4.5 BAND EDGE TEST

4.5.1 LIMIT

FCC Part15, Subpart C Section 15.247. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

4.5.2 TEST EQUIPMENT

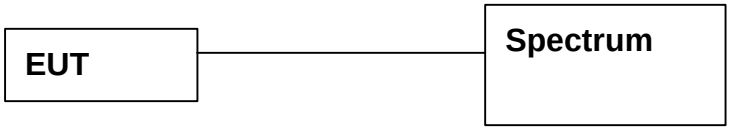
The following test equipment was used during the test:

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9kHz-7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	MAR. 2005 ETC
SPECTRUM	9KHz-26.5GHz	HP	8953E/ 3710A03220	MAY 2005 ETC
PRE-AMPLIFIER	1GHz-26.5GHz Gain:30dB(typ.)	HP	8449B/ 3008A01019	DEC. 2004 ETC
HORN ANTENNA	1GHz to 18GHz	EMCO	3115/ 9602-4681	NOV. 2004 ETC
OATS	3 - 10 M measurement	SRT	SRT-1	APR. 2005 SRT

NOTE: The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

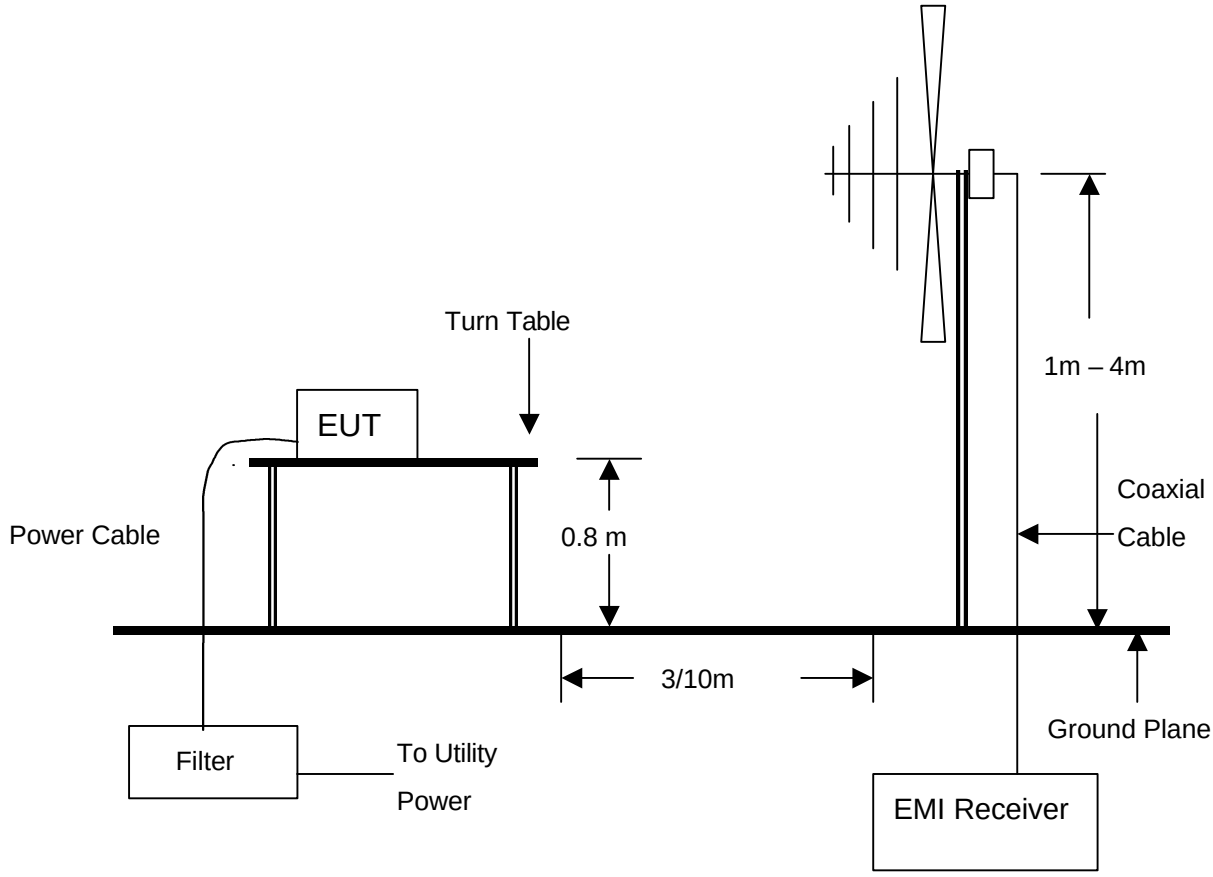
4.5.3 TEST SET-UP

FOR RF CONDUCTED TEST (dBc)



The EUT was connected to a spectrum through a 50 RF cable.

FOR RADIATED EMISSION TEST



NOTE :

1. The EUT system was put on a wooden table with 0.8m heights above a ground plane.
2. For the actual test configuration, please refer to the photos of testing.

4.5.4 TEST PROCEDURE

1. The EUT was operating in transmitter mode and could be controlled its channel. Printed out the test result from the spectrum by hard copy function.
2. The EUT was tested according to the requirement of ANSI C63.4:2003 and CISPR 22:2003. The measurements were made at an open area test site with 10 meter measurement distance under 1 GHz and with 3m distance above 1GHz. The frequency spectrum measured started from 30 MHz. Under 1 GHz. All readings were quasi-peak values with 120 kHz resolution bandwidth of the test receiver. Above 1 GHz, the measurements were made at an open area test site with 3 meter measurement distance and all readings were peak and average values with 1 MHz resolution bandwidth of the test receiver. The EUT system was operated in all typical methods by users. The cables connected to EUT and support units were moved to find the maximum emission levels for each frequency.

4.5.5 EUT OPERATING CONDITION

Same as section 4.1.5 of this report.

4.5.6 TEST RESULT

Temperature:	25°C	Humidity:	50%RH
Spectrum Detector:	PK. & AV.	Tested Mode:	IEEE 802.11g
Tested By:	Nick Chen	Modulation Type:	64QAM
Tested Date:	Oct. 22, 2004		

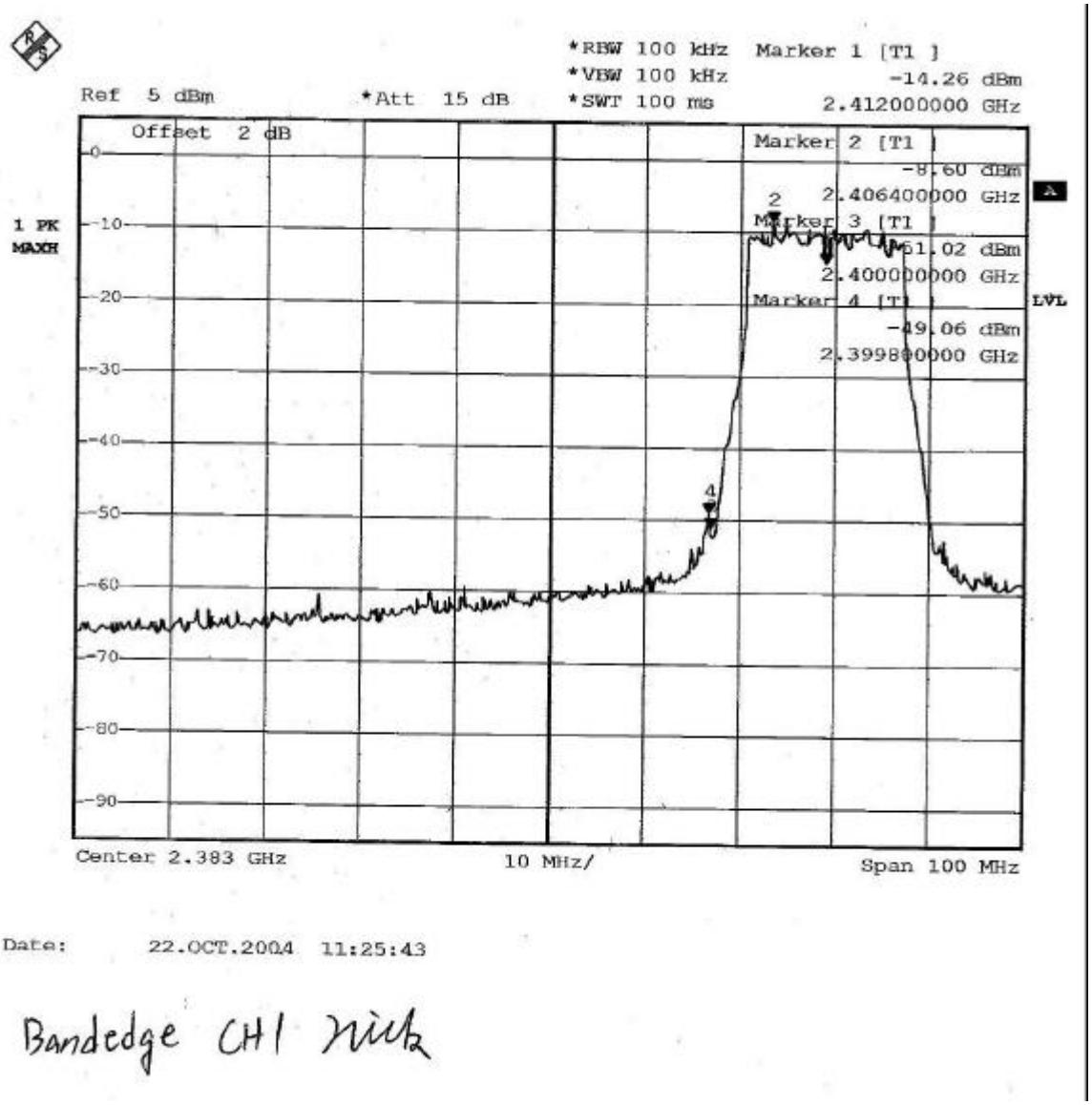
1.Conducted test

Frequency (MHz)	PEAK POWER OUTPUT (dBm)	Emission read Value(dBm)	Result of Band edge (dBc)	Band edge LIMIT (dBc)
<2400	-8.6	-49.06	40.49	>20dBc
>2483.5	-9.58	-57.67	48.09	>20dBc

2.Radiated emission test

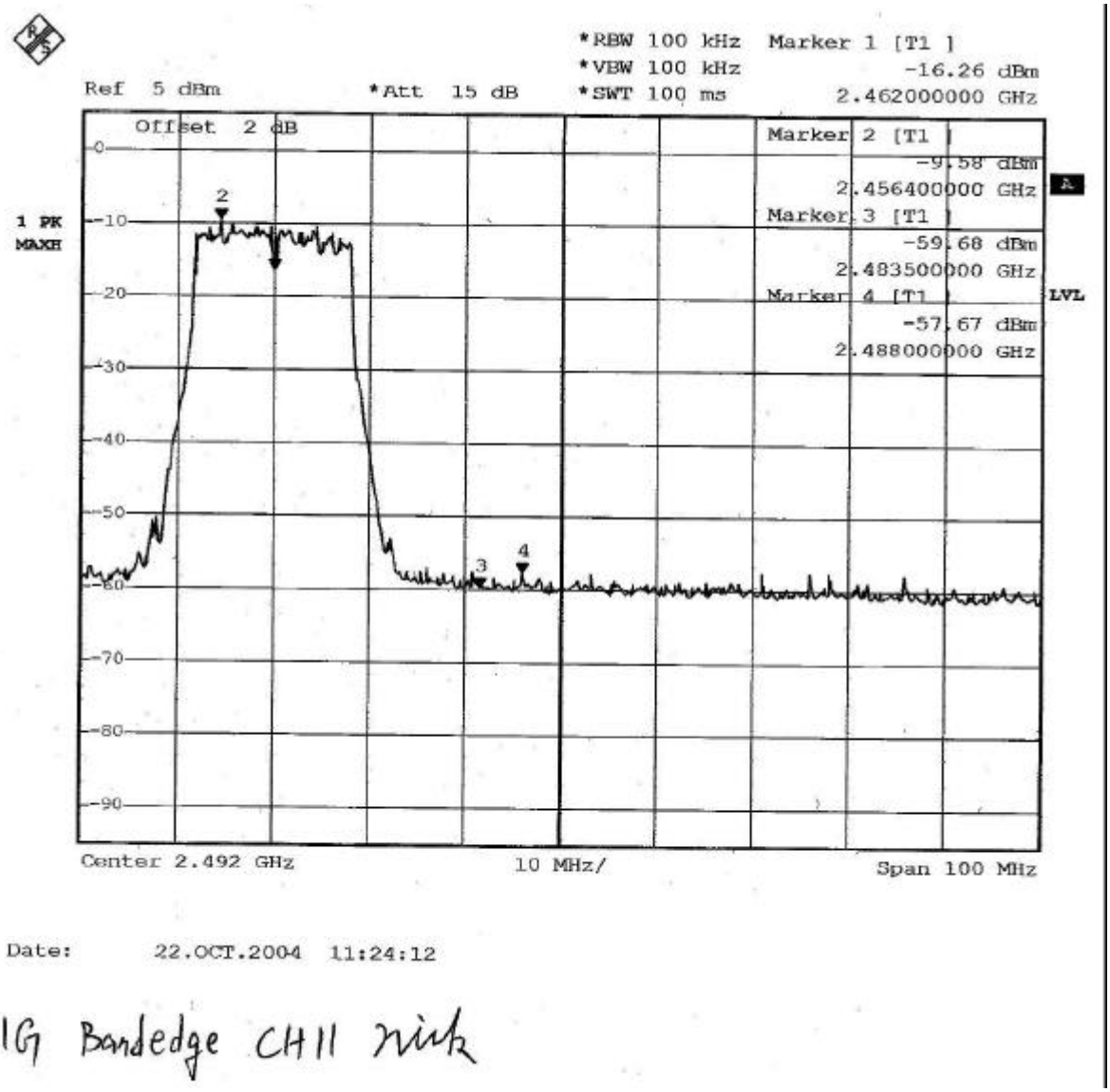
Frequency (MHz)	Antenna polarization (H/V)	Reading (dBuV)		Emission (dBuV/m)		Band edge Limit (dBuV/m)	
		PK	AV	PK	AV	PK	AV
<2400	V	48.7	*	44.6	*	74.0	54.0
>2483.5	V	45.1	*	41.7	*	74.0	54.0

<2400MHz



11G Bandedge CH1 Vert

>2483.5MHz



11G Bandedge CH11 Vert

Temperature:	25°C	Humidity:	50%RH
Spectrum Detector:	PK. & AV.	Tested Mode:	IEEE 802.11b
Tested By:	Hugo Yeh	Modulation Type:	CCK
Tested Date:	Nov. 23, 2004		

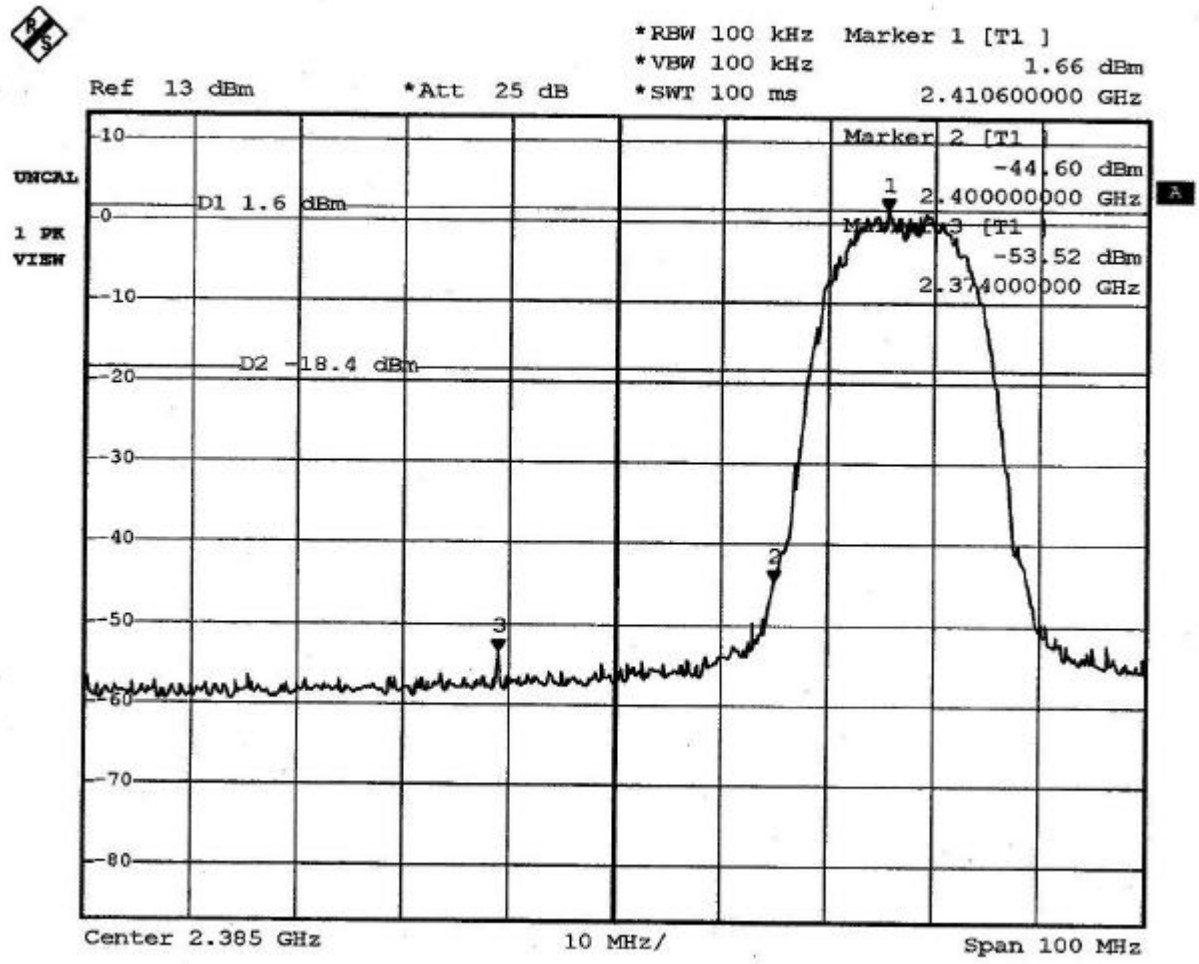
1.Conducted test

Frequency (MHz)	PEAK POWER OUTPUT (dBm)	Emission read Value(dBm)	Result of Band edge (dBc)	Band edge LIMIT (dBc)
<2400	1.66	-44.60	46.26	>20dBc
>2483.5	0.82	-52.48	53.30	>20dBc

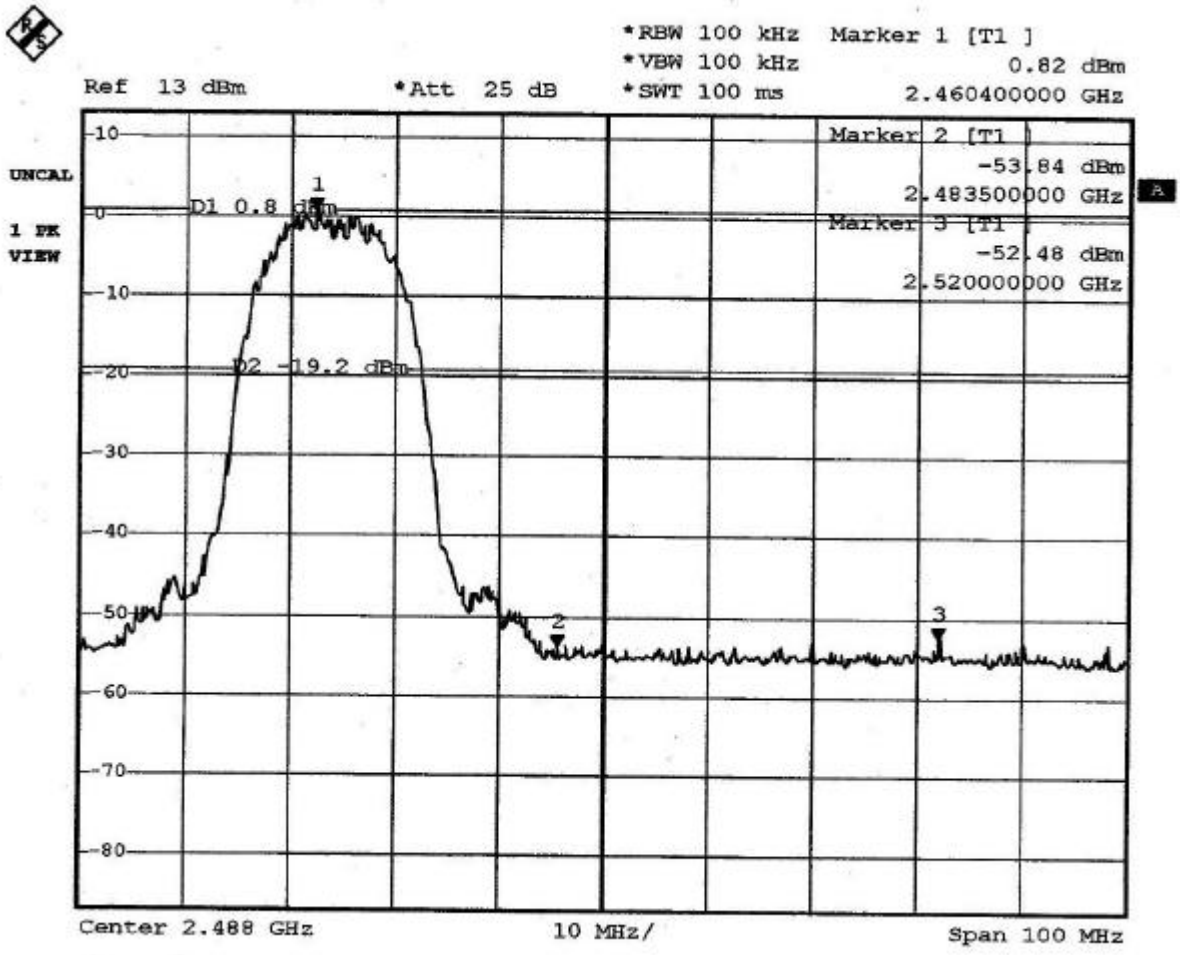
2.Radiated emission test

Frequency (MHz)	Antenna polarization (H/V)	Reading (dBuV)		Emission (dBuV/m)		Band edge Limit (dBuV/m)	
		PK	AV	PK	AV	PK	AV
<2400	V	44.6	33.8	40.4	29.6	74.0	54.0
>2483.5	V	44.6	32.4	40.6	28.4	74.0	54.0

<2400MHz


*RBW 100 kHz
*VBW 100 kHz
*SWT 100 ms
Marker 1 [T1]
1.66 dBm
2.410600000 GHz
Ref 13 dBm
*Att 25 dB
Marker 2 [T1]
-44.60 dBm
2.400000000 GHz
Marker 3 [T1]
-53.52 dBm
2.374000000 GHz
UNCAL
1 PK
VIEW
D1 1.6 dBm
D2 -18.4 dBm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.385 GHz
10 MHz/
Span 100 MHz

>2483.5MHz


*RBW 100 kHz
*VBW 100 kHz
*SWT 100 ms
Marker 1 [T1]
0.82 dBm
2.460400000 GHz
Ref 13 dBm
*Att 25 dB
Marker 2 [T1]
-53.84 dBm
2.483500000 GHz
Marker 3 [T1]
-52.48 dBm
2.520000000 GHz
UNCAL
1 PK
VIEW
D1 0.8 dBm
D2 -19.2 dBm
Center 2.488 GHz
10 MHz/
Span 100 MHz

4.6 POWER DENSITY TEST

4.6.1 LIMIT

FCC Part15, Subpart C Section 15.247

FREQUENCY RANGE (MHz)	Limit(dBm/kHz)
902-928	8dBm/3kHz
2400-2483.5	
5725-5850	

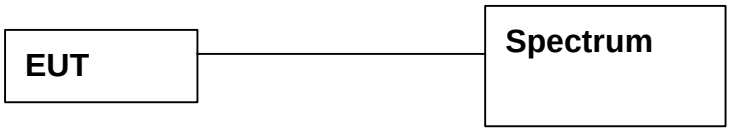
4.6.2 TEST EQUIPMENT

The following test equipment was used during the radiated emission test:

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9kHz-7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	MAR. 2005 ETC

NOTE: The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

4.6.3 TEST SET-UP



The EUT was connected to a spectrum through a 50 RF cable.

4.6.4 TEST PROCEDURE

The EUT was operating in transmitter mode and could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

4.6.5 EUT OPERATING CONDITION

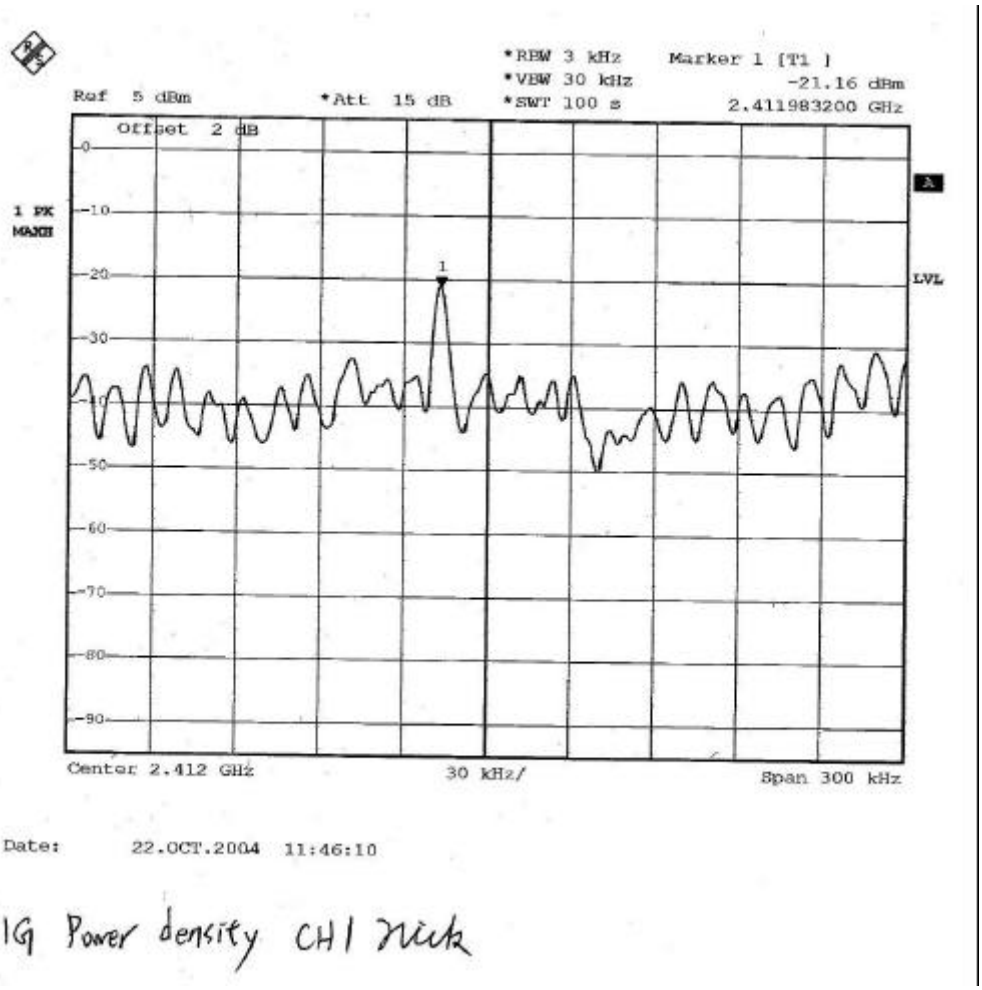
Same as section 4.1.5 of this report.

4.6.6 TEST RESULT

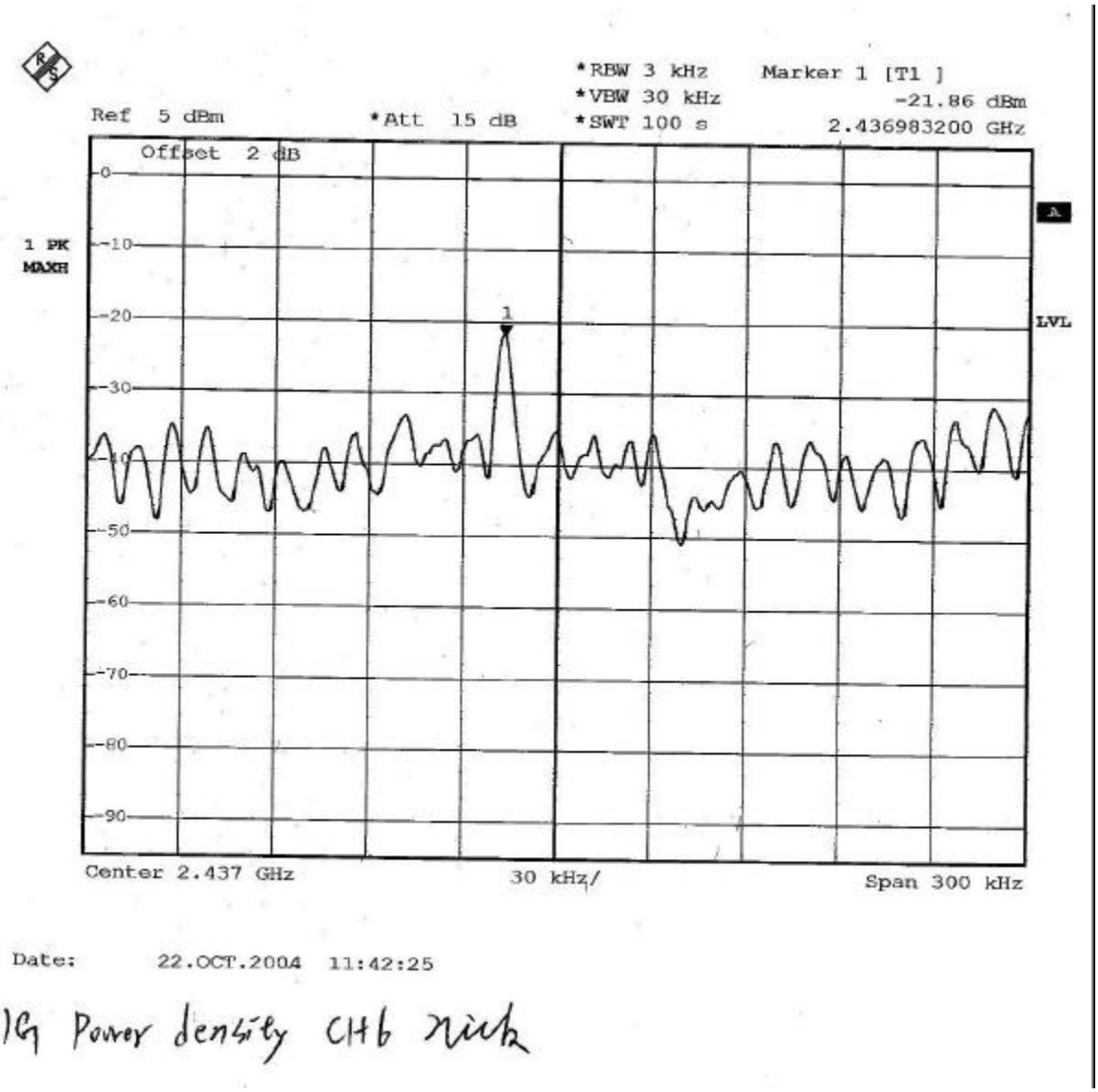
Temperature:	23°C	Humidity:	65%RH
Spectrum Detector:	PK.	Tested Mode:	IEEE 802.11g
Tested By:	Nick Chen	Modulation Type:	64QAM
Tested Date:	Oct. 22, 2004		

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 3KHz BW (dBm/3kHz)	MAXIMUM LIMIT (dBm/3kHz)
1	2412	-21.16	8
6	2437	-21.86	8
11	2462	-22.43	8

CH 1:

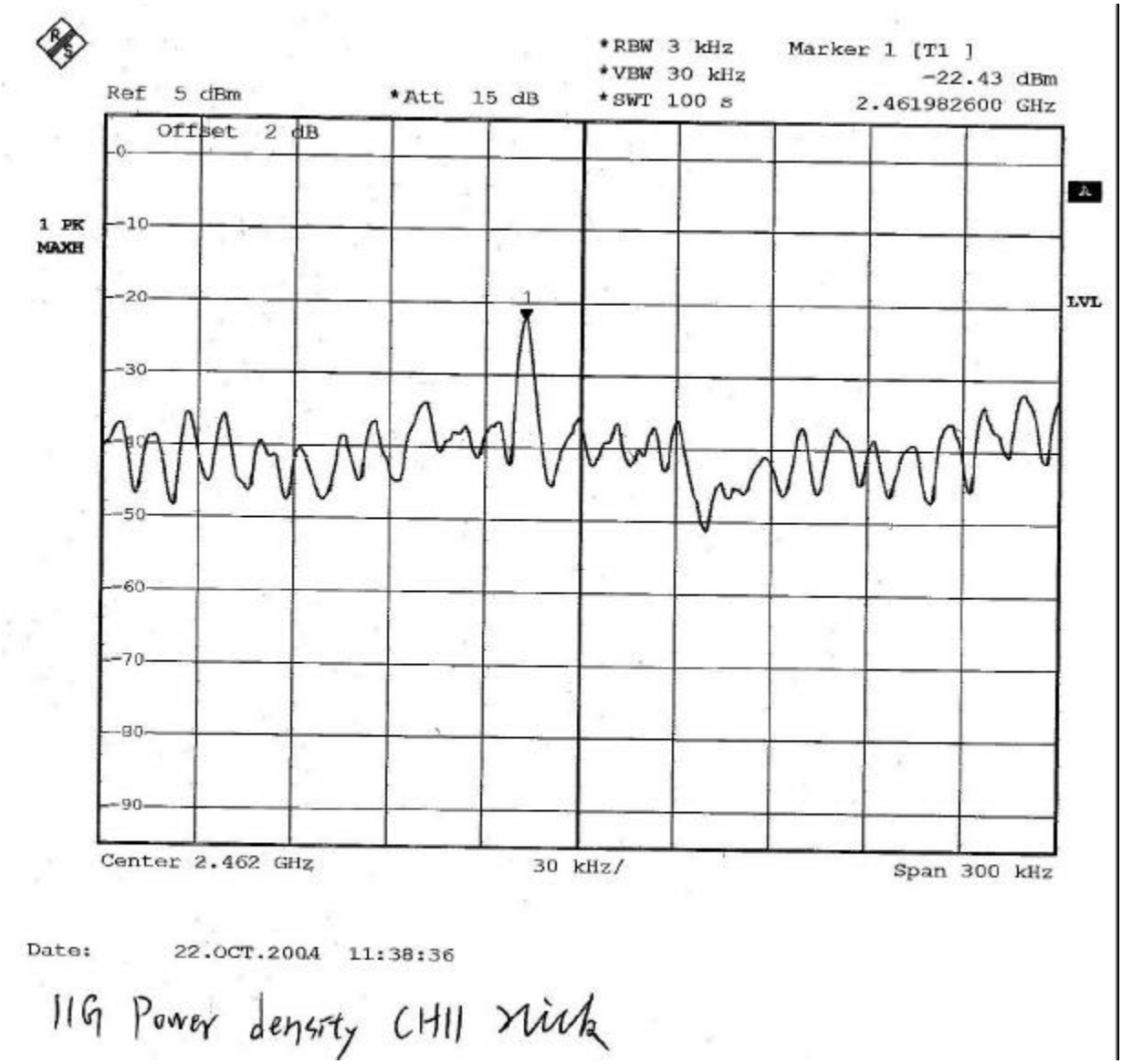


CH 6:



11G Power density CH6 mid

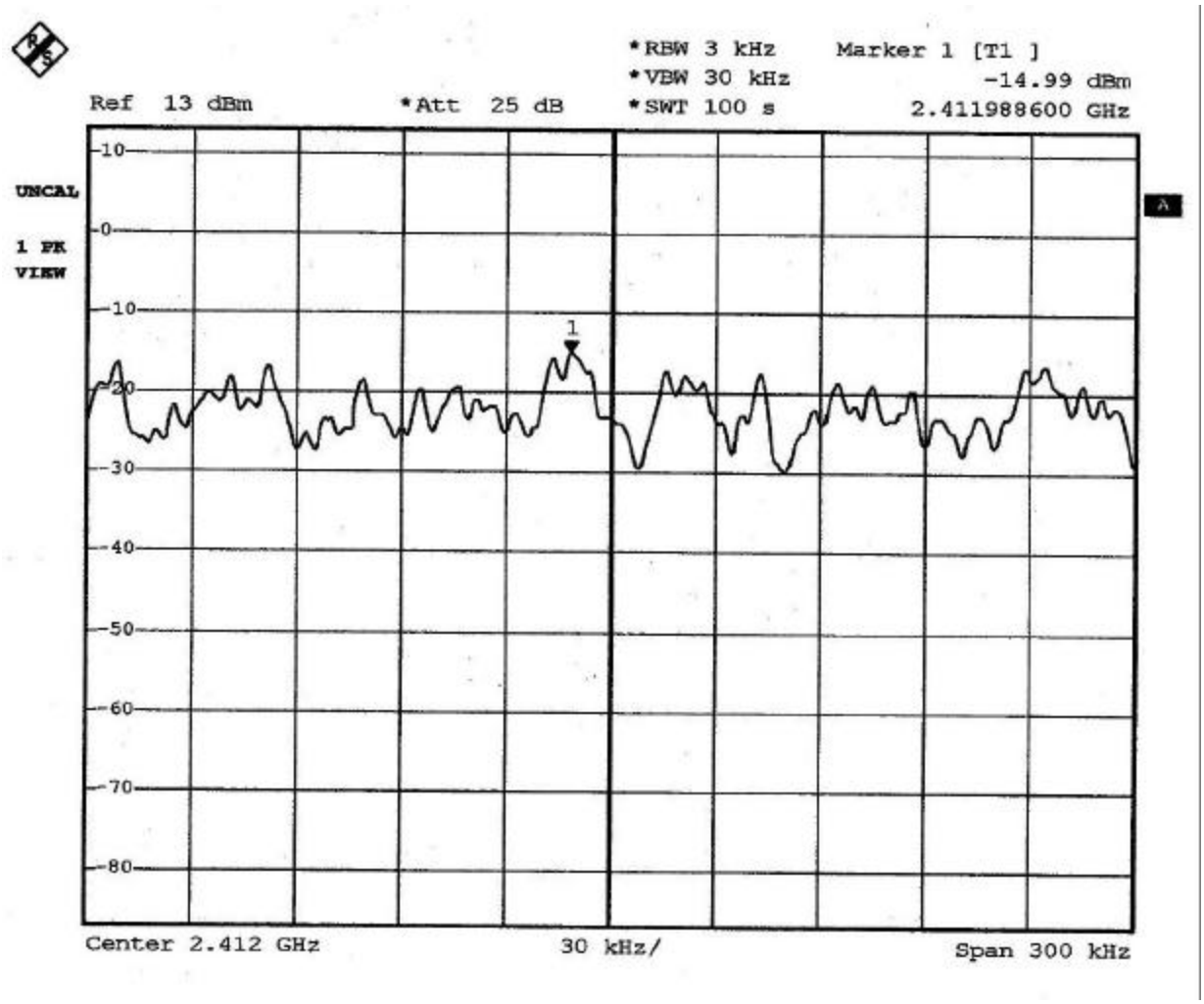
CH 11:


*RBW 3 kHz
*VBW 30 kHz
*SWT 100 s
Marker 1 [T1]
-22.43 dBm
2.461982600 GHz
Ref 5 dBm
*Att 15 dB
Offset 2 dB
1 PK
MAXH
A
LVL
0
-10
-20
-30
-50
-60
-70
-80
-90
Center 2.462 GHz
30 kHz/
Span 300 kHz
Date: 22.OCT.2004 11:38:36
11G Power density CH11

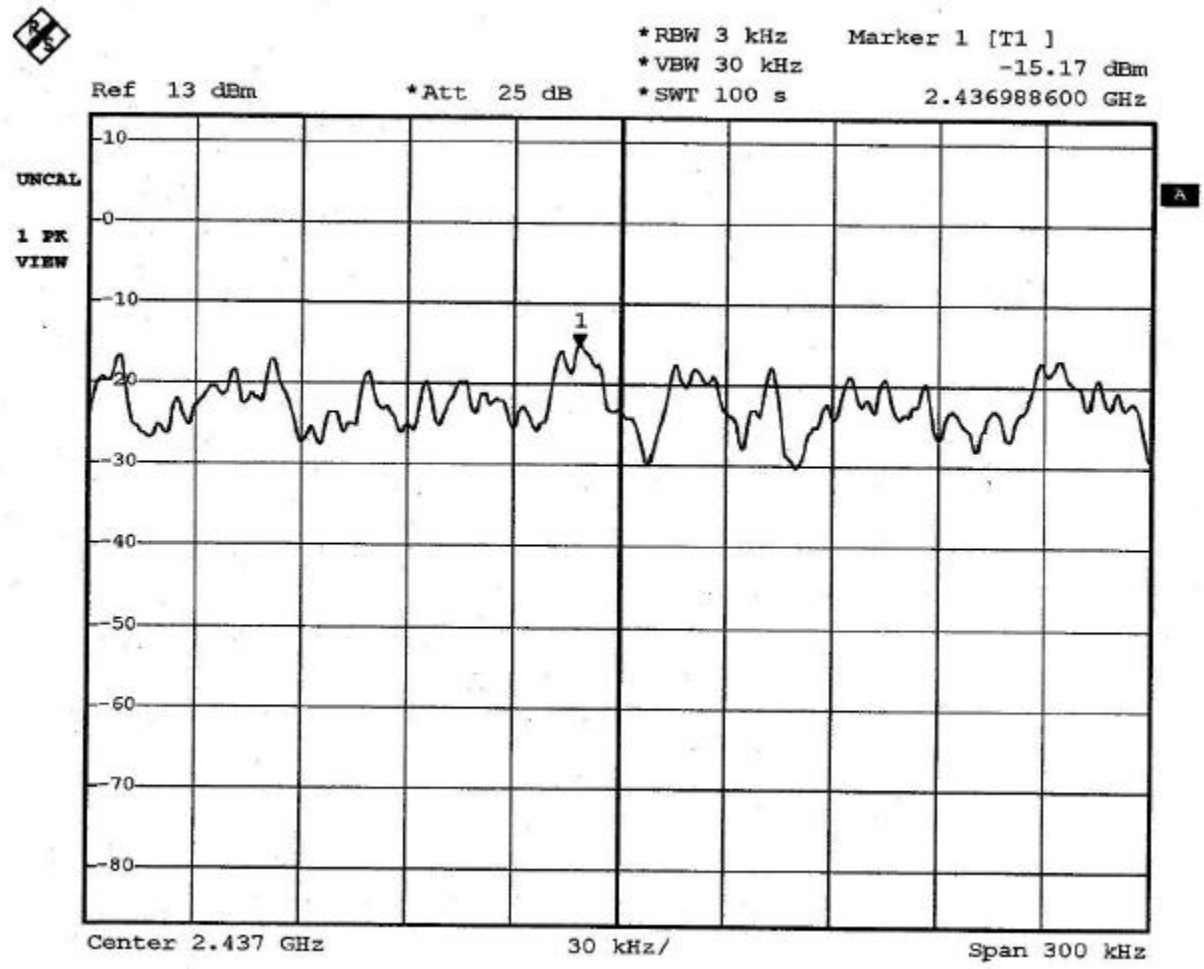
Temperature:	23°C	Humidity:	65%RH
Spectrum Detector:	PK.	Tested Mode:	IEEE 802.11b
Tested By:	Hugo Yeh	Modulation Type:	CCK
Tested Date:	Nov. 23, 2004		

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 3KHz BW (dBm/3kHz)	MAXIMUM LIMIT (dBm/3kHz)
1	2412	-14.99	8
6	2437	-15.17	8
11	2462	-15.94	8

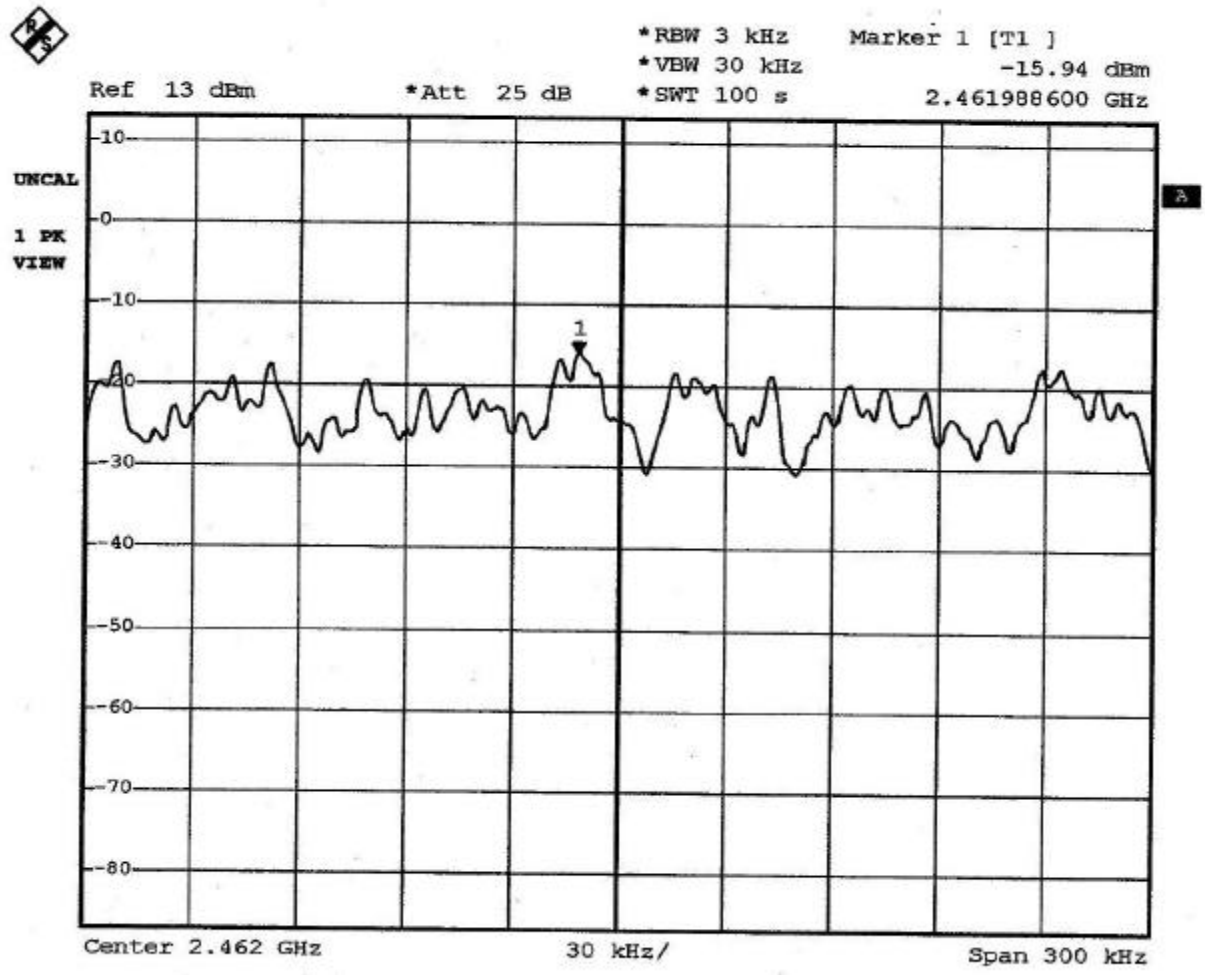
CH 1:



CH 6:


*RBW 3 kHz
*VBW 30 kHz
*SWT 100 s
Marker 1 [T1]
-15.17 dBm
2.436988600 GHz
Ref 13 dBm
*Att 25 dB
UNCAL
1 PK
VIEW
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1
Center 2.437 GHz
30 kHz/
Span 300 kHz

CH 11:


*RBW 3 kHz
*VBW 30 kHz
*SWT 100 s
Marker 1 [T1]
-15.94 dBm
2.461988600 GHz
Ref 13 dBm
*Att 25 dB
UNCAL
1 PK
VIEW
10
0
-10
-20
-30
-40
-50
-60
-70
-80
1
A
Center 2.462 GHz
30 kHz/
Span 300 kHz

4.7 RF POWER EXPOSURE EVALUATION TEST

4.7.1 LIMIT

According to the requirement of IEEE C95.1 and FCC OET Bulletin 65.

Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength(E) (V/m)	Magnetic Field Strength(H) (A/m)	Power density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength(E) (V/m)	Magnetic Field Strength(H) (A/m)	Power density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz *Plane-wave equivalent power density

NOTE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

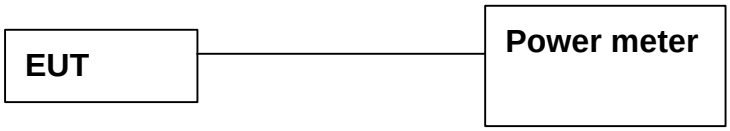
4.7.2 TEST EQUIPMENT

The following test equipment was used during the test:

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
POWER METER	N/A	BOONTON	4232A/ 29001	MAY 2005 ETC
POWER SENSOR	DC-8GHz 50	BOONTON	51011EMC/ 31181	NOV. 2005 ETC

NOTE: The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

4.7.3 TEST SET-UP



The EUT was connected to a spectrum through a 50 RF cable.

4.7.4 TEST PROCEDURE

1. The EUT was operating in transmitter mode and could be controlled its channel. The power meter read power value.
2. The EUT uses notebook' s antenna and the antenna gain is 0.5dBi declared by manufacturer.
3. As discussed in OET Bulletin 65, calculations can be made to predict RF field strength and power density levels around typical RF sources. For example, in the case of a non-directional antenna, a prediction for power density in the far-field of the antenna can be made by use of the general Equations (1) or (2) below [for conversion to electric or magnetic field strength see Equation (3) above]. These equations are generally accurate in the far-field of an antenna but will over-predict power density in the near field, where it could be used for making a" worst case" or conservative prediction.

$$S=PG/4\pi R^2 \quad \text{(Eq.1)}$$

$$S=EIRP/4\pi R^2 \quad \text{(Eq. 2)}$$

$$S=E^2/3770=37.7H^2 \quad \text{(Eq. 3)}$$

where: S = power density (mW/cm2)

E = electric field strength (V/m)

H = magnetic field strength (A/m)

S = power density (in appropriate units, e.g. mW/cm^2)

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 (dBi)

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

where: EIRP = equivalent (or effective) isotropically radiated power

4.7.5 EUT OPERATING CONDITION

Same as section 4.1.5 of this report.

4.7.6 RESULT

Temperature:	23°C	Humidity:	65%RH
Spectrum Detector:	PK.	Tested Mode:	IEEE 802.11g
Tested By:	Nick Chen	Modulation Type:	64QAM
Tested Date:	Oct. 22, 2004		

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	RF Output Power (mW)	Result calculated when nearby person (cm)	Limit when nearby person (cm)
1	2412	16.60	1.15	20
6	2437	14.22	1.06	20
11	2462	12.33	0.99	20

NOTE : The EUT uses a dipole antenna and the antenna gain is 0.5dBi (1.12 numeric)

Temperature:	23°C	Humidity:	65%RH
Spectrum Detector:	PK.	Tested Mode:	IEEE 802.11b
Tested By:	Hugo Yeh	Modulation Type:	CCK
Tested Date:	Nov. 23, 2004		

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	RF Output Power (mW)	Result calculated when nearby person (cm)	Limit when nearby person (cm)
1	2412	67.92	2.33	20
6	2437	63.53	2.25	20
11	2462	53.33	2.06	20

NOTE : The EUT uses a dipole antenna and the antenna gain is 0.5dBi (1.12 numeric)

5. ANTENNA APPLICATION

5.1 ANTENNA REQUIREMENT

The EUT uses antenna is met the requirement of FCC part15C section15.203 and 15.204.

FCC part15C section15.247 requirement:
Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.2 RESULT

The EUT without antenna. The notebook' s antenna gain is 0.6dBi and meets the EUT.
The location of the antenna as show in the attached EUT PHOTOS.

6. PHOTOS OF TESTING

- Conducted test

- Radiated test (RX)

- Radiated test (TX)

7. TERMS OF ABRIVATION

AV.	Average detection
AZ(°)	Turn table azimuth
Correct.	Correction
EL(m)	Antenna height (meter)
EUT	Equipment Under Test
Horiz.	Horizontal direction
LISN	Line Impedance Stabilization Network
NSA	Normalized Site Attenuation
PK.	Peak detection
Q.P.	Quasi-peak detection
SRT Lab	Spectrum Research & Testing Laboratory, Inc.
Vert.	Vertical direction