



INTERNATIONAL STANDARDS LABORATORY

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## Certificate

Applicant:  
BEHAVIOR TECH COMPUTER CORP.  
2F,51,Tung Hsing Rd.,  
Taipei 110  
Taiwan, R. O. C.

Test Report No.: ISL-04LE223FB  
Issue Date: 2004/07/27

Product Name: Keyboard  
Model: 5211A  
Responsible Party: BEHAVIOR TECH COMPUTER CORP.  
Address: 2F,51,Tung Hsing Rd.,  
Taipei 110  
Taiwan, R. O. C.

FCC Rule Part(s): **FCC Rules Part 15 Subpart B Class B**  
**ANSI C63.4-2001**

We, **International Standards Laboratory**, certify that

The device bearing the trade name and model specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified. (see Test Report if any modifications were made for compliance).

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

We certify that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988.21 U.S.C. 853(a)

*Eddy Hsiung*

Eddy Hsiung/Director  
International Standards Laboratory



NVLAP Lab. Code: 200234-0

# TEST REPORT

## FOR

### FCC PART 15 Subpart B

*of*

### Keyboard

*Model*

**5211A**

*Applied by:*

BEHAVIOR TECH COMPUTER CORP.  
2F,51,Tung Hsing Rd.,  
Taipei 110  
Taiwan, R. O. C.

*Test Performed by:*  
**International Standards Laboratory**



(NVLAP Lab. Code: 200234-0)

| Hsichih LAB                                               | (V) Lung-Tan LAB                                          |
|-----------------------------------------------------------|-----------------------------------------------------------|
| <b>Site Registration No.:</b> (NVLAP Lab. Code: 200234-0) | <b>Site Registration No.:</b> (NVLAP Lab. Code: 200234-0) |
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**Report Number: ISL-04LE223FB**

**Issue Date: 2004/07/27**

**HC LAB:**NVLAP:200234-0;VCCI: R-341,C-354;NEMKO:ELA 113a,113c;BSMI:SL2-IN-E-0037;SL2-R1-E-0037;CNLA:1178

**LT LAB:**NVLAP:200234-0;VCCI: R-1435,C-1440;NEMKO:ELA 113b,113d;BSMI:SL2-IN-E-0013;CNLA:0997

ISL-T10-R4-9

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**LT LAB:**NVLAP:200234-0;VCCI: R-1435,C-1440;NEMKO:ELA 113b,113d;BSMI:SL2-IN-E-0013;CNLA:0997

ISL-T10-R4-9

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## 1. General

### 1.1 Certification of Accuracy of Test Data

**Standards:** ANSI C63.4-2001, CFR 47 Part 15 Subpart B  
or EN55022: 1998  
Industry Canada Interference-Causing Equipment Standard  
ICES-003 Issue 4: 2004

**Equipment Tested** Keyboard

**Model:** 5211A

**Applied by** BEHAVIOR TECH COMPUTER CORP.

**Sample received Date:** 2004/07/19

**Final test Date :** refer to the date of test data

**Test Result** PASS

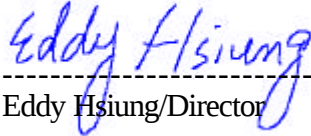
**Test Engineer:**   
Jason Liao

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the radiated and power line conducted electromagnetic emissions generated by sample equipment under test at the time of the test.

The sample equipment tested as described in this report is in compliance with the limits of above standards.

Approve & Signature

  
-----  
Eddy Hsiung/Director

Test results given in this report apply only to the specific sample(s) tested under stated test conditions. This report shall not be reproduced other than in full without the explicit written consent of ISL. This report totally contains 32 pages, including 1 cover page, 1 contents page, and 30 pages for the test description.  
This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government.

This test data shown below is traceable to NIST or national or international standard.  
International Standards Laboratory certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

**International Standards Laboratory**

**Report Number: ISL-04LE223FB**

**HC LAB:** NVLAP: 200234-0; VCCI: R-341, C-354; NEMKO: ELA 113a, 113c; BSMI: SL2-IN-E-0037, SL2-R1-E-0037; CNLA:1178  
**LT LAB:** NVLAP: 200234-0; VCCI: R-1435, C-1440; NEMKO: ELA 113b, 113d; BSMI: SL2-IN-E-0013; CNLA:0997

## 1.2 Applicant Information

Applicant: BEHAVIOR TECH COMPUTER CORP.  
2F,51,Tung Hsing Rd.,  
Taipei 110  
Taiwan, R. O. C.

## 1.3 Operation Environment

**Test Site:** Chamber 02; Conduction 02

**Test Distance** 10M

Temperature refer to each site test data

Humidity: refer to each site test data

**input power:** Conduction input power: AC 110 V / 60 Hz  
Radiation input power: AC 110 V / 60 Hz

## 2. Powerline Conducted Emissions

### 2.1 Configuration and Procedure

#### 2.1.1 EUT Configuration

The EUT was set up on the non-conductive table that is 1.0 by 1.5 meter, 80cm above ground. The wall was 40cm to the rear of the EUT.

Power to the EUT was provided through the LISN. The impedance vs. frequency characteristic of the LISN is complied with the limit of standards used.

Both lines (neutral and hot) were connected to the LISN in series at testing. A coaxial-type connector which provides one 50 ohms impedance termination was connected to the test instrument. The excess length of the power cord was folded back and forth at the center of the lead to form a bundle 30cm to 40cm in length.

Any changes made to the configuration or modifications made to EUT during testing, are noted in the following test record.

If EUT has an extra auxiliary AC outlet which can provide power to an external monitor, all measurements will be made with the monitor power from EUT-mounted AC outlet and then from floor-mounted AC outlet.

#### 2.1.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. The main power line conducted EMI tests were run on both hot and neutral conductors of the power cord and the results were recorded. The effect of varying the position of the interface cables has been investigated to find the configuration that produces maximum emission.

At the frequencies where the peak values of the emissions were higher than 6dB below the applicable limits, the emissions were also measured with the quasi-peak detectors. At the frequencies where the quasi-peak values of the emissions were higher than 6dB below the applicable average limits, the emissions were also measured with the average detectors.

The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

#### 2.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

|                       |                           |
|-----------------------|---------------------------|
| Frequency Range:      | 150KHz~30MHz              |
| Detector Function:    | Quasi-Peak / Average Mode |
| Resolution Bandwidth: | 9KHz                      |

## 2.2 Test Data: *The EUT inserted into the Personal Computer PS/2 Keyboard port*

**Table 2.2.1 Power Line Conducted Emissions (Hot)**

Operator: Jason Liao

Temperature (C): 23

Humidity (%): 55

02:22:18 PM, Wednesday, July 21, 2004

| Frequency | LISN Loss | Cable Loss | QP Corrct. | QP Limit | QP Margin | AVE Corrct. | AVE Limit | AVE Margin |
|-----------|-----------|------------|------------|----------|-----------|-------------|-----------|------------|
| MHz       | (dB)      | (dB)       | Amp.(dBuV) | (dBuV)   | (dB)      | Amp.(dBuV)  | (dBuV)    | (dB)       |
| 0.21868   | 0.10      | 0.06       | 47.48      | 64.04    | -16.56    | 46.76       | 54.04     | -7.28      |
| 0.32683   | 0.10      | 0.10       | 42.80      | 60.95    | -18.15    | 41.63       | 50.95     | -9.32      |
| 0.76161   | 0.16      | 0.07       | 36.50      | 56.00    | -19.50    | 35.38       | 46.00     | -10.62     |
| 0.87008   | 0.18      | 0.07       | 36.57      | 56.00    | -19.43    | 35.01       | 46.00     | -10.99     |
| 0.97906   | 0.20      | 0.07       | 33.65      | 56.00    | -22.35    | 32.64       | 46.00     | -13.36     |
| 1.41414   | 0.26      | 0.08       | 35.03      | 56.00    | -20.97    | 34.53       | 46.00     | -11.47     |
| 1.52325   | 0.25      | 0.08       | 35.38      | 56.00    | -20.62    | 34.78       | 46.00     | -11.22     |
| 3.18588   | 0.20      | 0.12       | 28.05      | 56.00    | -27.95    | 21.82       | 46.00     | -24.18     |
| 14.0009   | 0.38      | 0.28       | 37.63      | 60.00    | -22.37    | 32.88       | 50.00     | -17.12     |
| 14.0994   | 0.38      | 0.28       | 35.13      | 60.00    | -24.87    | 28.91       | 50.00     | -21.09     |

\* Note:

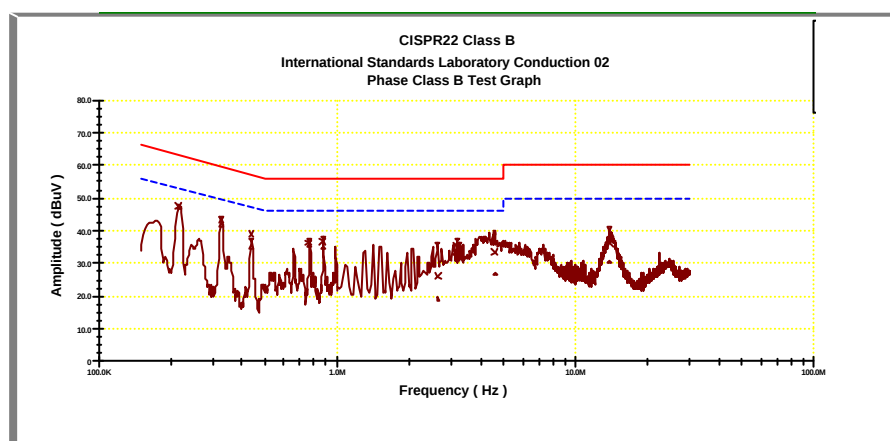
Margin = Corrected Amplitude - Limit

Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss

A margin of -8dB means that the emission is 8dB below the limit

The total Uncertainty value is 1.701dB .

**Graph 2.2.1 Power Line Conducted Emissions (Hot)**



**Table 2.2.2 Power Line Conducted Emissions (Neutral)**

Operator: Jason Liao

Temperature (C): 23

02:34:46 PM, Wednesday, July 21, 2004

Humidity (%): 55

| Frequency | LISN Loss | Cable Loss | QP Corrt.  | QP Limit | QP Margin | AVE Corrt. | AVE Limit | AVE Margin |
|-----------|-----------|------------|------------|----------|-----------|------------|-----------|------------|
| MHz       | (dB)      | (dB)       | Amp.(dBuV) | (dBuV)   | (dB)      | Amp.(dBuV) | (dBuV)    | (dB)       |
| 0.3266    | 0.10      | 0.10       | 44.49      | 60.95    | -16.47    | 43.02      | 50.95     | -7.94      |
| 0.43568   | 0.11      | 0.08       | 42.76      | 57.84    | -15.08    | 40.17      | 47.84     | -7.67      |
| 0.87108   | 0.18      | 0.07       | 38.32      | 56.00    | -17.68    | 37.09      | 46.00     | -8.91      |
| 0.9783    | 0.20      | 0.07       | 36.84      | 56.00    | -19.16    | 35.33      | 46.00     | -10.67     |
| 0.97836   | 0.20      | 0.07       | 36.83      | 56.00    | -19.17    | 35.31      | 46.00     | -10.69     |
| 2.06603   | 0.20      | 0.09       | 35.61      | 56.00    | -20.39    | 34.79      | 46.00     | -11.21     |
| 2.61047   | 0.20      | 0.11       | 33.82      | 56.00    | -22.18    | 32.14      | 46.00     | -13.86     |
| 2.71938   | 0.20      | 0.11       | 34.03      | 56.00    | -21.97    | 32.07      | 46.00     | -13.93     |
| 4.05356   | 0.20      | 0.14       | 33.42      | 56.00    | -22.58    | 26.10      | 46.00     | -19.90     |
| 4.5125    | 0.20      | 0.15       | 34.67      | 56.00    | -21.33    | 29.33      | 46.00     | -16.67     |

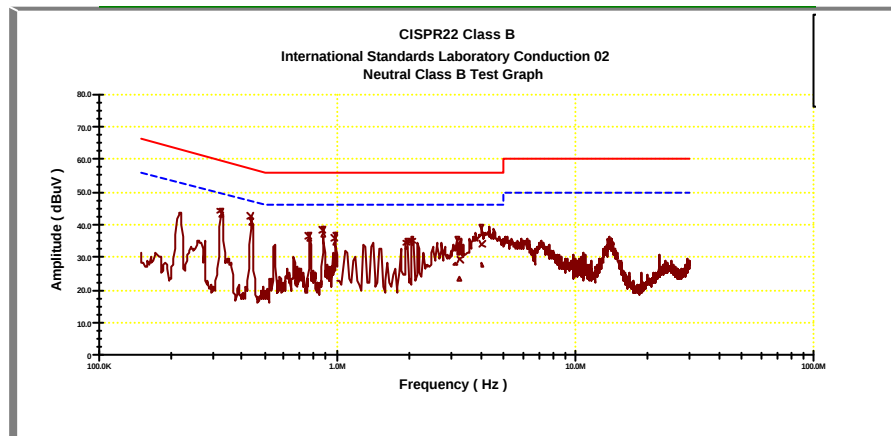
\* Note:

Margin = Corrected Amplitude - Limit

Corrected Amplitude = Receiver Reading + LISN Loss + Cable Loss

A margin of -8dB means that the emission is 8dB below the limit

The total Uncertainty value is 1.701dB .

**Graph 2.2.2 Power Line Conducted Emissions (Neutral)****International Standards Laboratory****Report Number: ISL-04LE223FB**

HC LAB: NVLAP: 200234-0; VCCI: R-341, C-354; NEMKO: ELA 113a, 113c; BSMI: SL2-IN-E-0037, SL2-R1-E-0037; CNLA:1178

LT LAB: NVLAP: 200234-0; VCCI: R-1435, C-1440; NEMKO: ELA 113b, 113d; BSMI: SL2-IN-E-0013; CNLA:0997

### 3. Open Field Radiated Emissions

#### 3.1 Configuration and Procedure

##### 3.1.1 EUT Configuration

The equipment under test was set up on a non-conductive table 80cm above ground, on a 10 meter open field or 10 meter chamber. The excess length of the power cord was folded back and forth at the center of the lead to form a bundle 30cm to 40cm in length.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

If EUT has an extra auxiliary AC outlet which can provide power to an external monitor, all measurements will be made with the monitor power from EUT-mounted AC outlet and then from floor-mounted AC outlet.

##### 3.1.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. The maximum emission was measured by varying the height of antenna and then by rotating the turntable. Both polarization of antenna, horizontal and vertical, were measured.

The highest emissions between 30 MHz to 1000 MHz were analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission. The highest emissions of frequency higher than 1000 MHz was analyzed in peak mode and/or average mode to determine the precise amplitude of the emission.

##### 3.1.3 Spectrum Analyzer Configuration (for the frequencies tested)

|                       |                 |
|-----------------------|-----------------|
| Frequency Range:      | 30MHz--1000MHz  |
| Detector Function:    | Quasi-Peak Mode |
| Resolution Bandwidth: | 120KHz          |

|                       |                   |
|-----------------------|-------------------|
| Frequency Range:      | Above 1000Mhz     |
| Detector Function:    | Peak/Average Mode |
| Resolution Bandwidth: | 1MHz              |

### 3.2 Test Data: *The EUT inserted into the Personal Computer PS/2 Keyboard port*

**Table 3.2.1 Radiated Emissions (Horizontal)**

Operator: Jason Liao

Temperature (C): 24

Humidity (%): 58

08:11:13 AM, Friday, July 23, 2004

| Frequency<br>MHz | RX_R<br>dBuV | Ant_F<br>dB/m | Cab_L<br>dB | PreAmp<br>dB | Emission<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Ant.Pos<br>cm | Table Pos<br>deg. |
|------------------|--------------|---------------|-------------|--------------|--------------------|-----------------|--------------|---------------|-------------------|
| 66.86            | 15.45        | 5.40          | 1.46        | 0.00         | 22.31              | 30.00           | -7.69        | 288           | 187               |
| 96.93            | 5.30         | 9.69          | 1.84        | 0.00         | 16.83              | 30.00           | -13.17       | 159           | 226               |
| 129.91           | 3.70         | 11.40         | 2.21        | 0.00         | 17.31              | 30.00           | -12.69       | 115           | 164               |
| 139.61           | 5.05         | 10.34         | 2.28        | 0.00         | 17.68              | 30.00           | -12.32       | 105           | 58                |
| 149.31           | 4.50         | 9.46          | 2.35        | 0.00         | 16.32              | 30.00           | -13.68       | 189           | 335               |
| 169.68           | 5.00         | 8.51          | 2.57        | 0.00         | 16.08              | 30.00           | -13.92       | 292           | 153               |
| 190.05           | 5.12         | 8.50          | 2.80        | 0.00         | 16.43              | 30.00           | -13.57       | 399           | 293               |
| 199.75           | 4.66         | 8.89          | 2.90        | 0.00         | 16.44              | 30.00           | -13.56       | 292           | 56                |
| 664.38           | 5.05         | 19.00         | 6.32        | 0.00         | 30.36              | 37.00           | -6.64        | 162           | 110               |
| 972.84           | 4.55         | 21.15         | 8.29        | 0.00         | 33.99              | 37.00           | -3.01        | 205           | 65                |

\* Note:

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain

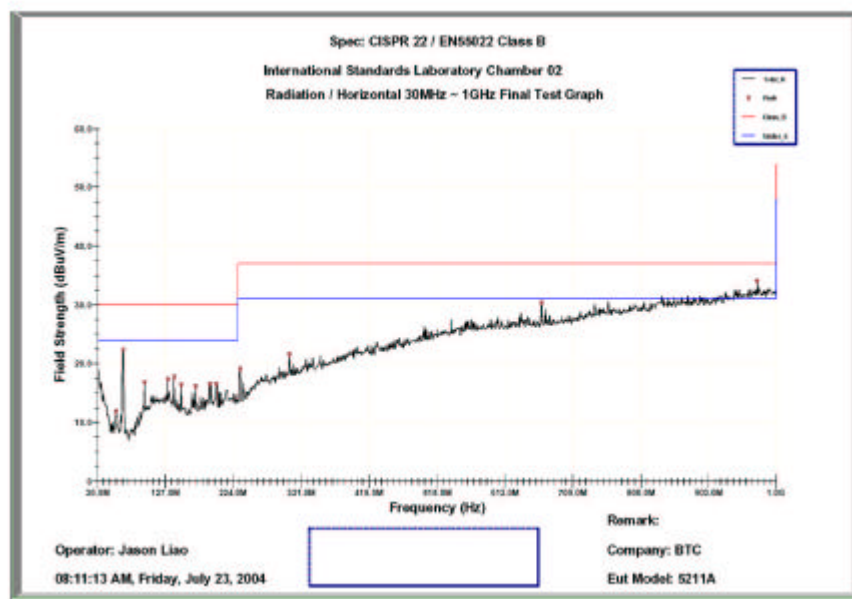
A margin of -8dB means that the emission is 8dB below the limit

BILOG Antenna Distance: 10 meter, Frequency: under 1000MHz

Horn Antenna Distance: 3 meter, Frequency: 1000MHz–48GHz

The total Uncertainty value is 1.831 dB .

**Graph 3.2.1 Open Field Radiated Emissions (Horizontal)**



**International Standards Laboratory**

**Report Number: ISL-04LE223FB**

HC LAB: NVLAP: 200234-0; VCCI: R-341, C-354; NEMKO: ELA 113a, 113c; BSMI: SL2-IN-E-0037, SL2-R1-E-0037; CNLA:1178

LT LAB: NVLAP: 200234-0; VCCI: R-1435, C-1440; NEMKO: ELA 113b, 113d; BSMI: SL2-IN-E-0013; CNLA:0997

Table 3.2.2 Radiated Emissions (Vertical)

Operator: Jason Liao

Temperature (C): 24

08:41:06 AM, Friday, July 23, 2004

Humidity (%): 58

| Frequency | RX_R  | Ant_F | Cab_L | PreAmp | Emission | Limit  | Margin | Ant.Pos | Table Pos |
|-----------|-------|-------|-------|--------|----------|--------|--------|---------|-----------|
| MHz       | dBuV  | dB/m  | dB    | dB     | dBuV/m   | dBuV/m | dB     | cm      | deg.      |
| 34.85     | 10.07 | 15.18 | 1.01  | 0.00   | 26.26    | 30.00  | -3.74  | 152     | 268       |
| 49.4      | 10.77 | 7.59  | 1.26  | 0.00   | 19.62    | 30.00  | -10.38 | 368     | 137       |
| 59.1      | 6.00  | 5.57  | 1.38  | 0.00   | 12.95    | 30.00  | -17.05 | 174     | 127       |
| 125.06    | 4.30  | 11.55 | 2.16  | 0.00   | 18.01    | 30.00  | -11.99 | 165     | 87        |
| 194.9     | 6.00  | 8.70  | 2.82  | 0.00   | 17.52    | 30.00  | -12.48 | 346     | 174       |
| 215.27    | 5.94  | 8.35  | 3.01  | 0.00   | 17.29    | 30.00  | -12.71 | 219     | 205       |
| 497.54    | 5.16  | 17.44 | 5.28  | 0.00   | 27.88    | 37.00  | -9.12  | 173     | 202       |
| 582.9     | 4.83  | 18.87 | 5.78  | 0.00   | 29.47    | 37.00  | -7.53  | 288     | 173       |
| 973.81    | 4.51  | 21.15 | 8.30  | 0.00   | 33.96    | 37.00  | -3.04  | 205     | 63        |

\* Note:

Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss – Pre-Amplifier Gain

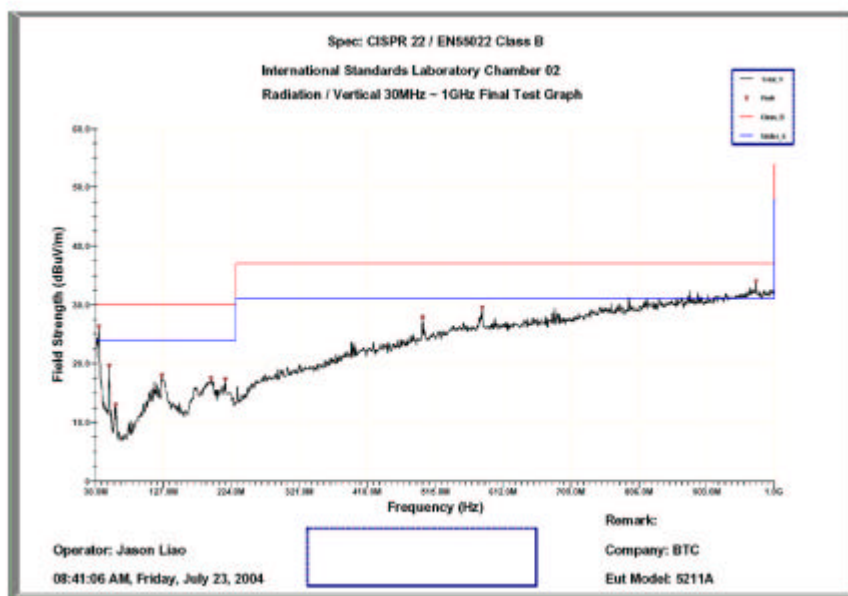
A margin of -8dB means that the emission is 8dB below the limit

BILOG Antenna Distance: 10 meter, Frequency: under 1000MHz

Horn Antenna Distance: 3 meter, Frequency: 1000MHz–18GHz

The total Uncertainty value is 1.831 dB .

Graph 3.2.2 Open Field Radiated Emissions (Vertical)



International Standards Laboratory

Report Number: ISL-04LE223FB

HC LAB: NVLAP: 200234-0; VCCI: R-341, C-354; NEMKO: ELA 113a, 113c; BSMI: SL2-IN-E-0037, SL2-R1-E-0037; CNLA:1178

LT LAB: NVLAP: 200234-0; VCCI: R-1435, C-1440; NEMKO: ELA 113b, 113d; BSMI: SL2-IN-E-0013; CNLA:0997

## 4. Appendix

### 4.1 Appendix A: Warning Labels

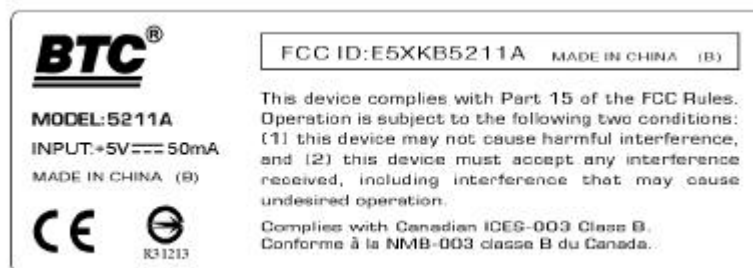
#### Label Requirements

A Class B digital device subject to FCC shall carry a label which includes the following statement:

**\*\*\* WARNING \*\*\***

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.

The sample label shown shall be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.



## 4.2 Appendix B: Warning Statement

### Statement Requirements

The operators manual for a Class B digital device shall contain the following statements or their equivalent:

#### **\* \* \* W A R N I N G \* \* \***

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 when the equipment is operated 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 manual may cause harmful interference to radio communications. 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.

Notice: The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equivalent.

\* \* \* \* \*

If the EUT was tested with special shielded cables the operators manual for such product shall also contain the following statements or their equivalent:

Shielded interface cables and/or AC power cord, if any, must be used in order to comply with the emission limits.

#### **4.3 Appendix C: Measurement Procedure for Powerline Conducted Emissions**

The measurements are performed in a 3.5m x 3.4m x 2.5m shielded room, which referred as Conduction 01 test site, or a 3m x 3m x 2.3m test site, which referred as Conduction 02 test site. The EUT was placed on non-conduction 1.0m x 1.5m table, which is 0.8 meters above an earth-grounded.

Power to the EUT was provided through the LISN which has the Impedance (50ohm/50uH) vs. Frequency Characteristic in accordance with the standard. Power to the LISNs were filtered to eliminate ambient signal interference and these filters were bonded to the ground plane. Peripheral equipment required to provide a functional system (support equipment) for EUT testing was powered from the second LISN through a ganged, metal power outlet box which is bonded to the ground plane at the LISN.

If the EUT is supplied with a flexible power cord, the power cord length in excess of the distance separating the EUT from the LISN shall be folded back and forth at the center of the lead so as to form a bundle not exceeding 40cm in length. If the EUT is provided with a permanently coiled power cord, bundling of the cord is not required. If the EUT is supplied without a power cord, the EUT shall be connected to the LISN by a power cord of the type specified by the manufacturer which shall not be longer than 1 meter. The excess power cord shall be bundled as described above. If a non-flexible power cord is provided with the EUT, it shall be cut to the length necessary to attach the EUT to the LISN and shall not be bundled.

The interconnecting cables were arranged and moved to get the maximum measurement. Both the line of power cord, hot and neutral, were measured.

The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

#### **4.4 Appendix D: Test Procedure for Radiated Emissions**

##### **Preliminary Measurements in the Anechoic Chamber**

The radiated emissions are initially measured in the anechoic chamber at a measurement distance of 3 meters. Desktop EUT are placed on a wooden stand 0.8 meter in height. The measurement antenna is 3 meters from the EUT. The test setup in anechoic chamber is the same as open site. The turntable rotated 360°C. The antenna height is varied from 1-2.5m. The primary objective of the radiated measurements in the anechoic chamber is to identify the frequency spectrum in the absence of the electromagnetic environment existing on the open test site. The frequencies can then be pre-selected on the open test site to obtain the corresponding amplitude. The initial scan is made with the spectrum analyzer in automatic sweep mode. The spectrum peaks are then measured manually to determine the exact frequencies.

##### **Measurements on the Open Site or 10m EMC Chamber**

The radiated emissions test will then be repeated on the open site or 10m EMC chamber to measure the amplitudes accurately and without the multiple reflections existing in the shielded room. The EUT and support equipment are set up on the turntable of one of 3 or 10 meter open field sites. Desktop EUT are set up on a wooden stand 0.8 meter above the ground.

For the initial measurements, the receiving antenna is varied from 1-4 meter height and is changed in the vertical plane from vertical to horizontal polarization at each frequency. Both readings are recorded with the quasi-peak detector with 120KHz bandwidth. For frequency between 30 MHz and 1000MHz, the reading is recorded with peak detector or quasi-peak detector. For frequency above 1 GHz, the reading is recorded with peak detector or average detector with 1 MHz bandwidth.

At the highest amplitudes observed, the EUT is rotated in the horizontal plane while changing the antenna polarization in the vertical plane to maximize the reading. The interconnecting cables were arranged and moved to get the maximum measurement. Once the maximum reading is obtained, the antenna elevation and polarization will be varied between specified limits to maximize the readings.

## 4.5 Appendix E: Test Equipment

### 4.5.1 Test Equipment List

| Location        | Equipment Name                    | Brand             | Model         | S/N               | Last Cal. Date | Next Cal. Date |
|-----------------|-----------------------------------|-------------------|---------------|-------------------|----------------|----------------|
| Conduction      | CDN T2 03                         | FCC Inc.          | FCC-801-T2    | 02066             | 01/07/2004     | 01/07/2005     |
| Conduction      | CDN T4 04                         | FCC Inc.          | FCC-801-T4    | 02069             | 01/07/2004     | 01/07/2005     |
| Conduction      | Coaxial Cable 1F-C2               | Harbourindustries | RG400         | 1F-C2             | 06/02/2004     | 06/02/2005     |
| Conduction      | Current Probe                     | Schaffner         | SMZ 11        | 18030             | 12/30/2003     | 12/30/2004     |
| Conduction      | Digital Hygro-Thermometer Conduct | MicroLife         | HT-2126G      | ISL-Conduction02  | 12/04/2002     | 12/04/2004     |
| Conduction      | EMI Receiver 02                   | HP                | 85460A        | 3448A00183        | 10/02/2003     | 10/02/2004     |
| Conduction      | ISN T4                            | Schaffner         | ISN T400      | 16593             | 12/19/2003     | 12/19/2004     |
| Conduction      | ISN T4 02                         | FCC               | F-CMISN-CAT 5 | 02003             | 12/29/2003     | 12/29/2004     |
| Conduction      | Capacitive Voltage Probe          | FCC               | F-CVP-1       | 68                | 05/19/2004     | 05/19/2005     |
| Conduction      | LISN 04                           | EMCO              | 3810/2        | 9604-1429         | 12/18/2003     | 12/18/2004     |
| Conduction      | LISN 01                           | R&S               | ESH2-Z5       | 890485/013        | 04/29/2004     | 04/29/2005     |
| Radiation       | BILOG Antenna 08                  | Schaffner         | CBL6112B      | 2756              | 06/02/2004     | 06/02/2005     |
| Radiation       | Coaxial Cable Chmb 02-10M         | Belden            | RG-8/U        | Chmb 02-10M       | 06/24/2004     | 06/24/2005     |
| Radiation       | Digital Hygro-Thermometer Chmb 02 | MicroLife         | HT-2126G      | Chmb 02           | 12/04/2002     | 12/04/2004     |
| Radiation       | EMI Receiver 03                   | HP                | 85460A        | 3448A00209        | 01/08/2004     | 01/08/2005     |
| Radiation       | Loop Antenna 01                   | R&S               | HFH2-Z2       | 881056/46         | 01/20/2004     | 01/20/2005     |
| Radiation       | Microwave Cable Chmb 02 3M        | HUBER+SUHNER AG.  | Sucoflex 103  | 42731/3 & 42729/3 | 03/15/2004     | 03/15/2005     |
| Radiation       | Spectrum Analyzer 08              | Advantest         | R3132         | 111000867         | 12/16/2003     | 12/16/2004     |
| Rad. Above 1Ghz | BILOG Antenna 07                  | Schaffner         | CBL6112B      | 2755              | 12/19/2003     | 12/19/2006     |
| Rad. Above 1Ghz | Digital Hygro-Thermometer Chmb 05 | MicroLife         | HT-2126G      | Chmb 05           | 12/04/2002     | 12/04/2004     |
| Rad. Above 1Ghz | High Pass Filter 01               | HEWLETT-PACKARD   | 84300-80038   | 001               | N/A            | N/A            |
| Rad. Above 1Ghz | High Pass Filter 02               | HEWLETT-PACKARD   | 84300-80039   | 005               | N/A            | N/A            |
| Rad. Above 1Ghz | Horn Antenna 02                   | Com-Power         | AH-118        | 10088             | 02/17/2004     | 02/17/2005     |
| Rad. Above 1Ghz | Horn Antenna 04                   | Com-Power         | AH-826        | 081-001           | 01/07/2004     | 01/07/2005     |
| Rad. Above 1Ghz | Horn Antenna 05                   | Com-Power         | AH-640        | 100A              | 09/18/2003     | 09/18/2005     |
| Rad. Above 1Ghz | Microwave Cable RF SK-01          | HUBER+SUHNER AG.  | Sucoflex 102  | 22139 /2          | 02/17/2004     | 02/17/2005     |
| Rad. Above 1Ghz | Microwave Cable RF SK-03          | HUBER+SUHNER AG.  | Sucoflex 102  | 20085 /2          | 06/18/2004     | 06/18/2005     |

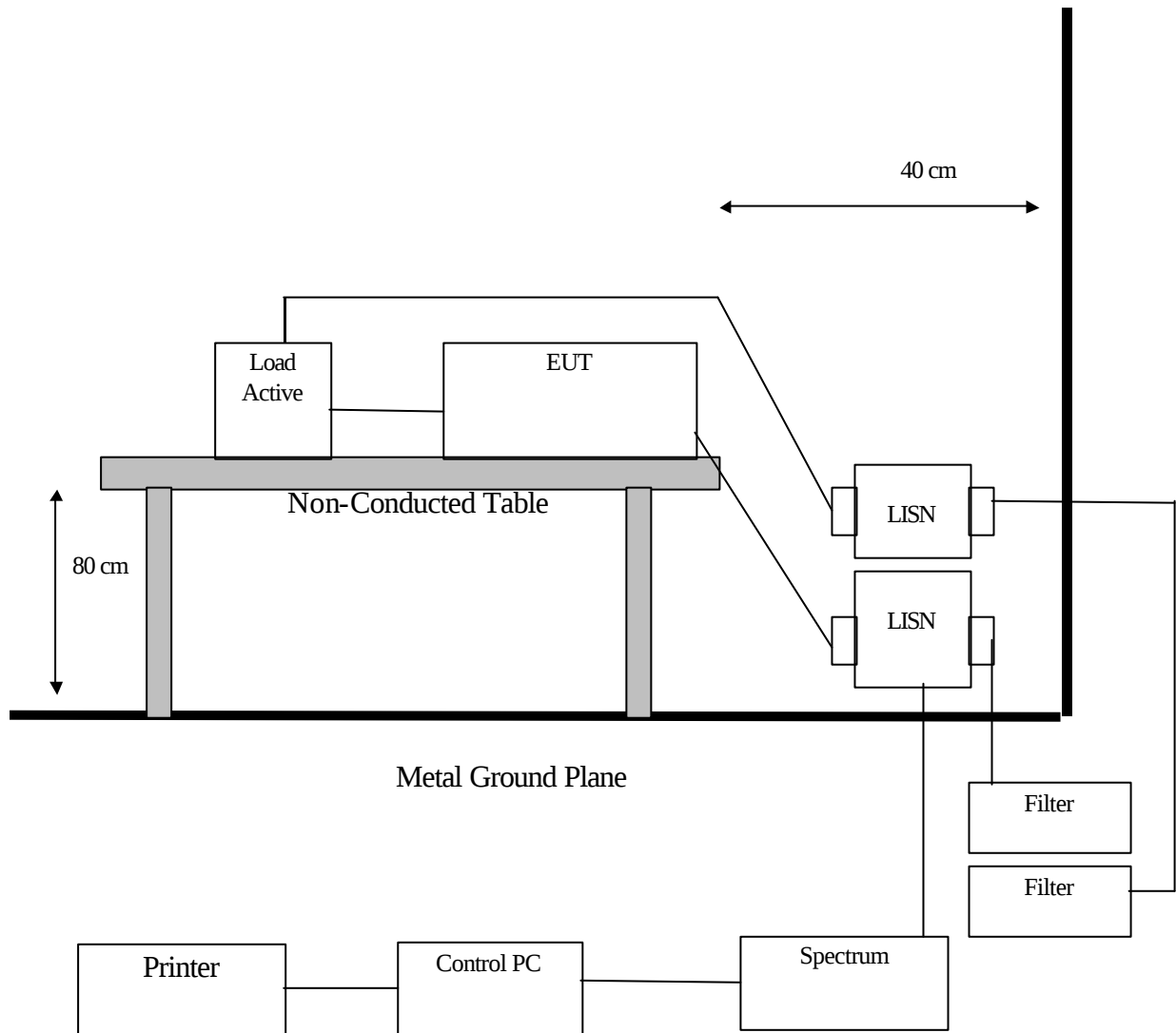
|                 |                      |           |                              |            |            |            |
|-----------------|----------------------|-----------|------------------------------|------------|------------|------------|
| Rad. Above 1Ghz | Peak Power Analyzer  | HP        | 8990A                        | 3621A01269 | 01/02/2004 | 01/02/2005 |
| Rad. Above 1Ghz | Power Meter 01       | HP        | 438A                         | 3513U06187 | 01/07/2004 | 01/07/2005 |
| Rad. Above 1Ghz | Power Sensor -4-3/-6 | HP        | 8482A                        | 3318A29614 | 01/09/2004 | 01/09/2005 |
| Rad. Above 1Ghz | Power Sensor Radar   | HP        | 84815A                       | 3318A01828 | 01/02/2004 | 01/02/2006 |
| Rad. Above 1Ghz | Power Sensor RF 01   | HP        | 8481H                        | MY41091048 | 05/28/2004 | 05/28/2005 |
| Rad. Above 1Ghz | Preamplifier 02      | MITEQ     | AFS44-0010265<br>0-40-10P-44 | 728229     | 05/12/2004 | 05/12/2005 |
| Rad. Above 1Ghz | Preamplifier 09      | MITEQ     | AFS44-0010265<br>0-40-10P-44 | 858687     | 05/12/2004 | 05/12/2005 |
| Rad. Above 1Ghz | Preamplifier 10      | MITEQ     | JS-26004000-27-<br>5A        | 818471     | N/A        | N/A        |
| Rad. Above 1Ghz | Spectrum Analyzer 07 | Advantest | R3182                        | 110600649  | 04/08/2004 | 04/08/2005 |

#### 4.5.2 Software for Controlling Spectrum/Receiver and Calculating Test Data

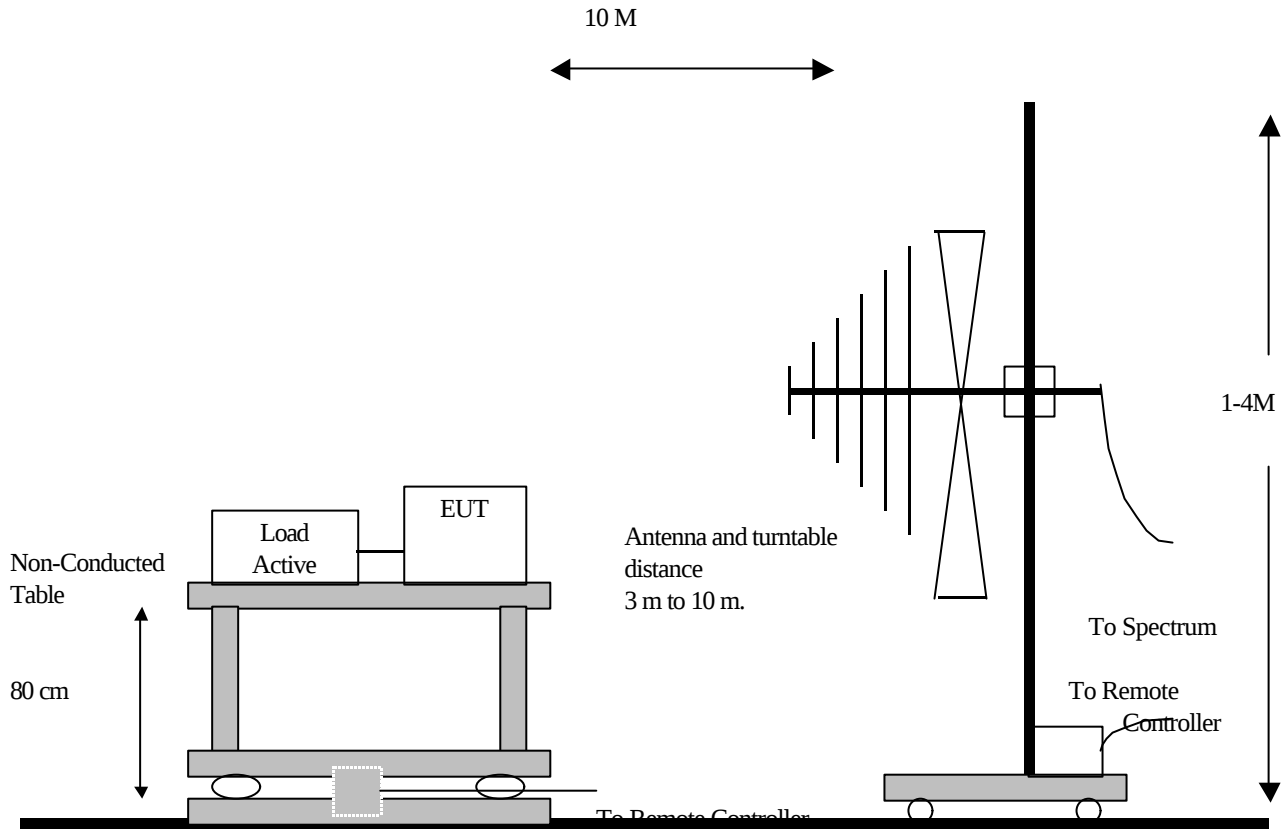
| Radiation/Conduction | Filename | Version | Issued Date |
|----------------------|----------|---------|-------------|
| Hsichih Conduction   | Tile.exe | 2.0.P   | 2/12/2002   |
| Hsichih Radiation    | Tile.exe | 2.0.P   | 2/12/2002   |
| Lung_Tan Conduction  | Tile.exe | 2.3.B   | 12/30/2003  |
| Lung_Tan Radiation   | Tile.exe | 2.3.B   | 12/30/2003  |

## 4.6 Appendix F: Layout of EUT and Support Equipment

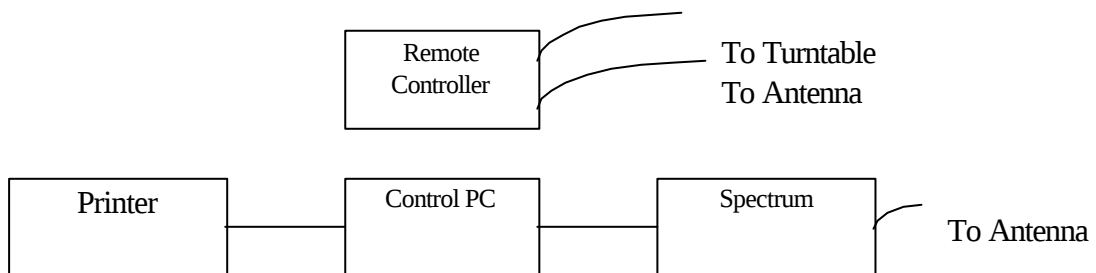
### 4.6.1 General Conducted Test Configuration



#### 4.6.2 General Radiation Test Configuration



Metal Full Soldered Ground Plane



## 4.7 Appendix G: Description of Support Equipment

### 4.7.1 Description of Support Equipment

#### Support Unit 1.

|                              |                                  |
|------------------------------|----------------------------------|
| Description:                 | USB 2.0 Card Reader/Writer       |
| Model Number:                | UID12W                           |
| Serial Number:               | N/A                              |
| Power Supply Type:           | From USB Port                    |
| USB 2.0 Port:                | one 4-pin                        |
| SD/MMC Card Slot:            | one                              |
| SecureDigital Card (Option): | SD (Model: SD-M16B1) 16MB        |
| USB Cable:                   | Shielded, Detachable (With Cord) |
| FCC ID:                      | (Comply with FCC DOC)            |

#### Support Unit 1.

|                              |                                  |
|------------------------------|----------------------------------|
| Description:                 | USB 2.0 Card Reader/Writer       |
| Model Number:                | UID12W                           |
| Serial Number:               | N/A                              |
| Power Supply Type:           | From USB Port                    |
| USB 2.0 Port:                | one 4-pin                        |
| SD/MMC Card Slot:            | one                              |
| SecureDigital Card (Option): | SD (Model: SD-M16B1) 16MB        |
| USB Cable:                   | Shielded, Detachable (With Cord) |
| FCC ID:                      | (Comply with FCC DOC)            |

#### Support Unit 2.

|                    |                |
|--------------------|----------------|
| Description:       | KOKA Headphone |
| Model Number:      | ST-304         |
| Serial Number:     | N/A            |
| Power Supply Type: | N/A            |
| Power Cord:        | N/A            |
| FCC ID:            | N/A            |

#### Support Unit 3.

|                    |                |
|--------------------|----------------|
| Description:       | KOKA Headphone |
| Model Number:      | ST-304         |
| Serial Number:     | N/A            |
| Power Supply Type: | N/A            |
| Power Cord:        | N/A            |
| FCC ID:            | N/A            |

## Support Unit 4.

|                    |                 |
|--------------------|-----------------|
| Description:       | KOKA Microphone |
| Model Number:      | DM-510          |
| Serial Number:     | N/A             |
| Power Supply Type: | N/A             |
| Power Cord:        | N/A             |
| FCC ID:            | N/A             |

## Support Unit 5.

|                    |                             |
|--------------------|-----------------------------|
| Description:       | Coson radio cassette player |
| Model Number:      | C-2087                      |
| Serial Number:     | N/A                         |
| Power Supply Type: | N/A                         |
| Power Cord:        | N/A                         |

## Support Unit 6.

|                    |                                          |
|--------------------|------------------------------------------|
| Description:       | HP Printer (for parallel interface port) |
| Model Number:      | C2642A                                   |
| Serial Number:     | TH84T1N3J3                               |
| Power Supply Type: | AC Adaptor (HP Model: C2175A)            |
| Power Cord:        | Non-shielded, Detachable                 |
| Data Cable:        | Shielded, Detachable, With Metal Hood    |
| FCC ID:            | B94C2642X                                |

## Support Unit 7.

|                    |             |
|--------------------|-------------|
| Description:       | DELL Mouse  |
| Model Number:      | M-SAW34     |
| Serial Number:     | LZE24108086 |
| Power Supply Type: | N/A         |
| Power Cord:        | N/A         |
| FCC ID:            | DZL211029   |

## Support Unit 8.

|                    |                                                               |
|--------------------|---------------------------------------------------------------|
| Description:       | Aceex Modem<br>(for serial interface port 1)                  |
| Model Number:      | DM1414                                                        |
| Serial Number:     | 0301000558                                                    |
| Power Supply Type: | Linear, Power Adapter<br>( AC to AC Xfmr, Wall Mounted Type ) |
| Power Cord:        | Nonshielded, Without Grounding Pin                            |
| FCC ID:            | IFAXDM1414                                                    |

## Support Unit 9.

|                    |                                                               |
|--------------------|---------------------------------------------------------------|
| Description:       | Aceex Modem<br>(for serial interface port 2)                  |
| Model Number:      | DM1414                                                        |
| Serial Number:     | 0301000557                                                    |
| Power Supply Type: | Linear, Power Adapter<br>( AC to AC Xfmr, Wall Mounted Type ) |
| Power Cord:        | Nonshielded, Without Grounding Pin                            |
| FCC ID:            | IFAXDM1414                                                    |

## Support Unit 10.

|                |                             |
|----------------|-----------------------------|
| Description:   | Acer Monitor                |
| Model:         | G781                        |
| Serial Number: | 999007101214400445T7AA31T   |
| Power Cord:    | Non-shielded, Detachable    |
| FCC ID:        | (Comply with FCC Standards) |

## Support Unit 11.

|                     |                                   |
|---------------------|-----------------------------------|
| Description:        | Acer Personal Computer            |
| Model:              | VT7200                            |
| Serial No.:         | N/A                               |
| Power Supply Type:  | Delta (Model: DPS-300GB-1)        |
| Hard Disk Drive:    | Maxtor (Model:53073U6)30GB        |
| Floppy Driver:      | Panasonic (Model: JU-256A047P K2) |
| CD-ROM Drive:       | AOpen (Model: CD-952E/AKH)        |
| VGA Card:           | WinFast (Model: LRI2830)          |
| Modem Card:         | AMBIT(Model: 1456VQH20E-04)       |
| Parallel Port:      | one 25-pin                        |
| Serial Port:        | two 9-pin                         |
| LAN Port:           | one 8-pin                         |
| Keyboard Connector: | one 6-pin                         |
| Mouse Connector:    | one 6-pin                         |
| USB Connector:      | two 4-pin                         |
| Game Port:          | one 15-pin                        |
| Speaker Port:       | one                               |
| Microphone Port:    | one                               |
| Line In Port:       | one                               |
| Power Cord:         | Non-shielded, Detachable          |

## Support Unit 12.

|                     |                                   |
|---------------------|-----------------------------------|
| Description:        | Acer Personal Computer            |
| Model:              | VT7200                            |
| Serial No.:         | N/A                               |
| Power Supply Type:  | Delta (Model: DPS-300GB-1)        |
| Hard Disk Drive:    | Maxtor (Model:53073U6)30GB        |
| Floppy Driver:      | Panasonic (Model: JU-256A047P K2) |
| CD-ROM Drive:       | AOpen (Model: CD-952E/AKH)        |
| VGA Card:           | WinFast (Model: LRI2830)          |
| Modem Card:         | AMBIT(Model: 1456VQH20E-04)       |
| Parallel Port:      | one 25-pin                        |
| Serial Port:        | two 9-pin                         |
| LAN Port:           | one 8-pin                         |
| Keyboard Connector: | one 6-pin                         |
| Mouse Connector:    | one 6-pin                         |
| USB Connector:      | two 4-pin                         |
| Speaker Port:       | one                               |
| Microphone Port:    | one                               |
| Line In Port:       | one                               |
| Power Cord:         | Non-shielded, Detachable          |

#### 4.7.2 Software for Controlling Support Unit

Test programs exercising various part of EUT were used. The programs were executed as follows:

- A. Read and write to the disk drives.
- A. R/W memory card form EUT USB Port through Card Reader/Writer
- B. Send audio signal to the headphone.
- C. Receive audio signal from the microphone.
- D. Receive audio signal from walkman.
- E. Send H pattern to the parallel port device (Printer).
- F. Send H pattern to the serial port device (Modem 1).
- G. Send H pattern to the serial port device (Modem 2).
- H. Send H pattern to the video port device (Monitor).
- I. Send signal from EUT to server through LAN port.
- J. Press the "H" font key, Send H pattern to the WordPad file show on the monitor screen.
- K. Repeat the above steps.

|          | Filename     | Issued Date |
|----------|--------------|-------------|
| LAN      | EMC.exe      | 11/22/1996  |
| Monitor  | HH.bat       | 8/20/1991   |
| Modem 1  | Hm.bat       | 8/20/1991   |
| Modem 2  | Hm.bat       | 8/20/1991   |
| Printer1 | Wordpad.exe  | 11/11/1999  |
| Winthrax | Winthrax.exe | 5/21/1996   |
| WordPad  | WordPad.exe  | 8/21/2002   |

#### 4.7.3 I/O Cable Condition of EUT and Support Units

| Description            | Path                                        | Cable Length | Cable Type                       | Connector Type           |
|------------------------|---------------------------------------------|--------------|----------------------------------|--------------------------|
| AC Power Cord          | 110V (~240V) to AC Power Cord Inlet (3-pin) | 1.8M         | Nonshielded, Detachable          | Plastic Head             |
| Server Data Cable      | Server to EUT LAN Port                      | 33 feet      | Non-shielded, Detachable         | RJ-45, with Plastic Head |
| Monitor Data Cable     | Monitor to PC VGA port                      | 1.6M         | Shielded, Un-detachable          | Metal Head               |
| Modem Data Cable       | Modem to PC COM 1 port                      | 1.5M         | Shielded, Detachable             | Metal Head               |
| Modem Data Cable       | Modem to PC COM 2 port                      | 1.5M         | Shielded, Detachable             | Metal Head               |
| Mouse Data Cable       | Mouse to PC Mouse port                      | 1.8M         | Shielded, Un-detachable          | Metal Head               |
| Printer Data Cable     | Printer to PC Parallel port                 | 1.5M         | Shielded, Detachable             | Metal Head               |
| Audio-in Data Cable    | Walkman to PC Line In Port                  | 2M           | Non-shielded, Detachable         | Plastic Head             |
| Microphone Data Cable  | Microphone to PC Microphone Port            | 1.5M         | Nonshielded, Undetachable        | Plastic Head             |
| Headphone Data Cable*2 | Headphone to PC Line Out Port               | 1.2M         | Nonshielded, Undetachable        | Plastic Head             |
| USB Data Cable*2       | EUT USB Port to Card Reader/Writer          | 1.0 M        | Shielded, detachable (with cord) | Metal Head               |
| Data Cable             | EUT to Personal Computer PS/2 port          | 1.7M         | Shielded, Un-detachable          | Metal Head               |

#### 4.8 Appendix H: Description of Equipment Under Test

### EUT

|                         |                                  |
|-------------------------|----------------------------------|
| Description:            | Keyboard                         |
| Condition:              | Pre-Production                   |
| Model:                  | 5211A                            |
| Serial Number:          | N/A                              |
| Power:                  | From Personal Computer PS/2 port |
| PS/2 Connector:         | one 6 pin                        |
| PS/2 Signal Data Cable: | Shielded, Un-detachable          |

The test configuration is listed below:

Configuration 1:

The EUT was inserted into the Personal Computer PS/2 Keyboard port.

EMI Noise Source:

U1:1.8MHZ

EMI Solution:

1. On PS/2 Signal Data Cable end of Keyboard add a Core. Vendor: Type: 10.4\*5\*5.8

The difference between the Model number: 5211A is described as below table.

| BRAND  | MODEL |
|--------|-------|
| BTC    | 5211A |
| EMPREX | 5211A |

#### 4.9 Appendix I: Uncertainty of Measurement

The measurement uncertainties mentioned below refer to CISPR 16-4: 2002 Uncertainty in EMC measurements.

Test Site: Conduction 02 for LT LAB

| Item | Source of Uncertainty                                                         | Probability Distribution | Total Uncertainties (dB) |              | Standard Uncertainty (dB) |       |
|------|-------------------------------------------------------------------------------|--------------------------|--------------------------|--------------|---------------------------|-------|
| 1    | Systematic Effects: (Assessment from 20 repeat observation; 1 reading on EUT) | Normal                   | k=2                      | 0.104        | k=1                       | 0.052 |
| 2    | Random Effects: (Assessment from 20 random observations; 1 reading on EUT)    | Normal                   | k=2                      | 0.330        | k=1                       | 0.165 |
| 3    | Receiver Calibration                                                          | Rectangular              | k=1.73                   | 1.000        | k=1                       | 0.577 |
| 4    | LISN Factor Calibration                                                       | Normal                   | k=2                      | 1.200        | k=1                       | 0.600 |
| 5    | Cable Loss Calibration                                                        | Normal                   | k=2                      | 1.000        | k=1                       | 0.500 |
| 6    | Combined Standard Uncertainty $U_c(y)$                                        | Normal                   |                          |              | k=1                       | 0.850 |
| 7    | <b>Total Uncertainty @95% minimum Confidence Level</b>                        | <b>Normal</b>            | <b>k=2</b>               | <b>1.701</b> |                           |       |

Measurement Uncertainty Calculations:

$$U_c(y) = \text{square root} ( u_1(y)^2 + u_2(y)^2 + \dots + u_n(y)^2 )$$

$$U = 2 * U_c(y)$$

Test Site: Chamber 02-10M for LT LAB

| Item | Source of Uncertainty                                                            | Probability Distribution | Total Uncertainties (dB) |              | Standard Uncertainty (dB) |       |
|------|----------------------------------------------------------------------------------|--------------------------|--------------------------|--------------|---------------------------|-------|
| 1    | Systematic Effects:<br>(Assessment from 20 repeat observation; 1 reading on EUT) | Normal                   | k=2                      | 0.134        | k=1                       | 0.067 |
| 2    | Random Effects:<br>(Assessment from 20 random observations; 1 reading on EUT)    | Normal                   | k=2                      | 0.206        | k=1                       | 0.103 |
| 3    | Receiver Calibration                                                             | Rectangular              | k=1.73                   | 1.000        | k=1                       | 0.577 |
| 4    | Antenna Factor Calibration                                                       | Normal                   | k=2                      | 1.400        | k=1                       | 0.700 |
| 5    | Cable Loss Calibration                                                           | Normal                   | k=2                      | 1.000        | k=1                       | 0.500 |
| 6    | Combined Standard Uncertainty Uc(y)                                              | Normal                   |                          |              | k=1                       | 0.916 |
| 7    | <b>Total Uncertainty @95% minimum Confidence Level</b>                           | <b>Normal</b>            | <b>k=2</b>               | <b>1.831</b> |                           |       |

Measurement Uncertainty Calculations:

$$U_c(y) = \text{square root} (u_1(y)^2 + u_2(y)^2 + \dots + u_n(y)^2)$$

$$U = 2 * U_c(y)$$

Test Site: OATS 02 for LT LAB

| Item | Source of Uncertainty                                                         | Probability Distribution | Total Uncertainties (dB) |              | Standard Uncertainty (dB) |       |
|------|-------------------------------------------------------------------------------|--------------------------|--------------------------|--------------|---------------------------|-------|
| 1    | Systematic Effects: (Assessment from 20 repeat observation; 1 reading on EUT) | Normal                   | k=2                      | 0.735        | k=1                       | 0.367 |
| 2    | Random Effects: (Assessment from 20 random observations; 1 reading on EUT)    | Normal                   | k=2                      | 0.539        | k=1                       | 0.270 |
| 3    | Receiver Calibration                                                          | Rectangular              | k=1.73                   | 1.000        | k=1                       | 0.577 |
| 4    | Antenna Factor Calibration                                                    | Normal                   | k=2                      | 1.000        | k=1                       | 0.500 |
| 5    | Cable Loss Calibration                                                        | Normal                   | k=2                      | 1.000        | k=1                       | 0.500 |
| 6    | Combined Standard Uncertainty $U_c(y)$                                        | Normal                   |                          |              | k=1                       | 0.889 |
| 7    | <b>Total Uncertainty @95% minimum Confidence Level</b>                        | <b>Normal</b>            | <b>k=2</b>               | <b>1.779</b> |                           |       |

Measurement Uncertainty Calculations:

$$U_c(y) = \text{square root} (u_1(y)^2 + u_2(y)^2 + \dots + u_n(y)^2)$$

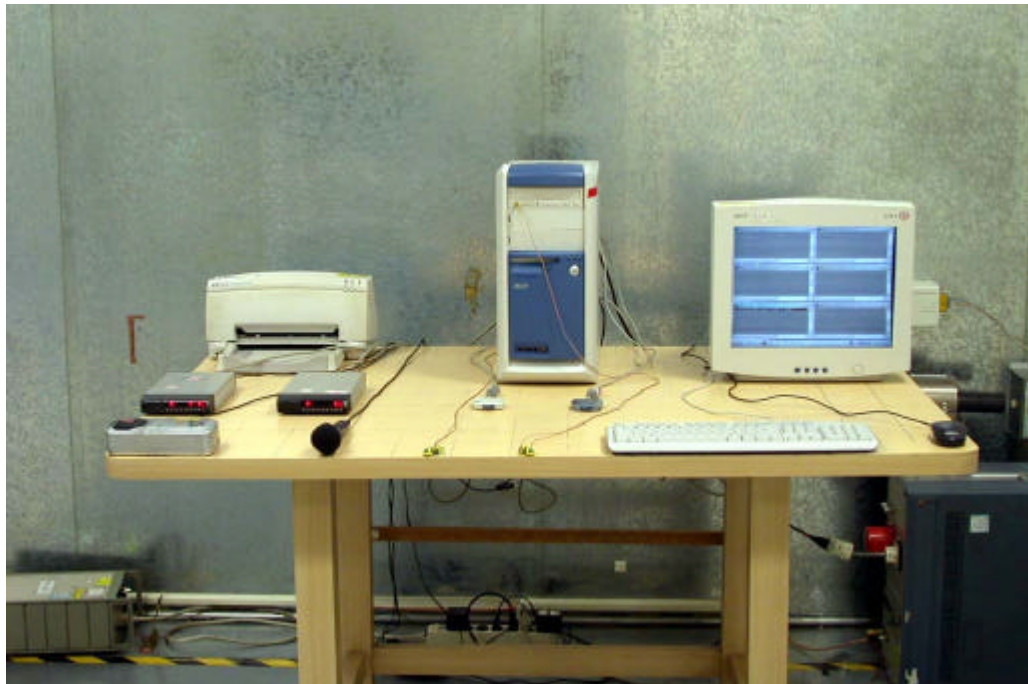
$$U = 2 * U_c(y)$$

#### 4.10 Appendix J: Photographs of EUT Configuration Test Set Up

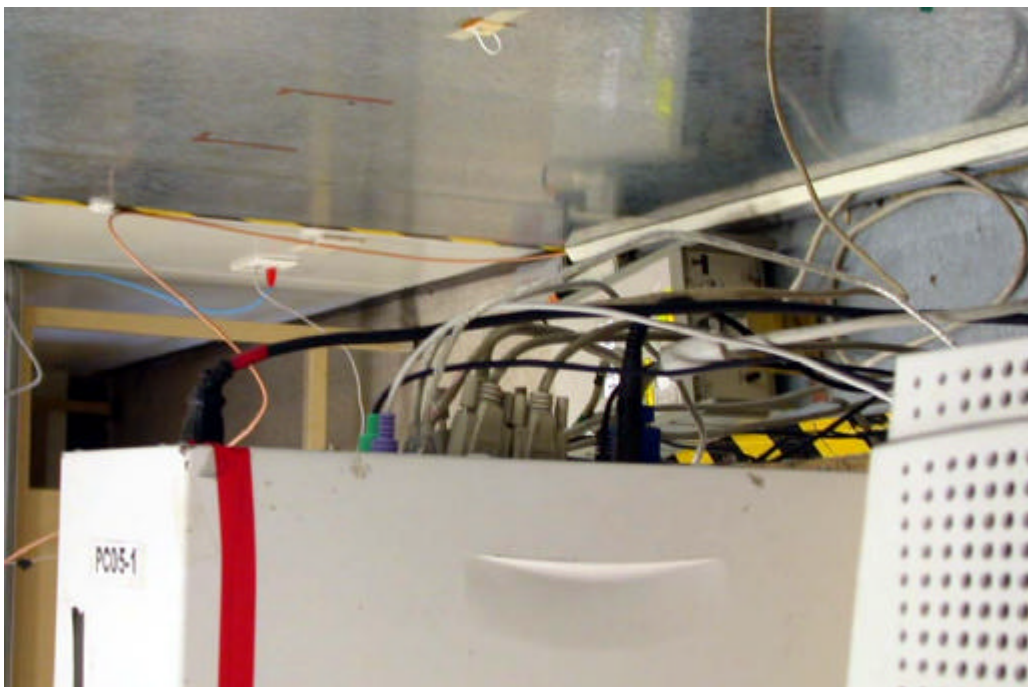
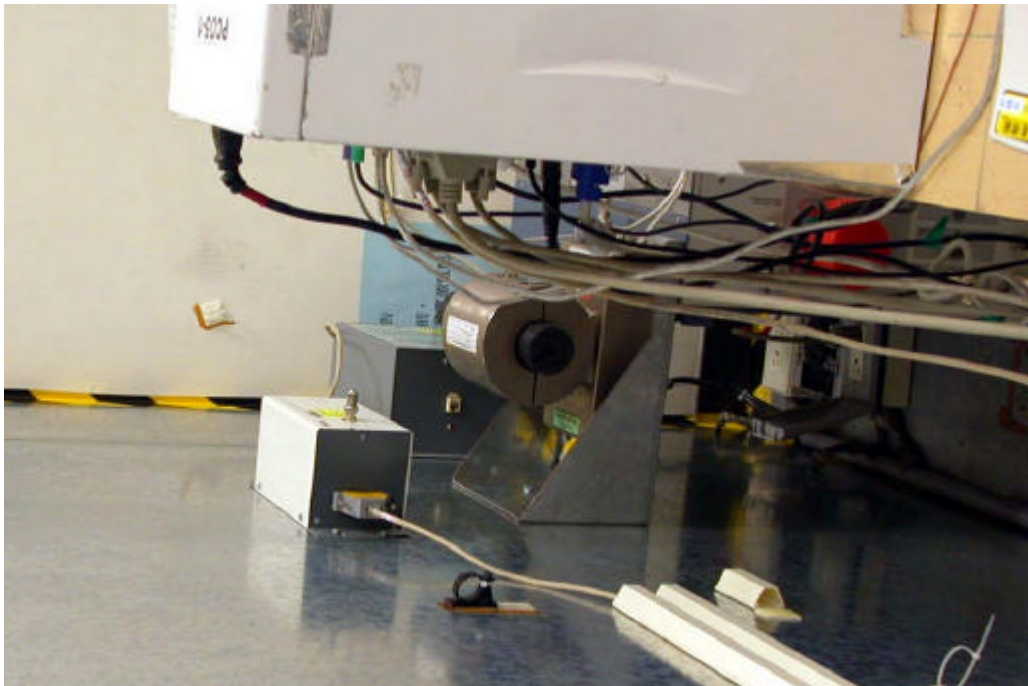
The measurement results along with the appropriate limits for comparison shall be presented in tabular form. If an alternate test method is used, the test report must identify that method and justification for its use shall be provided. Instrumentation, instrument attenuator and bandwidth settings, detector function, EUT arrangements, a sample calculation with all conversion factors and all other pertinent details shall be included along with the measurement results. When automatic scan techniques are used, an explanation of how each emission from the EUT was maximized shall be included in the test report along with the scan rate used to obtain each level.

The justification for selecting a particular EUT configuration and particular length of interface cable to produce maximized emissions must be documented in the test report. Photographs clearly showing the test set-up and interface cable arrangement for the highest radiated and line conducted emission measured shall be included.

The Front View of Highest Conducted Set-up For EUT



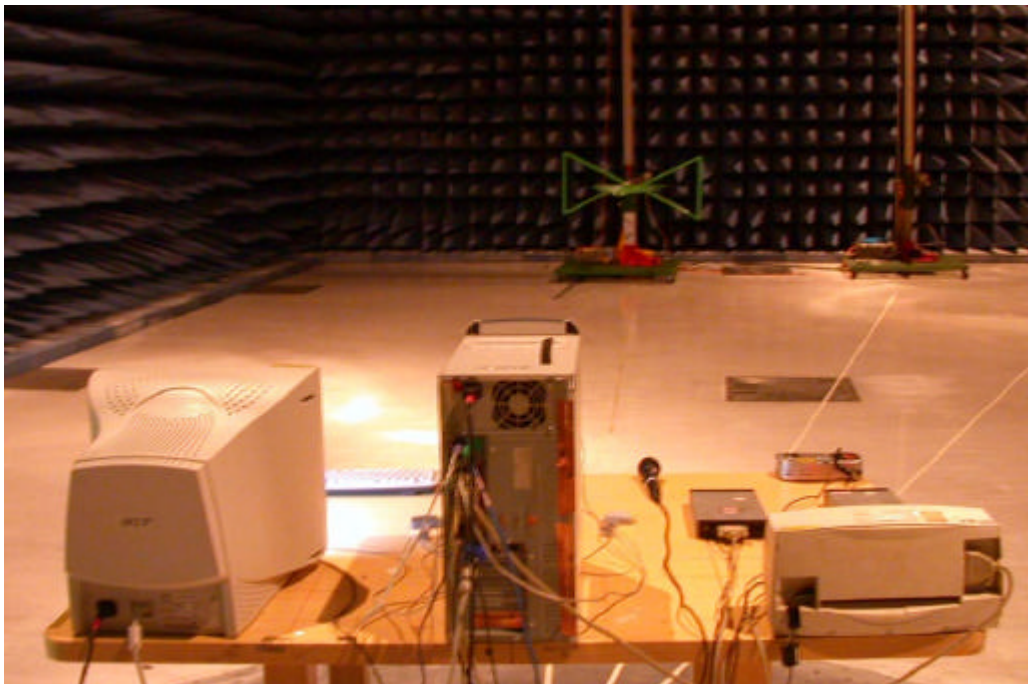
The Back View of Highest Conducted Set-up For EUT



The Front View of Highest Radiated Set-up For EUT



The Back View of Highest Radiated Set-up For EUT



#### **4.11 Appendix K: Photographs of EUT**

Please find this appendix in the File of **ISL-04LE223P**