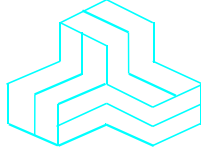


# ENGINEERING TEST REPORT



## Rugged Mobile Video Camera with Integrated Radio Model No.: MCD2000

**FCC ID: T78-MCD2000**

*Applicant:*

**Librestream Technologies, Inc.**  
895 Waverley Street, Suite 110  
Winnipeg, Manitoba, Canada, R3T 5P4

*In Accordance With*

**Federal Communications Commission (FCC)  
Part 15, Subpart C, Section 15.247  
Digital Modulation Systems (DTS) Operating in 2400 – 2483.5 MHz Band**

**UltraTech's File No.: LIBT-015F15C247**

This Test report is Issued under the Authority  
of  
Tri M. Luu, Professional Engineer,  
Vice President of Engineering  
UltraTech Group of Labs



Date: July 25, 2008

Report Prepared by: JaeWook Choi

Tested by: Mr. Hung Trinh, EMI/RFI Technician

Issued Date: July 25, 2008

Test Dates: July 9, 10, 14 & 17, 2008

*The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.  
This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

## UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4  
Tel.: (905) 829-1570 Fax.: (905) 829-8050  
Website: [www.ultratech-labs.com](http://www.ultratech-labs.com), Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Email: [tri@ultratech-labs.com](mailto:tri@ultratech-labs.com)



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31040/SIT



C-1376



46390-2049



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SL2-IN-E-1119R

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## EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	<ul style="list-style-type: none"> <li>▪ Exhibit 1: Submittal check lists</li> <li>▪ Exhibit 2: Introduction</li> <li>▪ Exhibit 3: Performance Assessment</li> <li>▪ Exhibit 4: EUT Operation and Configuration during Tests</li> <li>▪ Exhibit 5: Summary of test Results</li> <li>▪ Exhibit 6: Measurement Data</li> <li>▪ Exhibit 7: Measurement Uncertainty</li> </ul>	OK
1	Test Setup Photos	<ul style="list-style-type: none"> <li>▪ Power Line Conducted Emissions Setup Photos</li> <li>▪ Radiated Emissions Setup Photos</li> </ul>	OK
2	External EUT Photos	External EUT Photos	OK
3	Internal EUT Photos	Internal EUT Photos	OK
4	Cover Letters	<ul style="list-style-type: none"> <li>▪ Letter from Ultratech for Certification Request</li> <li>▪ Letter from the Applicant to appoint Ultratech to act as an agent</li> <li>▪ Letter from the Applicant to request for Confidentiality Filing</li> </ul>	OK
5	Attestation Statements	--	--
6	ID Label/Location Info	ID Label and Location of Label	OK
7	Block Diagrams	Block Diagram	OK
8	Schematic Diagrams	Schematics	OK
9	Parts List/Tune Up Info	Parts List	OK
10	Operational Description	Operation Description	OK
11	RF Exposure Info	SAR test report	OK
12	Users Manual	User's Guide	OK

### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: LIBT-015F15C247  
 July 25, 2008

*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

## EXHIBIT 2. INTRODUCTION

### 2.1. SCOPE

<b>Reference:</b>	FCC Part 15, Subpart C, Section 15.247
<b>Title:</b>	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
<b>Purpose of Test:</b>	Equipment Certification for Digital Modulation Systems (DTS) Transmitter Operating in the Frequency Band 2400-2483.5 MHz.
<b>Test Procedures:</b>	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
<b>Environmental Classification:</b>	[ x ] Commercial, industrial or business environment [ x ] Residential environment

### 2.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

### 2.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2007	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	2006 2006	Information Technology Equipment - Radio Disturbance Characteristics – Limits and Methods of Measurement
CISPR 16-1-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement
KDB Publication No. 558074	2005	Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

## EXHIBIT 3. PERFORMANCE ASSESSMENT

### 3.1. CLIENT INFORMATION

APPLICANT	
<b>Name:</b>	Librestream Technologies, Inc.
<b>Address:</b>	895 Waverley Street, Suite 110 Winnipeg, Manitoba, Canada, R3T 5P4
<b>Contact Person:</b>	Mr. Bill Gillanders Phone #: 204-487-0612 ext 207 Fax #: 204-487-0914 Email Address: <a href="mailto:Bill.gillanders@librestream.com">Bill.gillanders@librestream.com</a>

MANUFACTURER	
<b>Name:</b>	Librestream Technologies, Inc.
<b>Address:</b>	895 Waverley Street, Suite 110 Winnipeg, Manitoba, Canada, R3T 5P4
<b>Contact Person:</b>	Mr. Bill Gillanders Phone #: 204-487-0612 ext 207 Fax #: 204-487-0914 Email Address: <a href="mailto:Bill.gillanders@librestream.com">Bill.gillanders@librestream.com</a>

### 3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

<b>Brand Name:</b>	Librestream nSight or Tandbert FieldView
<b>Product Name:</b>	Rugged Mobile Video Camera with Integrated Radio
<b>Model Name or Number:</b>	MCD2000
<b>Serial Number:</b>	Test Sample
<b>Type of Equipment:</b>	Digital Modulation Transmitter
<b>Input Power Supply Type:</b>	External Power Supply Adapter: 120/230Vac 50/60 Hz (AC/DC Adaptor, CUI Inc, M/N: 3A-181WP12) Li-Ion Battery (7.2VDC, 2400mAh, P/N: 100229)
<b>Primary User Functions of EUT:</b>	Provide wireless video and audio data communication

### 3.3. EUT'S TECHNICAL SPECIFICATIONS

<b>TRANSMITTER</b>	
<b>Equipment Type:</b>	Portable
<b>Intended Operating Environment:</b>	Residential Commercial, industrial or business
<b>Power Supply Requirement:</b>	12.0VDC ± 10%
<b>RF Output Power Rating:</b>	802.11b: 15.56 dBm peak conducted 802.11g: 18.94 dBm peak conducted
<b>Operating Frequency Range:</b>	2412 – 2462 MHz
<b>Channel Spacing:</b>	5 MHz
<b>Duty Cycle:</b>	100 %
<b>6 dB bandwidth:</b>	802.11b: 9.980 802.11g: 16.653
<b>Modulation Type:</b>	802.11b: DBPSK(1Mbps), DQPSK(2Mbps), CCK(5.5/11Mbps) 802.11g: OFDM(6M-54Mbps)
<b>Oscillator Frequencies:</b>	Y1                    25.000 MHz Y10                   32.758 kHz Y2, Y5                48.000 MHz Y4, Y9                8.000 MHz Y6                     14.31818 MHz Y7, Y11              32.768 kHz Y8                     12.288 MHz
<b>Antenna Description:</b>	Manufacturer:        Centurion Type:                    Internal antenna – embedded Model:                  NonoBlue Frequency Range:    2400-2500 MHz Gain (dBi):            2 dBi
<b>Antenna Connector Type:</b>	U.FL

### 3.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	USB	1	USB-A	Shielded
2	S-Video	1	S-Video	Shielded
3	Line/Mic in Audio	1	2.5mm jack	Shielded
4	Headset Audio	1	3.5mm jack	Non-Shielded
5	Ethernet Port	1	UTP, RJ45	Non-Shielded
6	Power	1	2.1mm x 5.5mm barrel	Non-Shielded

### 3.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

<b>Ancillary Equipment # 1</b>	
Description:	Laptop
Brand name:	Toshiba
Model Name or Number:	16050DS/4.3
Serial Number:	1027387CU
Connected to EUT's Port:	-

<b>Ancillary Equipment # 2</b>	
Description:	Wireless-G AP & router
Brand name:	Linksys
Model Name or Number:	WRT54G V8
Serial Number:	CDFG1GB13551
Connected to EUT's Port:	Ethernet port

<b>Ancillary Equipment # 3</b>	
Description:	Headset with 10nF cap on microphone element
Brand name:	Eartec
Model Name or Number:	Monarch
Serial Number:	N/A
Connected to EUT's Port:	2.5mm jack

<b>Ancillary Equipment # 4</b>	
Description:	USB Hub
Brand name:	N/A
Model Name or Number:	N/A
Serial Number:	N/A
Connected to EUT's Port:	USB-A

## EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

### 4.1. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

<b>Operating Modes:</b>	Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements.
<b>Special Test Software:</b>	Special software and hardware by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing.
<b>Special Hardware Used:</b>	None
<b>Transmitter Test Antenna:</b>	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

<b>Transmitter Test Signals</b>	
<b>Frequency Band(s):</b>	2400 – 2483.5 MHz
<b>Frequency(ies) Tested:</b> (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	2412 MHz, 2437MHz and 2462MHz
<b>RF Power Output:</b> (measured maximum output power at antenna terminals)	802.11b: 15.56 dBm peak conducted 802.11g: 18.94 dBm peak conducted
<b>Normal Test Modulation:</b>	802.11b: DBPSK(1Mbps), DQPSK(2Mbps), CCK(5.5/11Mbps) 802.11g: OFDM(6M-54Mbps)
<b>Modulating Signal Source:</b>	Internal



## EXHIBIT 5. SUMMARY OF TEST RESULTS

### 5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada Site No.: 2049A-3, Expiry Date: May 17, 2009).

### 5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes
15.207(a)	Power Line Conducted Emissions	Yes
15.247(a)(2)	6 dB Bandwidth	Yes
15.247(b)(3)	Peak Conducted Output Power - DTS	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(e)	Power Spectral Density	Yes
15.247(i) 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure	See SAR test report
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices. The engineering test report is available upon request.		

### 5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

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#### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: LIBT-015F15C247  
July 25, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

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## **EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS**

### **6.1. TEST PROCEDURES**

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4; FCC KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems.

### **6.2. MEASUREMENT UNCERTAINTIES**

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

### **6.3. MEASUREMENT EQUIPMENT USED**

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1-1.

### **6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER**

The rugged mobile video camera with integrated radio provides wireless video and audio data communication.

## 6.5. POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

### 6.5.1. Limit(s)

The equipment shall meet the limits of the following table:

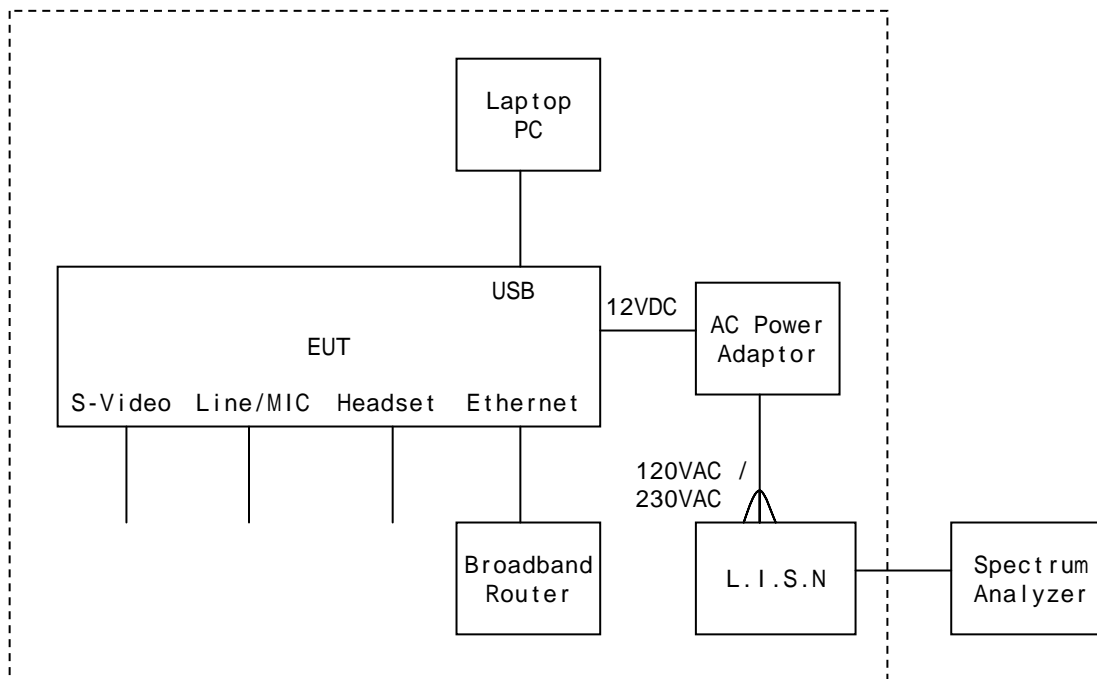
Frequency of emission (MHz)	Conducted Limits (dB $\mu$ V)		Measuring Bandwidth
	Quasi-peak	Average	
0.15–0.5 .....	66 to 56* .....	56 to 46*	RBW = 9 kHz
0.5–5 .....	56 .....	46	VBW $\geq$ 9 kHz for QP
5–30 .....	60 .....	50	VBW = 1 Hz for Average

\*Decreases linearly with the logarithm of the frequency

### 6.5.2. Method of Measurements

ANSI C63.4

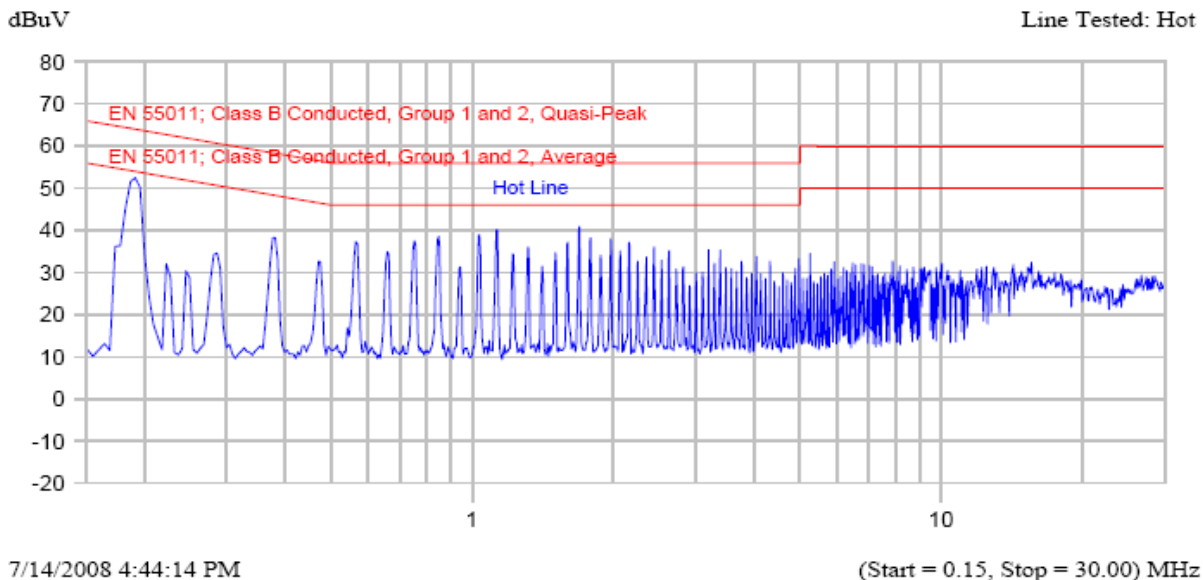
### 6.5.3. Test Arrangement



6.5.4. Test Data

**Plot 6.5.5.1** Power Line Conducted Emissions  
 Line Voltage: 120 VAC 60 Hz  
 Line Tested: Hot

Current Graph

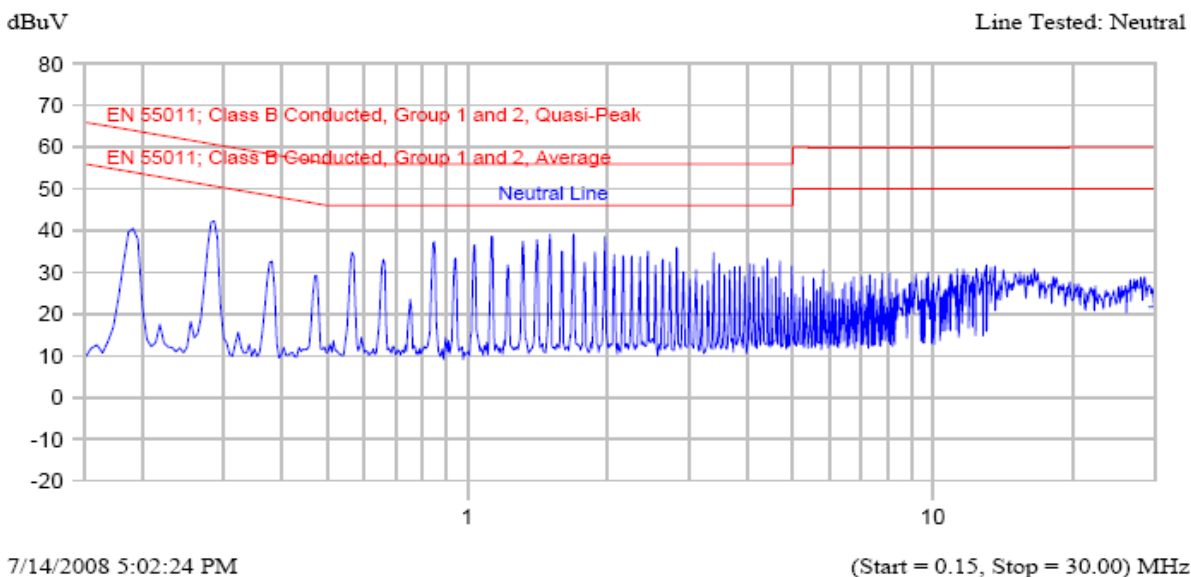


Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.187	53.7	52.3	-12.7	40.2	-14.8	Hot Line
0.375	43.5	42.4	-17.1	39.5	-10.0	Hot Line
0.563	41.2	40.1	-15.9	37.9	-8.1	Hot Line
0.845	41.4	40.4	-15.6	38.0	-8.0	Hot Line
1.126	40.3	39.1	-16.9	34.1	-11.9	Hot Line
1.689	41.4	40.2	-15.8	37.0	-9.0	Hot Line
1.970	40.4	39.2	-16.8	35.2	-10.8	Hot Line

**Plot 6.5.5.2** Power Line Conducted Emissions  
 Line Voltage: 120 VAC 60 Hz  
 Line Tested: Neutral

**Current Graph**

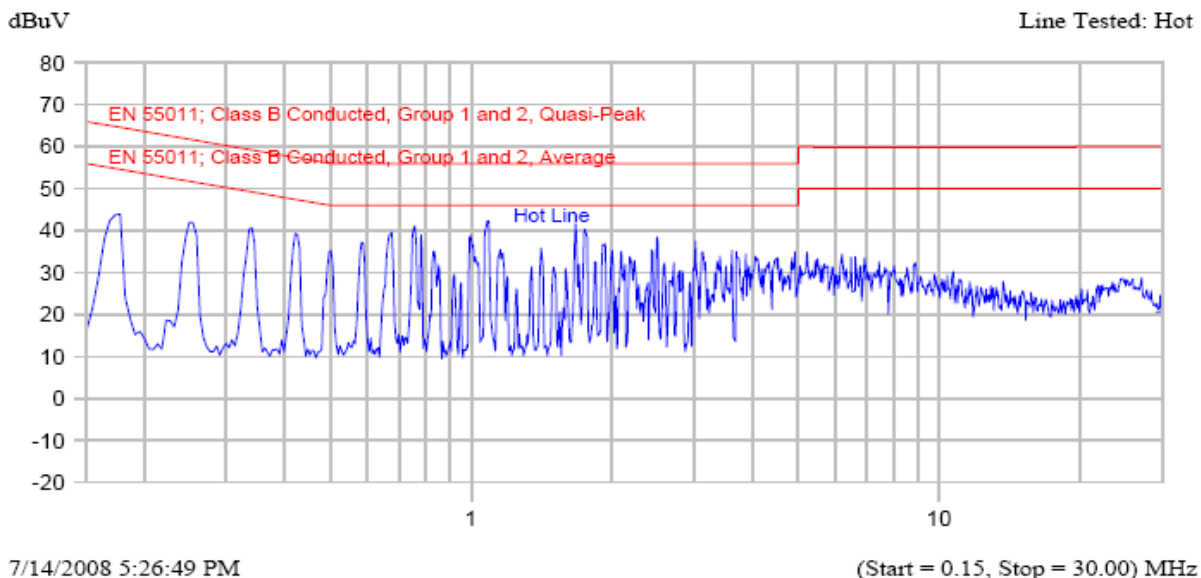


**Current List**

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp dB	Limit	Avg dBuV	Delta Avg-Avg dB	Limit	Trace Name
0.188	53.0	52.0	-12.9		40.2	-14.7		Neutral Line
0.281	43.2	42.1	-20.1		32.8	-19.4		Neutral Line
0.562	35.8	34.7	-21.3		28.9	-17.1		Neutral Line
0.844	38.0	37.3	-18.7		34.8	-11.2		Neutral Line
1.125	40.2	39.3	-16.7		35.9	-10.1		Neutral Line
1.501	41.7	40.4	-15.6		38.2	-7.8		Neutral Line
1.970	39.4	38.3	-17.7		32.3	-13.7		Neutral Line
2.813	35.8	34.6	-21.4		28.7	-17.3		Neutral Line

**Plot 6.5.5.3** Power Line Conducted Emissions  
 Line Voltage: 230 VAC 60 Hz  
 Line Tested: Hot

**Current Graph**

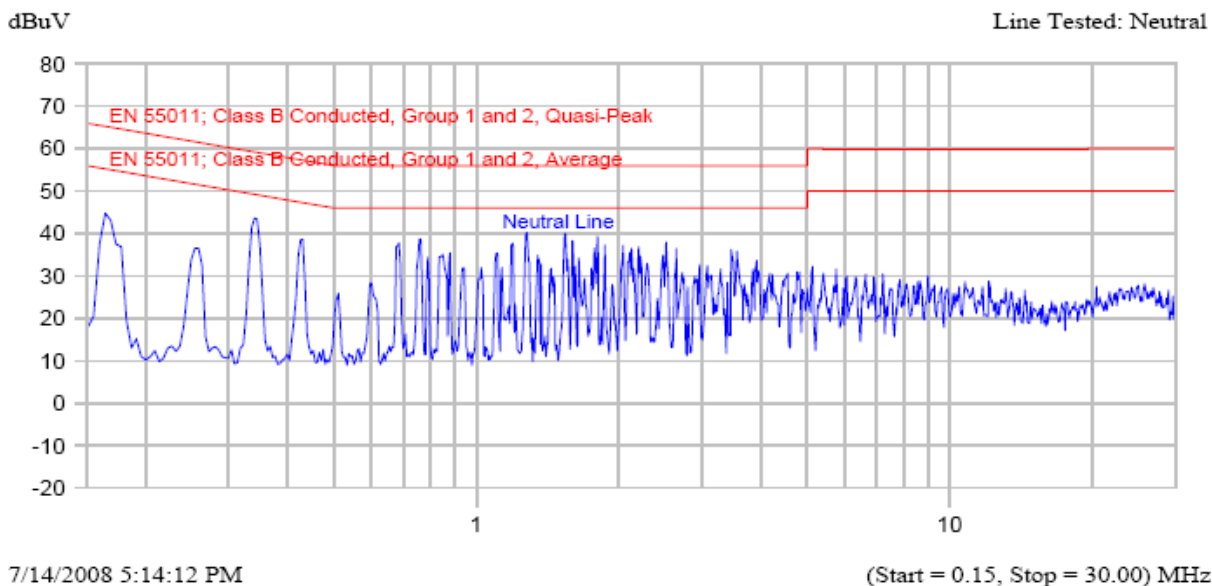


**Current List**

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.170	52.9	49.1	-16.3	37.8	-17.6	Hot Line
0.248	50.7	49.5	-13.6	43.2	-9.9	Hot Line
0.334	47.8	46.7	-14.0	42.1	-8.6	Hot Line
0.417	39.9	38.5	-19.8	32.8	-15.6	Hot Line
0.667	43.6	42.3	-13.7	37.1	-8.9	Hot Line
0.748	43.0	41.2	-14.8	35.5	-10.5	Hot Line
1.086	42.3	40.6	-15.4	32.9	-13.1	Hot Line
1.672	42.5	40.5	-15.5	31.3	-14.7	Hot Line
2.496	38.3	34.7	-21.3	23.8	-22.2	Hot Line

**Plot 6.5.5.4** Power Line Conducted Emissions  
 Line Voltage: 230 VAC 60 Hz  
 Line Tested: Neutral

**Current Graph**



**Current List**

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp dB	Limit	Avg dBuV	Delta Avg-Avg dB	Limit	Trace Name
0.168	52.7	51.6	-13.8		40.2	-15.3		Neutral Line
0.250	49.5	48.1	-15.0		39.7	-13.4		Neutral Line
0.334	45.7	44.5	-16.2		38.5	-12.2		Neutral Line
0.420	38.8	37.0	-21.2		32.9	-15.4		Neutral Line
0.674	39.6	38.2	-17.8		31.1	-14.9		Neutral Line
0.760	40.6	39.0	-17.0		31.7	-14.3		Neutral Line
1.271	40.8	37.1	-18.9		24.0	-22.0		Neutral Line
1.530	39.9	34.7	-21.3		17.8	-28.2		Neutral Line

## 6.6. OCCUPIED BANDWIDTH [§ 15.247(a)(2)]

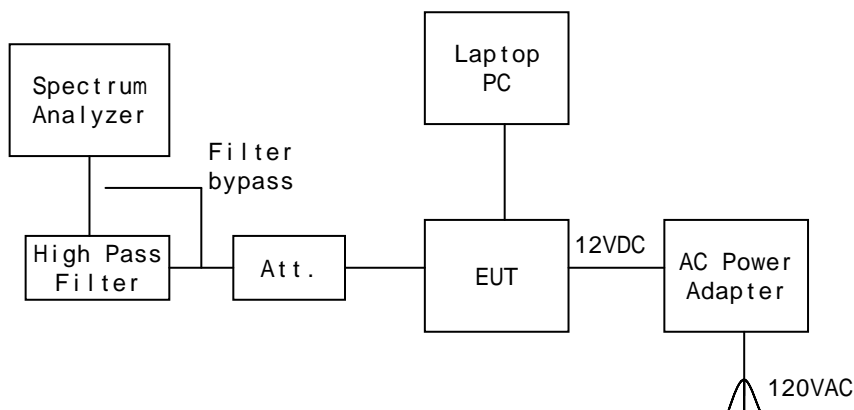
### 6.6.1. Limit(s)

For a Digital Modulation System, the minimum 6 dB bandwidth shall be at least 500 KHz.

### 6.6.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247):

### 6.6.3. Test Arrangement



### 6.6.4. Test Data

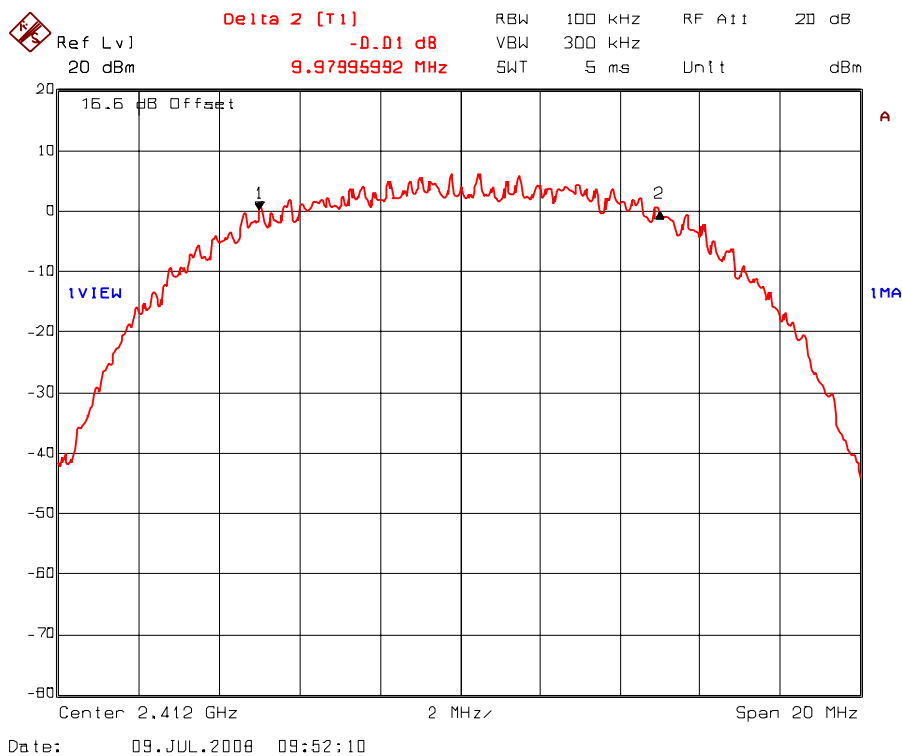
#### 6.6.4.1. 802.11b mode, 11 Mbps data rate, CCK

Frequency (MHz)	6 dB Bandwidth (MHz)
2412	9.980
2437	9.940
2462	9.940

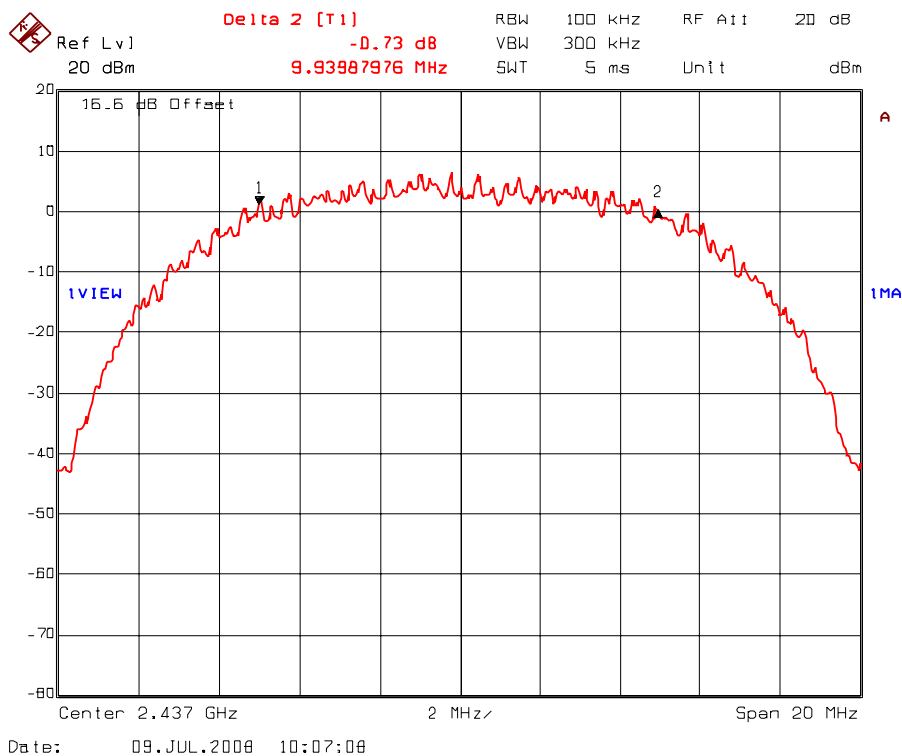
See the following plots for detailed measurements.



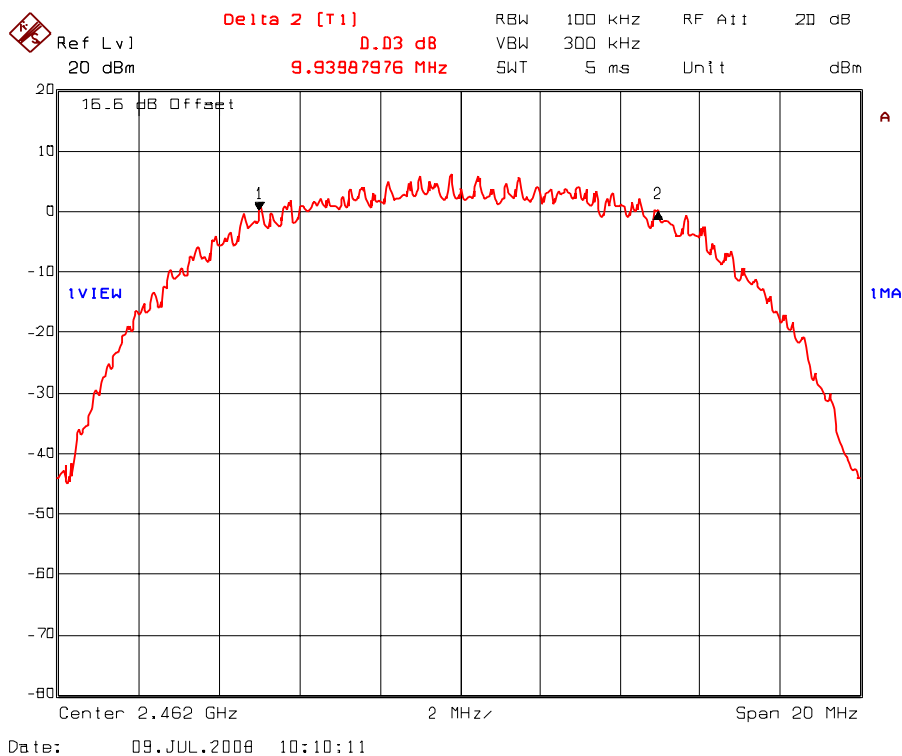
Plot 6.6.4.1.1. 6 dB Bandwidth  
Frequency: 2412 MHz



Plot 6.6.4.1.2. 6 dB Bandwidth  
Frequency: 2437MHz



Plot 6.6.4.1.3. 6 dB Bandwidth  
Frequency: 2462MHz

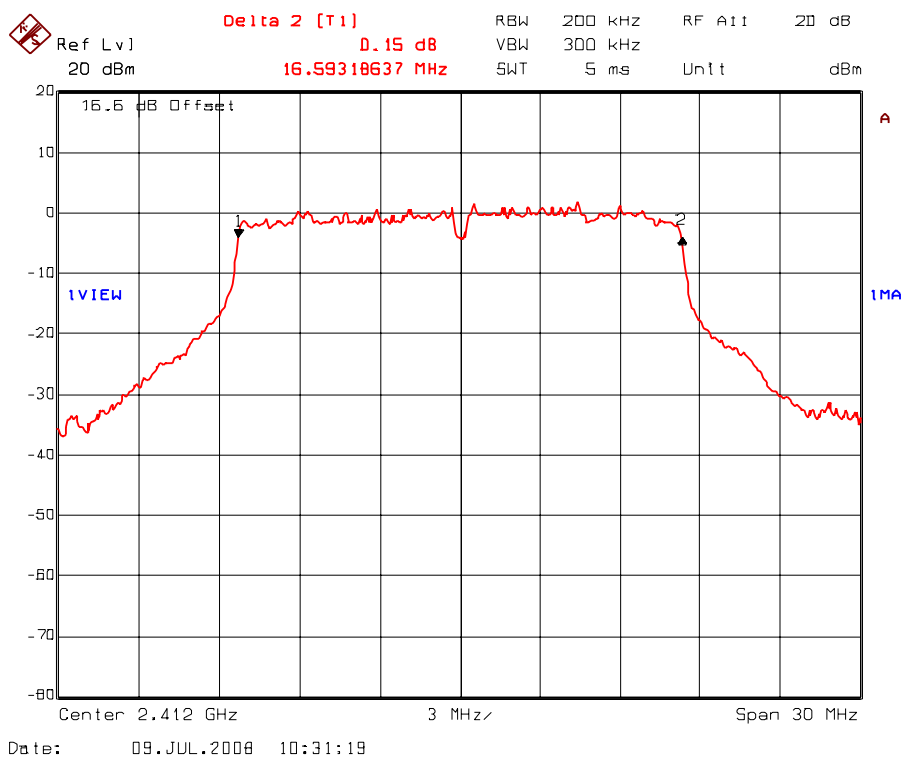


6.6.4.2. 802.11g mode, 54 Mbps data rate, 64QAM

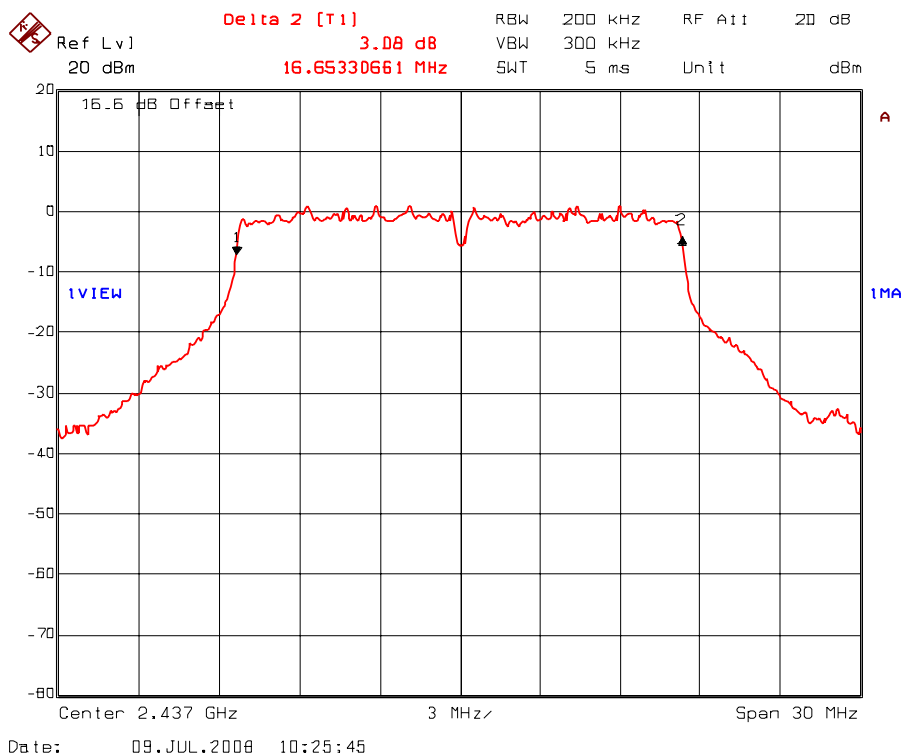
Frequency (MHz)	6 dB Bandwidth (MHz)
2412	16.593
2437	16.653
2462	16.593

See the following plots for detailed measurements.

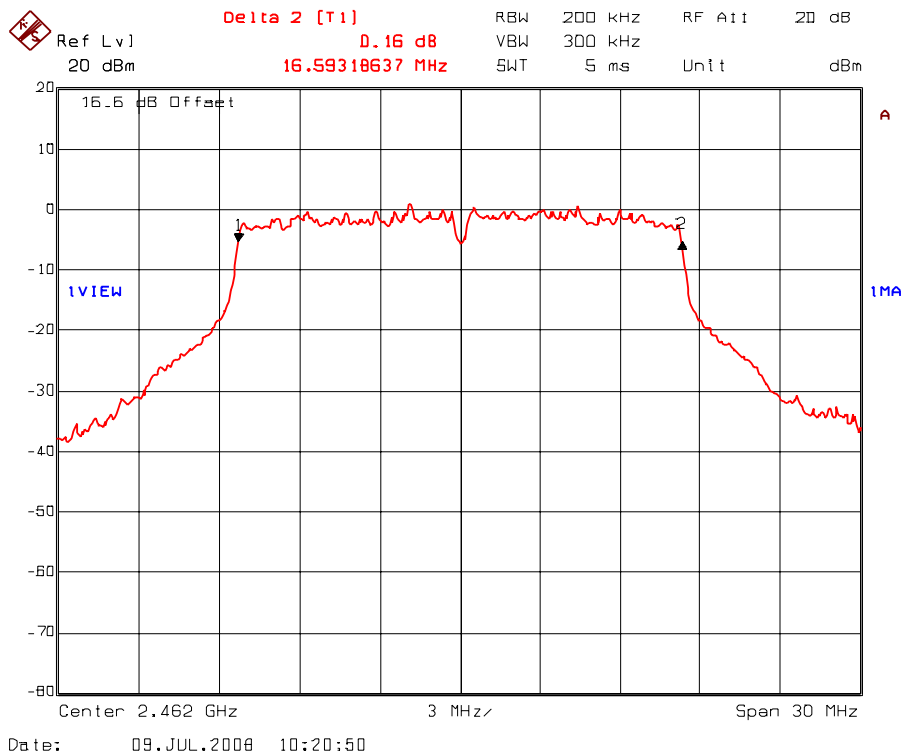
Plot 6.6.4.2.1. 6 dB Bandwidth  
 Frequency: 2412 MHz



Plot 6.6.4.2.2. 6 dB Bandwidth  
Frequency: 2437MHz



Plot 6.6.4.2.3. 6 dB Bandwidth  
Frequency: 2462MHz



## 6.7. PEAK CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)]

### 6.7.1. Limit(s)

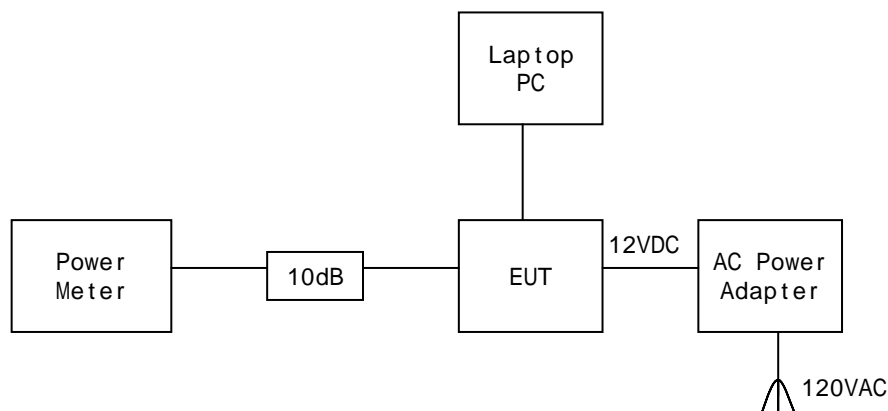
§ 15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

§15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 6.7.2. Method of Measurements & Test Arrangement

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247): Power Output Option 1

### 6.7.3. Test Arrangement



#### 6.7.4. Test Data

##### 6.7.4.1. 802.11b mode

Data Rate (Mbps)	Power Setting	Peak Power Conducted (dBm)		
		2412 MHz (CH1)	2437 MHz (CH6)	2462 MHz (CH11)
1 (BPSK)	14 dBm	15.39	15.50	15.56
2 (QPSK)	14 dBm	15.21	15.21	15.33
11 (CCK)	14 dBm	15.15	15.15	15.27

##### 6.7.4.2. 802.11g mode

Data Rate (Mbps)	Power Setting	Peak Power Conducted (dBm)		
		2412 MHz (CH1)	2437 MHz (CH6)	2462 MHz (CH11)
9 (BPSK)	14 dBm	18.51	18.78	18.83
18 (QPSK)	14 dBm	18.48	18.75	18.81
36 (16QAM)	14 dBm	18.73	18.91	18.94
64 (64QAM)	14 dBm	18.70	18.86	18.83



## 6.8. TRANSMITTER BAND-EDGE & SPURIOUS CONDUCTED EMISSIONS [§ 15.247(d)]

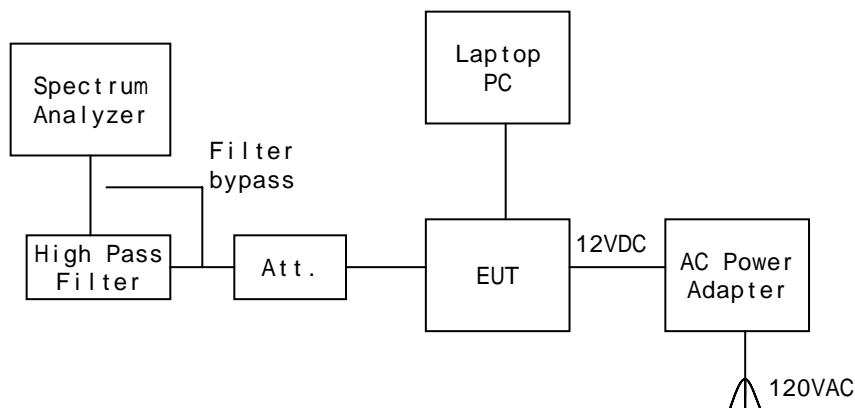
### 6.8.1. Limit(s)

§ 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

### 6.8.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

### 6.8.3. Test Arrangement

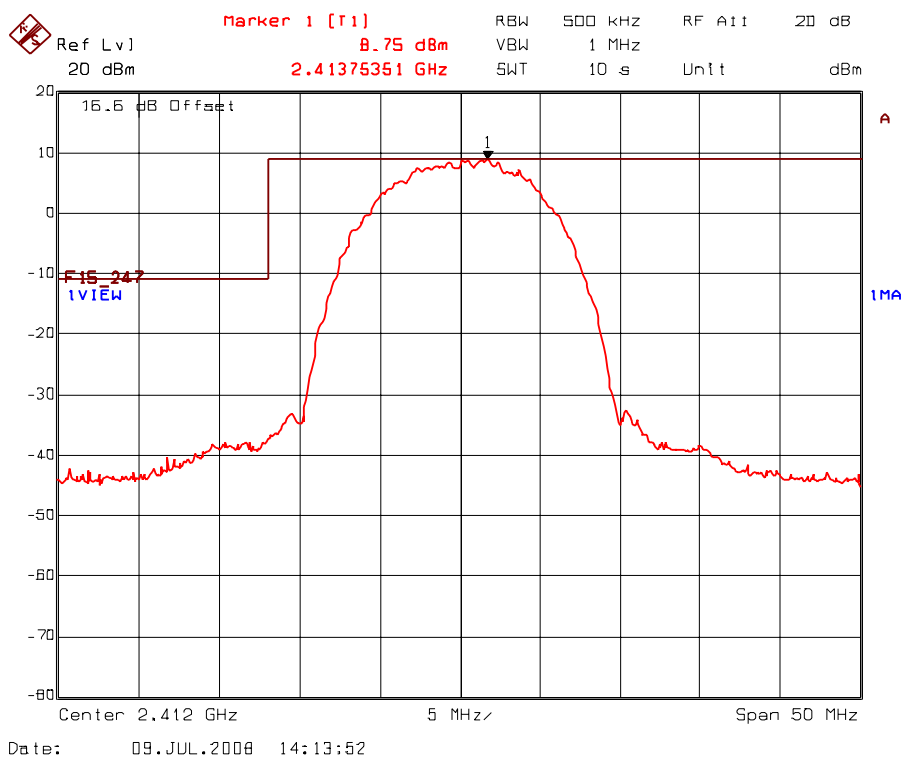


### 6.8.4. Test Data

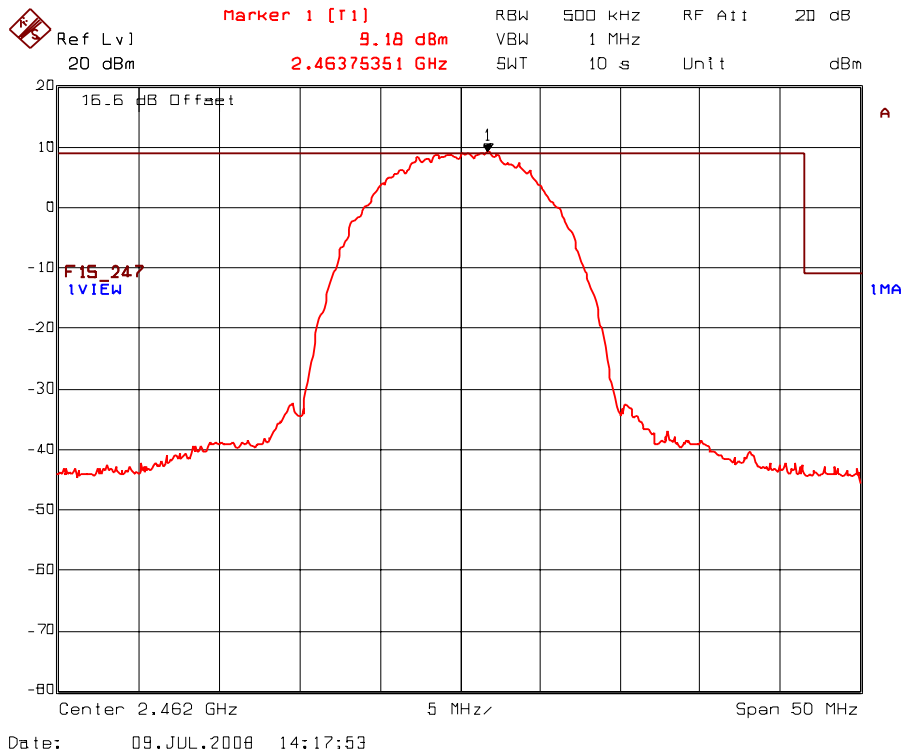
#### 6.8.4.1. Band-Edge RF Conducted Emissions

##### 6.8.4.1.1. 802.11b mode, 11 Mbps data rate, CCK

**Plot 6.8.4.1.1.1. Band-Edge RF Conducted Emissions  
Low End of Frequency Band**

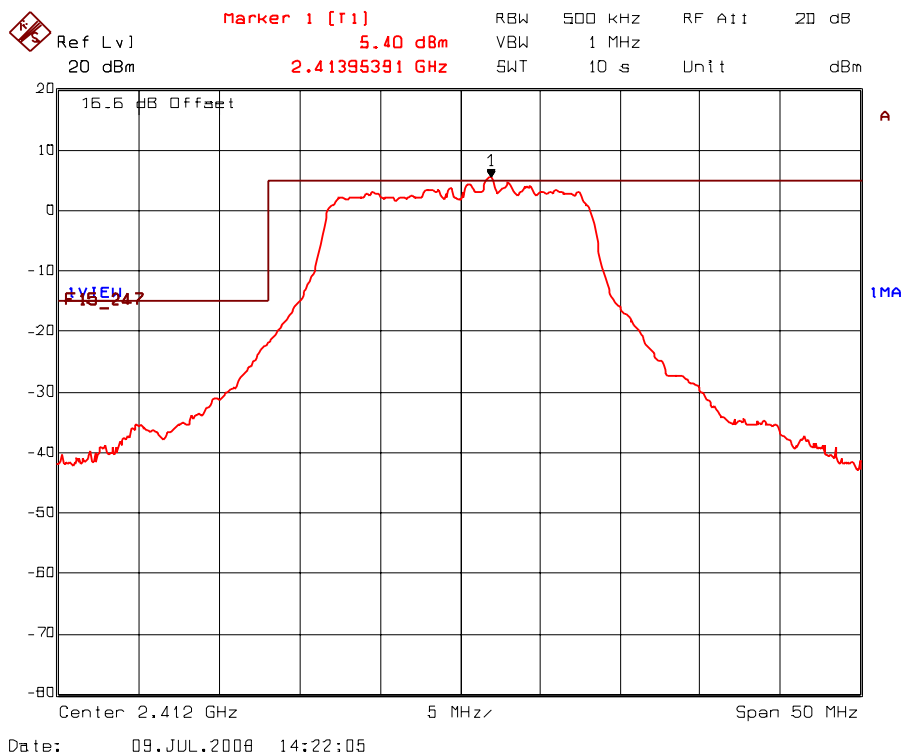


Plot 6.8.4.1.1.2. Band-Edge RF Conducted Emissions  
High End of Frequency Band

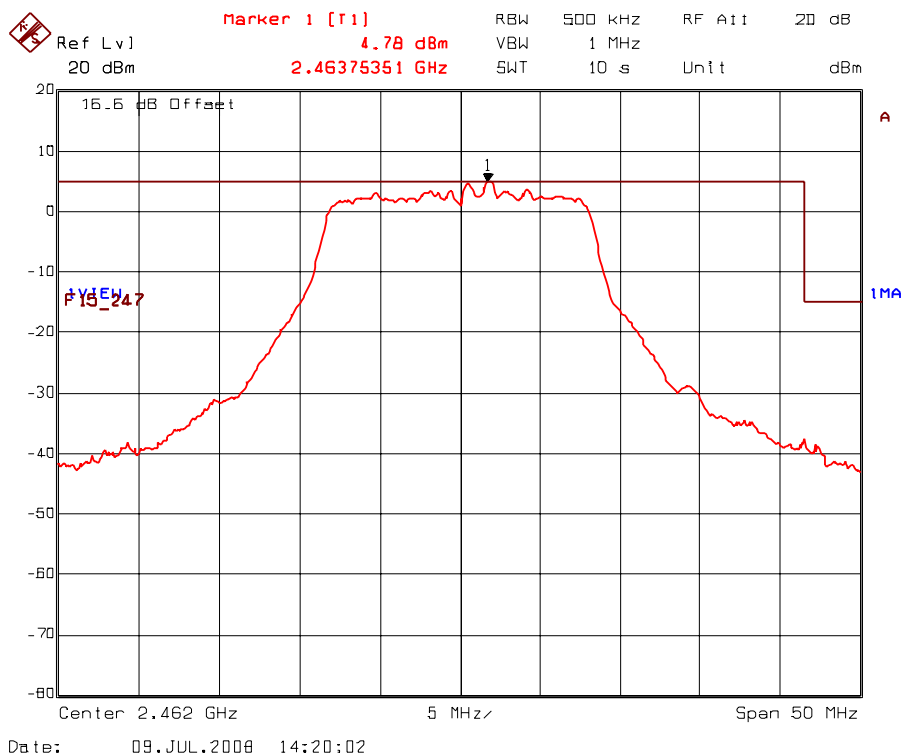


6.8.4.1.2. 802.11g mode, 54 Mbps data rate, 64QAM

Plot 6.8.4.1.2.1. Band-Edge RF Conducted Emissions  
Low End of Frequency Band



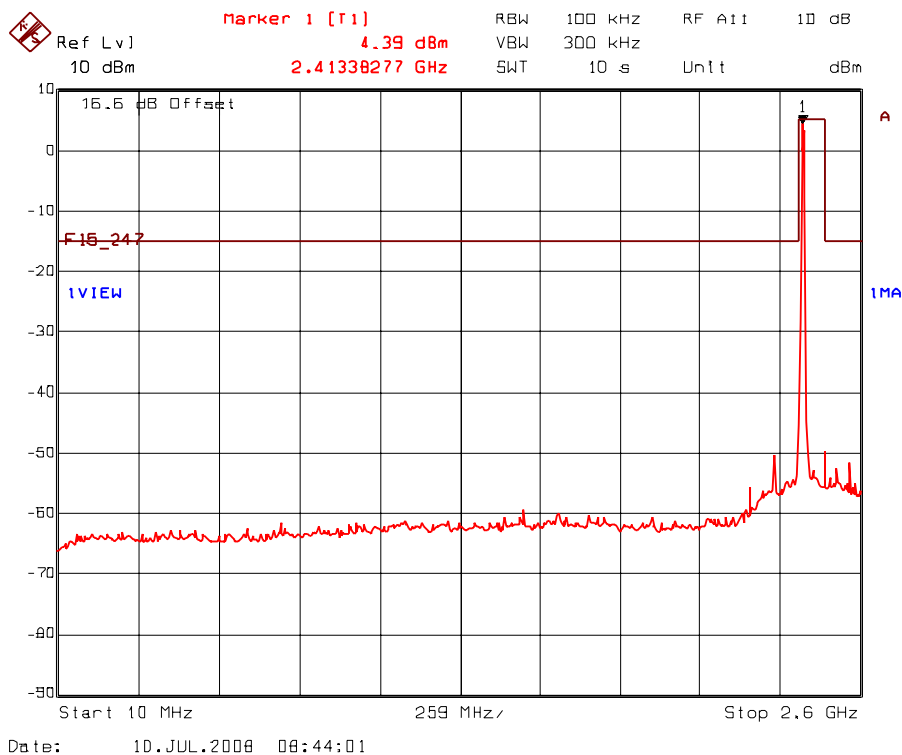
Plot 6.8.4.1.2.2. Band-Edge RF Conducted Emissions  
High End of Frequency Band



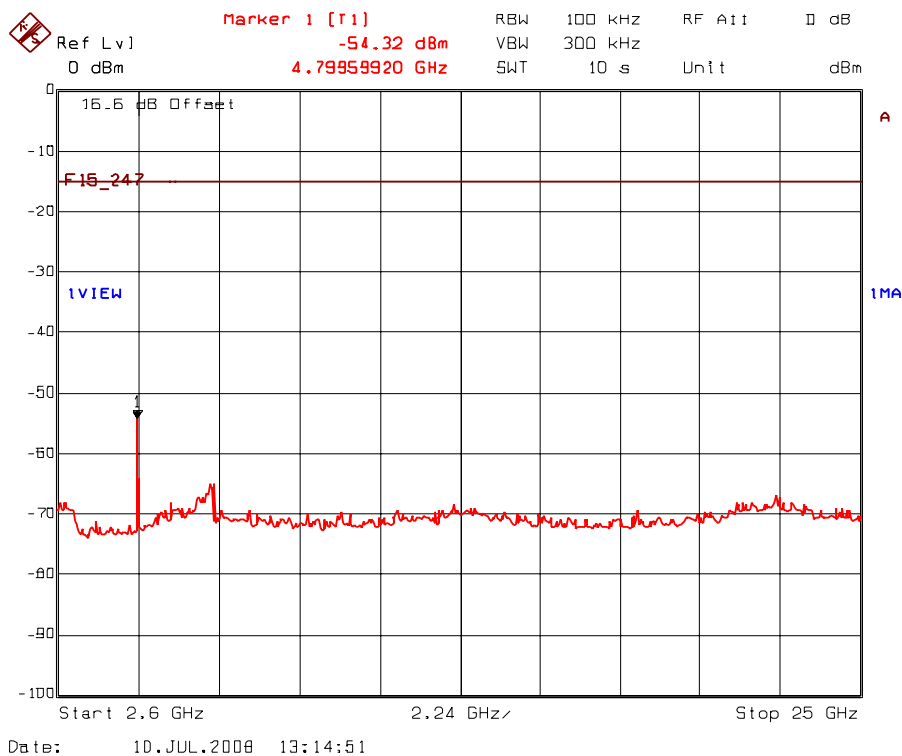
### 6.8.4.2. Spurious RF Conducted Emissions

#### 6.8.4.2.1. 802.11b mode, 11 Mbps data rate, CCK

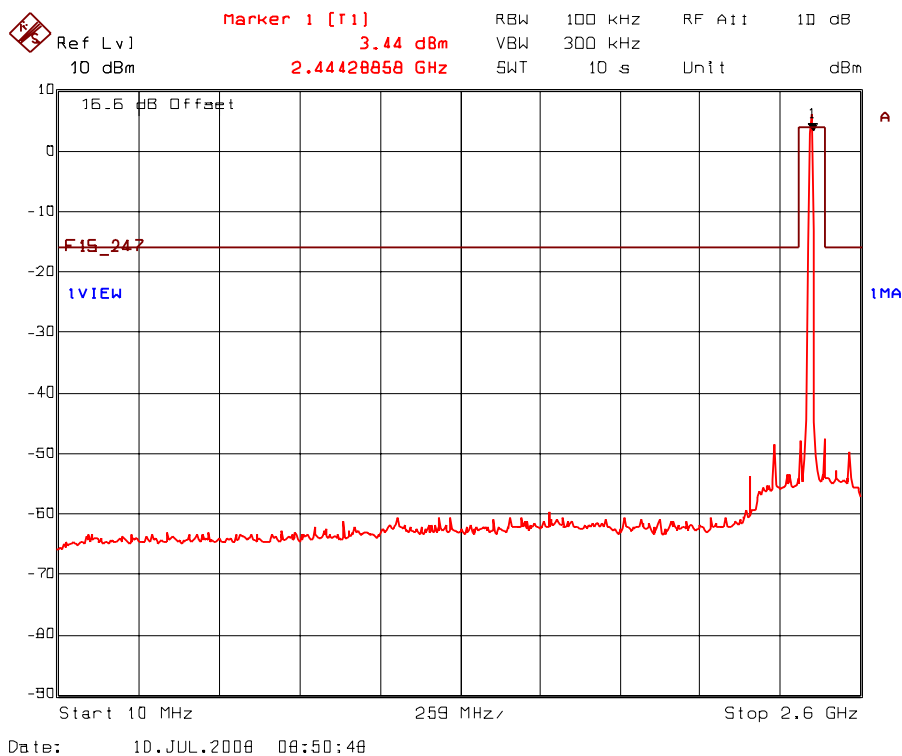
**Plot 6.8.4.2.1.1. Spurious RF Conducted Emissions**  
Transmitter Frequency: 2412 MHz



Plot 6.8.4.2.1.2. Spurious RF Conducted Emissions  
Transmitter Frequency: 2412 MHz

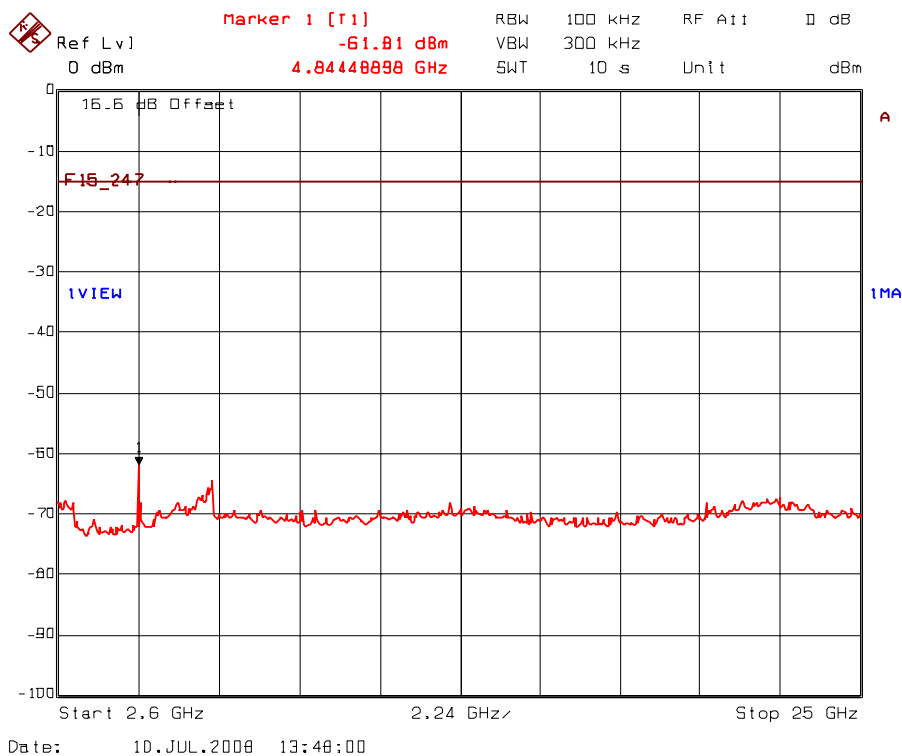


Plot 6.8.4.2.1.3. Spurious RF Conducted Emissions  
Transmitter Frequency: 2437 MHz

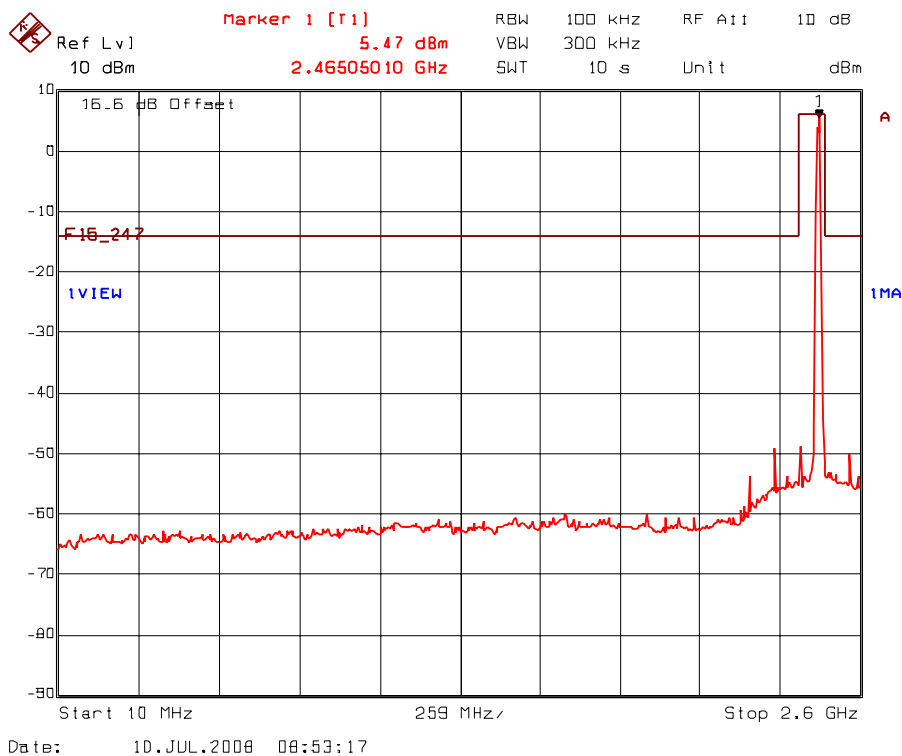




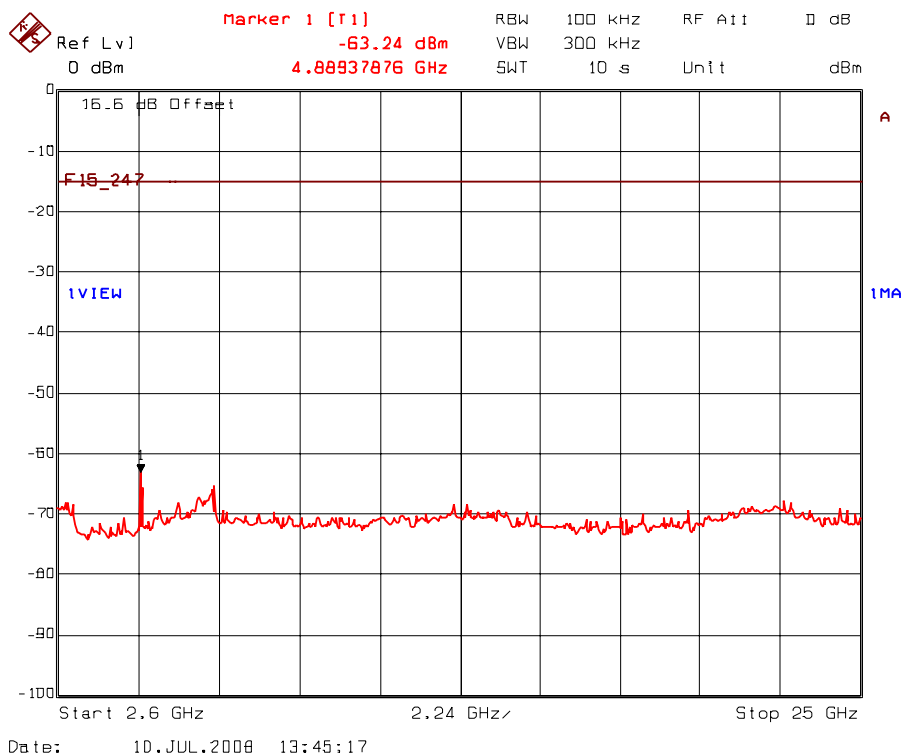
Plot 6.8.4.2.1.4. Spurious RF Conducted Emissions  
Transmitter Frequency: 2437 MHz



Plot 6.8.4.2.1.5. Spurious RF Conducted Emissions  
Transmitter Frequency: 2462 MHz

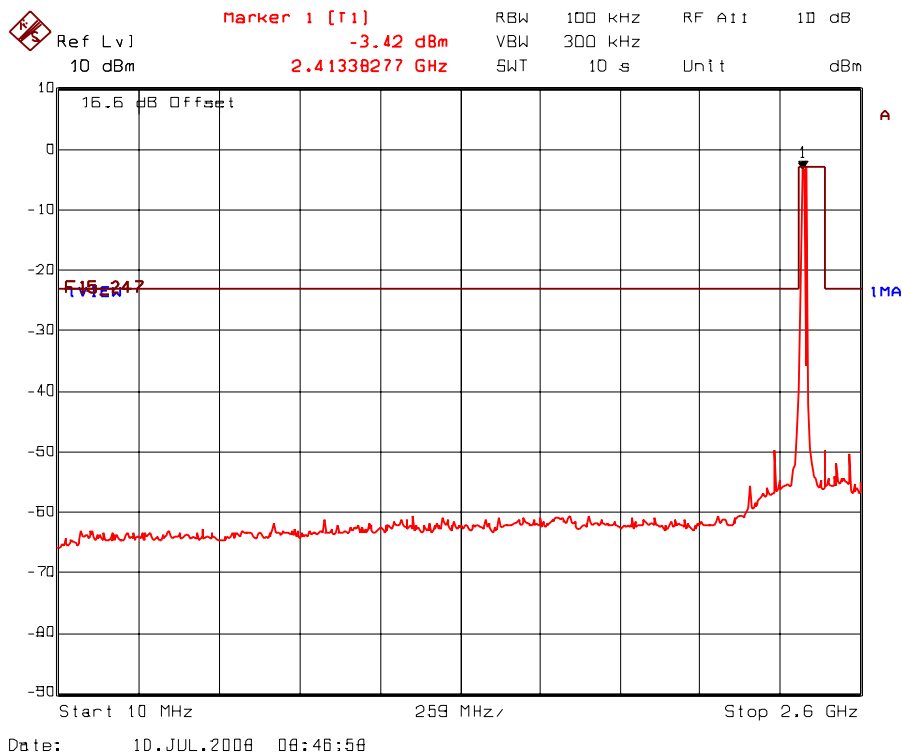


Plot 6.8.4.2.1.6. Spurious RF Conducted Emissions  
Transmitter Frequency: 2462 MHz

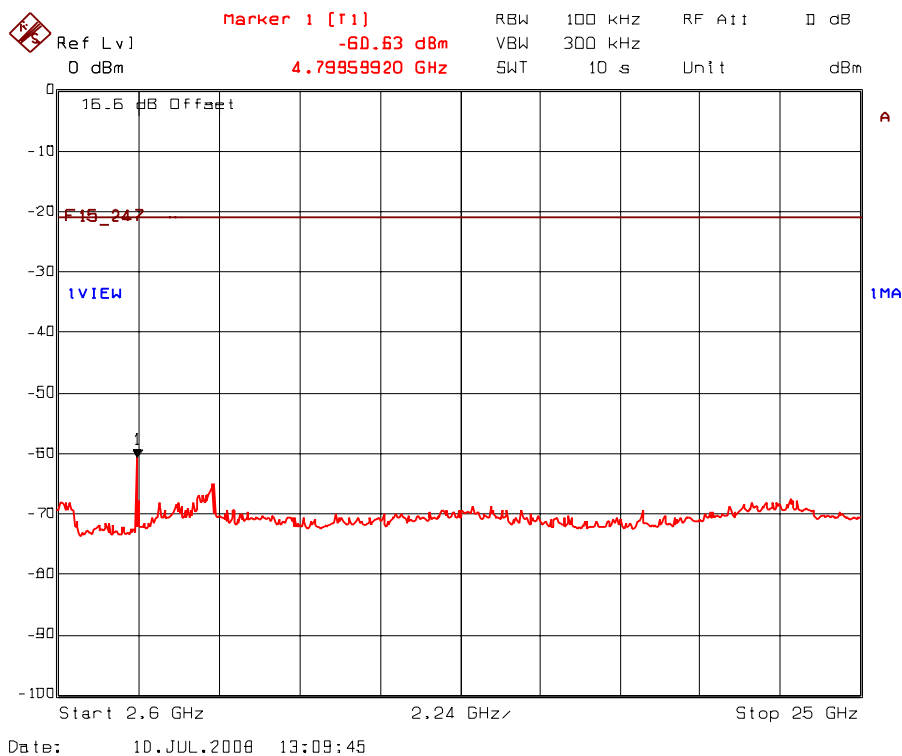


6.8.4.2.2. 802.11g mode, 54 Mbps data rate, 64QAM

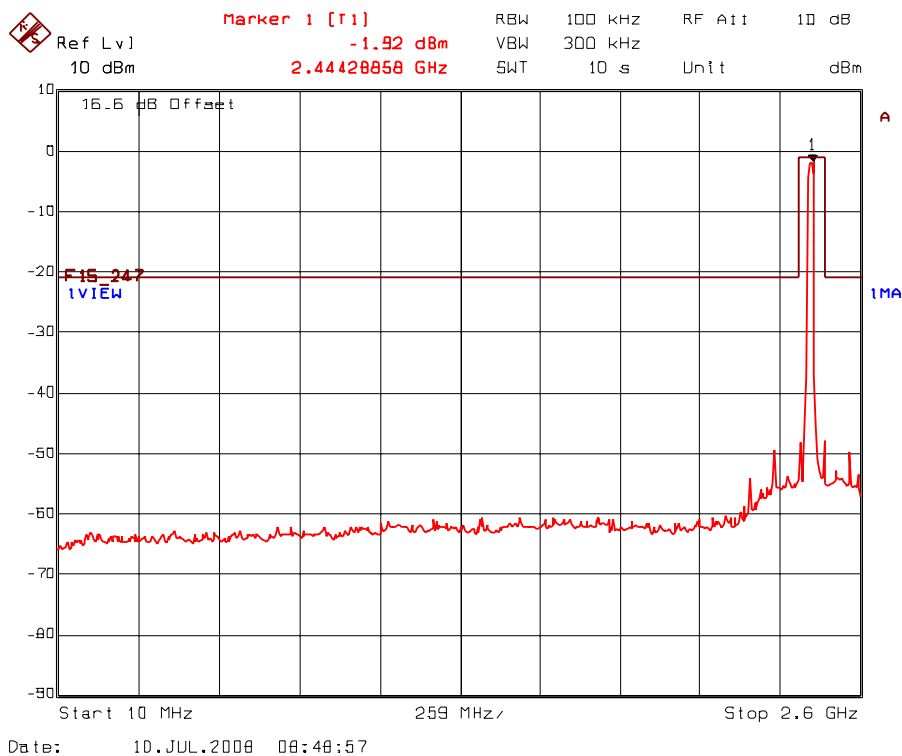
**Plot 6.8.4.2.2.1. Spurious RF Conducted Emissions**  
Transmitter Frequency: 2412 MHz



Plot 6.8.4.2.2.2. Spurious RF Conducted Emissions  
Transmitter Frequency: 2412 MHz



Plot 6.8.4.2.2.3. Spurious RF Conducted Emissions  
Transmitter Frequency: 2437 MHz



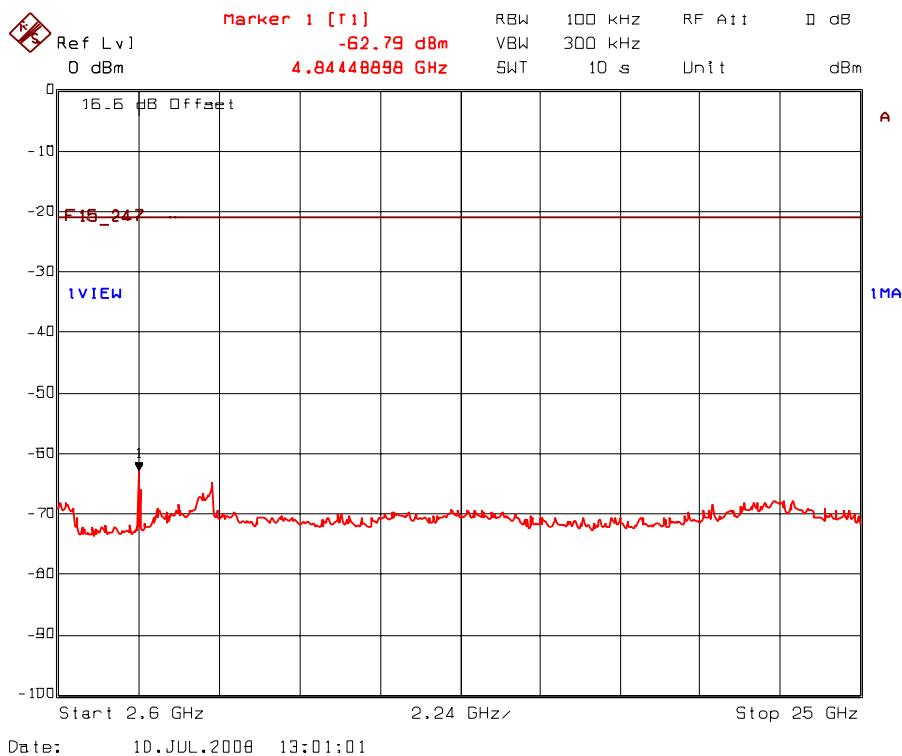
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: LIBT-015F15C247  
July 25, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 6.8.4.2.2.4. Spurious RF Conducted Emissions  
Transmitter Frequency: 2437 MHz



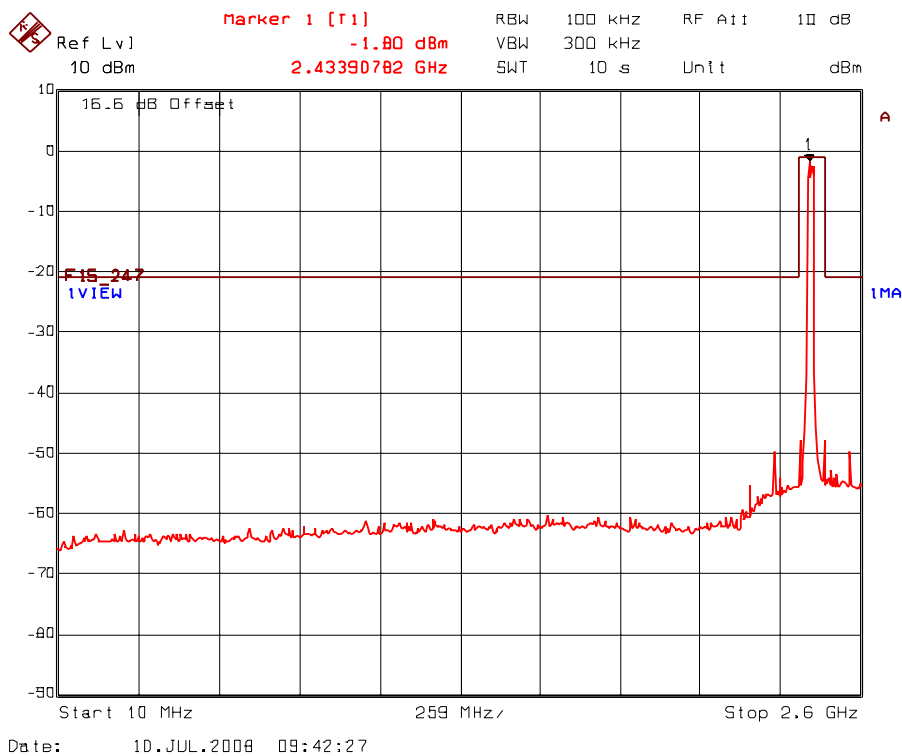
**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: LIBT-015F15C247  
July 25, 2008

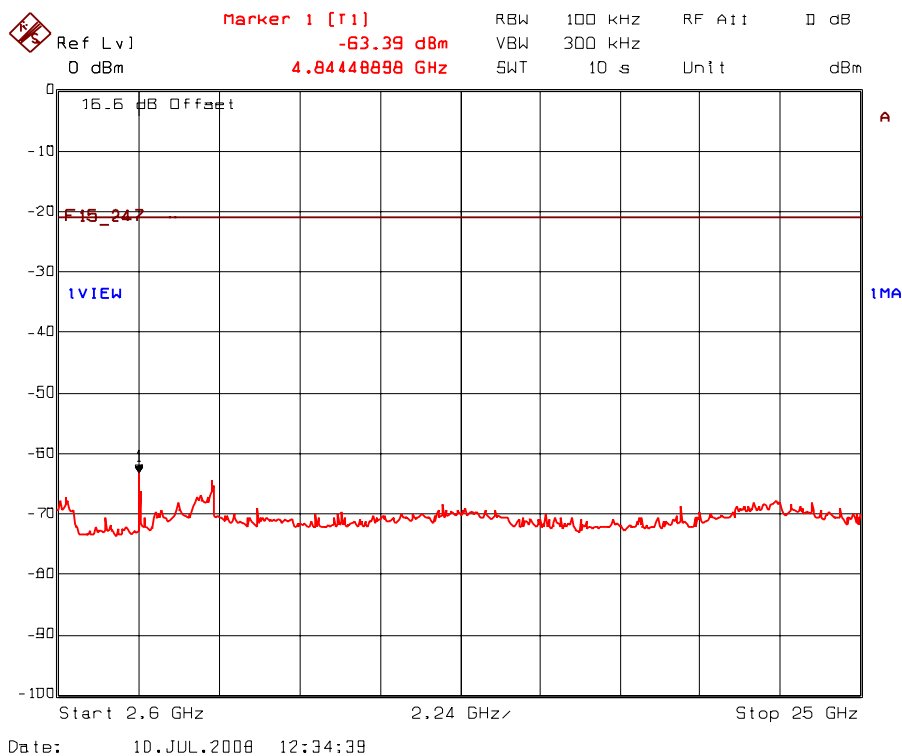
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

**Plot 6.8.4.2.2.5. Spurious RF Conducted Emissions**  
Transmitter Frequency: 2462 MHz





Plot 6.8.4.2.2.6. Spurious RF Conducted Emissions  
Transmitter Frequency: 2462 MHz



**6.9. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]**

**6.9.1. Limit(s)**

§ 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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)).

**Section 15.205(a) - Restricted Bands of Operation**

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
<sup>1</sup> 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	( <sup>2</sup> )
13.36–13.41			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

<sup>2</sup> Above 38.6

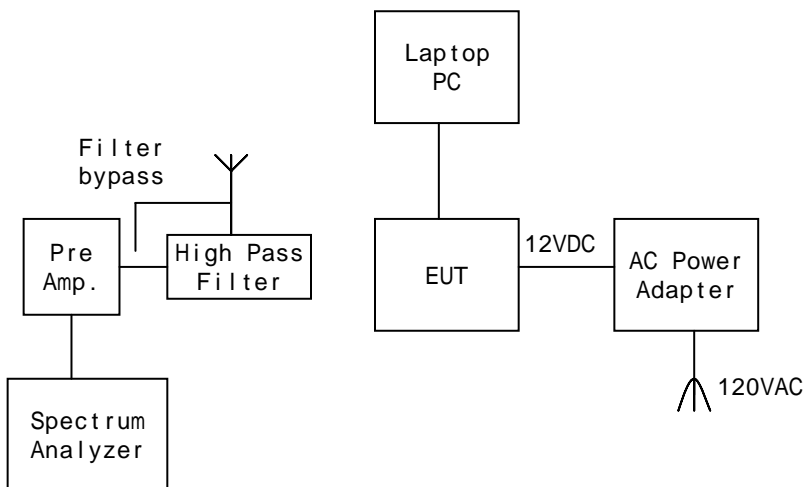
**Section 15.209(a)**  
**-- Field Strength Limits within Restricted Frequency Bands --**

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

### 6.9.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

### 6.9.3. Test Arrangement

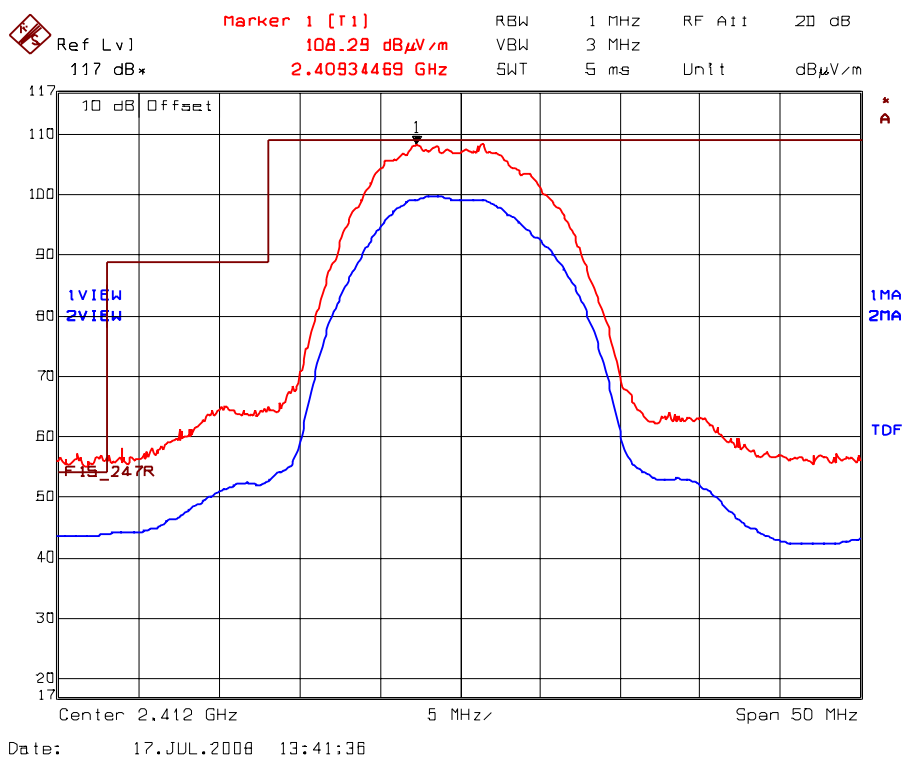


6.9.4. Test Data

6.9.4.1. Band-Edge RF Radiated Emissions @ 3m

6.9.4.1.1. 802.11b mode, 11 Mbps data rate, CCK

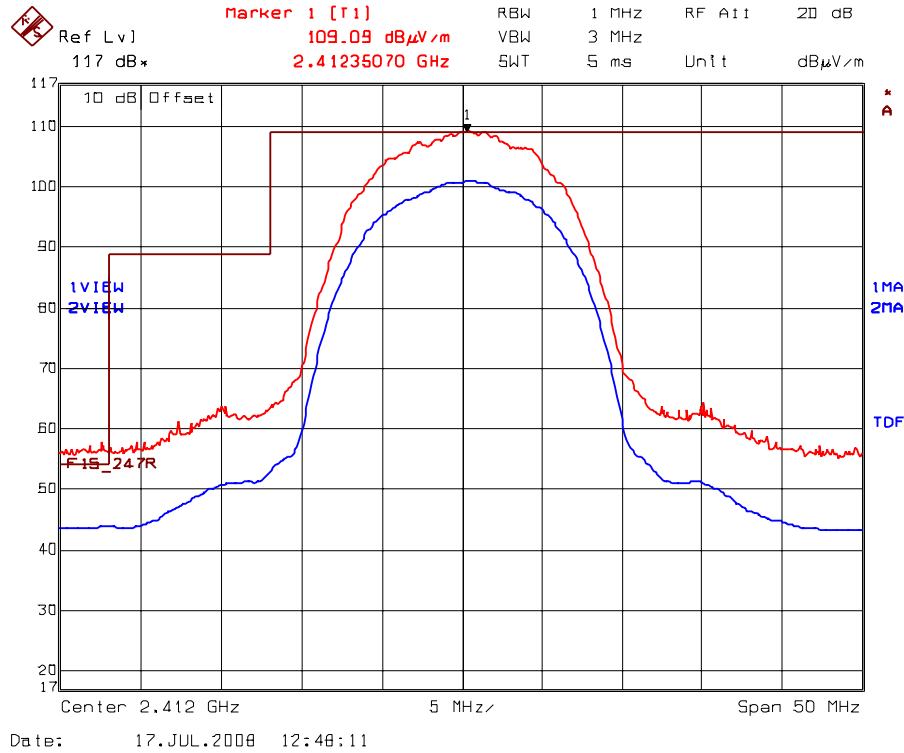
Plot 6.9.4.1.1.1. Band-Edge RF Radiated Emissions @ 3 m  
 Low End of Frequency Band  
 Rx Antenna Orientation: Horizontal



Trace 1: RBW= 1 MHz, VBW= 3 MHz

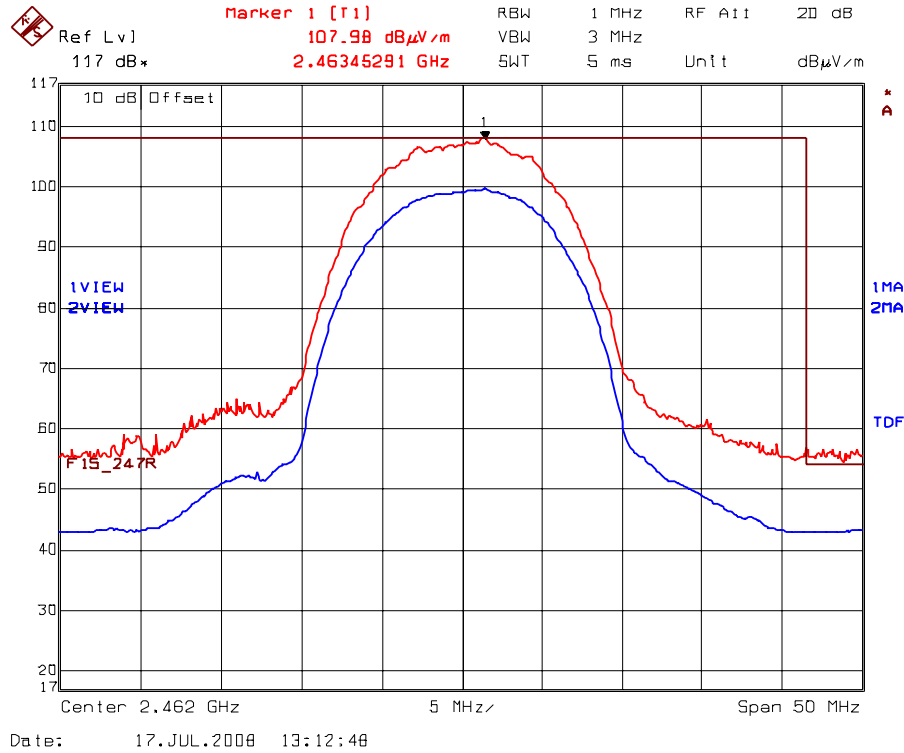
Trace 2: RBW= 1 MHz, VBW= 10Hz

**Plot 6.9.4.1.1.2. Band-Edge RF Radiated Emissions @ 3 m**  
 Low End of Frequency Band  
 Rx Antenna Orientation: Vertical



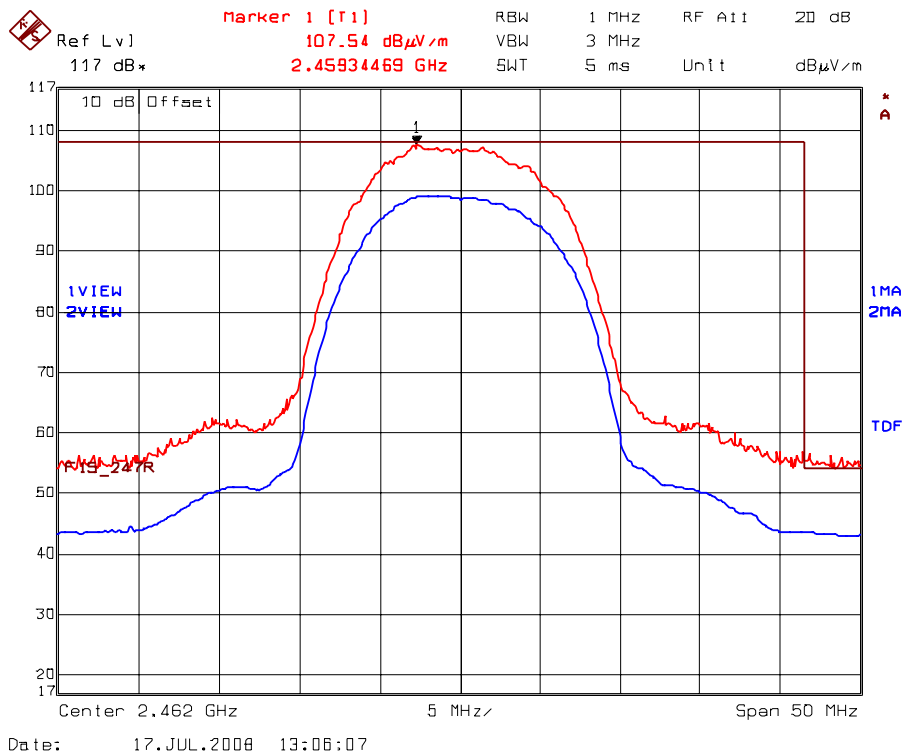
Trace 1: RBW= 1 MHz, VBW= 3 MHz  
 Trace 2: RBW= 1 MHz, VBW= 10Hz

**Plot 6.9.4.1.1.3. Band-Edge RF Radiated Emissions @ 3 m**  
 High End of Frequency Band  
 Rx Antenna Orientation: Horizontal



Trace 1: RBW= 1 MHz, VBW= 3 MHz  
 Trace 2: RBW= 1 MHz, VBW= 10Hz

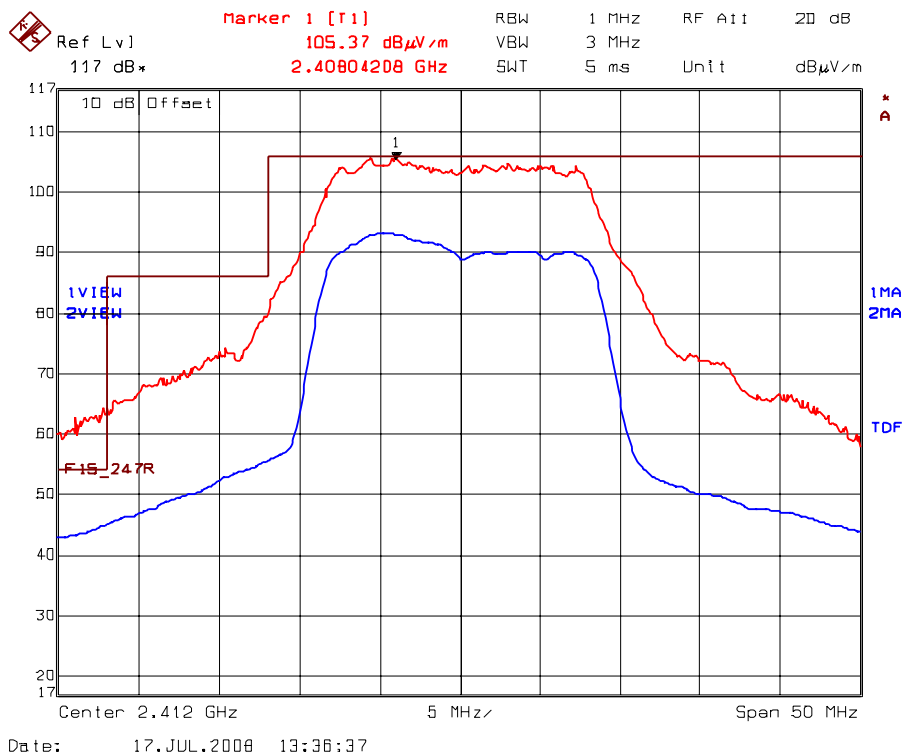
**Plot 6.9.4.1.1.4. Band-Edge RF Radiated Emissions @ 3 m**  
 High End of Frequency Band  
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz  
 Trace 2: RBW= 1 MHz, VBW= 10Hz

6.9.4.1.2. 802.11g mode, 54 Mbps data rate, 64QAM

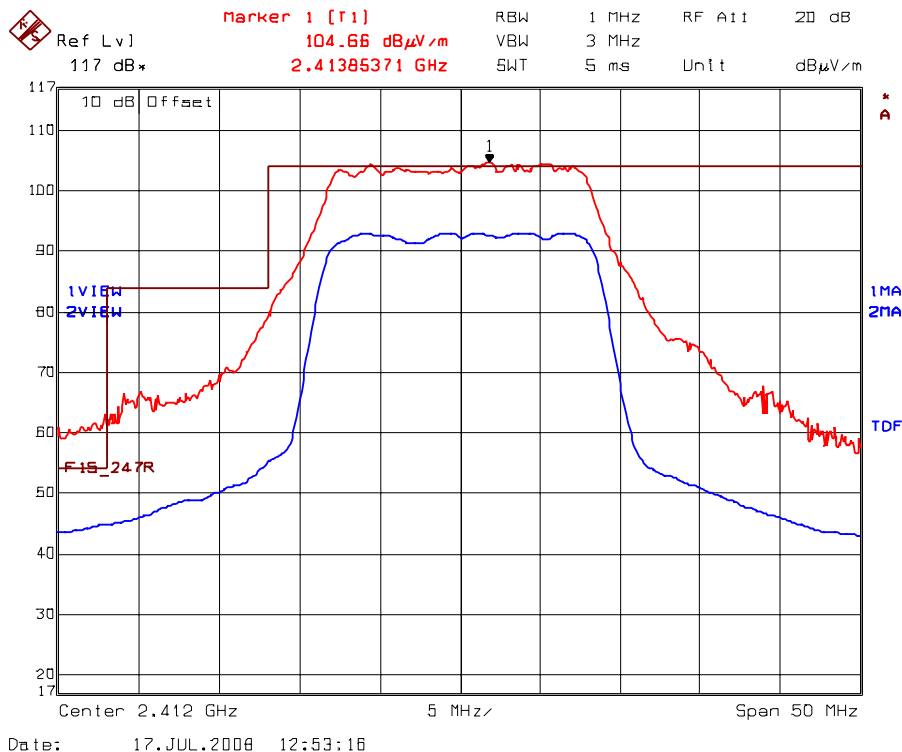
**Plot 6.9.4.1.2.1. Band-Edge RF Radiated Emissions @ 3 m**  
Low End of Frequency Band  
Rx Antenna Orientation: Horizontal



Trace 1: RBW= 1 MHz, VBW= 3 MHz  
Trace 2: RBW= 1 MHz, VBW= 10Hz

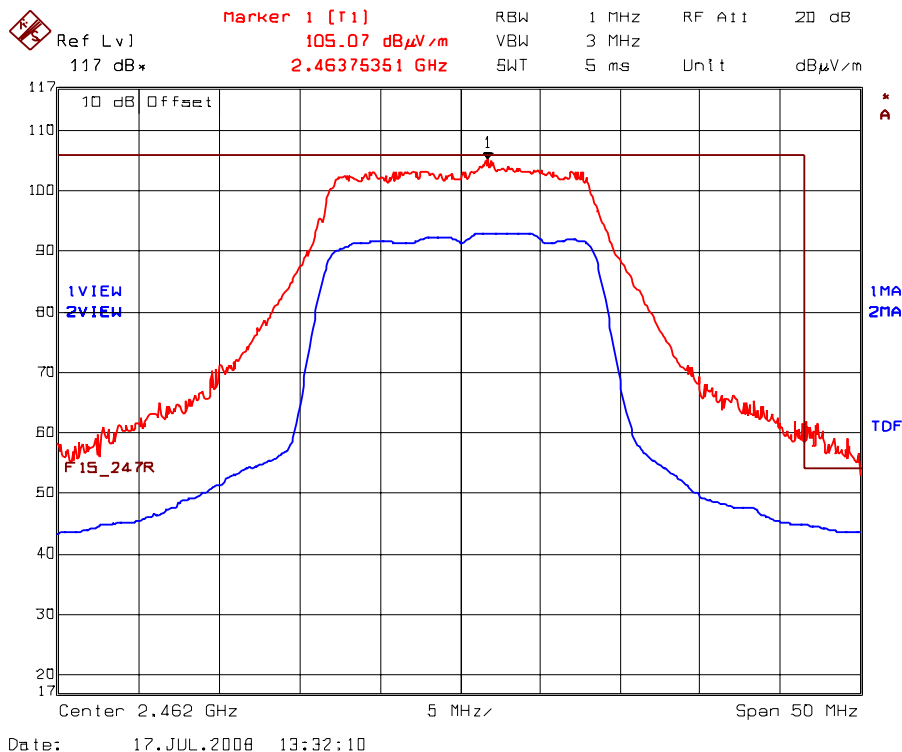


**Plot 6.9.4.1.2.2. Band-Edge RF Radiated Emissions @ 3 m**  
Low End of Frequency Band  
Rx Antenna Orientation: Vertical



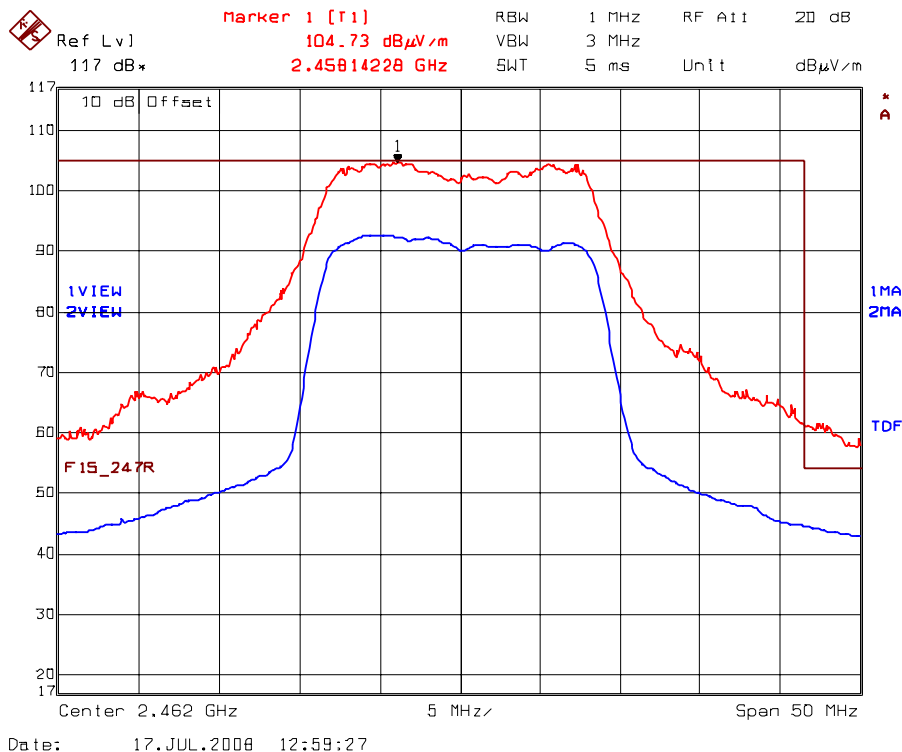
Trace 1: RBW= 1 MHz, VBW= 3 MHz  
Trace 2: RBW= 1 MHz, VBW= 10Hz

**Plot 6.9.4.1.2.3. Band-Edge RF Radiated Emissions @ 3 m**  
High End of Frequency Band  
Rx Antenna Orientation: Horizontal



Trace 1: RBW= 1 MHz, VBW= 3 MHz  
Trace 2: RBW= 1 MHz, VBW= 10Hz

**Plot 6.9.4.1.2.4. Band-Edge RF Radiated Emissions @ 3 m**  
 High End of Frequency Band  
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz  
 Trace 2: RBW= 1 MHz, VBW= 10Hz

**6.9.4.2. Spurious RF Conducted Emissions**

**Remarks:**

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT is tested in normal position (Rx vertical) and on battery side position (Rx horizontal).
- The following test results are the worst-case measurements in 802.11b mode and level in 802.11g mode were found to be lower than that in 802.11b mode.

Fundamental Frequency:		2412 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2412	109.09	--	V	--	--	--	--
2412	109.29	--	H	--	--	--	--
4824	63.15	50.85	V	54.0	89.29	-3.15	Pass*
4824	60.50	47.86	H	54.0	89.29	-6.14	Pass*

\*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

Fundamental Frequency:		2437MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2437	108.36	--	V	--	--	--	--
2437	108.55	--	H	--	--	--	--
4874	62.26	50.48	V	54.00	88.55	-3.52	Pass*
4874	62.82	50.57	H	54.00	88.55	-3.43	Pass*

\*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

Fundamental Frequency:		2462MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2462	107.54	--	V	--	--	--	--
2462	107.98	--	H	--	--	--	--
4924	63.07	50.06	V	54.0	87.98	-3.94	Pass*
4924	62.28	50.24	H	54.0	87.98	-3.76	Pass*

\*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

## 6.10. POWER SPECTRAL DENSITY [§ 15.247(e)]

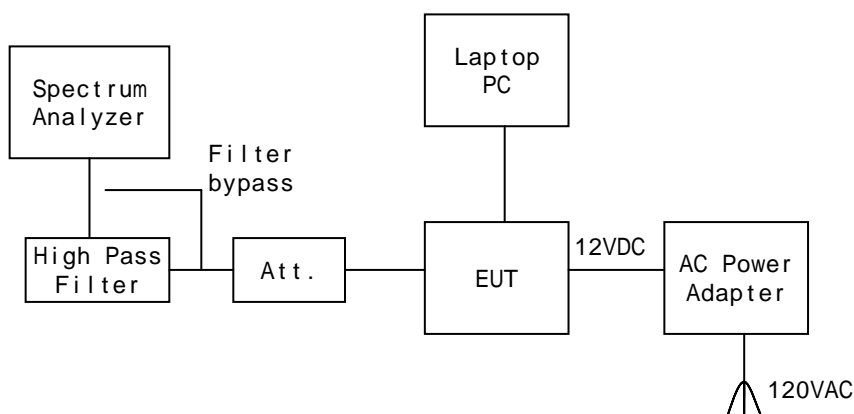
### 6.10.1. Limit(s)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 6.10.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), PSD Option 1 method.

### 6.10.3. Test Arrangement



**6.10.4. Test Data**

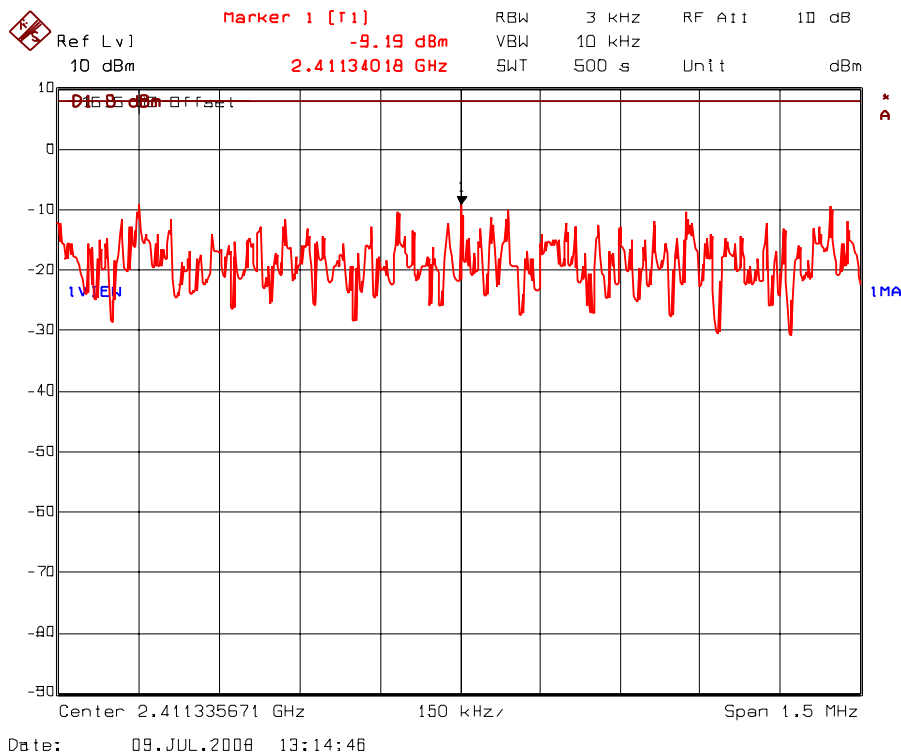
Remark: Measurement method: Power spectral density (PSD) Option 1.

**6.10.4.1. 802.11b mode, 11 Mbps, CCK**

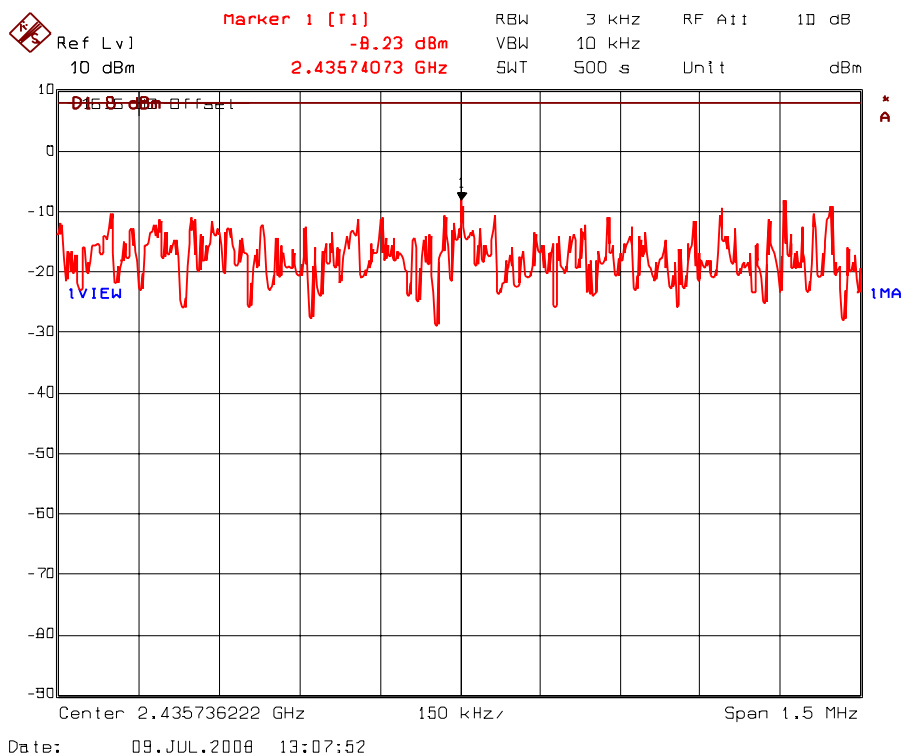
Frequency (MHz)	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)	Comments (Pass/Fail)
2412	-9.19	8	-17.19	Pass
2437	-8.23	8	-16.23	Pass
2462	-7.36	8	-15.36	Pass

\*See the following plots for measurement details.

**Plot 6.10.4.1.1. Power Spectral Density**  
 Frequency: 2412 MHz



Plot 6.10.4.1.2. Power Spectral Density  
Frequency: 2437 MHz



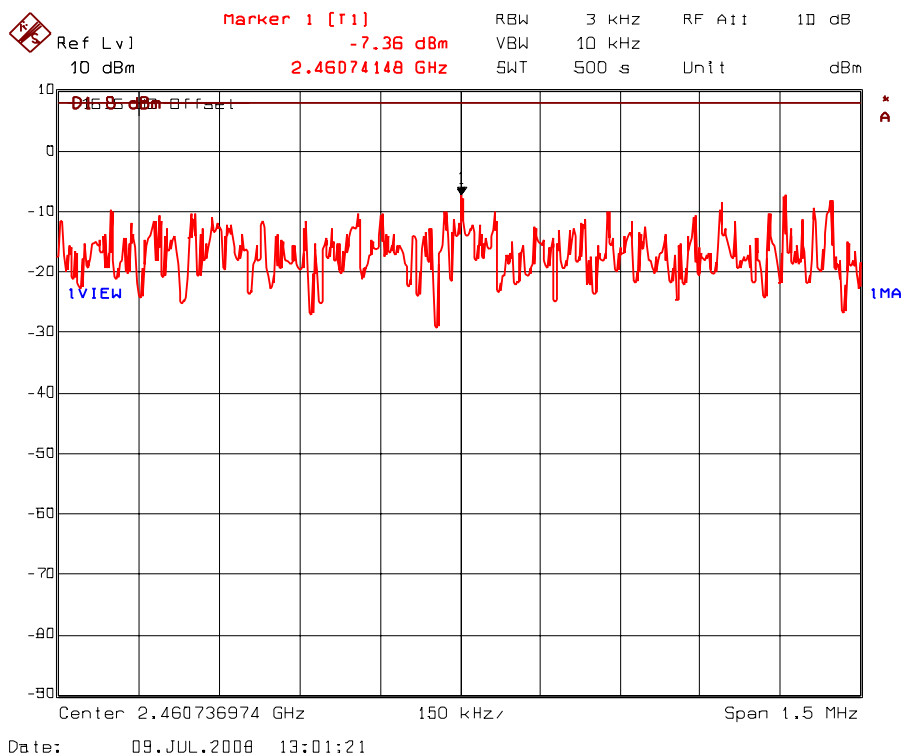
**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: LIBT-015F15C247  
July 25, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 6.10.4.1.3. Power Spectral Density  
Frequency: 2462 MHz



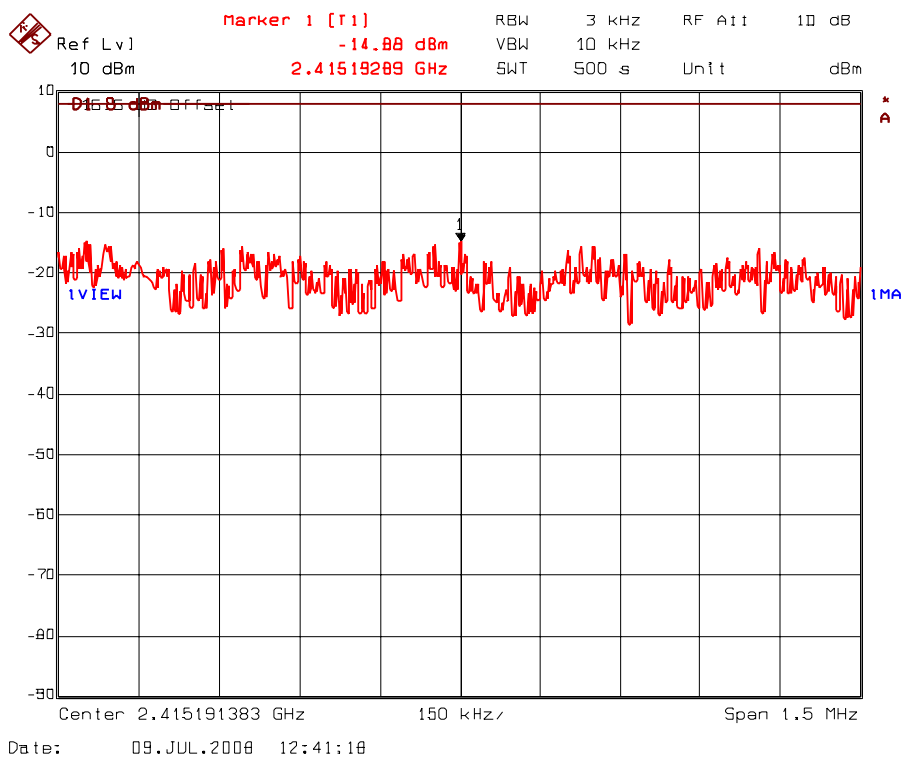


6.10.4.2. 802.11g mode, 54 Mbps, 64QAM

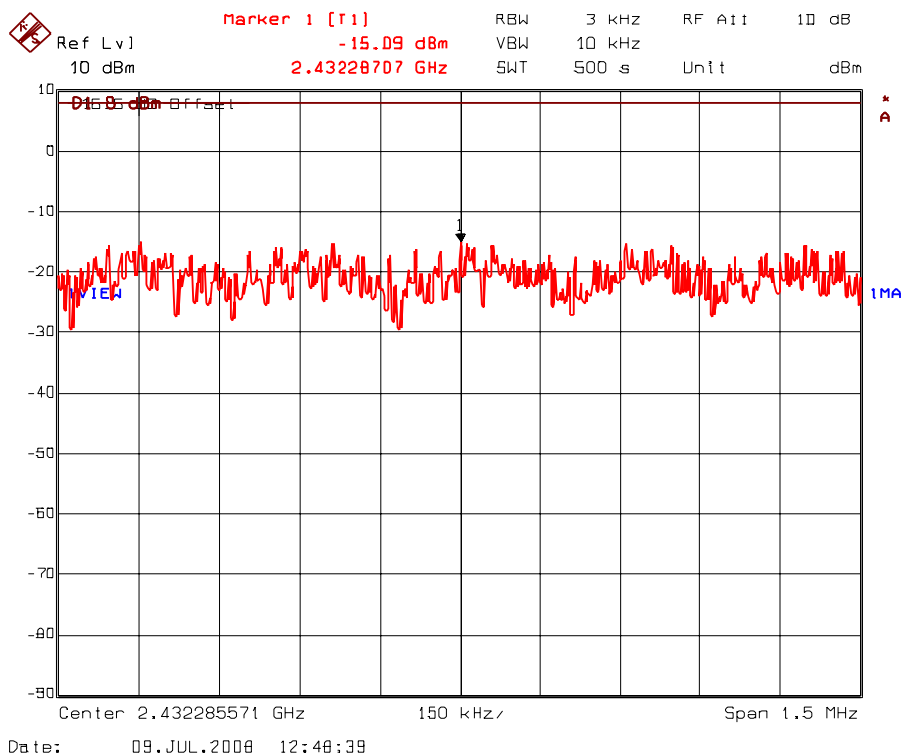
Frequency (MHz)	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)	Comments (Pass/Fail)
2412	-14.88	8	-22.88	Pass
2437	-15.09	8	-23.09	Pass
2462	-14.45	8	-22.45	Pass

\*See the following plots for measurement details.

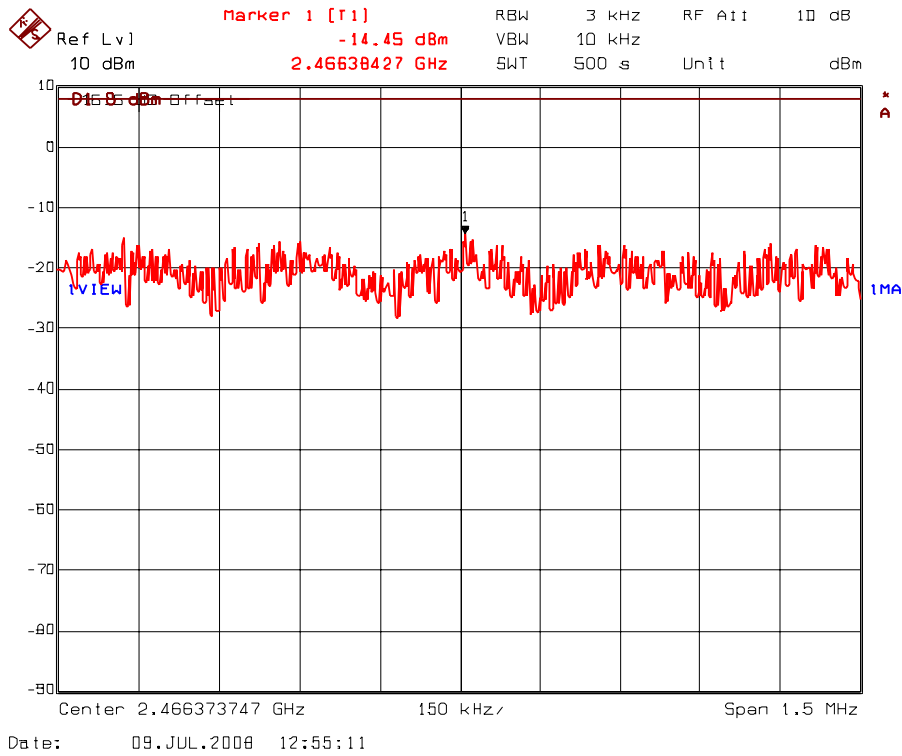
Plot 6.10.4.2.1. Power Spectral Density  
 Frequency: 2412 MHz



Plot 6.10.4.2.2. Power Spectral Density  
Frequency: 2437 MHz



Plot 6.10.4.2.3. Power Spectral Density  
Frequency: 2462 MHz



## EXHIBIT 7. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Attenuator (10dB)	Narda	4768-20	N/A	DC – 40 GHz
Attenuator (10dB)	Narda	4768-10	N/A	DC – 40 GHz
Biconilog antenna	EMCO	3142C	34792	26 - 3000 MHz
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 3.4 GHz
Horn Antenna	EMCO	3155	6570	1 – 18 GHz
Horn Antenna	EMCO	3160-09	1007	18 – 26.5 GHz
L.I.S.N.	Emco	3825/2	8.9E+07	9 kHz- 200 MHz (50ohms/50uH)
Peak Power Meter	Hewlett Packard	8900D	2131A01044	0.1 - 18 GHz
Power Sensor	Hewlett Packard	84811A	2551A01484	0.1 - 18 GHz
RF Amplifier	Com-Power	PA-103	161057	1 - 1000 MHz
RF Amplifier	Hewlett Packard	8449B	3008A00769	1 – 26.5 GHz
Spectrum Analyzer	Hewlett Packard	8593EM	3412A00103	9 kHz- 26.5 GHz
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz
Transient Limiter	Hewlett Packard	11947A	3.1E+08	9 kHz- 200 MHz (10dB)

## EXHIBIT 8. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

### 8.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	$\pm 1.5$	$\pm 1.5$
LISN coupling specification	Rectangular	$\pm 1.5$	$\pm 1.5$
Cable and Input Transient Limiter calibration	Normal (k=2)	$\pm 0.3$	$\pm 0.5$
Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8(9 \text{ kHz}) 0.2 (30 \text{ MHz})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	$\pm 0.2$	$\pm 0.3$
System repeatability	Std. deviation	$\pm 0.2$	$\pm 0.05$
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	$\pm 1.25$	$\pm 1.30$
Expanded uncertainty U	Normal (k=2)	$\pm 2.50$	$\pm 2.60$

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

## 8.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY ( $\pm$ dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	$\pm 1.0$	$\pm 1.0$
Cable Loss Calibration	Normal (k=2)	$\pm 0.3$	$\pm 0.5$
EMI Receiver specification	Rectangular	$\pm 1.5$	$\pm 1.5$
Antenna Directivity	Rectangular	$\pm 0.5$	$\pm 0.5$
Antenna factor variation with height	Rectangular	$\pm 2.0$	$\pm 0.5$
Antenna phase center variation	Rectangular	0.0	$\pm 0.2$
Antenna factor frequency interpolation	Rectangular	$\pm 0.25$	$\pm 0.25$
Measurement distance variation	Rectangular	$\pm 0.6$	$\pm 0.4$
Site imperfections	Rectangular	$\pm 2.0$	$\pm 2.0$
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$ (Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	+1.1 -1.25	$\pm 0.5$
System repeatability	Std. Deviation	$\pm 0.5$	$\pm 0.5$
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$