## 2.5. Test Result of Conducted Emission

Product : Wireless LAN PC Card
Test Item : Conducted Emission Test
Test Mode : Transmit (11Mbps)

| Frequency | Cable Loss | LISN Factor | Reading Level | Emission Level | Limits |
|---|---|---|---|---|---|
| MHz | dB | dB | dBuV | dBuV | dBuV |
| **Line 1** | | | | | |
| **Quasi-Peak:** | | | | | |
| 0.466 | 0.06 | 0.21 | 28.95 | 29.22 | 48.00 |
| 0.665 | 0.08 | 0.24 | 30.61 | 30.93 | 48.00 |
| 1.329 | 0.12 | 0.31 | 27.59 | 28.01 | 48.00 |
| * 4.451 | 0.19 | 0.42 | 34.59 | 35.20 | 48.00 |
| 15.478 | 0.33 | 0.54 | 26.75 | 27.61 | 48.00 |
| 24.575 | 0.38 | 0.58 | 26.41 | 27.37 | 48.00 |
| **Line 2** | | | | | |
| **Quasi-Peak:** | | | | | |
| 0.466 | 0.06 | 0.21 | 29.97 | 30.24 | 48.00 |
| 1.196 | 0.11 | 0.30 | 30.69 | 31.10 | 48.00 |
| * 1.462 | 0.12 | 0.32 | 32.13 | 32.57 | 48.00 |
| 4.251 | 0.19 | 0.42 | 31.95 | 32.56 | 48.00 |
| 9.831 | 0.28 | 0.49 | 24.03 | 24.80 | 48.00 |
| 16.277 | 0.33 | 0.54 | 26.11 | 26.98 | 48.00 |

Note:

1. All Reading Levels are Quasi-Peak value.
2. " * ", means this data is the worst emission level.
3. Emission Level = Reading Level + LISN Factor + Cable loss

# 3. Peak Power Output

## 3.1. Test Equipment

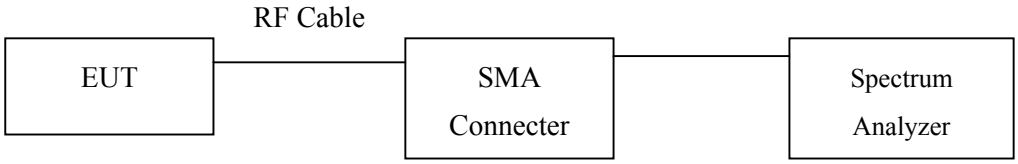
The following test equipments are used during the radiated emission tests:

| | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|
| X | Spectrum Analyzer | Advantest | R3272 / 72421194 | May, 2001 |

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

## 3.2. Test Setup

**Conduction Power Measurement**




## 3.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

## 3.4. Minimum Standard

The maximum peak power shall be less 1 Watt.

## 3.5. Test Result of Peak Power Output

Product : Wireless LAN PC Card
Test Item : Peak Power Output Data
Test Site : No.1 OATS
Test Mode : Transmit

**Data Speed: 1Mbps**

| Channel No. | Frequency (MHz) | Measurement | Required Limit | Result |
|---|---|---|---|---|
| 1 | 2412 | 19.8 dBm | 1Watt= 30 dBm | Pass |
| 6 | 2437 | 19.4 dBm | 1Watt= 30 dBm | Pass |
| 11 | 2462 | 19.7 dBm | 1Watt= 30 dBm | Pass |

**Data Speed: 11Mbps**

| Channel No. | Frequency (MHz) | Measurement | Required Limit | Result |
|---|---|---|---|---|
| 1 | 2412 | 22.7dBm | 1Watt= 30 dBm | Pass |
| 6 | 2437 | 19.6dBm | 1Watt= 30 dBm | Pass |
| 11 | 2462 | 19.7 dBm | 1Watt= 30 dBm | Pass |

# 4. RF Exposure Evaluation

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)
LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density ($mW/cm^2$) | Average Time (Minutes) |
|---|---|---|---|---|
| (A) Limits for Occupational/ Control Exposures | | | | |
| 300-1500 | -- | -- | F/300 | 6 |
| 1500-100,000 | -- | -- | 5 | 6 |
| (B) Limits for General Population/ Uncontrolled Exposures | | | | |
| 300-1500 | -- | -- | F/1500 | 6 |
| 1500-100,000 | -- | -- | 1 | 30 |

F= Frequency in MHz

## 4.1. Friis Formula

Friis transmission formula: $Pd = (Pout*G)/(4*pi*r^2)$

Where
Pd = power density in $mW/cm^2$
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
R = distance between observation point and center of the radiator in cm

Pd id the limit of MPE, 1 $mW/cm^2$ . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

## 4.2. EUT Operation condition

A software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

## 4.3. Test Result of RF Exposure Evaluation

Product : Wireless LAN PC Card
Test Item : RF Exposure Evaluation Data
Test Site : No.1 OATS
Test Mode : Transmit

### 4.3.1 Antenna Gain

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.6dBi or 1.45in linear scale.

### 4.3.2 Output Power Into Antenna & RF Exposure Evaluation Distance

| Channel | Channel Frequency (MHz) | Output Power to Antenna (dBm) | Minimum Allowable Distance ® From Skin(cm) |
|---|---|---|---|
| 1 (1Mbps) | 2412 | 19.8 | 2.47 |
| 1 (11Mbps) | 2412 | 22.7 | 3.45 |
| 6 (1Mbps) | 2437 | 19.4 | 2.35 |
| 6 (11Mbps) | 2437 | 19.6 | 2.41 |
| 11 (1Mbps) | 2462 | 19.7 | 2.43 |
| 11 (11Mbps) | 2462 | 19.7 | 2.43 |

The distance r (4$^{th}$ column) calculated from the Friis transmission formula is far shorter than 20 cm separation requirement. So, RF exposure limit warning or SAR test are not required.

# 5. Radiated Emission

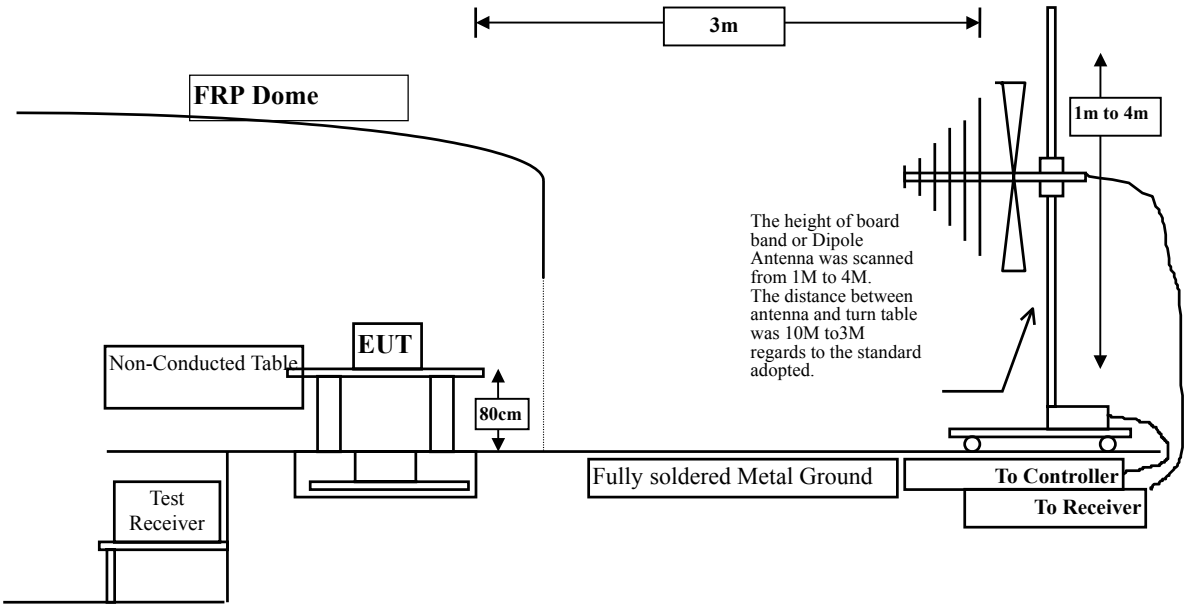
## 5.1. Test Equipment

The following test equipment are used during the radiated emission test:

| Test Site | | Equipment | Manufacturer | Model No./Serial No. | Last Cal. |
|---|---|---|---|---|---|
| Site # 1 | X | Test Receiver | R & S | ESCS 30 / 825442/14 | May, 2001 |
| | X | Spectrum Analyzer | Advantest | R3261C / 71720140 | May, 2001 |
| | X | Pre-Amplifier | HP | 8447D/3307A01812 | May, 2001 |
| | X | Bilog Antenna | Chase | CBL6112B / 12452 | Sep., 2001 |
| | X | Horn Antenna | EM | EM6917 / 103325 | May, 2001 |
| Site # 2 | | Test Receiver | R & S | ESCS 30 / 825442/17 | May, 2001 |
| | | Spectrum Analyzer | Advantest | R3261C / 71720609 | May, 2001 |
| | | Pre-Amplifier | HP | 8447D/3307A01814 | May, 2001 |
| | | Bilog Antenna | Chase | CBL6112B / 2455 | Sep., 2001 |
| | | Horn Antenna | EM | EM6917 / 103325 | May, 2001 |

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

## 5.2. Test Setup




Spurious Emissions
(Band Edge Antenna Radiated)

## 5.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

## 5.4. Limits

➢ **General Radiated Emission Limits**

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

| Frequency MHz | 15.209 Limits (dBuV/m @3m) |
|---|---|
| 30-88 | 40 |
| 88-216 | 43.5 |
| 216-960 | 46 |
| Above 960 | 54 |

Remarks : 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

2. In the Above Table, the tighter limit applies at the band edges.

3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

## 5.5. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:1992 on radiated measurement.
The additional latch filter below 1GHz was used to measure the level of harmonics radiated emission during field dtrength of harmonics measurement.
The bandwidth below 1GHz setting on the field strength meter (R&S Test Receiver ESCS 30 )is 120 kHz, above 1GHz are 1 MHz.
The frequency range from 30MHz to 10th harminics is checked.

## 5.6. Test Result of Radiated Emission

Product : Wireless LAN PC Card
Test Item : Harmonic Radiated Emission Data
Test Mode : Transmit Channel 1(1Mbps)

| Freq. | Cable Loss | Probe Factor | PreAMP | Reading Level | Emission Level | Margin | Limit |
|---|---|---|---|---|---|---|---|
| MHz | dB | dB/m | dB | dBuV | dBuV/m | dB | dBuV/m |
| **Peak Detector (Horizontal)** | | | | | | | |
| 4823.950 | 6.27 | 33.50 | 0.00 | 20.26 | 60.03 | 13.97 | 74.00 |
| 7236.250 | 8.32 | 36.24 | 0.00 | 18.01 | <62.57 | 11.43 | 74.00 |
| 9647.450 | 10.18 | 37.43 | 0.00 | 17.90 | <65.51 | 8.49 | 74.00 |
| **Average Detector (Horizontal)** | | | | | | | |
| 4823.950 | 6.27 | 33.50 | 0.00 | 6.52 | 46.29 | 7.71 | 54.00 |
| 7236.450 | 8.32 | 36.24 | 0.00 | 5.61 | <50.17 | 3.83 | 54.00 |
| 9647.850 | 10.18 | 37.43 | 0.00 | 4.88 | <52.49 | 1.51 | 54.00 |
| **Peak Detector (Vertical)** | | | | | | | |
| 4823.950 | 6.27 | 33.50 | 0.00 | 19.92 | 59.69 | 14.31 | 74.00 |
| 7236.250 | 8.32 | 36.24 | 0.00 | 18.82 | <63.38 | 10.62 | 74.00 |
| 9647.250 | 10.18 | 37.43 | 0.00 | 18.25 | <65.86 | 8.14 | 74.00 |
| **Average Detector (Vertical)** | | | | | | | |
| 4823.950 | 6.27 | 33.50 | 0.00 | 6.16 | 45.93 | 8.07 | 54.00 |
| 7236.250 | 8.32 | 36.24 | 0.00 | 5.26 | <49.82 | 4.18 | 54.00 |
| 9647.250 | 10.18 | 37.43 | 0.00 | 3.45 | <51.06 | 2.94 | 54.00 |

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Emission Level = Reading Level + Probe Factor + Cable loss.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Wireless LAN PC Card
Test Item : Harmonic Radiated Emission Data
Test Mode : Transmit Channel 6(1Mbps)

| Freq. MHz | Cable Loss dB | Probe Factor dB/m | PreAMP dB | Reading Level dBuV | Emission Level dBuV/m | Margin dB | Limit dBuV/m |
|---|---|---|---|---|---|---|---|
| **Peak Detector (Horizontal)** | | | | | | | |
| 4874.150 | 6.32 | 33.56 | 0.00 | 20.47 | 60.35 | 13.65 | 74.00 |
| 7311.950 | 8.38 | 36.31 | 0.00 | 18.28 | <62.96 | 11.04 | 74.00 |
| 9748.050 | 10.24 | 37.45 | 0.00 | 18.65 | <66.34 | 7.66 | 74.00 |
| **Average Detector (Horizontal)** | | | | | | | |
| 4874.340 | 6.32 | 33.56 | 0.00 | 6.17 | 46.05 | 7.95 | 54.00 |
| 7311.900 | 8.38 | 36.31 | 0.00 | 5.58 | <50.26 | 3.74 | 54.00 |
| 9748.010 | 10.24 | 37.45 | 0.00 | 3.90 | <51.59 | 2.41 | 54.00 |
| **Peak Detector (Vertical)** | | | | | | | |
| 4874.650 | 6.32 | 33.56 | 0.00 | 19.29 | 59.17 | 14.83 | 74.00 |
| 7311.450 | 8.38 | 36.31 | 0.00 | 17.90 | <62.58 | 11.42 | 74.00 |
| 9748.150 | 10.24 | 37.45 | 0.00 | 18.12 | <65.81 | 8.19 | 74.00 |
| **Average Detector (Vertical)** | | | | | | | |
| 4874.450 | 6.32 | 33.56 | 0.00 | 6.61 | 46.49 | 7.51 | 54.00 |
| 7311.410 | 8.38 | 36.31 | 0.00 | 5.89 | <50.57 | 3.43 | 54.00 |
| 9748.320 | 10.24 | 37.45 | 0.00 | 4.02 | <51.71 | 2.29 | 54.00 |

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Emission Level = Reading Level + Probe Factor + Cable loss.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Wireless LAN PC Card
Test Item : Harmonic Radiated Emission Data
Test Mode : Transmit Channel 11(1Mbps)

| Freq. MHz | Cable Loss dB | Probe Factor dB/m | PreAMP dB | Reading Level dBuV | Emission Level dBuV/m | Margin dB | Limit dBuV/m |
|---|---|---|---|---|---|---|---|
| **Peak Detector (Horizontal)** | | | | | | | |
| 4924.050 | 6.37 | 33.62 | 0.00 | 19.53 | 59.52 | 14.48 | 74.00 |
| 7385.550 | 8.43 | 36.37 | 0.00 | 18.25 | <63.06 | 10.94 | 74.00 |
| 9849.850 | 10.33 | 37.47 | 0.00 | 17.38 | <65.18 | 8.82 | 74.00 |
| **Average Detector (Horizontal)** | | | | | | | |
| 4924.010 | 6.37 | 33.62 | 0.00 | 6.23 | 46.22 | 7.78 | 54.00 |
| 7385.250 | 8.43 | 36.37 | 0.00 | 5.85 | <50.66 | 3.34 | 54.00 |
| 9849.270 | 10.33 | 37.47 | 0.00 | 4.20 | <52.00 | 2.00 | 54.00 |
| **Peak Detector (Vertical)** | | | | | | | |
| 4924.850 | 6.37 | 33.62 | 0.00 | 19.93 | 59.92 | 14.08 | 74.00 |
| 7388.150 | 8.45 | 36.39 | 0.00 | 18.06 | <62.90 | 11.10 | 74.00 |
| 9850.050 | 10.33 | 37.47 | 0.00 | 19.01 | <66.81 | 7.19 | 74.00 |
| **Average Detector (Vertical)** | | | | | | | |
| 4924.840 | 6.37 | 33.62 | 0.00 | 6.24 | 46.23 | 7.77 | 54.00 |
| 7388.080 | 8.45 | 36.39 | 0.00 | 5.42 | <50.26 | 3.74 | 54.00 |
| 9850.080 | 10.33 | 37.47 | 0.00 | 4.52 | <52.32 | 1.68 | 54.00 |

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Emission Level = Reading Level + Probe Factor + Cable loss.
3. The average measurement was not performed when the peak measured data under the limit of average detection.