# MEASUREMENT REPORT
# of
# *802.11b Wireless LAN Card Bus Adapter*

| | | |
|---|---|---|
| **Applicant** | : | CAMEO COMMUNICATIONS, INC. |
| **Model No.** | : | WLB-110, TEW-221PC, LW2110N |
| **EUT** | : | 802.11b Wireless LAN Card Bus Adapter |
| **FCC ID** | : | NHPWLB1100 |
| **Report No.** | : | C5115268 |

**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 C Section 15.247.

| | | |
|---|---|---|
| **Applicant** | : | Cameo Communications, Inc. |
| **Applicant address** | : | 6F, No.22, Chung Shin Rd., Hsi-Chih, Taipei 221, Taiwan, R.O.C. |
| **EUT** | : | 802.11b Wireless LAN Card Bus Adapter |
| **Model No.** | : | WLB-1100, TEW-221PC, LW2110N |
| **FCC ID** | : | NHPWLB1100 |
| **Report No.** | : | C5115268 |
| **Test Date** | : | January 20, 2003 |

**Prepared by:** *Eric Wong* **Approved by:** *Frank Tsai*

**Tested by :**

## *Training Research Co., Ltd.*

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

255 Nanyang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C.

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# Ⅰ. GENERAL

## 1.1 Introduction

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

## 1.2 Description of EUT

| | | |
|---|---|---|
| **EUT** | **:** | 802.11b Wireless LAN Card Bus Adapter |
| **Model No.** | **:** | WLB-1100, TEW-221PC, LW2110N |
| **Granted FCC ID** | **:** | NHPWLB1100 |
| **Frequency Range** | **:** | 2.412 GHz ~ 2.462GHz |
| **Support Channel** | **:** | 11 Channel |
| **Modulation Skill** | **:** | DBPSK, DQPSK, CCK |
| **Power Type** | **:** | By the PCMCIA of Notebook |

## 1.3 Test method

1. Insert the EUT into the PCMCIA interface of the notebook computer
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.

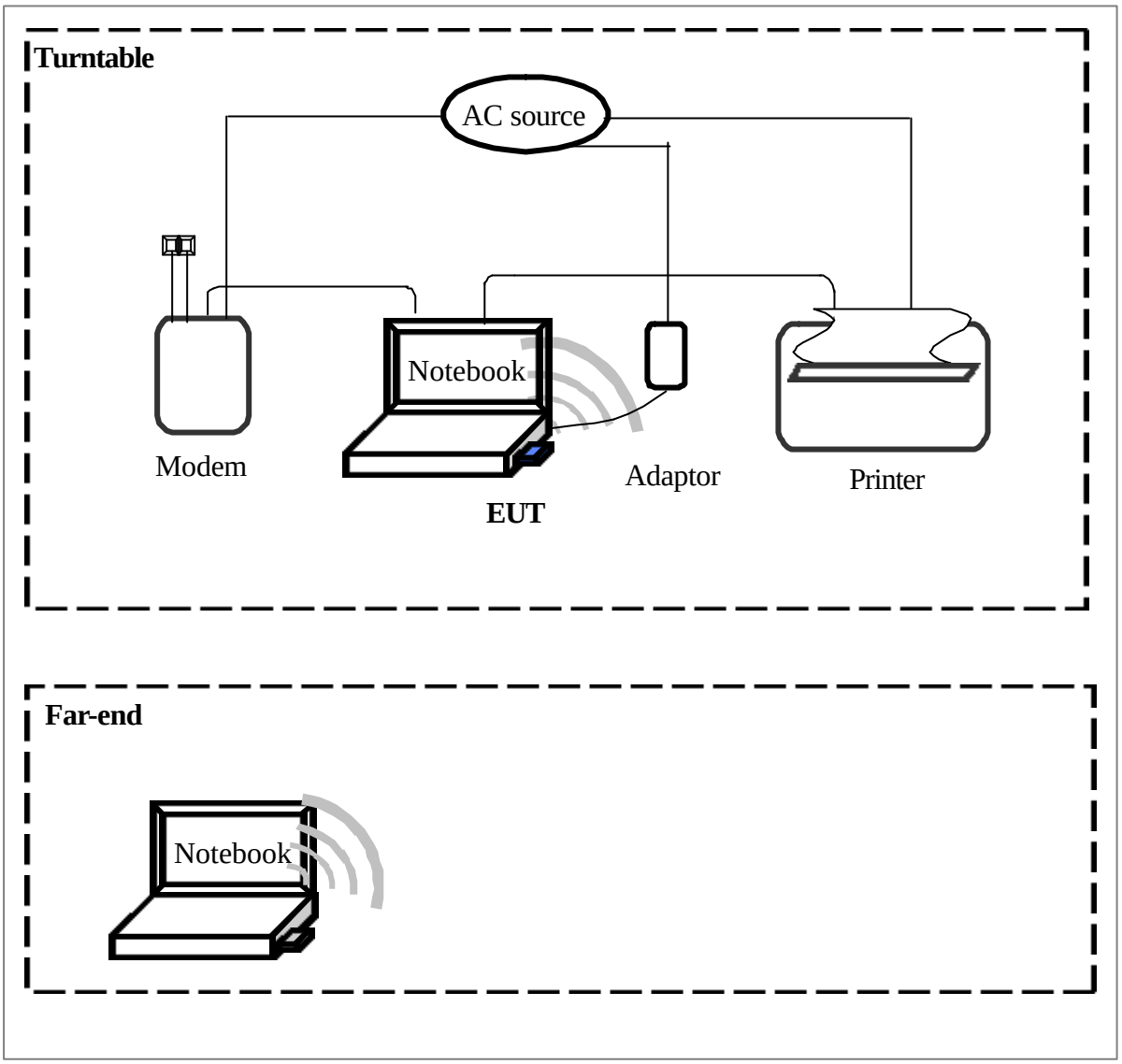
| | | |
|---|---|---|
| **Notebook** | **:** | **IBM Think Pad X20** |
| Model No. | : | 2662-11T |
| Serial No. | : | FX-1192200/09 |
| FCC ID | : | N/A, Doc Approved |
| 檢磁 | : | 3892B565 |
| **Adaptor** | **:** | **IBM** |
| Model No. | : | PA2450U |
| Serial No. | : | 02K6654 |
| FCC ID | : | N/A, Doc Approved |
| Power type | : | I/P: 100 ~ 240vac, 50 ~ 60 Hz, 0.5A ~ 1.2A; O/P: 16Vdc, 4.5A |
| Power cord | : | Non-shielded, 1.80m long, Plastic, with ferrite core |
| **Fax/Modem** | **:** | **Aceex** |
| Model No. | : | DM-1414 |
| Serial No. | : | 9010582 |
| FCC ID | : | IFAXDM1414 |
| Power type | : | 110 VAC / 50 ~ 60 Hz, Switching |
| Power Cord | : | Non-shielded, 1.90m long, Plastic hoods, and no ferrite bead |
| Data Cable | : | RS-232→Shielded, 1.30m long, Metal hoods , No bead |
| | | RJ-11Cx2→Non-shielded, 7’ long, Plastic hoods, No bead |
| **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 |

| | | |
|---|---|---|
| **Mouse** | **:** | **Logitech** |
| Model No. | : | M-BA47 |
| Serial No. | : | LZE92250027 |
| FCC ID | : | DoC Approved |
| 檢磁 | : | 4872A220 |
| Power type | : | Powered by Computer |
| Power Cable | : | Shielded, 1.5m long, Plastic hoods, No ferrite bead |

| | | |
|---|---|---|
| **USB** | | |
| **Gamepad** | **:** | **Rockfire** |
| Model No. | : | QF-337uv |
| Serial No. | : | 10600545, KR91379759 |
| FCC ID | : | None (CE approval) |
| 檢磁 | : | 3862A574 |
| Power type | : | By computer |
| Data Cable | : | Shielded, 1.81m long, Plastic, with ferrite core |

## 1.5 Configuration of System Under Test

***(Conducted and Radiated for unintentional)***




**Connections of Computer:**

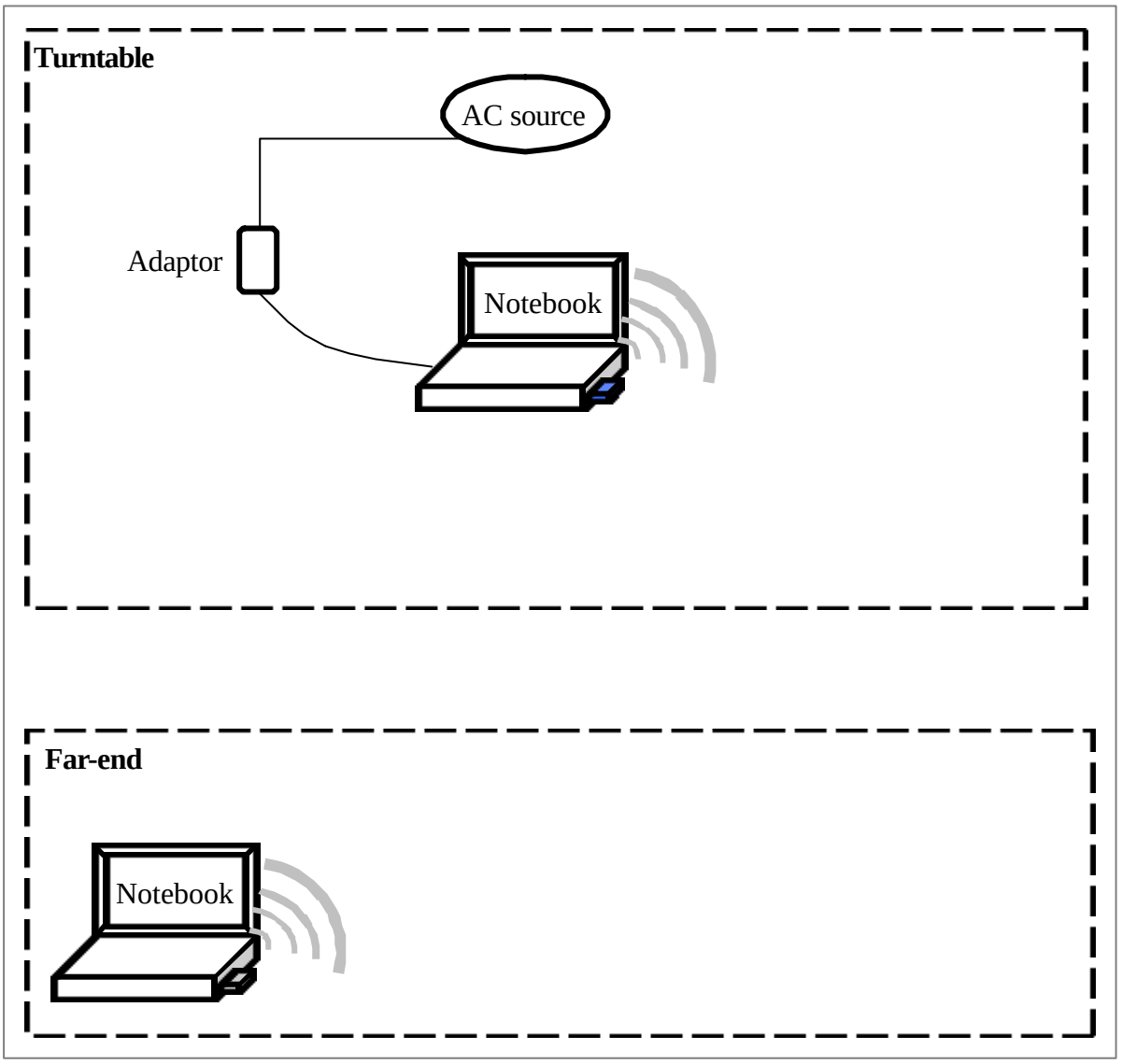
*Parallel Port --- a printer

*Serial Port --- an external modem

*USB Port --- a USB mouse

*PCMCIA Port --- **EUT**

***(Radiated of 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 setting up procedure was recorded in <1.3> test method.

## 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>, 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 PCMCIA interface 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 Certification 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) we' d performed respectively. We dropped this part, as the result will be repeated as the part we mentioned above.

## III. Section 15.203: Antenna requirement

The EUT has an integrated antenna permanently attached on the PCB. In addition, there is no external antenna or 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 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 450 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 2.4.

There is a test condition applies in this test item, the test procedure description as the following: EUT transmit only:

Using the LAN port of notebook computer and software to control the EUT. The setting up procedure is recorded on <1.3>. 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

| | | | | **Calibration Date** | |
|---|---|---|---|---|---|
| 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: Testing room : Temperature : 20.6 °C Humidity : 52.7 % 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 | 166.00 | 51.41 | --- | --- | 65.54 | 55.54 | -4.13 |
| | 187.00 | 49.38 | --- | --- | 64.94 | 54.94 | -5.56 |
| | 206.00 | 47.07 | --- | --- | 64.40 | 54.40 | -7.33 |
| | 262.00 | 40.13 | --- | --- | 62.80 | 52.80 | -12.67 |
| | 409.00 | 41.67 | --- | --- | 58.60 | 48.60 | -6.93 |
| | 461.00 | 35.92 | --- | --- | 57.11 | 47.11 | -11.19 |
| Line 2 | 177.00 | 44.20 | --- | --- | 65.23 | 55.23 | -11.03 |
| | 216.00 | 48.38 | --- | --- | 64.11 | 54.11 | -5.73 |
| | 243.00 | 45.74 | --- | --- | 63.34 | 53.34 | -7.60 |
| | 288.00 | 38.84 | --- | --- | 62.06 | 52.06 | -13.22 |
| | 409.00 | 40.20 | --- | --- | 58.60 | 48.60 | -8.40 |
| | 456.00 | 35.89 | --- | --- | 57.26 | 47.26 | -11.37 |

NOTE:

(1) Margin = 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 | 164.00 | 51.55 | --- | --- | 65.60 | 55.60 | -4.05 |
| | 208.00 | 44.87 | --- | --- | 64.34 | 54.34 | -9.47 |
| | 226.00 | 43.53 | --- | --- | 63.83 | 53.83 | -10.30 |
| | 255.00 | 38.68 | --- | --- | 63.00 | 53.00 | -14.32 |
| | 409.00 | 41.81 | --- | --- | 58.60 | 48.60 | -6.79 |
| | 452.00 | 37.22 | --- | --- | 57.37 | 47.37 | -10.15 |
| Line 2 | 159.00 | 39.54 | --- | --- | 65.74 | 55.74 | -16.20 |
| | 205.00 | 46.49 | --- | --- | 64.34 | 54.34 | -7.85 |
| | 255.00 | 36.63 | --- | --- | 63.00 | 53.00 | -16.37 |
| | 409.00 | 42.09 | --- | --- | 58.60 | 48.60 | -6.51 |
| | 456.00 | 35.81 | --- | --- | 57.26 | 47.26 | -11.45 |
| | 504.00 | 35.25 | --- | --- | 56.00 | 46.00 | -10.75 |

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 | 208.00 | 45.77 | --- | --- | 64.34 | 54.34 | -8.57 |
| | 250.00 | 37.80 | --- | --- | 63.14 | 53.14 | -15.34 |
| | 291.00 | 37.83 | --- | --- | 61.97 | 51.97 | -14.14 |
| | 405.00 | 43.03 | --- | --- | 58.71 | 48.71 | -5.68 |
| | 509.00 | 35.91 | --- | --- | 56.00 | 46.00 | -10.09 |
| | 752.00 | 27.42 | --- | --- | 56.00 | 46.00 | -18.58 |
| Line 2 | 205.00 | 46.54 | --- | --- | 64.43 | 54.43 | -7.89 |
| | 252.00 | 37.90 | --- | --- | 63.09 | 53.09 | -15.19 |
| | 355.00 | 35.35 | --- | --- | 60.14 | 50.14 | -14.79 |
| | 405.00 | 42.48 | --- | --- | 58.71 | 48.71 | -6.23 |
| | 509.00 | 35.82 | --- | --- | 56.00 | 46.00 | -10.18 |
| | 558.00 | 28.32 | --- | --- | 56.00 | 46.00 | -17.68 |

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

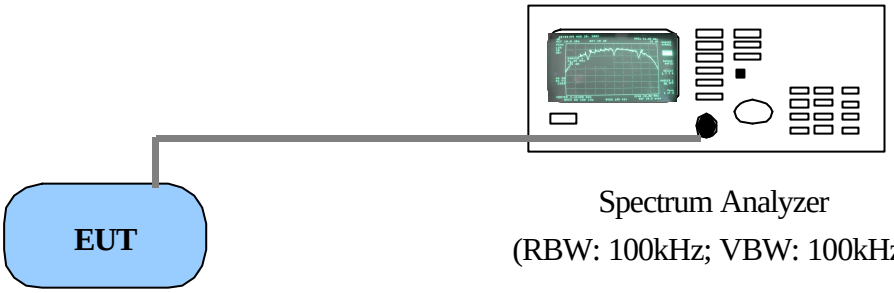
Based on the Section 2.1, *Direct Sequence System* is a spread spectrum system in which the carrier has been modulated by a high speed spreading code and an information data stream. The high speed code sequence dominates the "modulating function" and is the direct cause of the wide spreading of the transmitted signal. In the Exhibit, 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(a)(2): Bandwidth for Direct Sequence System.

## 6.1 Test Condition & Setup

The transmitter bandwidth measurements were performed by the contact manner. The EUT was set to transmit continuously, also various channels were investigated to find the maximum occupied bandwidth.. The output of the EUT was connected to the spectrum analyzer. The bandwidth of the fundamental frequency is observed by the spectrum analyzer with 100kHz RBW and 100kHz VBW.

## 6.2 Test Instruments Configuration




Test Configuration of Bandwidth for Direct Sequence System

***P.S.: Notebook computer to control the EUT at maximal power output and channel number and set antenna kit***

## 6.3 List of Test Instruments

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Spectrum Analyzer | 8564E | H P | US36433002 | 08/01/02 | 08/01/03 |

## 6.4 Test Result of Bandwidth

**Bandwidth of Channel 1**

| | | |
|---|---|---|
| Bandwidth | : | 8.80 MHz |
| The min. 6 dB BW at least | : | 500 KHz |

**Bandwidth of Channel 6**

| | | |
|---|---|---|
| Bandwidth | : | 8.83 MHz |
| The min. 6 dB BW at least | : | 500 KHz |

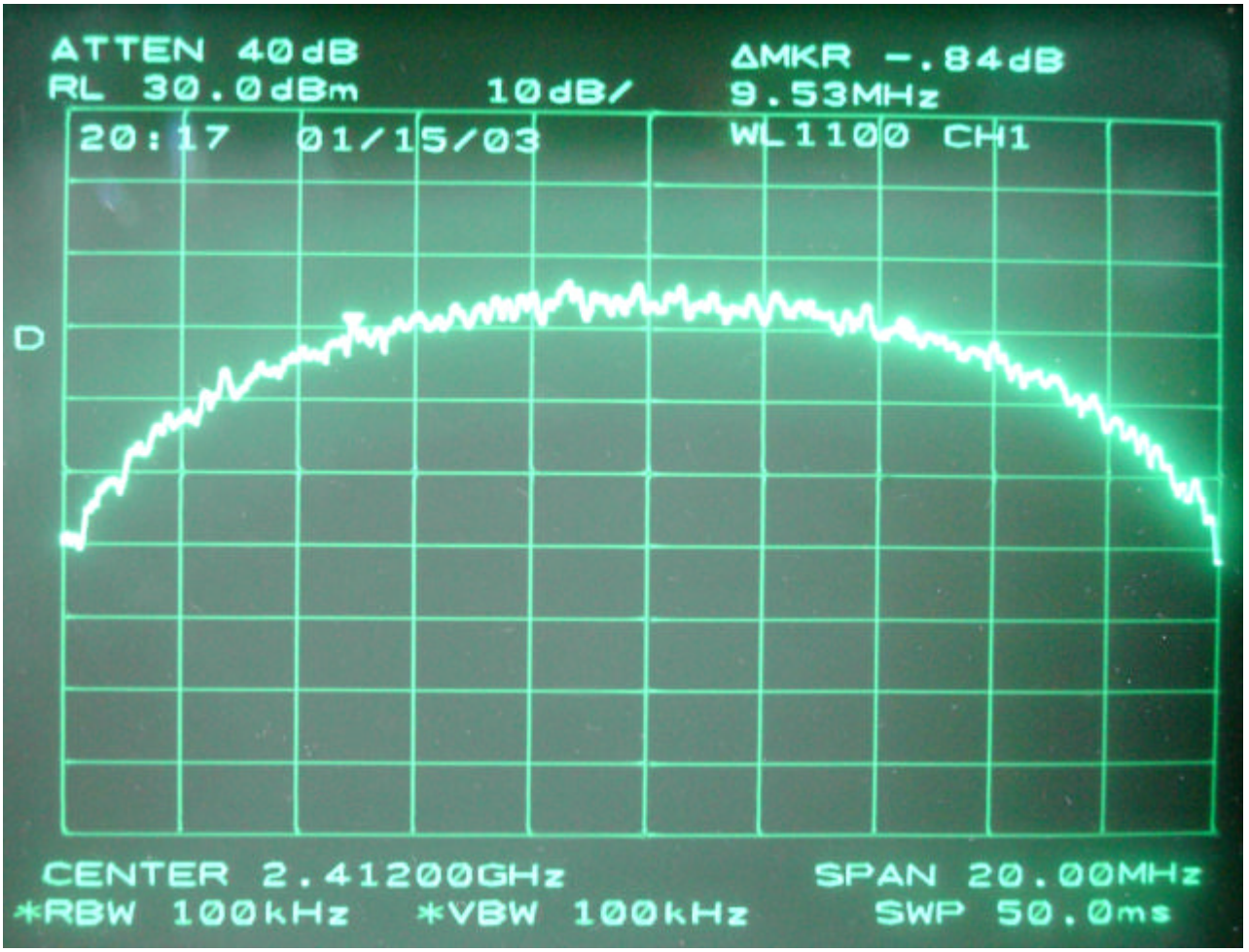
**Bandwidth of Channel 11**

| | | |
|---|---|---|
| Bandwidth | : | 8.80 MHz |
| The min. 6 dB BW at least | : | 500 KHz |

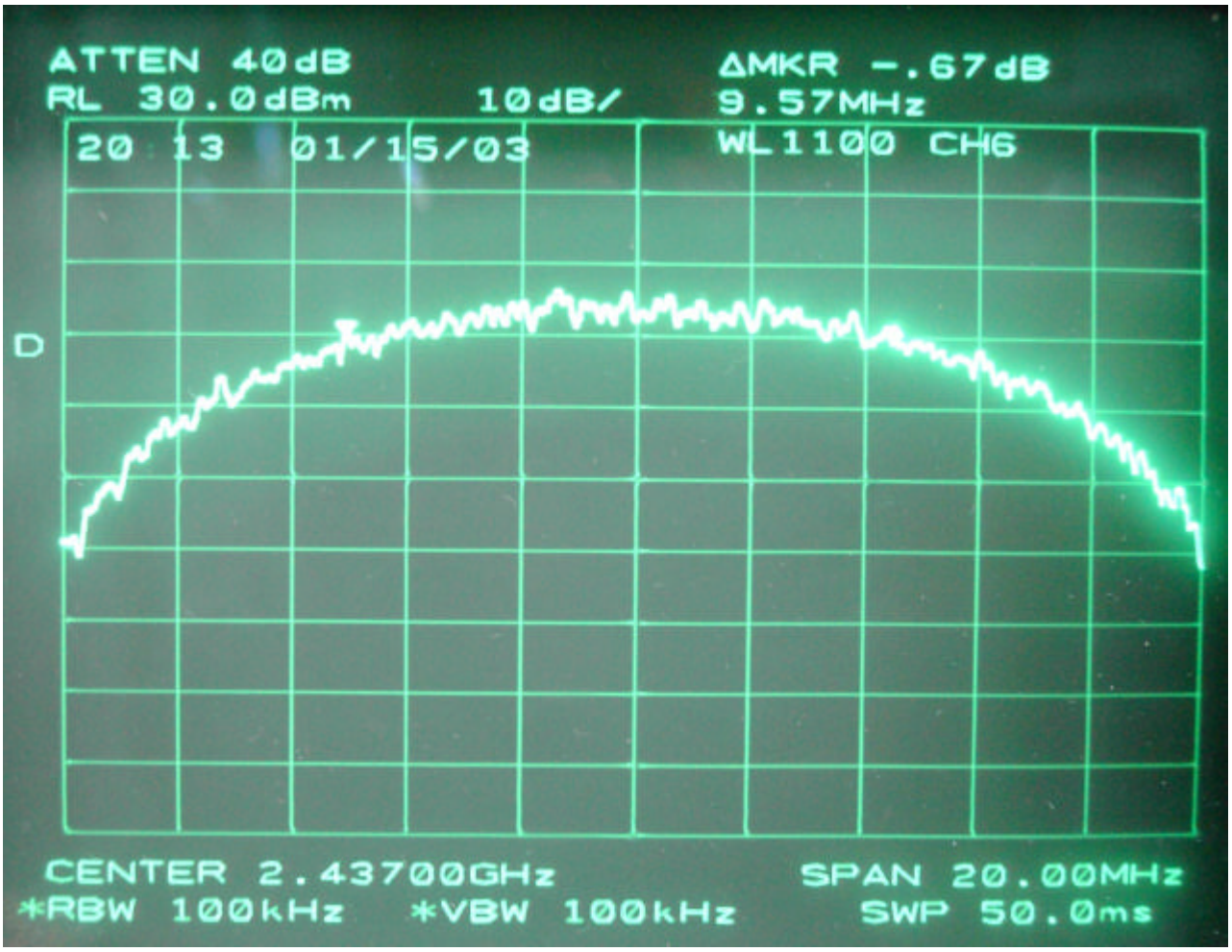
Note:

1. The data in the above table are summarizing the following attachment spectrum analyzer hard copy. According to the guidance, we' d made the measurement with the spectrum analyzer' s resolution bandwidth *(RBW)=100kHz* and set the *span>>RBW*. The results show the measured 6dB bandwidth comply with the minimum 500kHz requirement.
2. The attachments show these on the following pages.

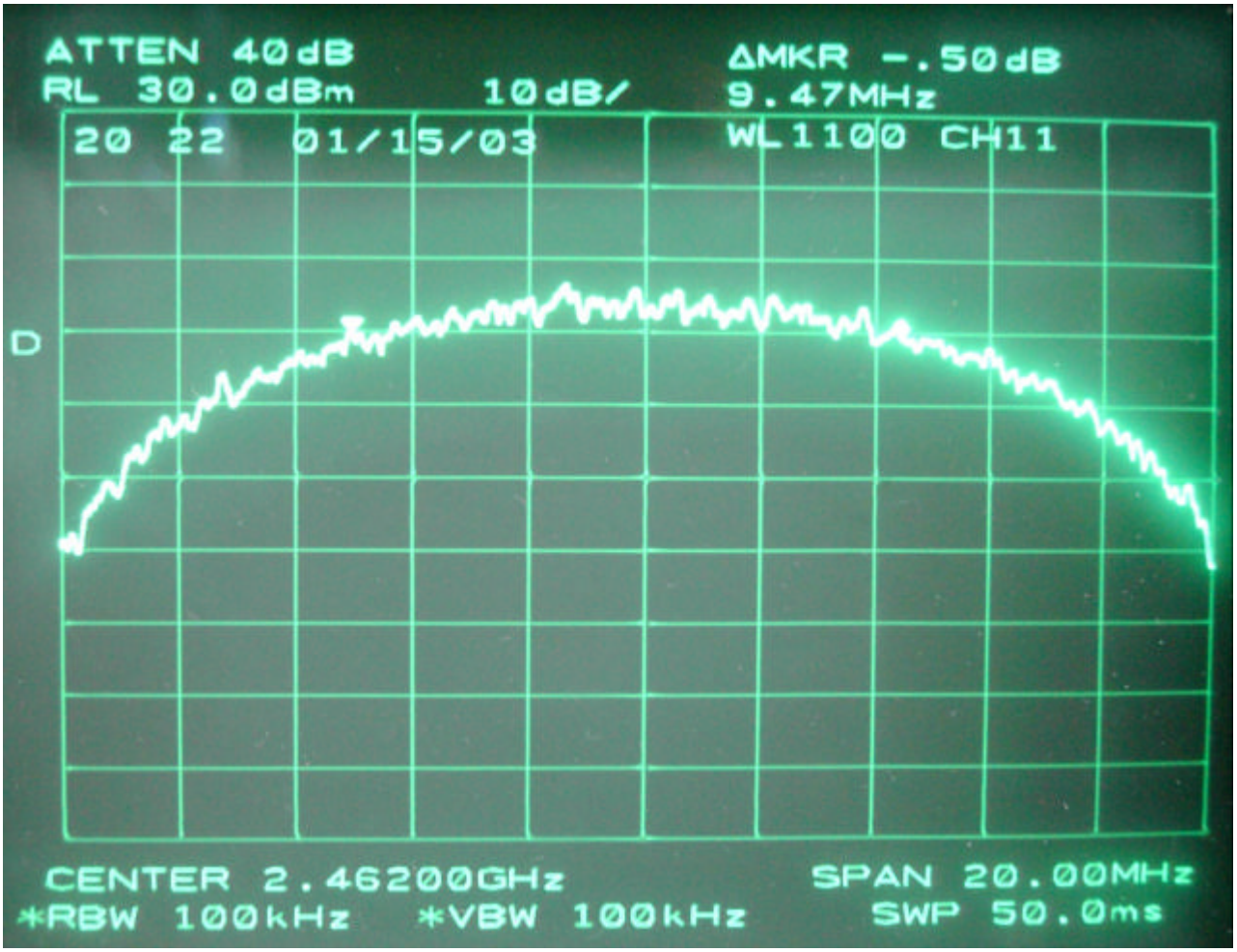
***Bandwidth of Channel 1: 9.53 MHz***



***Bandwidth of Channel 6: 9.57 MHz***

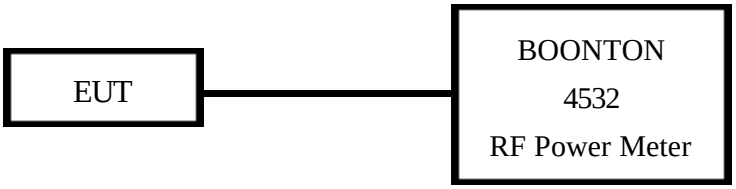


***Bandwidth of Channel 11: 9.47 MHz***



# VII. Section 15.247(b): Power Output

## 7.1 Test Condition & Setup




1. The output of the transmitter is connected to the BOONTON RF Power Meter.
2. The calibration is performed before every tests. The values of the output power of the EUT will shown in the dBm directly are the transmitter output peak power. Recording as follows.

## 7.2 List of Test Instruments

| Instrument Name | Model No. | Brand | Serial No. |
|---|---|---|---|
| RF Power Meter | 4532 | BOONTON | 117501 |

## 7.3 Test Result

**Formula:** Signal generator + |Cable loss| = Output peak power

| Channel | Signal Generator | Cable Loss | Limit | Output peak power | |
|---|---|---|---|---|---|
| | dBm | dBm | (DTS) | dBm | mW |
| CH 1 | 10.18 | 1.8 | 100mW | 11.98 | 15.78 |
| CH 6 | 10.03 | 1.8 | 100mW | 11.83 | 15.24 |
| CH 11 | 9.96 | 1.8 | 100mW | 11.76 | 15.00 |

Note:

The limit is vary according to the equipment class, listed below:

1. Digital Transmission System (DTS): 100mW
2. Spread Spectrum Transmitter (DSS): 1W

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

## 8.1 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 spectrum HP 85460A and spectrum was examined from 1GHz to 18GHz using an Hewlett Packard 8564E Spectrum Analyzer, EMCO Horn Antenna (Model 3115) for 1G ~ 18GHz.

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 18 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

## 8.2 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 Antenna and Balun | BBVU9135 UBAA9114 | Schwarzeck | 127 | 05/07/02 | 05/07/03 |
| 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 |
| 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 .

### 8.3 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: Testing room : Temperature : 24.6 ° C Humidity : 54.2 % RH

***Table 4 Radiated Emissions for 30MHz 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)* |
| 200.36 | 32.03 | 1.00 | 129 | 1.61 | 33.64 | 43.50 | -9.86 |
| 234.31 | 32.73 | 1.00 | 279 | 1.57 | 34.30 | 46.00 | -11.70 |
| 261.59 | 31.99 | 1.00 | 138 | 1.51 | 33.50 | 46.00 | -12.50 |
| 300.39 | 32.33 | 1.00 | 83 | 2.05 | 34.38 | 46.00 | -11.62 |
| 325.85 | 31.42 | 1.00 | 202 | 2.60 | 34.02 | 46.00 | -11.98 |
| 399.81 | 26.94 | 1.00 | 251 | 5.07 | 32.01 | 46.00 | -13.99 |

***Table 5 Radiated Emissions For 30MHz 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)* |
| 234.31 | 28.40 | 1.00 | 0 | 1.57 | 29.97 | 46.00 | -16.03 |
| 391.32 | 29.52 | 1.00 | 158 | 4.74 | 34.26 | 46.00 | -11.74 |
| 4.4.37 | 26.92 | 1.00 | 156 | 6.59 | 33.51 | 46.00 | -12.49 |
| 528.34 | 23.50 | 1.00 | 55 | 10.62 | 34.12 | 46.00 | -11.88 |
| 634.43 | 20.08 | 1.00 | 247 | 14.89 | 34.97 | 46.00 | -11.03 |
| 721.12 | 19.57 | 1.00 | 189 | 17.11 | 36.68 | 46.00 | -9.32 |

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 6 Open Field Radiated Emissions For 1GHz 18GHz [Horizontal] [CH 1]*

| 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. | |
| 4825.14 | 1.00 | 122 | 3.76 | 49.70 | --- | 74.00 | 53.96 | -4.30 |
| 7237.24 | 1.00 | 97 | 10.09 | 52.35 | 44.86 | 74.00 | 53.96 | -9.14 |

*Table 7 Open Field Radiated Emissions For 1GHz 18GHz [ Vertical] [CH 1]*

| 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. | |
| 4825.14 | 1.00 | 334 | 3.76 | 48.70 | 43.53 | 74.00 | 53.96 | -10.47 |
| 7237.78 | 1.00 | 147 | 10.10 | 51.37 | 48.35 | 74.00 | 53.96 | -5.65 |
| 9650.42 | 1.00 | 52 | 11.47 | 47.08 | --- | 74.00 | 53.96 | -6.92 |

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF conducted 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 8 Open Field Radiated Emissions For 1GHz 18GHz [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. | |
| 4873.47 | 1.00 | 165 | 3.95 | 49.23 | --- | 74.00 | 53.96 | -4.77 |
| 7310.28 | 1.00 | 172 | 10.30 | 50.07 | --- | 74.00 | 53.96 | -3.93 |

*Table 9 Open Field Radiated Emissions For 1GHz 18GHz [ 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. | |
| 4873.96 | 1.00 | 317 | 3.96 | 54.56 | 43.07 | 74.00 | 53.96 | -10.93 |
| 7311.49 | 1.00 | 20 | 10.30 | 52.90 | 45.07 | 74.00 | 53.96 | -8.93 |
| 9751.11 | 1.00 | 241 | 11.90 | 47.84 | --- | 74.00 | 53.96 | -6.16 |

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF conducted 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 10 Open Field Radiated Emissions For 1GHz 18GHz [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. | |
| 4925.84 | 1.00 | 214 | 4.13 | 51.40 | --- | 74.00 | 53.96 | -2.60 |
| 7382.78 | 1.00 | 108 | 10.43 | 47.37 | --- | 74.00 | 53.96 | -6.63 |

*Table 11 Open Field Radiated Emissions For 1GHz 18GHz [ 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. | |
| 4922.60 | 1.00 | 156 | 4.12 | 53.74 | | 74.00 | 53.96 | -10.11 |
| 7387.84 | 1.00 | 318 | 10.42 | 53.36 | | 74.00 | 53.96 | -10.14 |
| 9851.80 | 1.00 | 28 | 11.93 | 48.04 | --- | 74.00 | 53.96 | -5.96 |

Note:

1. Margin = Corrected - Limit.
2. The EUT utilizes a *permanently attached antenna*. In addition the spurious RF conducted 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.

## 8.4 Test Result of the Bandedge

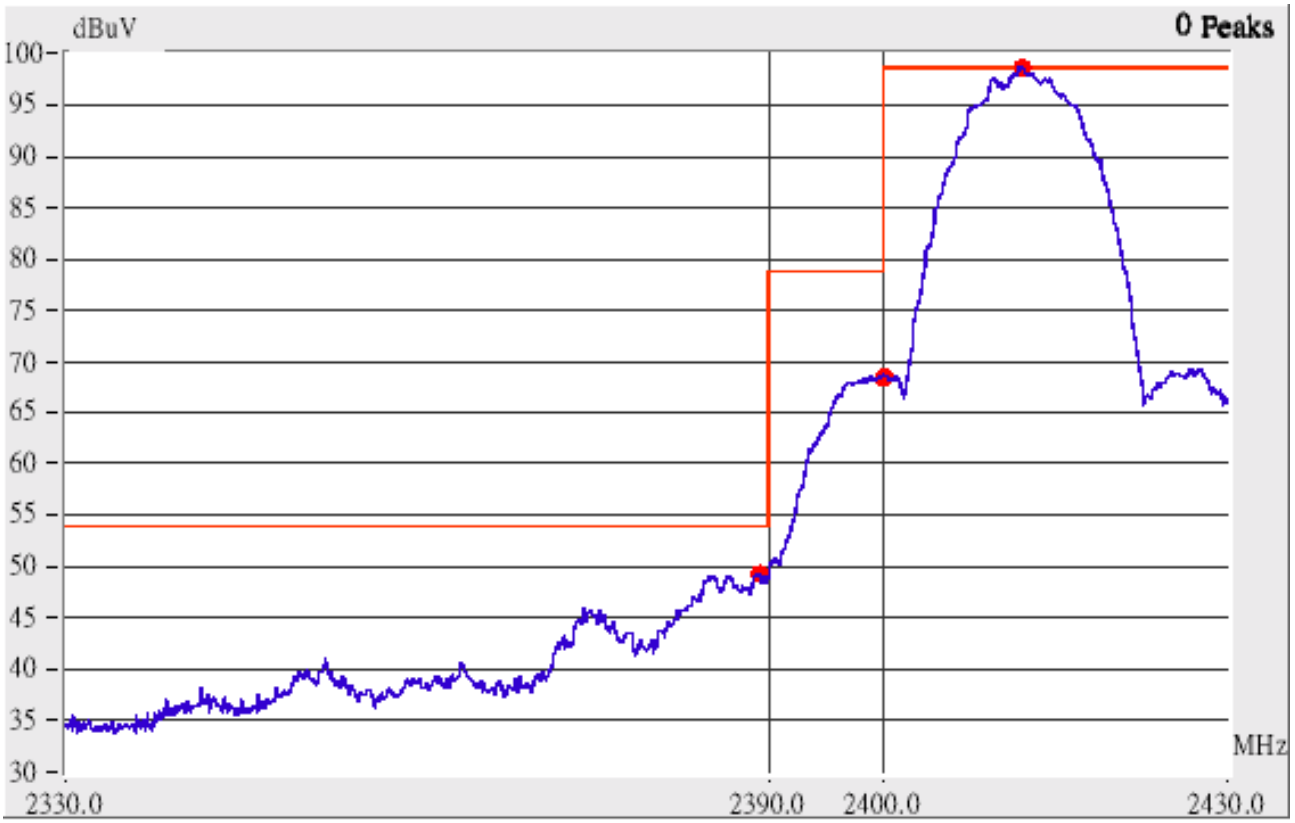
If any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either *at least 20 dB below that in any 100 kHz bandwidth within the band that contains 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 10th 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 Part 15.205(a) must also *comply with the radiated emission limits specified in Part 15.209(a).*

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

Test Condition & Setup: same as < 3.1 >

***Channel 1***




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

1. The lobe right by the fundamental side is already 20dB below the highest emission level.
2. The emissions recorded in the restricted band (<2400MHz) is do comply with the Part 15.209(a) – under the limited line marked in red color.

***Channel 11***


This is the hard copy of our bandedge measurement generated by our bandedge testing program. The picture 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 (>2483.5MHz) is do comply with the Part 15.209(a) – under the limited line marked in red color.

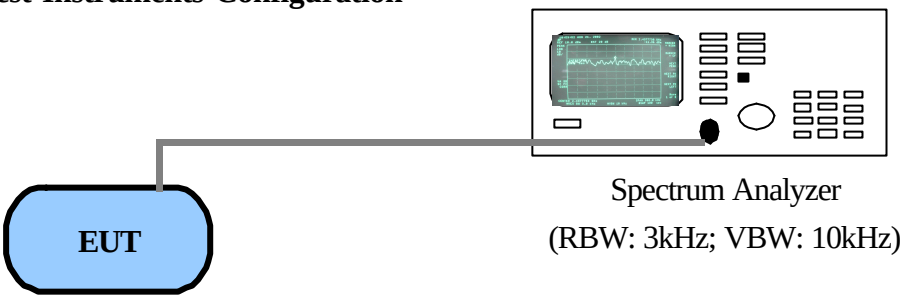
# IX. Section 15.247(d): Power Spectral Density

## 9.1 Test Condition & Setup

The tests below are running with the EUT transmitter set at high power in TDD mode. The EUT is needed to force selection of output power level and channel number. While testing, the EUT was set to transmit continuously and to be tested by the contact manner with the spectrum analyzer.

The attachments below show our observation.

## 9.2 Test Instruments Configuration




***P.S.: Notebook computer to control the EUT at maximal power output and channel number and set antenna kit***

Test Configuration of Power Spectral Density

## 9.3 List of Test Instruments

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| Spectrum Analyzer | 8564E | H P | US36433002 | 08/01/02 | 08/01/03 |

## 9.4 Test Result of Power spectral density

The following table shows a summary of the test results of the Power Spectral Density.

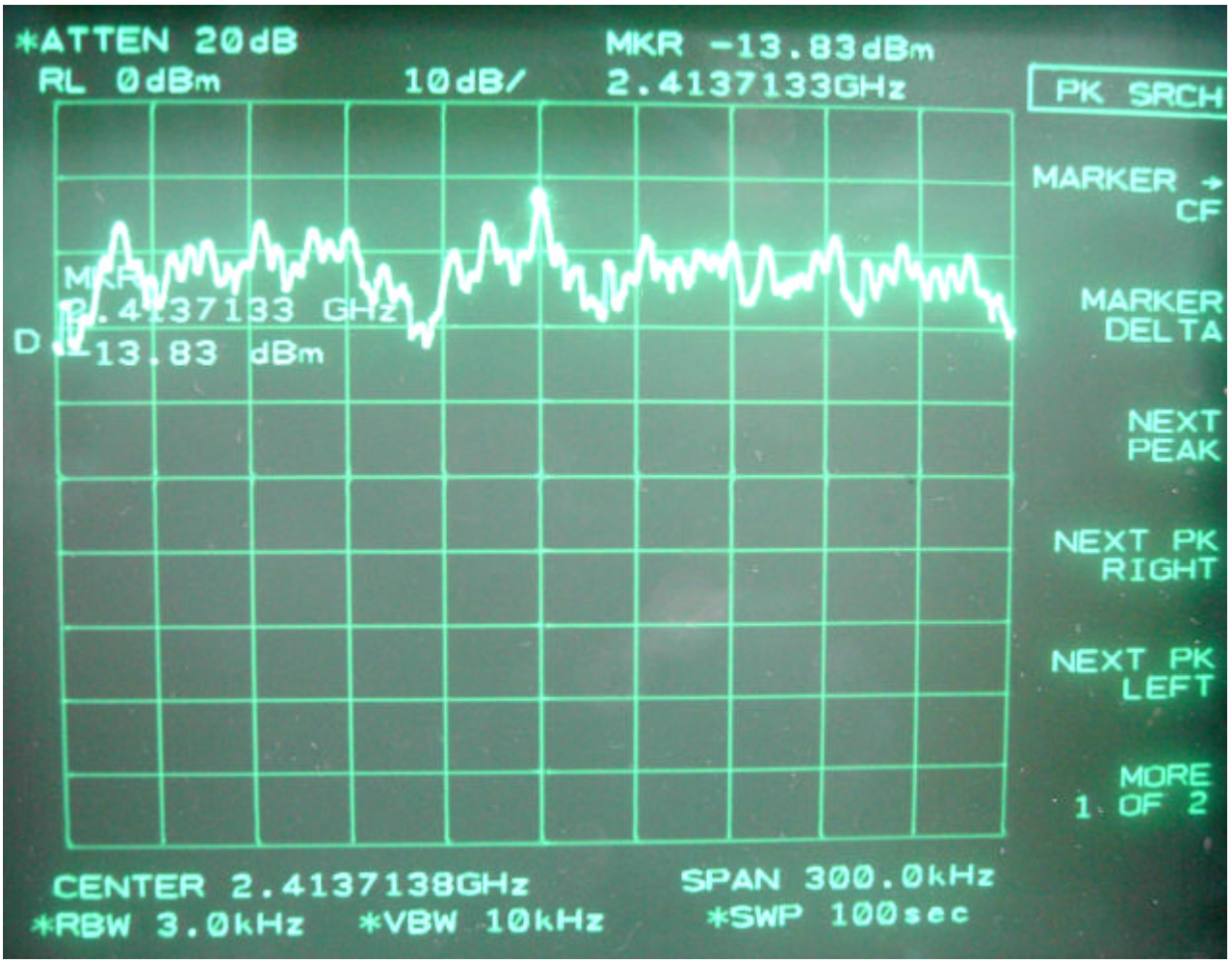
| *Channel* | *Frequency (GHz)* | *Ppr (dBm)* | *Cable Loss (dB)* | *Ppq (dBm)* | *Limit (dB)* | *Margin (dB)* |
|---|---|---|---|---|---|---|
| CH 01 | 2.412 | -13.83 | 1.80 | -12.03 | 8.00 | -20.03 |
| CH 06 | 2.437 | -13.83 | 1.85 | -11.98 | 8.00 | -19.98 |
| CH 11 | 2.462 | -13.67 | 1.93 | -11.74 | 8.00 | -19.74 |

Note:

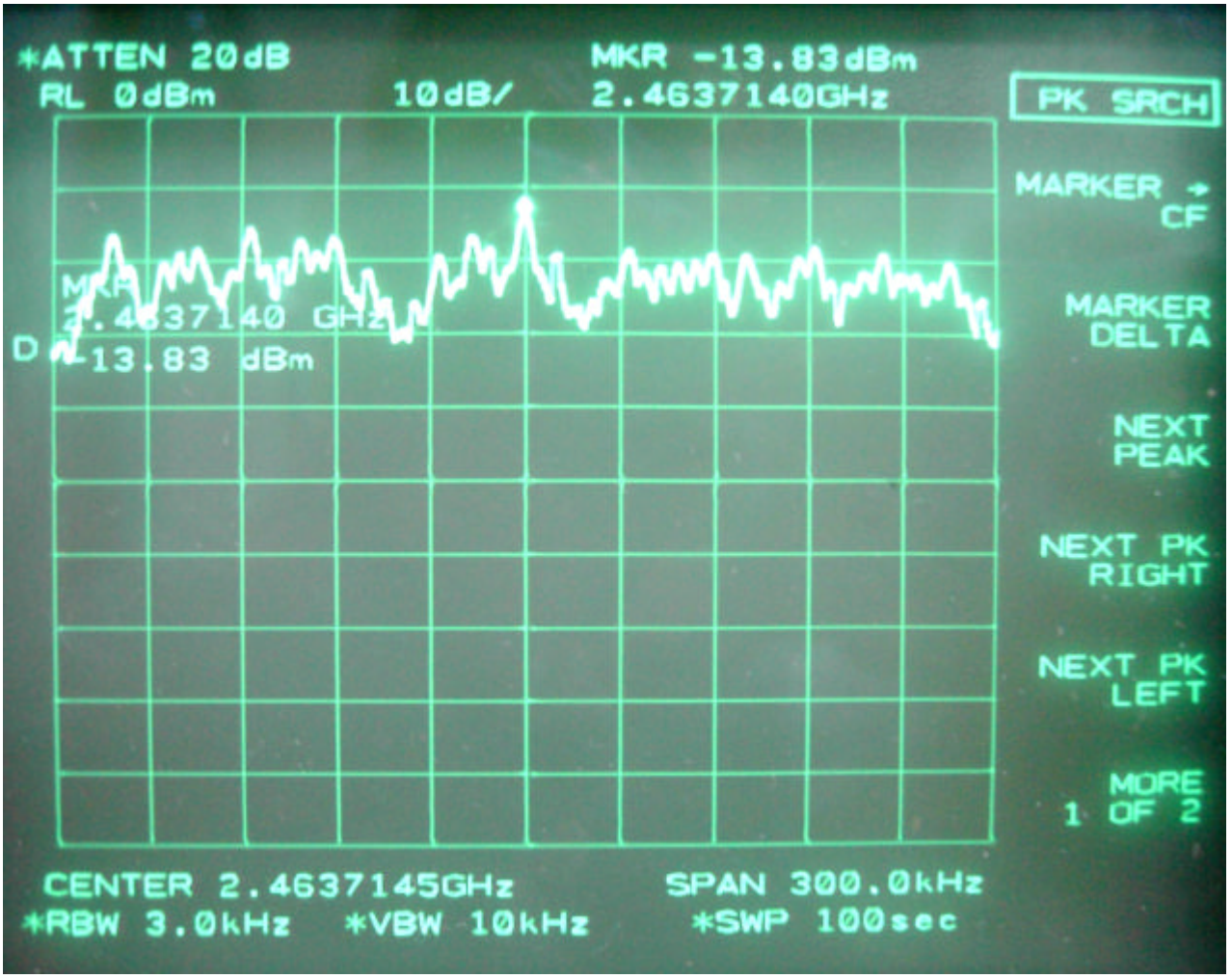
1. The attachment following by this page.
2. Ppr: spectrum read power density (using peak search mode),

   Ppq: actual peak power density in the spread spectrum band.
3. Ppq = Ppr + |Cable Loss|

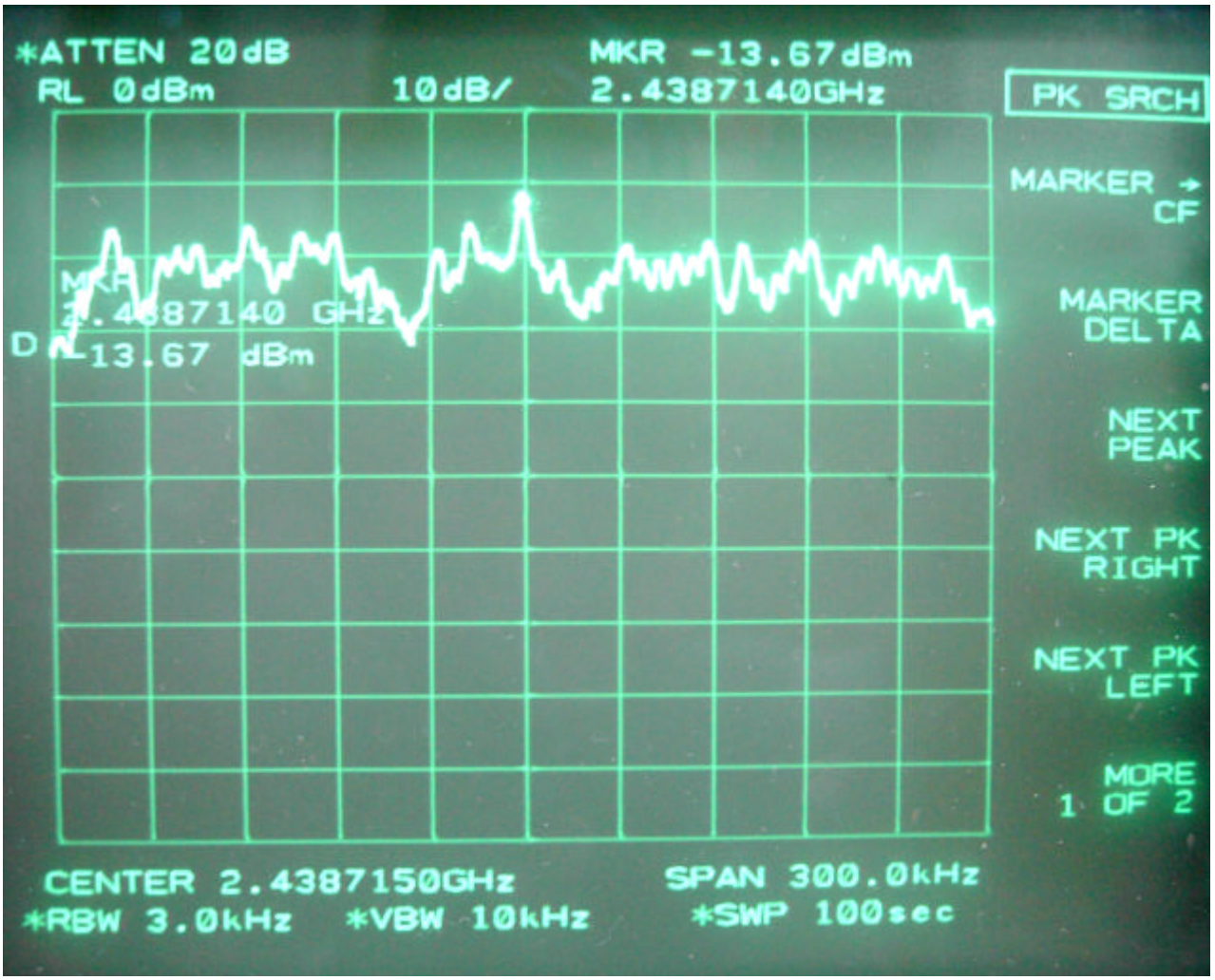
***Channel 01***


*ATTEN 20dB
RL 0dBm
10dB/
MKR -13.83dBm
2.4137133GHz
PK SRCH
MARKER → CF
MARKER DELTA
NEXT PEAK
NEXT PK RIGHT
NEXT PK LEFT
MORE 1 OF 2
MKR
2.4137133 GHz
D -13.83 dBm
CENTER 2.4137138GHz
SPAN 300.0kHz
*RBW 3.0kHz
*VBW 10kHz
*SWP 100sec

***Channel 06***


*ATTEN 20dB
RL 0dBm
10dB/
MKR -13.83dBm
2.4637140GHz
PK SRCH
MARKER → CF
MARKER DELTA
NEXT PEAK
NEXT PK RIGHT
NEXT PK LEFT
MORE 1 OF 2
MKR
2.4637140 GHz
D -13.83 dBm
CENTER 2.4637145GHz
SPAN 300.0kHz
*RBW 3.0kHz
*VBW 10kHz
*SWP 100sec

***Channel 11***


*ATTEN 20dB
RL 0dBm
10dB/
MKR -13.67dBm
2.4387140GHz
PK SRCH
MARKER → CF
MARKER DELTA
NEXT PEAK
NEXT PK RIGHT
NEXT PK LEFT
MORE 1 OF 2
MKR
2.4387140 GHz
D M 13.67 dBm
CENTER 2.4387150GHz
SPAN 300.0kHz
*RBW 3.0kHz
*VBW 10kHz
*SWP 100sec

# *EXHIBIT D*

## *Test Set-up Photos*

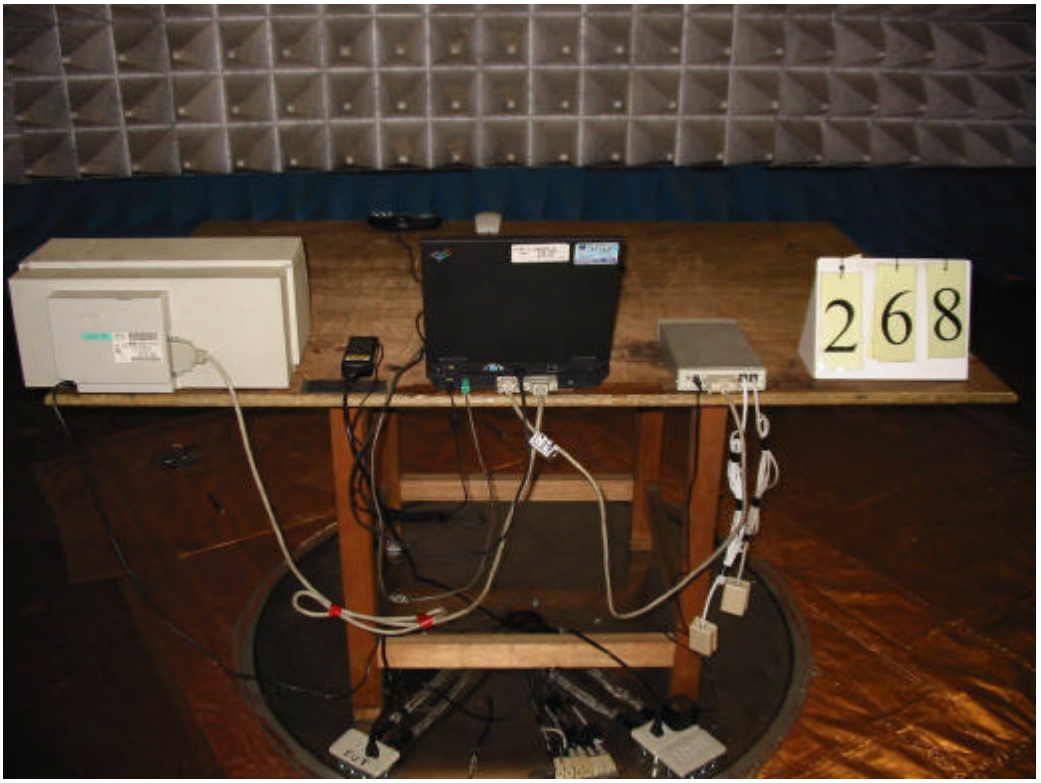
## *Conducted Test Setup Placement: (Photographs)*


Front View of the Test Configuration


Rear View of the Test Configuration

## *Radiated Test Setup Placement: (Unintentional)*


Front View of the Test Configuration of Unintentional




Rear View of the Test Configuration of Unintentional

## *Radiated Test Setup Placement: (Intentional)*


Front View of the Test Configuration of Intentional


Rear View of the Test Configuration of Intentional