 48.00 | -18.60 | -33.72 |
| 0.464 | N | 38.76 | 13.82 | 56.62 | 46.62 | -17.86 | -32.80 |
| 0.527 | N | 37.01 | 12.35 | 56.00 | 46.00 | -18.99 | -33.65 |
| 7.850 | N | 32.23 | 27.01 | 60.00 | 50.00 | -27.77 | -22.99 |

Test Engineer : 
 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 C63.4-1992. 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

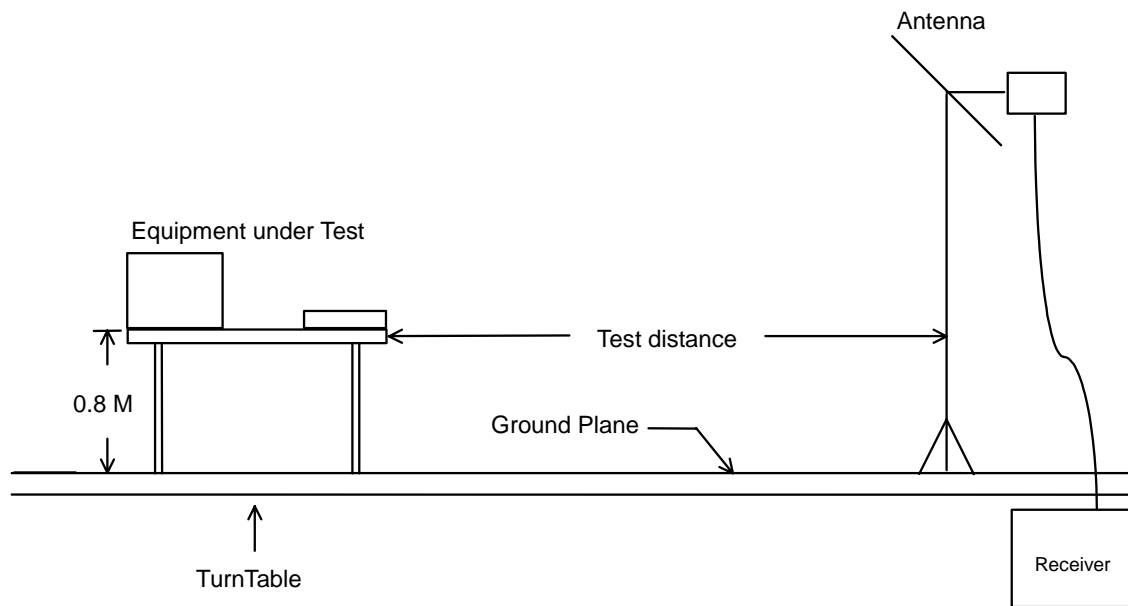
5.6.1. Major Measuring Instruments

- from 30MHz to 1GHz
 - Amplifier (HP 8447D)
 - RF Gain 30 dB
 - Signal Input 100 KHz to 1.3 GHz
 - Spectrum Analyzer (R&S FSP)
 - Attenuation 10 dB
 - Start Frequency 30 MHz
 - Stop Frequency 1000 MHz
 - Resolution Bandwidth 120 KHz
 - Signal Input 9 KHz to 7 GHz
- above 1GHz
 - Spectrum analyzer (R&S FSP40)
 - Attenuation 10 dB
 - Start Frequency 1 GHz
 - Stop Frequency 25 GHz
 - Resolution Bandwidth 1 MHz
 - Video Bandwidth 1 MHz
 - Signal Input 9 KHz to 40 GHz
 - Amplifier (MITEQ AFS44)
 - RF Gain 40 dB
 - Signal Input 100 MHz to 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.
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 (2412MHz)
- Test Distance : 3 M
- Temperature : 24 °C
- Relative Humidity : 56 %
- Test Date : Feb. 14, 2003
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 3 m, turn table degree is 359°.

- Spurious Emission
- For 30MHz to 1GHz

| Frequency (MHz) | Antenna Polarity | Cable Factor | Loss | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Level (dBuV/m) | Margin (uV/m) | Detect (dB) | Mode |
|----------------------|---------------------|-----------------|------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|------|
| 78.060 | V | 5.64 | 1.73 | 27.99 | 40.00 | 100 | 35.36 | 58.61 | -4.64 | Peak |
| 624.100 | V | 17.46 | 5.62 | 18.47 | 46.00 | 200 | 41.55 | 119.54 | -4.45 | Peak |
| 750.100 | V | 18.40 | 6.16 | 17.73 | 46.00 | 200 | 42.29 | 130.17 | -3.71 | Peak |
| 83.730 | H | 6.97 | 1.77 | 27.03 | 40.00 | 100 | 35.77 | 61.45 | -4.23 | Peak |
| 146.370 | H | 9.72 | 2.31 | 26.98 | 43.50 | 150 | 39.01 | 89.23 | -4.49 | Peak |
| 750.100 | H | 18.40 | 6.16 | 17.11 | 46.00 | 200 | 41.67 | 121.20 | -4.33 | Peak |

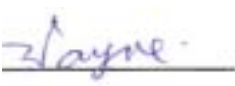
- For above 1GHz

| Frequency (MHz) | Antenna Polarity | Cable Factor | Loss | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Level (dBuV/m) | Margin (uV/m) | Detect (dB) | Mode |
|----------------------|---------------------|-----------------|------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|------|
| 2350.000 | V | 30.31 | 5.90 | 12.96 | 74.00 | 5012 | 49.17 | 287.41 | -24.83 | Peak |
| 2476.000 | V | 30.03 | 6.06 | 15.74 | 74.00 | 5012 | 51.83 | 390.39 | -22.17 | Peak |
| 2516.000 | V | 29.98 | 6.12 | 9.07 | 74.00 | 5012 | 45.17 | 181.34 | -28.83 | Peak |
| 2348.000 | H | 30.31 | 5.89 | 7.99 | 74.00 | 5012 | 44.19 | 161.99 | -29.81 | Peak |
| 2478.000 | H | 30.02 | 6.06 | 9.10 | 74.00 | 5012 | 45.18 | 181.55 | -28.82 | Peak |
| 4822.000 | H | 33.80 | 9.16 | 1.66 | 74.00 | 5012 | 44.62 | 170.22 | -29.38 | Peak |

■ Field strength of fundamental and harmonics

| Frequency (MHz) | Antenna Polarity | Cable Factor | Cable Loss | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Level (dBuV/m) | Margin (uV/m) | Detect (dB) | Mode |
|----------------------|---------------------|-----------------|---------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|----------|
| 2414.000 | H | 30.17 | 5.98 | 62.33 | - | - | 98.48 | 83946.00 | | Peak |
| 2414.000 | H | 30.17 | 5.98 | 57.30 | - | - | 93.45 | 47043.54 | | AV |
| 2412.000 | V | 30.17 | 5.98 | 57.56 | - | - | 93.71 | 48473.01 | | Peak |
| 2412.000 | V | 30.17 | 5.98 | 52.04 | - | - | 88.19 | 25674.38 | | AV |
| 4824.000 | V/H | | | | | | - | | | AV/ Peak |
| 7236.000 | V/H | | | | | | - | | | AV/ Peak |
| 9648.000 | V/H | | | | | | - | | | AV/ Peak |
| 12060.000 | V/H | | | | | | - | | | AV/ Peak |
| 14472.000 | V/H | | | | | | - | | | AV/ Peak |
| 16884.000 | V/H | | | | | | - | | | AV/ Peak |
| 19296.000 | V/H | | | | | | - | | | AV/ Peak |
| 21708.000 | V/H | | | | | | - | | | AV/ Peak |
| 24120.000 | V/H | | | | | | - | | | AV/ Peak |

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 : 24 °C
- Relative Humidity : 56 %
- Test Date : Feb. 14, 2003
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 3 m, turn table degree is 359°.

■ Spurious Emission

- For 30MHz to 1GHz

| Frequency (MHz) | Antenna Polarity | Cable Factor (dB/m) | Loss (dB) | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Level (dBuV/m) | Margin (uV/m) | Detect (dB) | Mode |
|----------------------|---------------------|-----------------------------|----------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|------|
| 78.060 | V | 5.64 | 1.73 | 28.11 | 40.00 | 100 | 35.48 | 59.43 | -4.52 | Peak |
| 696.900 | V | 17.98 | 5.93 | 16.66 | 46.00 | 200 | 40.57 | 106.78 | -5.43 | Peak |
| 750.100 | V | 18.40 | 6.16 | 17.69 | 46.00 | 200 | 42.25 | 129.57 | -3.75 | Peak |
| 83.730 | H | 6.97 | 1.77 | 26.95 | 40.00 | 100 | 35.69 | 60.88 | -4.31 | Peak |
| 147.180 | H | 9.65 | 2.32 | 26.05 | 43.50 | 150 | 38.02 | 79.62 | -5.48 | Peak |
| 750.100 | H | 18.40 | 6.16 | 17.21 | 46.00 | 200 | 41.77 | 122.60 | -4.23 | Peak |

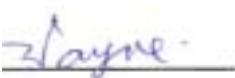
- For above 1GHz

| Frequency (MHz) | Antenna Polarity | Cable Factor (dB/m) | Loss (dB) | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Level (dBuV/m) | Margin (uV/m) | Detect (dB) | Mode |
|----------------------|---------------------|-----------------------------|----------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|------|
| 2374.000 | V | 30.26 | 5.93 | 10.52 | 74.00 | 5012 | 46.71 | 216.52 | -27.29 | Peak |
| 2500.000 | V | 29.99 | 6.09 | 14.63 | 74.00 | 5012 | 50.71 | 343.16 | -23.29 | Peak |
| 2534.000 | V | 29.96 | 6.15 | 5.49 | 74.00 | 5012 | 41.60 | 120.23 | -32.40 | Peak |
| 1446.000 | H | 27.05 | 4.58 | 9.11 | 74.00 | 5012 | 40.74 | 108.89 | -33.26 | Peak |
| 2388.000 | H | 30.22 | 5.94 | 7.65 | 74.00 | 5012 | 43.81 | 155.06 | -30.19 | Peak |
| 2510.000 | H | 29.98 | 6.11 | 6.85 | 74.00 | 5012 | 42.94 | 140.28 | -31.06 | Peak |

■ Field strength of fundamental and harmonics

| Frequency (MHz) | Antenna Polarity | Cable Factor | Cable Loss | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Level (dBuV/m) | Margin (uV/m) | Detect (dB) | Mode |
|----------------------|---------------------|-----------------|---------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|----------|
| 2436.000 | H | 30.12 | 6.01 | 62.69 | - | - | 98.82 | 87297.14 | | Peak |
| 2436.000 | H | 30.12 | 6.01 | 57.45 | - | - | 93.58 | 47752.93 | | AV |
| 2436.000 | V | 30.12 | 6.01 | 56.48 | - | - | 92.61 | 42707.09 | | Peak |
| 2436.000 | V | 30.12 | 6.01 | 51.06 | - | - | 87.19 | 22882.32 | | AV |
| 4874.000 | V/H | | | | | | - | | | AV/ Peak |
| 7311.000 | V/H | | | | | | - | | | AV/ Peak |
| 9748.000 | V/H | | | | | | - | | | AV/ Peak |
| 12185.000 | V/H | | | | | | - | | | AV/ Peak |
| 14472.000 | V/H | | | | | | - | | | AV/ Peak |
| 14622.000 | V/H | | | | | | - | | | AV/ Peak |
| 17059.000 | V/H | | | | | | - | | | AV/ Peak |
| 19496.000 | V/H | | | | | | - | | | AV/ Peak |
| 21933.000 | V/H | | | | | | - | | | AV/ Peak |
| 24370.000 | V/H | | | | | | - | | | AV/ Peak |

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 : 24 °C
- Relative Humidity : 56 %
- Test Date : Feb. 14, 2003
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Antenna Factor + Cable Loss + Reading = Emission

The test was passed at the minimum margin that marked under gray area in the following table, and its antenna height is 3 m, turn table degree is 359°.

■ Spurious Emission

- For 30MHz to 1GHz

| Frequency (MHz) | Antenna Polarity | Antenna Factor (dB/m) | Cable Loss (dB) | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Emission (dBuV/m) | Level (uV/m) | Margin (dB) | Detect Mode |
|----------------------|---------------------|-------------------------------|-------------------------|---------------------|----------------------|----------------------|------------------------|-------------------|------------------|----------------|
| 78.060 | V | 5.64 | 1.73 | 27.86 | 40.00 | 100 | 35.23 | 57.74 | -4.77 | Peak |
| 99.390 | V | 9.36 | 1.90 | 26.29 | 43.50 | 150 | 37.55 | 75.42 | -5.95 | Peak |
| 144.210 | V | 9.91 | 2.29 | 25.49 | 43.50 | 150 | 37.69 | 76.65 | -5.81 | Peak |
| 83.730 | H | 6.97 | 1.77 | 27.03 | 40.00 | 100 | 35.77 | 61.45 | -4.23 | Peak |
| 89.940 | H | 8.76 | 1.83 | 27.19 | 43.50 | 150 | 37.78 | 77.45 | -5.72 | Peak |
| 145.020 | H | 9.83 | 2.30 | 25.89 | 43.50 | 150 | 38.02 | 79.62 | -5.48 | Peak |

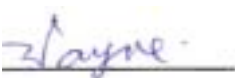
- For above 1GHz

| Frequency (MHz) | Antenna Polarity | Antenna Factor (dB/m) | Cable Loss (dB) | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Emission (dBuV/m) | Level (uV/m) | Margin (dB) | Detect Mode |
|----------------------|---------------------|-------------------------------|-------------------------|---------------------|----------------------|----------------------|------------------------|-------------------|------------------|----------------|
| 1588.000 | V | 27.08 | 4.80 | 7.48 | 74.00 | 5012 | 39.36 | 92.90 | -34.64 | Peak |
| 2396.000 | V | 30.21 | 5.96 | 12.15 | 74.00 | 5012 | 48.32 | 260.62 | -25.68 | Peak |
| 2524.000 | V | 29.97 | 6.14 | 13.79 | 74.00 | 5012 | 49.90 | 312.61 | -24.10 | Peak |
| 1558.000 | H | 27.12 | 4.75 | 6.52 | 74.00 | 5012 | 38.39 | 83.08 | -35.61 | Peak |
| 4772.000 | H | 33.68 | 9.14 | 0.08 | 74.00 | 5012 | 42.90 | 139.64 | -31.10 | Peak |

■ Field strength of fundamental and harmonics

| Frequency (MHz) | Antenna Polarity | Cable Factor | Cable Loss | Reading (dBuV) | Limits (dBuV/m) | Emission (uV/m) | Level (dBuV/m) | Margin (uV/m) | Detect (dB) | Mode |
|----------------------|---------------------|-----------------|---------------|---------------------|----------------------|----------------------|---------------------|--------------------|------------------|----------|
| 2460.000 | H | 30.06 | 6.04 | 55.79 | - | - | 91.89 | 39309.72 | | Peak |
| 2460.000 | H | 30.06 | 6.04 | 51.04 | - | - | 87.14 | 22750.97 | | AV |
| 2462.000 | V | 30.06 | 6.04 | 63.69 | - | - | 99.79 | 97611.28 | | Peak |
| 2462.000 | V | 30.06 | 6.04 | 57.39 | - | - | 93.49 | 47260.68 | | AV |
| 4924.000 | V/H | | | | | | - | | | AV/ Peak |
| 7386.000 | V/H | | | | | | - | | | AV/ Peak |
| 9848.000 | V/H | | | | | | - | | | AV/ Peak |
| 12310.000 | V/H | | | | | | - | | | AV/ Peak |
| 14772.000 | V/H | | | | | | - | | | AV/ Peak |
| 16884.000 | V/H | | | | | | - | | | AV/ Peak |
| 17234.000 | V/H | | | | | | - | | | AV/ Peak |
| 19696.000 | V/H | | | | | | - | | | AV/ Peak |
| 22158.000 | V/H | | | | | | - | | | AV/ Peak |
| 24620.000 | V/H | | | | | | - | | | AV/ Peak |

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

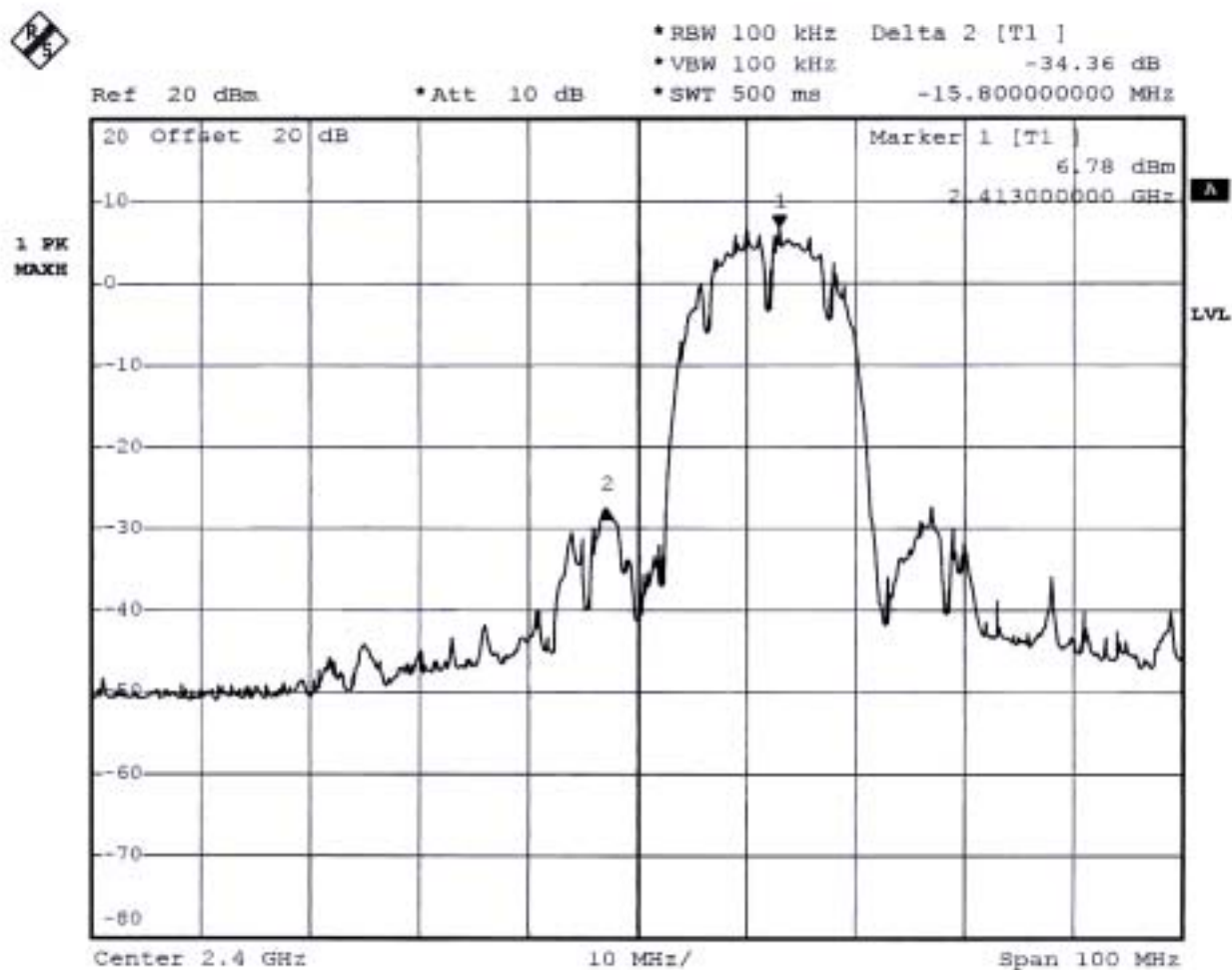
The band edge emission plot on page 34. shows 40.44dB delta between carrier maximum power and local maximum emission in the restricted band (2.4835GHz).

| 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 |
|----------|---|--|----------------------|-------------|---------|
| V | 99.79 | 59.35 | 74.00 | -14.65 | Peak |
| V | 93.49 | 53.05 | 54.00 | -0.95 | Average |
| H | 91.89 | 51.45 | 74.00 | -22.55 | Peak |
| H | 87.14 | 46.70 | 54.00 | -7.30 | Average |

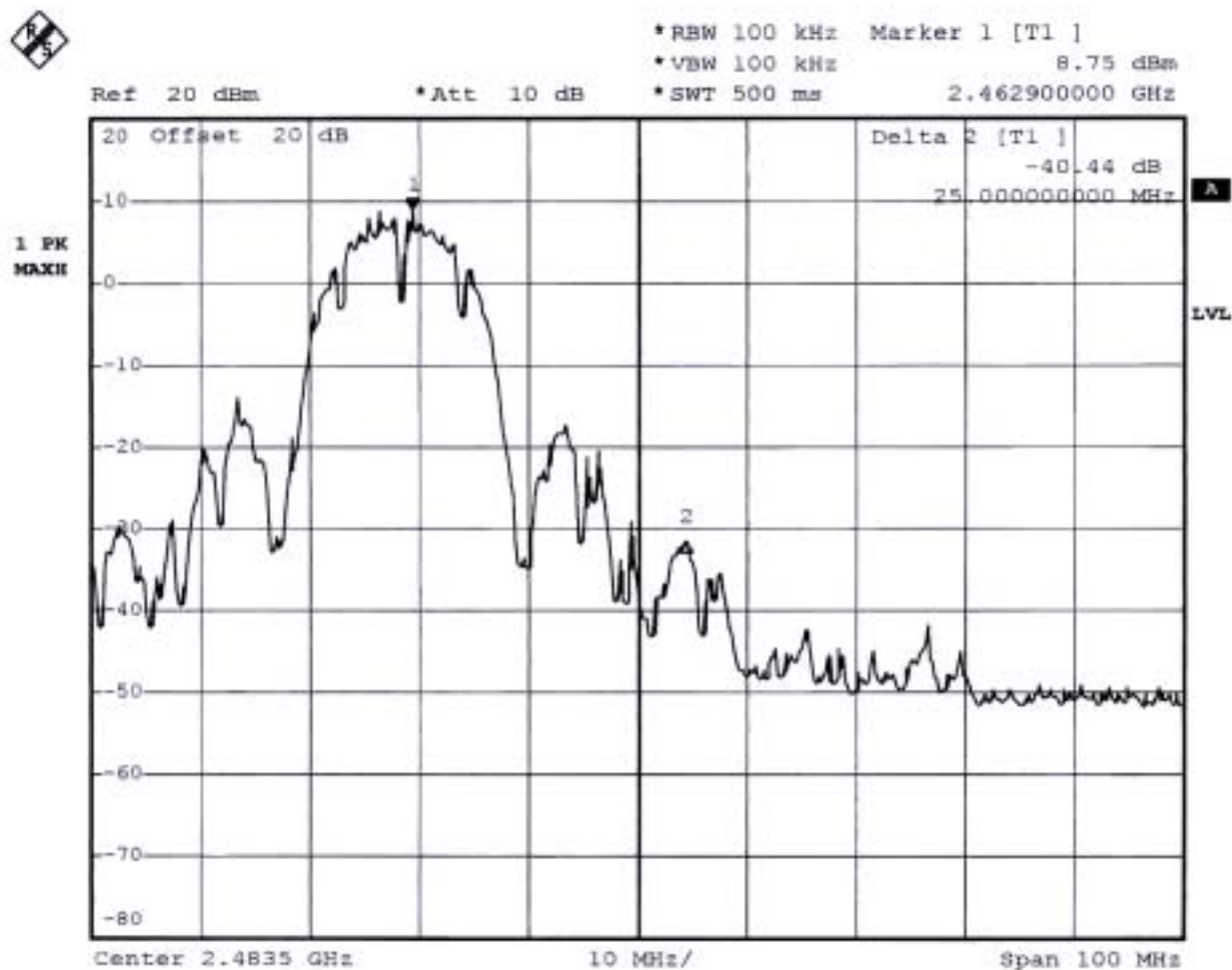
* The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

The spectrum analyzer plots are attached as below :

Plot1 (Channel 1) :



Plot2 (Channel 11) :



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

5.8. Antenna Requirements

The EUT use a detachable antenna via Reverse SMA 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 Reverse SMA.

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 ²) | Averaging Time E ² , H ² 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 ²) | Averaging Time E ² , H ² 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

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

- 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/cm². We can change the formula to:

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

| Channel No. | Gain (dBi) | Gain Numeric | Peak Output Power (mW) | Calculated RF Exposure Separation Distance (cm) | Minimum RF Exposure Separation Distance (cm) |
|-------------|-------------|--------------|--------------------------|---|--|
| Channel 1 | 2 | 1.58 | 54.20 | 0.83 | 20 |
| Channel 6 | 2 | 1.58 | 57.28 | 0.85 | 20 |
| Channel 11 | 2 | 1.58 | 59.43 | 0.87 | 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

No EMI suppression components.

7. Antenna Factor & Cable Loss

- from 30MHz to 1GHz

| Frequency (MHz) | Antenna Factor (dB) | Cable Loss (dB) |
|-----------------|---------------------|-----------------|
| 30 | 15.35 | 1.00 |
| 35 | 13.63 | 1.08 |
| 40 | 11.11 | 1.18 |
| 45 | 10.59 | 1.24 |
| 50 | 6.47 | 1.30 |
| 55 | 5.83 | 1.38 |
| 60 | 5.18 | 1.44 |
| 65 | 4.81 | 1.52 |
| 70 | 4.43 | 1.59 |
| 75 | 5.10 | 1.68 |
| 80 | 5.91 | 1.75 |
| 85 | 7.33 | 1.77 |
| 90 | 8.74 | 1.83 |
| 95 | 9.05 | 1.85 |
| 100 | 9.36 | 1.90 |
| 110 | 9.65 | 2.01 |
| 120 | 9.97 | 2.06 |
| 130 | 10.51 | 2.16 |
| 140 | 10.32 | 2.24 |
| 150 | 9.42 | 2.34 |
| 160 | 8.09 | 2.42 |
| 170 | 7.43 | 2.56 |
| 180 | 7.60 | 2.62 |
| 190 | 7.43 | 2.67 |
| 200 | 7.26 | 2.76 |
| 220 | 9.11 | 2.92 |
| 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 |

- above 5GHz

| Frequency (MHz) | Antenna Factor (dB) | Cable Loss (dB) |
|-----------------|---------------------|-----------------|
| 1000 | 24.30 | 3.28 |
| 2000 | 31.10 | 4.69 |
| 3000 | 29.60 | 5.84 |
| 4000 | 30.80 | 6.87 |
| 5000 | 34.20 | 7.53 |
| 6000 | 33.30 | 8.60 |
| 7000 | 37.80 | 9.33 |
| 8000 | 39.40 | 9.84 |
| 9000 | 38.40 | 10.67 |
| 10000 | 38.90 | 11.20 |
| 11000 | 41.10 | 12.11 |
| 12000 | 42.70 | 12.37 |
| 13000 | 43.90 | 12.62 |

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 | FSP40 | 100004/040 | 9KHZ-40GHZ | Aug. 07, 2002 | Radiation (03CH03-HY) |
| Amplifier | HP | 8447D | 2944A09072 | 100KHz – 1.3GHz | Oct. 21, 2002 | Radiation (03CH03-HY) |
| Bilog Antenna | SCHAFFNER | CBL6112B | 2687 | 30MHz –2GHz | Dec. 21, 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) |
| Half-wave dipole antenna | R&S | HZ12 HZ13 | 83924403 83924503 | 30MHz - 1GHz | Sep. 23, 2002 | 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 Receiver VSWR $\Gamma_1=0.09$ Antenna VSWR $\Gamma_2=0.67$ 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 Receiver VSWR $\Gamma_1=0.09$ LISN VSWR $\Gamma_2=0.33$ 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 |

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