# FCC Part 15
# EMI TEST REPORT

# of

E.U.T. : Bluetooth USB Dongle

MODEL : BD-U01

FCC ID. : QSG0212000001

# for

APPLICANT : Lit Logic Technology Inc.

ADDRESS : 5F, No.6, Sec 1, Jung-Shing Rd., Wugu-Shinang, Taipei, Taiwan, 248 R.O.C.

Test Performed by

**ELECTRONICS TESTING CENTER, TAIWAN**

NO. 34, LIN 5, DING FU TSUN, LINKOU HSIANG

TAIPEI HSIEN, TAIWAN, R.O.C.

Tel:(02)26023052

Fax:(02)26010910

http://www.etc.org.tw

Report Number : ET91R-12-072-04

# TEST REPORT CERTIFICATION

Applicant : Lit Logic Technology Inc.
5F, No.6, Sec 1, Jung-Shing Rd., Wugu-Shinang, Taipei, Taiwan, 248 R.O.C.

Manufacturer : Lit Logic Technology Inc.
5F, No.6, Sec 1, Jung-Shing Rd., Wugu-Shinang, Taipei, Taiwan, 248 R.O.C.

Description of EUT :

a) Type of EUT : Bluetooth USB Dongle

b) Trade Name : ---

c) Model No. : BD-U01

d) Power Supply : DC 5.0V From PC

e) Working Frequency : 2400MHz~2483.5MHz

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C (2002)

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 founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Issued Date : Dec. 31, 2002

Test Engineer : S. S. Liou
( S. S. Liou )

Approve & Authorized Signer : Will Yauo
Will Yauo, Manager
EMC Dept. II of ELECTRONICS TESTING CENTER, TAIWAN

# Table of Contents Page

**1 GENERAL INFORMATION ..... 1**

1.1 Product Description ..... 1
1.2 Characteristics of Device ..... 1
1.3 Test Methodology ..... 1
1.4 Test Facility ..... 1

**2 PROVISIONS APPLICABLE ..... 2**

2.1 Definition ..... 2
2.2 Requirement for Compliance ..... 3
2.3 Restricted Bands of Operation ..... 5
2.4 Labeling Requirement ..... 5
2.5 User Information ..... 6

**3. SYSTEM TEST CONFIGURATION ..... 7**

3.1 Justification ..... 7
3.2 Devices for Tested System ..... 7

**4 RADIATED EMISSION MEASUREMENT ..... 8**

4.1 Applicable Standard ..... 8
4.2 Measurement Procedure ..... 8
4.3 Measuring Instrument ..... 10
4.4 Radiated Emission Data ..... 11
4.4.1 RF Portion ..... 11
4.4.2 Other Emission ..... 14
4.5 Field Strength Calculation ..... 14
4.6 Photos of Radiation Measuring Setup ..... 15

**5 CONDUCTED EMISSION MEASUREMENT ..... 16**

5.1 Standard Applicable ..... 16
5.2 Measurement Procedure ..... 16
5.3 Conducted Emission Data ..... 17
5.4 Result Data Calculation ..... 18
5.5 Conducted Measurement Equipment ..... 19
5.6 Photos of Conduction Measuring Setup ..... 20

**6 ANTENNA REQUIREMENT ..... 21**

6.1 Standard Applicable ..... 21
6.2 Antenna Construction ..... 21

**7 BAND EDGES MEASUREMENT ..... 22**

7.1 Standard Applicable ..... 22
7.2 Measurement Procedure ..... 22
7.3 Measurement Equipment ..... 22
7.4 Measurement Data ..... 22

**APPENDIX 1 : PLOTTED DATA OF POWER LINE CONDUCTED EMISSIONS ..... 23**

**APPENDIX 2 : PLOTTED DATA OF BAND EDGES EMISSION ..... 30**

# 1 GENERAL INFORMATION

## 1.1 Product Description

a) Type of EUT : Bluetooth USB Dongle

b) Trade Name : ---

c) Model No. : BD-U01

d) Power Supply : DC 5.0V From PC

## 1.2 Characteristics of Device

The Lit Logic Technology Inc. Universal Class 2 Bluetooth™ USB Dongle BD-U01 is compact and qualified module that provide a complete 2.4GHz Bluetooth™ system for wireless data and voice communications. The BD-U01 includes an integrated antenna and a USB connector interface, offering a simple Bluetooth solution for electronic devices with USB interface.

## 1.3 Test Methodology

For Bluetooth USB Dongle, both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.4 (1992). Other required measurements were illustrated in separate sections of this test report for details.

## 1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No.34, Lin 5, Ding Fu Tsun, Linkou Hsiang, Taipei Hsien, Taiwan, R.O.C.

This site has been fully described in a report submitted to your office, and accepted in a letter dated Feb. 10, 2000.

# 2 PROVISIONS APPLICABLE

## 2.1 Definition

**Unintentional radiator:**
A device that intentionally generates and 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 A Digital Device:
A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

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.

**Intentional radiator:**
A device that intentionally generates and emits radio frequency energy by radiation or induction.

## 2.2 Requirement for Compliance

### (1) Conducted Emission Requirement

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50MH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency MHz | Quasi Peak dBìV | Average dBìV |
|---|---|---|
| 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 §15.109(a), except for Class A digital devices, 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 dBì V/m** | **Radiated ì V/m** |
|---|---|---|---|
| 30 - 88 | 3 | 40.0 | 100 |
| 88 - 216 | 3 | 43.5 | 150 |
| 216 - 960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

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

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

For intentional radiator device, per §15.249(a), the field strength of emissions shall comply with the following :

| **Frequency** | **Distance** | **Fundamental** | | **Harmonic** | |
|---|---|---|---|---|---|
| **MHz** | **Meters** | **dBì V/m** | **mV/m** | **dBì V/m** | **ì V/m** |
| 902 - 928 | 3 | 94 | 50 | 54 | 500 |
| 2400 - 2483.5 | 3 | 94 | 50 | 54 | 500 |
| 5725 - 5875 | 3 | 94 | 50 | 54 | 500 |
| 24000 - 24250 | 3 | 108 | 250 | 68 | 2500 |

In accordance with §15.249(d), limits shown in above table are based on average limits for frequencies above 1000 MHz, and frequencies below 1000 MHz are based on quasi peak. However, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20 dB.

**(3) Spurious in Out Band Requirement**

For intentional device, according to §15.249 (c), emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits in §15.209.

**(4) Antenna Requirement**

For intentional device, according to §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.

## 2.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.25 |
| 0.495 - 0.505 ** | 16.69475 - 16.69525 | 608-614 | 5.35-5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475 - 156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2655-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3360-4400 | Above 38.6 |
| 13.36-13.41 | | | |

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

## 2.4 Labeling 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.

## 2.5 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 Justification

For both radiated and conducted emissions, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation.

All measurement were intentional to maximum the emissions from EUT by varying the connection cables, therefore, the test result is sure to meet the applicable requirement.

## 3.2 Devices for Tested System

| Device | Manufacture | Model / FCC ID. | Description |
|---|---|---|---|
| Bluetooth USB Dongle * | Lit Logic Technology Inc. | BD-U01<br>QSG0212000001 | ---- |
| Notebook PC | IBM | X21 | 2.0m Unshielded AC Power Cord |
| Mouse | Microsoft | PN X05-95266 | 1.5m Unshielded Cable |
| Modem | Smar TEAM Co. | 1200AT | 1.2m Unshielded Cable |
| Printer | EPSON | STYLE PHOTOS 700 | 1.5m Unshielded AC Power Cord |

Remark "*" means equipment under test.

# 4 RADIATED EMISSION MEASUREMENT

## 4.1 Applicable Standard

For intentional radiators, according to §15.249 (a), operation within the frequency band of 2.4 to 2.4835 GHz, the fundamental field strength shall not exceed 94 dBuV/m and the harmonics shall not exceed 54 dBuV/m. For out band emission except for harmonics shall be comply with §15.209 or at least attenuated by 50 dB below the level of the fundamental.

## 4.2 Measurement Procedure

**A. Preliminary Measurement For Portable Devices**

For portable devices, the following procedure was performed to determine the maximum emission axis of EUT:

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

**B. Final Measurement**

1. Setup the configuration per figure 5 and 6 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. 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 highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.

Note : A band pass filter was used to avoid pre-amplifier saturated when measure TX operation mode in frequency band above 1 GHz.

5. Repeat step 4 until all frequencies need to be measured were complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

7. Check the three frequencies of 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

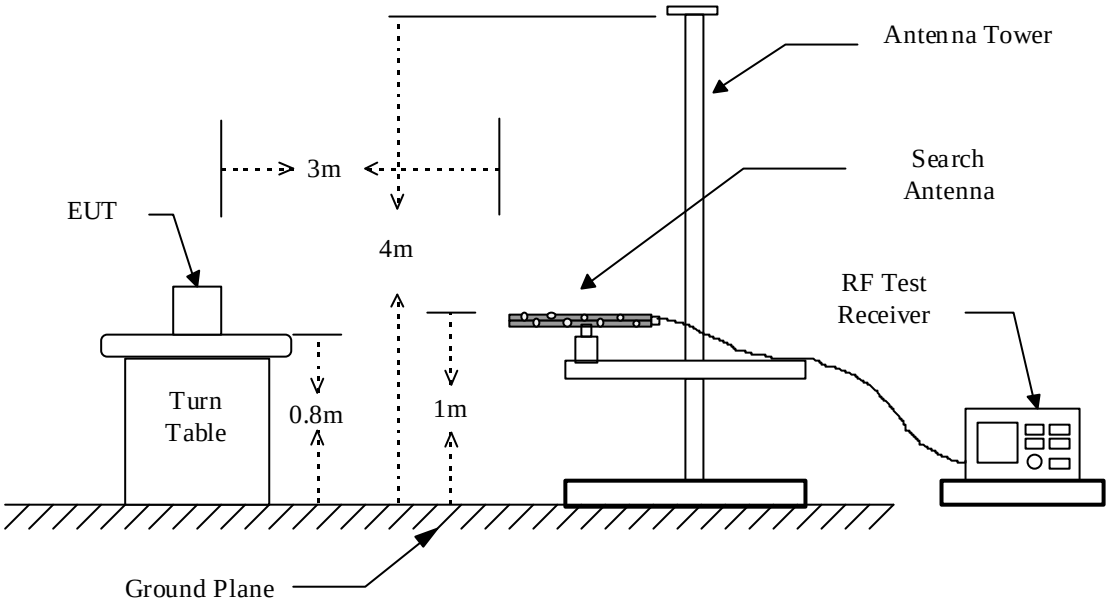
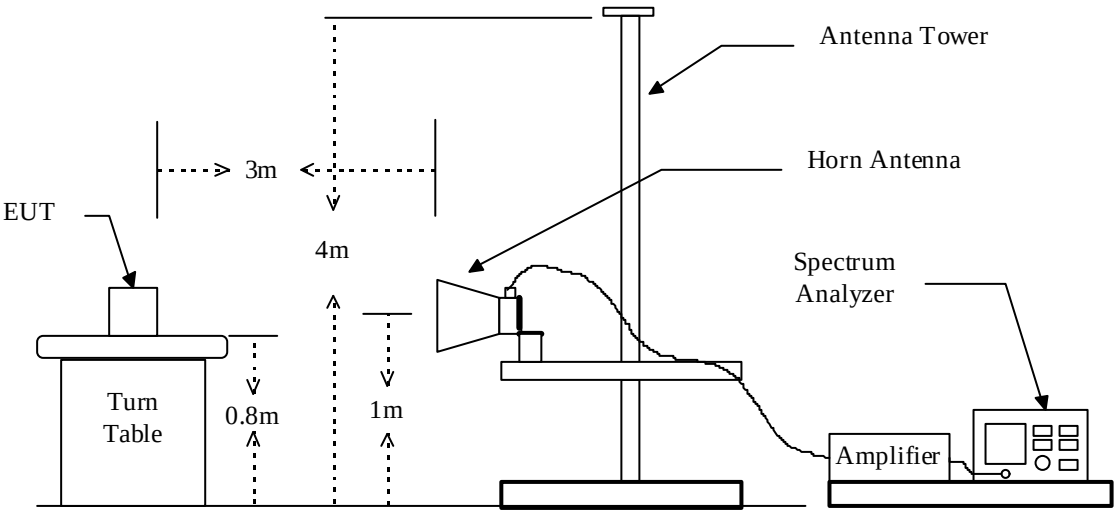



Figure 2 : Frequencies measured above 1 GHz configuration



## 4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

| Equipment | Manufacturer | Model No. | Next Cal. Date |
|---|---|---|---|
| Spectrum Analyzer | Hewlett-Packard | 8568B | 01/10/2003 |
| Pre-selector | Hewlett-Packard | 85685A | 01/10/2003 |
| Quasi Peak Detector | Hewlett-Packard | 85650A | 01/10/2003 |
| RF Test Receiver | Rohde & Schwarz | ESVS 30 | 08/05/2003 |
| Log periodic Antenna | EMCO | 3146 | 11/04/2002 |
| Biconical Antenna | EMCO | 3110B | 11/04/2002 |
| Horn Antenna | EMCO | 3115 | 05/09/2003 |
| Preamplifier | Hewlett-Packard | 8447D | 10/14/2002 |
| Preamplifier | Hewlett-Packard | 8449B | 05/10/2003 |
| Spectrum Analyzer | Hewlett-Packard | 8564E | 04/16/2003 |

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 |
| | Spectrum Analyzer | Peak | 100 kHz | 100 kHz |
| Above 1000 | Spectrum Analyzer | Peak | 1 MHz | 1 MHz |
| | Spectrum Analyzer | Average | 1 MHz | 300Hz |

## 4.4 Radiated Emission Data

### 4.4.1 RF Portion

**A.**

Operation Mode : TX
Fundamental Frequency : 2402 MHz
Test Date : Jul. 31, 2002 Temperature : 25 ℃ Humidity : 60 %

| Frequency (MHz) | Reading (dBuV) H Peak | H Ave | V Peak | V Ave | Factor (dB) Corr. | Result @3m (dBuV/m) Peak | Result Ave | Limit @3m (dBuV/m) Peak | Limit Ave. | Margin (dB) | Table Deg. (Deg.) | Ant. High (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2402.007 | 90.8 | 90.7 | 88.5 | 88.5 | -3.1 | 87.7 | 87.6 | 114.0 | 94.0 | -6.4 | 204 | 1.50 |
| 4804.014 | --- | --- | --- | --- | 2.5 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 7206.021 | --- | --- | --- | --- | 5.7 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 9608.028 | --- | --- | --- | --- | 7.2 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 12010.035 | --- | --- | --- | --- | 9.2 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 14412.042 | --- | --- | --- | --- | 11.5 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 16814.049 | --- | --- | --- | --- | 11.8 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 19216.056 | --- | --- | --- | --- | 8.9 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 21618.063 | --- | --- | --- | --- | 9.7 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 24020.070 | --- | --- | --- | --- | 10.3 | --- | --- | 74.0 | 54.0 | --- | --- | --- |

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark "---" means that the emission level is too low to be measured, with a preamplifier of 35 dB.
3. Measuring data showed on above table was derived with peak detector function.
4. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.
5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

**B.**

Operation Mode : TX
Fundamental Frequency : 2441 MHz
Test Date : Jul. 31, 2002 Temperature : 25 ℃ Humidity : 60 %

| Frequency (MHz) | Reading (dBuV) H Peak | H Ave | V Peak | V Ave | Factor (dB) Corr. | Result @3m (dBuV/m) Peak | Result Ave | Limit @3m (dBuV/m) Peak | Limit Ave. | Margin (dB) | Table Deg. (Deg.) | Ant. High (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2441.020 | 91.7 | 91.3 | 88.0 | 87.7 | -2.9 | 88.8 | 88.4 | 114.0 | 94.0 | -5.6 | 200 | 1.50 |
| 4882.040 | --- | --- | --- | --- | 2.7 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 7323.060 | --- | --- | --- | --- | 5.9 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 9764.080 | --- | --- | --- | --- | 7.3 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 12205.100 | --- | --- | --- | --- | 9.3 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 14646.120 | --- | --- | --- | --- | 11.6 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 17087.140 | --- | --- | --- | --- | 13.3 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 19528.160 | --- | --- | --- | --- | 8.5 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 21969.180 | --- | --- | --- | --- | 9.9 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 24410.200 | --- | --- | --- | --- | 10.7 | --- | --- | 74.0 | 54.0 | --- | --- | --- |

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark "---" means that the emission level is too low to be measured, with a preamplifier of 35 dB.
3. Measuring data showed on above table was derived with peak detector function.
4. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.
5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

**C.**

Operation Mode : TX/RX
Fundamental Frequency : 2480 MHz
Test Date : Jul. 31, 2002 Temperature : 25 ℃ Humidity : 60 %

| Frequency (MHz) | Reading (dBuV) H Peak | H Ave | V Peak | V Ave | Factor (dB) Corr. | Result @3m (dBuV/m) Peak | Ave | Limit @3m (dBuV/m) Peak | Ave. | Margin (dB) | Table Deg. (Deg.) | Ant. High (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2480.030 | 92.0 | 91.7 | 88.2 | 88.0 | -2.8 | 89.2 | 88.9 | 114.0 | 94.0 | -5.1 | 204 | 1.50 |
| 4960.060 | --- | --- | --- | --- | 2.8 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 7440.090 | --- | --- | --- | --- | 6.1 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| **9920.120** | **---** | **---** | **---** | **---** | **7.4** | **---** | **---** | **74.0** | **54.0** | **---** | **---** | **---** |
| **12400.150** | **---** | **---** | **---** | **---** | **9.4** | **---** | **---** | **74.0** | **54.0** | **---** | **---** | **---** |
| **14880.180** | **---** | **---** | **---** | **---** | **11.5** | **---** | **---** | **74.0** | **54.0** | **---** | **---** | **---** |
| 17360.210 | --- | --- | --- | --- | 15.2 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 19840.240 | --- | --- | --- | --- | 8.6 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 22320.270 | --- | --- | --- | --- | 10.2 | --- | --- | 74.0 | 54.0 | --- | --- | --- |
| 24800.300 | --- | --- | --- | --- | 11.0 | --- | --- | 74.0 | 54.0 | --- | --- | --- |

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark "---" means that the emission level is too low to be measured, with a preamplifier of 35 dB.
3. Measuring data showed on above table was derived with peak detector function.
4. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.
5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

### 4.4.2 Other Emission

Operation Mode : Working
Test Date : Aug. 02, 2002 Temperature : 27 ℃ Humidity: 70 %

| Emission **Frequency** ( MHz) | **Meter Reading** ( dBìV ) | | Corr'd **Factor** ( dB ) | **Results** ( dBìV/m ) | | **AH** (m) | | **DRT** degree | | **Limit** @10m (dBìV/m) | **Margin** ( dB ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Hor.** | **Ver.** | | **Hor.** | **Ver.** | **Hor.** | **Ver.** | **Hor.** | **Ver.** | | |
| 200.457 | 46.6 | 41.7 | -12.8 | 33.8 | 28.9 | 3.0 | 1.0 | 205 | 174 | 43.5 | -9.7 |
| 213.846 | 45.6 | 45.8 | -12.8 | 32.8 | 33.0 | 2.9 | 1.0 | 211 | 180 | 43.5 | -10.5 |
| 275.857 | 41.6 | 51.3 | -9.7 | 31.9 | 41.6 | 3.4 | 1.3 | 192 | 200 | 46.0 | -4.4 |
| 293.990 | 51.1 | 43.8 | -8.7 | 42.4 | 35.1 | 2.7 | 1.5 | 191 | 196 | 46.0 | -3.6 |
| 299.216 | 49.1 | 46.7 | -8.3 | 40.8 | 38.4 | 2.9 | 1.2 | 187 | 165 | 46.0 | -5.2 |
| 561.329 | 40.5 | 36.3 | -3.5 | 37.0 | 32.8 | 3.1 | 1.4 | 175 | 204 | 46.0 | -9.0 |

Note :

1. Remark "---" means that the emission level is too low to be measured.
2. The expanded uncertainty of the radiated emission tests is 3.53 dB.

## 4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) 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 + High Pass Filter Loss - Amplifier Gain

## 4.6 Photos of Radiation Measuring Setup

# 5 CONDUCTED EMISSION MEASUREMENT

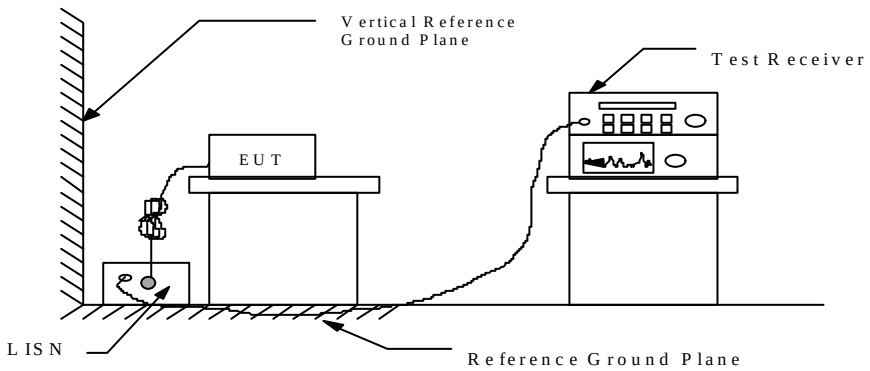
## 5.1 Standard Applicable

For intentional device, Line Conducted Emission Limits are in accordance to §15.207(a).

## 5.2 Measurement Procedure

1. Setup the configuration per figure 3.
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 6 or 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 three 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 3 : Conducted emissions measurement configuration



## 5.3 Conducted Emission Data

**A. CH LO**

Operation Mode : TX/RX

Test Date : Aug. 01, 2002 Temperature : 25℃ Humidity: 65%

| Freq. | Meter Reading (dBìV) | | | | Factor | Limit (dBìV) | | Result (dBìV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q.P Value | | AVG. Value | | | Q.P | AVG. | Q.P Value | | AVG. Value | |
| (MHz) | N | L1 | N | L1 | (dB) | Value | Value | N | L1 | N | L1 |
| 0.1627 | 48.4 | 47.1 | ---- | ---- | 0.2 | 65.3 | 55.3 | 48.6 | 47.3 | ---- | ---- |
| 0.2193 | 36.4 | 35.7 | ---- | ---- | 0.2 | 62.8 | 52.8 | 36.6 | 35.9 | ---- | ---- |
| 0.2723 | 37.2 | 37.3 | ---- | ---- | 0.2 | 61.0 | 51.0 | 37.4 | 37.5 | ---- | ---- |
| 0.6701 | 32.3 | 33.4 | ---- | ---- | 0.3 | 56.0 | 46.0 | 32.6 | 33.7 | ---- | ---- |
| 1.3085 | 33.1 | 31.7 | ---- | ---- | 0.4 | 56.0 | 46.0 | 33.5 | 32.1 | ---- | ---- |
| 2.2357 | 29.6 | 30.9 | ---- | ---- | 0.5 | 56.0 | 46.0 | 30.1 | 31.4 | ---- | ---- |

**B. CH MID**

Operation Mode : TX/RX

Test Date : Aug. 01, 2002 Temperature : 25℃ Humidity: 65%

| Freq. | Meter Reading (dBìV) | | | | Factor | Limit (dBìV) | | Result (dBìV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q.P Value | | AVG. Value | | | Q.P | AVG. | Q.P Value | | AVG. Value | |
| (MHz) | N | L1 | N | L1 | (dB) | Value | Value | N | L1 | N | L1 |
| 0.1627 | 49.1 | 47.3 | ---- | ---- | 0.2 | 65.3 | 55.3 | 49.3 | 47.5 | ---- | ---- |
| 0.2193 | 37.0 | 35.4 | ---- | ---- | 0.2 | 62.8 | 52.8 | 37.2 | 35.6 | ---- | ---- |
| 0.2723 | 37.1 | 37.8 | ---- | ---- | 0.2 | 61.0 | 51.0 | 37.3 | 38.1 | ---- | ---- |
| 0.6701 | 32.6 | 33.5 | ---- | ---- | 0.3 | 56.0 | 46.0 | 32.9 | 33.8 | ---- | ---- |
| 1.3085 | 34.1 | 32.5 | ---- | ---- | 0.4 | 56.0 | 46.0 | 34.5 | 32.8 | ---- | ---- |
| 2.2357 | 30.2 | 30.8 | ---- | ---- | 0.5 | 56.0 | 46.0 | 30.7 | 31.3 | ---- | ---- |

**C. CH HIGH**

Operation Mode : TX/RX

Test Date : Aug. 01, 2002 Temperature : 25℃ Humidity: 65%

| Freq. | Meter Reading (dBìV) | | | | Factor | Limit (dBìV) | | Result (dBìV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q.P Value | | AVG. Value | | | Q.P | AVG. | Q.P Value | | AVG. Value | |
| (MHz) | N | L1 | N | L1 | (dB) | Value | Value | N | L1 | N | L1 |
| 0.1627 | 48.1 | 46.8 | ---- | ---- | 0.2 | 65.3 | 55.3 | 48.3 | 47.0 | ---- | ---- |
| 0.2193 | 35.7 | 35.1 | ---- | ---- | 0.2 | 62.8 | 52.8 | 35.9 | 35.3 | ---- | ---- |
| 0.2723 | 36.7 | 36.9 | ---- | ---- | 0.2 | 61.0 | 51.0 | 37.0 | 37.2 | ---- | ---- |
| 0.6701 | 31.7 | 34.3 | ---- | ---- | 0.3 | 56.0 | 46.0 | 32.0 | 34.6 | ---- | ---- |
| 1.3085 | 33.2 | 32.6 | ---- | ---- | 0.4 | 56.0 | 46.0 | 33.6 | 33.0 | ---- | ---- |
| 2.2357 | 29.1 | 30.0 | ---- | ---- | 0.5 | 56.0 | 46.0 | 29.6 | 30.5 | ---- | ---- |

*Note : 1. Please see appendix 1 for Plotted Data*

*2. The expanded uncertainty of the conducted emission tests is 2.45 dB.*

## 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 dBìV is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dBìV.

RESULT = 22.5 + 0.1 = 22.6 dBìV

Level in ìV = Common Antilogarithm[(22.6 dBìV)/20]

= 13.48 ìV

## 5.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test.

| Equipment | Manufacturer | Model No. | Next Cal. Date |
|---|---|---|---|
| RF Test Receiver | Rohde and Schwarz | ESH3 | 01/03/2003 |
| Spectrum Monitor | Rohde and Schwarz | EZM | N.C.R. |
| Line Impedance Stabilization network | Kyoritsu | KNW-407 | 12/02/2002 |
| Line Impedance Stabilization network | Rohde & Schwarz | ESH2-Z5 | 08/05/2003 |
| Plotter | Hewlett-Packard | 7440A | N/A |
| Shielded Room | Riken | N/A | N.C.R. |

## 5.6 Photos of Conduction Measuring Setup

# 6 ANTENNA REQUIREMENT

## 6.1 Standard Applicable

According to §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.

## 6.2 Antenna Construction

The antenna is integrated on the Main PCB, no consideration of replacement.

# 7 BAND EDGES MEASUREMENT

## 7.1 Standard Applicable

According to 15.249(c), out band emission except for harmonics shall be comply with §15.209 or at least attenuated by 50 dB below the level of the fundamental.

## 7.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
4. Repeat above procedures until all measured frequencies were complete.

## 7.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Next Cal. Date |
|---|---|---|---|
| Spectrum Analyzer | Hewlett-Packard | 8564E | 04/16/2003 |
| Plotter | Hewlett-Packard | 7440A | N/A |

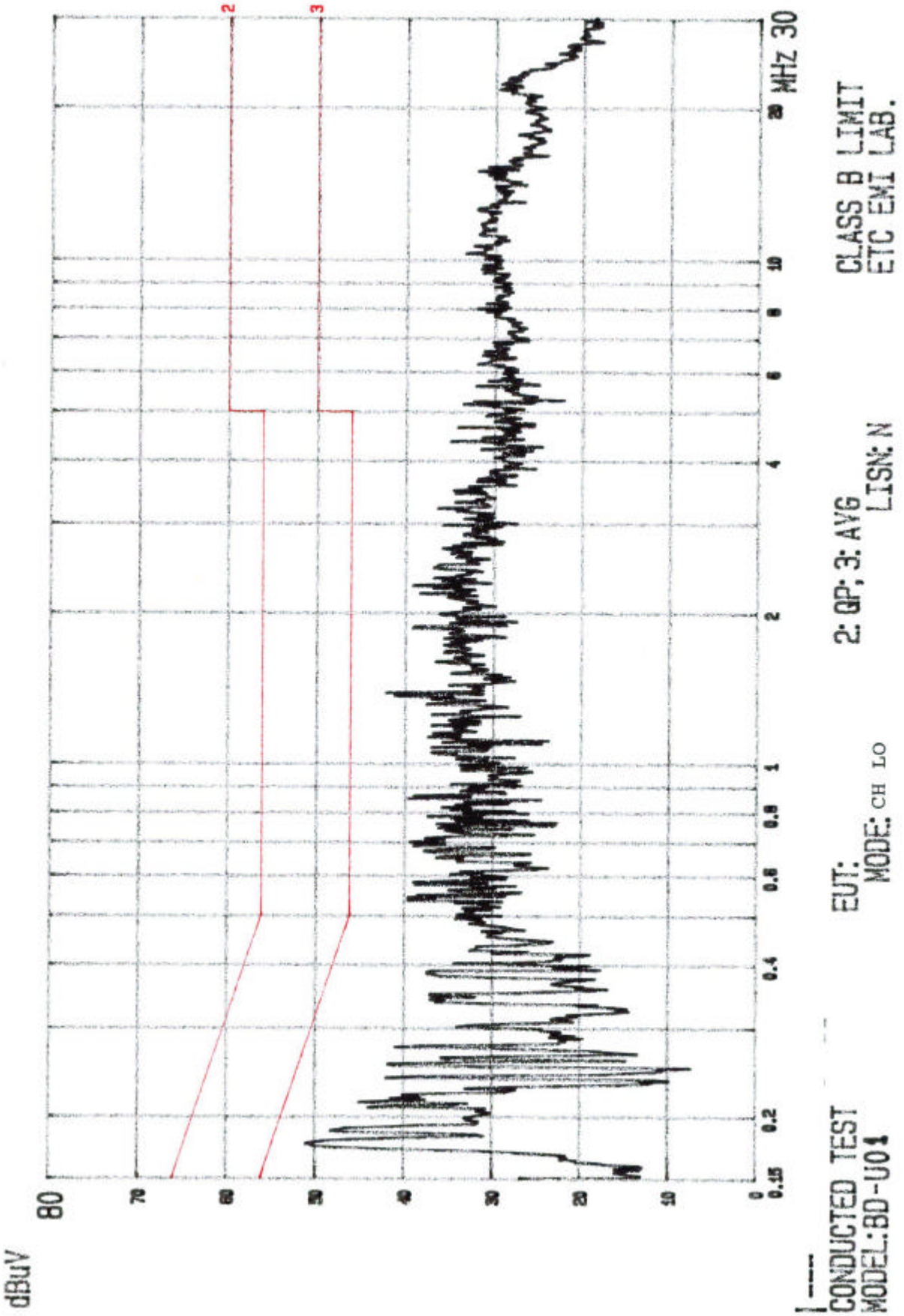
## 7.4 Measurement Data

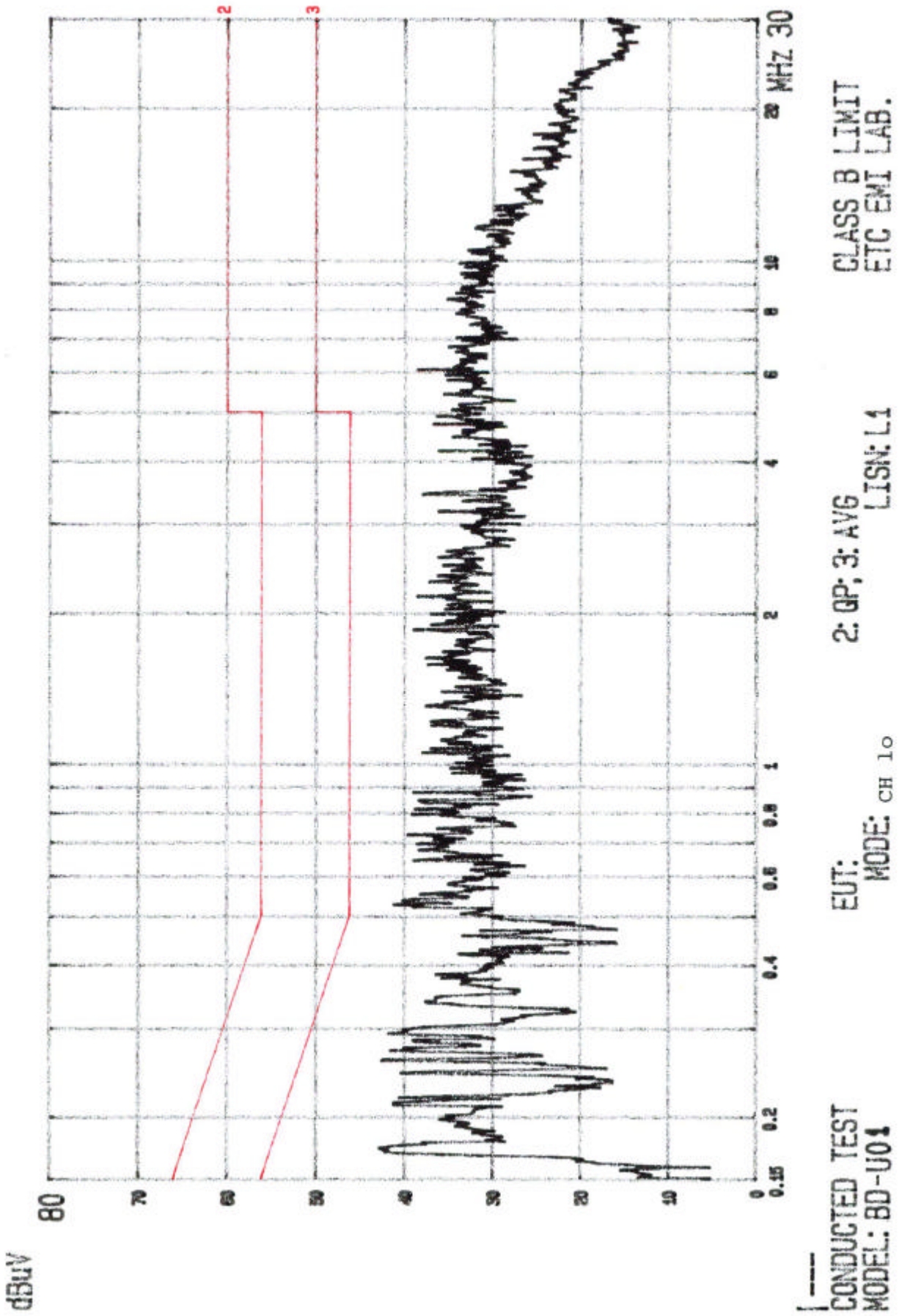
***Test Result:***

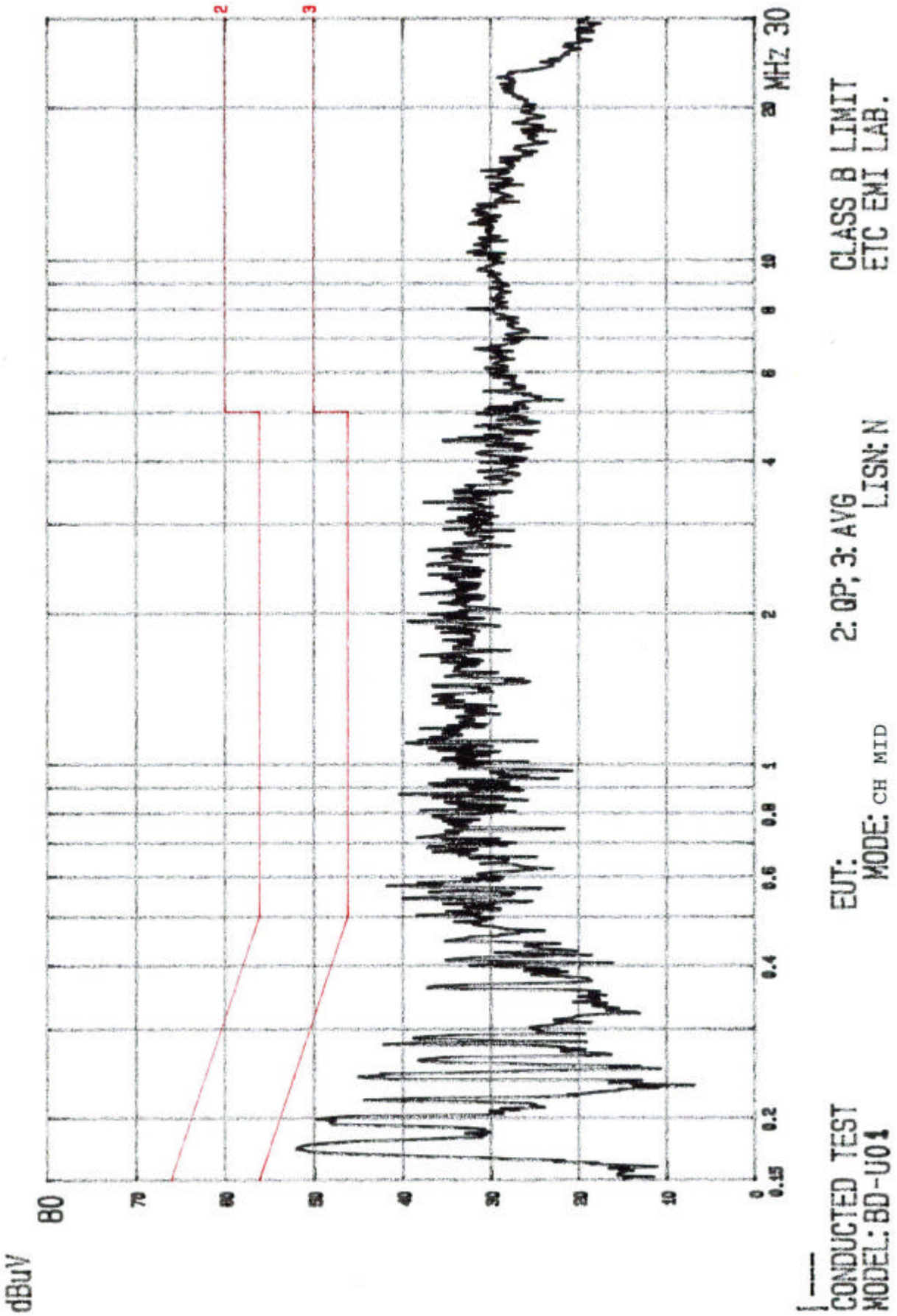
1. *Lower band edge: Emission radiated outside of the lower band edge are attenuated by at least 50dB below the level of the fundamental. The maximum is –59.33dBm at 2.39817GHz which complies with the limits.*
2. *Upper band edge: Emission radiated outside of the upper band edge are attenuated by at least 50dB below the level of the fundamental. The maximum is –59.33dBm at 2.48406GHz which complies with the limits.*

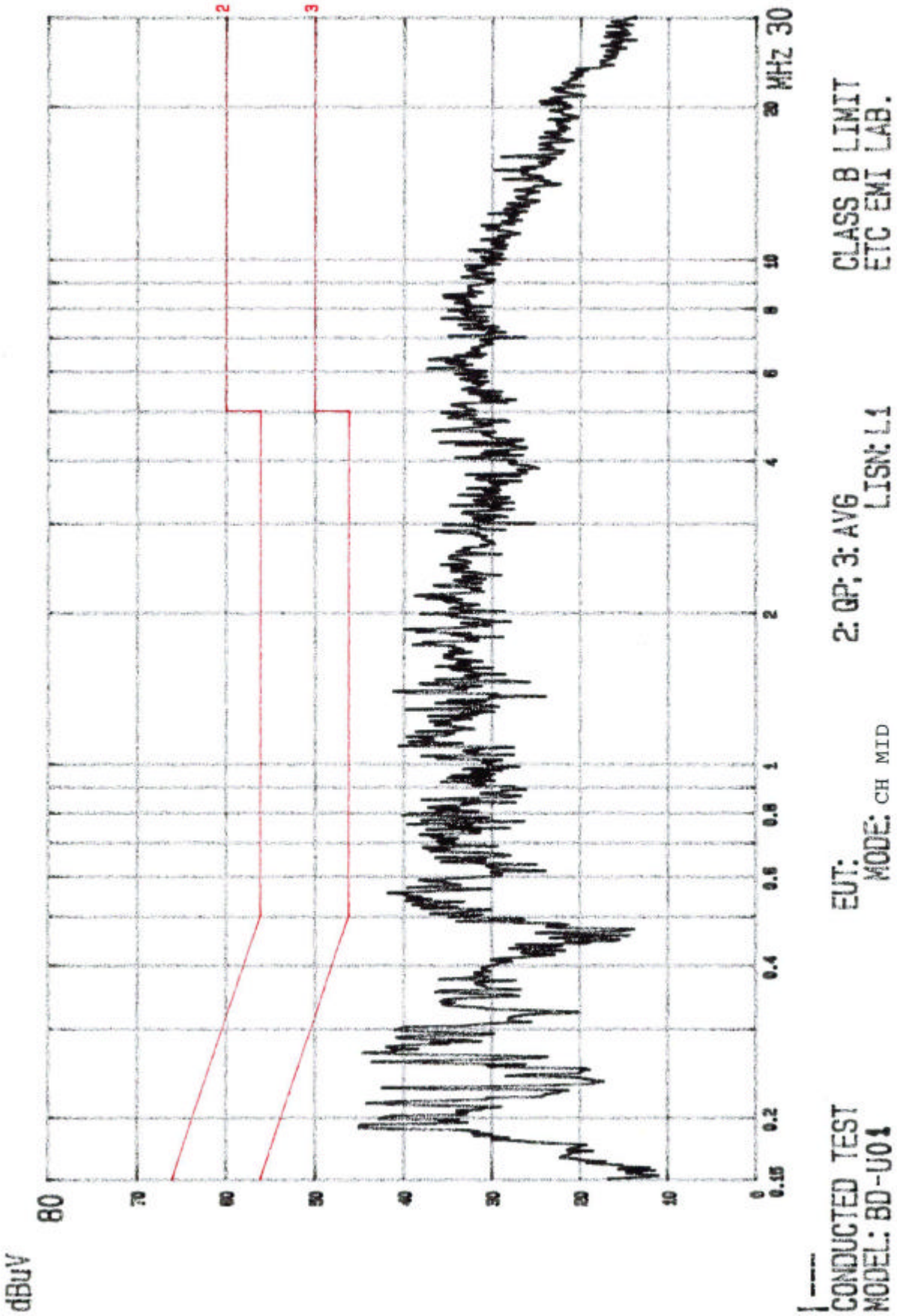
***Note : 1. The expanded uncertainty of the band edges tests is 1000Hz.***
***2. Please see appendix 2 for Plotted Data***

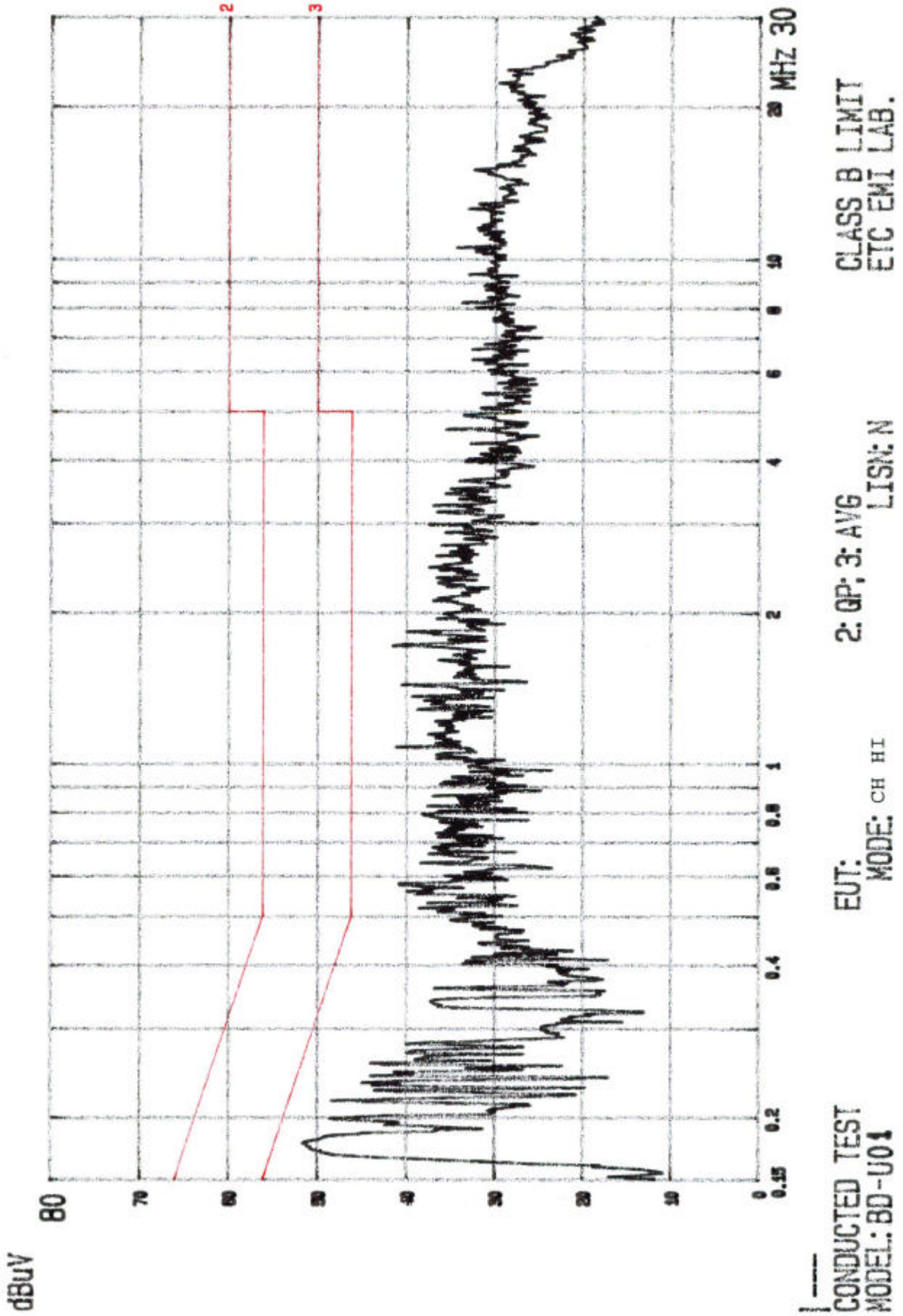
# Appendix 1 : Plotted Data of Power Line Conducted Emissions

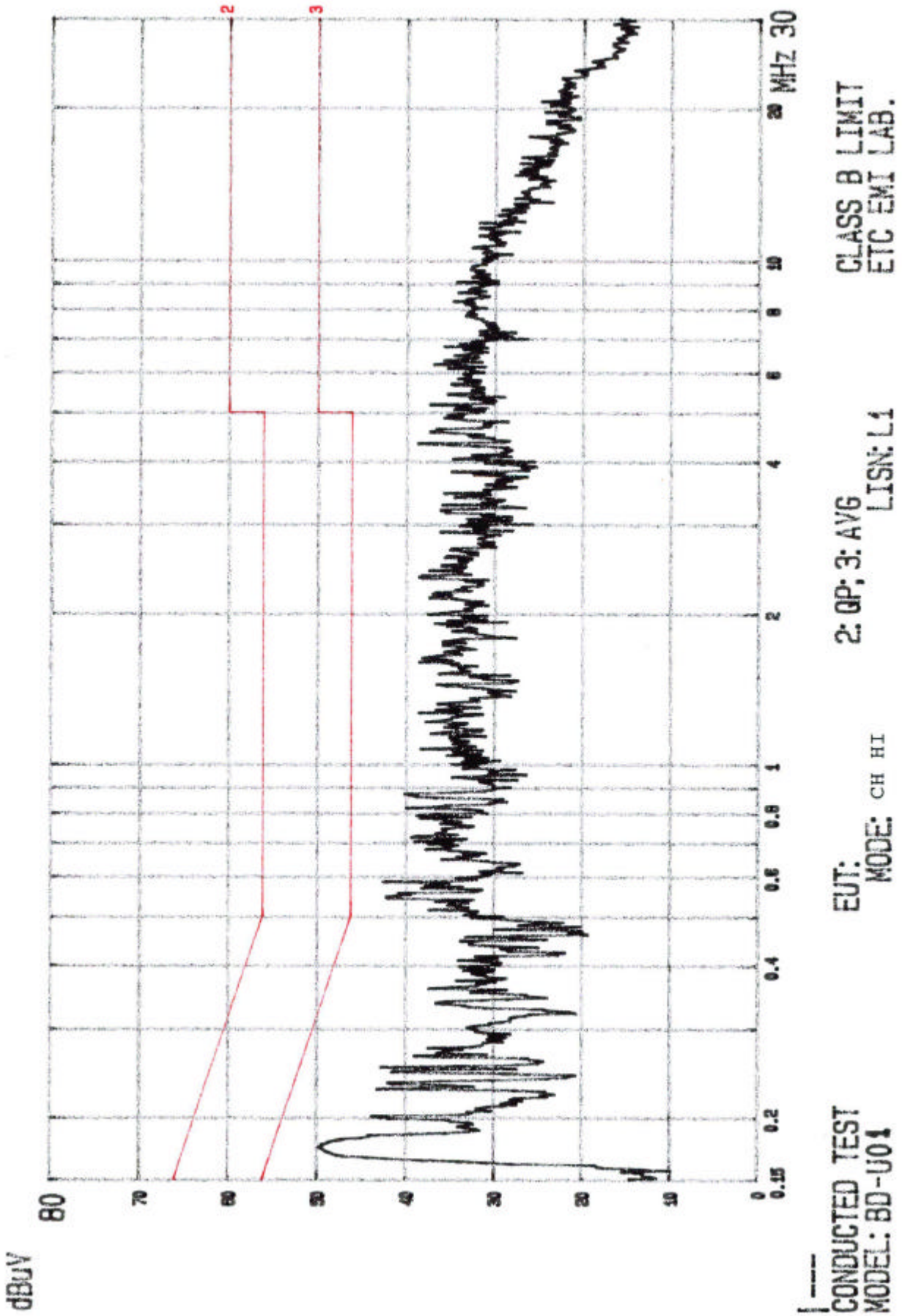

dBuV
80
70
60
50
40
30
20
10
0
0.15
0.2
0.4
0.6
0.8
1
2
4
6
8
10
20
30 MHz
2
3
CONDUCTED TEST
MODEL:BD-U01
EUT:
MODE: CH LO
2: QP; 3: AVG
LISN: N
CLASS B LIMIT
ETC EMI LAB.


dBuV
80
70
60
50
40
30
20
10
0
0.15
0.2
0.4
0.6
0.8
1
2
4
6
8
10
20
30
MHz
2
3
CONDUCTED TEST
MODEL: BD-U01
EUT:
MODE: CH 1o
2: QP; 3: AVG
LISN: L1
CLASS B LIMIT
ETC EMI LAB.

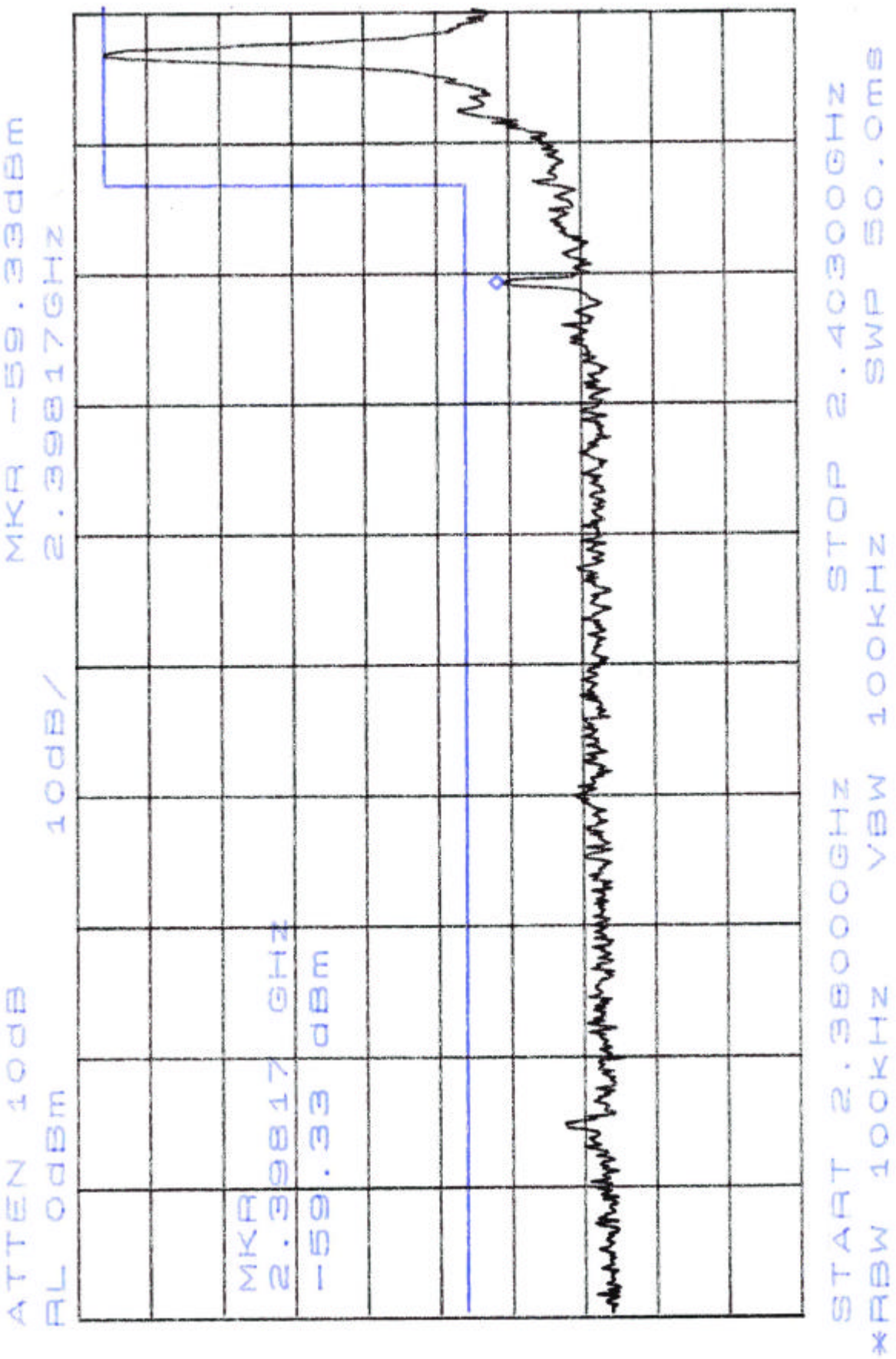

dBuV
80
70
60
50
40
30
20
10
0
0.15
0.2
0.4
0.6
0.8
1
2
4
6
8
10
20
30 MHz
2
3
CONDUCTED TEST
MODEL: BD-U01
EUT:
MODE: CH MID
2: QP; 3: AVG
LISN: N
CLASS B LIMIT
ETC EMI LAB.

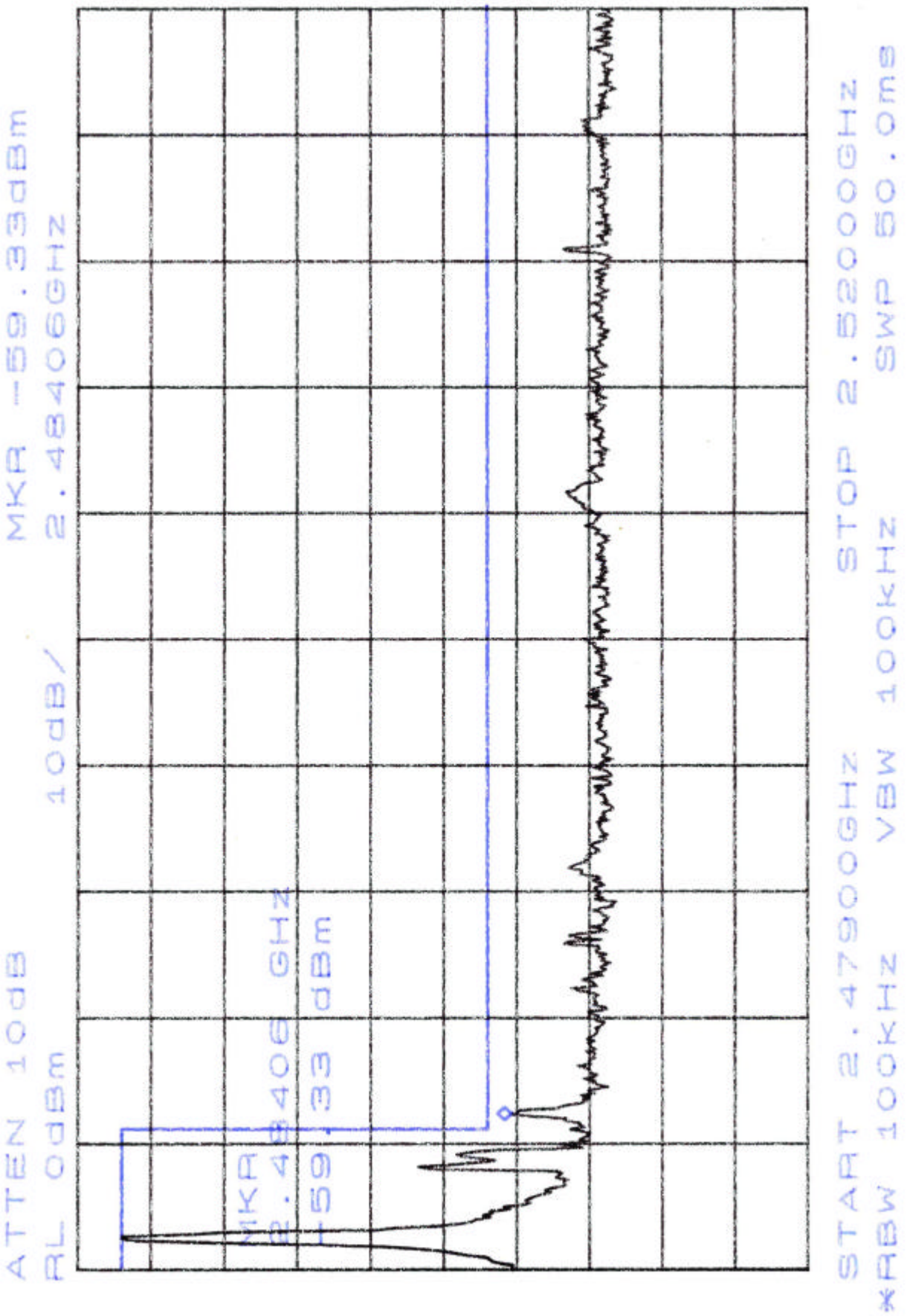

dBuV
80
70
60
50
40
30
20
10
0
0.15
0.2
0.4
0.6
0.8
1
2
4
6
8
10
20
30
MHz
2
3
CONDUCTED TEST
MODEL: BD-U01
EUT:
MODE: CH MID
2: QP; 3: AVG
LISN: L1
CLASS B LIMIT
ETC EMI LAB.


dBuV
80
70
60
50
40
30
20
10
0
0.15
0.2
0.4
0.6
0.8
1
2
4
6
8
10
20
30 MHz
2
3
CONDUCTED TEST
MODEL: BD-U01
EUT:
MODE: CH HI
2: QP; 3: AVG
LISN: N
CLASS B LIMIT
ETC EMI LAB.


dBuV
80
70
60
50
40
30
20
10
0
0.15
0.2
0.4
0.6
0.8
1
2
4
6
8
10
20
30 MHz
2
3
CONDUCTED TEST
MODEL: BD-U01
EUT:
MODE: CH HI
2: QP; 3: AVG
LISN: L1
CLASS B LIMIT
ETC EMI LAB.

# Appendix 2 : Plotted Data of Band Edges Emission


ATTEN 10dB
RL 0dBm
MKR
2.398817 GHz
-59.33 dBm
10dB/
MKR -59.33dBm
2.398817GHz
START 2.380GHz
*RBW 100kHz
VBW 100kHz
STOP 2.430GHz
SWP 50.0ms


ATTEN 10dB
RL 0dBm
10dB/
MKR -59.33dBm
2.48406GHZ
MKR
2.48406 GHZ
-59.33 dBm
START 2.47900GHZ
RBW 100KHZ
VBW 100KHZ
STOP 2.52000GHZ
SWP 50.0ms