# EMI TEST REPORT

NVLAP Lab Code 200133-0

| | |
|---|---|
| Product | : Cable/DSL 802.11g 54Mbps Wireless Router |
| Model No. | : TEW-431BRP |
| Applicant | : TRENDware International, Inc. |
| Manufacturer | : TRENDware |
| Regulation Applied | : FCC Rules and Regulations Part 15 Subpart B (2003). |
| Report Number | : ET92S-11-084-05 |
| Date of Issue | : Dec. 10, 2003 |



BSMI ISO 9001 and 17025.
TÜV Product Service ISO9001 and EN45001.
NIST NVLAP Accredited Laboratory for FCC Part 15/ CISPR 22/ AS/NZS 3548.
CNLA ISO/ IEC 17025.
NEMKO, FIMKO , SGS , TÜV Laboratory Assessment
FCC, VCCI Registered.

# TEST REPORT CERTIFICATE

| | |
|---|---|
| Applicant | : TRENDware International, Inc.<br>3135 Kashiwa Street, Torrance, CA 90505 U.S.A |
| Manufacturer | : TRENDware International Inc.<br>3135 Kashiwa Street, Torrance, CA 90505, USA |
| Description of EUT: | |
| a) Type of EUT | : Cable/DSL 802.11g 54Mbps Wireless Router |
| b) Trame Name | : TRENDware |
| c) Model No./Type No. | : TEW-431BRP |
| d) Power Source | : AC 110Vac, 60Hz |
| Regulation Applied | : FCC Rules and Regulations Part 15 Subpart B (2003). |
| Classification | : Class B |

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.4 and the energy emitted by the device was found to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note:
1. The results of the testing report relate only to the items tested.
2. The testing report shall not be reproduced except in full, without the written approval of ETC.
3. The report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

Test Date: Nov. 12, 2003

Test Engineer: Jerry Huang

Jerry Huang

Approve & Authorized Signer: Win-Po Tsai

Signature
Win-Po Tsai
Manager of EMC Testing Department I
Electronics Testing Center, Taiwan

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# 1. GENERAL INFORMATION

## 1.1 Product Description

Congratulations on the purchase of your new Wireless Router. The Wireless Router is a multi-function device providing the following services:

- ***Shared Broadband Internet Access*** for all LAN users.
- ***4-Port Switching Hub*** for 10BaseT or 100BaseT connections.
- ***Wireless Access Point*** for 802.11b and 802.11g Wireless Stations.

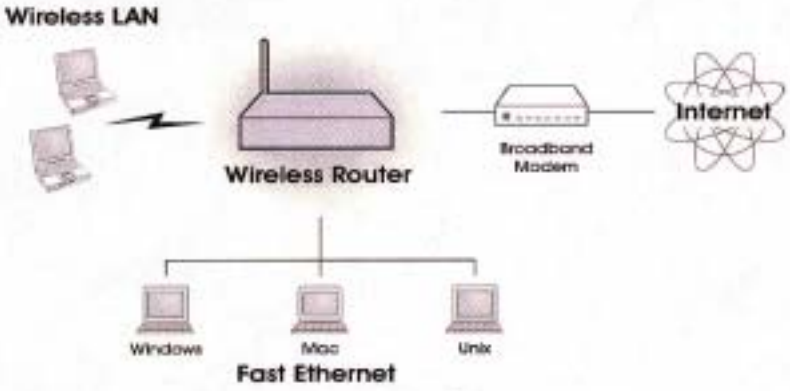



**Figure 1: Wireless Router**

### Wireless Router Features

The Wireless Router incorporates many advanced features, carefully designed to provide sophisticated functions while being easy to use.

### Internet Access Features

- ***Shared Internet Access.*** All users on the LAN or WLAN can access the Internet through the Wireless Router, using only a single external IP Address. The local (invalid) IP Addresses are hidden from external sources. This process is called NAT (Network Address Translation).
- ***DSL & Cable Modem Support.*** The Wireless Router has a 10/100BaseT Ethernet port for connecting a DSL or Cable Modem. All popular DSL and Cable Modems are supported. SingTel RAS and Big Pond (Australia) login support is also included.
- ***PPPoE, PPTP, SingTel RAS and Telstra Big Pond Support.*** The Internet (WAN port) connection supports PPPoE (PPP over Ethernet), PPTP (Peer-to-Peer Tunneling Protocol), SingTel RAS and Telstra Big Pond (Australia), as well as "Direct Connection" type services.
- ***Fixed or Dynamic IP Address.*** On the Internet (WAN port) connection, the Wireless Router supports both Dynamic IP Address (IP Address is allocated on connection) and Fixed IP Address.

## 1.2 Test Methodology

Both conducted and radiated emissions were performed according to the procedures in ANSI C63.4.

## 1.3 Test Facility

The Open Area Test Site and conducted measurement facility used to collect the radiated and conducted data are located inside the Building at No.8, Lane 29, Wen-ming Road, Lo-shan Tsun, Kweishan Hsiang, Taoyuan, Taiwan, R.O.C.
This site has been accreditation as a FCC filing site.

# 2. PROVISIONS APPLICABLE

## 2.1 Definition

**Unintentional radiator:**

A device that intentionally generates radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

**Class B Digital Device:**

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

## 2.2 Requirement for Compliance

**(1) Conducted Emission Requirement**

For unintentional device, according to **FCC§ 15.107(a)** Line Conducted Emission Limits class B is as following:

| Frequency MHz | Quasi Peak dBμV | Average dBμV |
|---|---|---|
| 0.15 - 0.5 | 66-56 | 56-46 |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

For unintentional device, according to **CISPR 22** Line Conducted Emission Limits class B is as following:

| Frequency MHz | Quasi Peak dBμV | Average dBμV |
|---|---|---|
| 0.15 - 0.5 | 66-56 | 56-46 |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

For unintentional device, according to **AS/NZS 3548** Line Conducted Emission Limits class B is as following:

| Frequency MHz | Quasi Peak dBμV | Average dBμV |
|---|---|---|
| 0.15 - 0.5 | 66-56 | 56-46 |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

**(2) Radiated Emission Requirement**

For unintentional device, according to **FCC § 15.109(a)**, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency MHz | Distance Meters | Radiated μV/m | Radiated dBμV/m |
|---|---|---|---|
| 30 - 88 | 3 | 100 | 40.0 |
| 88 - 216 | 3 | 150 | 43.5 |
| 216 - 960 | 3 | 200 | 46.0 |
| above 960 | 3 | 500 | 54.0 |

For unintentional device, according to **CISPR 22** Radiated Emission Limits class B is as following:

| Frequency MHz | Distance Meters | Radiated dBμV/m |
|---|---|---|
| 30 to 230 | 10 | 30 |
| 230 to 1000 | 10 | 37 |

For unintentional device, according to **AS/ NZS 3548** Radiated Emission Limits class B is as following:

| Frequency MHz | Distance Meters | Radiated dBμV/m |
|---|---|---|
| 30 to 230 | 10 | 30 |
| 230 to 1000 | 10 | 37 |

## 2.3 Labelling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions : (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 2.4 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio / TV technician for help.

# 3. SYSTEM TEST CONFIGURATION

## 3.1 EUT configuration and operating

The EUT connected with the following peripheral devices.

## 3.2 Devices for Tested System

The EUT connected with the following peripheral devices.

Following peripheral devices and interface cables were connected during the measurement:

| Product | Manufacturer | Model No. | I/O Cable |
|---|---|---|---|
| Keyboard | IBM | KB-9910 | 2.0m, Unshielded Cable |
| Mouse | IBM | M-SAU-IBM6 | 1.8m, Unshielded Cable |
| PC | Compaq | D380mx | 1.8m, Unshielded Power Cord |
| LCD | HP | D5063 | 1.7m, Shielded Cable (with a core)<br>Adapter: (with a core)<br>3.6m, Unshielded Power Cord |
| RJ45 | N/A | N/A | 1.0m*4, Unshielded Cable<br>10m*1, Unshielded Cable |

## 3.3 Deviation Statement

(If any deviation from additions to or exclusions from test method must be stated)

N/A

## 3.4 Modification Record

N/A

# 4. RADIATED EMISSION MEASUREMENT

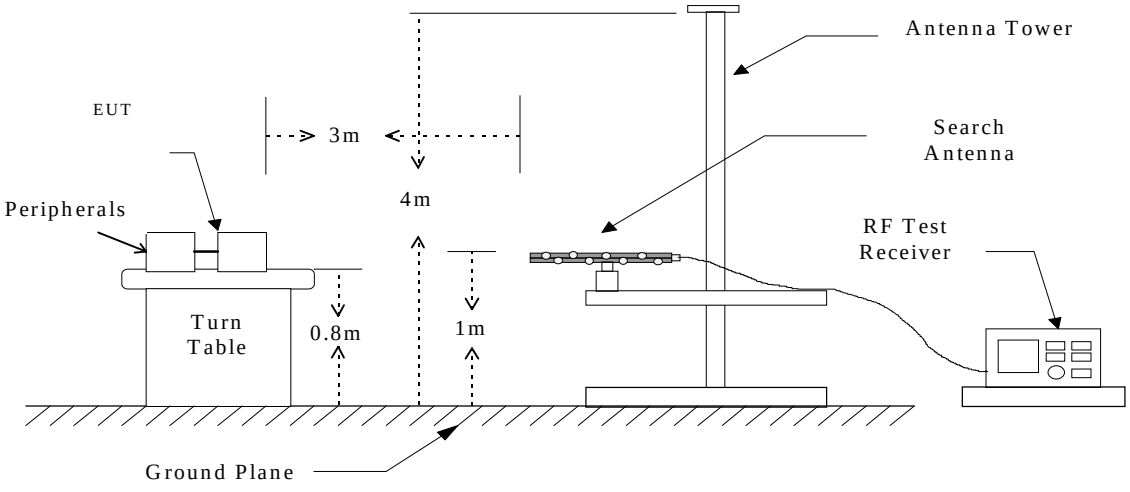
## 4.1 Applicable Standard

For unintentional radiator digital devices, the radiated emission shall comply with § 15.109(a). And according to § 15.109 (g), as an alternative to the radiated emission limits is CISPR 22.

## 4.2 Measurement Procedure

1. Setup the configuration per figure 1.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a semi-anechoic chamber to determine the accurate frequencies of higher emissions then each selected frequency is precisely measured.
3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that the highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
4. Repeat step 3 until all frequencies need to be measured were complete.
5. Repeat step 4 with search antenna in vertical polarized orientations.
6. Check the frequency of the highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration



## 4.3 Radiated Emission Data

A. Data Link Mode

Test Date : Oct. 30, 2003 Temperature : 25 ℃ Humidity : 61 %

| Emission **Frequency** (MHz) | **Meter Reading** (dBuV) | | CORR'd **Factor** (dB/m) | **Results** (dBuV/m) | | **Limit** (3m) (dBuV/m) | **Margins** (dB) | **Table Degree** (deg) | | **Ant. High** (m) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **HOR.** | **VERT.** | | **HOR.** | **VERT.** | | | **HOR.** | **VERT.** | **HOR.** | **VERT.** |
| 55.310 | *** | 30.1 | 7.8 | *** | 37.9 | 40.0 | -2.1 | *** | 186 | *** | 1.1 |
| 58.130 | 28.8 | *** | 7.5 | 36.3 | *** | 40.0 | -3.7 | 180 | *** | 2.0 | *** |
| 126.030 | *** | 23.8 | 10.6 | *** | 34.4 | 43.5 | -9.1 | *** | 179 | *** | 1.1 |
| 162.890 | 26.3 | *** | 11.6 | 37.9 | *** | 43.5 | -5.6 | 175 | *** | 2.1 | *** |
| 255.040 | 21.3 | 19.6 | 15.6 | 36.9 | 35.2 | 46.0 | -9.1 | 174 | 175 | 1.9 | 1.0 |
| 324.820 | 20.0 | *** | 17.5 | 37.5 | *** | 46.0 | -8.5 | 12 | *** | 1.9 | *** |
| 324.880 | *** | 16.4 | 17.5 | *** | 33.9 | 46.0 | -12.1 | *** | 10 | *** | 1.0 |
| 484.930 | *** | 15.2 | 22.3 | *** | 37.5 | 46.0 | -8.5 | *** | 170 | *** | 1.2 |
| 487.840 | 18.6 | *** | 22.3 | 40.9 | *** | 46.0 | -5.1 | 169 | *** | 2.1 | *** |
| 644.970 | 17.9 | *** | 26.1 | 44.0 | *** | 46.0 | -2.0 | 10 | *** | 2.4 | *** |
| 644.980 | *** | 16.2 | 26.1 | *** | 42.3 | 46.0 | -3.7 | *** | 10 | *** | 1.2 |

Note:

1. AH means antenna height, DRT means degrees of rotation of turntable.
2. If the data table appeared symbol of "***" means the value was too low to be measured.
3. The EUT is a hand-held product. In order to get the worse data, X, Y, Z direction were adjusted during the data.
4. The estimated measurement uncertainty of the result measurement is ± 3dB.

## 4.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

***Result = Reading + Corrected Factor***

where

Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain

## 4.5 Radiated Measuring Instrument

The following instrument are used for radiated emissions measurement :

| Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
|---|---|---|---|---|
| EMI Test Receiver | HP | 8546A | 13054404-001 | Jun. 19, 2004 |
| Ant.-LogBicone | Schwarzbeck | VULB 9160 | 13057310-001 | Sep. 18, 2004 |

Note: The standards used to perform this calibration are traceable to NML/ROC and NIST/USA.

Measuring instrument setup in measured frequency band when specified detector function is used :

| Frequency Band (MHz) | Instrument | Function | Resolution bandwidth | Video Bandwidth |
|---|---|---|---|---|
| 30 to 1000 | RF Test Receiver | Quasi-Peak | 120 kHz | N/A |

## 4.6 Photos of Radiation Measuring Setup

# 5. CONDUCTED EMISSION MEASUREMENT

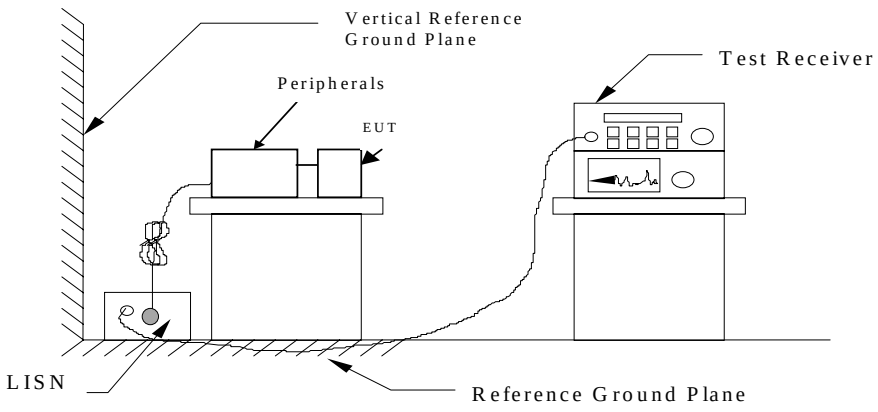
## 5.1 Applicable Standard

For unintentional digital devices, Line Conducted Emission Limits are in accordance to § 15.107(a) . And according to § 15.107(e), an alternative to the conducted limits is CISPR 22.

## 5.2 Measurement Procedure

1. Setup the configuration per figure 2.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 4 to 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 2 : Conducted emissions measurement configuration



## 5.3 Conducted Emission Data

A. Data Link Mode

Test Date : Nov. 01, 2003 Temperature : 24 ℃ Humidity : 64 %

| Freq. (MHz) | Meter Reading (dBuV) | | | | Factor (dB) | Result (dBuV) | | | | Limit (dBuV) | | Margins (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q.P Value | | AVG. Value | | | Q.P Value | | AVG. Value | | Q.P Value | AVG. Value | Q.P. or AVG. |
| | L1 | L2 | L1 | L2 | | L1 | L2 | L1 | L2 | | | |
| 0.150 | *** | 49.1 | ---- | ---- | 0.1 | *** | 49.2 | ---- | ---- | 66.0 | 56.0 | -16.8 |
| 0.154 | 48.3 | *** | ---- | ---- | 0.1 | 48.4 | *** | ---- | ---- | 65.8 | 55.8 | -17.4 |
| 0.228 | 47.8 | *** | ---- | ---- | 0.1 | 47.9 | *** | ---- | ---- | 62.5 | 52.5 | -14.6 |
| 0.235 | *** | 48.1 | ---- | ---- | 0.1 | *** | 48.2 | ---- | ---- | 62.3 | 52.3 | -14.1 |
| 0.372 | 44.0 | *** | ---- | ---- | 0.1 | 44.1 | *** | ---- | ---- | 58.5 | 48.5 | -14.4 |
| 0.396 | *** | 44.4 | ---- | ---- | 0.1 | *** | 44.5 | ---- | ---- | 57.9 | 47.9 | -13.4 |
| 0.493 | *** | 42.7 | ---- | ---- | 0.1 | *** | 42.8 | ---- | ---- | 56.1 | 46.1 | -13.3 |
| 0.568 | 40.1 | *** | ---- | ---- | 0.1 | 40.2 | *** | ---- | ---- | 56.0 | 46.0 | -15.8 |
| 1.683 | 36.7 | *** | ---- | ---- | 0.2 | 36.9 | *** | ---- | ---- | 56.0 | 46.0 | -19.1 |
| 1.988 | *** | 40.3 | ---- | ---- | 0.2 | *** | 40.5 | ---- | ---- | 56.0 | 46.0 | -15.5 |
| 23.129 | 34.1 | 34.5 | ---- | ---- | 0.5 | 34.6 | 35.0 | ---- | ---- | 60.0 | 50.0 | -25.0 |

Note:

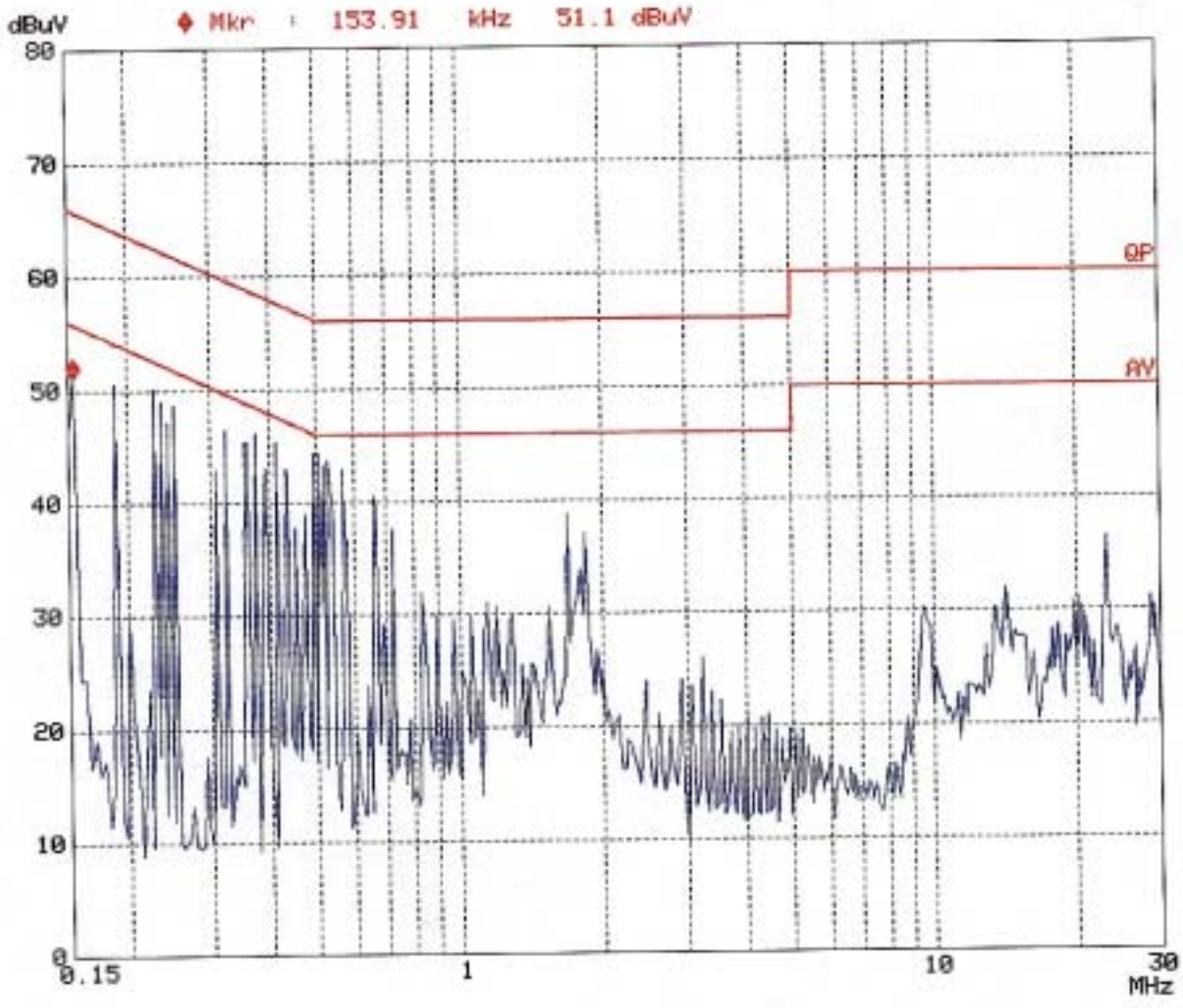
1. The full frequency range scanning test data is shown in next two pages.
2. “***” means the value was too low to be measured.
3. If the data table appeared symbol of "----" means the Q.P. value is under the limit for AVG. so, the AVG. value doesn't need to be measured.
4. The estimated measurement uncertainty of the result measurement is ± 3dB.

Conduction Emission Test
Peak Value

Operator: JERRY
Test Spec: FCC
Comment: L1
File name: 55022.RES
Date: 31. Oct 92 20:03

Overview Scan Settings (4 Ranges)

| Frequencies | | | Receiver Settings | | | | |
|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp |
| 150k | 1M | 3.9k | 9k | PK | 0.05ms | 10dBLN | OFF |
| 1M | 3M | 3.9k | 9k | PK | 0.05ms | 10dBLN | OFF |
| 3M | 10M | 3.9k | 9k | PK | 1ms | 10dBLN | OFF |
| 10M | 30M | 3.9k | 9k | PK | 1ms | 10dBLN | OFF |

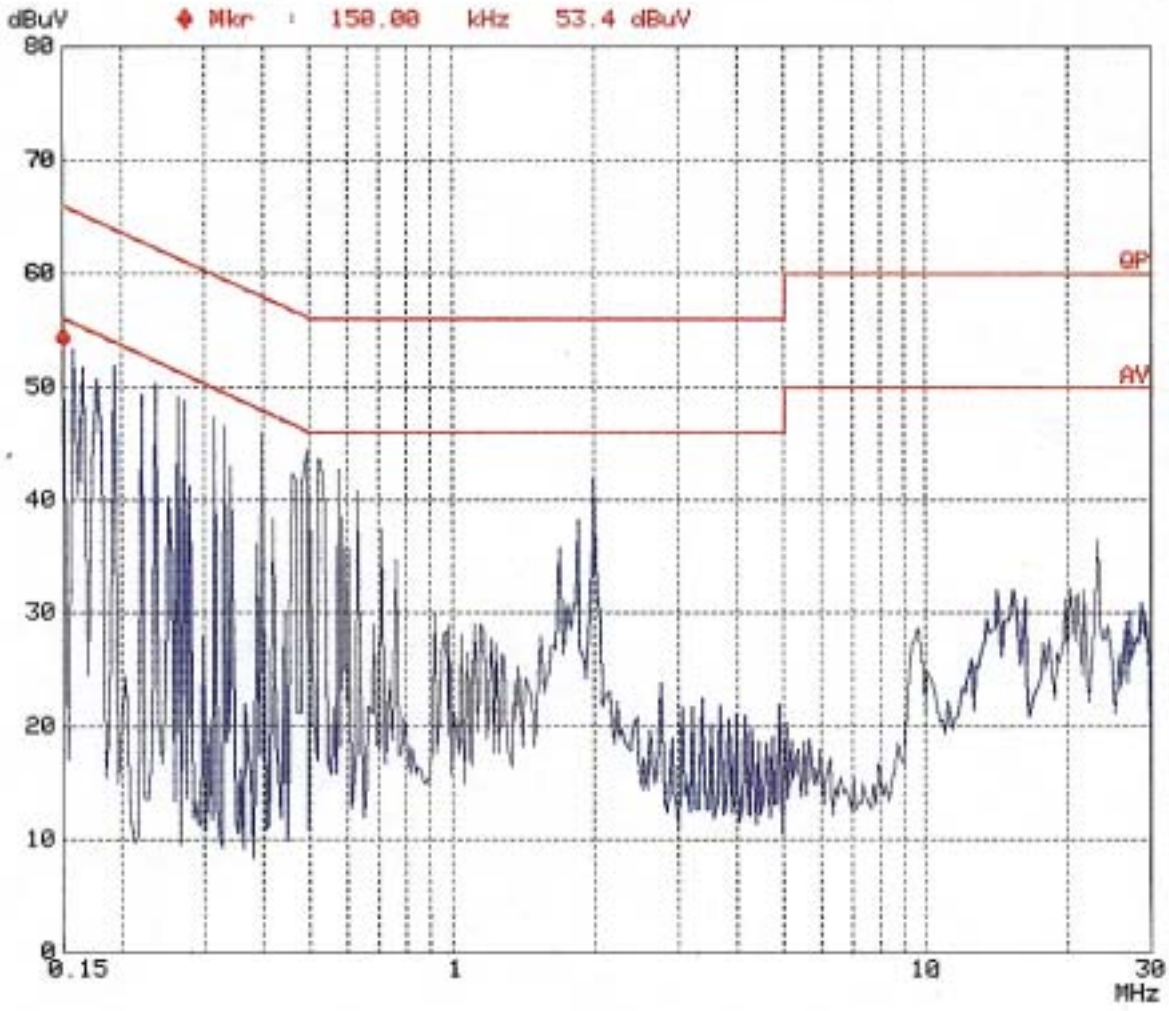


Conduction Emission Test
Peak Value

Operator: JERRY
Test Spec: FCC
Comment: L2
File name: 55022.RES
Date: 31. Oct 92 20:09

Overview Scan Settings (4 Ranges)

| Frequencies | | | Receiver Settings | | | | |
|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp |
| 150k | 1M | 3.9k | 9k | PK | 0.05ms | 10dBLN | OFF |
| 1M | 3M | 3.9k | 9k | PK | 0.05ms | 10dBLN | OFF |
| 3M | 10M | 3.9k | 9k | PK | 1ms | 10dBLN | OFF |
| 10M | 30M | 3.9k | 9k | PK | 1ms | 10dBLN | OFF |



## 5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

***RESULT = READING + LISN FACTOR***

Assume a receiver reading of 22.5 dB μ V is obtained, and LISN Factor is 0.1 dB, then the total of field strength is 22.6 dB μ V.

RESULT = 22.5 + 0.1 = 22.6 dB μ V
Level in μ V = Common Antilogarithm[(22.6 dB μ V)/20]
= 13.48 μ V

## 5.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test .

| Equipment | Manufacturer | Model No. | Serial No. | Calibrated until |
|---|---|---|---|---|
| EMI Test Receiver | R&S | ESCS30 | 834115 / 008 | Sep. 23, 2004 |
| LISN | EMCO | 3825 | 13057704-001 | Nov. 02, 2004 |

Note: The standards used to perform this calibration are traceable to NML/ROC and NIST/USA.

## 5.6 Photos of Conduction Measuring Setup

## 6. CONSTRUCTED PHOTOS of EUT

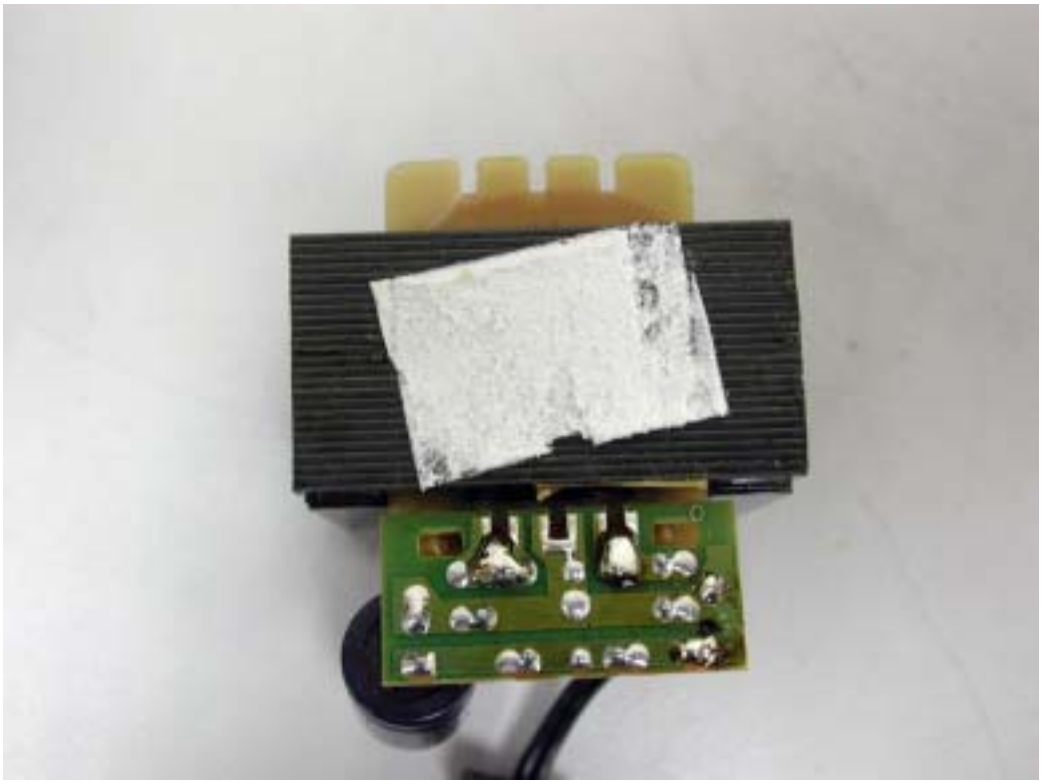
1. Outside view 1 of EUT

2. Outside view 2 of EUT

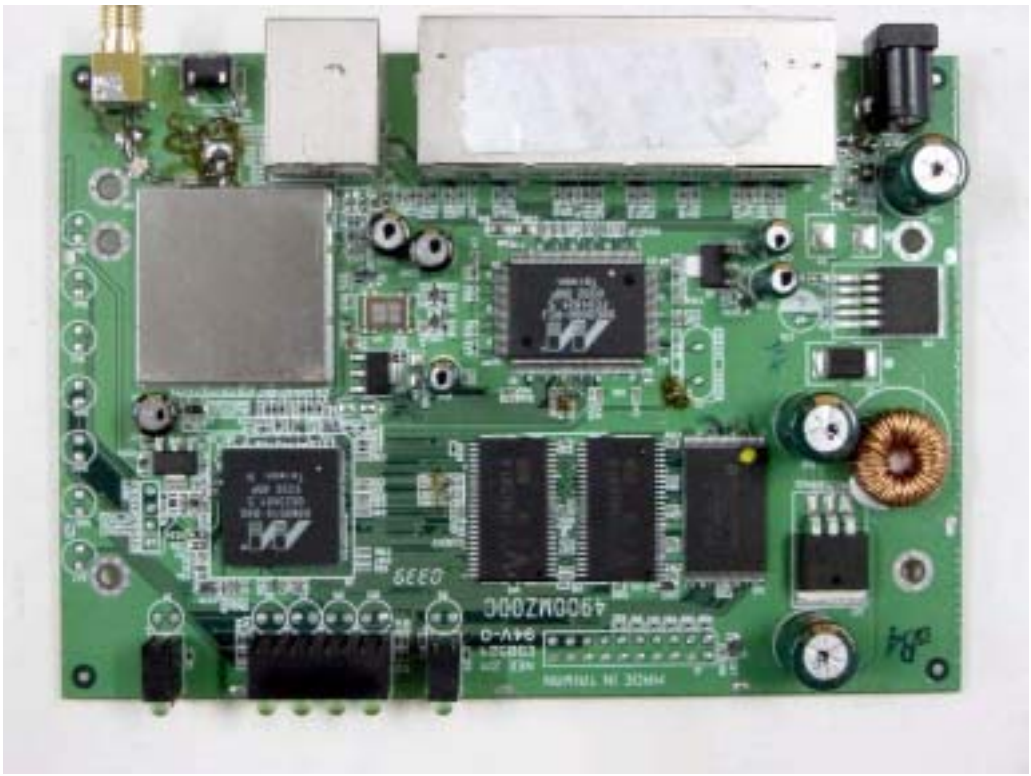
3. Outside view of Adaptor


4. Inside view 1 of Adaptor

5. Inside view 2 of Adaptor



6. Front view of PCB



7. Rear view of PCB