

EMC TEST REPORT

Report No. : EME-050235

Model No. : WUG2400

Issued Date : Mar. 30, 2005

**Applicant : AboCom Systems, Inc.
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Taiwan**

**Test By : Intertek Testing Services Taiwan Ltd.
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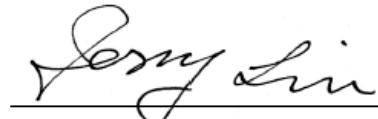
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Project Engineer



Victor Wen

Reviewed By



Jerry Liu

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Summary of Tests**802.11b/g Wireless LAN USB2.0 Adapter-Model: WUG2400**
FCC ID: MQ4WUG2400

Test	Reference	Results
Minimum 6dB Bandwidth test	15.247(a)(2)	Complies
Maximum Output Power test	15.247(b)	Complies
Radiated Spurious Emission test	15.205, 15.209	Complies
Power Spectrum Density test	15.247(d)	Complies
Power Line Conducted Emission test	15.207	Complies

1. General information

1.1 Identification of the EUT

Applicant : AboCom Systems, Inc.
Product : 802.11b/g Wireless LAN USB2.0 Adapter
Model No. : WUG2400
FCC ID. : MQ4WUG2400
Frequency Range : 2400 MHz to 2483.5MHz
Channel Number : 11 Channels
Frequency of Each Channel : 2412MHz, 2417MHz, 2422MHz, 2427MHz, 2432MHz, 2437MHz, 2442MHz, 2447MHz, 2452MHz, 2457MHz, 2462MHz
Type of Modulation : DSSS, OFDM
Rated Power : 5Vdc from Notebook PC
Power Cord : N/A
Sample Received : Mar. 16, 2005
Test Date(s) : Mar. 16, 2005 ~ Mar. 24, 2005

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

The 802.11b/g Wireless LAN USB2.0 Adapter is a device that allows you connect your computer to a wireless local area network (LAN). A wireless LAN allows your system to use wireless Radio Frequency (RF) technology to transmit and receive data without physically attaching to the network. The Wireless protocols that come with this product ensure data security and isolation from interference generated by other radio frequencies.

For more detail features, please refer to User's manual as file name "Installation guide.pdf"

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 2.0dBi max

Antenna Type : Chip antenna

Connector Type : N/A

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook PC	DELL	PP05L	CN-0G5152-48643-498-6810	FCC DoC Approved
AP	SMC	WG 4005-17 2 (A3)	C-G 3030232-1-1-3*1000	FCC DoC Approved
Printer	HP	Deskjet 400	N/A	FCC DoC Approved
Modem	Dynalink	V1456VQE	00A230A00116311	FCC DoC Approved

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section § 15.205、§15.207、§15.209、§15.247 and ANSI C63.4/2003.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

Plug the EUT into Notebook PC to USB interface, and then turn on the Notebook PC power run the test program “ Radio scope.exe” which provide by manufacturer.

During Conduction test, the EUT was in normal mode communicating with AP. While in other tests, the EUT works in the status of continuously transmitted.

After verifying the maximum output power, we found the maximum output power of 802.11b was occurred at 11Mbps data rate and 802.11g were occurred at 54Mbps data rate. The final test was executed under this condition and recorded in this report individually.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Intertek ID No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	EC303	04/13/2005
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	EC317	07/14/2005
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	EC353	07/13/2005
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	EC365	10/18/2005
Horn Antenna	EMCO	1GHz~18GHz	3115	EC338	08/16/2005
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	EC351	07/08/2005
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	EC368	05/20/2005
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981	EC373	4/13/2005
Pre-Amplifier	MITEQ	26GHz~40GHz	828825	EC374	1/27/2006
Wideband Peak Power Meter/ Sensor	Anritsu	100MHz~18GHz	ML2497A/ MA2491A	EC396	10/18/2005
Controller	HDGmbH	N/A	HD 100	EP317-1	N/A
Antenna Tower	HDGmbH	N/A	MA 240	EP317-2	N/A
Turn Table	HDGmbH	N/A	DS 420S	EP317-3	N/A
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5	EC344	01/13/2006

Note: The above equipments are within the valid calibration period.

3. Minimum 6dB Bandwidth test

3.1 Operating environment

Temperature: 23 °C
Relative Humidity: 54 %
Atmospheric Pressure: 1023 hPa

3.2 Test setup & procedure

The minimum 6dB bandwidth per FCC §15.247(a)(2) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW. The test was performed at 3 channels (lowest, middle and highest channel). The minimum 6-dB modulation bandwidth is in the following Table.

3.3 Measured data of Minimum 6dB Bandwidth test results

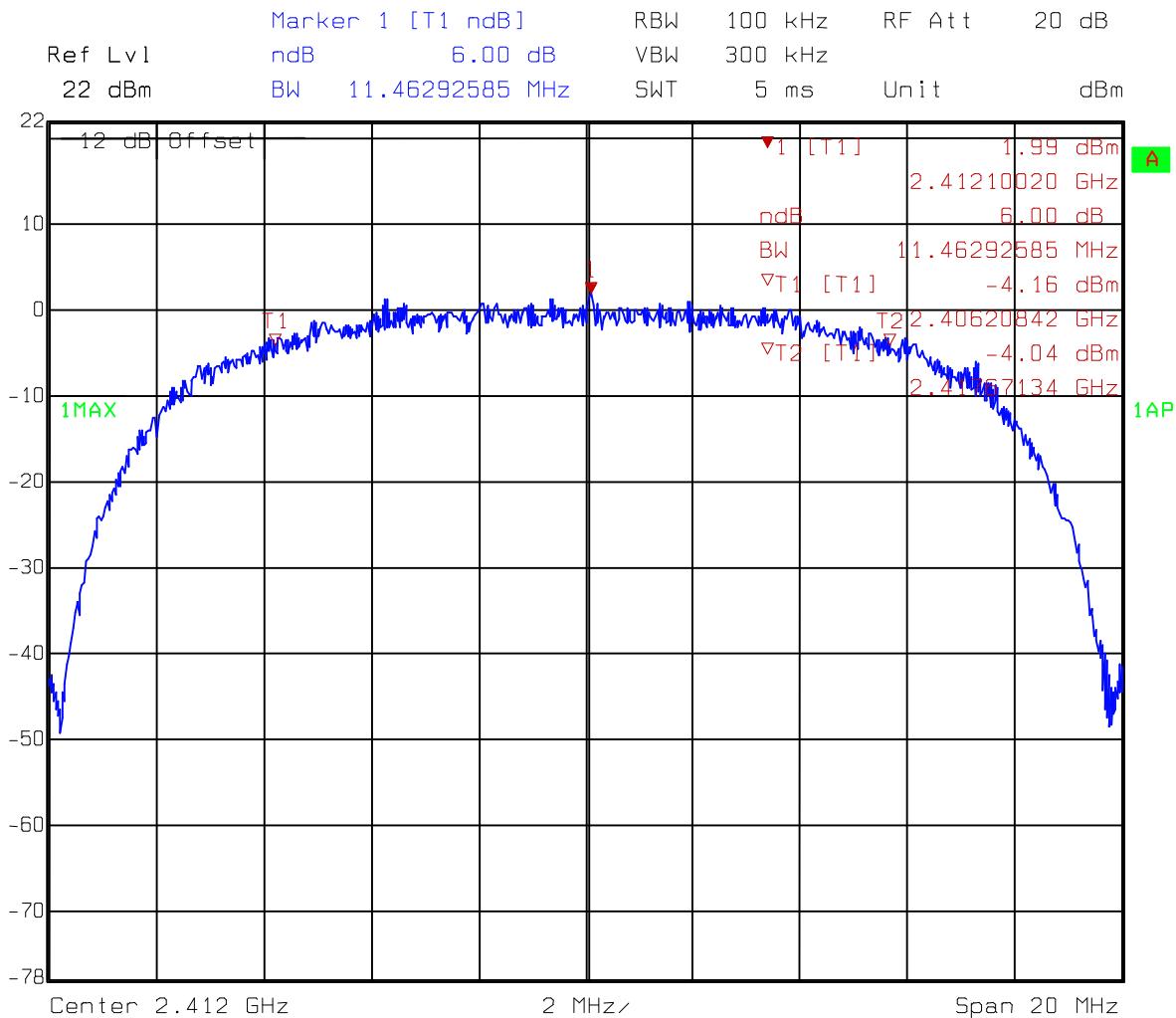
Test Mode: 802.11b operating mode (DSSS Modulation)

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit
1	2412	11.46292	>500kHz
6	2437	10.98196	>500kHz
11	2462	10.90180	>500kHz

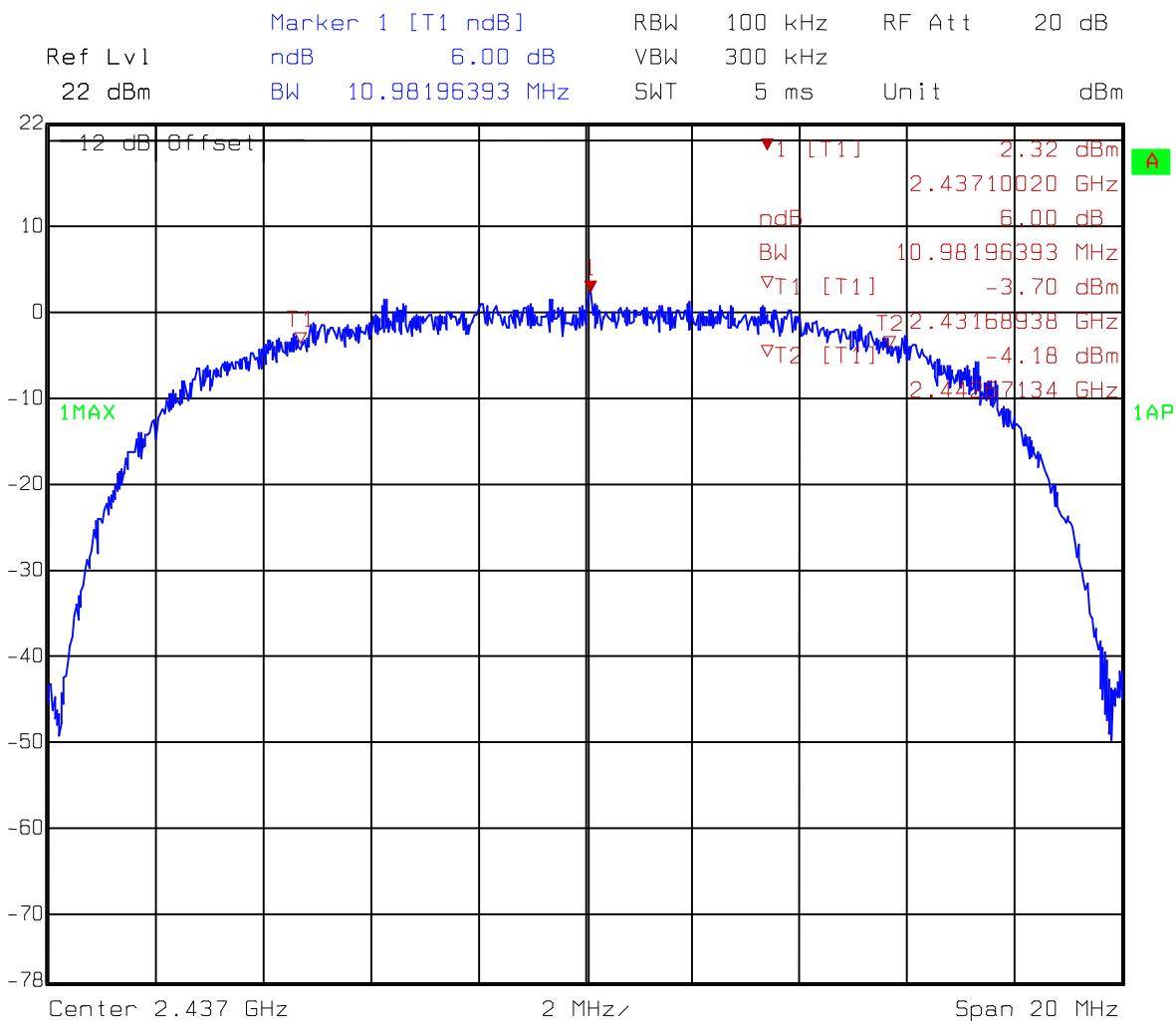
Test Mode: 802.11g operating mode (OFDM Modulation)

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit
1	2412	16.59318	>500kHz
6	2437	16.59318	>500kHz
11	2462	16.59318	>500kHz

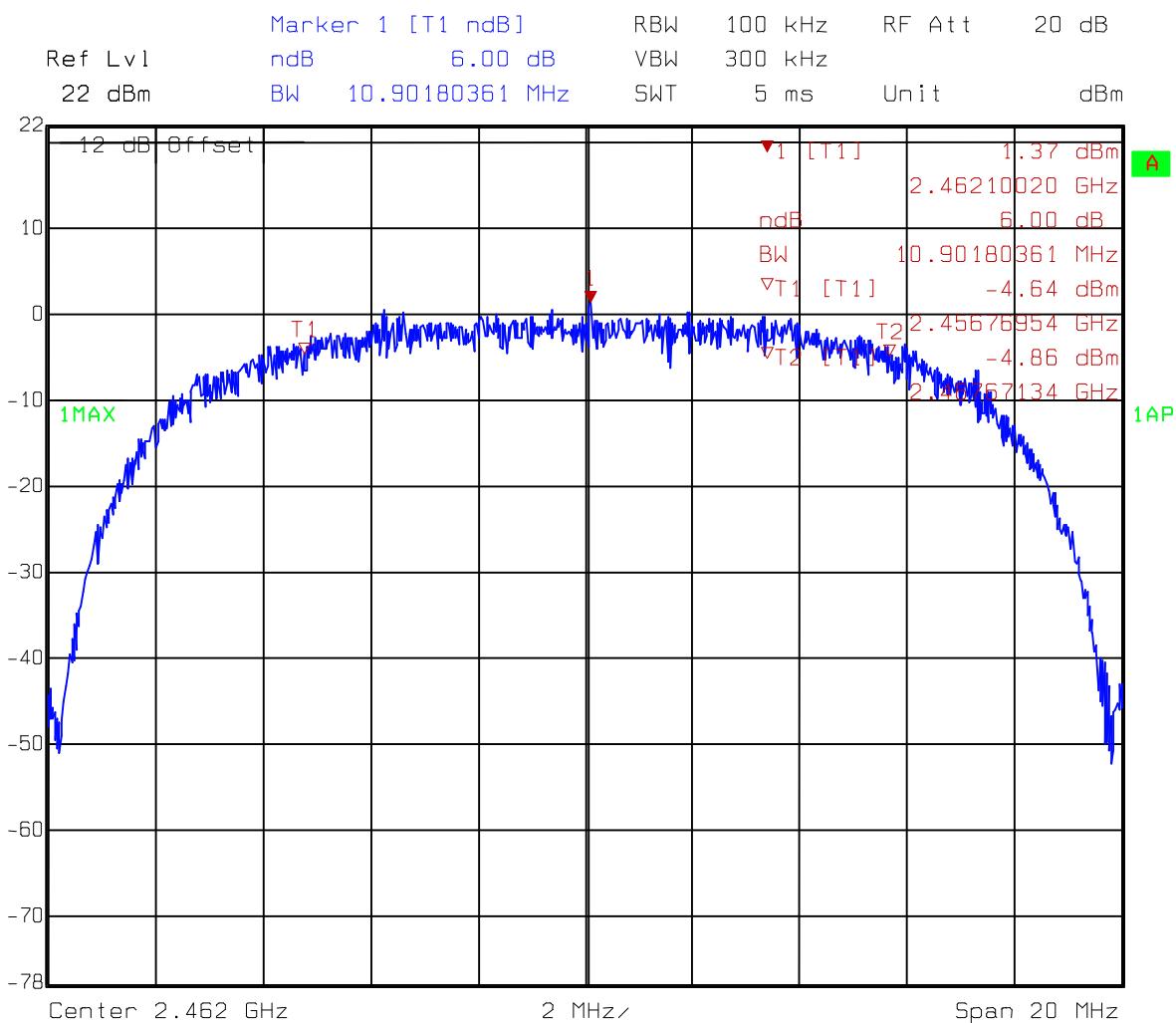
Please see the plot below.

Test Mode: 802.11b operating mode (DSSS Modulation)


Comment A: 6dB BW
 11b tx low(EC365)
 Date: 22.MAR.2005 13:51:52

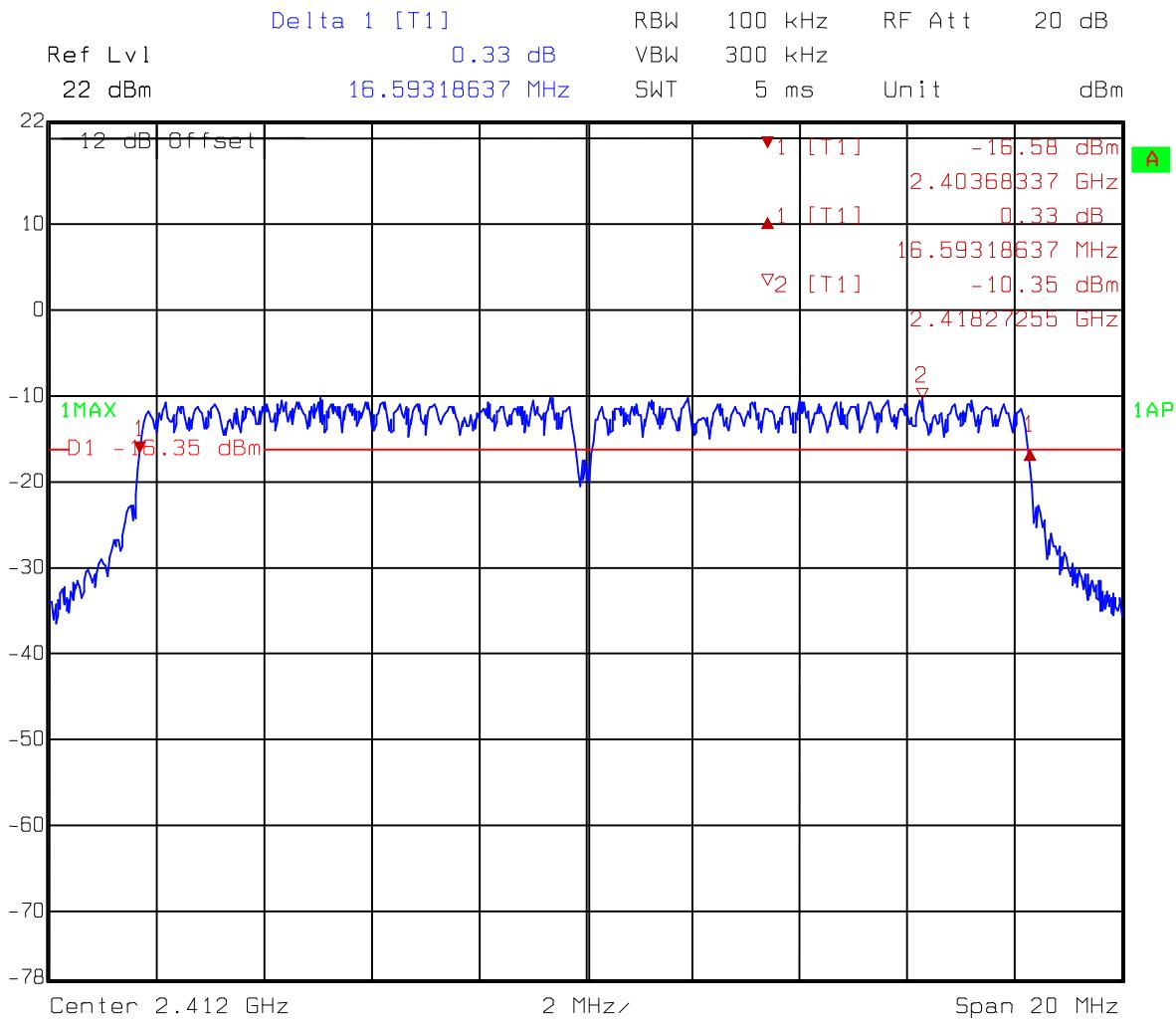


Comment A: 6dB BW
 11b tx Mid(EC365)
 Date: 22.MAR.2005 14:00:06

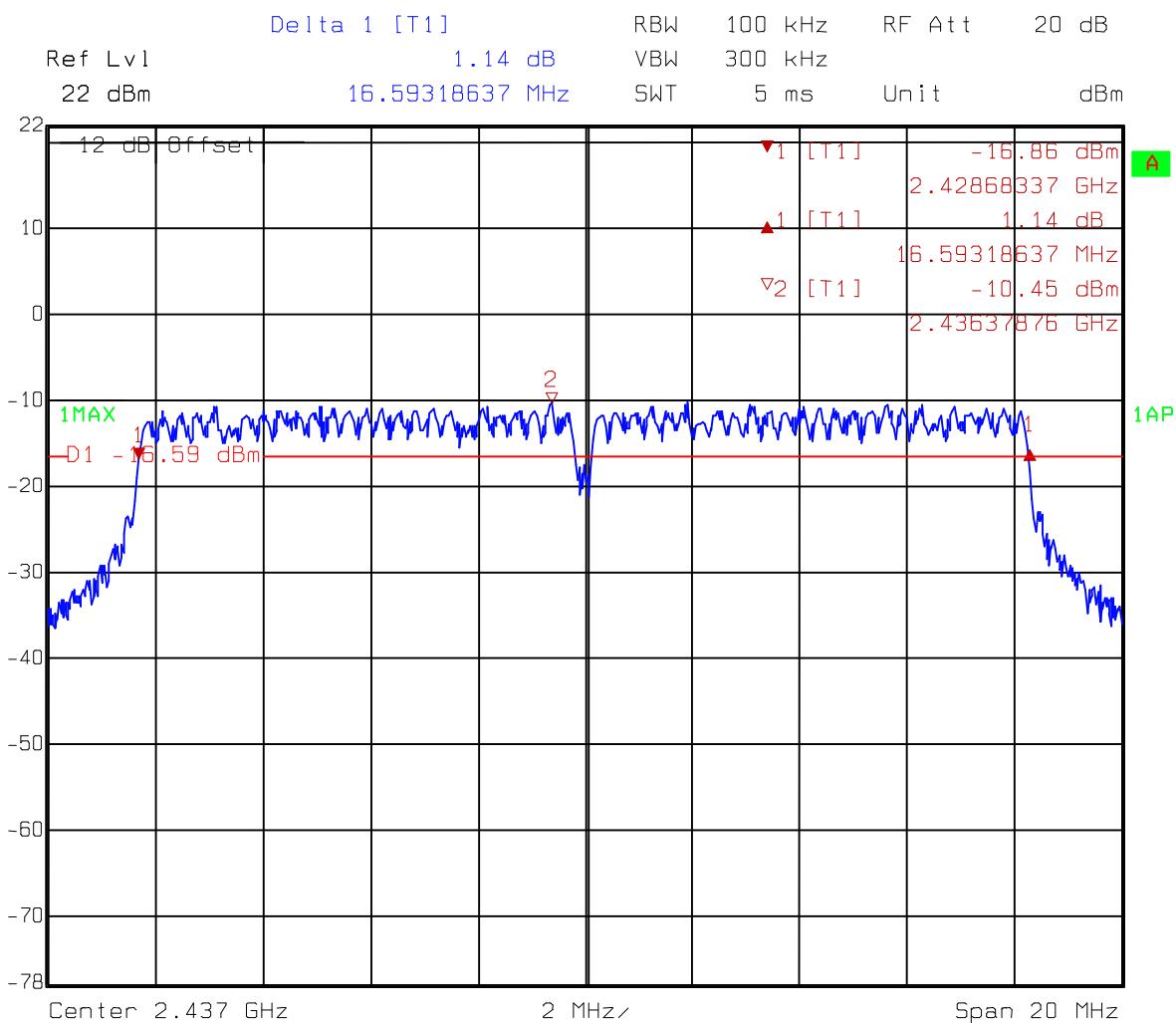


Comment A: 6dB BW
 11b tx Hi(EC365)
 Date: 22.MAR.2005 14:02:34

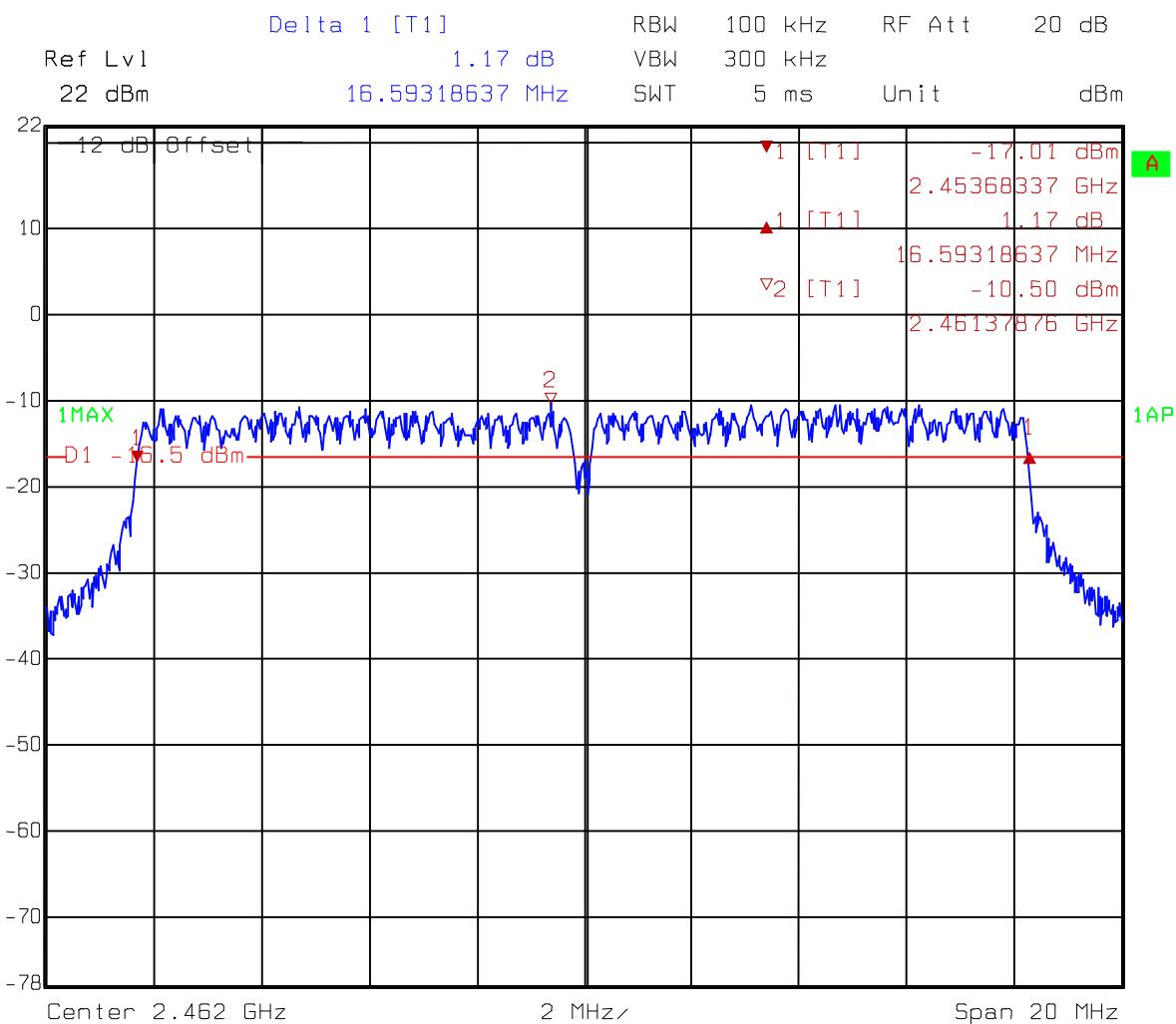
Test Mode: 802.11g operating mode (OFDM Modulation)



Comment A: 6dB BW
11g tx Low(EC365)
Date: 22.MAR.2005 14:10:18



Comment A: 6dB BW
11g tx Mid(EC365)
Date: 22.MAR.2005 14:14:31



Comment A: 6dB BW
 11g tx Hi(EC365)
 Date: 22.MAR.2005 14:16:59

4. Maximum Output Power test

4.1 Operating environment

Temperature: 25 °C
 Relative Humidity: 52 %
 Atmospheric Pressure: 1023 hPa

4.2 Test setup & procedure

The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm SMA cable connected to peak power meter via power sensor. Power was read directly and cable loss correction (2 dB) was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel).

4.3 Measured data of Maximum Output Power test results

Test Mode: 802.11b operating mode (DSSS Modulation)

Channel	Freq. (MHz)	C.L. (dB)	Reading (dBm)	Conducted Peak Output Power		Limit (W)
				(dBm)	(mW)	
1	2412	2.00	14.02	16.02	39.99	1
6	2437	2.00	14.03	16.03	40.09	1
11	2462	2.00	14.05	16.05	40.27	1

Remark:

Conducted Peak Output Power = Reading + C.L.

Test Mode: 802.11g operating mode (OFDM Modulation)

Channel	Freq. (MHz)	C.L. (dB)	Reading (dBm)	Conducted Peak Output Power		Limit (W)
				(dBm)	(mW)	
1	2412	2.00	11.01	13.01	19.99	1
6	2437	2.00	11.10	13.10	20.42	1
11	2462	2.00	11.10	13.10	20.42	1

Remark:

Conducted Peak Output Power = Reading + C.L.

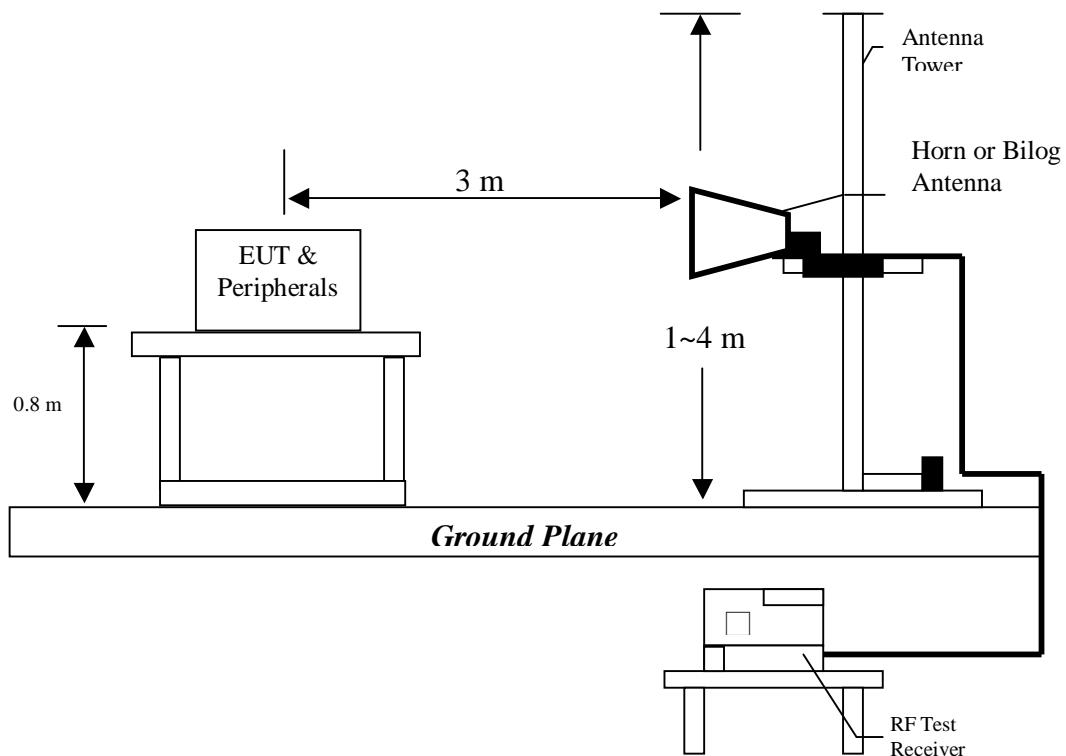
5. Radiated Emission test

5.1 Operating environment

Temperature: 20 °C
Relative Humidity: 55 %
Atmospheric Pressure: 1023 hPa

5.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



Radiated emissions were investigated over the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1MHz RBW/VBW) recorded also on the report.

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

5.3 Emission limits

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81.

Expanded uncertainty ($k=2$) of radiated emission measurement is ± 4.98 dB.

5.4 Radiated spurious emission test data**5.4.1 Measurement results: frequencies equal to or less than 1 GHz**

The test was performed on EUT under 802.11b and 802.11g continuously transmitting mode. Channel 1, 6, 11 were verified. The worst case occurred at 802.11g Tx at channel 1.

EUT : WUG2400
Worst Case : 802.11g Tx at channel 1

Frequency (MHz)	Spectrum Analyzer	Antenna	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
35.880	QP	V	12.67	13.77	26.44	40.00	-13.56	110.00	233.00
69.410	QP	V	13.22	12.78	26.00	40.00	-14.00	115.00	351.00
111.640	QP	V	11.80	21.60	33.40	43.50	-10.10	120.00	34.00
134.120	QP	V	13.34	15.12	28.46	43.50	-15.04	110.00	68.00
167.725	QP	V	14.92	13.54	28.46	43.50	-15.04	120.00	33.00
804.340	QP	V	24.29	4.85	29.14	46.00	-16.86	115.00	350.00
70.620	QP	H	11.62	15.49	27.11	40.00	-12.89	110.00	250.00
109.650	QP	H	10.92	14.71	25.63	43.50	-17.87	100.00	332.00
171.850	QP	H	14.29	16.23	30.52	43.50	-12.98	100.00	142.00
307.910	QP	H	14.45	9.88	24.33	46.00	-21.67	115.00	330.00
481.360	QP	H	18.61	7.49	26.10	46.00	-19.90	125.00	29.00
597.620	QP	H	20.86	4.24	25.10	46.00	-20.90	110.00	354.00

Remark:

1. Corrected Level = Reading Level + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss

5.4.2 Measurement results: frequency above 1GHz

EUT : WUG2400

Test Condition : 802.11b Tx at channel 1

Test Result:

No spurious emission was found above the spectrum analyzer's noise floor.
The noise floor are listed as below:

Noise floor level**For PK:**

1GHz-3GHz: 20dBuV
3GHz-14GHz: 27dBuV
14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV
3GHz-14GHz: 16dBuV
14GHz-26.5GHz: 28dBuV

EUT : WUG2400

Test Condition : 802.11b Tx at channel 6

Test Result:

No spurious emission was found above the spectrum analyzer's noise floor.
The noise floor are listed as below:

Noise floor level

For PK:

1GHz-3GHz: 20dBuV
3GHz-14GHz: 27dBuV
14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV
3GHz-14GHz: 16dBuV
14GHz-26.5GHz: 28dBuV

EUT : WUG2400

Test Condition : 802.11b Tx at channel 11

Test Result:

No spurious emission was found above the spectrum analyzer's noise floor.
The noise floor are listed as below:

Noise floor level

For PK:

1GHz-3GHz: 20dBuV
3GHz-14GHz: 27dBuV
14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV
3GHz-14GHz: 16dBuV
14GHz-26.5GHz: 28dBuV

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EUT : WUG2400

Test Condition : 802.11g Tx at channel 1

Test Result:

No spurious emission was found above the spectrum analyzer's noise floor.

The noise floor are listed as below:

Noise floor level

For PK:

1GHz-3GHz: 20dBuV
3GHz-14GHz: 27dBuV
14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV
3GHz-14GHz: 16dBuV
14GHz-26.5GHz: 28dBuV

EUT : WUG2400

Test Condition : 802.11g Tx at channel 6

Test Result:

No spurious emission was found above the spectrum analyzer's noise floor.
The noise floor are listed as below:

Noise floor level

For PK:

1GHz-3GHz: 20dBuV
3GHz-14GHz: 27dBuV
14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV
3GHz-14GHz: 16dBuV
14GHz-26.5GHz: 28dBuV

EUT : WUG2400

Test Condition : 802.11g Tx at channel 11

Test Result:

No spurious emission was found above the spectrum analyzer's noise floor.
The noise floor are listed as below:

Noise floor level

For PK:

1GHz-3GHz: 20dBuV
3GHz-14GHz: 27dBuV
14GHz-26.5GHz: 39dBuV

For AV:

1GHz-3GHz: 10dBuV
3GHz-14GHz: 16dBuV
14GHz-26.5GHz: 28dBuV

6. Power Spectrum Density test

6.1 Operating environment

Temperature: 25 °C
Relative Humidity: 55 %
Atmospheric Pressure 1023 hPa

6.2 Test setup & procedure

The power spectrum density per FCC §15.247(d) was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 10kHz, a span of 1.5 MHz, and the sweep time set at 500 seconds. Power Density was read directly correction was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel). The Power Spectral Density measured result is in the following table.

6.3 Measured data of Power Spectrum Density test results

Test Mode: 802.11b operating (DSSS Modulation) mode

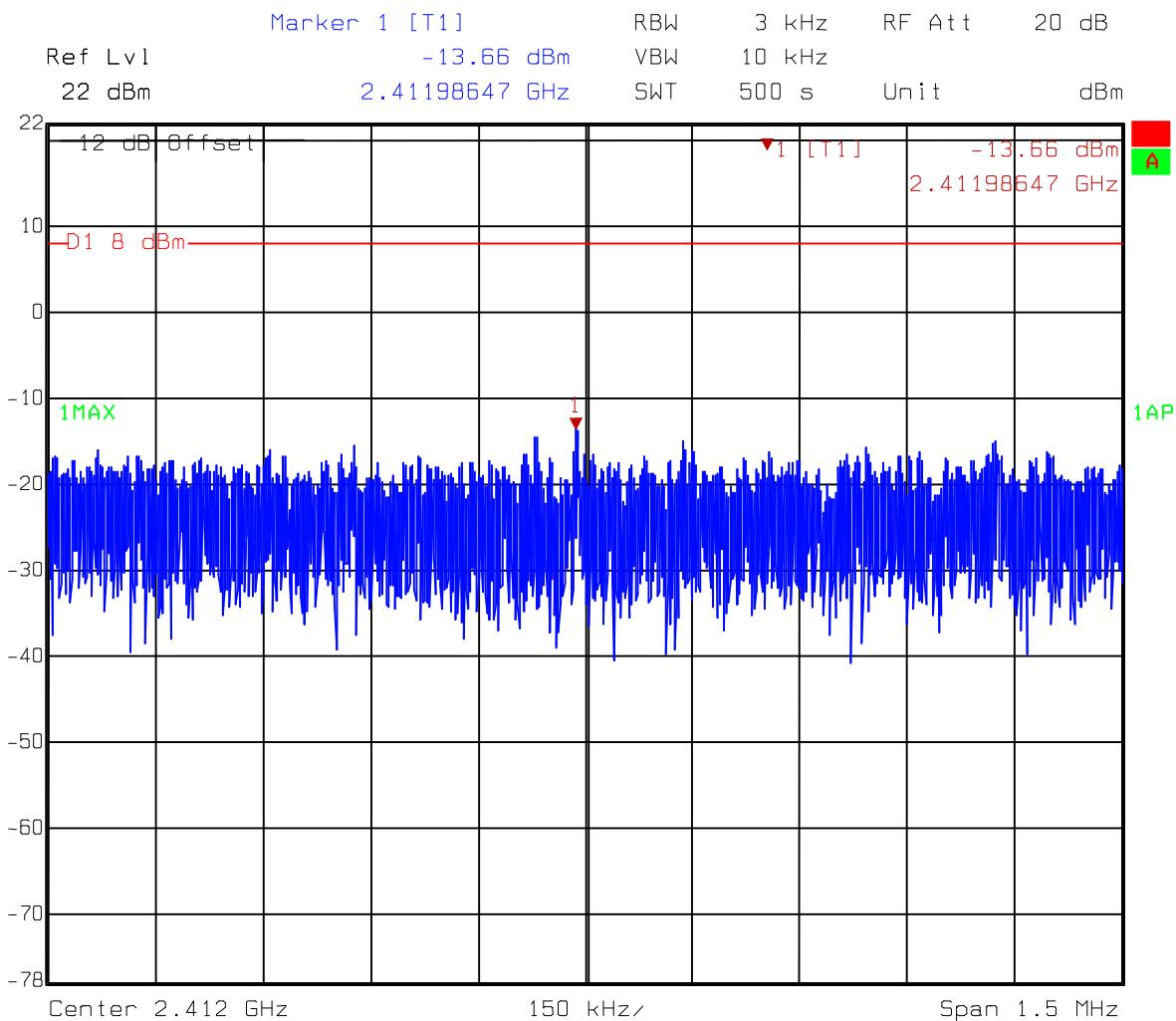
Channel	Frequency (MHz)	Measured level (dBm)	Limit (dBm)
1	2412	-13.66	8
6	2437	-13.44	8
11	2462	-13.43	8

Test Mode: 802.11g operating (OFDM Modulation) mode

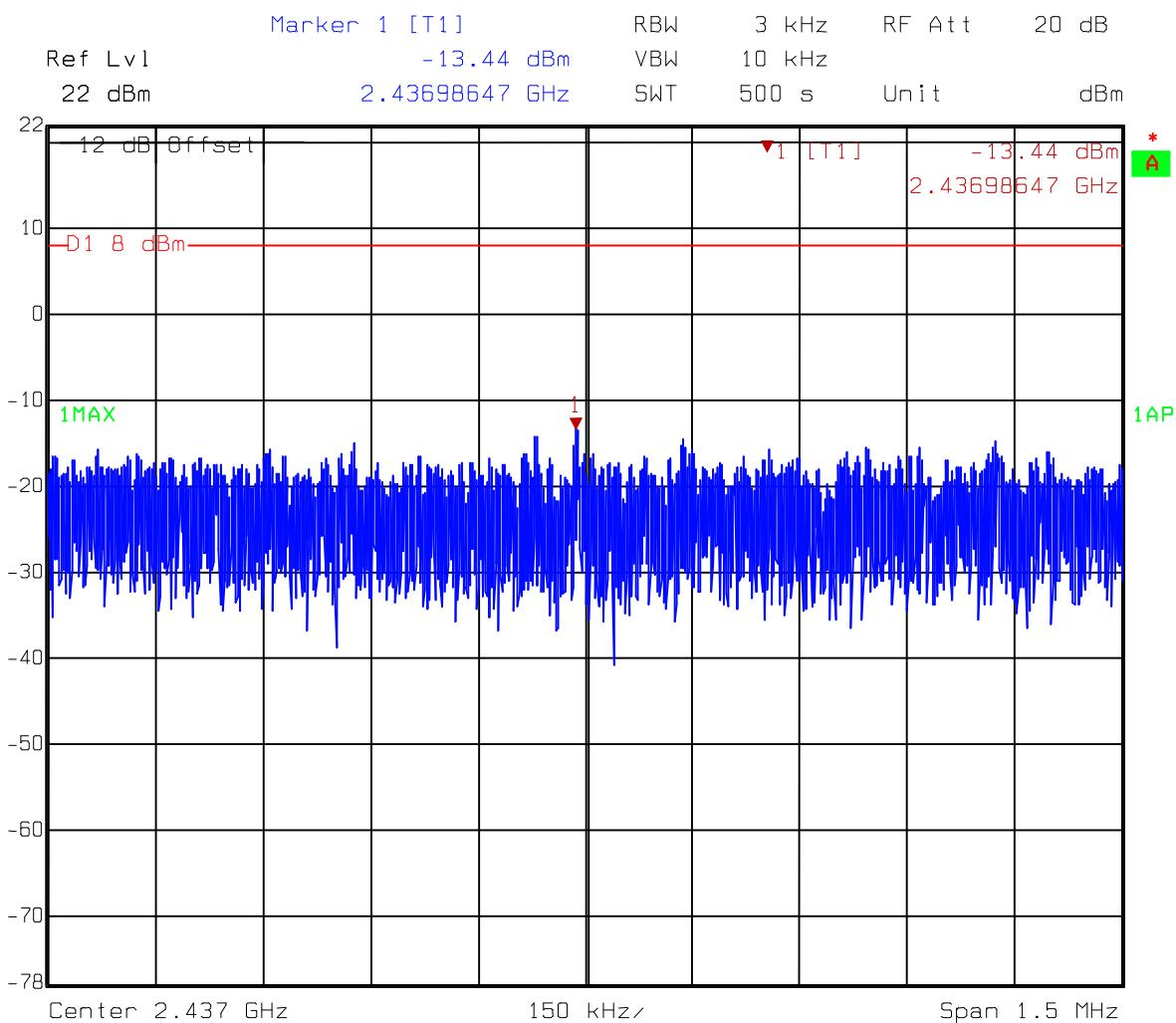
Channel	Frequency (MHz)	Measured level (dBm)	Limit (dBm)
1	2412	-24.49	8
6	2437	-24.56	8
11	2462	-24.47	8

Please see the plot below.

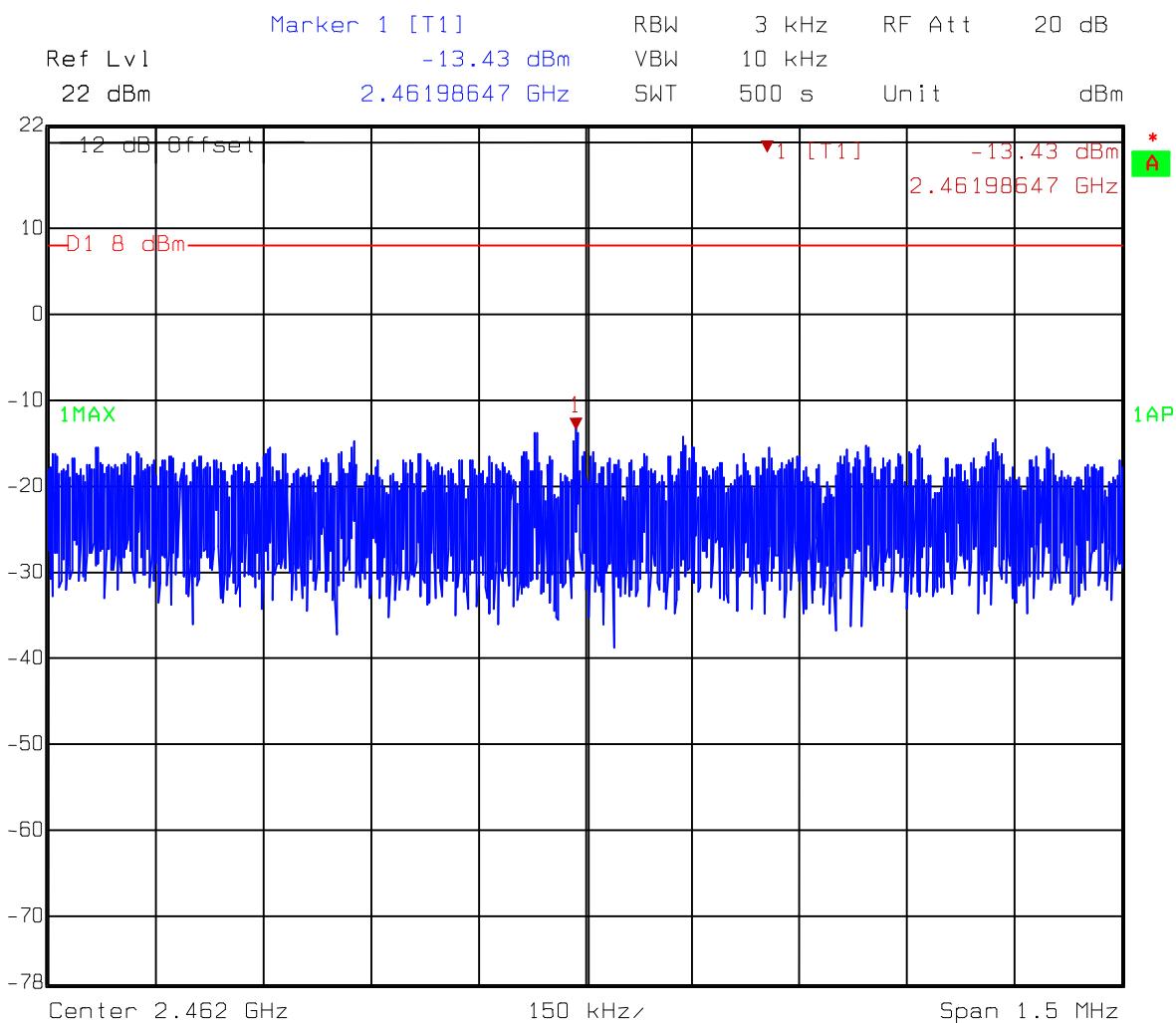
Test Mode: 802.11b operating (DSSS Modulation) mode



Comment A: Power Density
 11b tx Low(EC365)
 Date: 22.MAR.2005 14:28:42

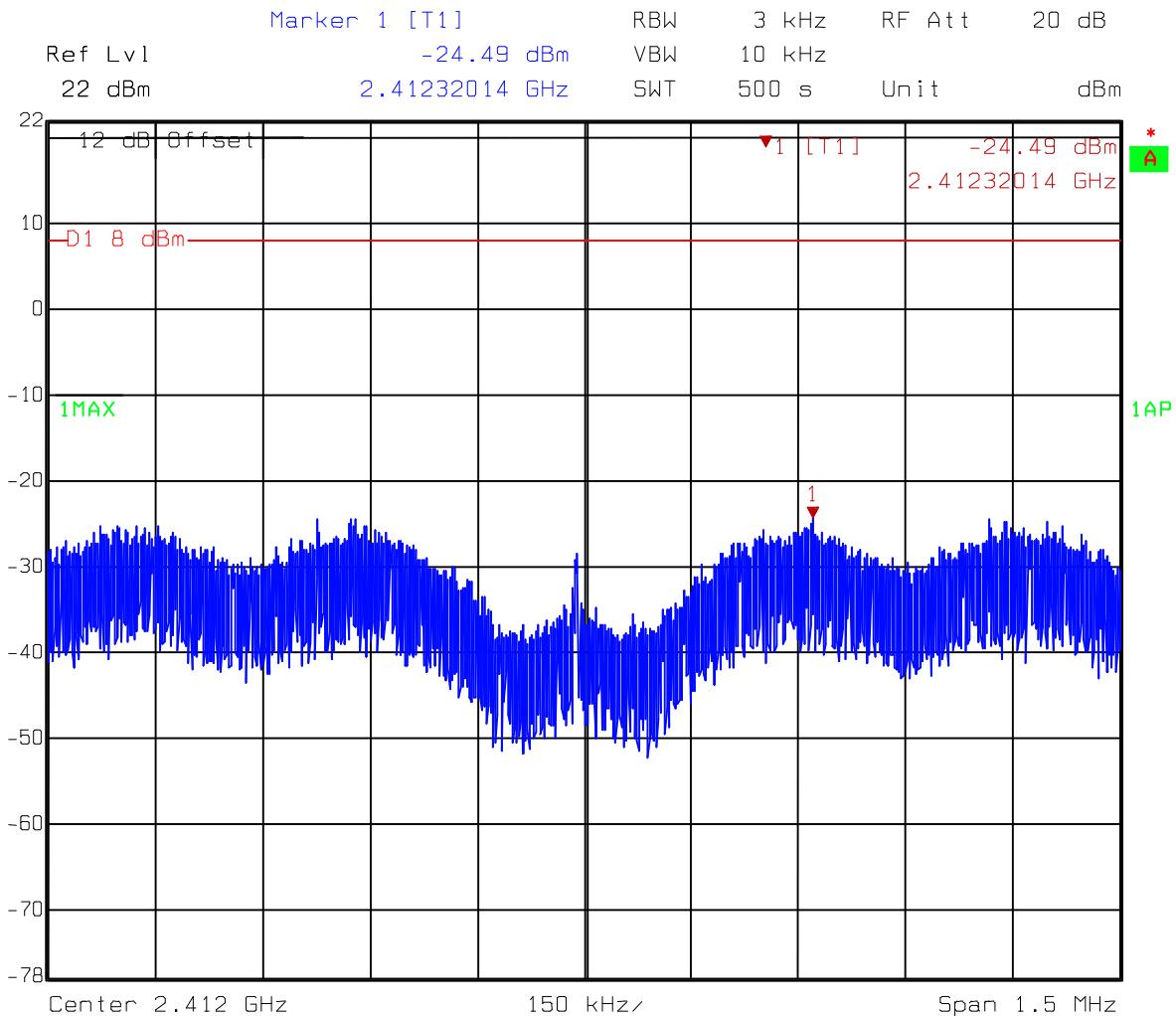


Comment A: Power Density
 11b tx Mid(EC365)
 Date: 22.MAR.2005 14:31:51

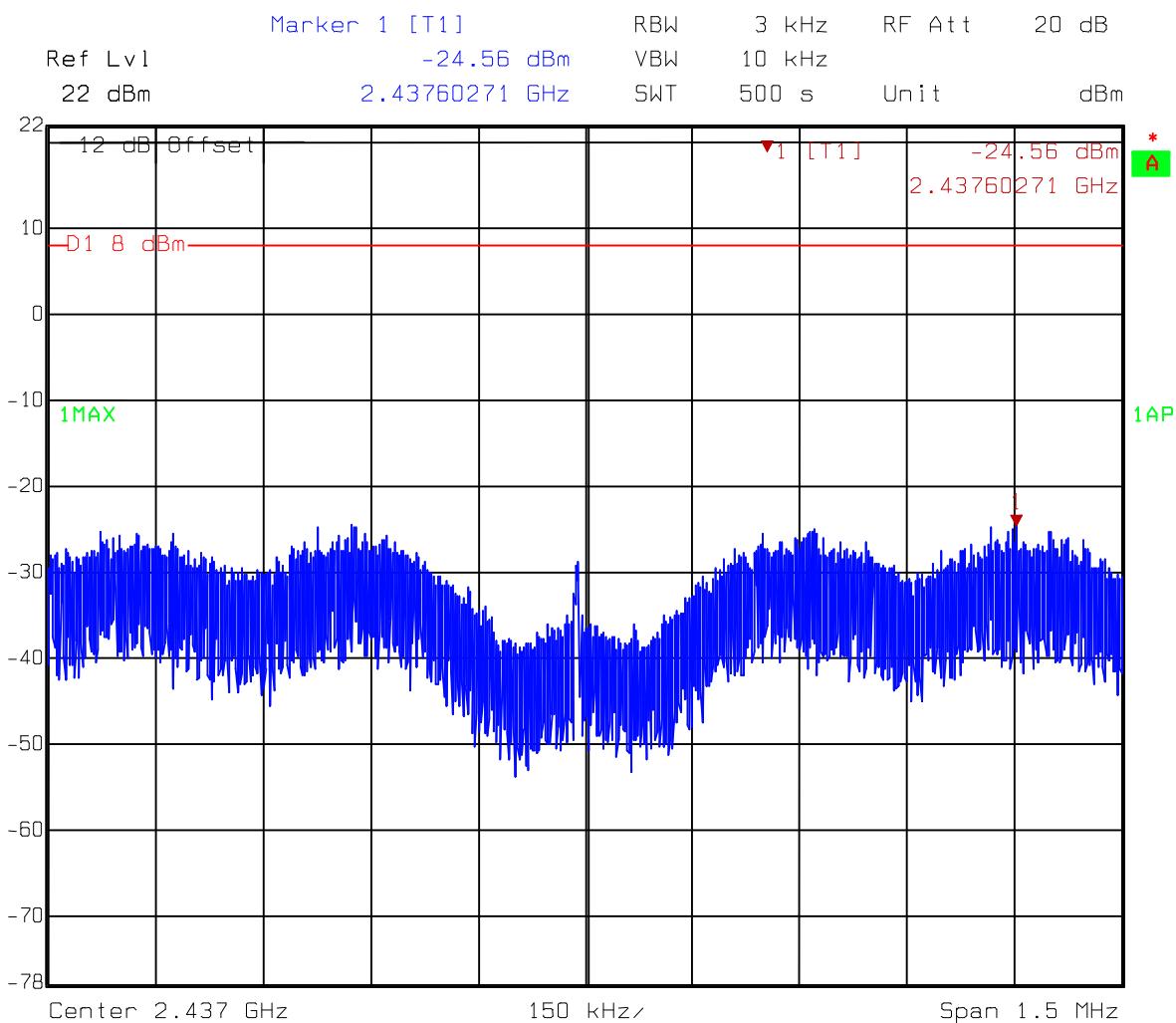


Comment A: Power Density
 11b tx H1(EC365)
 Date: 22.MAR.2005 14:34:09

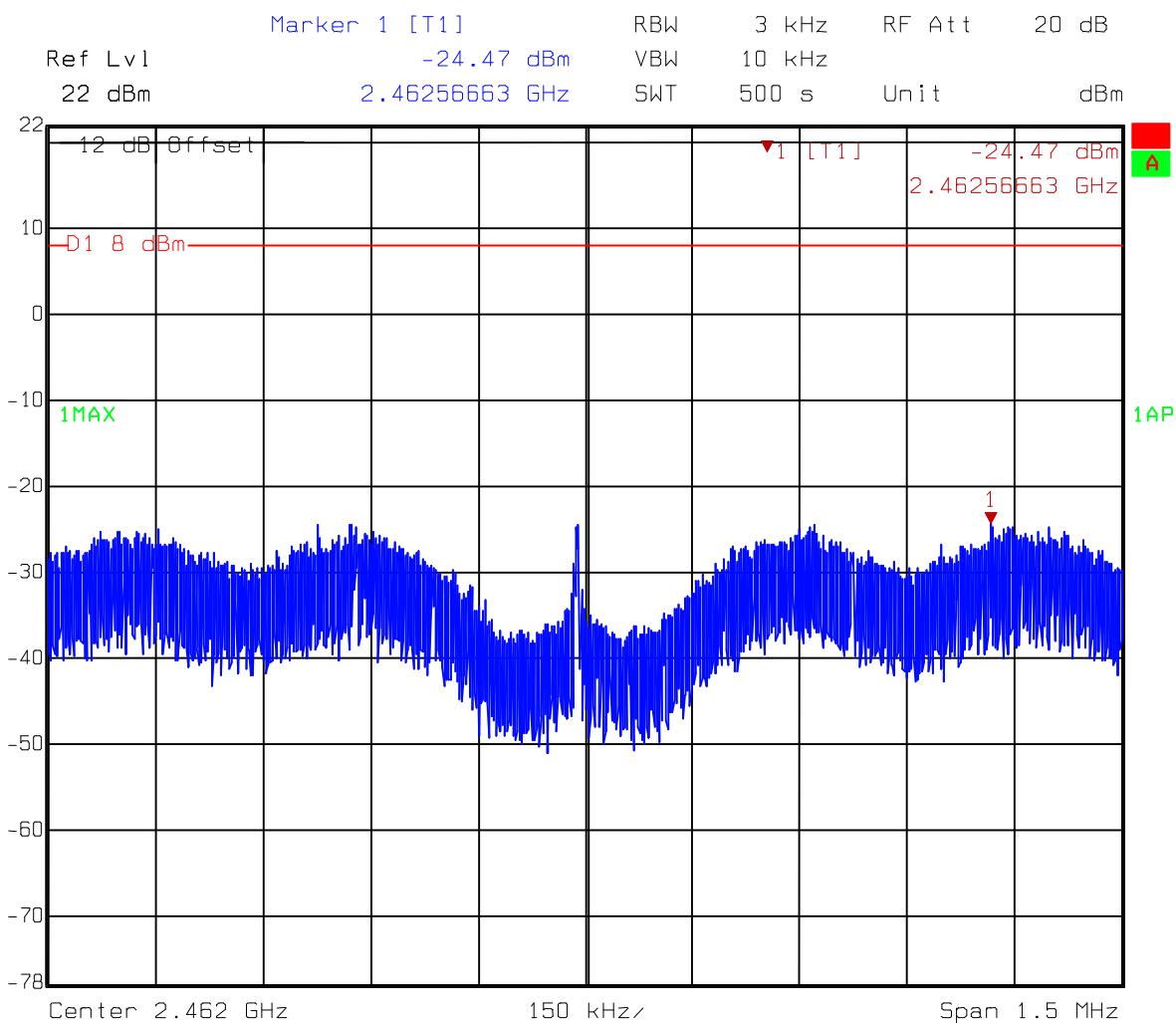
Test Mode: 802.11g operating (OFDM Modulation) mode



Comment A: Power Density
 11g tx Low(EC365)
 Date: 22.MAR.2005 14:36:24



Comment A: Power Density
 11g tx Mid(EC365)
 Date: 22.MAR.2005 14:43:05



Comment A: Power Density
 11g tx H1(EC365)
 Date: 22.MAR.2005 14:41:18

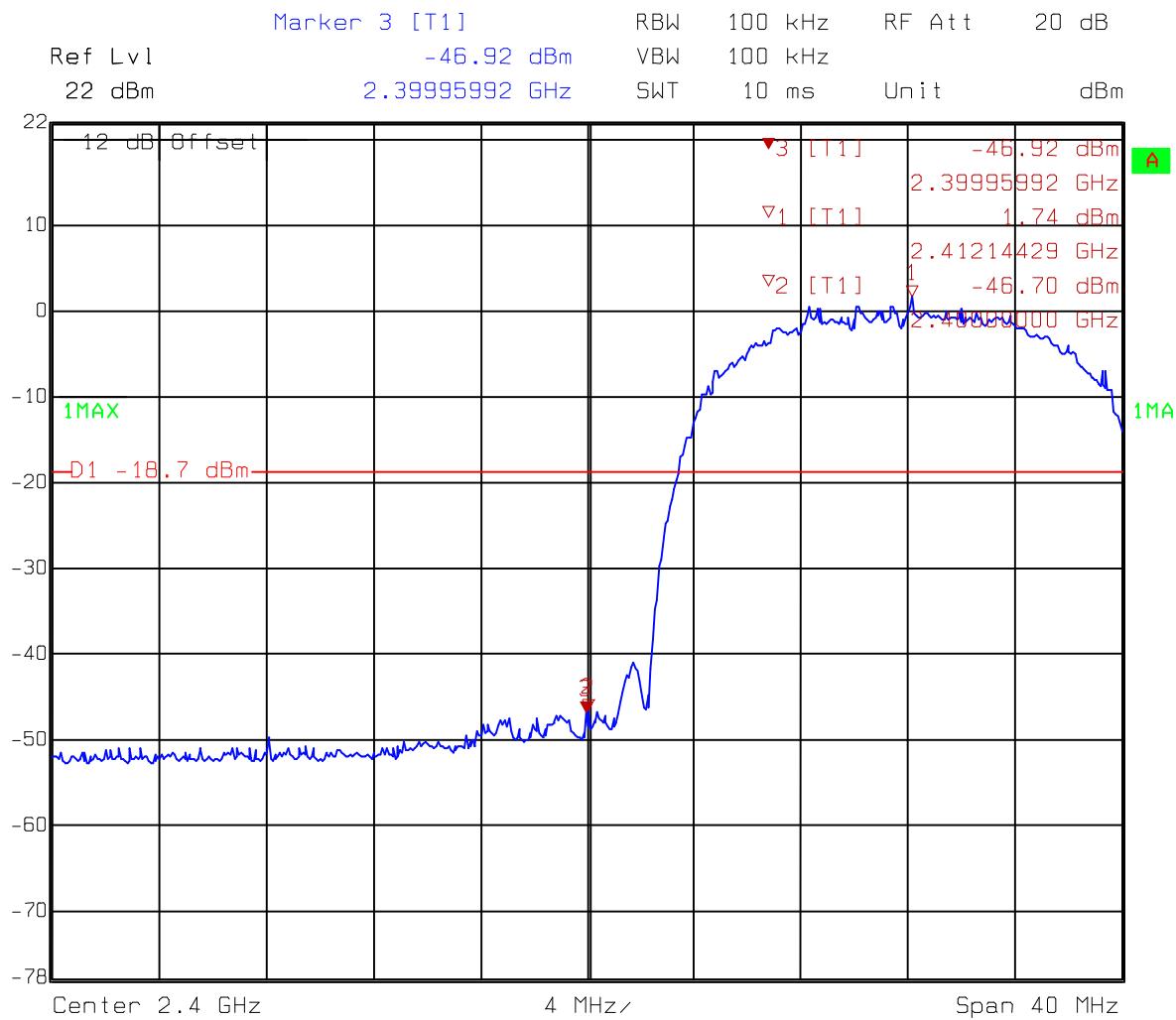
7. Emission on the band edge §FCC 15.247(C)

In any 100kHz 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.

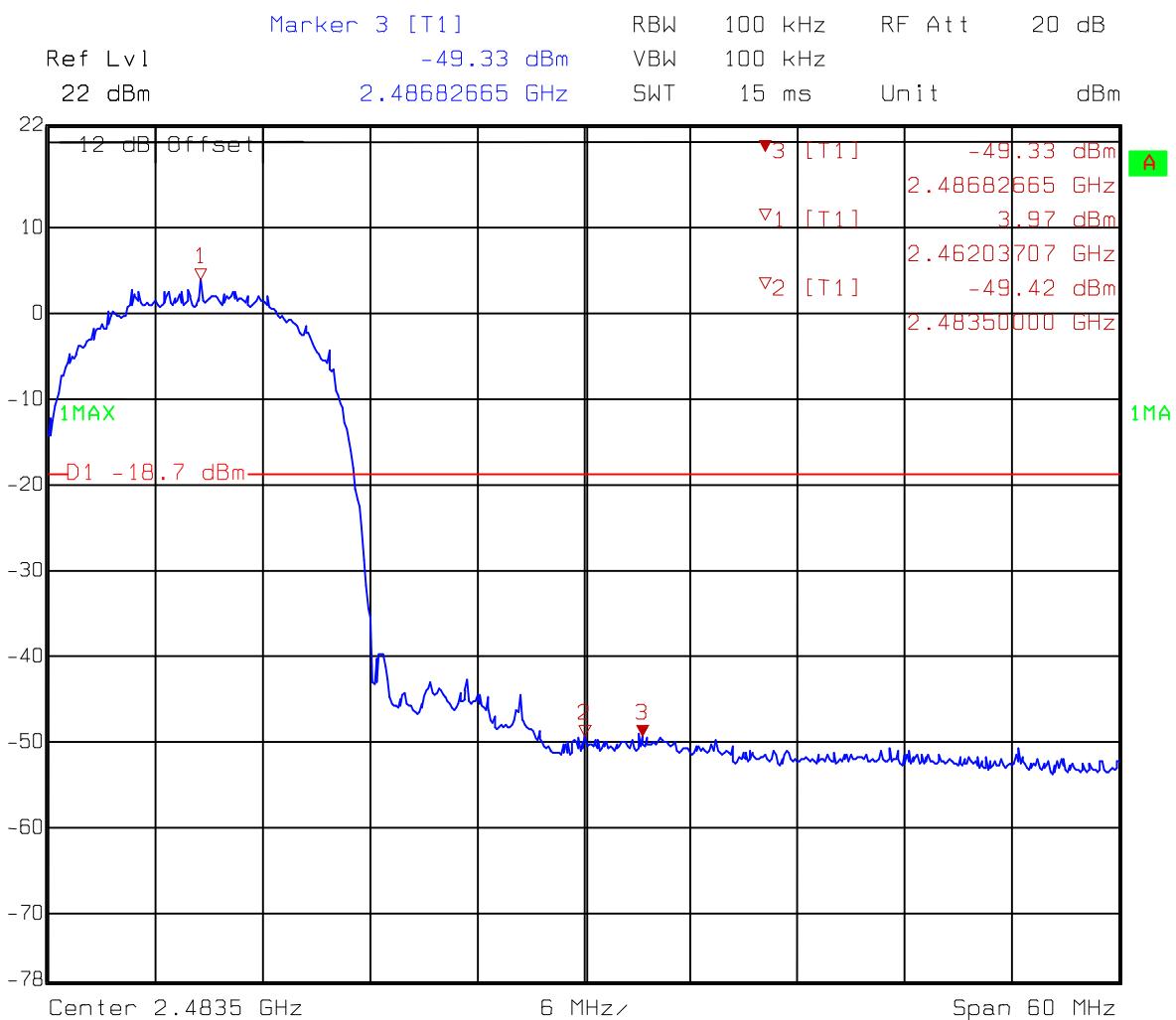
Please see the plot below.

7.1 Band-edge (Conducted method)

Test Mode: 802.11b operating (DSSS Modulation) mode

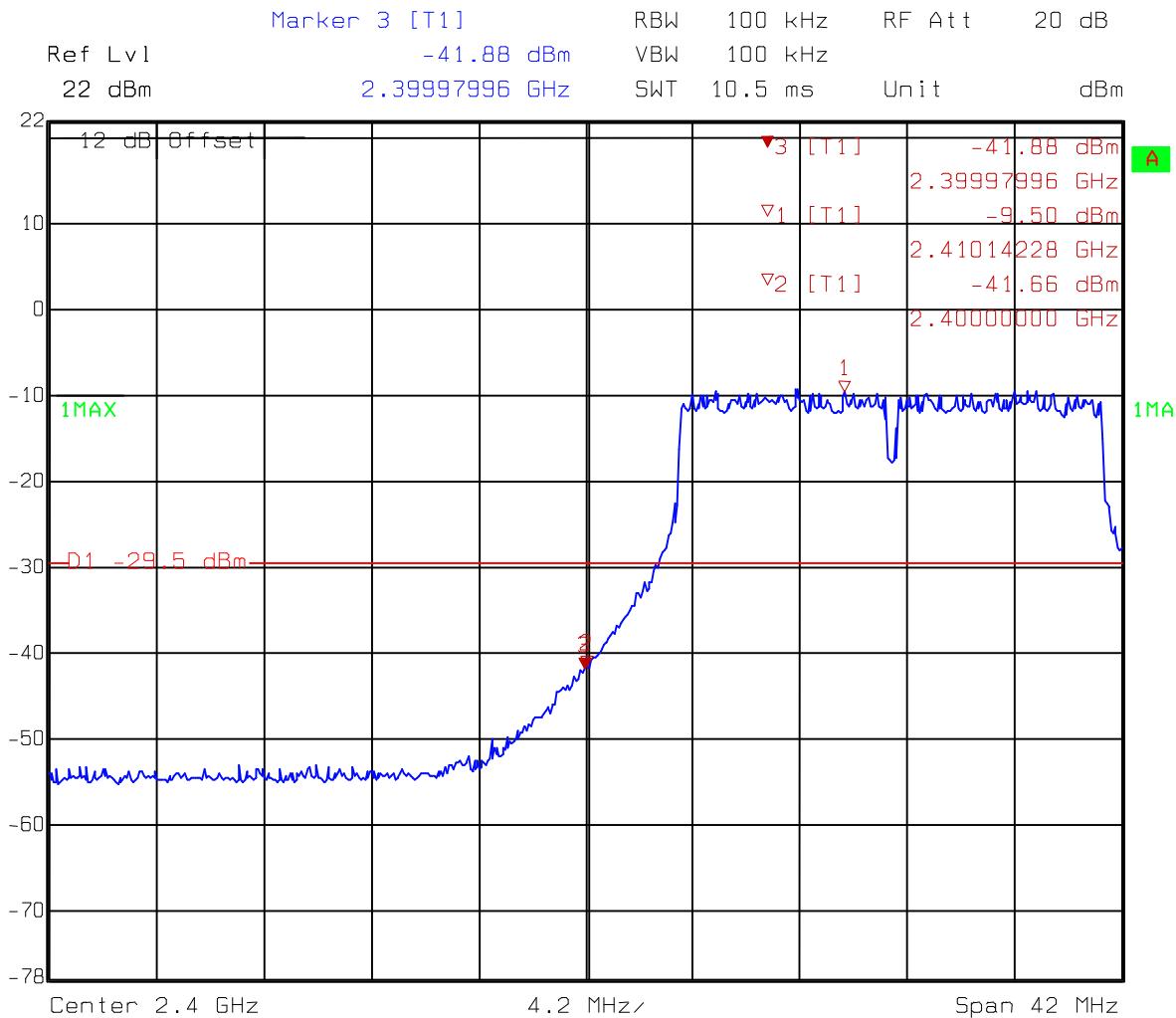


Comment A: Band-Edge
 11b tx Low(EC365)
 Date: 22.MAR.2005 14:55:27

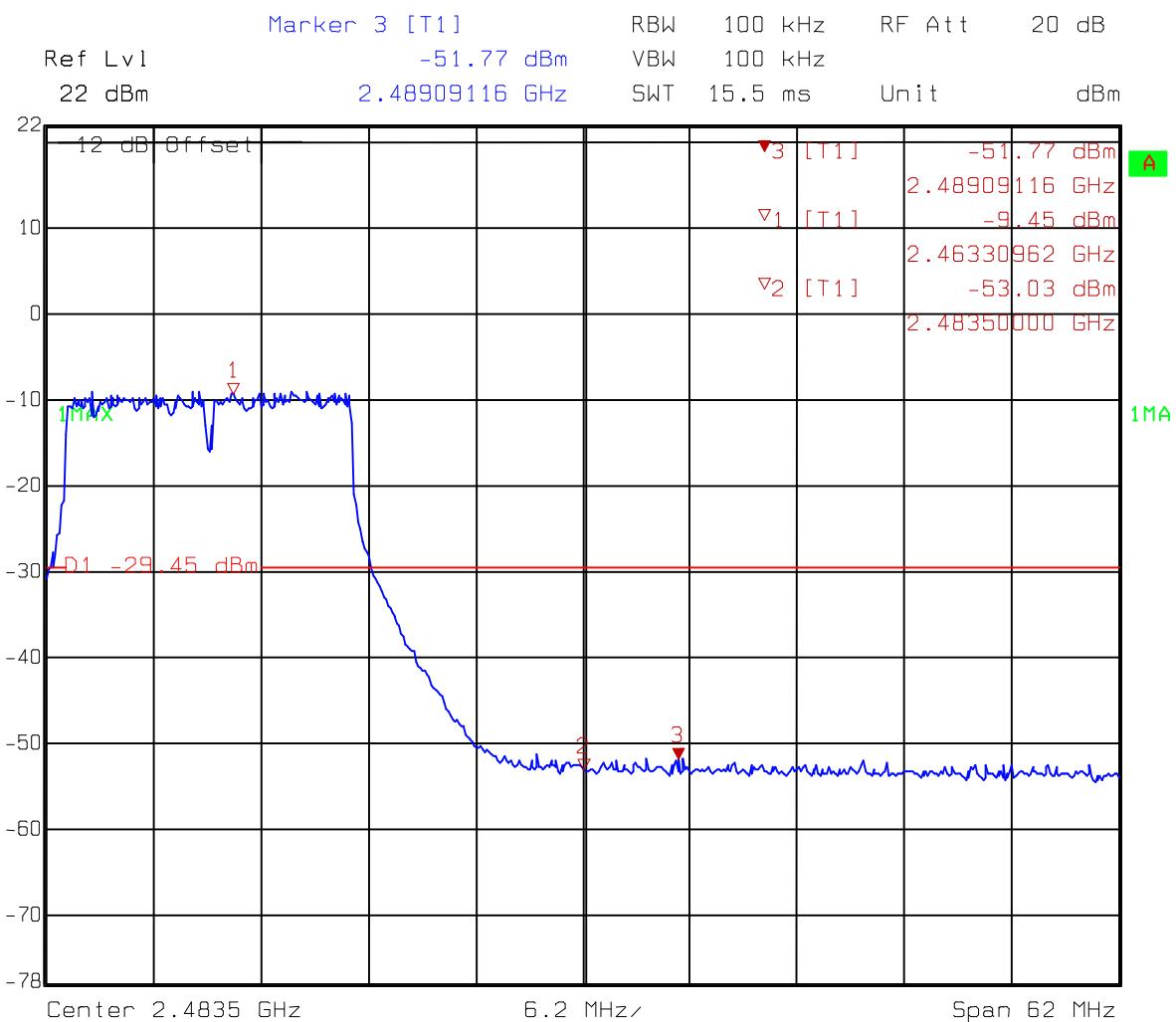


Comment A: Band-Edge
 11b tx H1(EC365)
 Date: 22.MAR.2005 14:59:38

Test Mode: 802.11g operating (OFDM Modulation) mode



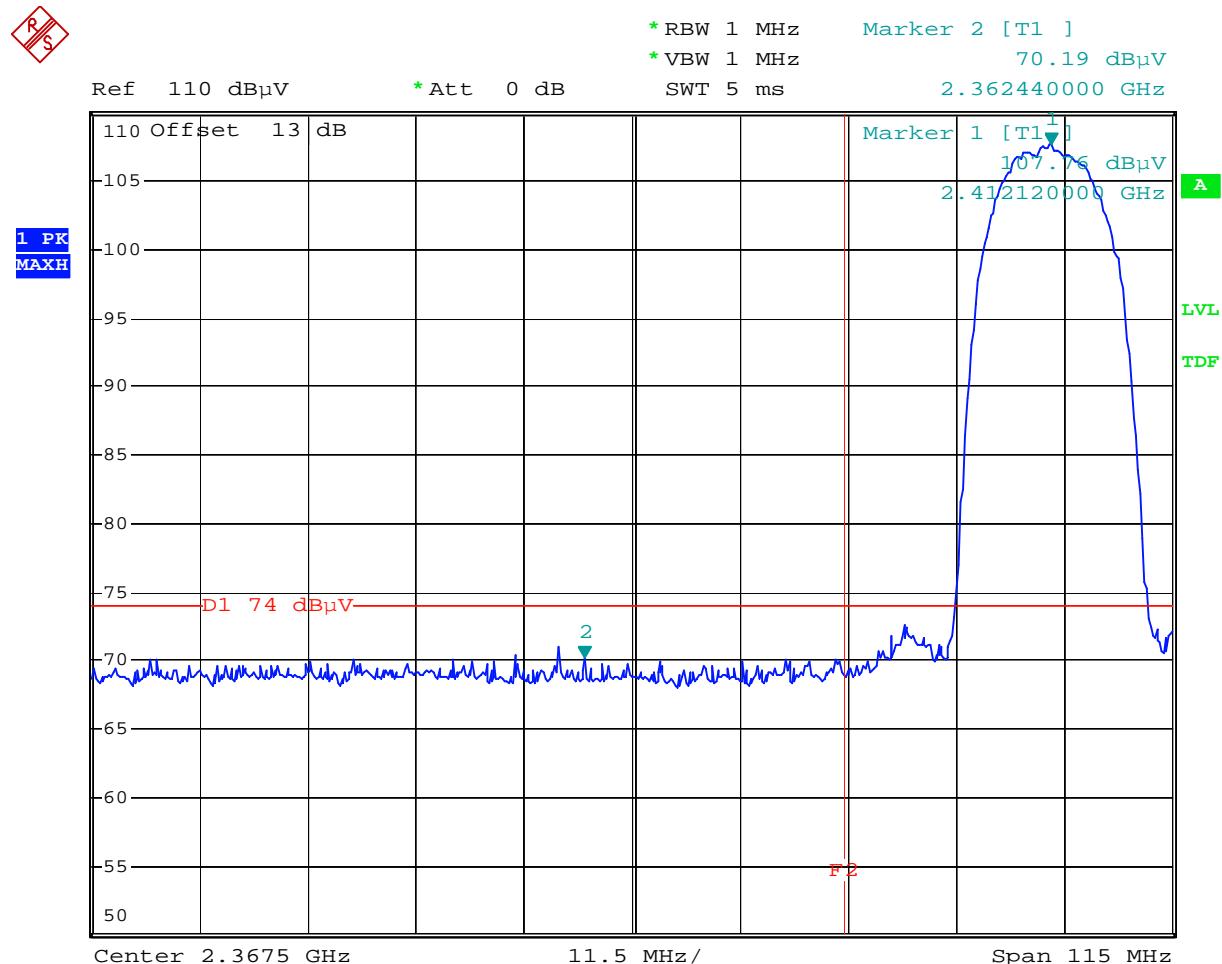
Comment A: Band-Edge
11g tx Low(EC365)
Date: 22.MAR.2005 15:11:05



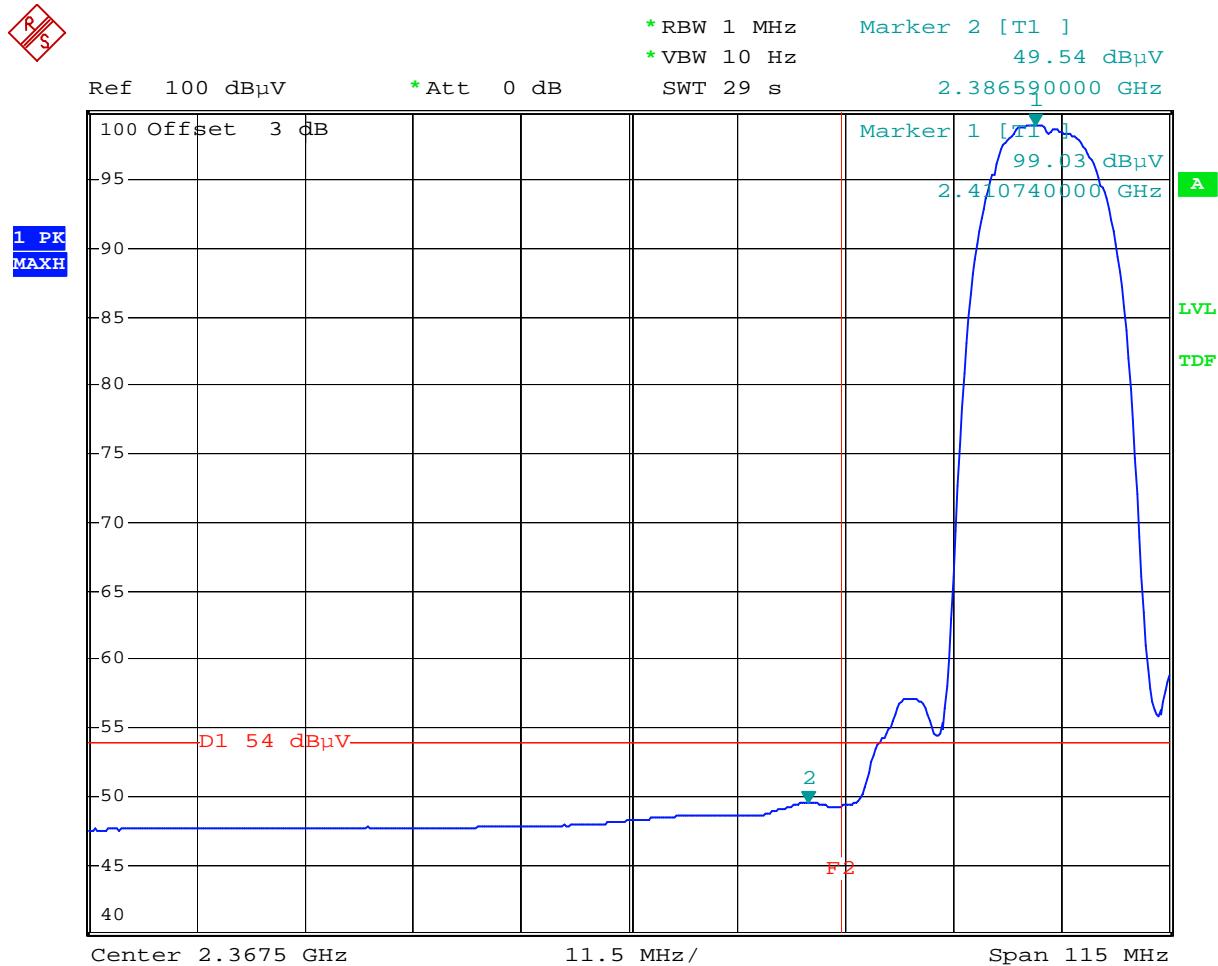
Comment A: Band-Edge
 11g tx H1(EC365)
 Date: 22.MAR.2005 15:19:00

7.2 Band-edge (Radiated method)

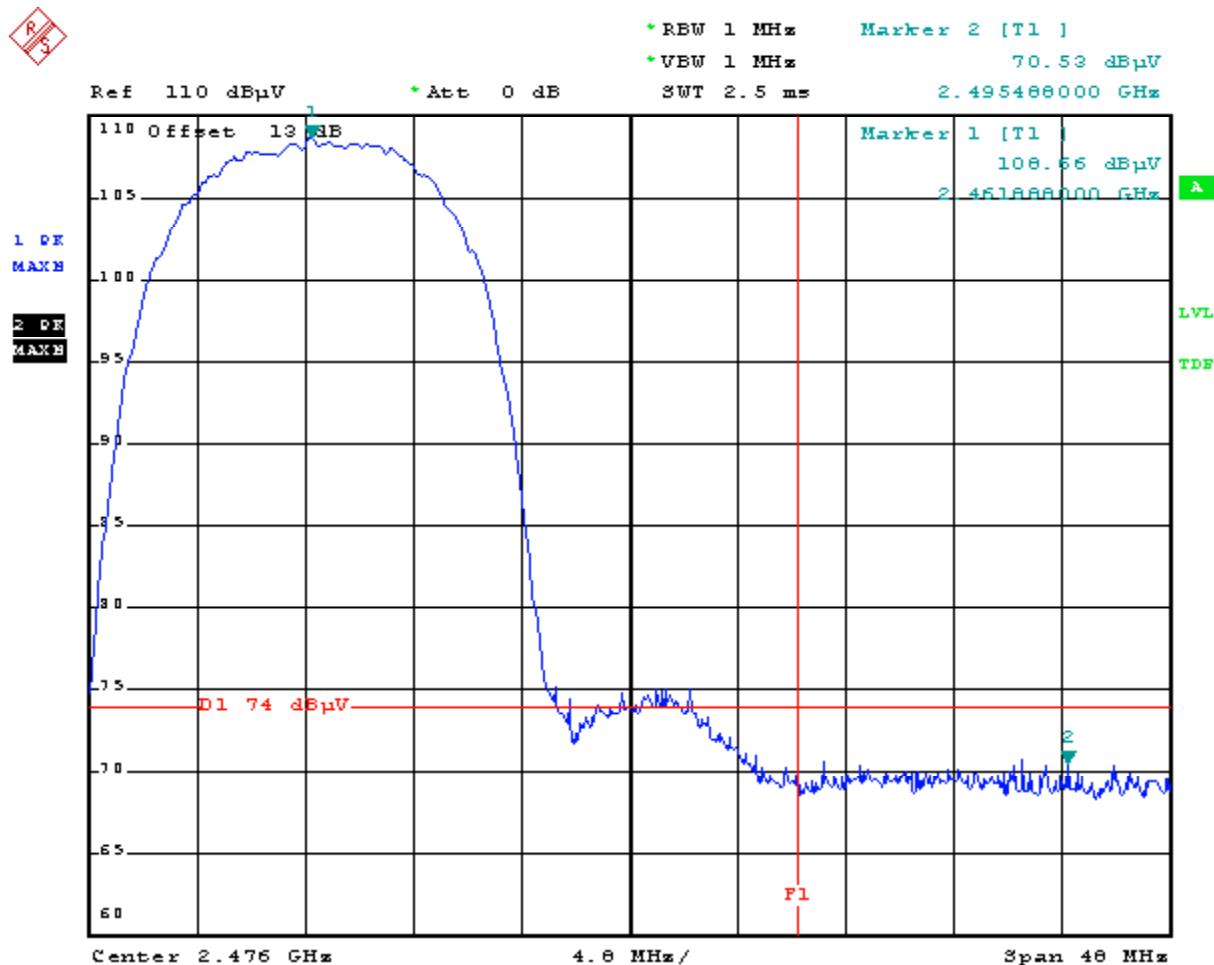
Test Mode: 802.11b operating (DSSS Modulation) mode



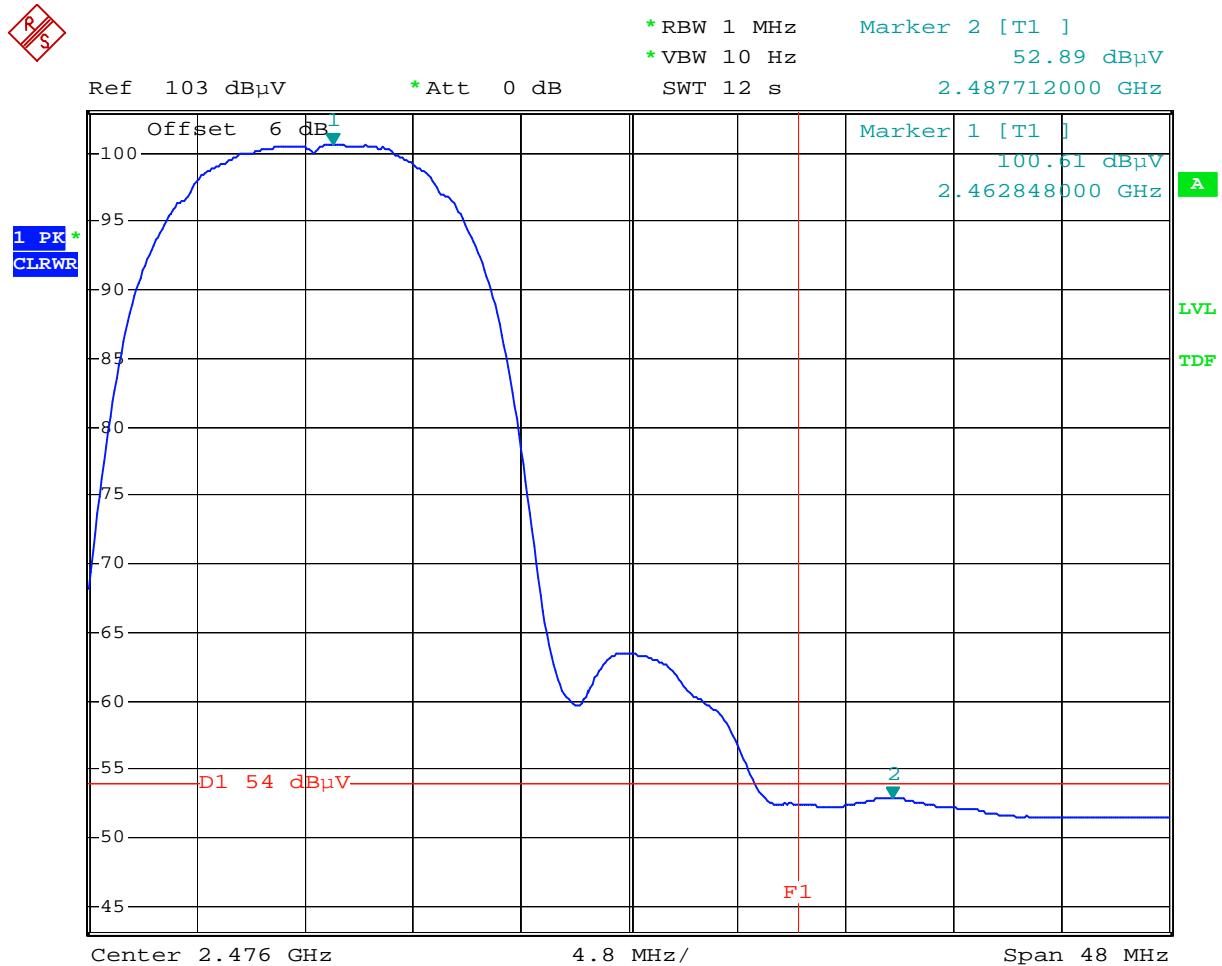
Comment: Band-Edge at 11b low channel F2=2390MHz
 Comment: PK external ATT=13dB (EC371/EC353)(177.7dg/106.5cm)
 Date: 21.MAR.2005 16:40:25



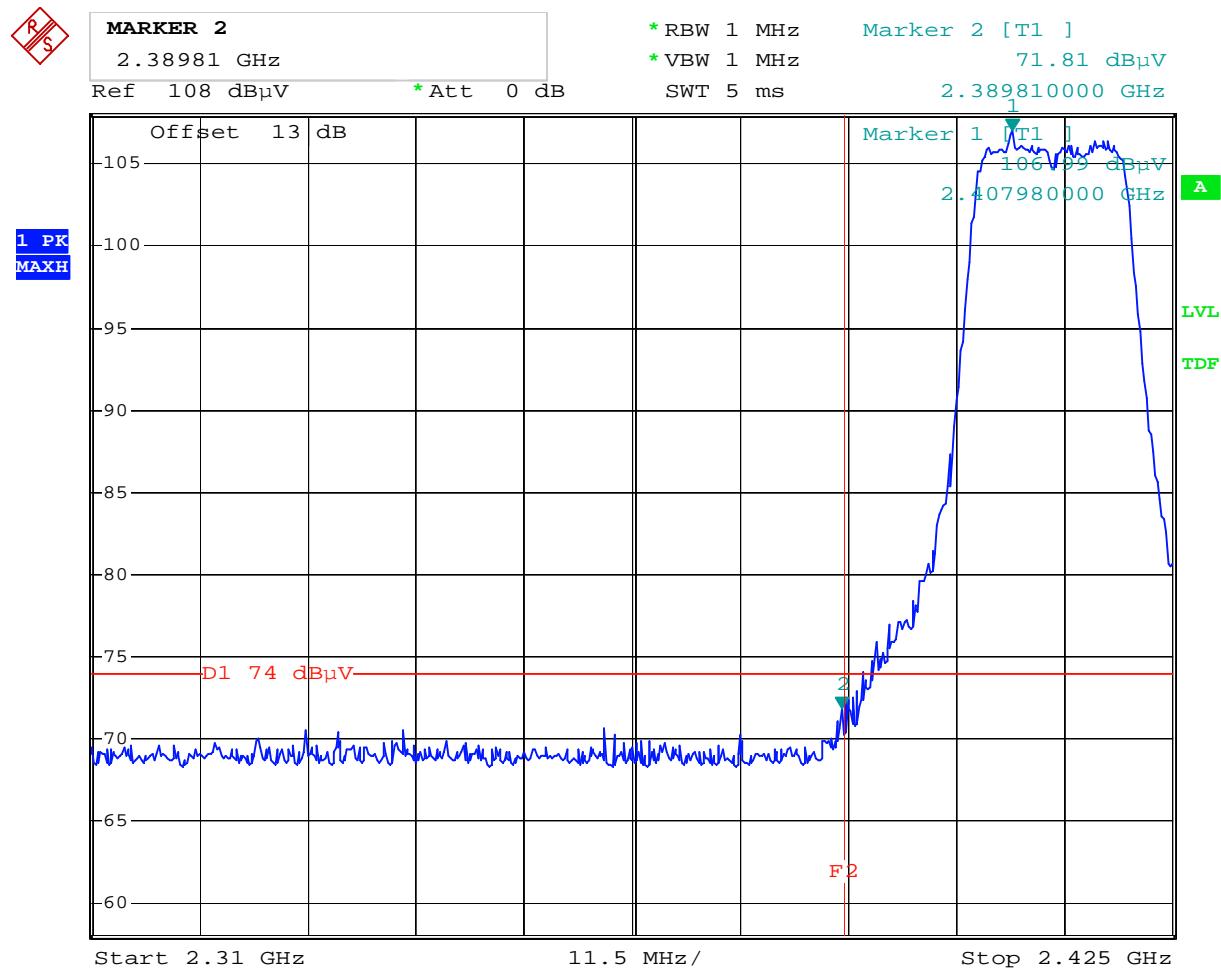
Comment: Band-Edge at 11b low channel F2=2390MHz
 Comment: AV external ATT=3dB (EC371/EC353)(177.7dg/106.5cm)
 Date: 21.MAR.2005 16:34:55



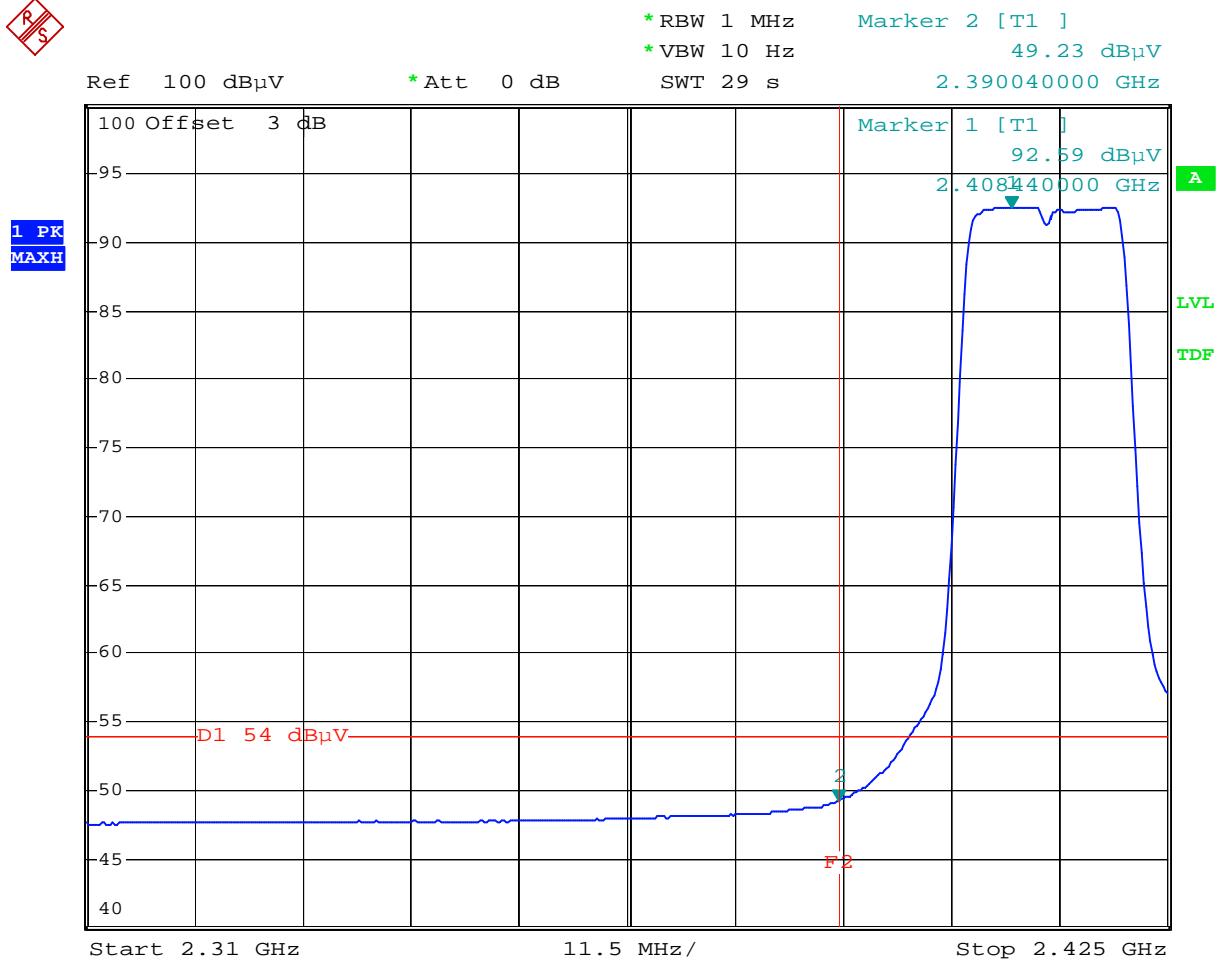
Comment: Band-Edge at 11b high channel F1=2483.5MHz
 Comment: PK external ATT=13dB (EC371/EC353) (168.9dg/109.4cm)
 Date: 21.MAR.2005 17:05:13



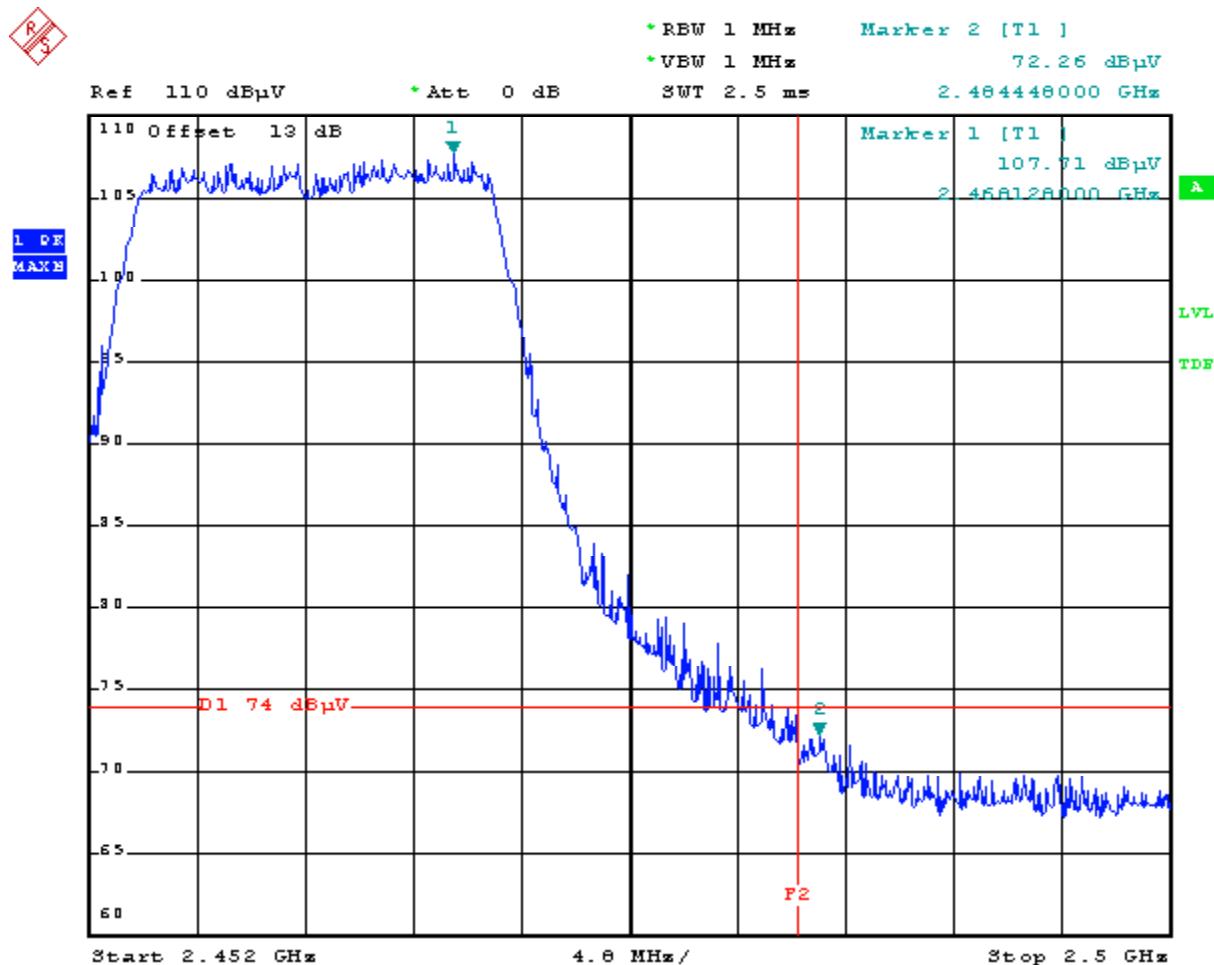
Comment: Band-Edge at 11b high channel F1=2483.5MHz
 Comment: AV external ATT=6dB (EC371/EC353)(168.9dg/109.4cm)
 Date: 21.MAR.2005 17:18:11

Test Mode: 802.11g operating (OFDM Modulation) mode


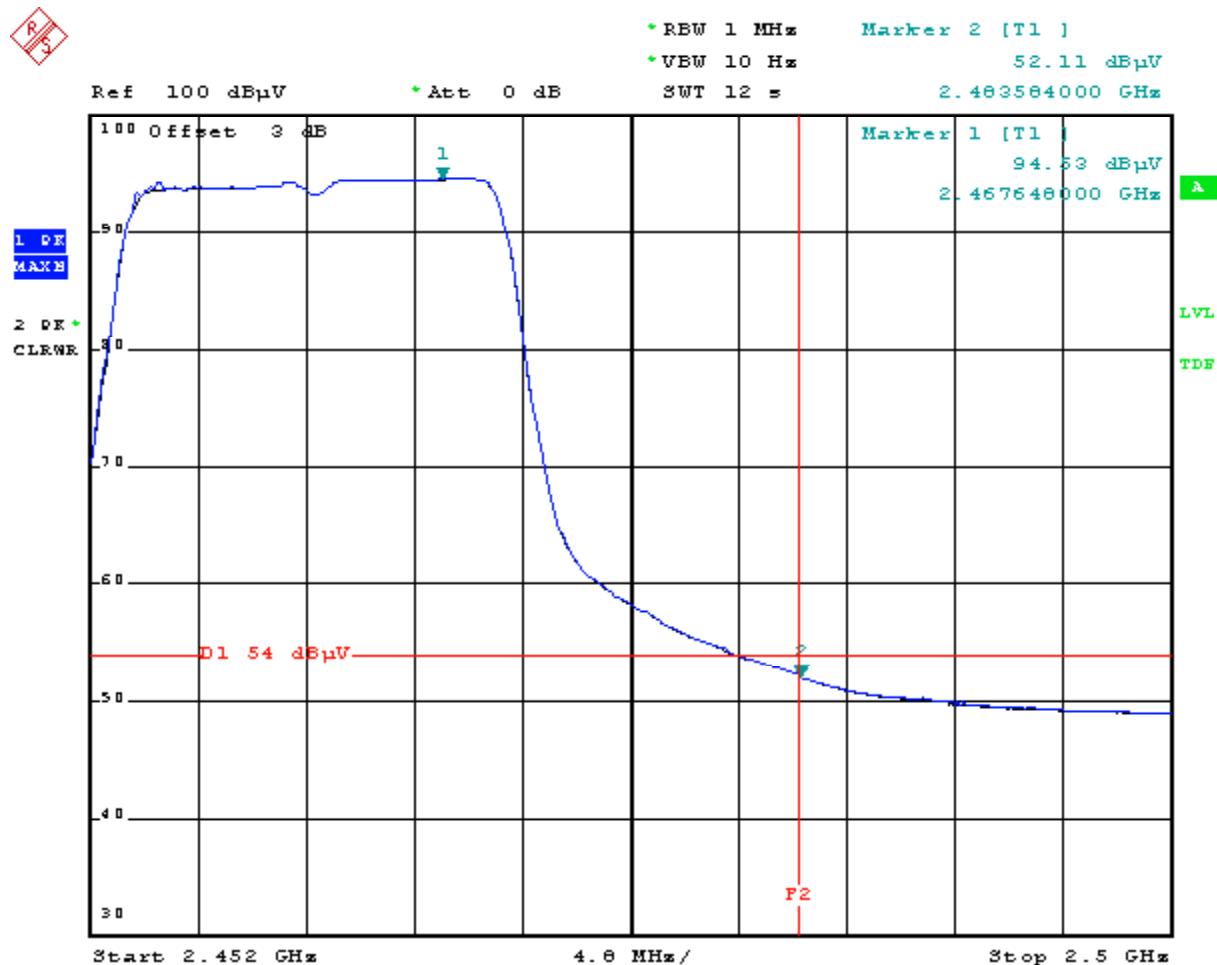
Comment: Band-Edge at 11g low channel F2=2390MHz
 Comment: PK external ATT=13dB (EC371/EC353)(142.3dg/106.9cm)
 Date: 21.MAR.2005 16:15:04

R
S


Comment: Band-Edge at 11g low channel F2=2390MHz
 Comment: AV external ATT=3dB (EC371/EC353)(142.3dg/106.9cm)
 Date: 21.MAR.2005 16:19:59



Comment: Band-Edge at 11g high channel F1=2483.5MHz
 Comment: PK external ATT=13dB (EC371/EC353) (143.1dg/107.9cm)
 Date: 21.MAR.2005 15:56:55



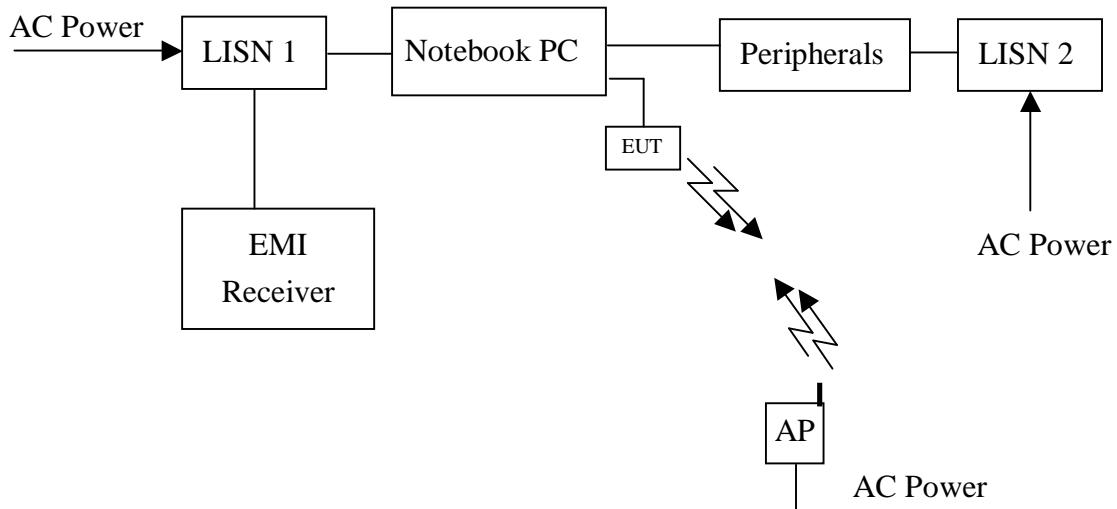
Comment: Band-Edge at 11g high channel F1=2463.5MHz
 Comment: AV external ATT=3dB (EC371/EC353) (143.1dg/107.9cm)
 Date: 21.MAR.2005 15:45:41

8. Power Line Conducted Emission test §FCC 15.207

8.1 Operating environment

Temperature: 23 °C
Relative Humidity: 55 %
Atmospheric Pressure 1023 hPa

8.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/2003 on conducted measurement. The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

The EUT configuration please refer to the “Conducted set-up photo.pdf”.

8.3 Emission limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

8.4 Uncertainty of Conducted Emission

Expanded uncertainty (k=2) of conducted emission measurement is ± 2.6 dB.

8.5 Power Line Conducted Emission test data

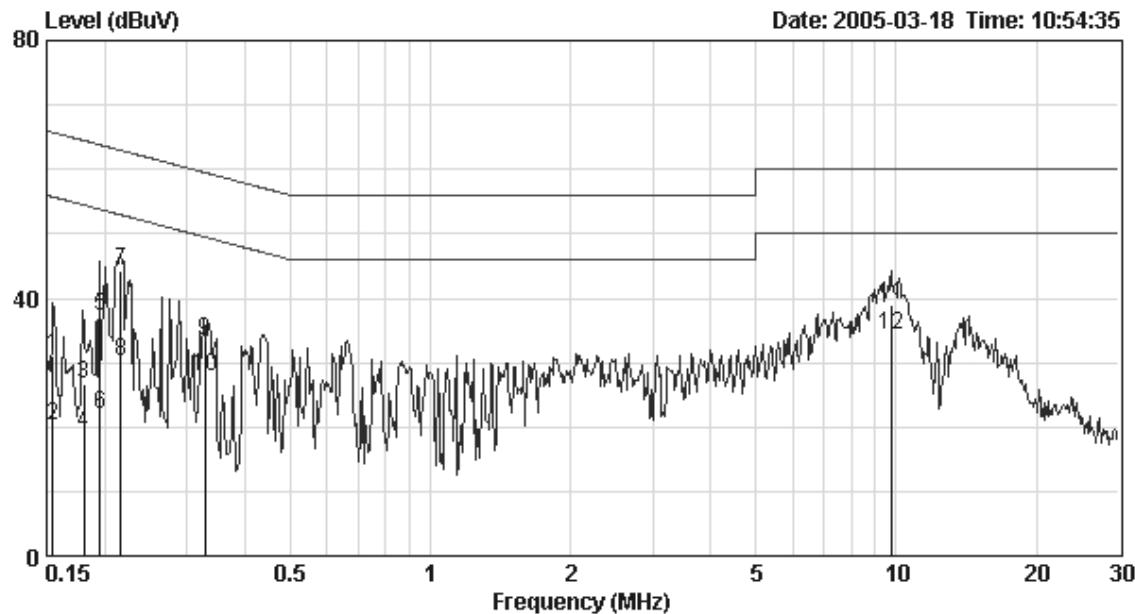
The test was performed the 802.11b and 802.11g normal operating modes, the worst case was occurred at 802.11g normal operating mode.

Phase: Line
Model No.: WUG2400
Worst Case: 802.11g normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB)	
-----	-----	-----	-----	-----	-----	Qp	Av
0.155	0.10	31.00	65.74	20.36	55.74	-34.74	-35.38
0.180	0.10	26.74	64.48	19.07	54.48	-37.74	-35.41
0.195	0.10	37.34	63.82	22.07	53.82	-26.48	-31.75
0.216	0.10	44.34	62.96	30.28	52.96	-18.62	-22.68
0.328	0.10	33.37	59.51	27.71	49.51	-26.14	-21.80
9.759	0.49	38.96	60.00	34.40	50.00	-21.04	-15.60

Remark:

1. Corr. Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral
Model No.: WUG2400
Worst Case: 802.11g normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB)	
-----	-----	-----	-----	-----	-----	Qp	Av
0.166	0.10	20.44	65.14	12.29	55.14	-44.70	-42.85
0.216	0.10	44.41	62.96	33.46	52.96	-18.55	-19.50
0.222	0.10	44.59	62.76	24.98	52.76	-18.17	-27.78
0.273	0.10	18.15	61.04	21.78	51.04	-42.89	-29.26
0.666	0.10	28.96	56.00	21.51	46.00	-27.04	-24.49
9.682	0.30	38.58	60.00	32.76	50.00	-21.42	-17.24

Remark:

1. Corr. Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)

