MEASUREMENT REPORT
of
WIRELESS LAN

Applicant	**:**	UAT Inc.
Model No.	**:**	WL-2111
EUT	**:**	Wireless LAN
FCC ID	**:**	PGCWL-2111
Report No.	**:**	U1215223

Test by :

Training Research Co., Ltd.

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

2, Lane 194, Huan-Ho Street, Hsichih, 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.***, 2, Lane 194, Huan-Ho Street, Hsichih, 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	:	UAT Inc.
Model No.	:	WL-2111
EUT	:	Wireless LAN
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Test Date	:	July 5, 2001

Prepared by: *Miro Chueh* **Approved by:** *Frank Tsai*

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Ⅰ. GENERAL

1.1 Introduction

The following measurement report is submitted on behalf of Applicant in support of a wireless lan 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	**:**	Wireless LAN
Model No.	**:**	WL-2111
Granted FCC ID	**:**	PGCWL-2111
Frequency Range	**:**	2.412 GHz ~ 2.462GHz
Support Channel	**:**	11 Channel
Modulation Skill	**:**	DBPSK, DQPSK, CCK
Power Type	**:**	Power by Computer
Data Cable	**:**	USB: shielded, 1.75 meter, with ferrite bead
Applicant	**:**	UAT Inc. 2F, No. 5, Alley 22, Lane 513, Jui Kuang Rd., Nei Hu, Taipei 114, Taiwan

1.3 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

Ultrabase	**:**	**IBM I/P X20**
Tart No.	:	08N1180
Serial No.	:	11S08K6451ZFX0820AJ0LB
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

Monitor	**:**	**HP 15' Color Monitor**
Model No.	:	D2832A
Serial No.	:	MY90615892
FCC ID	:	Doc Approved
檢磁	:	4872A167
Power type	:	100 ~ 240 VAC / 50 ~ 60 Hz, Switching
Power cord	:	Shielded, 1.80m long, No ferrite core
Data cable	:	Shielded, 1.50m long, with two ferrite cores

HUB	**:**	**Cameo Communications, Inc.**
Model No.	:	SOHO-SW16A
Serial No.	:	N/A
Power Type	:	Switch
FCC ID	:	N/A, DOC Approved
Power cord	:	Non-shielded, 1.95m long, Plastic, No ferrite core

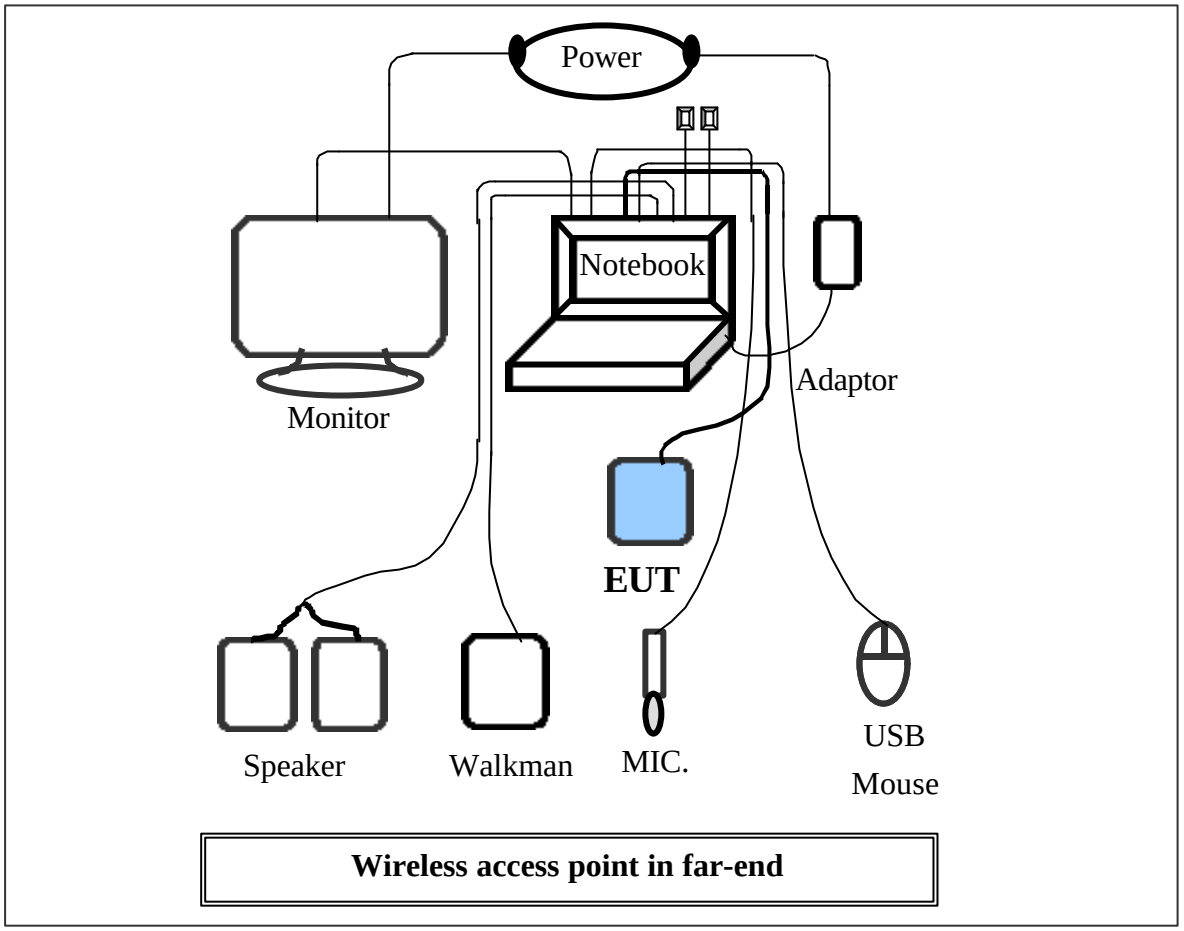
USB Mouse	**:**	**Logitech**
Model No.	:	M-BA47
Serial No.	:	LZB92250027
FCC ID	:	N/A, Doc Approved
檢磁	:	4872A220
Power type	:	Power by Notebook
Power cord	:	Shielded, 1.5m long, Plastic hoods, No ferrite bead

Microphone	**:**	**KOKA**
Model No.	:	DM-515
Power type	:	Dynamic
Data Cable	:	Non-shielded, 3m

Speaker	**:**	**Genius**
Model No.	:	SP-220
Data cable	:	Non-shielded, 1.6 m
Power type	:	Powered by PC

Walkman	**:**	**Panasonic**
Model No.	:	RQ-V52
Data Cable	:	Non-shielded, 1.2m long, No ferrite bead data cable

1.4 Configuration of System Under Test



Connections:

Notebook:

*VGA Port --- a monitor

*Line Jack --- connected a RJ11 cable with 600 ohm

*USB-A Port --- **EUT**

*USB-B Port --- a mouse

*Line-in Jack --- a walkman

*MIC. Jack --- a dynamic microphone

*SPK. Jack --- a pairs of speakers

(Each port on notebook is connected with suitable device)

EUT:

*USB Connector --- via a 1.75m long, shielded, with ferrite bead, USB cable to the USB port A of notebook computer

1.5 Verify the Frequency and Channel

1.5.1 Verify the Frequency Pairs

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 sure 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.

1.6 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 Appendix A, the detail setup was written on each test item.

1.7 Location of the Test Site

The radiated emissions measurements required by the rules were performed on the **three-meter**, **Open-Side (Registration Number: 94346)** maintained by *Training Research Co., Ltd. No. 5-3, Lane 21, Yen Chiu Yuan Rd., Sec. 4, Taipei, Taiwan* 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. 2, Lane 194, Huan-Ho Street, Hsichih, 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.

1.8 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 was 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 notebook computer. The ch1, ch6 and ch11 of EUT were all tested. The setting up procedure is recorded on Appendix A.

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

2.1 Test Condition & Setup

The power line conducted emission measurements were performed in a shielded room. 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 CISPR 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:

1. EUT transmit only:

   Using the USB port of notebook computer and software to control the EUT and link wireless access point. Then making access to the mode of continuous transmission and set testing channel. Three channels were tested, one in the top (CH01), one in the middle (CH06) and the other in bottom (CH11).

2. Idle state (Rx mode)

The setting up procedure is recorded on Appendix A.

2.2 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum analyzer	8591EM	H P	3710A01203	02/22/01	02/22/02
Pre-selector (<30MHz)	AMP-01	TRC	REP-001	08/09/00	08/09/01
LISN (EUT)	TRC LISN01	TRC	LISN-01	08/21/00	08/21/01
LISN (Support E.)	LISN01	TRC	9912-01, 02	12/18/00	12/18/01

2.3 Test configuration

Conducted Emissions Test Placement

2.4 Test Result of Conducted Emissions

2.4.1 EUT station transmit only

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

Table 1 Power Line Conducted Emissions (Channel 1)

Power Connected Emissions				*FCC Class B*	
Conductor	***Frequency (KHz)***	***Peak Amplitude (dB μV)***	***QP Amplitude (dB μV)***	***Limit (dB μV)***	***Margin (dB)***
Line 1	556.00	42.34	###.##	48.00	-5.66
	575.00	40.85	###.##	48.00	-7.15
	593.00	43.01	###.##	48.00	-4.99
	608.00	44.35	###.##	48.00	-3.65
	637.00	44.40	###.##	48.00	-3.60
	759.00	41.66	###.##	48.00	-6.34
	803.00	41.38	###.##	48.00	-6.62
	922.00	42.26	###.##	48.00	-5.74
	960.00	40.67	###.##	48.00	-7.33
	1257.00	42.52	###.##	48.00	-5.48
Line 2	538.00	39.84	###.##	48.00	-8.16
	553.00	40.88	###.##	48.00	-7.12
	568.00	41.45	###.##	48.00	-6.55
	590.00	41.46	###.##	48.00	-6.54
	604.00	42.26	###.##	48.00	-5.74
	624.00	42.32	###.##	48.00	-5.68
	645.00	43.02	###.##	48.00	-4.98
	1257.00	39.85	###.##	48.00	-8.15
	1583.00	41.78	###.##	48.00	-6.22
	1646.00	42.23	###.##	48.00	-5.77

NOTE:

1. Margin = Peak Amplitude - 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 Power Line Conducted Emissions (Channel 6)

Power Connected Emissions				*FCC Class B*	
Conductor	*Frequency (KHz)*	*Peak Amplitude (dB μV)*	*QP Amplitude (dB μV)*	*Limit (dB μV)*	*Margin (dB)*
Line 1	579.00	42.66	###.##	48.00	-5.34
	590.00	42.69	###.##	48.00	-5.31
	608.00	44.49	###.##	48.00	-3.51
	641.00	44.86	###.##	48.00	-3.14
	663.00	44.65	###.##	48.00	-3.35
	808.00	42.07	###.##	48.00	-5.93
	862.00	42.01	###.##	48.00	-5.99
	916.00	42.19	###.##	48.00	-5.81
	1299.00	42.86	###.##	48.00	-5.14
	1340.00	42.67	###.##	48.00	-5.33
Line 2	612.00	41.25	###.##	48.00	-6.75
	624.00	41.76	###.##	48.00	-6.24
	663.00	43.77	###.##	48.00	-4.23
	675.00	41.96	###.##	48.00	-6.04
	688.00	41.95	###.##	48.00	-6.05
	1266.00	41.34	###.##	48.00	-6.66
	1365.00	40.78	###.##	48.00	-7.22
	1657.00	41.97	###.##	48.00	-6.03
	1702.00	41.61	###.##	48.00	-11.61
	30000.00	24.84	###.##	48.00	-23.16

The reading amplitudes are all under limit.

Table 3 Power Line Conducted Emissions (Channel 11)

Power Connected Emissions				*FCC Class B*	
Conductor	*Frequency (KHz)*	*Peak Amplitude (dB μV)*	*QP Amplitude (dB μV)*	*Limit (dB μV)*	*Margin (dB)*
Line 1	553.00	41.55	###.##	48.00	-6.45
	593.00	41.97	###.##	48.00	-6.03
	608.00	43.17	###.##	48.00	-4.83
	658.00	44.47	###.##	48.00	-3.53
	680.00	44.05	###.##	48.00	-3.95
	692.00	44.75	###.##	48.00	-3.25
	714.00	42.91	###.##	48.00	-5.09
	803.00	42.32	###.##	48.00	-5.68
	1063.00	41.77	###.##	48.00	-6.23
	1365.00	42.93	###.##	48.00	-5.07
Line 2	457.00	40.55	###.##	48.00	-7.45
	538.00	40.85	###.##	48.00	-7.15
	641.00	41.74	###.##	48.00	-6.26
	658.00	41.44	###.##	48.00	-6.56
	675.00	42.43	###.##	48.00	-5.57
	688.00	41.42	###.##	48.00	-6.58
	714.00	41.69	###.##	48.00	-6.31
	1365.00	41.02	###.##	48.00	-6.98
	1725.00	41.93	###.##	48.00	-6.07
	1935.00	40.45	###.##	48.00	-7.55

The reading amplitudes are all under limit.

Ⅲ. Section 15.247(a)(2): Bandwidth for Direct Sequence System.

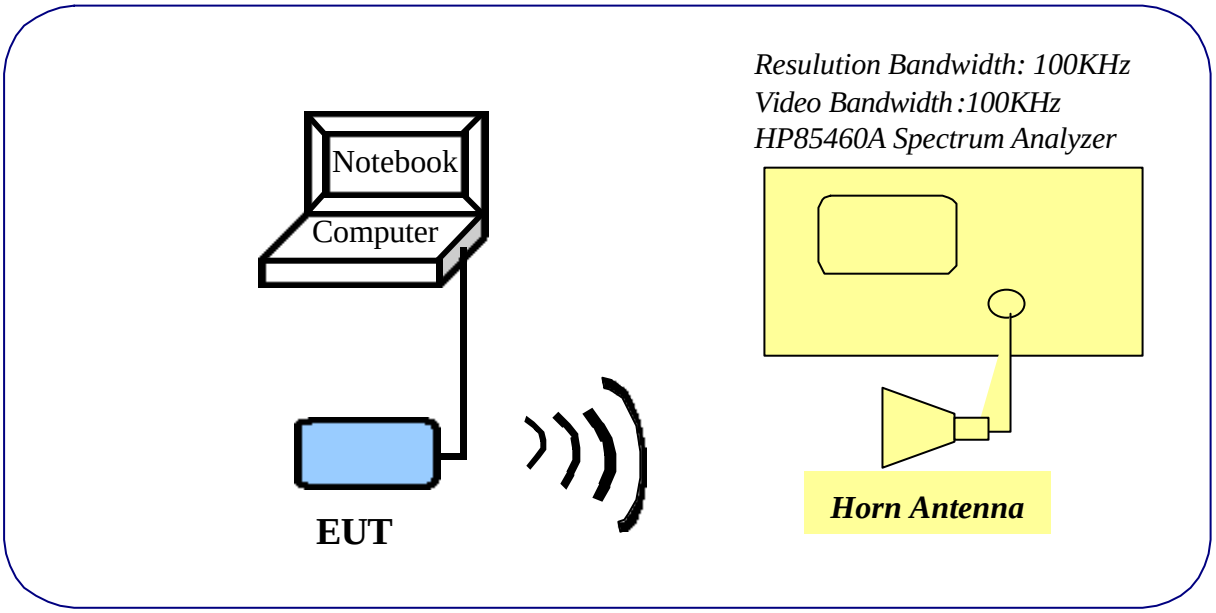
3.1 Test Condition & Setup

The transmitter bandwidth measurements were performed in an anechoic chamber. The EUT was placed on a wooded table, which is 0.8 meters height. The EUT was set to transmit continuously. Various channels were also investigated to find the maximum occupied bandwidth. The minimum 6 dB bandwidth shall be at least 500 KHz.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 KHz. Set the span>> RBW. The detector function was set to peak and hold mode to clearly observe the components.

Setting up procedure is written on Appendix A.

3.2 Test Instruments Configuration



Test Configuration of Bandwidth for Direct Sequence System

3.3 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
EMI Receiver	8546A	H P	3520A00242	10/18/00	10/18/01
RF Filter Section	85460A	H P	3448A00217	10/18/00	10/18/01
Horn Antenna	3115	EMCO	9704 – 5178	08/15/00	08/15/01

3.4 Test Result of Bandwidth

Bandwidth of Channel 1

Bandwidth	:	10.08 MHz
The min. 6 dB BW at least	:	500 KHz

Bandwidth of Channel 6

Bandwidth	:	10.50 MHz
The min. 6 dB BW at least	:	500 KHz

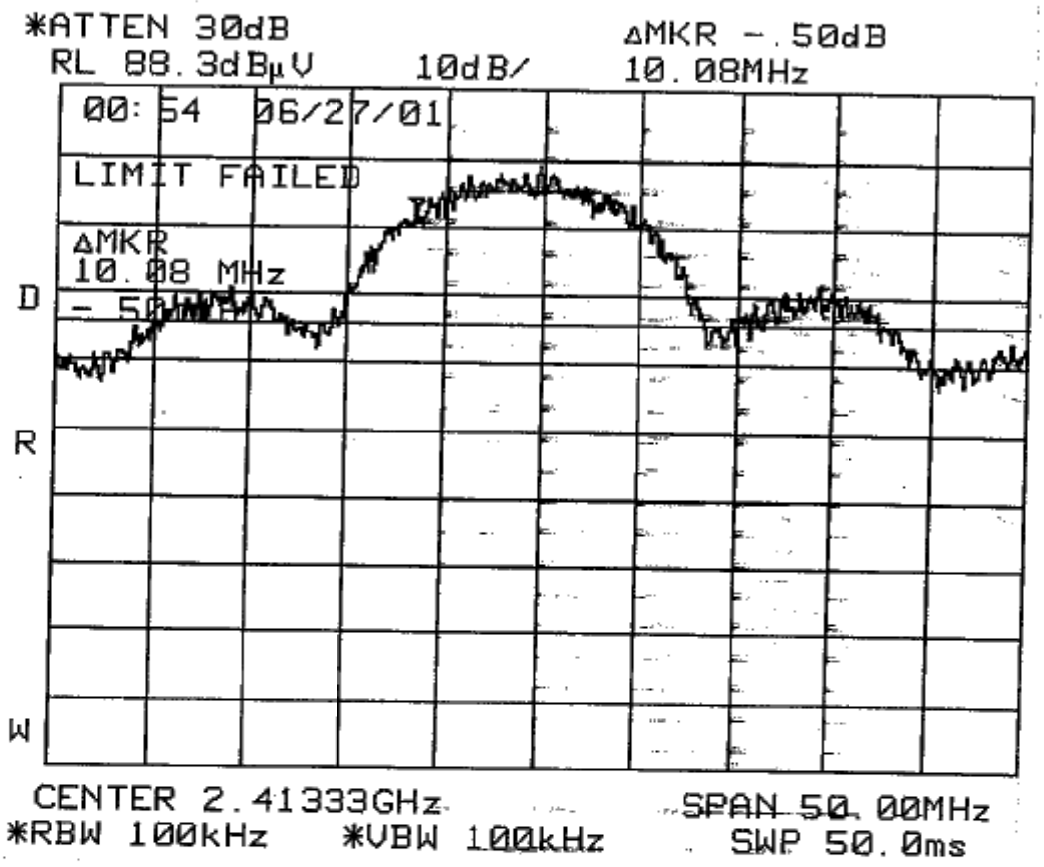
Bandwidth of Channel 11

Bandwidth	:	10.58 MHz
The min. 6 dB BW at least	:	500 KHz

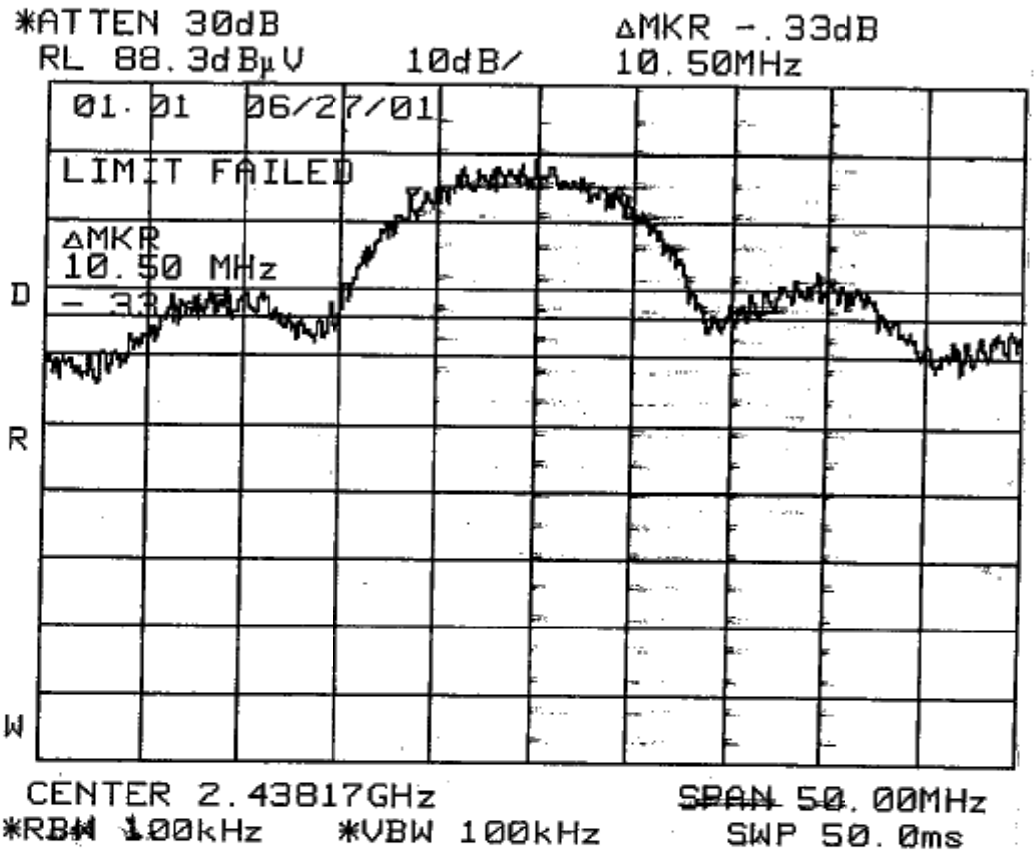
Note:

1. The data in the above table are summarizing the following attachment spectrum analyzer hard copy.
2. The attachments follow page.

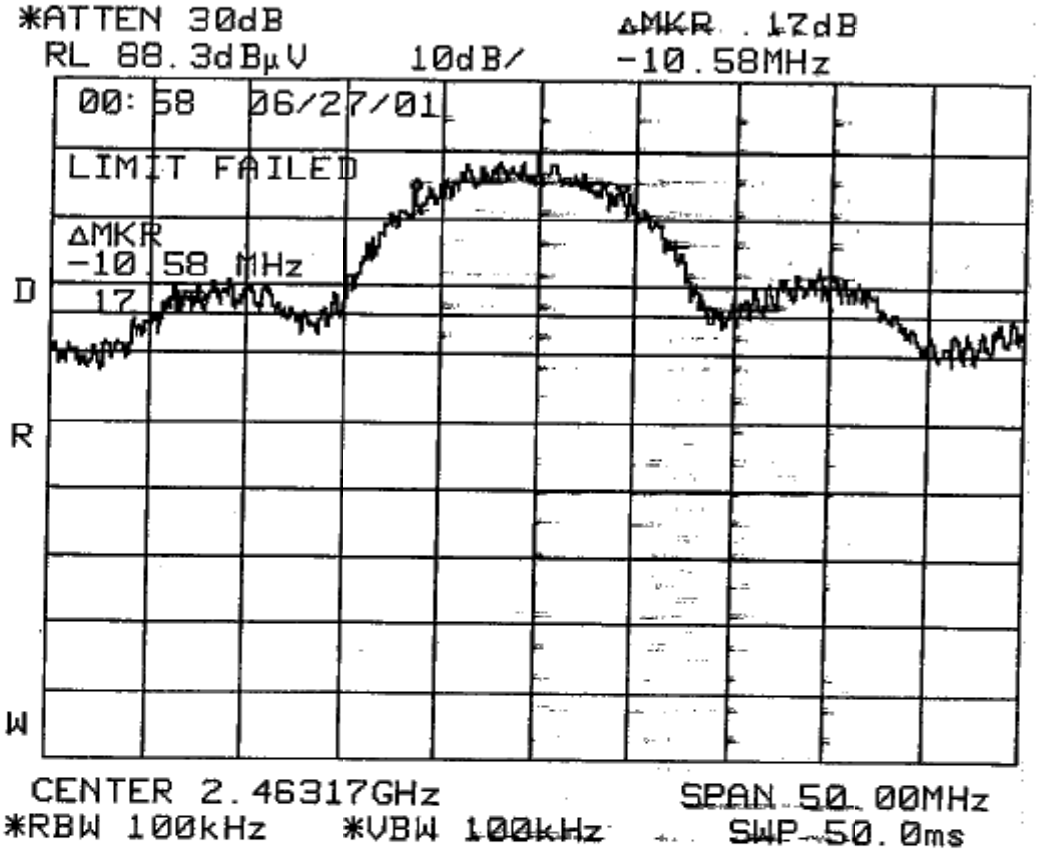
Bandwidth of Channel 1: 10.08 MHz



Bandwidth of Channel 6: 10.50 MHz



Bandwidth of Channel 11: 10.58 MHz



Ⅳ. Section 15.247(B): Power Output

4.1 Test Condition & Setup

The EUT was placed in an shielded room 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 that produced the highest emissions was noted so it could be reproduced later during the final tests. 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, OATS. 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 9KHz to 245GHz using a Hewlett Packard spectrum 8564E, EMCO whole range Horn antenna (Model No.: 3115) is used to measure frequency from operating frequency. The final test is used the spectrum HP 8564E. 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. The spectrum HP 8564E used on this testing for foundational frequency. No post-detector video filters were used in the test. Set the RB= 3 MHz, VB = 3MHz and the span = 5 MHz. The analyzer was operated in the maximum hold mode.

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

EUT transmit only:

Using the USB port of notebook computer and software to control the EUT and link wireless access point. Then making access to the mode of continuous transmission. 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 antenna at EUT, Radiates spurious emissions falling within the restricted bands of 15.209 were measured at operating frequencies corresponding to low, mid and high 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.

4.2 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
EMI Receiver	8546A	H P	3520A00242	10/18/00	10/18/01
RF Filter Section	85460A	H P	3448A00217	10/18/00	10/18/01
Horn Antenna	3115	EMCO	9704 – 5178	08/15/00	08/15/01

4.3 Test Result of Fundamental Emissions

The peak values of fundamental emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following.

Table 4 Fundamental Emissions

Channel	*Frequency (GHz)*	*A.P. (H/V)*	*A.H. (M)*	*Table (degree)*	*Amplitude (dBmV/m)*	*CF (dB)*	*Corrected Amplitude (dBmV/m)*	*E.I.R.P.*	
								mW	*dBm*
CH 1	2.412	H	1.00	24	75.30	-8.67	83.97	0.075	-11.259
	2.412	V	1.00	164	74.96	-8.67	83.63	0.069	-11.599
CH 6	2.437	H	1.00	179	75.13	-8.67	83.80	0.072	-11.429
	2.437	V	1.00	208	75.30	-8.67	83.97	0.075	-11.259
CH 11	2.462	H	1.00	113	75.46	-8.67	84.13	0.078	-11.099
	2.462	V	1.00	70	75.63	-8.67	84.30	0.081	-10.929

Note:

A.P. means antenna polarization, horizontal and vertical.

A.H. means antenna height.

Table means turntable turning position.

Corrected Factor (C. F.) = Cable Loss + Antenna Factor – Amplified Gain

Corrected Amplitude = Peak Amplitude + Corrected Factor

Amplitude means the fundamental emission measured.

Conducted output power "P", $P= (E d)^2 / 30G$

Since G=1. P=EIRP

E is the measured maximum field strength in V/m utilizing the maximum hold mode

RBW (3MHz)
G is the numeric gain of the transmitting antenna over an isotropic radiator (1.00)
d is the distance in meters from which the field strength was measured (3 meter)

Example: the Max Radiation Emission of EUT for CH 11 = 84.30 dBμV/m

$10^{(84.30/20)} \text{ X } 10^{-6} = 0.016406$ V

E.I.R.P. = $(0.016406 \text{ x } 3)^2 / 30 = 0.081$ mW = 10 x log (0.081 mW / 1 mW)

= -10.929 dBm

So, the Max Radiation Emission of EUT for CH 11 = 84.30 dBμV/m, output power for 0.081 mW.

Ⅴ. Section 15.247 (C)(2): Spurious Emissions (Radiated)

5.1 Test Condition & Setup

The EUT was placed in an shielded room 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. 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, OATS. 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 30MHz to 1000MHz using an Hewlett Packard 8568B spectrum. Schaffner whole range Bi-Log antenna (Model No.: CBL6141A) 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 8568B 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 6 dB 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 following:

EUT transmit only:

Using the USB port of notebook computer and software to control the EUT and link wireless access point. Then making access to the mode of continuous transmission. Three channels is 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 low, mid and high 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.

For frequency between 30MHz to 1000MHz

FIa (dBμV/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

The setting up procedure is recorded on Appendix A.

5.2 List of Test Instruments

Instrument Name	Model No	Brand	Serial No.	Last time	Next time
Spectrum analyzer	8591EM	H P	3619A01203	02/22/01	02/22/02
Pre-selector (>30MHz)	AMP-01	TRC	REP-001	10/02/00	10/02/01
Spectrum analyzer	8568B	H P	3004A18617	06/04/01	06/04/02
Quasi-peak Adapter	85650A	H P	2521A00984	06/04/01	06/04/02
RF Pre-selector	85685A	H P	2947A01011	06/05/01	06/05/02
RF Pre-selector	AMP-01	TRC	REP-002	10/02/00	10/02/01
Bi-log Antenna	CBL6141A	Schffner	4188	08/31/00	08/31/01
Antenna (30M-2GHz)	3142	EMCO	9610-1094	10/02/00	10/02/01
EMI Receiver	8546A	H P	3520A00242	10/18/00	10/18/01
RF Filter Section	85460A	H P	3448A00217	10/18/00	10/18/01
Horn Antenna	3115	EMCO	9704 – 5178	08/15/00	08/15/01
Open test side (Antenna, Amplify, cable calibrated together)				05/20/01	05/20/02

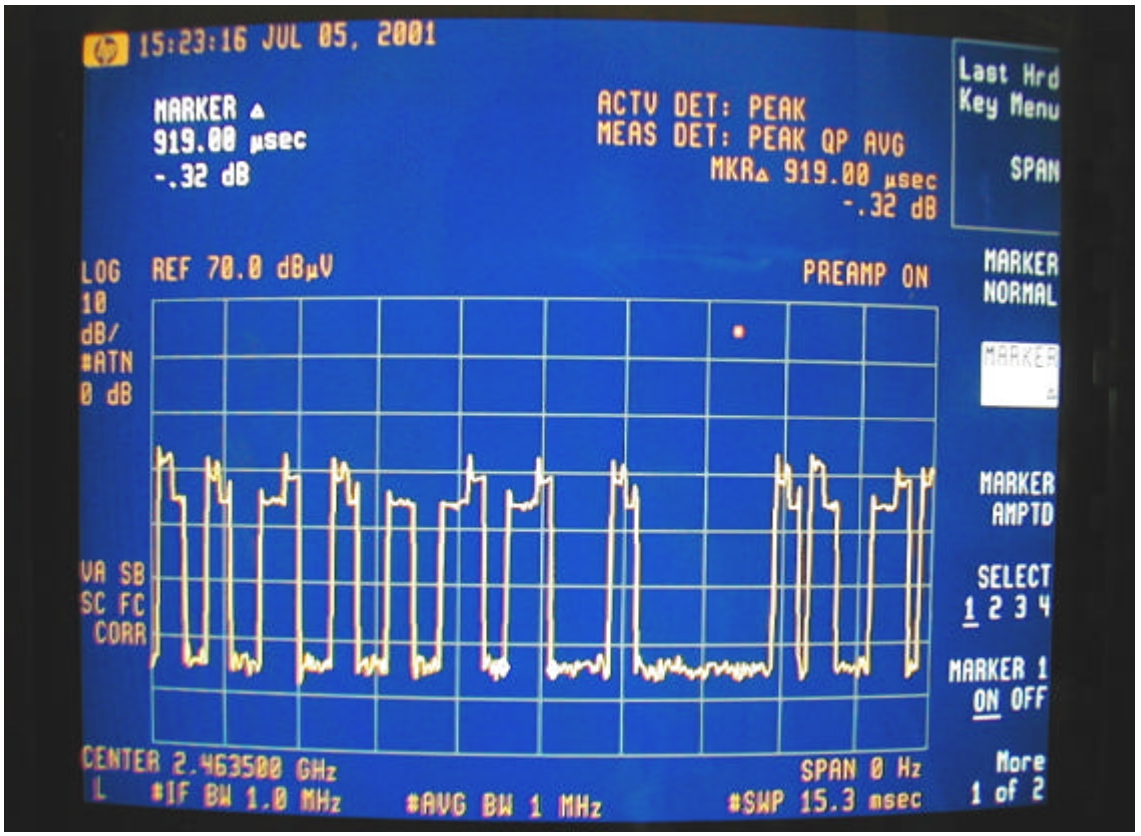
5.2.1 Duty Cycle Factor Measurement

The duty cycle factor measurement is performed in a shield enclosure. The test condition and setup is as same as paragraph **III**. Set the RB = 1MHz, VB=1MHz, and span = 0 MHz. Link the EUT, then get the Time of duty and cycle as follow page.

Total pulse time is

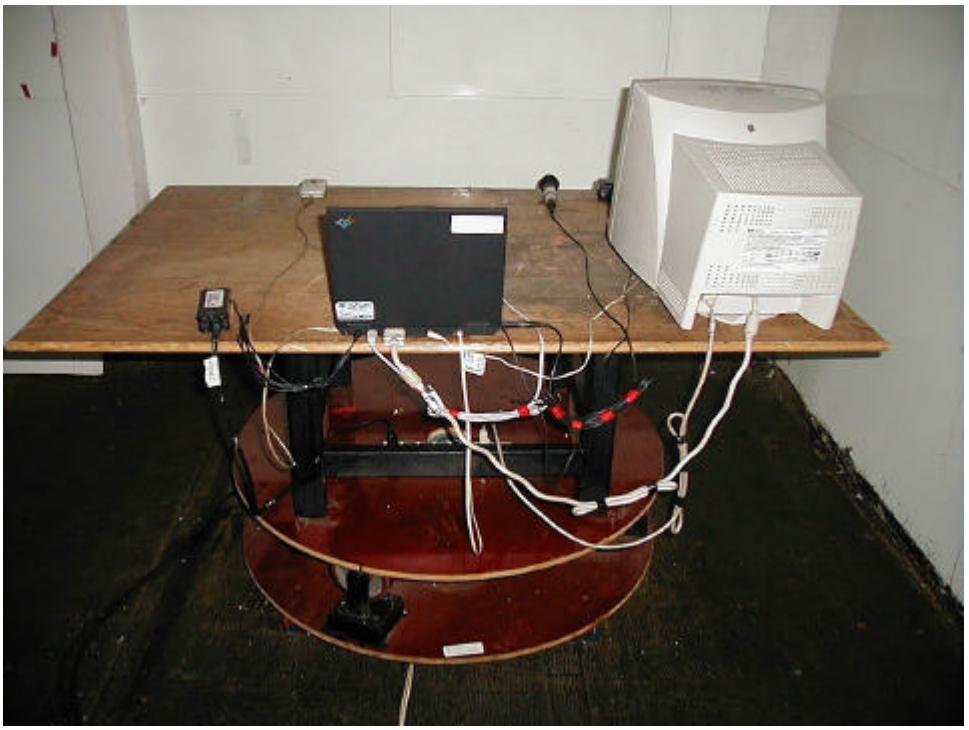
0.689+0.574+0.881+0.574+0.575+0.881+0.919+0.536+0.613+0.651+0.843+0.269 = 8.005 mS

The duty cycle factor = 20 log (T_{duty} / T_{cycle}) = 20 log (8.005/ 15.300) = – 5.627



5.3 Test Instruments Configuration

Radiated Emissions Test Placement



5.4 Test Result of Second Harmonic

Set the spectrum RB= 3 MHz, VB = 3MHz and span = 5MHz. The correction factors of the second harmonic is the second harmonic must lower 20 dB than the fundamental.

FCC ID : PGCWL-2111

Table 5 Second Harmonic Attendation

Channel	*Fundamental (MHz)*	*Fundamental (dBmV/m)*	*2nd Harmonic (GHz)*	*2nd Harmonic (dBmV/m)*	*Result (F/H dB)*	*Limit (dB)*	*Margin (dB)*
CH 1	2.412	83.97	4.063	47.77	36.20	20.00	16.20
CH 6	2.437	83.80	4.118	47.94	35.86	20.00	15.86
CH 11	2.462	84.30	4.172	50.27	34.03	20.00	14.03

Note:

1. The 2nd Harmonic is comply with 15.209.
2. Result = Fundamental – 2nd Harmonic must over 20 dB and comply with 15.209.

5.5 Test Result of Spurious Radiated Emissions

5.5.1 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.

FCC ID : PGCWL-2111

Test Conditions: Testing room : Temperature : 26 ° C Humidity : 69 % RH
Testing site : Temperature : 32 ° C Humidity : 81 % RH

Table 6 Radiated Emissions For 30MHz 1GHz [CH 1, Horizontal]

Radiated Emission				*Correction Factors*	*Corrected Amplitude*	*FCC Class B (3 m)*	
Frequency (MHz)	*Amplitude (dBmV/m)*	*Ant. H. (m)*	*Table (°)*	*(dB)*	*(dBmV/m)*	*Limit (dBmV/m)*	*Margin (dB)*
122.887	45.30	2.56	264	-12.59	32.71	43.50	-10.79
144.015	41.80	2.56	45	-11.05	30.75	43.50	-12.75
275.000	39.20	1.00	131	-10.04	29.16	46.00	-16.84
336.036	38.10	1.00	19	-8.00	30.10	46.00	-15.90
503.996	32.60	1.00	123	-2.95	29.65	46.00	-16.35
912.999	26.80	1.00	242	7.24	34.04	46.00	-11.96
***							

Note:

1. Margin = Corrected Amplitude – Limit.
2. Peak Amplitude + Correction Factors = Corrected Amplitude

Table 7 Radiated Emissions for above 1GHz [CH 1, Horizontal]

Radiated Emission				*Correction Factors*	*Corrected Amplitude*	*FCC Class B (3 m)*	
Frequency (GHz)	*Amplitude (dBm V/m)*	*Ant. H. (m)*	*Table (°)*	*(dB)*	*(dBm V/m)*	*Limit (dBm V/m)*	*Margin (dB)*
4.063	53.08	1.00	119	-5.64	47.44	54.00	-6.56
4.822	41.53	1.00	350	3.91	45.44	54.00	-8.56
6.100	35.05	1.00	110	9.72	44.77	54.00	-9.23
7.233	36.22	1.00	54	9.72	45.94	54.00	-8.06
***							

Note:

1. Margin = Corrected - Limit.
2. Peak Amplitude + Correction Factor = Corrected

***Above emissions of 10GHz, they are all under the limits more than 20dB in Test Site.**

Table 8 Radiated Emissions For 30MHz 1GHz [CH 1, Vertical]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 m)	
Frequency (MHz)	Amplitude (dBmV/m)	Ant. H. (m)	Table (°)	(dB)	(dBmV/m)	Limit (dBmV/m)	Margin (dB)
147.462	46.30	4.00	318	-10.77	35.53	43.50	-7.97
209.000	40.50	1.00	55	-13.63	26.87	43.50	-16.63
240.023	39.80	2.55	289	-11.90	27.90	46.00	-18.10
336.034	42.40	1.00	101	-8.00	34.40	46.00	-11.60
432.043	35.30	1.00	98	-4.58	30.72	46.00	-15.28
561.336	34.30	2.55	320	-1.36	32.94	46.00	-13.06
***							

Table 9 Radiated Emissions For above 1GHz [CH 1, Vertical]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 m)	
Frequency (GHz)	Amplitude (dBm V/m)	Ant. H. (m)	Table (°)	(dB)	(dBm V/m)	Limit (dBm V/m)	Margin (dB)
4.063	53.41	1.00	159	-5.64	47.77	54.00	-6.23
4.822	46.03	1.00	207	3.91	49.94	54.00	-4.06
6.100	36.05	1.00	47	9.72	45.77	54.00	-8.23
7.233	38.39	1.00	250	9.72	48.11	54.00	-5.89
***							

***Above emissions of 10GHz, they are all under the limits more than 20dB in Test Site.**

Table 10 Radiated Emissions For 30MHz 1GHz [CH 6, Horizontal]

Radiated Emission				*Correction Factors*	*Corrected Amplitude*	*FCC Class B (3 m)*	
Frequency (MHz)	*Amplitude (dBmV/m)*	*Ant. H. (m)*	*Table (°)*	*(dB)*	*(dBmV/m)*	*Limit (dBmV/m)*	*Margin (dB)*
122.886	44.90	2.55	259	-12.59	32.31	43.50	-11.19
144.015	40.60	2.55	37	-11.06	29.54	43.50	-13.96
275.000	38.90	1.00	130	-10.04	28.86	46.00	-17.14
336.036	37.50	1.00	27	-8.00	29.50	46.00	-16.50
503.996	32.10	1.00	121	-2.95	29.15	46.00	-16.85
912.999	26.40	1.00	242	7.24	33.64	46.00	-12.36
***							

Table 11 Radiated Emissions For above 1GHz [CH 6, Horizontal]

Radiated Emission				*Correction Factors*	*Corrected Amplitude*	*FCC Class B (3 m)*	
Frequency (GHz)	*Amplitude (dBm V/m)*	*Ant. H. (m)*	*Table (°)*	*(dB)*	*(dBm V/m)*	*Limit (dBm V/m)*	*Margin (dB)*
4.118	42.20	1.00	41	3.91	46.11	54.00	-7.89
4.872	39.86	1.00	337	3.91	43.77	54.00	-10.23
***							

***Above emissions of 10GHz, they are all under the limits more than 20dB in Test Site.**

Table 12 Radiated Emissions For 30MHz 1GHz [CH 6, Vertical]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 m)	
Frequency (MHz)	Amplitude (dBmV/m)	Ant. H. (m)	Table (°)	(dB)	(dBmV/m)	Limit (dBmV/m)	Margin (dB)
147.462	47.90	1.00	0	-10.77	37.13	43.50	-6.37
209.000	40.60	1.00	216	-13.63	26.97	43.50	-16.53
240.023	39.10	4.00	199	-11.90	27.20	46.00	-18.80
336.034	40.30	1.00	228	-8.00	32.30	46.00	-13.70
432.043	36.80	4.00	189	-4.58	32.22	46.00	-13.78
561.336	30.00	2.55	152	-1.36	28.64	46.00	-17.36
***							

Table 13 Radiated Emissions For above 1GHz [CH 6, Vertical]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 m)	
Frequency (GHz)	Amplitude (dBm V/m)	Ant. H. (m)	Table (°)	(dB)	(dBm V/m)	Limit (dBm V/m)	Margin (dB)
4.118	44.03	1.00	335	3.91	47.94	54.00	-6.06
4.872	42.70	1.00	167	3.91	46.61	54.00	-7.39
6.180	37.55	1.00	208	9.72	47.27	54.00	-6.73
8.250	41.05	1.00	38	9.72	50.77	54.00	-3.23
***							

***Above emissions of 10GHz, they are all under the limits more than 20dB in Test Site.**

Table 14 Radiated Emissions For 30MHz 1GHz [CH11, Horizontal]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 m)	
Frequency (MHz)	Amplitude (dBmV/m)	Ant. H. (m)	Table (°)	(dB)	(dBmV/m)	Limit (dBmV/m)	Margin (dB)
122.886	44.10	2.56	260	-12.59	31.51	43.50	-11.99
144.015	39.40	1.00	59	-11.06	28.34	43.50	-15.16
275.000	38.40	1.00	127	-10.04	28.36	46.00	-17.64
336.036	37.60	1.00	223	-8.00	29.60	46.00	-16.40
503.996	32.30	1.00	121	-2.95	29.35	46.00	-16.65
912.999	26.30	1.00	243	7.24	33.54	46.00	-12.46
***							

Table 15 Radiated Emissions For above 1GHz [CH 11, Horizontal]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 m)	
Frequency (GHz)	Amplitude (dBm V/m)	Ant. H. (m)	Table (°)	(dB)	(dBm V/m)	Limit (dBm V/m)	Margin (dB)
4.172	43.03	1.00	192	3.91	46.94	54.00	-7.06
4.922	44.20	1.00	46	3.91	48.11	54.00	-5.89
6.252	35.72	1.00	271	9.72	45.44	54.00	-8.56
8.343	34.55	1.00	341	9.72	44.27	54.00	-9.73
9.844	34.55	1.00	55	9.72	48.61	54.00	-9.73
***							

***Above emissions of 10GHz, they are all under the limits more than 20dB in Test Site.**

Table 16 Radiated Emissions For 30MHz 1GHz [CH 11, Vertical]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 m)	
Frequency (MHz)	Amplitude (dBmV/m)	Ant. H. (m)	Table (°)	(dB)	(dBmV/m)	Limit (dBmV/m)	Margin (dB)
147.462	39.40	1.00	248	-10.77	28.63	43.50	-14.87
209.000	40.90	1.00	186	-13.63	27.27	43.50	-16.23
240.023	39.20	4.00	196	-11.90	27.30	46.00	-18.70
336.034	39.40	1.00	253	-8.00	31.40	46.00	-14.60
432.043	35.50	1.00	66	-4.58	30.92	46.00	-15.08
561.366	30.90	4.00	320	-1.36	29.54	46.00	-16.46
***							

Table 17 Radiated Emissions For above 1GHz [CH 11, Vertical]

Radiated Emission				Correction Factors	Corrected Amplitude	FCC Class B (3 m)	
Frequency (GHz)	Amplitude (dBm V/m)	Ant. H. (m)	Table (°)	(dB)	(dBm V/m)	Limit (dBm V/m)	Margin (dB)
4.172	46.36	1.00	94	3.91	50.27	54.00	-3.73
4.922	48.20	1.00	167	3.91	52.11	54.00	-1.89
6.252	37.89	1.00	248	9.72	47.61	54.00	-6.39
8.343	39.05	1.00	223	9.72	48.77	54.00	-5.23
9.844	39.05	1.00	157	9.72	49.94	54.00	-5.23
***							

***Above emissions of 10GHz, they are all under the limits more than 20dB in Test Site.**

Ⅵ. Section 15.247(d): Power Spectral Density

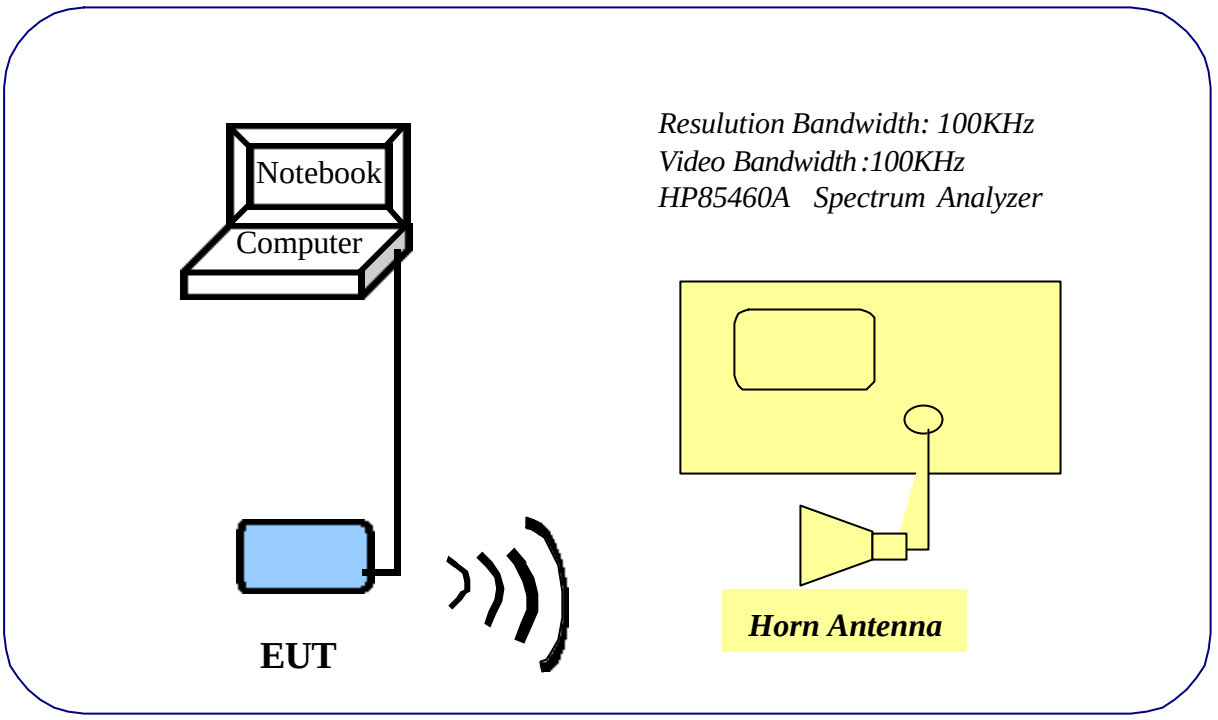
6.1 Test Condition & Setup

The tests below are running with the EUT transmitter set at high power in TDD mode .A mini-pci port from a notebook computer to the EUT. The EUT is needed to force selection of output power level and channel number. While testing, EUT was set to transmit continuously. A horn antenna was connected with the spectrum analyzer.

The EUT is tested in open field site. Put EUT on the middle of a wooden table. Set spectrum analyzer RBW = 3 KHz, VBW > RBW (e.g. VBW = 10 KHz), Span = 2 MHz. Turn around the table to find maximum emission. Then set the Span = 300 KHz and sweep time = 100 sec . Peak the maximum emission again. The peak level measured must be no greater than + 8dBm.

The setting up procedure is recorded on Appendix A.

6.2 Test Instruments Configuration



Test Configuration of Power Spectral Density

6.3 List of Test Instruments

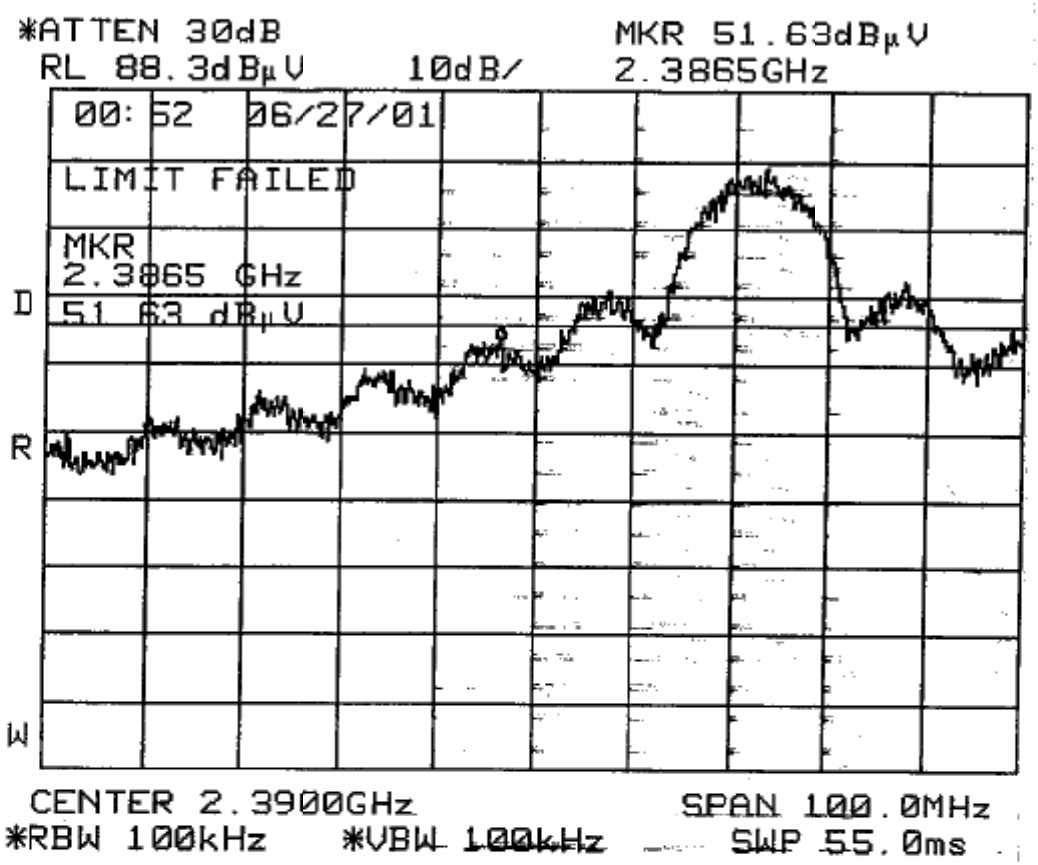
Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
EMI Receiver	8546A	H P	3520A00242	10/18/00	10/18/01
RF Filter Section	85460A	H P	3448A00217	10/18/00	10/18/01
Horn Antenna	3115	EMCO	9704 – 5178	08/15/00	08/15/01

6.4 Required of Carrier frequency

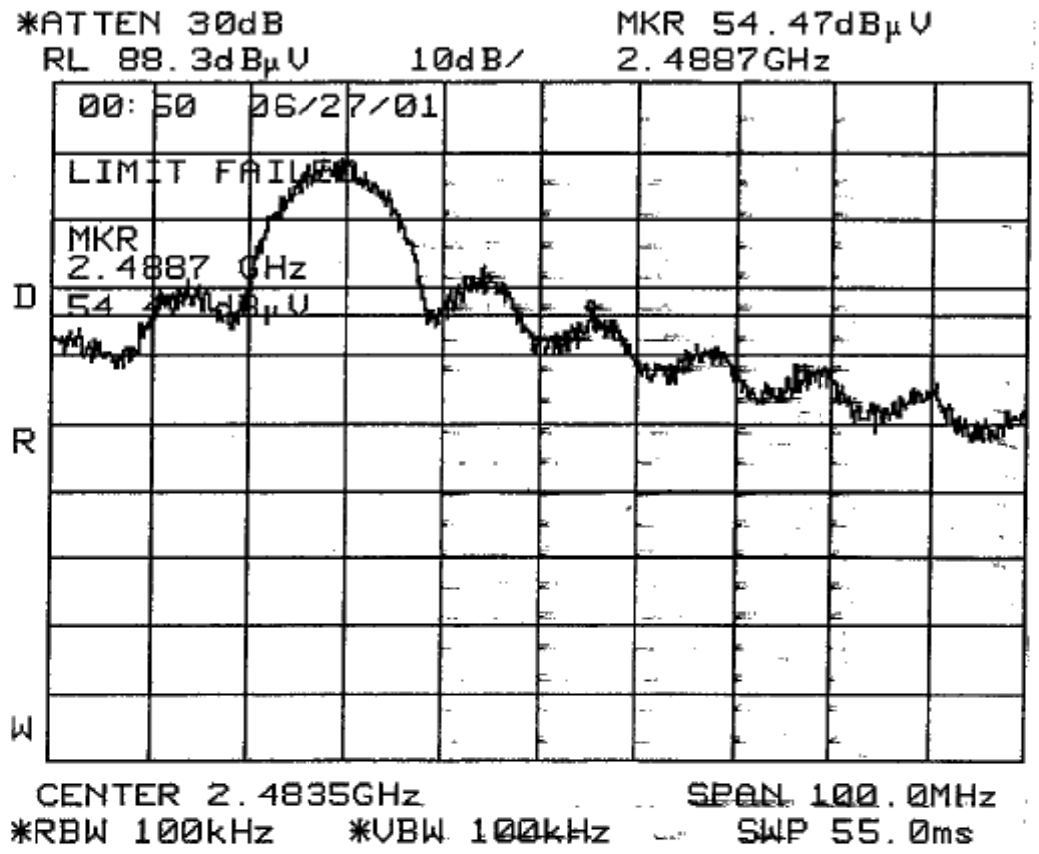
If any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains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

Test Condition & Setup: same as 3.1

Channel 1


*ATTEN 30dB
RL 88.3dBµV
10dB/
MKR 51.63dBµV
2.3865GHz
00: 52 06/27/01
LIMIT FAILED
MKR
2.3865 GHz
51.63 dBµV
D
R
W
CENTER 2.3900GHz
SPAN 100.0MHz
*RBW 100kHz
*VBW 100kHz
SWP 55.0ms

Channel 11


*ATTEN 30dB
RL 88.3dBμV
10dB/
MKR 54.47dBμV
2.4887GHz
00:50 06/27/01
LIMIT FAIL
MKR
2.4887 GHz
54.47dBμV
D
R
W
CENTER 2.4835GHz
SPAN 100.0MHz
*RBW 100kHz
*VBW 100kHz
SWP 55.0ms

6.5 Test Result of Power spectral density

The following table shows a summary of the highest power out of UT.

FCC ID : PGCWL-2111

Channel	*Frequency (GHz)*	*Ppr (dBμV)*	*CF (dB)*	*Ppq (dBm)*	*Limit (dB)*	*Margin (dB)*
CH 01	2.411	65.63	35.60	6.00	8.00	-2.00
CH 06	2.438	66.13	35.60	6.50	8.00	-1.50
CH 11	2.461	65.63	35.60	6.00	8.00	-2.00

Note:

1. The attachment follow by this page and there is no page number.

2. Ppr: spectrum read power density (using peak search mode), CF: correct factor, Ppq: actual peak
power density in the spread spectrum band.

3. Ppq = Ppr + CF

4. Effective Radiation Power (E.R.P.) = $(E\ d)^2 / 30G$

"E" is the measured maximum field strength in V/m utilizing the maximum hold mode RBW (3KHz)

"G" is the numeric gain of the transmitting antenna over an isotropic radiator (1.00).

"d" is the distance in meters from which the field strength was measured (3M).

Example: the Max Radiation Emission = 66.13 + (35.60) = 101.73 dBμV/m

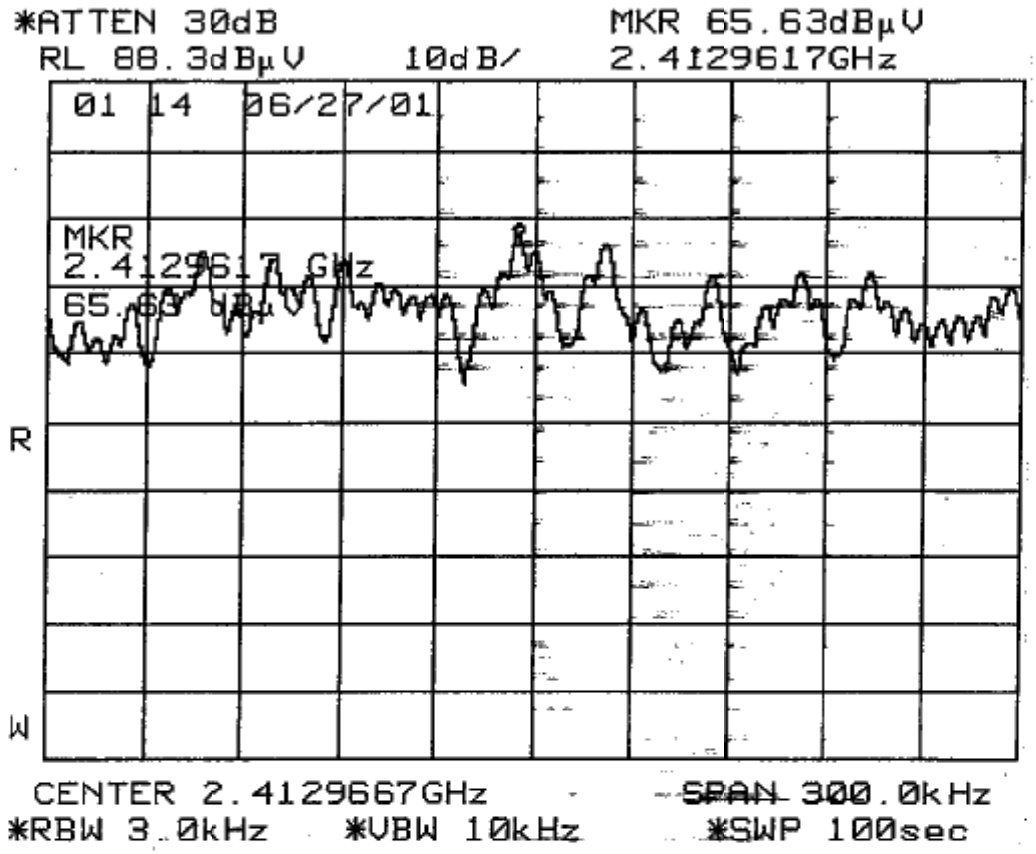
$10^{(101.73/20)} \times 10^{-6} = 0.122039$ V

E.R.P. = $(0.122039 \times 3)^2 / 30 = 4.468083$ mW

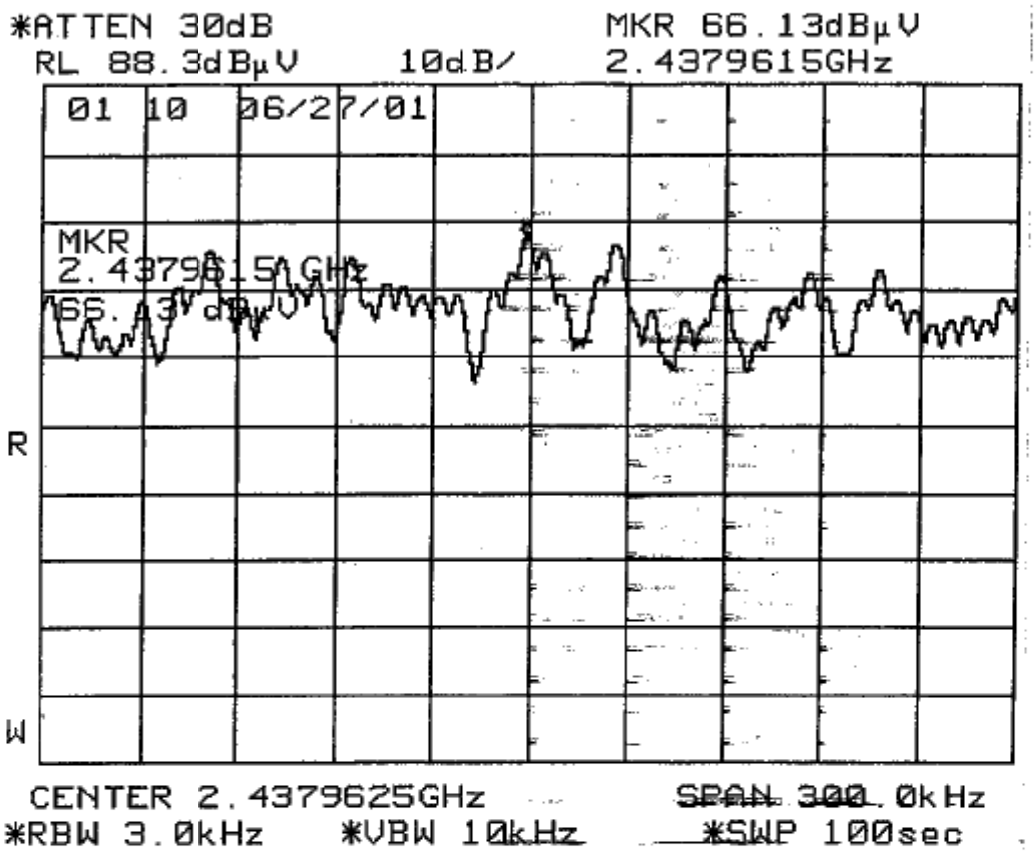
= 10 x log (4.468083 mW/1mW)

= 6.50 dBm

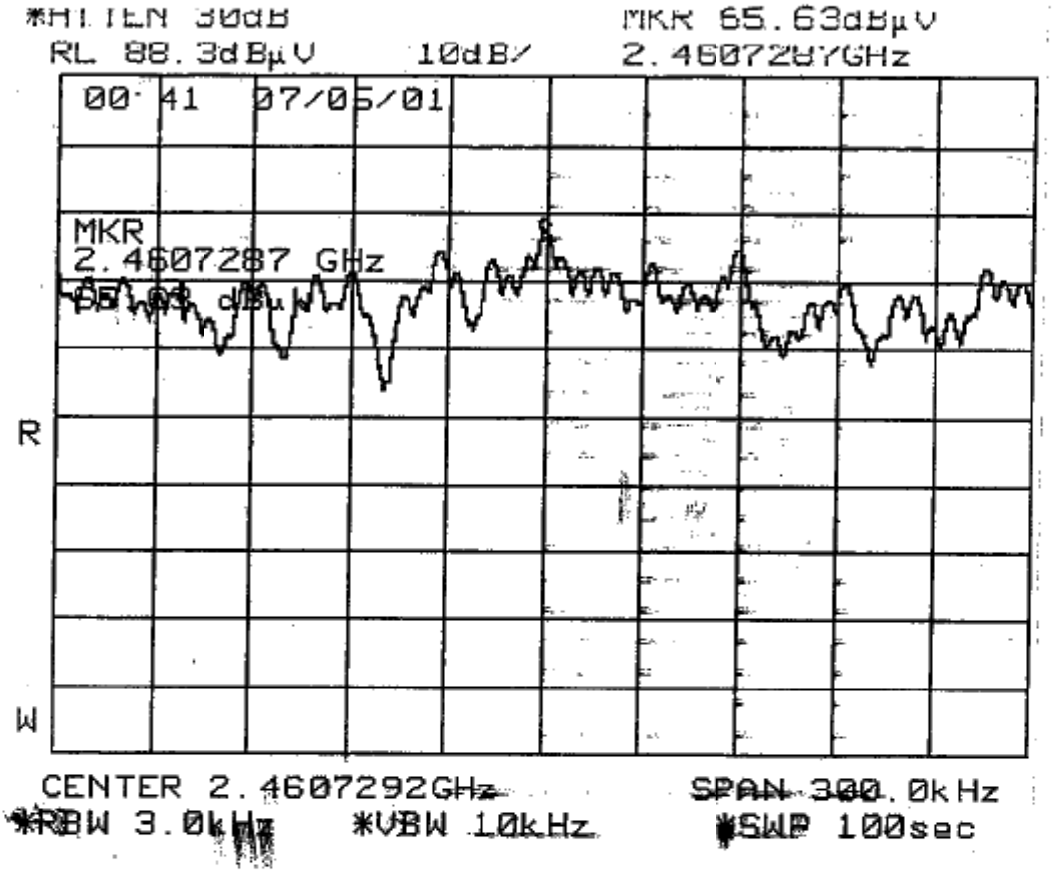
Power Spectral Density of Channel 1



Power Spectral Density of Channel 6



Power Spectral Density of Channel 11



Appendix A

Setting up Procedure

1. Using the USB port of notebook computer and software to control the EUT and link wireless access point, then making access to the mode of continuous transmission.
2. Use the software that is given by the customer and operated in the windows or DOS to control the EUT's continuous transmission.
3. Then making access to the mode of continuous transmission and set testing channel.

Appendix B

Antenna Spec.

Inverted F antenna

No.	Items	Specification
1.	Frequency range/MHz	2.4~2.5GHz
2.	Antenna Type	Inverted F
3.	Antenna peak gain/dBi	4dBi
4.	VSWR	1.8
5.	Polarization	Linear
6.	Impedance	(22+j28)Ohms
7.	Temperature	25 degree celsius
8.	Out put connector	none
9.	Weight	Part of PCB
10.	Notice	

Appendix C

The antenna of the device is fixed outside of EUT, the user can not remove it freely without any tools from outside the device. This is comply with the FCC rules part 15.203

Appendix D

RF Exposure Calculations

From FCC 1.1310 table 1A, the maximum permissible RF exposure for an uncontrolled environment is $1mW/cm^2$. The Electric field generated for a $1mW/cm^2$ exposure (S) is calculated as follows:

$S = E^2 / Z$

Where:

S = Power density

E = Electric field

Z = Impedance.

$E = \sqrt{S \times Z}$

$1mW/cm^2 = 10 W/m^2$

The impedance of free space is 337 ohms, where E and H fields are perpendicular.

Thus:

$E = \sqrt{10 \times 377} = 61.4$ V/m which is equivalent to $1mW/cm^2$

Using the relationship between Electric field E, Power in watts P, and distance in meters d, the corresponding

Antenna numeric gain G and the transmitter output power and solving for d,

$$d = \frac{\sqrt{P_{eak} \times 30 \times G}}{E}$$

The Numeric gain G of antenna with a gain specified in dB is determined by:

$G = Log^{-1}$ (dB gain/10)

$G = Log^{-1} (4.0/10) = 2.512$

Notice in Installation Manual:

While installing and operating this transmitter and antenna combination the radio frequency exposure limit of 1mW/cm^2 may be exceeded at distances close to the antennas installed. Therefore, the user must maintain a minimum distance of 20cm from the antenna at all time.

The table in follow page identifies the distances where the 1mW/cm ^{2} exposure limits may be exceeded during continuous transmission using the antenna

Antenna Type	**Gain (dBi)**	**Gain Numeric**	**Peak Output Power (mW)**	**Calculated RF Exposure Separation Distance (cm)**	**Minimum RF Exposure Separation Distance (cm)**
Dipole	4.0	2.512	0.081	0.127	20

RF SAFETY MPE calculation for this Wall mounted Mobile device (at 20 cm)

According to **OET BULLETIN 56 Fourth Edition/August 1999**,
Equation for Predicting RF Fields:

$$S = \frac{PG}{4\pi R^2} \quad S = \frac{0.081 \times 2.512}{4\pi (20)^2} = \mathbf{0.000040479\ mW/cm^2}$$

Where: S = power density (in appropriate units, e.g. mW/cm2)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)