# CLASS II CHANGE MEASUREMENT REPORT

# *of*

# Wireless Cable Gateway

| | | |
|---|---|---|
| **Applicant** | **:** | The Linksys Group Inc. |
| **EUT** | **:** | Cable Gateway |
| **Model No.** | **:** | BEFCMUH4 |
| **FCC ID** | **:** | PKW-BEFCMUH4 |
| **Report No.** | **:** | L2115219 |

**Tested by :**

***Training Research Co., Ltd.***

**TEL : 886-2-26935155 FAX : 886-2-26934440**

No. 255, Nanyang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C.

# CERTIFICATION

**We here by verify that:**

The test data, data evaluation, test procedures and equipment configurations shown in this report were made mainly in accordance with the procedures given in ANSI C63.4 (1992) as a reference. All test were conducted by ***Training Research Co., Ltd.***, 255 Nanyang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. Also, we attest to the accuracy of each.

We further submit that the energy emitted by the sample EUT tested as described in the report is **in compliance with** the technical requirements set forth in the FCC Rules Part 15 Subpart B (Declaration of Conformity) and C Section 15.247.

| | | |
|---|---|---|
| **Applicant** | **:** | The Linksys Group Inc. |
| **Applicant address** | **:** | 17401 Armstrong Ave., Irvine CA 92614, U.S.A.. |
| **Product Name** | **:** | Cable Gateway |
| **Model Name** | **:** | BEFCMUH4 |
| **FCC ID** | **:** | PKW-BEFCMUH4 |
| **Report No.** | **:** | L2115219 |
| **Test Date** | **:** | January 1, 2003 |

**Prepared by:** Jack Tsai

**Approved by:** Frank Tsai

***Conditions of issue :***

(1) ***This test report shall not be reproduced except in full, without written approval of TRC. And the test result contained within this report only relate to the sample submitted for testing.***

(2) ***This report must not be used by the client to claim product endorsement by NVLAP or any agency of U.S. Government.***

★ ***NVLAP LAB CODE: 200174-0***

# *Federal Communications Commission*

# Declaration of Conformity (DoC)

*For the Following Equipment:*

**Product name : Cable Gateway**

**Model name : BEFCMUH4**

**Trade name : LINKSYS**

Is herewith confirmed and found to comply with the requirements of CFR 47 part15 Subpart B - Unintentional Radiators regulation. The results of electromagnetic mission evaluation are shown in the **report number :** L2115219

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

| ***Importer*** | ***USA local representative*** |
|---|---|
| **Company name:** The Linksys Group, Inc. | To be determined |
| **Computer address:** 17401 Amstrong Ave. Irvine, CALIFORNIA 92614, United States | |
| **ZIP / Postal code** 92614 | |
| **Contact person:** Lynn Lee | |
| **Title:** Sr. Specialist of President | |
| **Internet e-mail address:** | |
| **Tel / Fax:** (949) 784-2211 | |

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# Ⅰ. GENERAL

## 1.1 Introduction

The following measurement report is submitted on behalf of applicant in support that the certification in accordance with Part 2 Subpart J and Part 15 Subpart A, B and C of the Commission's Rules and Regulations.

## 1.2 Description of EUT

| | | |
|---|---|---|
| **Granted FCC ID** | **:** | PKW-BEFCMUH4 |
| **Product Name** | **:** | Cable Gateway |
| **Model Name** | **:** | BEFCMUH4 |
| **Frequency Range** | **:** | 2.412 GHz ~ 2.462GHz |
| **Support Channel** | **:** | 11 Channel |
| **Modulation Skill** | **:** | DBPSK, DQPSK, CCK |
| **Power Type** | **:** | By the Power adaptor<br>M/N: DSA-0151A-12<br>I/P: 100-120Vac, 50-60Hz, 40VA ;<br>O/P: +12VDC, 1.25A |
| **Power Cable** | **:** | 190cm long, non-shielded, with ferrite core |

## 1.3 Test method

1 Using the LAN port of notebook computer and software to control the wireless cable gateway.

2 Using the notebook computer and software provided by the manufacturer to control EUT. The software is operated under the Windows to control the EUT in the continuous transmission mode.

3 Set different channel being tested and repeat the procedures above.

(a) Radiated for intentional test:

making EUT to the mode of continuous transmission

(b) Conducted and Radiated for unintentional test:

making EUT to the linking (Rx/Tx) mode with far support equipments

## 1.4 Description of Support Equipment

In order to construct the minimum testing, following equipment were used as the support units.

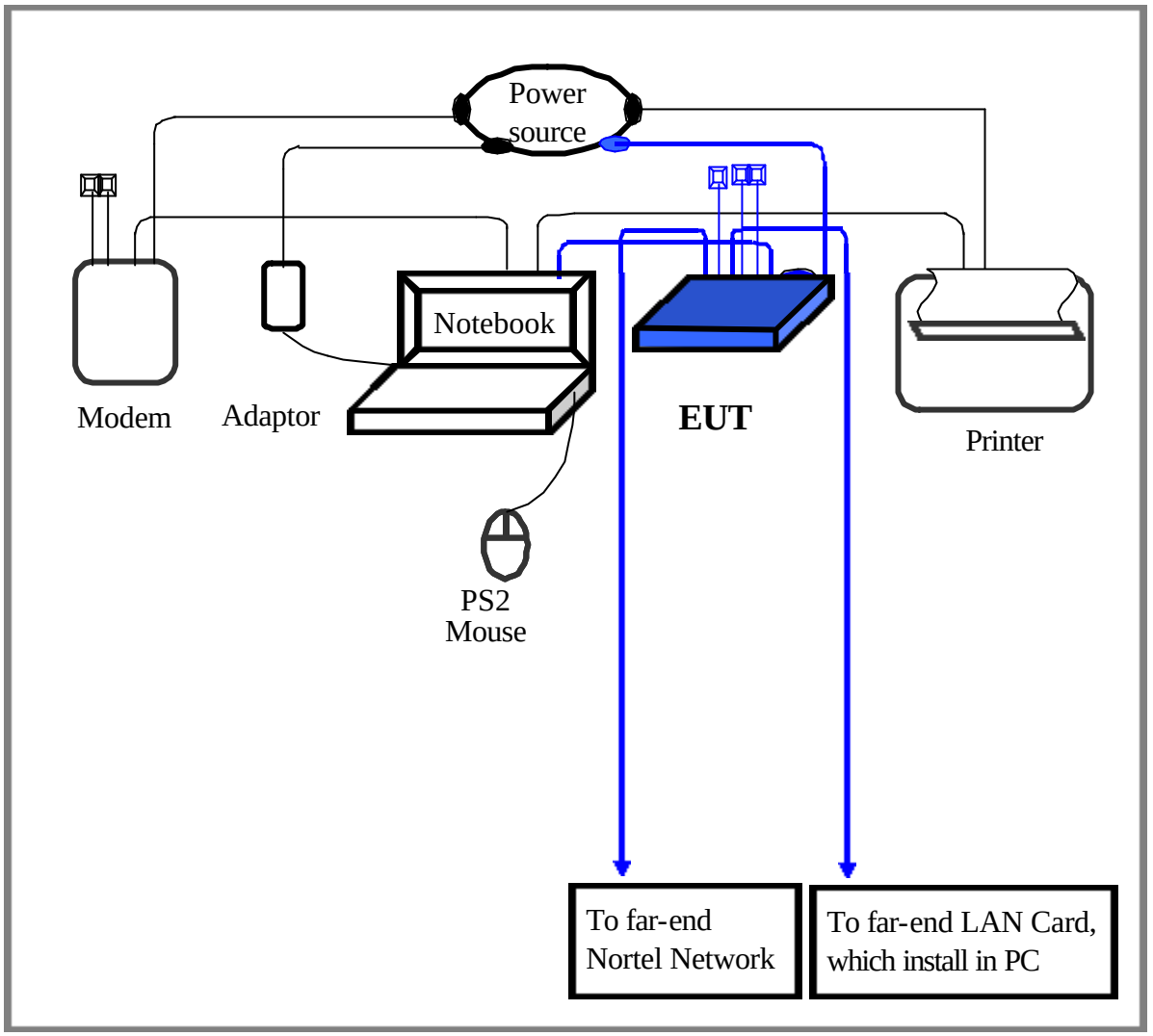
| | | |
|---|---|---|
| **Notebook** | **:** | **IBM Think Pad X20** |
| Type No. | : | 2662-11T |
| Serial No. | : | FX-11922 00/09 |
| FCC ID | : | Doc Approved |
| **檢磁** | : | 3892B565 |
| **AC Adaptor** | **:** | **IBM** |
| Model No. | : | PA2450U |
| Serial No. | : | 02K6654 |
| FCC ID | : | Doc Approved |
| Power Core | : | Non-shielded, 180cm long, Plastic hoods, with ferrite bead |
| Power type | : | 100 ~ 240VAC, 50 ~ 60Hz, 0.5A ~ 1.2A / 16Vdc, 4.5A |
| **USB** | | |
| **OpticMouse** | **:** | **Logitech Inc** |
| Model No. | : | M-BJ58 |
| Serial No. | : | LNA20901985 |
| FCC ID | : | Doc Approved |
| **檢磁** | : | 3902A701 |
| Data Cable | : | Shielded, 1.80m long, No ferrite core |
| **Wireless** | | |
| **LAN Card** | **:** | **LINKSYS** |
| Model No. | : | WPC11 ver.3 |
| FCC ID | : | PKW-WPC11-V3 |
| Canada Code | : | 3839A12075 |
| **LAN Card** | **:** | **D-Link** |
| Model No. | : | DFE-530TX |
| Serial No. | : | 0050BAE32FF3, 0050BAE3158B |
| FCC ID | : | N/A, DoC Approved |

| | | |
|---|---|---|
| **PC** | **:** | **HP Brio 85xx 6/350** |
| Model No. | : | D6928A |
| Serial No. | : | SG91801535 |
| FCC ID | : | N/A, DoC (Declaration of Confirmation) Approved |
| **檢磁** | : | 3872H013 |
| Power type | : | 100 ~ 230VAC / 50 ~ 60Hz, 5A, Switching |
| Power cord | : | Non-shielded, 2.33m long, Plastic, No ferrite core |
| **Monitor** | **:** | **HP 15' Color Monitor** |
| Model No. | : | D2827A |
| Serial No. | : | KR91161717 |
| FCC ID | : | C5F7NFCMC1518X |
| **檢磁** | : | 3872B039 |
| Power type | : | 100 ~ 240 VAC / 50 ~ 60 Hz, Switching |
| Power cord | : | Shielded, 1.83m long, No ferrite core |
| Data cable | : | Shielded, 1.46m long, with two ferrite cores |
| **Keyboard** | **:** | **HP** |
| Model No. | : | SK-2501K |
| Serial No. | : | M990308909 |
| FCC ID | : | GYUR38SK |
| **檢磁** | : | 3862A621 |
| Power type | : | By PC |
| Data cable | : | Shielded, 1.73m long, with ferrite core |
| **Mouse** | **:** | **HP** |
| Model No. | : | M-S34 |
| Serial No. | : | LZB90714122 |
| FCC ID | : | DZL211029 |
| **檢磁** | : | 4862A011 |
| Power type | : | By PC |
| Power cord | : | Non-shielded, 1.88m long, No ferrite core |

| | | |
|---|---|---|
| **Printer** | **:** | **HP** |
| Model No. | : | C6464A |
| Serial No. | : | TH16LEB5PK |
| FCC ID | : | N/A, DoC Approved |
| **檢磁** | : | 3892H381 |
| Power type | : | Switching adaptor |
| Power cord | : | Non-shielded, 173cm long, No ferrite core (between adaptor and AC source) |
| | | Non-shielded, 180cm long, with ferrite core (between printer and adaptor) |
| Data cable | : | Shielded, 1.70m long, No ferrite core |
| **Modem** | **:** | **ACEEX** |
| Model No. | : | XDM-56V14 |
| FCC ID | : | IFAXDM-56V14 |
| Power type | : | Linear |
| Power cord | : | Non-shielded, 1.9m long, No ferrite cord |
| Data cable | : | RS232, Shielded, 1.2m long, No ferrite core |
| | | RJ11C x 2, 7’ long non-shielded, No ferrite core |
| **Notebook PC** | **:** | **ASUSTek Computer** |
| Model No. | : | AB00F |
| Serial No. | : | 24NP016361 |
| FCC ID | : | Doc Approved |
| BSMI | : | 41016012 |
| Power type | : | 100 ~ 240VAC, 1A 50/60 Hz, Switching |
| **Power Adaptor** | **:** | **LITE-ON Electronics, Inc.** |
| Model No. | : | PA-1530-01 |
| Serial No. | : | 00151184 |
| FCC ID | : | Doc Approved |
| **檢磁** | : | 3882B259 |
| Power cable | : | Non-shielded, 1.72m length, Plastic hood, No ferrite core |
| | | (Between power adaptor and AC power source) |
| Power cable | : | Shielded, 1.48m length, Plastic hood, with ferrite core |
| | | (Between power adaptor and notebook) |

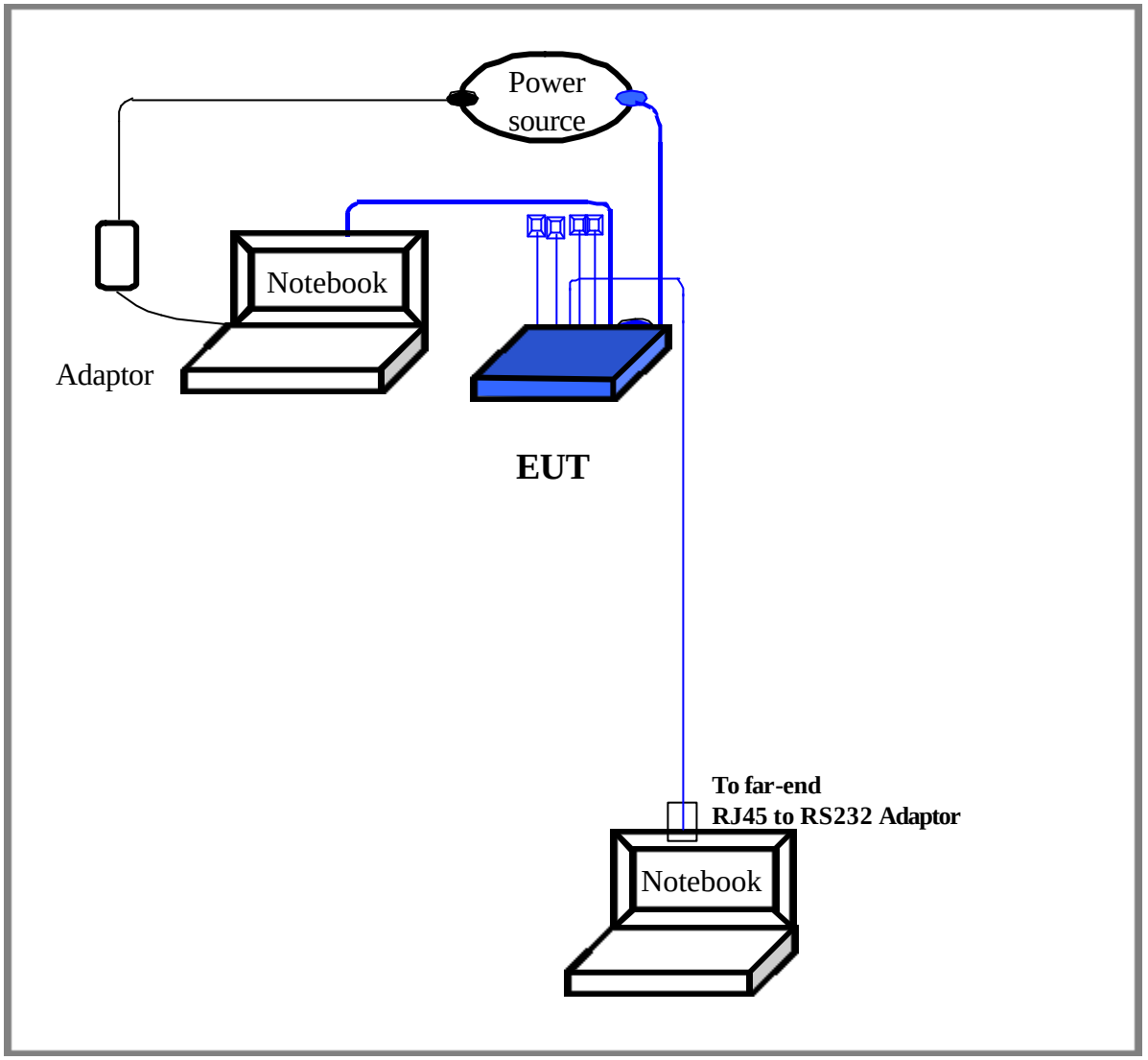
## 1.5 Configuration of System Under Test

**(Conducted and Radiated for unintentional)**




The setting up procedure was recorded in 1.3 test method.

**(Radiated for intentional)**




The tests below are carried out the EUT transmitter set at high power in TDD mode. The EUT is needed to force selection of output power level and channel number.

The EUT is connected to the computer through the LAN Port via RJ45 to RS232 adaptor. The setting up procedure was recorded in 1.3 test method.

## Connections of Equipment

**Notebook :**

*Parallel Port --- a printer

*Serial Port --- an external modem

*PS/2 Port --- a PS2 mouse

*USB Port --- **EUT**

**EUT (Power adaptor) :**

*M/N: DSA-0151A-12

*I/P: 100-120Vac, 50-60Hz, 40VA

*O/P: +12VDC, 1.25A

*Power cable of adaptor

--- 190cm long, non-shielded, with ferrite core

**EUT (Cable Gateway) :**

*RJ45 Cable x 3

--- 1.5m long, non-shielded, no ferrite core

*RJ45 Cable x 1

--- 30m long, non-shielded, no ferrite core

*USB Cable x 1

--- 1.85m long, shielded, no ferrite core

*BNC Cable x 1

--- 15m long, shielded, no ferrite core

### 1.6 Verify the Frequency and Channel

| Channel | Frequency (GHz) |
|---|---|
| 1 | 2.412 |
| 2 | 2.417 |
| 3 | 2.422 |
| 4 | 2.427 |
| 5 | 2.432 |
| 6 | 2.437 |
| 7 | 2.442 |
| 8 | 2.447 |
| 9 | 2.452 |
| 10 | 2.457 |
| 11 | 2.462 |

Note:

1. This is for confirming that all frequencies are in 2.412GHz to 2.462GHz.
2. Section 15.31(m): Measurements on intentional radiators or receivers shall be performed at three frequencies for operating frequency range over 10 MHz.
   (The locations of these frequencies one near the top, one near the middle and one near the bottom.)
3. After test, the EUT operating frequencies are in 2.412GHz to 2.462GHz. So all the items as followed in testing report are need to test these three frequencies:
   Top: Channel – 1; Middle: Channel – 6; Bottom: Channel – 11.

### 1.7 Test Procedure

All measurements contained in this report were performed mainly according to the techniques described in ANSI C63.4 (1992) and the pre-setup was written on 1.3 test method, the detail setup was written on each test item.

### 1.8 Location of the Test Site

The radiated emissions measurements required by the rules were performed on the **three-meter**, **Anechoic Chamber (Registration Number: 93906)** maintained by *Training Research Co., Ltd.* 1F, No. 255 Nanyang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the commission. The conducted power line emissions tests and other test items were performed in a anechoic chamber also located at Training Research Co., Ltd.

No. 255 Nanyang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. *Training Research Co., Ltd.* is listed by the FCC as a facility available to do measurement work for others on a contract basis.

### 1.9 General Test Condition

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests were chosen as that which produced the highest emission levels. However, only those conditions, which the EUT was considered likely to encounter in normal use were investigated.

In test, they were set in high power and continuously transmitting mode that controlled by computer. The ch01, ch06 and ch11 of EUT were all tested. The setting up procedure is recorded on 1.3 test method.

## II. Section 15.101(a): Equipment authorization of unintentional radiators

The EUT equipped with a Universal Serial Bus and should be operated with the computer. It was categorized to *Class B personal computers and peripherals* as cannot be operated stand-alone. The authorization requires **Declaration of Conformity (DoC)** and the items required such as Sect.15.107 (Conducted limits) and Sect.15.109 (Radiated emission limits) is same as Sect.15.207 and 15.247(C).

## III. Section 15.203: Antenna requirement

The EUT has an integrated antenna inside the housing. In addition, there is no external antenna or external connector employed. The antenna requirement stated in Sect.15.203 is inapplicable to this EUT.

# IV. Section 15.207: Power Line Conducted Emissions for AC Powered Units

## 4.1 Test Condition & Setup

The power line conducted emission measurements were performed in an anechoic chamber. The EUT was assembled on a wooden table, which is 80 centimeters high, was placed 40 centimeters from the backwall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and Line Impedance Stabilization Networks (LISNs). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer (or EMI receiver) was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPER quasi-peak and average detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 4.3.

There is a test condition apply in this test item, the test procedure description as the following:

EUT transmit only:

Using the LAN card install in computer and software to control the EUT. Then making EUT to the mode of continuous transmission and setting the testing channel. Three channels were tested, one in the top (CH01), one in the middle (CH06) and the other in bottom (CH11).

### 4.2 List of Test Instruments

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| EMI Receiver | 8546A | H P | 3520A00242 | 06/28/02 | 06/28/03 |
| RF Filter Section | 85460A | H P | 3448A00217 | 06/28/02 | 06/28/03 |
| LISN (EUT) | LISN-01 | TRC | 9912-03,04 | 06/04/02 | 06/04/03 |
| LISN (Support E.) | LISN-01 | TRC | 9912-05 | 07/15/02 | 07/15/03 |
| Auto Switch Box (< 30MHz) | ASB-01 | TRC | 9904-01 | 11/20/02 | 11/20/03 |

The level of confidence of 95%, the uncertainty of measurement of conducted emission is ± 2.02 dB.

### 4.3 Test Result of Conducted Emissions

**EUT station transmit only**

The following table shows a summary of the highest emissions of power line conducted emissions on the LIVE and NETURAL conductors of the EUT power cord.

Test Conditions: Temperature : 20.2 °C Humidity : 58.8 % RH

**Table 1 Test mode: Channel 1**

| *Power Connected Emissions* | | | | | *FCC Class B* | | |
|---|---|---|---|---|---|---|---|
| ***Conductor*** | ***Frequency (KHz)*** | ***Peak (dBmV)*** | ***QP (dBmV)*** | ***Average (dBmV)*** | ***QP-limit (dBmV)*** | ***AVG-limit (dBmV)*** | ***Margin (dB)*** |
| Line 1 | 159.000 | 43.31 | --- | --- | 65.74 | 55.74 | -12.43 |
| | 231.000 | 41.10 | --- | --- | 63.69 | 53.69 | -12.59 |
| | 348.000 | 39.71 | --- | --- | 60.34 | 50.34 | -10.63 |
| | 434.000 | 39.99 | --- | --- | 57.89 | 47.89 | -7.90 |
| | 537.000 | 40.36 | --- | --- | 56.00 | 46.00 | -5.64 |
| | 633.000 | 39.77 | --- | --- | 56.00 | 46.00 | -6.23 |
| | 832.000 | 40.04 | --- | --- | 56.00 | 46.00 | -5.96 |
| | 1017.000 | 40.11 | --- | --- | 56.00 | 46.00 | -5.89 |
| | 1598.000 | 38.77 | --- | --- | 56.00 | 46.00 | -7.23 |
| | 2741.000 | 39.30 | --- | --- | 56.00 | 46.00 | -6.70 |
| Line 2 | 155.000 | 40.02 | --- | --- | 65.86 | 55.86 | -15.84 |
| | 236.000 | 40.35 | --- | --- | 63.54 | 53.54 | -13.19 |
| | 359.000 | 41.07 | --- | --- | 60.03 | 50.03 | -8.96 |
| | 533.000 | 41.03 | --- | --- | 56.00 | 46.00 | -4.97 |
| | 627.000 | 40.71 | --- | --- | 56.00 | 46.00 | -5.29 |
| | 824.000 | 40.32 | --- | --- | 56.00 | 46.00 | -5.68 |
| | 1006.000 | 40.95 | --- | --- | 56.00 | 46.00 | -5.05 |
| | 1308.000 | 40.95 | --- | --- | 56.00 | 46.00 | -5.05 |
| | 2636.000 | 40.66 | --- | --- | 56.00 | 46.00 | -5.34 |

NOTE:

(1) Margin = Peak Amplitude – Limit, ***The reading amplitudes are all under limit.***

(2) A "+" sign in the margin column means the emission is OVER the Class B Limit and "–" sign of means UNDER the Class B limit

**Table 2 Test mode: Channel 6**

| *Power Connected Emissions* | | | | | *FCC Class B* | | |
|---|---|---|---|---|---|---|---|
| ***Conductor*** | ***Frequency (KHz)*** | ***Peak (dBmV)*** | ***QP (dBmV)*** | ***Average (dBmV)*** | ***QP-limit (dBmV)*** | ***AVG-limit (dBmV)*** | ***Margin (dB)*** |
| Line 1 | 164.000 | 41.24 | --- | --- | 65.60 | 55.60 | -14.36 |
| | 218.000 | 41.67 | --- | --- | 64.06 | 54.06 | -12.39 |
| | 355.000 | 40.06 | --- | --- | 60.14 | 50.14 | -10.08 |
| | 542.000 | 41.31 | --- | --- | 56.00 | 46.00 | -4.69 |
| | 633.000 | 39.89 | --- | --- | 56.00 | 46.00 | -6.11 |
| | 717.000 | 40.06 | --- | --- | 56.00 | 46.00 | -5.94 |
| | 832.000 | 40.49 | --- | --- | 56.00 | 46.00 | -5.51 |
| | 1017.000 | 40.16 | --- | --- | 56.00 | 46.00 | -5.84 |
| | 1308.000 | 39.64 | --- | --- | 56.00 | 46.00 | -6.36 |
| | 2767.000 | 39.40 | --- | --- | 56.00 | 46.00 | -6.60 |
| Line 2 | 218.000 | 41.14 | --- | --- | 64.06 | 54.06 | -12.92 |
| | 348.000 | 40.04 | --- | --- | 60.34 | 50.34 | -10.30 |
| | 542.000 | 41.26 | --- | --- | 56.00 | 46.00 | -4.74 |
| | 731.000 | 40.43 | --- | --- | 56.00 | 46.00 | -5.57 |
| | 832.000 | 40.36 | --- | --- | 56.00 | 46.00 | -5.64 |
| | 1017.000 | 40.53 | --- | --- | 56.00 | 46.00 | -5.47 |
| | 1113.000 | 40.12 | --- | --- | 56.00 | 46.00 | -5.88 |
| | 1320.000 | 40.47 | --- | --- | 56.00 | 46.00 | -5.53 |
| | 1398.000 | 40.06 | --- | --- | 56.00 | 46.00 | -5.94 |
| | 2767.000 | 40.18 | --- | --- | 56.00 | 46.00 | -5.82 |

**Table 3 Test mode: Channel 11**

| *Power Connected Emissions* | | | | | *FCC Class B* | | |
|---|---|---|---|---|---|---|---|
| *Conductor* | *Frequency (KHz)* | *Peak (dBmV)* | *QP (dBmV)* | *Average (dBmV)* | *QP-limit (dBmV)* | *AVG-limit (dBmV)* | *Margin (dB)* |
| Line 1 | 155.000 | 42.89 | --- | --- | 65.86 | 55.86 | -12.97 |
| | 224.000 | 40.69 | --- | --- | 63.89 | 53.89 | -13.20 |
| | 359.000 | 40.27 | --- | --- | 60.03 | 50.03 | -9.76 |
| | 430.000 | 39.07 | --- | --- | 58.00 | 48.00 | -8.93 |
| | 537.000 | 40.83 | --- | --- | 56.00 | 46.00 | -5.17 |
| | 627.000 | 40.02 | --- | --- | 56.00 | 46.00 | -5.98 |
| | 832.000 | 40.04 | --- | --- | 56.00 | 46.00 | -5.96 |
| | 1017.000 | 39.90 | --- | --- | 56.00 | 46.00 | -6.10 |
| | 1295.000 | 39.69 | --- | --- | 56.00 | 46.00 | -6.31 |
| | 2741.000 | 40.23 | --- | --- | 56.00 | 46.00 | -5.77 |
| Line 2 | 220.000 | 40.32 | --- | --- | 64.00 | 54.00 | -13.68 |
| | 359.000 | 39.90 | --- | --- | 60.03 | 50.03 | -10.13 |
| | 439.000 | 39.05 | --- | --- | 57.74 | 47.74 | -8.69 |
| | 528.000 | 40.41 | --- | --- | 56.00 | 46.00 | -5.59 |
| | 717.000 | 40.18 | --- | --- | 56.00 | 46.00 | -5.82 |
| | 817.000 | 40.39 | --- | --- | 56.00 | 46.00 | -5.61 |
| | 1102.000 | 40.23 | --- | --- | 56.00 | 46.00 | -5.77 |
| | 1295.000 | 39.88 | --- | --- | 56.00 | 46.00 | -6.12 |
| | 1629.000 | 38.61 | --- | --- | 56.00 | 46.00 | -7.39 |
| | 2741.000 | 40.89 | --- | --- | 56.00 | 46.00 | -5.11 |

## V. Section 15.247 (a): Technical description of the EUT

Based on the Section 2.1, *Direct Sequence System* is a spread spectrum system in which the carrier has been modulated by a high speed spreading code and an information data stream. The high speed code sequence dominates the "modulating function" and is the direct cause of the wide spreading of the transmitted signal. In the Exhibit H, operational description demonstrates the operation principles of the Baseband processor employed by the EUT, shows that which is a complete DSSS baseband processor and meets the definition of the Direct sequence spread spectrum system.

# VI. Section 15.247 (C): Spurious Emissions (Radiated)

## 6.1 Test Condition & Setup

We' d performed the test by the *radiated emission* skill: The EUT was placed in an anechoic chamber, and set the EUT transmitting continuously and scanned at 3-meter distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration, which produced the highest emissions was noted so it could be reproduced later during the final tests. For the measurement above 1GHz, according to the guidance we' d set the spectrum analyzer' s 6dB bandwidth RBW to 1MHz.

This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT. Final radiation measurements were made on a three-meter, anechoic chamber. The EUT system was placed on a nonconductive turntable, which is 0.8 meters height, top surface 1.0 x 1.5 meter.

The spectrum was examined from 30 MHz to 1000 MHz using an Hewlett Packard 85460A EMI Receiver, Schwarzeck whole range Small Biconical antenna (Model No.: BBVU9135) is used to measure frequency from 30 MHz to 1GHz. The final test is used the HP 85460A spectrum and 8564E spectrum was examined from 1GHz to 25GHz using an Hewlett Packard Spectrum Analyzer, EMCO/CMT Horn Antenna (Model 3115 / RA42-K-F-4B-C) for 1G - 25GHz. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. There are two spectrum analyzers use on this testing, HP 85460A for frequency 30MHz to 1000MHz, and 8564E for frequency 1GHz to 18GHz. No post-detector video filters were used in the test. The spectrum analyzer's 6dB bandwidth was set to 120KHz (spectrum was examined from 30 MHz to 1000 MHz), the spectrum analyzer's 6dB bandwidth was set to 1 MHz (spectrum was examined from 1GHz to 18GHz) and the analyzer was operated in the maximum hold mode. There is a test condition applies in this test item, the test procedure description as the <1.3> test method:

Three channels were tested, one in the top (CH01), one in the middle (CH06) and the other in bottom (CH11).

With the transmitter operating from a AC source and using the internal of EUT, radiates spurious emissions falling within the restricted bands of 15.209 were measured at operating frequencies corresponding to upper, middle and bottom channels in the 2400 ~ 2483.5 MHz band.

The actual field intensity in decibels referenced to 1 microvolt per meter (dBμV/m) is determined by algebraically adding the measured reading in dBμV, the antenna factor (dB), and cable loss (dB) at the appropriate frequency. Since the EUT was set to transmit continuously, no *duty cycle* is present.

**For frequency between 30MHz to 1000MHz**

FIa (dBuV/m) = FIr (dBμV) + Correction Factors

FIa : Actual Field Intensity

FIr : Reading of the Field Intensity

Correction Factors = Antenna Factor + Cable Loss – Amplifier Gain

**For frequency between 1 GHz to 25 GHz**

FIa (dBμV/m) = FIr (dBμV) + Correction Factor

FIa : Actual Field Intensity

FIr : Reading of the Field Intensity

Correction Factors = Antenna Factor + Cable Loss – Amplifier Gain

## 6.2 List of Test Instruments

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| EMI Receiver | 8546A | H P | 3520A00242 | 06/28/02 | 06/28/03 |
| RF Filter Section | 85460A | H P | 3448A00217 | 06/28/02 | 06/28/03 |
| Small Biconical | BBVU9135 | Schwarzeck | 127 | 05/07/02 | 05/07/03 |
| Antenna and Balun | UBAA9114 | | | | |
| Switch/Control Unit (>30MHz) | 3488A | HP | N/A | 11/20/02 | 11/20/03 |
| Auto Switch Box (>30MHz) | ASB-01 | TRC | 9904-01 | 11/20/02 | 11/20/03 |
| Spectrum Analyzer | 8564E | HP | US36433002 | 08/01/02 | 08/01/03 |
| Microwave Preamplifier | 83051A | HP | 3232A00347 | 08/01/02 | 08/01/03 |
| Horn Antenna | 3115 | EMCO | 9704 – 5178 | 08/01/02 | 08/01/03 |
| Horn Antenna | RA42-K-F-4B-C | CMT | 961505-003 | 02/01/03 | 02/01/04 |
| Anechoic Chamber (cable calibrated together) | | | | 05/20/02 | 05/20/03 |

The level of confidence of 95% , the uncertainty of measurement of radiated emission is ± 3.44dB .

### 6.3 Test Result of Spurious Radiated Emissions

**EUT's transmit only**

The highest peak values of radiated emissions form the EUT at various antenna heights, antenna polarizations, EUT orientation, etc. are recorded on the following.

Test Conditions: Temperature : 25.0 ° C Humidity : 73.0 % RH

***Table 4 Radiated Emissions for 30MHz to 1GHz [Horizontal]***

| *Radiated Emission* | | | | *Correction Factors* | *Corrected Amplitude* | *FCC Class B ( 3 m )* | |
|---|---|---|---|---|---|---|---|
| *Frequency (MHz)* | *Amplitude (dBmV)* | *Ant. H. (m)* | *Table ( ° )* | *(dB)* | *(dBmV/m)* | *Limit (dBmV/m)* | *Margin (dB)* |
| 176.00 | 36.88 | 1.00 | 123 | 1.69 | 38.57 | 43.50 | -4.93 |
| 192.03 | 35.31 | 1.00 | 266 | 1.72 | 37.03 | 43.50 | -6.47 |
| 300.00 | 37.74 | 1.00 | 338 | 2.04 | 39.78 | 46.00 | -6.22 |
| 353.74 | 33.92 | 1.00 | 338 | 3.28 | 37.20 | 46.00 | -8.80 |
| 701.73 | 20.51 | 1.00 | 57 | 16.89 | 37.40 | 46.00 | -8.60 |
| 800.04 | 19.27 | 1.00 | 10 | 18.87 | 38.14 | 46.00 | -7.86 |

***Table 5 Radiated Emissions For 30MHz to 1GHz [Vertical]***

| *Radiated Emission* | | | | *Correction Factors* | *Corrected Amplitude* | *FCC Class B ( 3 m )* | |
|---|---|---|---|---|---|---|---|
| *Frequency (MHz)* | *Amplitude (dBmV)* | *Ant. H. (m)* | *Table ( ° )* | *(dB)* | *(dBmV/m)* | *Limit (dBmV/m)* | *Margin (dB)* |
| 50.00 | 29.25 | 1.00 | 55 | 8.16 | 37.41 | 40.00 | -2.59 |
| 152.46 | 31.56 | 1.00 | 147 | 1.94 | 33.50 | 43.50 | -10.00 |
| 402.24 | 29.35 | 1.00 | 162 | 5.18 | 34.53 | 46.00 | -11.47 |
| 487.11 | 26.76 | 1.00 | 18 | 8.42 | 35.18 | 46.00 | -10.82 |
| 571.99 | 24.01 | 1.00 | 338 | 12.75 | 36.76 | 46.00 | -9.24 |
| 600.03 | 21.12 | 1.00 | 123 | 13.71 | 34.83 | 46.00 | -11.17 |

Note: 1. Margin = Amplitude – limit, *if margin is minus means under limit.*

2. Corrected Amplitude = Reading Amplitude + Correction Factors

3. Correction factor = Antenna factor + ( Cable Loss – Amplitude gain)

***Table 7 Radiated Emissions for 1GHz to 25GHz [Horizontal] [CH 1]***

| *Radiated Emission* | | | | *Corrected Amplitude (dBμV/m)* | | *FCC Class B ( 3m )* | | |
|---|---|---|---|---|---|---|---|---|
| *Frequency (MHz)* | *Ant. H. (m)* | *Table ( ° )* | *Correction Factors (dB)* | *Peak* | *Average* | *Limit (dBμV/m) Peak* | *Ave.* | *Margin (dB)* |
| 4041.33 | 1.00 | 159 | 1.42 | 41.20 | --- | 74.00 | 53.96 | -12.80 |
| 4824.33 | 1.00 | 25 | 3.76 | 51.20 | --- | 74.00 | 53.96 | -2.80 |
| 7335.25 | 1.00 | 103 | 10.35 | 45.12 | --- | 74.00 | 53.96 | -8.88 |
| 9648.00 | 1.00 | 63 | 11.46 | 50.40 | --- | 74.00 | 53.96 | -3.60 |

***Table 8 Radiated Emissions for 1GHz to 25GHz [ Vertical] [CH 1]***

| *Radiated Emission* | | | | *Corrected Amplitude (dBμV/m)* | | *FCC Class B ( 3m )* | | |
|---|---|---|---|---|---|---|---|---|
| *Frequency (MHz)* | *Ant. H. (m)* | *Table ( ° )* | *Correction Factors (Db)* | *Peak* | *Average* | *Limit (dBμV/m) Peak* | *Ave.* | *Margin (Db)* |
| 3821.42 | 1.00 | 76 | 0.56 | 41.83 | --- | 74.00 | 53.96 | -12.17 |
| 4824.33 | 1.00 | 146 | 3.76 | 52.37 | --- | 74.00 | 53.96 | -1.63 |
| 7642.17 | 1.00 | 265 | 11.03 | 50.97 | --- | 74.00 | 53.96 | -3.03 |
| 9648.00 | 1.00 | 11 | 11.46 | 49.57 | --- | 74.00 | 53.96 | -4.43 |

Note:

1. Margin = Corrected — Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF Radiated emissions levels do comply with the *20dBc limit* both at its bandedges and other spurious emissions.
3. As stated in Section 15.35(b), for any frequencies above 1000MHz, radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. As the results of our test, the peak amplitudes are already below the FCC limit. Thus the average amplitudes of the rest are omitted.

*Table 9 Radiated Emissions for 1GHz to 25GHz [Horizontal] [CH 6]*

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 3920.50 | 1.00 | 156 | 0.95 | 41.89 | --- | 74.00 | 53.96 | -12.11 |
| 4875.08 | 1.00 | 225 | 3.96 | 51.23 | --- | 74.00 | 53.96 | -2.77 |
| 9749.50 | 1.00 | 46 | 11.90 | 50.67 | --- | 74.00 | 53.96 | -3.33 |

*Table 10 Radiated Emissions for 1GHz to 25GHz [ Vertical] [CH 6]*

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 4875.08 | 1.00 | 81 | 3.96 | 52.73 | --- | 74.00 | 53.96 | -1.23 |
| 7680.83 | 1.00 | 140 | 10.90 | 50.01 | --- | 74.00 | 53.96 | -3.99 |
| 9749.50 | 1.00 | 45 | 11.90 | 50.50 | --- | 74.00 | 53.96 | -3.50 |

*Table 11 Radiated Emissions for 1GHz to 25GHz [Horizontal] [CH 11]*

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 3980.92 | 1.00 | 50 | 1.26 | 42.54 | --- | 74.00 | 53.96 | -11.46 |
| 4725.83 | 1.00 | 116 | 4.13 | 50.90 | --- | 74.00 | 53.96 | -3.10 |
| 9848.58 | 1.00 | 247 | 11.93 | 52.20 | --- | 74.00 | 53.96 | -1.80 |

*Table 12 Radiated Emissions for 1GHz to 25GHz [ Vertical] [CH 11]*

| Radiated Emission | | | | Corrected Amplitude (dBμV/m) | | FCC Class B ( 3m ) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Limit (dBμV/m) | | Margin (dB) |
| Frequency (MHz) | Ant. H. (m) | Table ( ° ) | Correction Factors (dB) | Peak | Average | Peak | Ave. | |
| 3980.92 | 1.00 | 230 | 1.26 | 45.04 | --- | 74.00 | 53.96 | -8.96 |
| 4923.92 | 1.00 | 128 | 4.12 | 53.07 | --- | 74.00 | 53.96 | -1.77 |
| 7961.17 | 1.00 | 16 | 10.83 | 48.94 | --- | 74.00 | 53.96 | -5.06 |
| 9848.58 | 1.00 | 177 | 11.93 | 51.70 | --- | 74.00 | 53.96 | -2.30 |

## 6.4 Test Result of the Bandedge

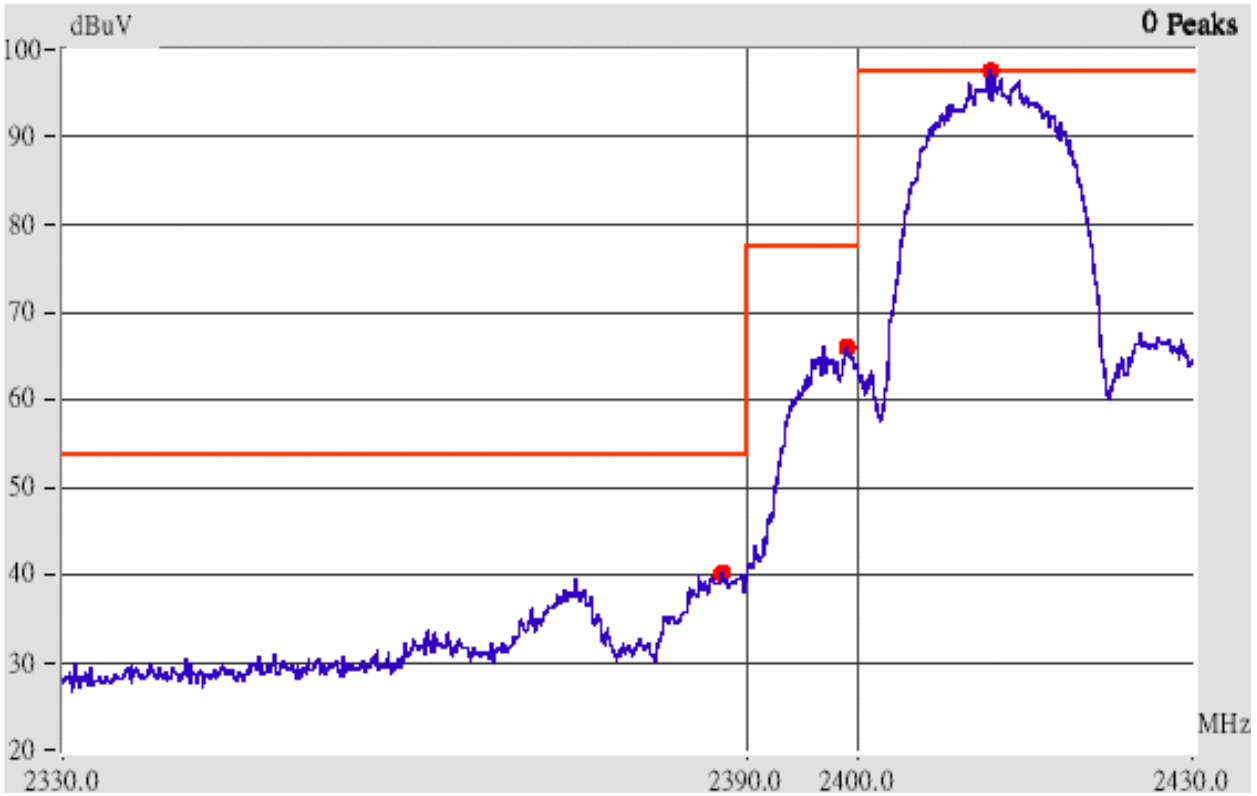
If any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either *at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified id §15.209(a),*

We perform this section by the *conducted* manner, the RBW is set to 100kHz and VBW>RBW. We' d made the observation *up to 10$^{th}$ harmonics and the criterion is all the harmonic/spurious emissions must be 20dB below the highest emission level measured.* If the emissions fall in the restricted bands stated in the Part15.205(a) must also *comply with the radiated emission limits specified in Part15.209(a). (Peak mode: RBW=VBW=1MHz, Average mode: RBW=1MHz; VBW=10Hz)*

The following pages show our observations referring to the channel 1 and 11 respectively.

Test Condition & Setup: same as < 6.1 >

***Channel 1***

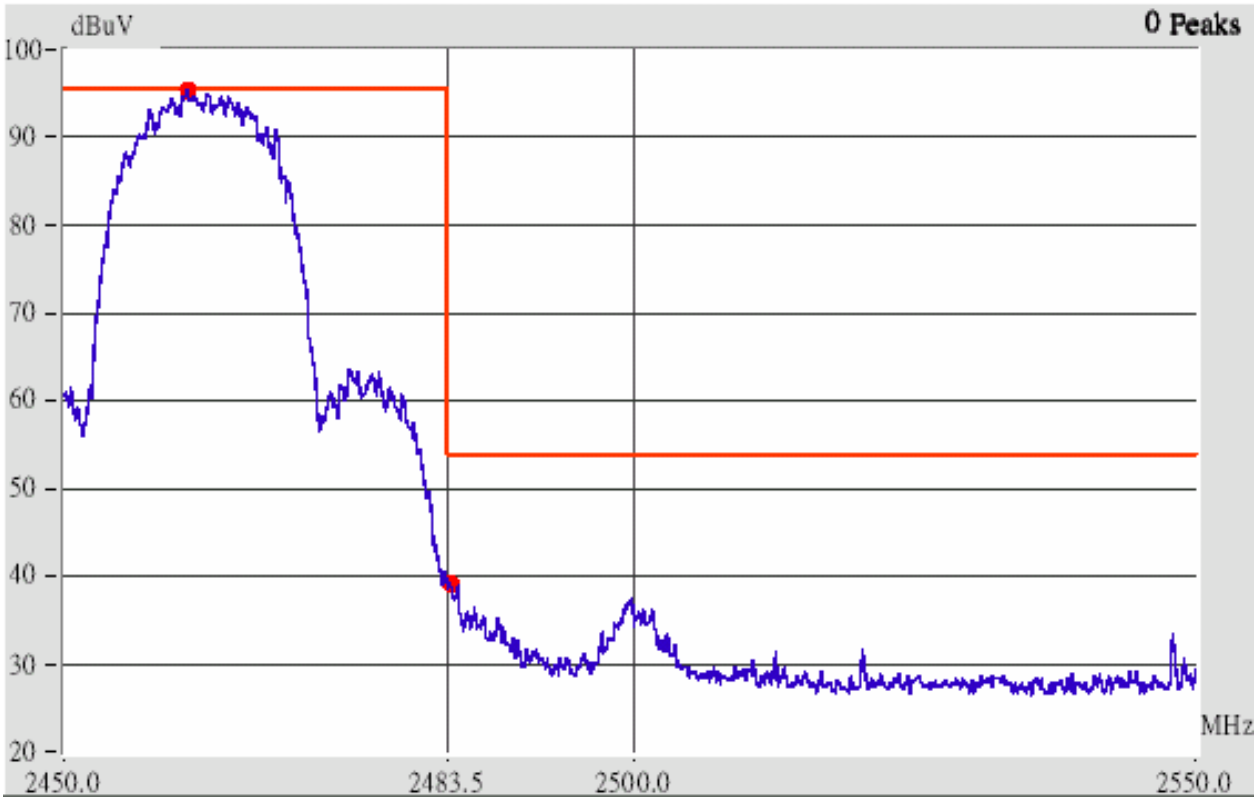



This is the hard copy of our bandedge measurement generated by our bandedge testing program. The plot shown above is the bandedge of channel 1.

1. The lobe left by the fundamental side is already 20dB below the highest emission level.
2. The emissions recorded in the restricted band is do comply with the Part 15.209(a) – as below.

| ***Radiated Emission*** | | | | | ***Corrected Amplitude (dBμV/m)*** | | ***FCC Class B ( 3m )*** | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Frequency (MHz)*** | ***Ant. P.*** | ***Ant. H. (m)*** | ***Table ( ° )*** | ***Factors (dB)*** | | | ***Limit (dBμV/m)*** | | ***Margin (dB)*** |
| | | | | | ***Peak*** | ***Average*** | ***Peak*** | ***Ave.*** | |
| 2386.33 | Hor | 1.00 | 258 | 3.12 | 49.12 | --- | 74.00 | 53.96 | -4.88 |
| 2390.07 | Hor | 1.00 | 169 | 3.14 | 48.97 | --- | 74.00 | 53.96 | -5.03 |
| 2388.07 | Ver | 1.00 | 45 | 3.13 | 44.46 | --- | 74.00 | 53.96 | -9.54 |
| 2390.07 | Ver | 1.00 | 144 | 3.14 | 44.30 | --- | 74.00 | 53.96 | -9.70 |

***Channel 11***




This is the hard copy of our bandedge measurement generated by our bandedge testing program. The plot shown above is the bandedge of channel 11.

1. The lobe right by the fundamental side is already 20dB below the highest emission level.
2. The emissions recorded in the restricted band is do comply with the Part 15.209(a) – as below

| ***Radiated Emission*** | | | | | ***Corrected Amplitude (dBμV/m)*** | | ***FCC Class B ( 3m )*** | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Frequency (MHz)*** | ***Ant. P.*** | ***Ant. H. (m)*** | ***Table ( ° )*** | ***Factors (dB)*** | ***Peak*** | ***Average*** | ***Limit (dBμV/m) Peak*** | ***Ave.*** | ***Margin (dB)*** |
| 2483.50 | Hor | 1.00 | 98 | 3.45 | 48.78 | --- | 74.00 | 53.96 | -5.22 |
| 2498.67 | Hor | 1.00 | 175 | 3.50 | 46.00 | --- | 74.00 | 53.96 | -8.00 |
| 2500.01 | Hor | 1.00 | 28 | 3.50 | 44.33 | --- | 74.00 | 53.96 | -9.67 |
| 2483.50 | Ver | 1.00 | 56 | 3.45 | 41.78 | --- | 74.00 | 53.96 | -12.22 |
| 2498.78 | Ver | 1.00 | 22 | 3.50 | 40.83 | --- | 74.00 | 53.96 | -13.17 |
| 2547.61 | Ver | 1.00 | 145 | 3.56 | 40.06 | --- | 74.00 | 53.96 | -13.94 |