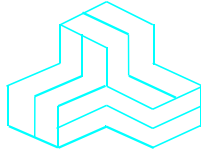


# ENGINEERING TEST REPORT



**XBee Wi-Fi RF Module**  
**Model: XBEE56**  
**FCC ID: MCQ-XBS6**

*Applicant:*

**Digi International Inc.**  
11001 Bren Road East  
Minnetonka, MN 55343

*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.: DIGI-043QF15C247**

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

Date: July 6, 2011

Report Prepared by: Dan Huynh

Tested by: Mr. Hung Trinh

Issued Date: July 6, 2011

Test Dates: May 25 ~ June 24, 2011

*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

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NvLap Lab Code 200093-0



SL2-IN-E-1119R



Korea KCC-RRL  
CA2049

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## EXHIBIT 1. INTRODUCTION

### 1.1. 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>	<ul style="list-style-type: none"><li>ANSI C63.4-2003</li><li>FCC, KDB Publication No. 558074</li></ul>
<b>Environmental Classification:</b>	<ul style="list-style-type: none"><li>[x] Commercial, industrial or business environment</li><li>[x] Residential environment</li></ul>

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

None.

### 1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2010	Code of Federal Regulations (CFR), Title 47 – Telecommunication
ANSI C63.4	2003 2009	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
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances
FCC, KDB Publication No. 558074	2005	Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

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File #: DIGI-043QF15C247

July 6, 2011

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

## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

APPLICANT	
<b>Name:</b>	Digi International Inc.
<b>Address:</b>	11001 Bren Road East Minnetonka, MN 55343 USA
<b>Contact Person:</b>	Mr. Frank Artner Phone #: 952-912-3235 Fax #: 952-912-4955 Email frank.artner@digi.com

MANUFACTURER	
<b>Name:</b>	Digi International Inc.
<b>Address:</b>	11001 Bren Road East Minnetonka, MN 55343 USA
<b>Contact Person:</b>	Mr. Frank Artner Phone #: 952-912-3235 Fax #: 952-912-4955 Email frank.artner@digi.com

### 2.2. 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>	Digi International Inc.
<b>Product Name:</b>	XBee Wi-Fi RF Module
<b>Model Name or Number:</b>	XBEE6
<b>Serial Number:</b>	Test Sample
<b>Type of Equipment:</b>	Digital Transmission System (DTS)
<b>Input Power Supply Type:</b>	External DC Power Supply
<b>Primary User Functions of EUT:</b>	The XBee Wi-Fi RF Modules are designed to operate within the 802.11b/g/n protocol and support the unique needs of low-cost, low-power wireless sensor networks.

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## 2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	<ul style="list-style-type: none"><li>• Mobile</li><li>• Base Station (fixed use)</li></ul>
Intended Operating Environment:	Commercial, industrial or business
Power Supply Requirement:	3.1 - 3.6 VDC
RF Output Power Rating:	802.11b: 11.16 dBm to 19.21 dBm (13.06 mW to 83.37 mW) Peak 802.11g: 13.89 dBm to 20.70 dBm (24.49 mW to 117.49 mW) Peak 802.11n: 14.17 dBm to 20.46 dBm (26.12 mW to 111.17 mW) Peak
Operating Frequency Range:	2412 – 2462 MHz
RF Output Impedance:	50 $\Omega$
Channel Spacing:	5 MHz
Duty Cycle:	100%
6 dB bandwidth:	17.88 MHz
Modulation Type:	OFDM, DSSS
Oscillator Frequency(ies):	40 MHz
Antenna Connector Types:	PCB Antenna, U.FL Connector, RPSMA Connector, or Integrated Wire

## 2.4. ASSOCIATED ANTENNA DESCRIPTION

The highest gain antenna from each type of antenna was selected for testing to represent the worst case. The following antennas were selected for testing in this filing:

1. Dipole Antenna (P/N: A24-HASM; Max. Antenna Gain: 2.1 dBi)
2. Omni-directional Antenna (P/N: A24-F15NF; Max. Antenna Gain: 15 dBi)
3. Panel Antenna (P/N: A24-19NF; Max. Antenna Gain: 19 dBi)
4. Yagi Antenna (P/N: A24-Y18NF; Max. Antenna Gain: 15 dBi)
5. Integrated Whip Monopole Antenna (P/N: A24-QI; Max. Antenna Gain: 1.5 dBi)

## 2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	RF port	1	U.FL	Shielded
2	RF port	1	RPSMA	Shielded
3	DC supply and I/O port	1	Pin	No cable, direct connection

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## 2.6. ANCILLARY EQUIPMENT

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

Ancillary Equipment # 1	
Description:	Test Jig Cable
Brand name:	Digi International
Model Name or Number:	N/A
Serial Number:	N/A
Connected to EUT's Port:	Module pin signals

---

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### EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

#### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power Input Source:	3.6 VDC

#### 3.2. 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>	Test jig cable connected to EUT.
<b>Transmitter Test Antenna:</b>	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral / non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
<b>Frequency Band(s):</b>	2412 - 2462 MHz
<b>Frequency(ies) Tested:</b> (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	2412, 2442 and 2462 MHz
<b>RF Power Output:</b> (measured maximum output power at antenna terminals)	20.70 dBm ( 117.49 mW) Peak
<b>Normal Test Modulation:</b>	OFDM, DSSS
<b>Modulating Signal Source:</b>	Internal

## EXHIBIT 4. SUMMARY OF TEST RESULTS

### 4.1. 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.

- AC 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.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

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

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes*
15.207(a)	AC 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	Yes

\* The EUT complies with the requirement; it employs a unique (non-standard) antenna connector or integral antenna (PCB Antenna, U.FL Connector, RPSMA Connector, or Integrated Wire).

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

None.

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## **EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS**

### **5.1. TEST PROCEDURES**

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4-2003 and FCC KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems.

### **5.2. MEASUREMENT UNCERTAINTIES**

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement. Refer to Exhibit 7 for Measurement Uncertainties.

### **5.3. 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.

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

The XBee Wi-Fi RF Modules are designed to operate within the 802.11b/g/n protocol and support the unique needs of low-cost, low-power wireless sensor networks.

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

### 5.5.1. Limit(s)

The equipment shall meet the limits of the following table:

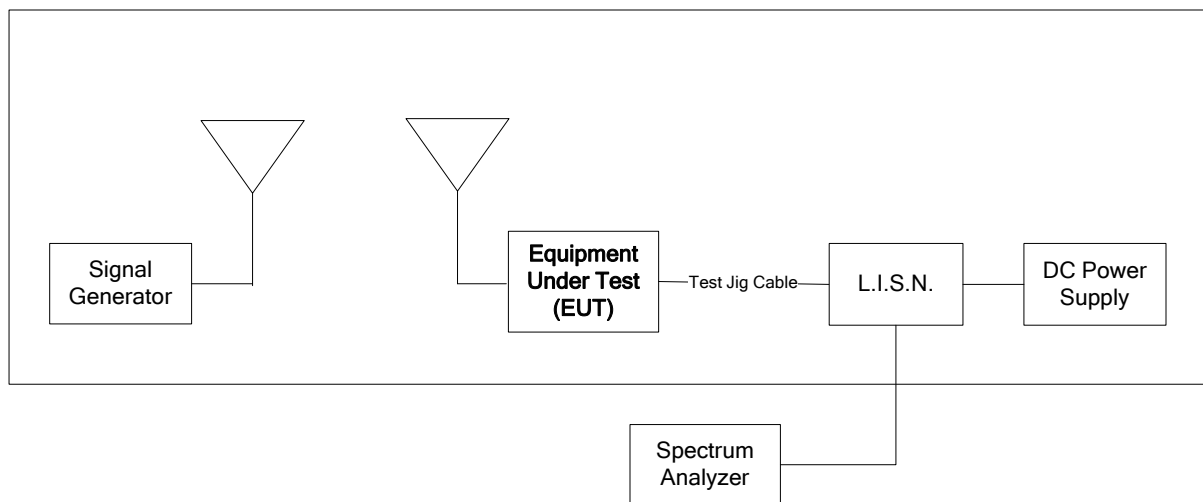
Frequency of emission (MHz)	Conducted Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15–0.5 .....	66 to 56* .....	56 to 46*
0.5–5 .....	56 .....	46
5–30 .....	60 .....	50

\*Decreases linearly with the logarithm of the frequency

### 5.5.2. Method of Measurements

ANSI C63.4-2003

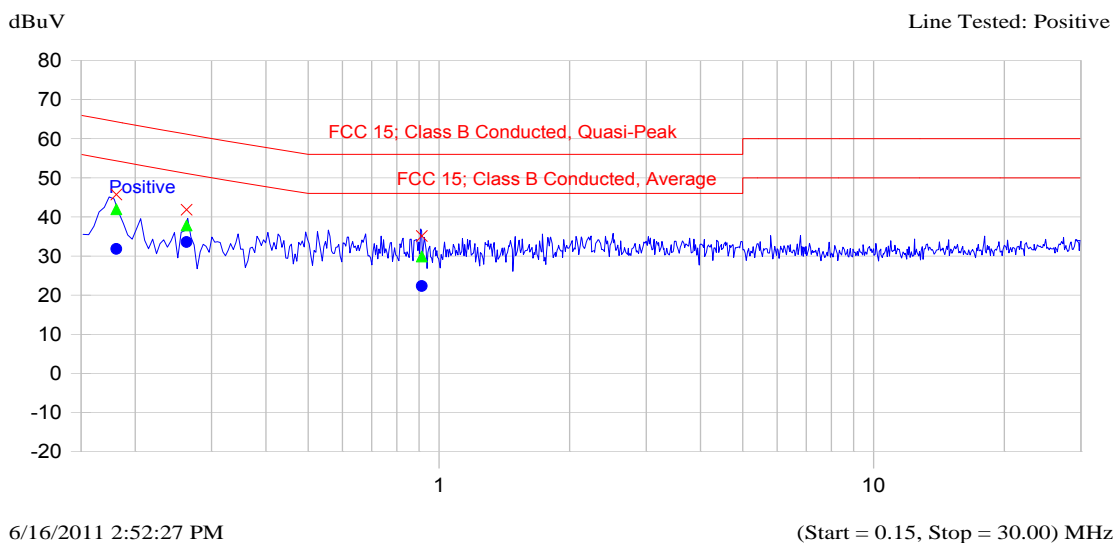
### 5.5.3. Test Arrangement



#### 5.5.4. Test Data

**Plot 5.5.4.1.** Power Line Conducted Emissions (Tx Mode)  
Line Voltage: 3.6VDC  
Line Tested: Positive

#### Current Graph

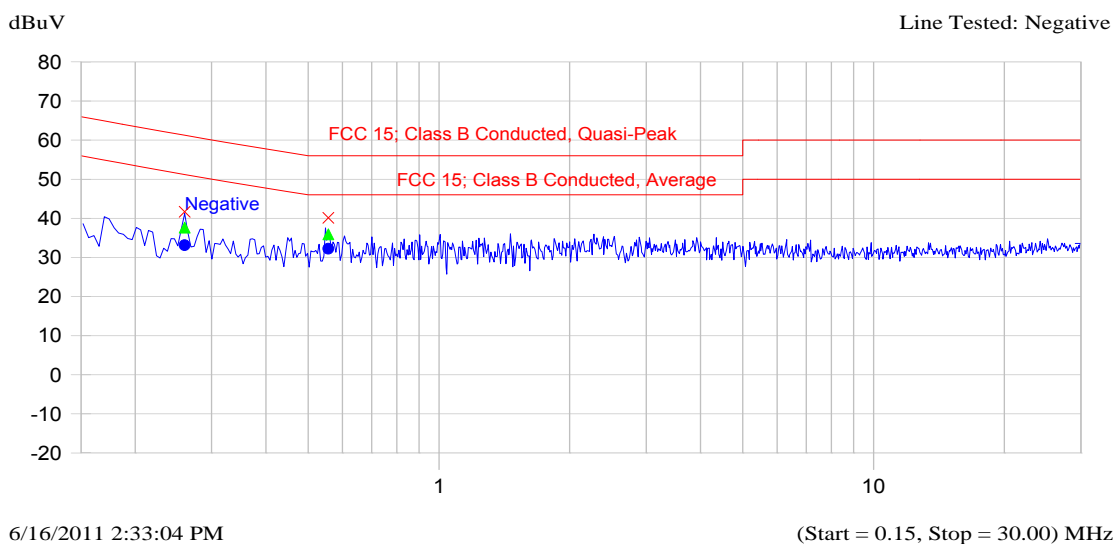


#### Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta dB	QP-QP Limit	Avg dBuV	Delta dB	Avg-Avg Limit	Trace Name
0.181	45.7	42.0	-22.5		31.8	-22.6		Positive
0.263	41.8	37.8	-23.5		33.5	-17.8		Positive
0.914	35.1	29.9	-26.1		22.3	-23.7		Positive

**Plot 5.5.4.2. Power Line Conducted Emissions (Tx Mode)**  
Line Voltage: 3.6VDC  
Line Tested: Negative

**Current Graph**

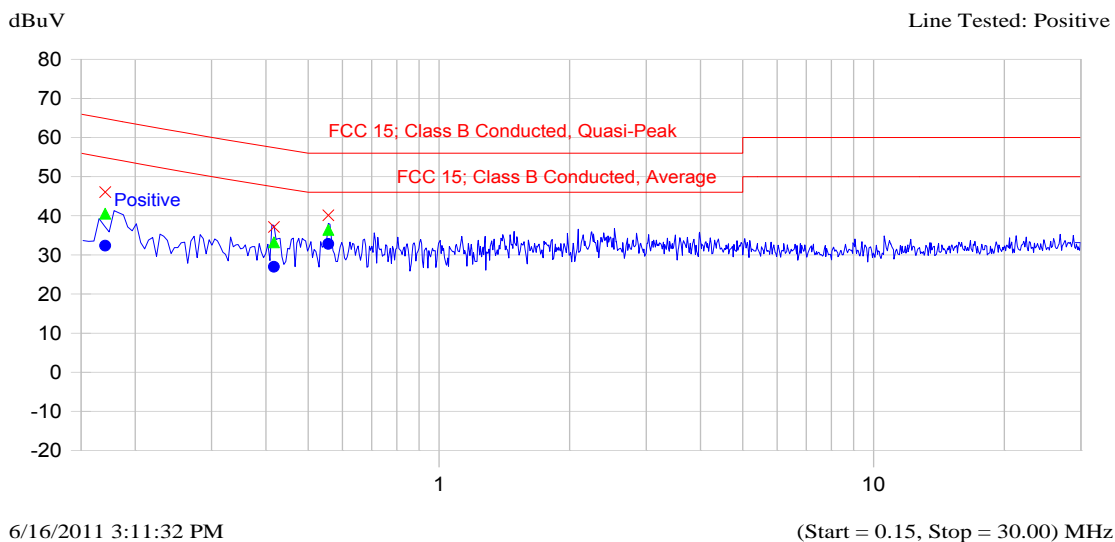


**Current List**

Frequency MHz	Peak dBuV	QP dBuV	Delta dB	QP-QP Limit dB	Avg dBuV	Delta dB	Avg-Avg Limit dB	Trace Name
0.260	41.7	37.6	-23.8		33.1	-18.3		Negative
0.557	40.1	35.9	-20.1		32.2	-13.8		Negative

**Plot 5.5.4.3.** Power Line Conducted Emissions (Rx Mode)  
Line Voltage: 3.6VDC  
Line Tested: Positive

### Current Graph

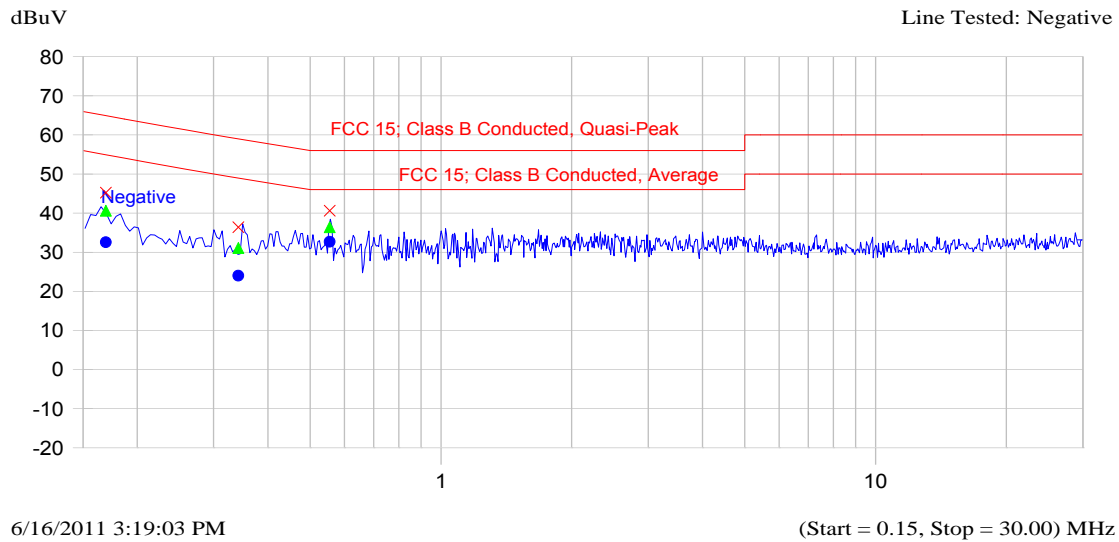


### Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta dB	QP-QP Limit	Avg dBuV	Delta dB	Avg-Avg Limit	Trace Name
0.171	46.0	40.5	-24.4		32.3	-22.6		Positive
0.417	37.1	33.2	-24.3		27.0	-20.5		Positive
0.557	40.1	36.4	-19.6		32.8	-13.2		Positive

**Plot 5.5.4.4. Power Line Conducted Emissions (Rx Mode)**  
Line Voltage: 3.6VDC  
Line Tested: Negative

**Current Graph**



**Current List**

Frequency MHz	Peak dBuV	QP dBuV	Delta dB	QP-QP Limit	Avg dBuV	Delta dB	Avg-Avg Limit	Trace Name
0.170	45.2	40.6	-24.4		32.5	-22.4		Negative
0.342	36.4	31.1	-28.1		24.0	-25.2		Negative
0.555	40.6	36.4	-19.6		32.7	-13.3		Negative

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

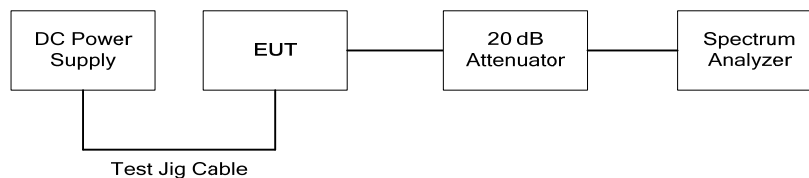
### 5.6.1. Limit(s)

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

### 5.6.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247) and ANSI C63.4-2003.

### 5.6.3. Test Arrangement



### 5.6.4. Test Data

802.11b Mode				
Frequency (MHz)	Modulation	Data Rate (Mbps)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2412	DBPSK	1	10.12	12.17
	DQPSK	2	10.12	12.22
	CCK	11	10.02	12.02
2442	DBPSK	1	10.17	12.12
	DQPSK	2	10.17	12.22
	CCK	11	10.02	12.02
2462	DBPSK	1	10.07	12.17
	DQPSK	2	10.07	12.22
	CCK	11	10.17	12.02

802.11g Mode				
Frequency (MHz)	Modulation	Data Rate (Mbps)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2412	BPSK	9	16.67	16.83
	QPSK	18	16.59	16.75
	16-QAM	36	16.59	16.75
	64-QAM	54	16.67	16.67
2442	BPSK	9	16.59	16.83
	QPSK	18	16.67	16.75
	16-QAM	36	16.59	16.75
	64-QAM	54	16.59	16.67
2462	BPSK	9	16.59	16.83
	QPSK	18	16.67	16.75
	16-QAM	36	16.59	16.75
	64-QAM	54	16.67	16.67

802.11n Mode				
Frequency (MHz)	Modulation	Data Rate (Mbps)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2412	BPSK1/2	6.5	17.80	17.88
	QPSK3/4	19.5	17.80	17.88
	16-QAM3/4	39	17.88	17.88
	64-QAM5/6	65	17.88	17.80
2442	BPSK1/2	6.5	17.80	17.88
	QPSK3/4	19.5	17.80	17.80
	16-QAM3/4	39	17.88	17.80
	64-QAM5/6	65	17.88	17.72
2462	BPSK1/2	6.5	17.80	17.88
	QPSK3/4	19.5	17.80	17.80
	16-QAM3/4	39	17.80	17.80
	64-QAM5/6	65	17.80	17.72

See the following plots for detailed measurements.

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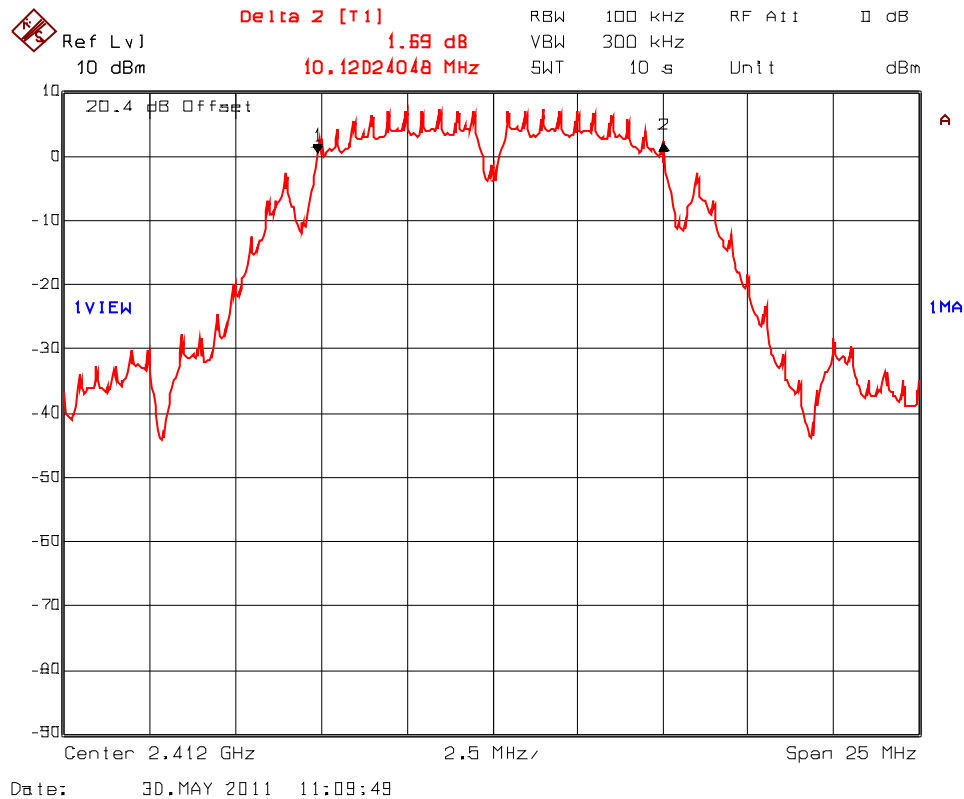
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**Plot 5.6.4.1. 6 dB Bandwidth, 802.11b, DBPSK 1 Mbps**  
Test Frequency: 2412 MHz



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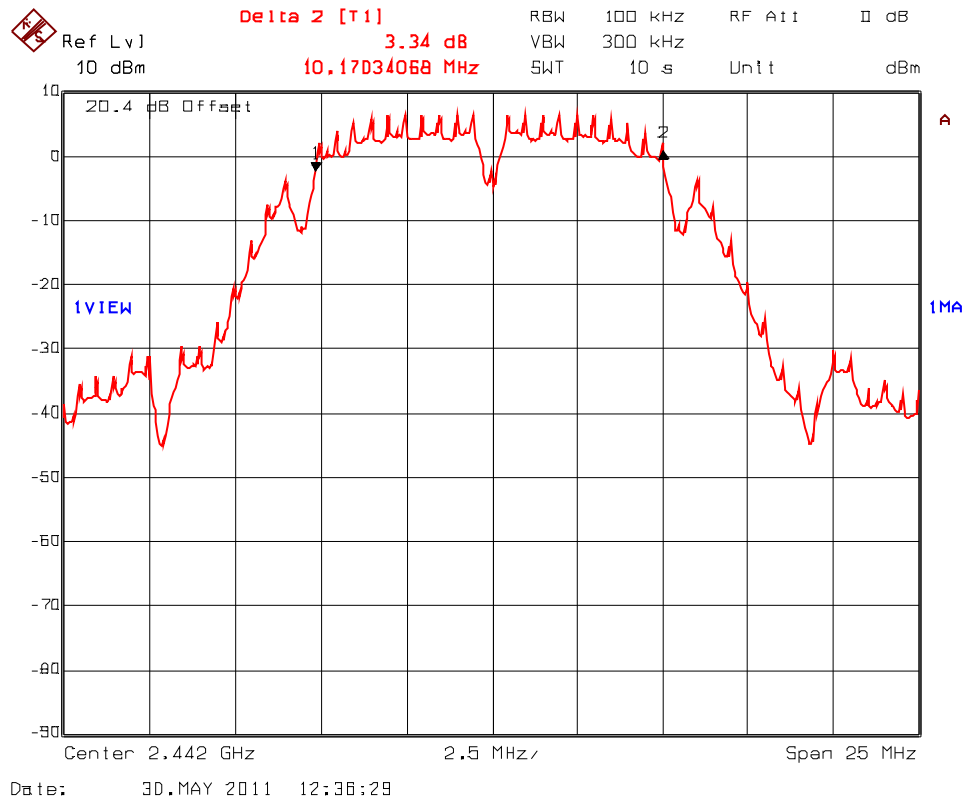
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**Plot 5.6.4.2. 6 dB Bandwidth, 802.11b, DBPSK 1 Mbps**  
Test Frequency: 2442 MHz



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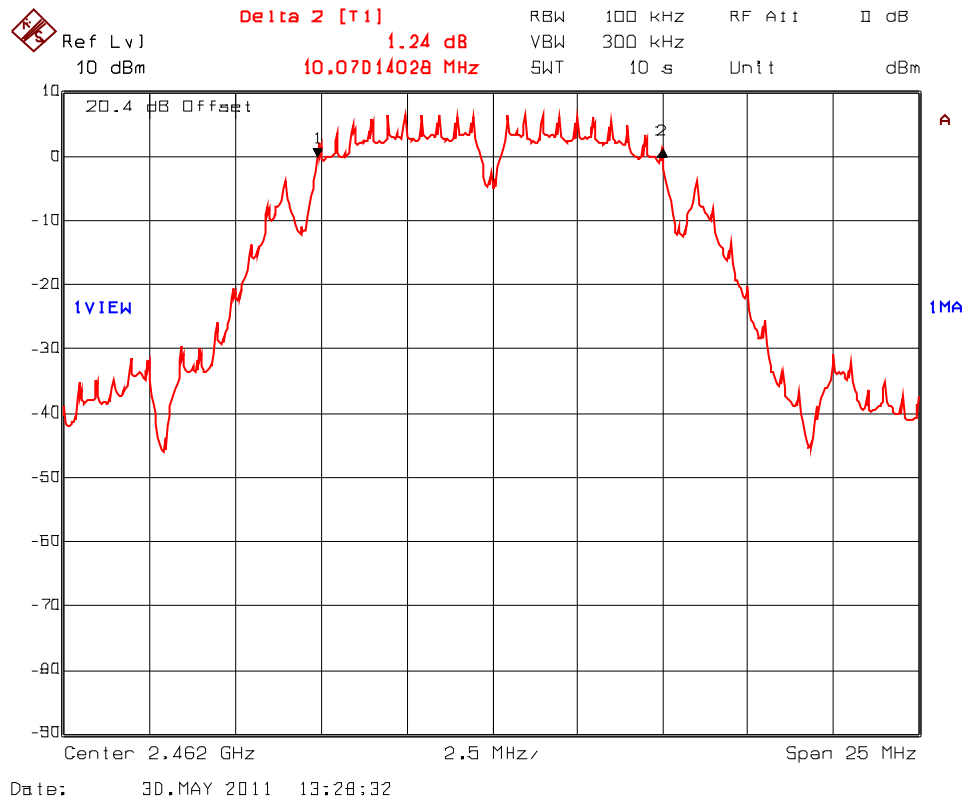
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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**Plot 5.6.4.3. 6 dB Bandwidth, 802.11b, DBPSK 1 Mbps**  
Test Frequency: 2462 MHz



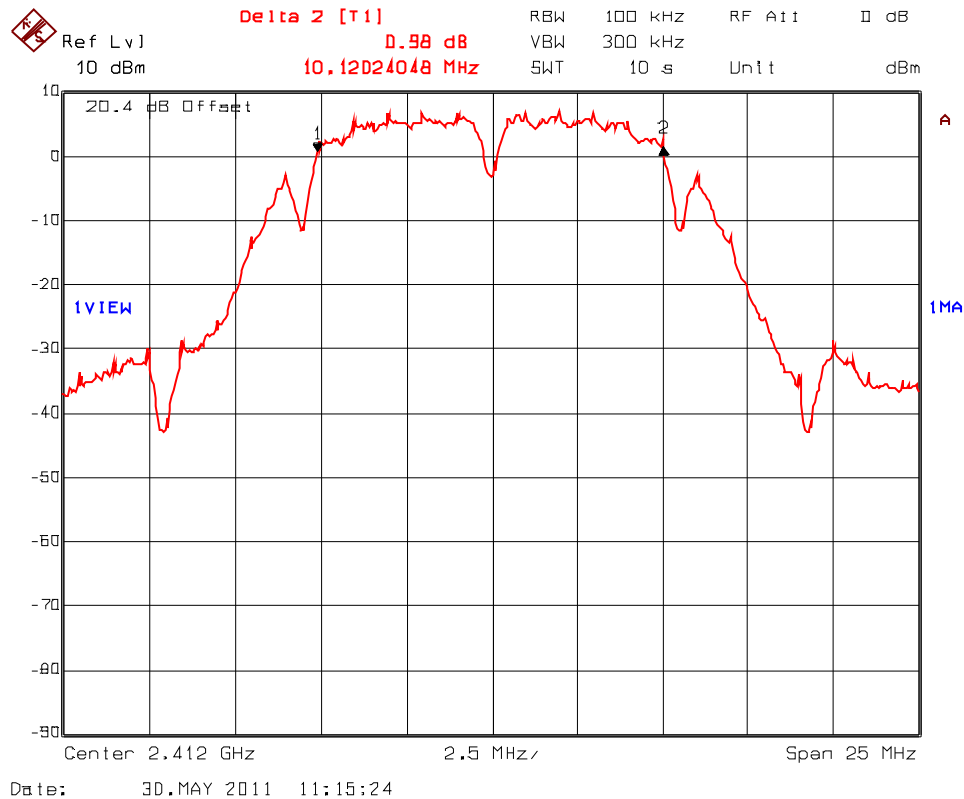
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.4. 6 dB Bandwidth, 802.11b, DQPSK 2 Mbps**  
Test Frequency: 2412 MHz



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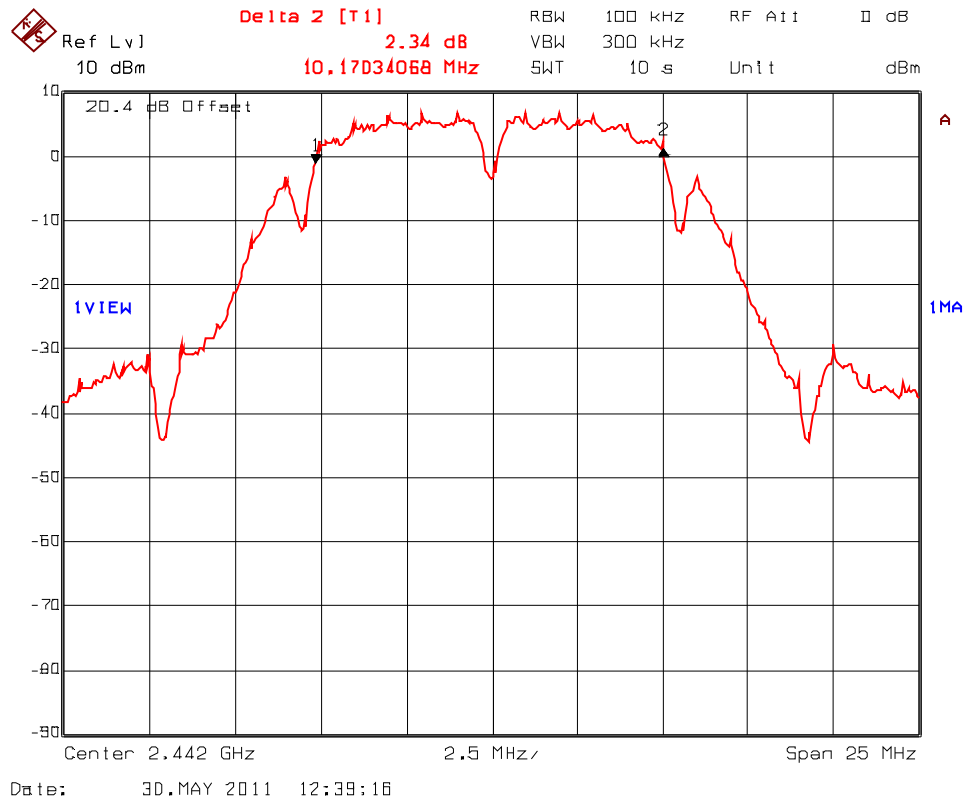
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.5. 6 dB Bandwidth, 802.11b, DQPSK 2 Mbps**  
Test Frequency: 2442 MHz



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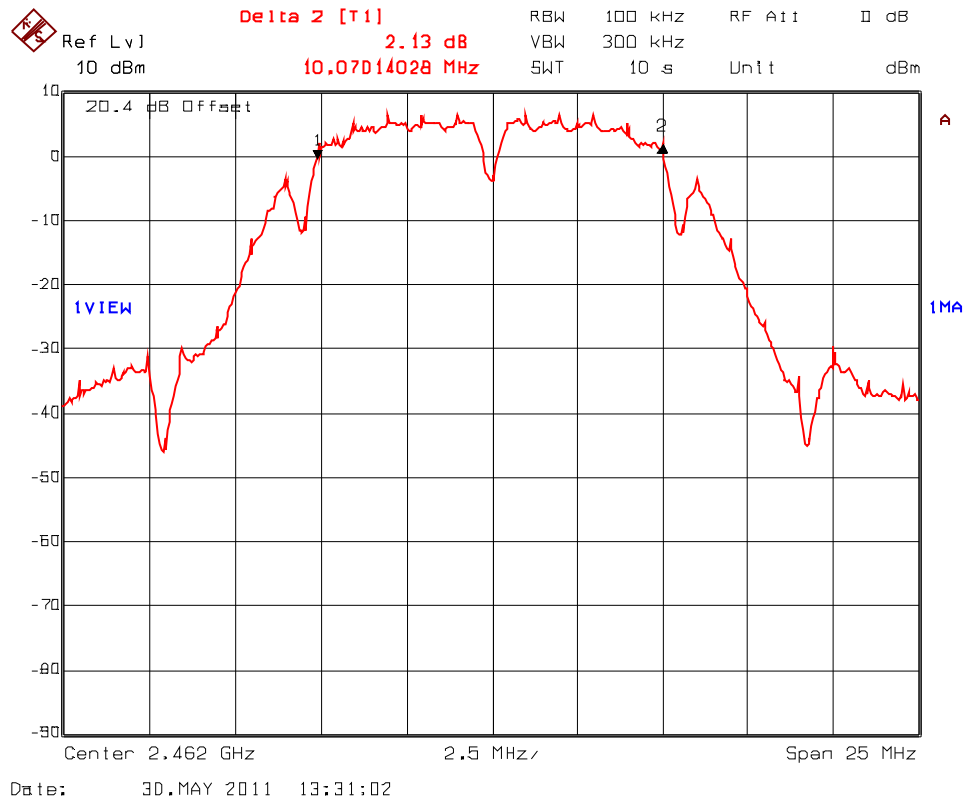
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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July 6, 2011

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**Plot 5.6.4.6. 6 dB Bandwidth, 802.11b, DQPSK 2 Mbps**  
Test Frequency: 2462 MHz



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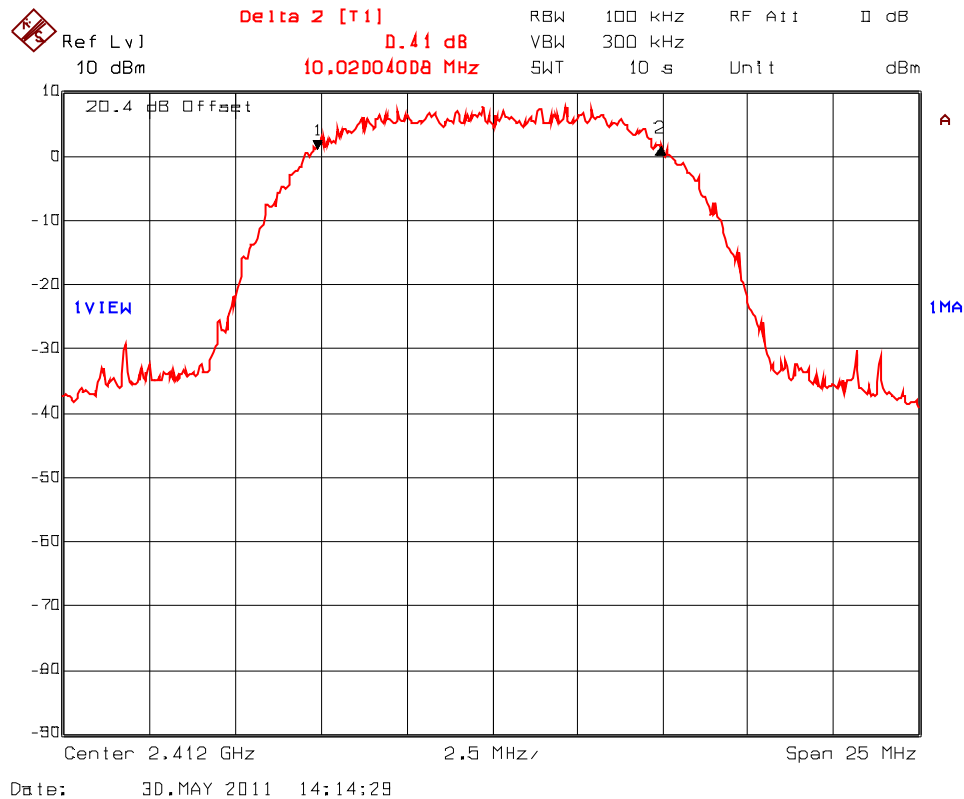
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.7. 6 dB Bandwidth, 802.11b, CCK 11 Mbps**  
Test Frequency: 2412 MHz



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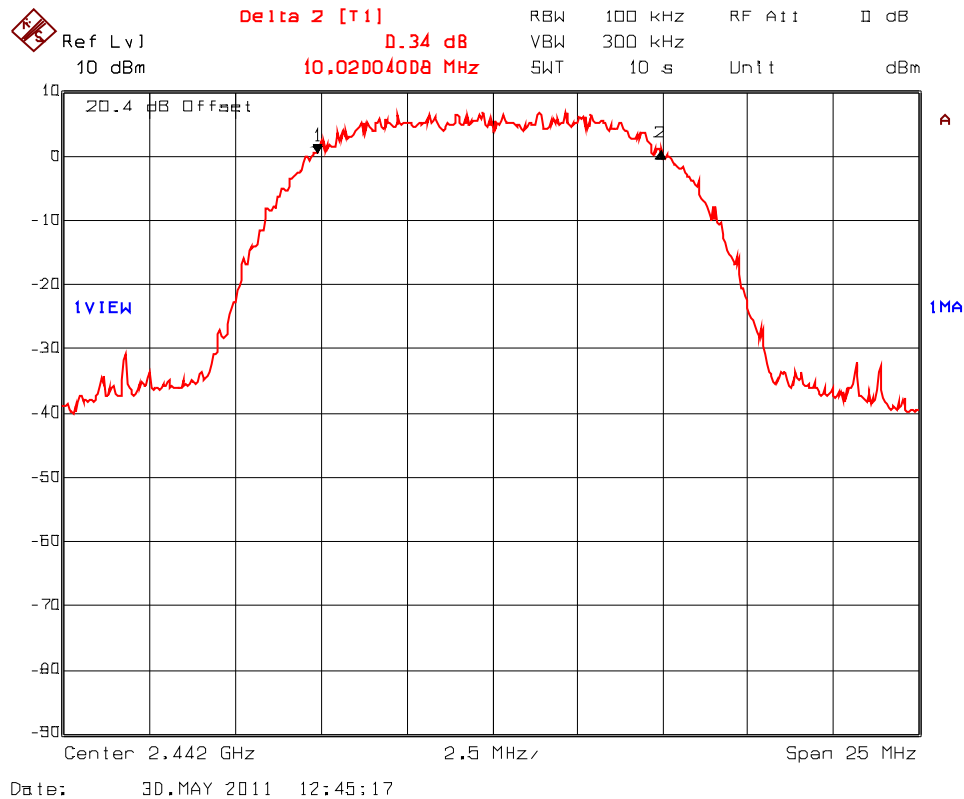
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.8. 6 dB Bandwidth, 802.11b, CCK 11 Mbps**  
Test Frequency: 2442 MHz



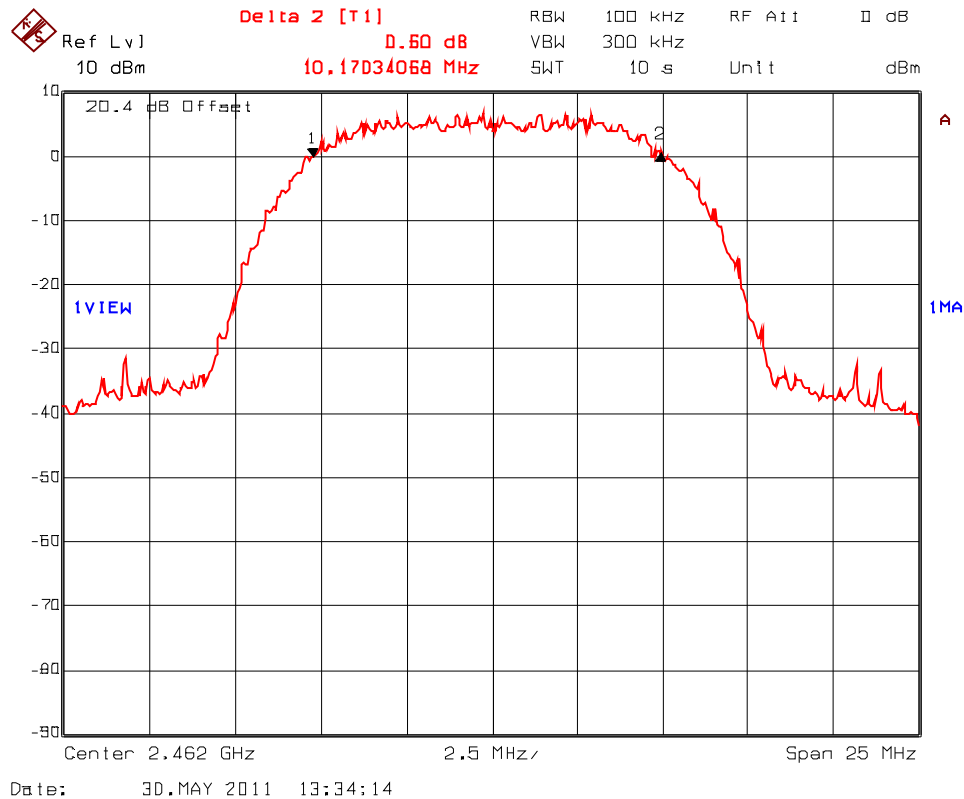
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.9. 6 dB Bandwidth, 802.11b, CCK 11 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

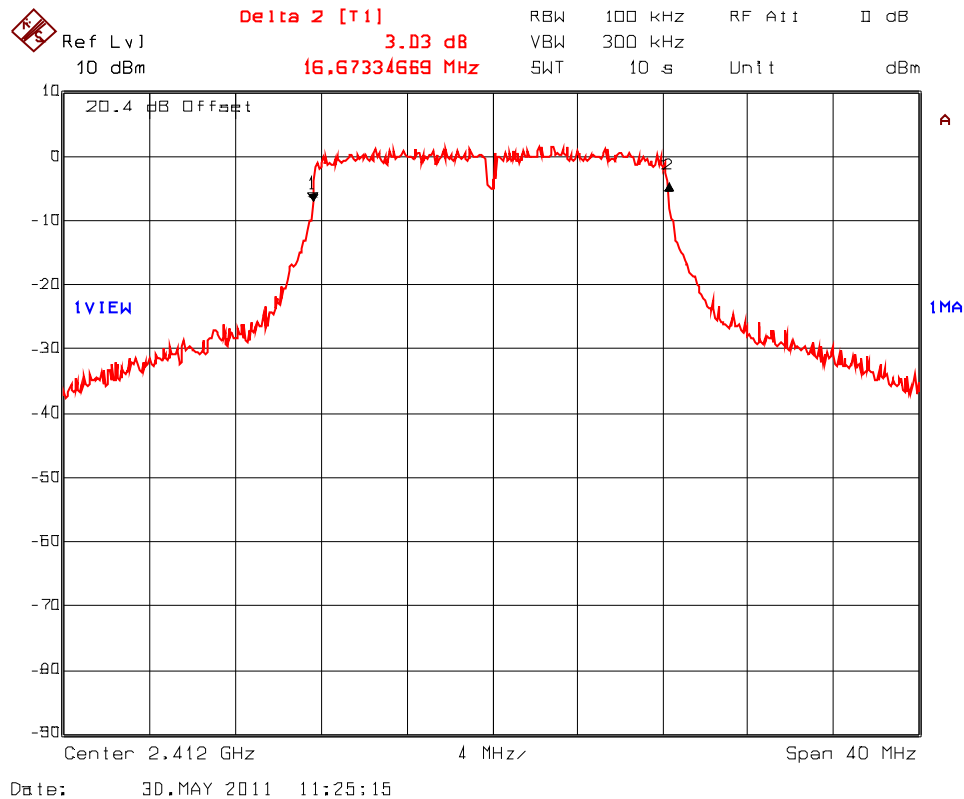
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.10. 6 dB Bandwidth, 802.11g, BPSK 9 Mbps**  
Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

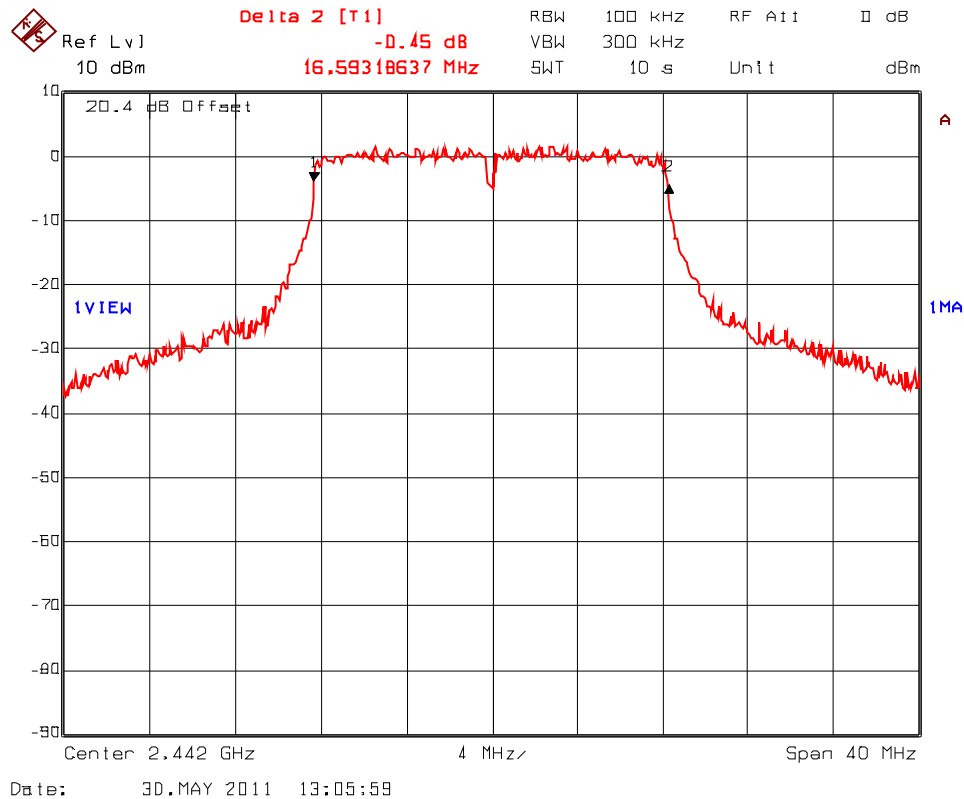
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.11. 6 dB Bandwidth, 802.11g, BPSK 9 Mbps**  
Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

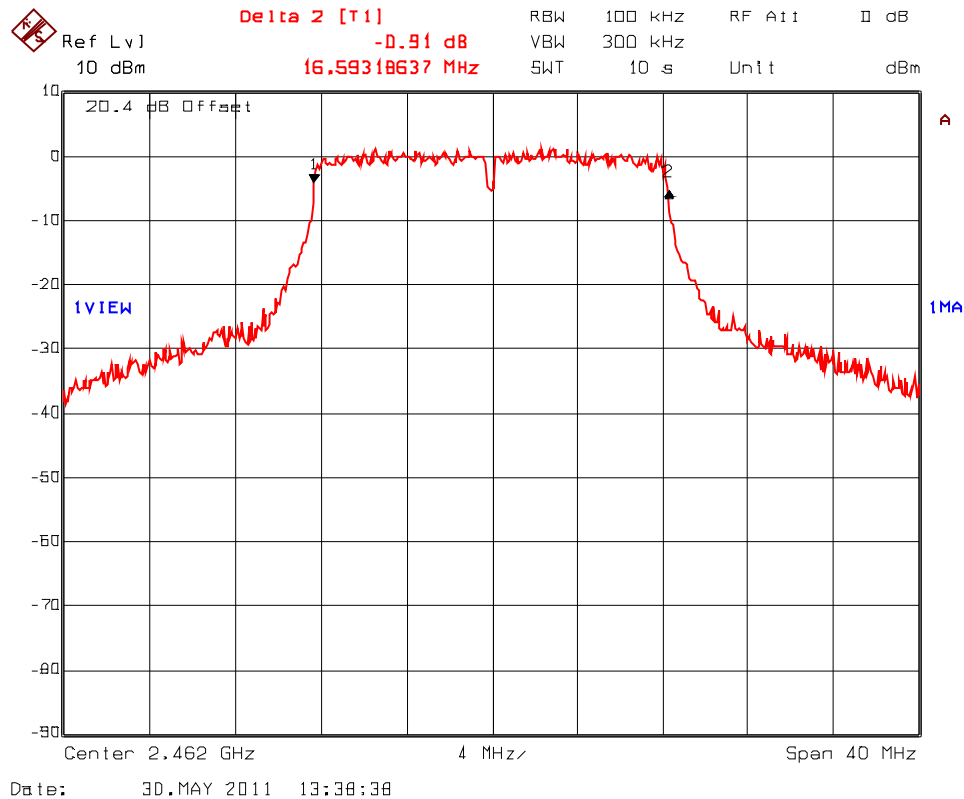
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.12. 6 dB Bandwidth, 802.11g, BPSK 9 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

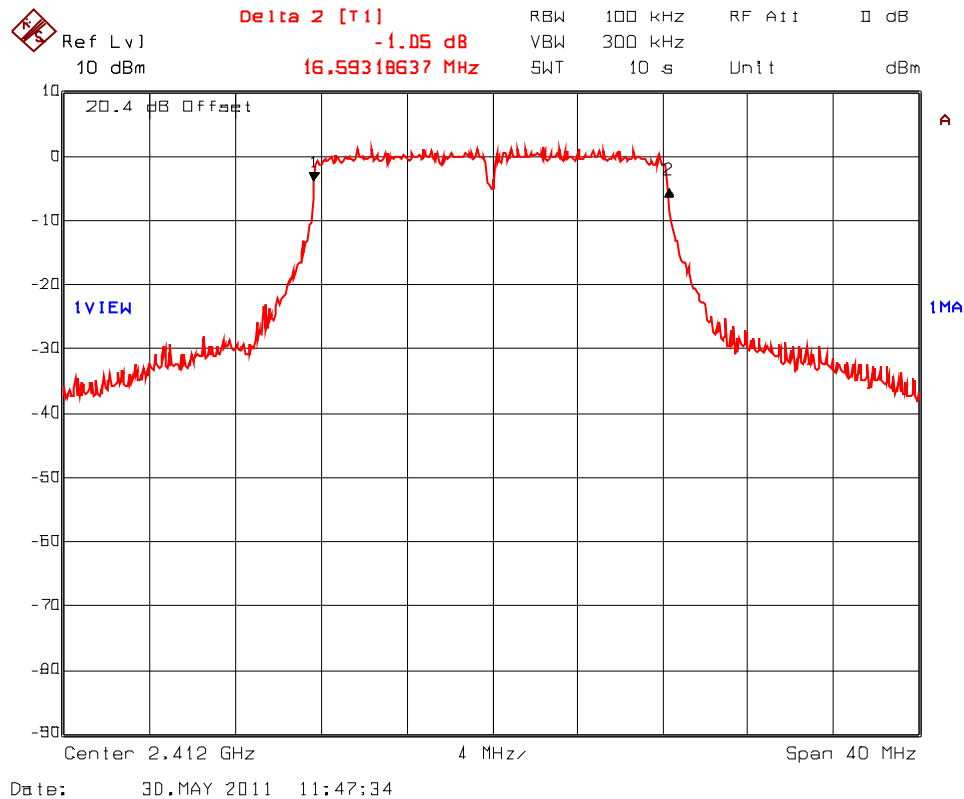
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.13. 6 dB Bandwidth, 802.11g, QPSK 18 Mbps**  
Test Frequency: 2412 MHz



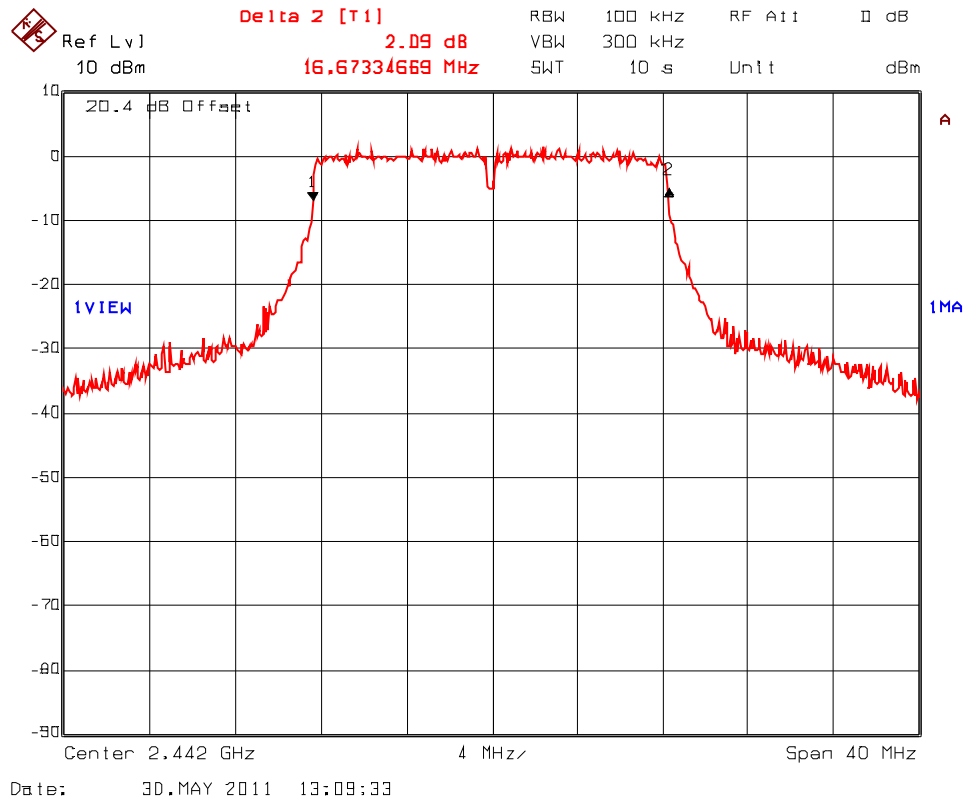
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**Plot 5.6.4.14. 6 dB Bandwidth, 802.11g, QPSK 18 Mbps**  
Test Frequency: 2442 MHz



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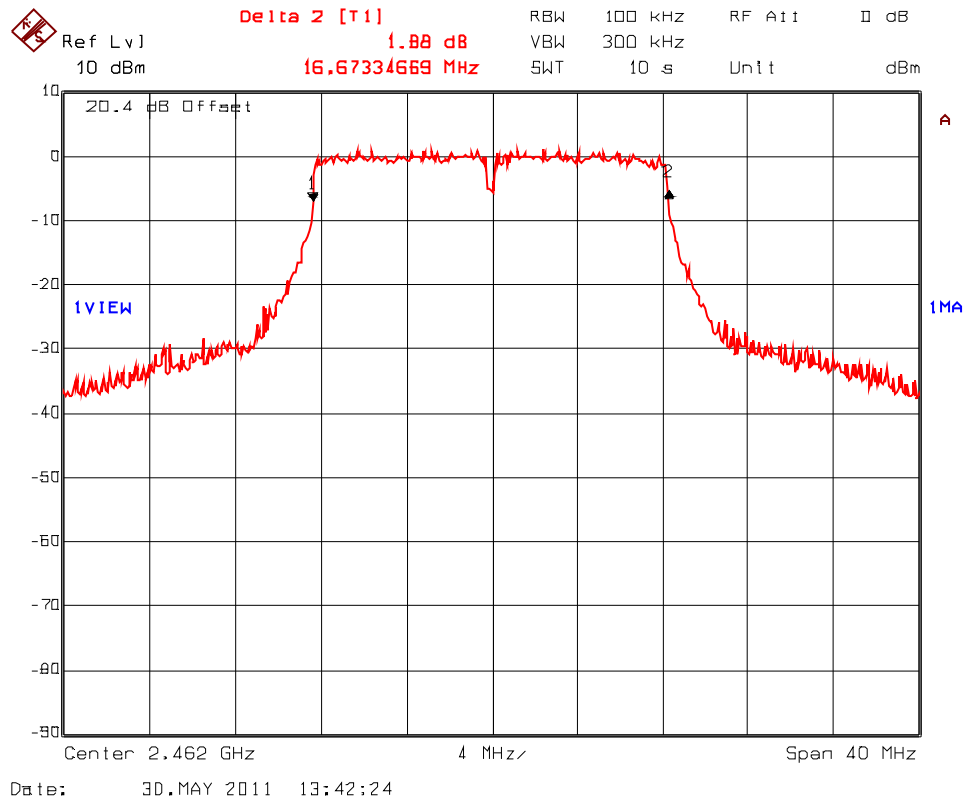
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.15. 6 dB Bandwidth, 802.11g, QPSK 18 Mbps**  
Test Frequency: 2462 MHz



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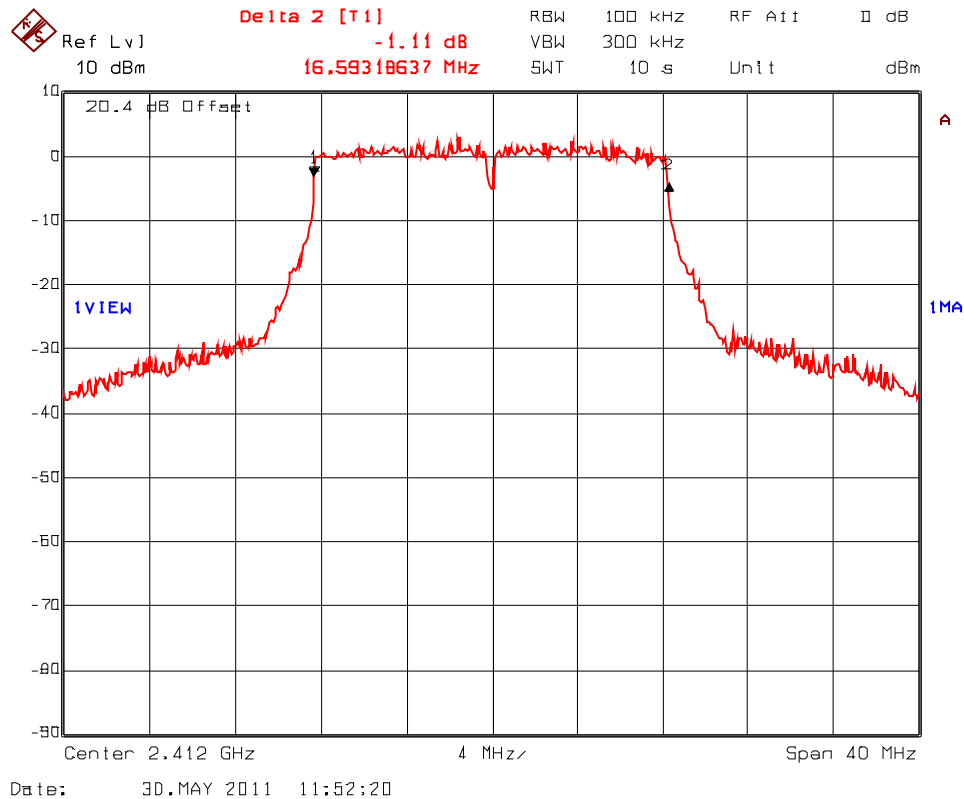
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.16. 6 dB Bandwidth, 802.11g, 16-QAM 36 Mbps**  
Test Frequency: 2412 MHz



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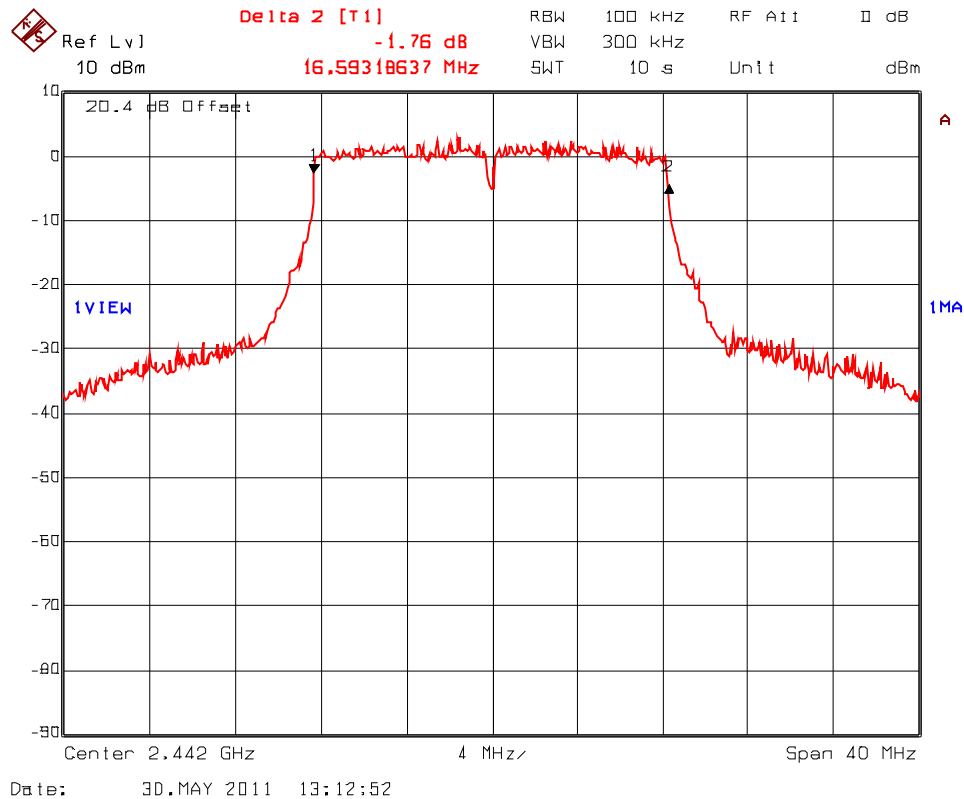
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.17. 6 dB Bandwidth, 802.11g, 16-QAM 36 Mbps**  
Test Frequency: 2442 MHz



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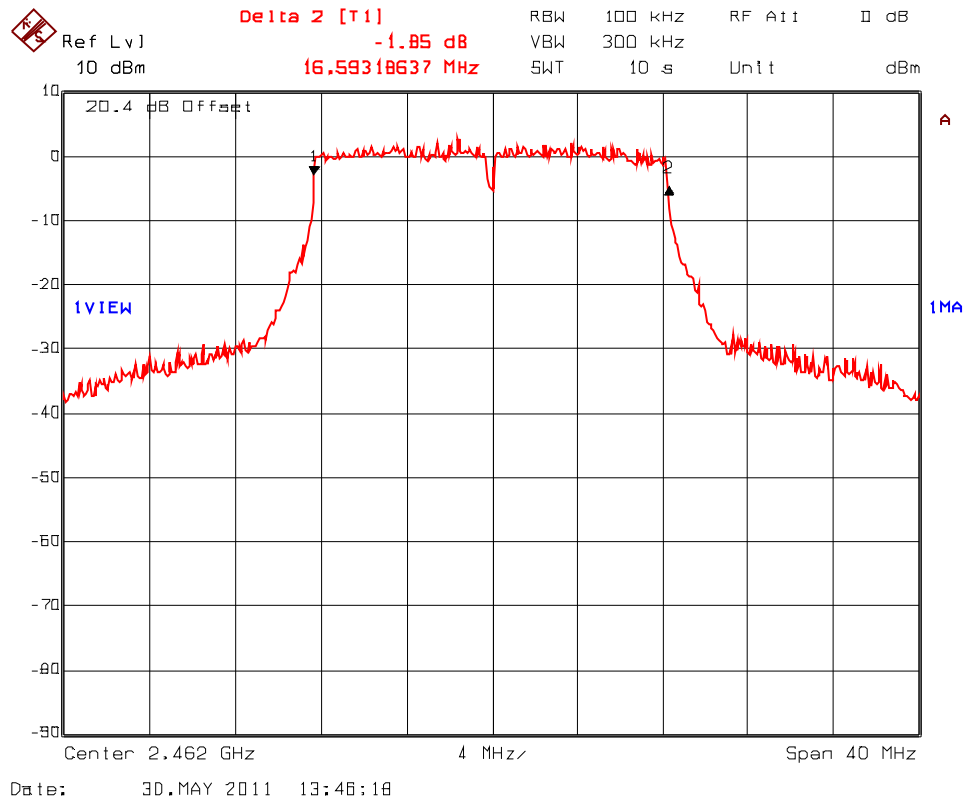
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.18.** 6 dB Bandwidth, 802.11g, 16-QAM 36 Mbps  
Test Frequency: 2462 MHz



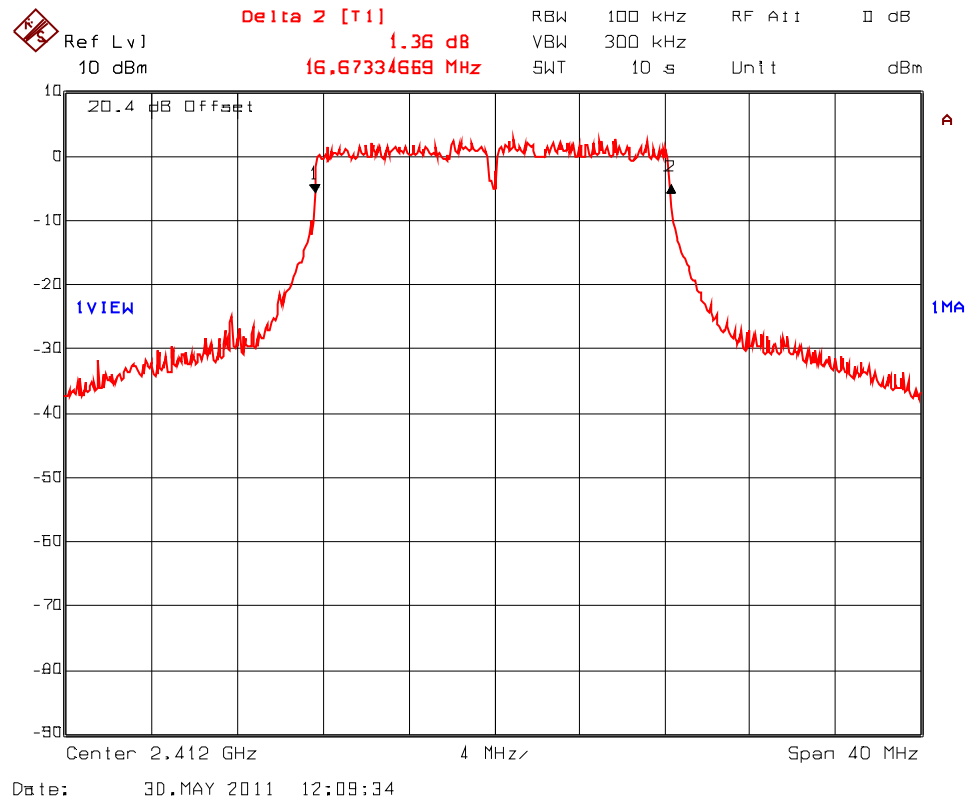
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.19. 6 dB Bandwidth, 802.11g, 64-QAM 54 Mbps**  
Test Frequency: 2412 MHz



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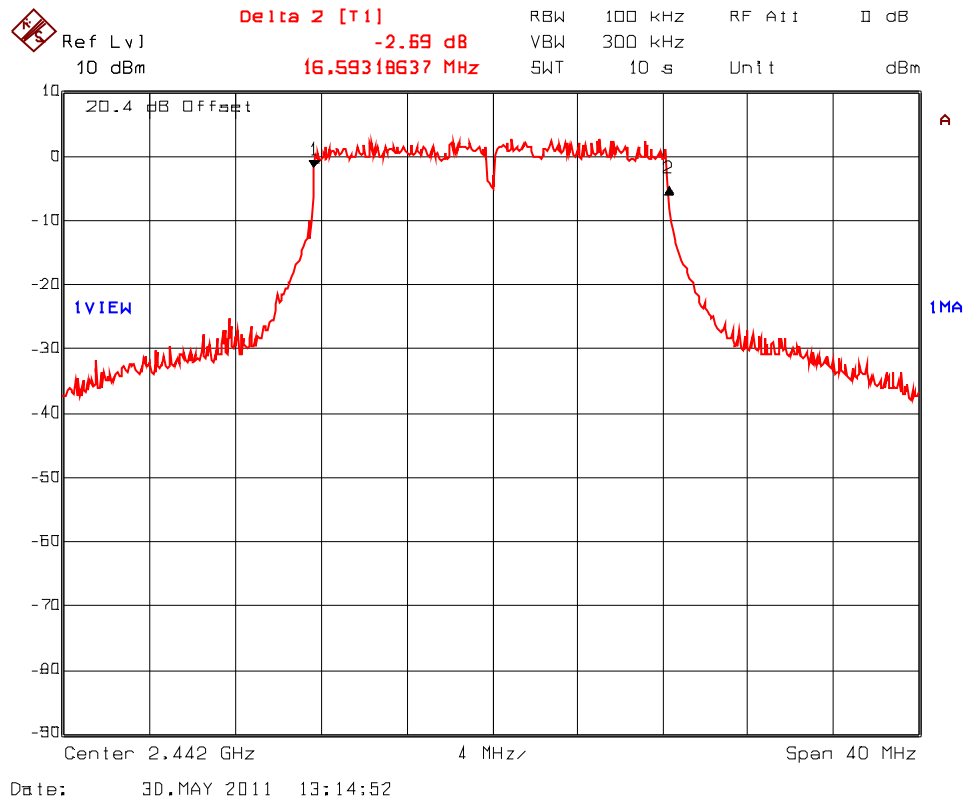
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.20. 6 dB Bandwidth, 802.11g, 64-QAM 54 Mbps**  
Test Frequency: 2442 MHz



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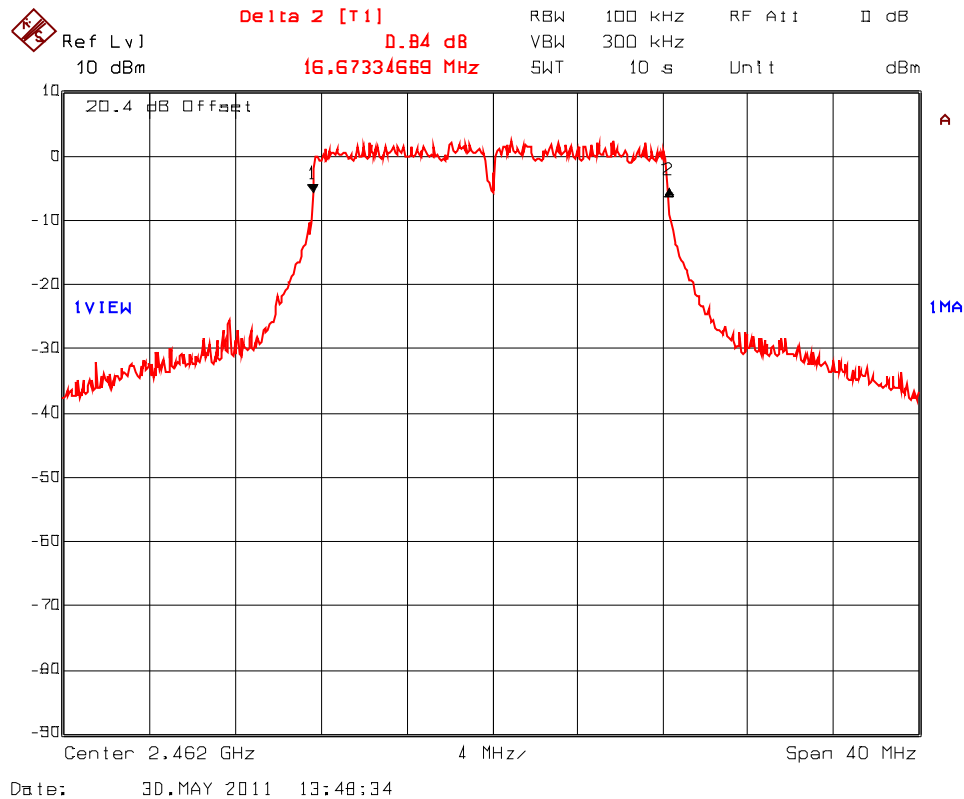
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.21. 6 dB Bandwidth, 802.11g, 64-QAM 54 Mbps**  
Test Frequency: 2462 MHz



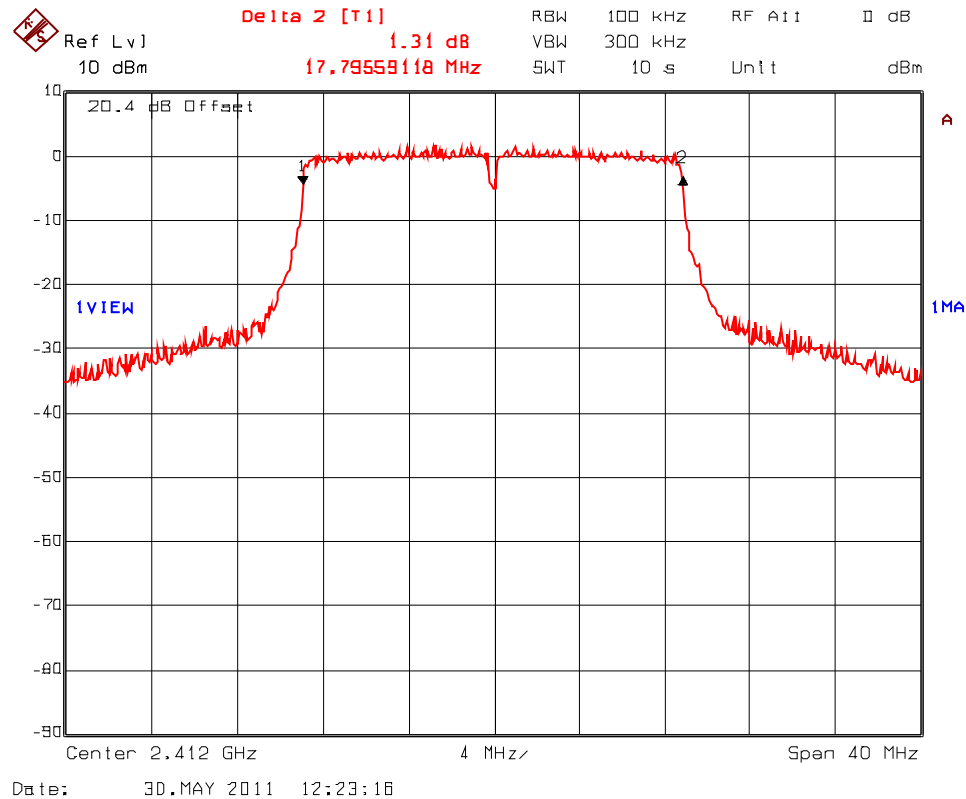
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**Plot 5.6.4.22. 6 dB Bandwidth, 802.11n MCS0 BPSK1/2 6.5 Mbps**  
Test Frequency: 2412 MHz



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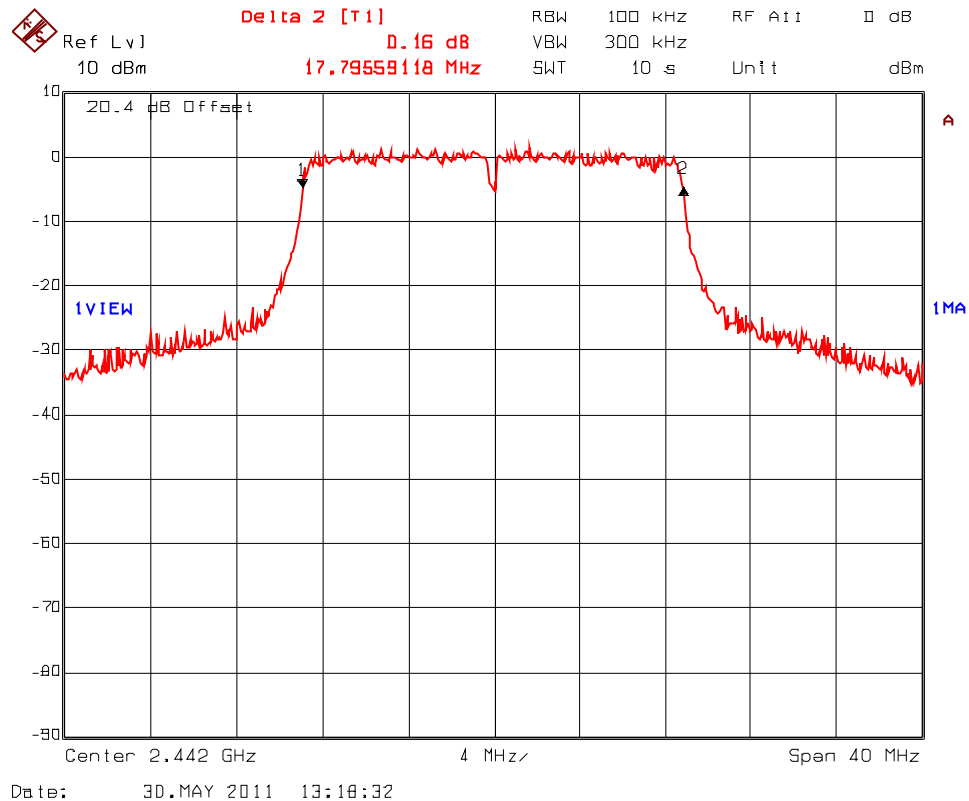
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.23. 6 dB Bandwidth, 802.11n MCS0 BPSK1/2 6.5 Mbps**  
Test Frequency: 2442 MHz



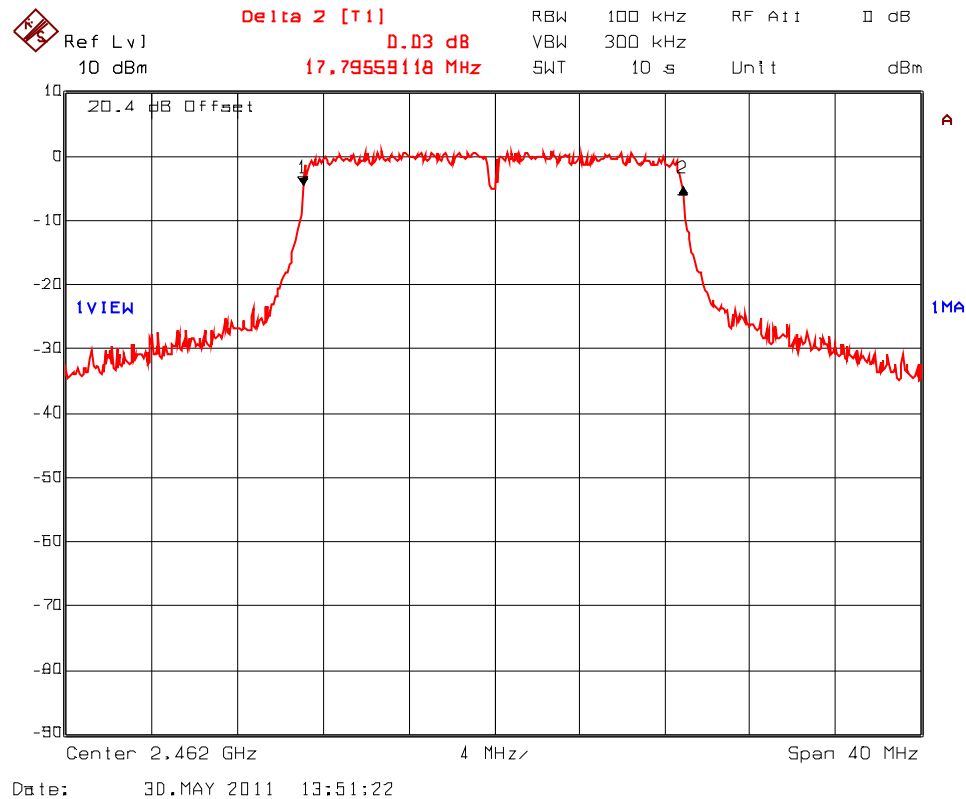
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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July 6, 2011

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**Plot 5.6.4.24. 6 dB Bandwidth, 802.11n MCS0 BPSK1/2 6.5 Mbps**  
Test Frequency: 2462 MHz



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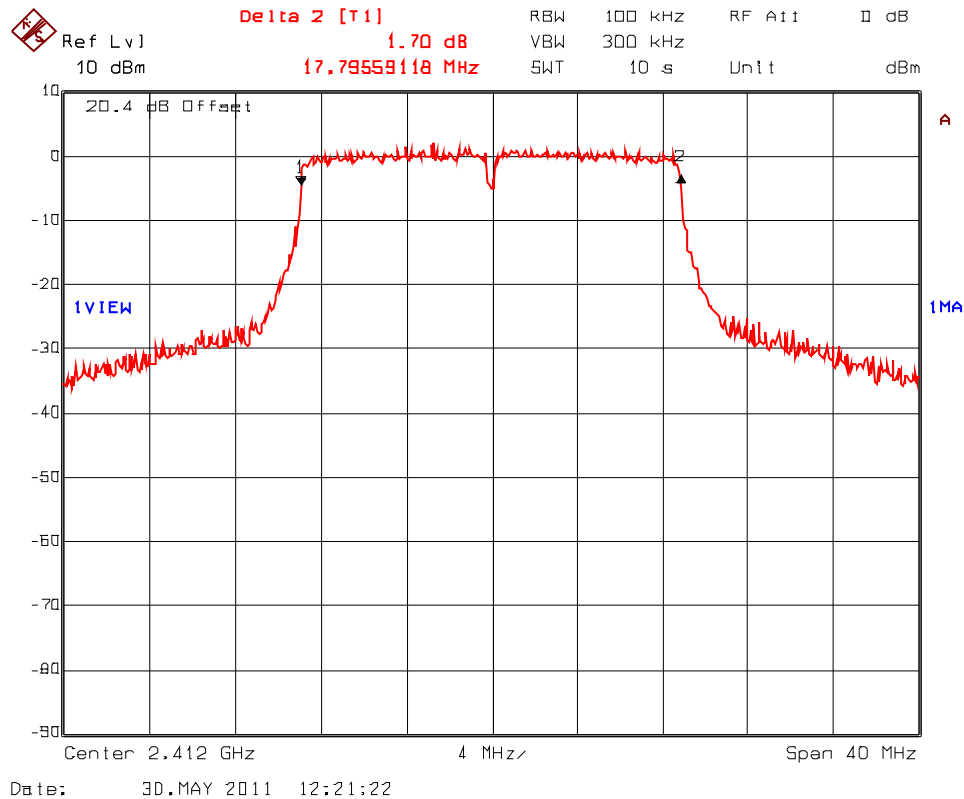
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.25. 6 dB Bandwidth, 802.11n, MCS2 QPSK3/4 19.5 Mbps**  
Test Frequency: 2412 MHz



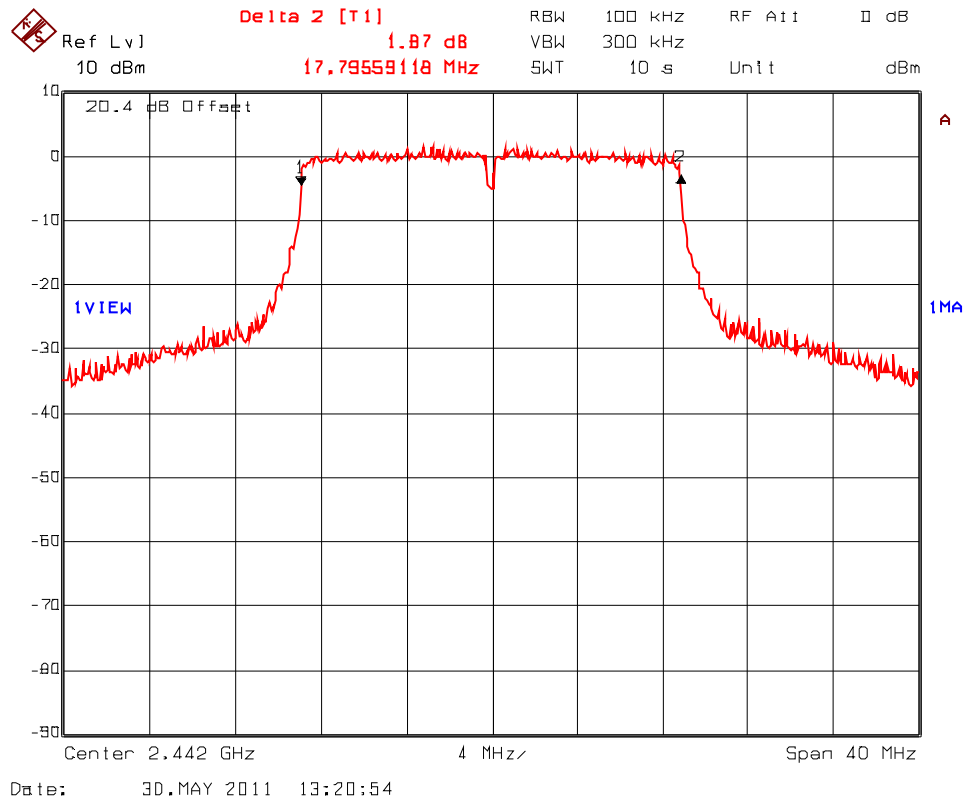
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247  
July 6, 2011

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**Plot 5.6.4.26. 6 dB Bandwidth, 802.11n, MCS2 QPSK3/4 19.5 Mbps**  
Test Frequency: 2442 MHz



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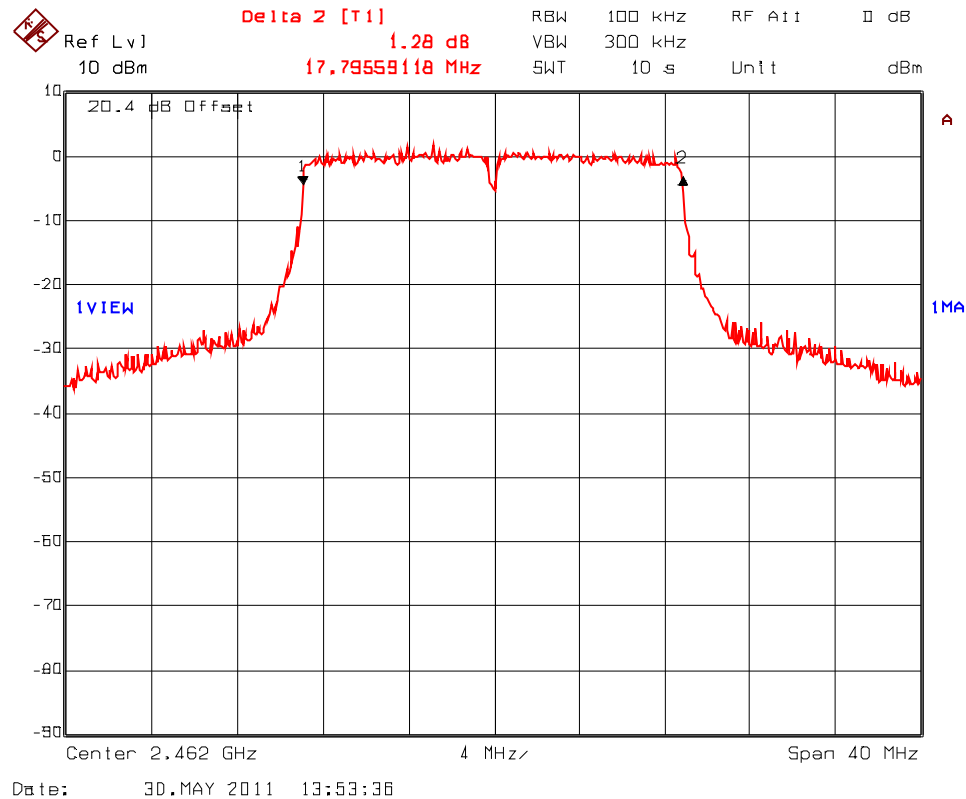
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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July 6, 2011

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**Plot 5.6.4.27. 6 dB Bandwidth, 802.11n, MCS2 QPSK3/4 19.5 Mbps**  
Test Frequency: 2462 MHz



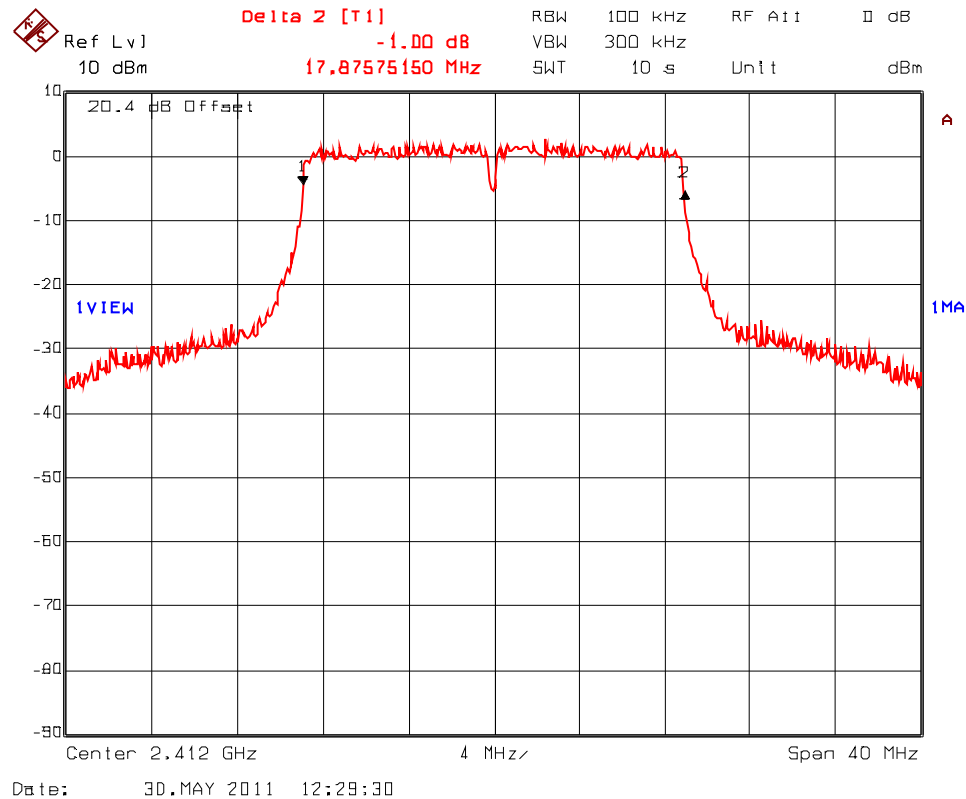
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247  
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**Plot 5.6.4.28. 6 dB Bandwidth, 802.11n, MCS4 16QAM3/4 39 Mbps**  
Test Frequency: 2412 MHz



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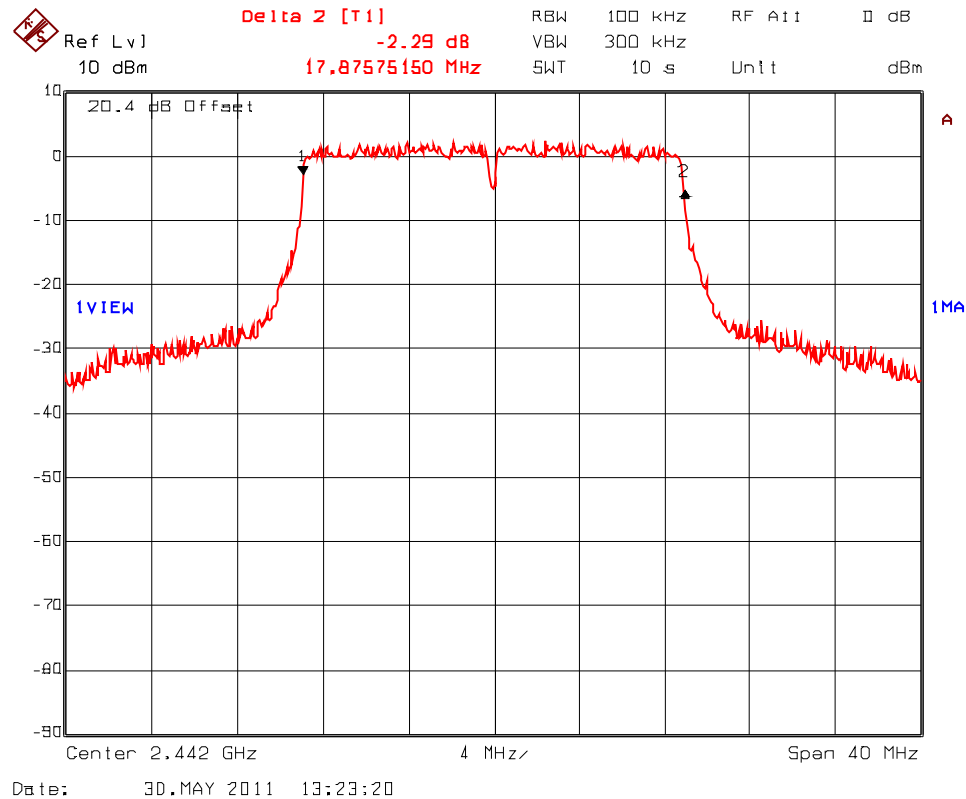
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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July 6, 2011

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**Plot 5.6.4.29. 6 dB Bandwidth, 802.11n, MCS4 16QAM3/4 39 Mbps**  
Test Frequency: 2442 MHz



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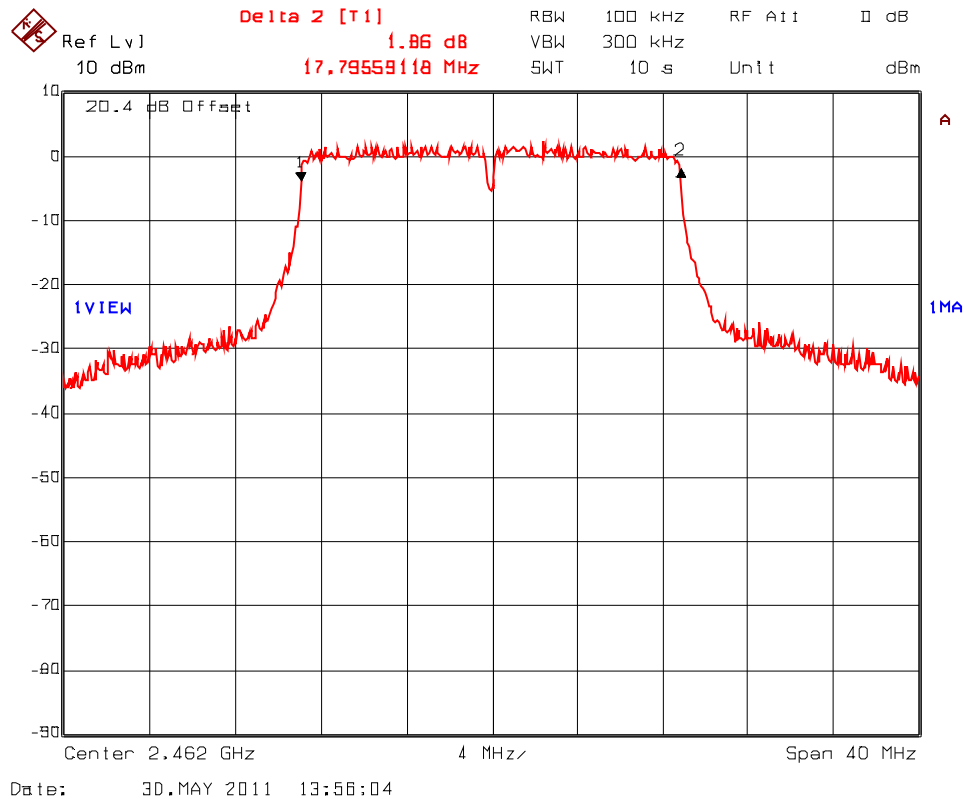
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.30. 6 dB Bandwidth, 802.11n, MCS4 16QAM3/4 39 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

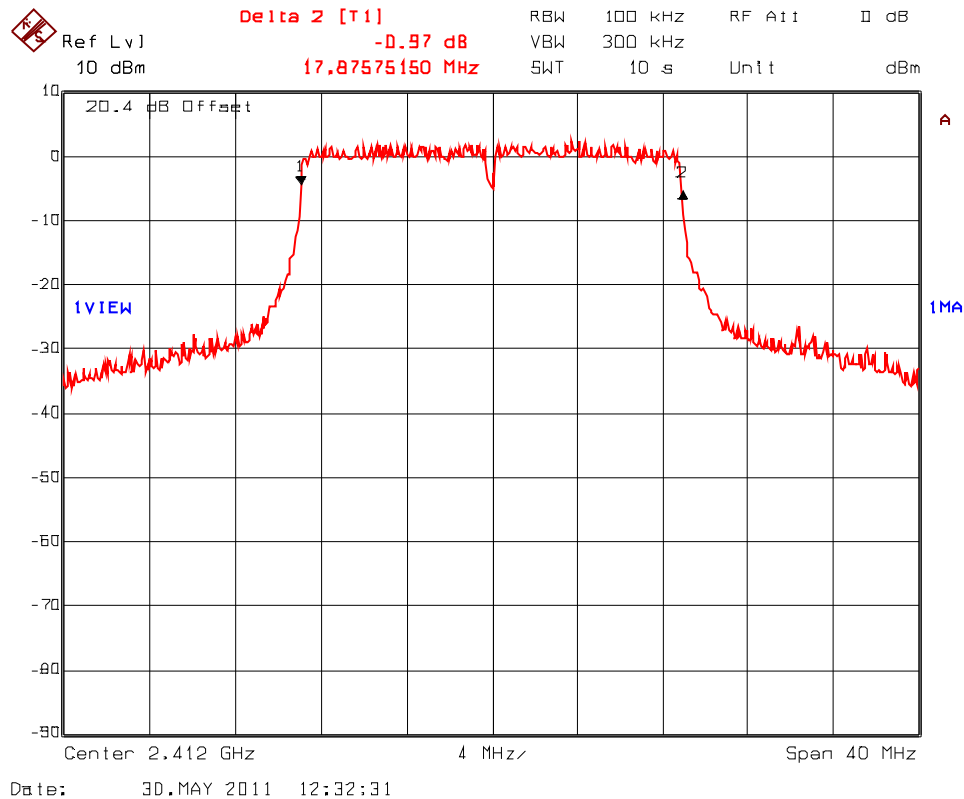
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

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**Plot 5.6.4.31. 6 dB Bandwidth, 802.11n, MCS7 64QAM5/6 65 Mbps**  
Test Frequency: 2412 MHz



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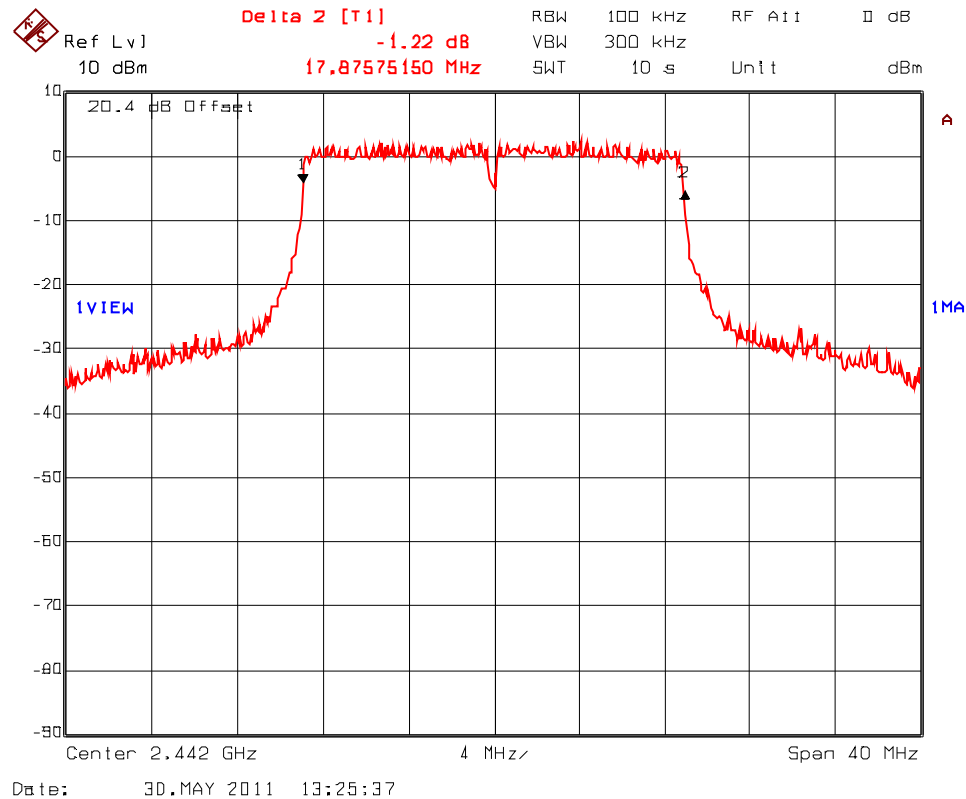
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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July 6, 2011

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**Plot 5.6.4.32. 6 dB Bandwidth, 802.11n, MCS7 64QAM5/6 65 Mbps**  
Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

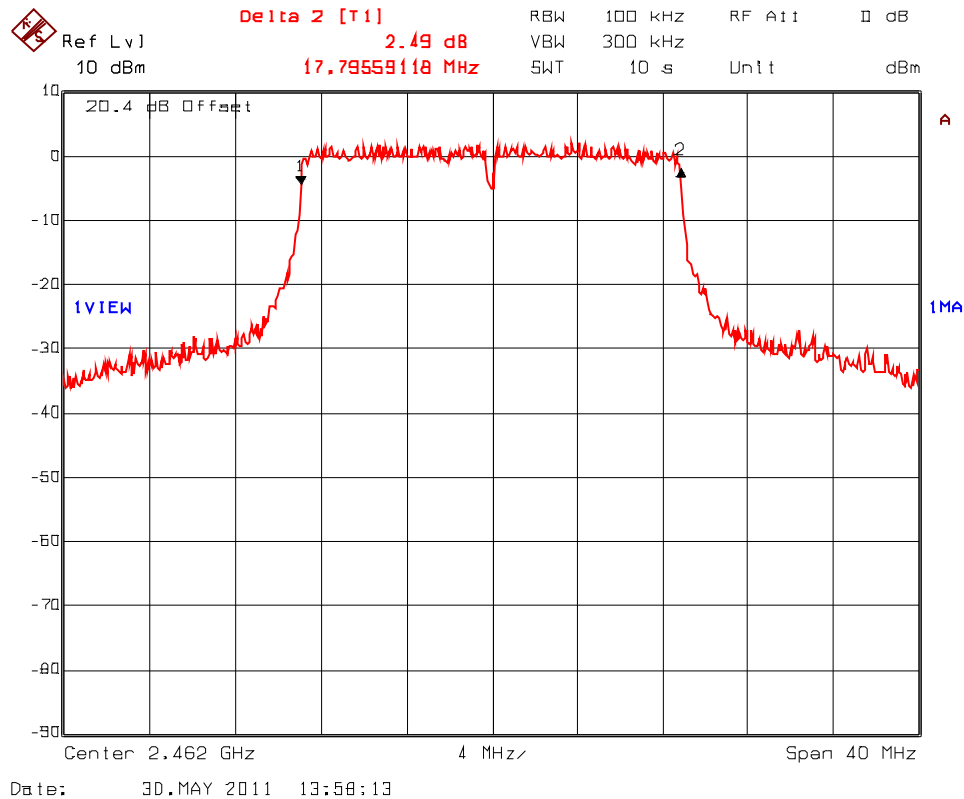
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.33. 6 dB Bandwidth, 802.11n, MCS7 64QAM5/6 65 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

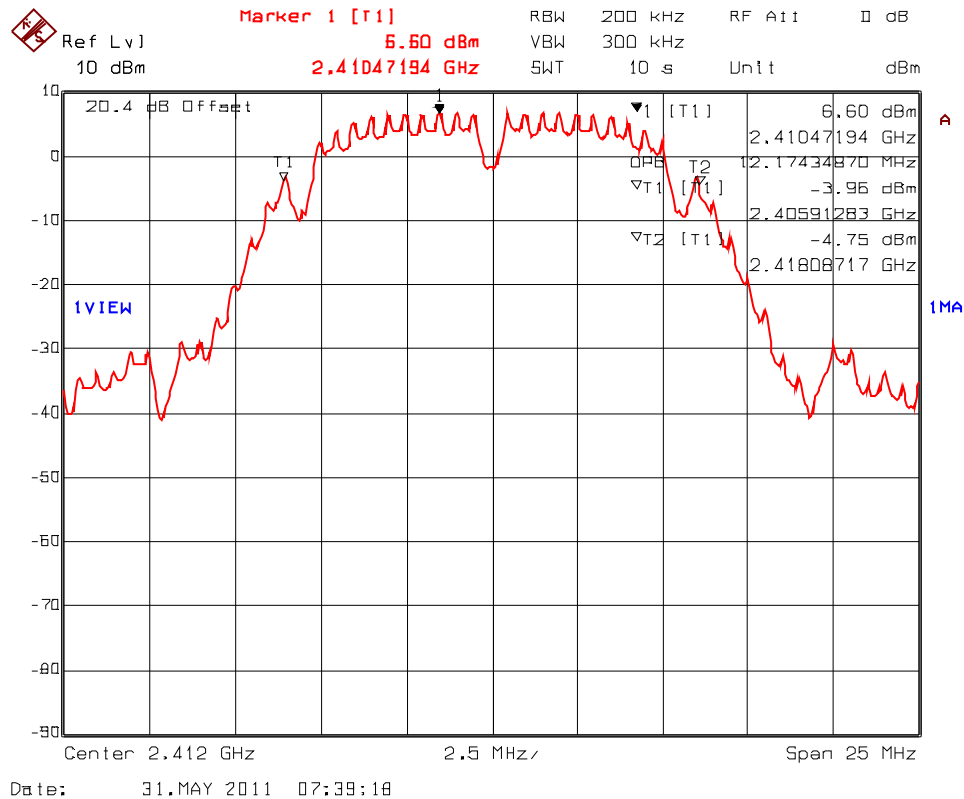
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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**Plot 5.6.4.34. 99% Occupied Bandwidth, 802.11b, DBPSK 1 Mbps**  
Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

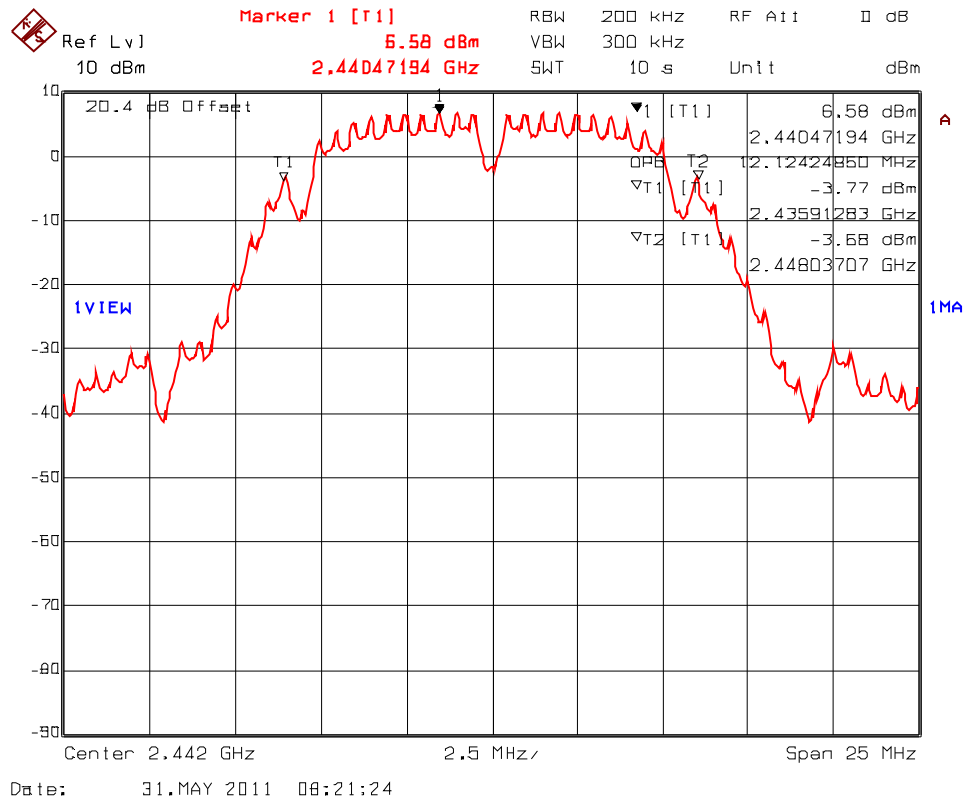
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

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**Plot 5.6.4.35. 99% Occupied Bandwidth, 802.11b, DBPSK 1 Mbps**  
Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

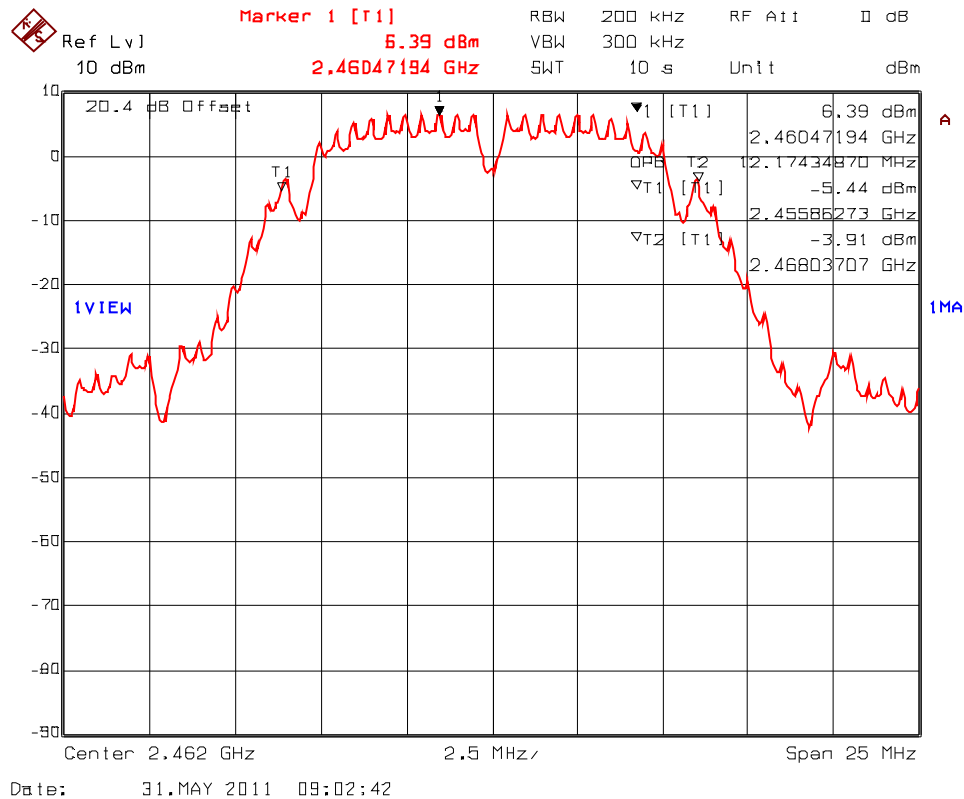
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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**Plot 5.6.4.36. 99% Occupied Bandwidth, 802.11b, DBPSK 1 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

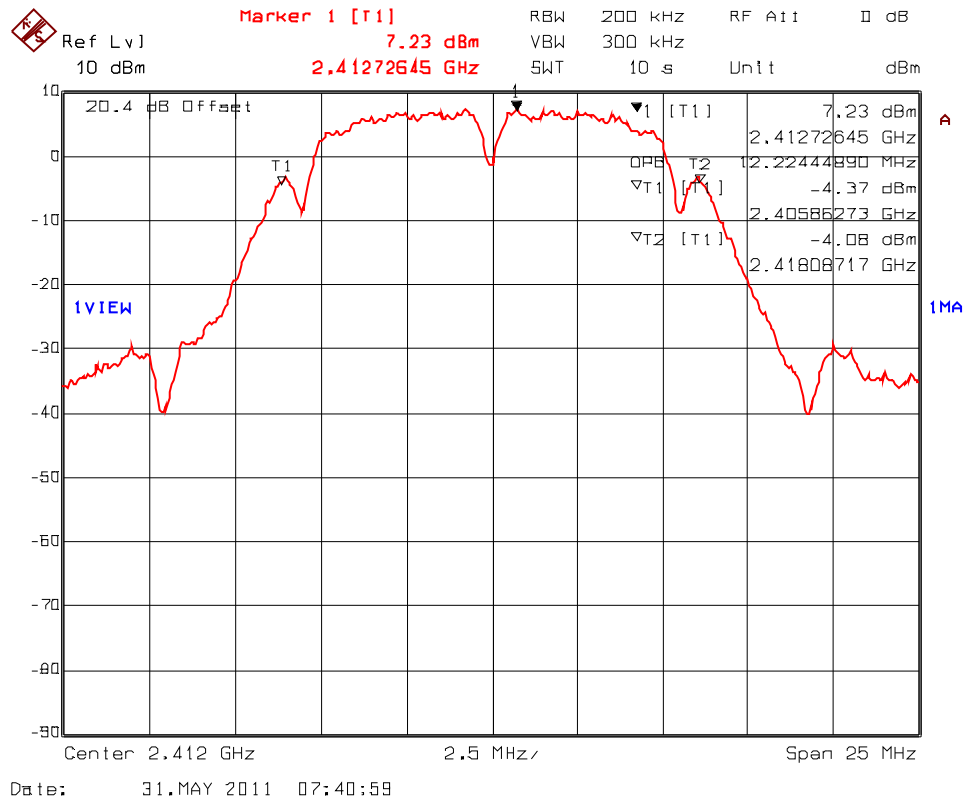
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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**Plot 5.6.4.37. 99% Occupied Bandwidth, 802.11b, DQPSK 2 Mbps**  
 Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

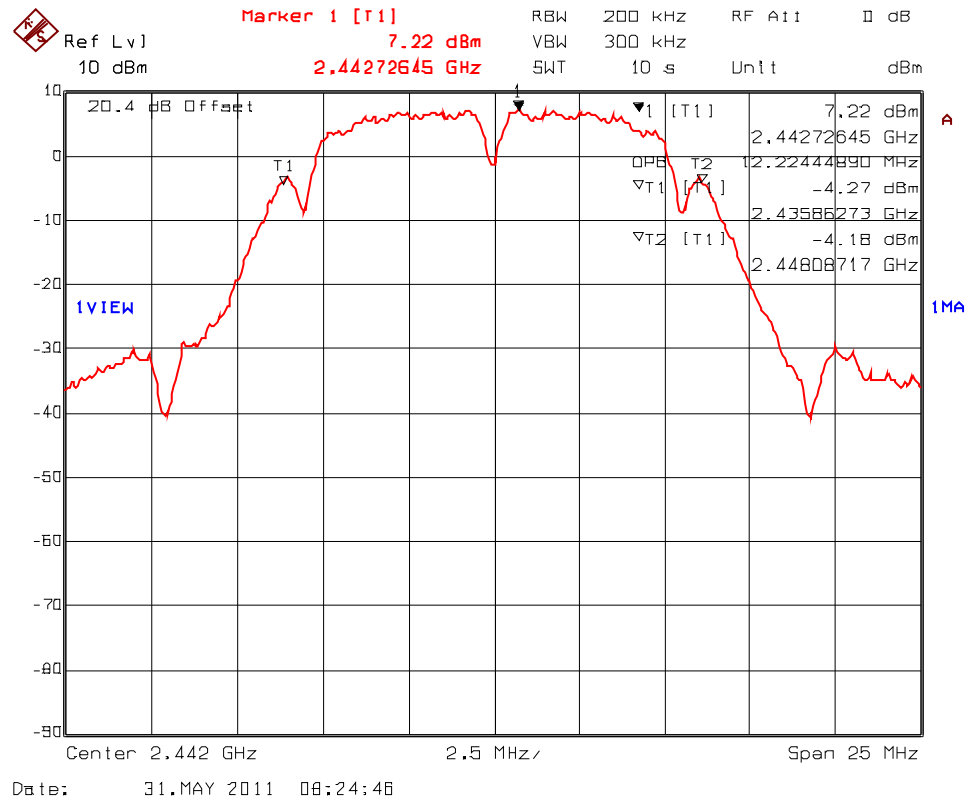
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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**Plot 5.6.4.38. 99% Occupied Bandwidth, 802.11b, DQPSK 2 Mbps**  
 Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

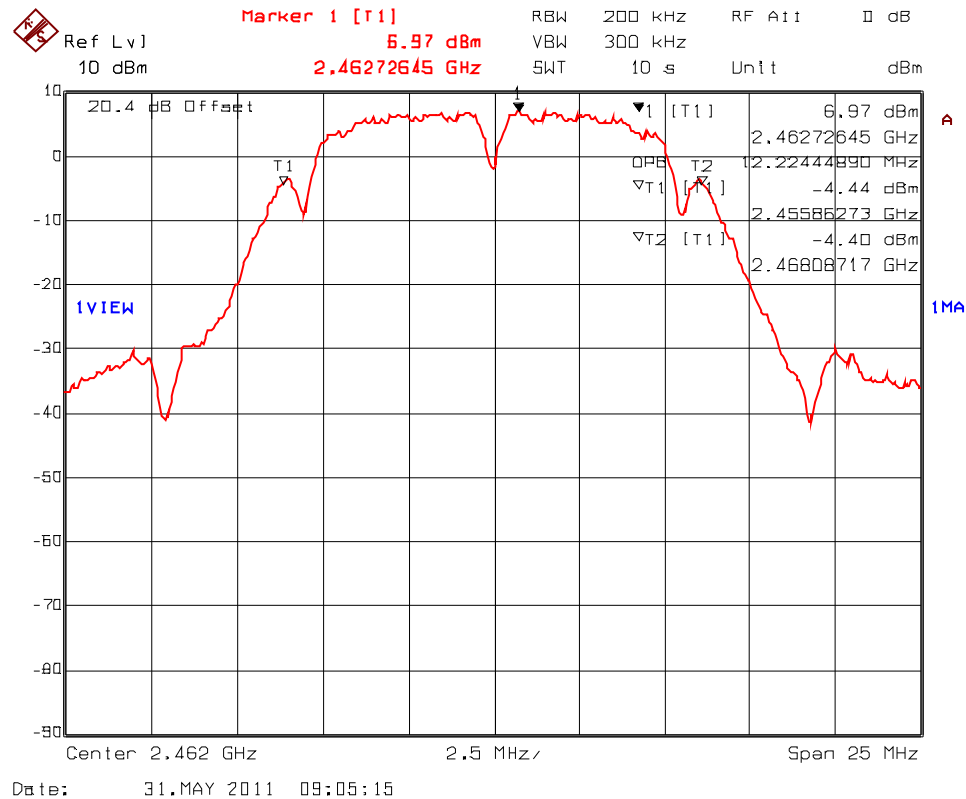
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.39. 99% Occupied Bandwidth, 802.11b, DQPSK 2 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

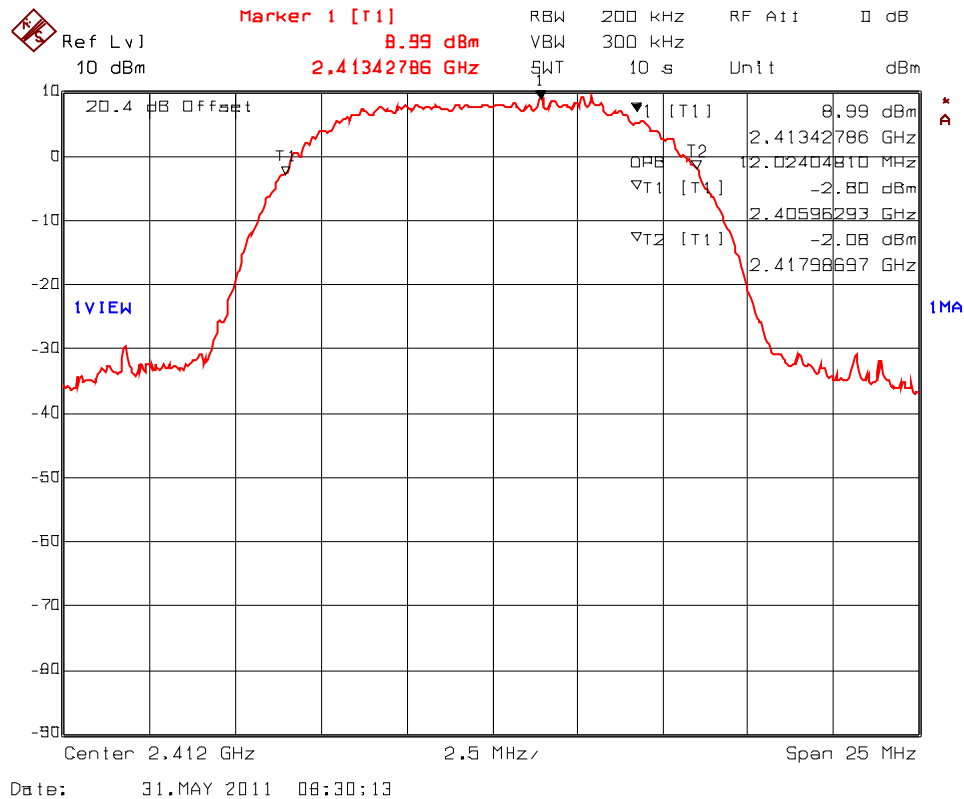
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.40. 99% Occupied Bandwidth, 802.11b, CCK 11 Mbps**  
 Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

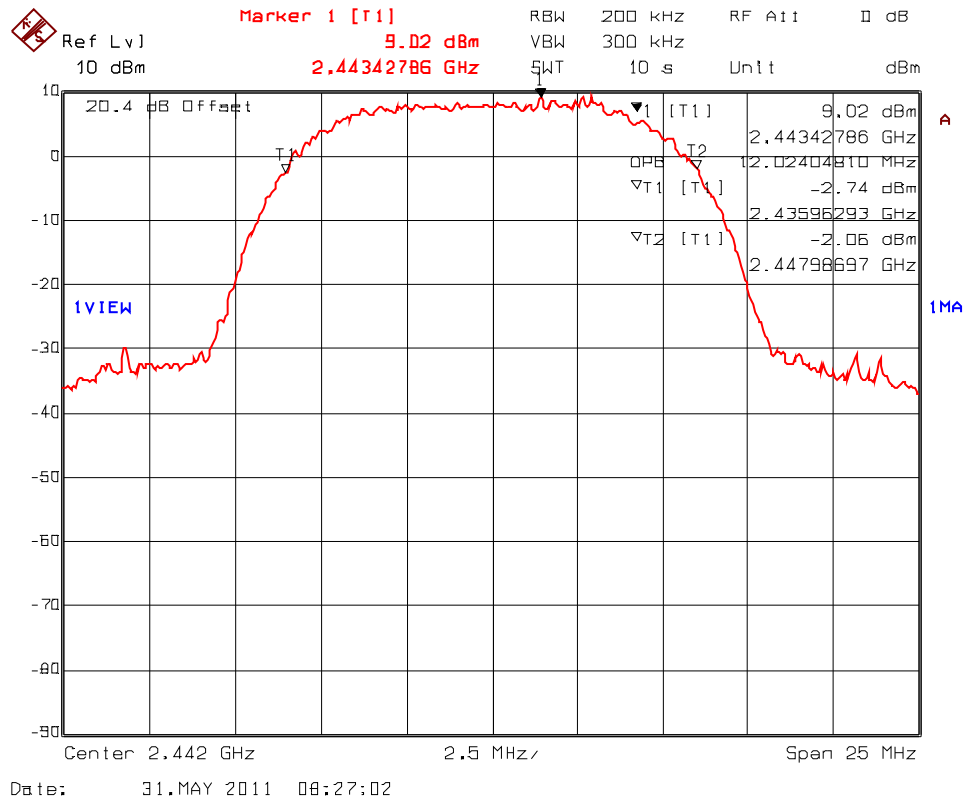
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.41. 99% Occupied Bandwidth, 802.11b, CCK 11 Mbps**  
 Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

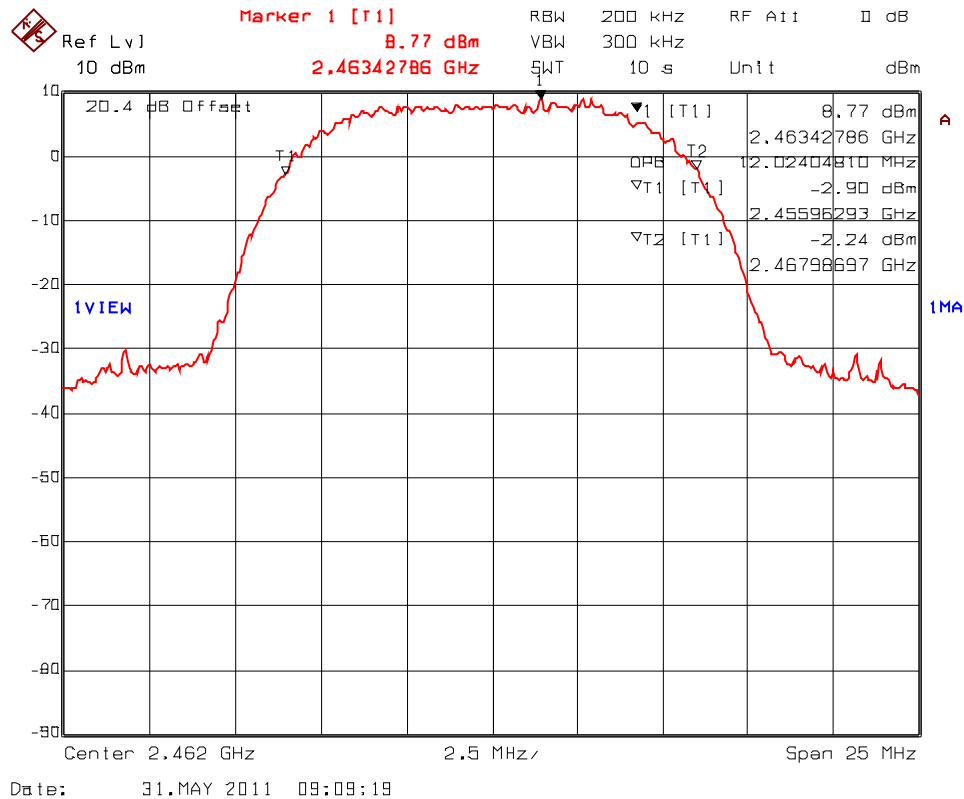
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 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.42. 99% Occupied Bandwidth, 802.11b, CCK 11 Mbps**  
 Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

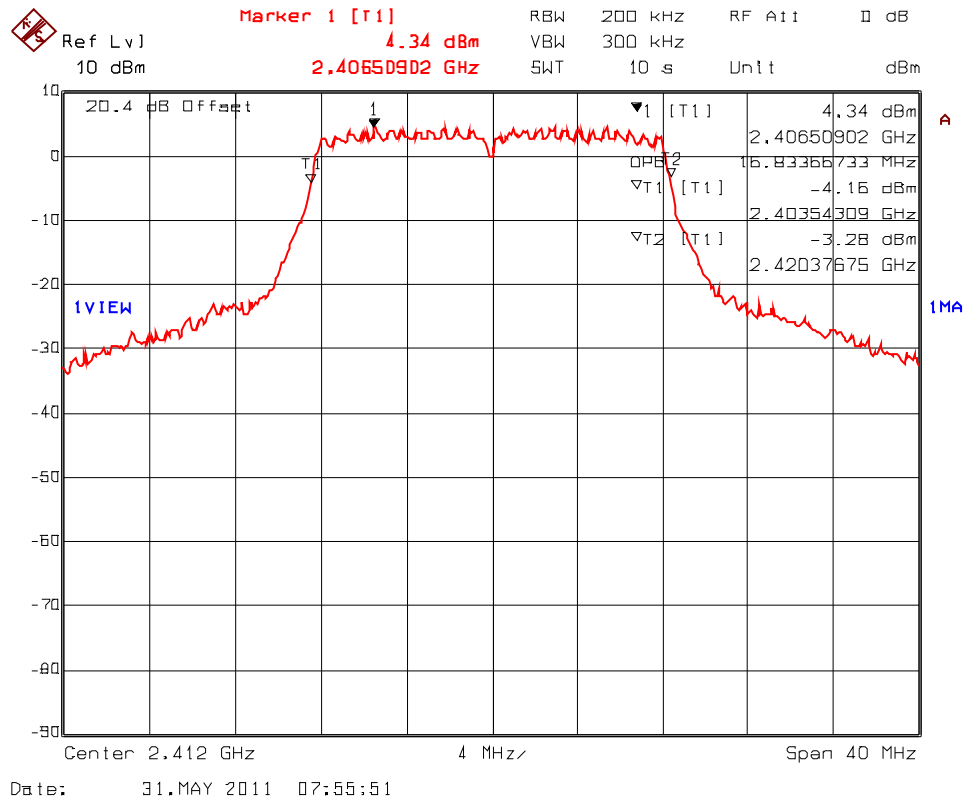
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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**Plot 5.6.4.43. 99% Occupied Bandwidth, 802.11g, BPSK 9 Mbps**  
Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

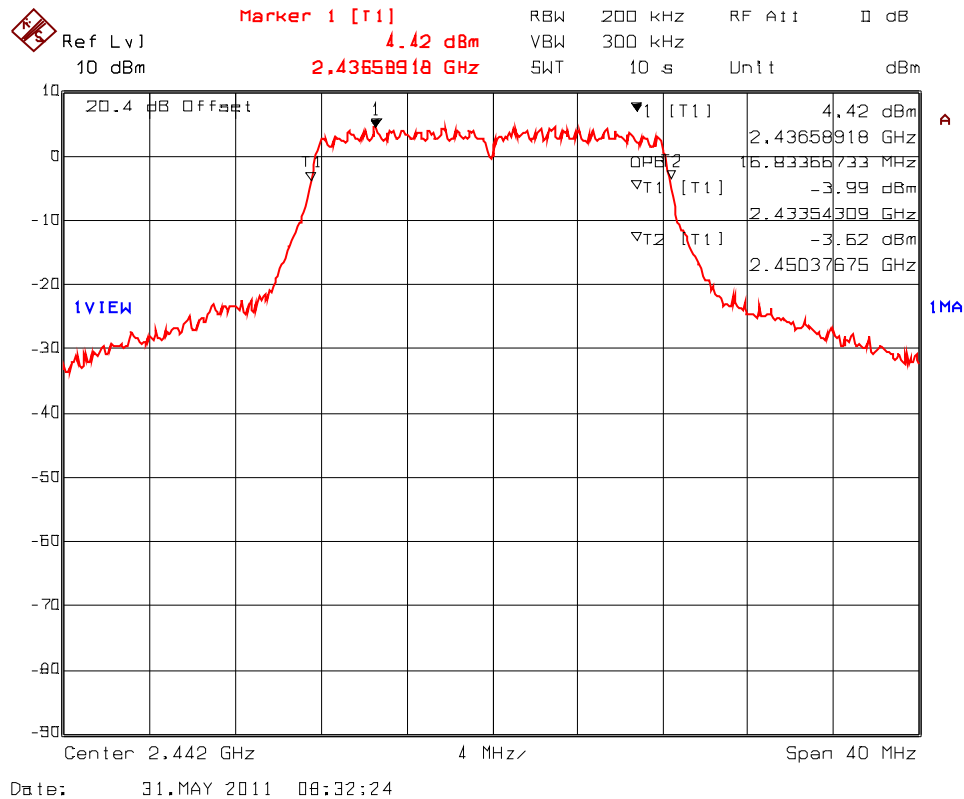
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.44. 99% Occupied Bandwidth, 802.11g, BPSK 9 Mbps**  
Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

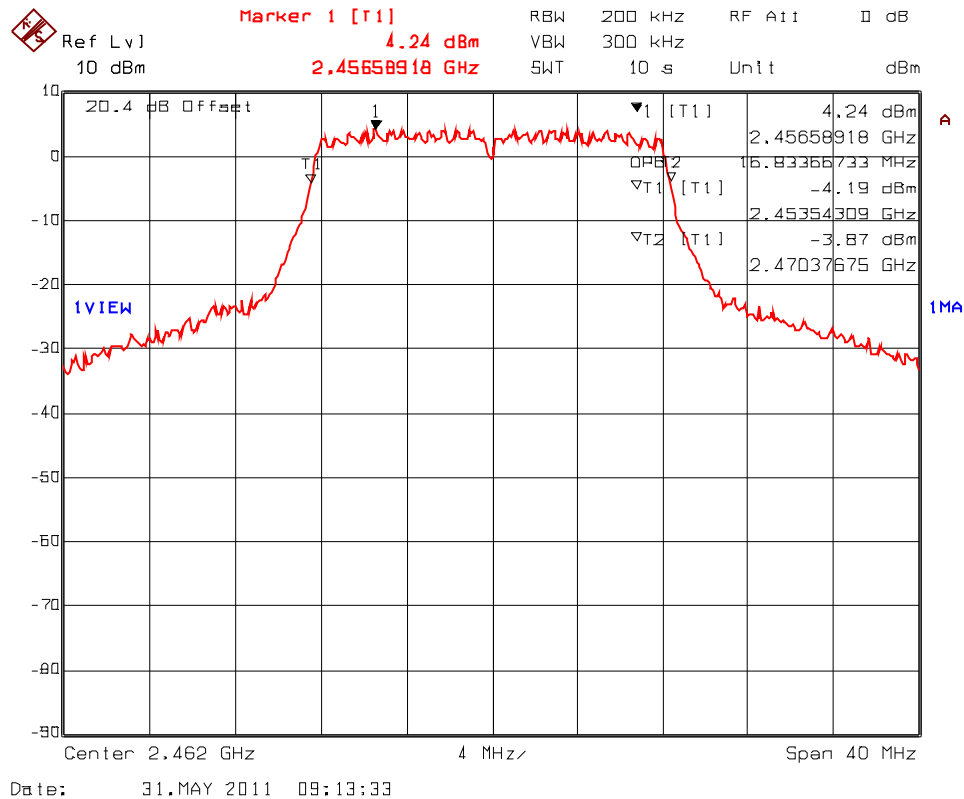
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.45. 99% Occupied Bandwidth, 802.11g, BPSK 9 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

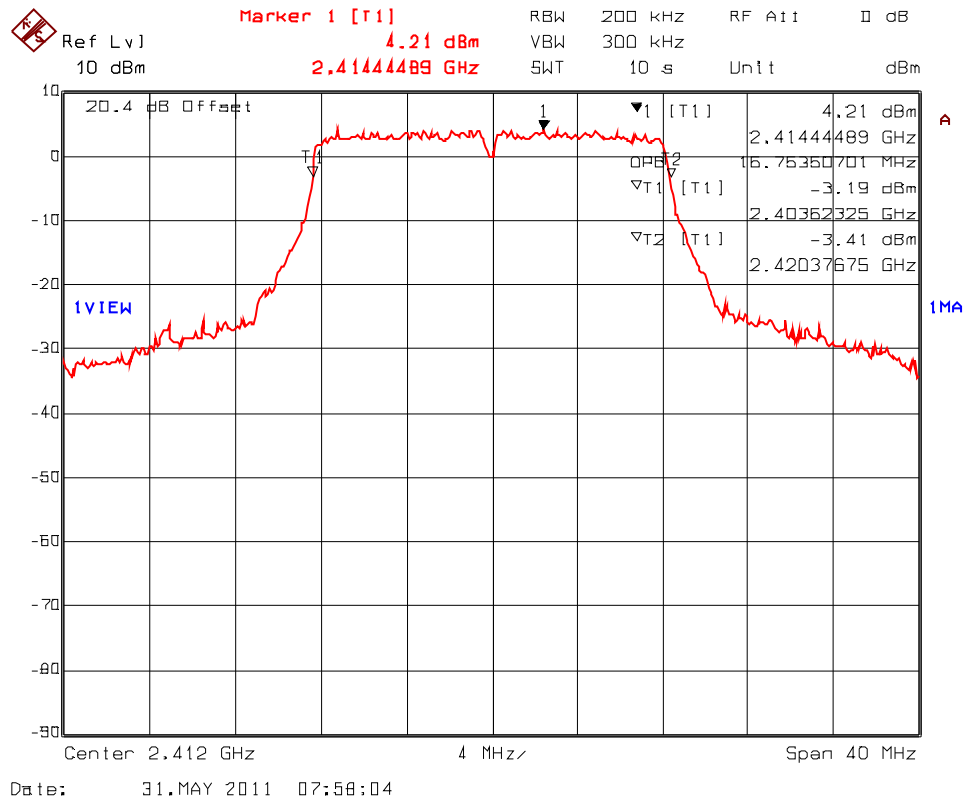
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.46. 99% Occupied Bandwidth, 802.11g, QPSK 18 Mbps**  
Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

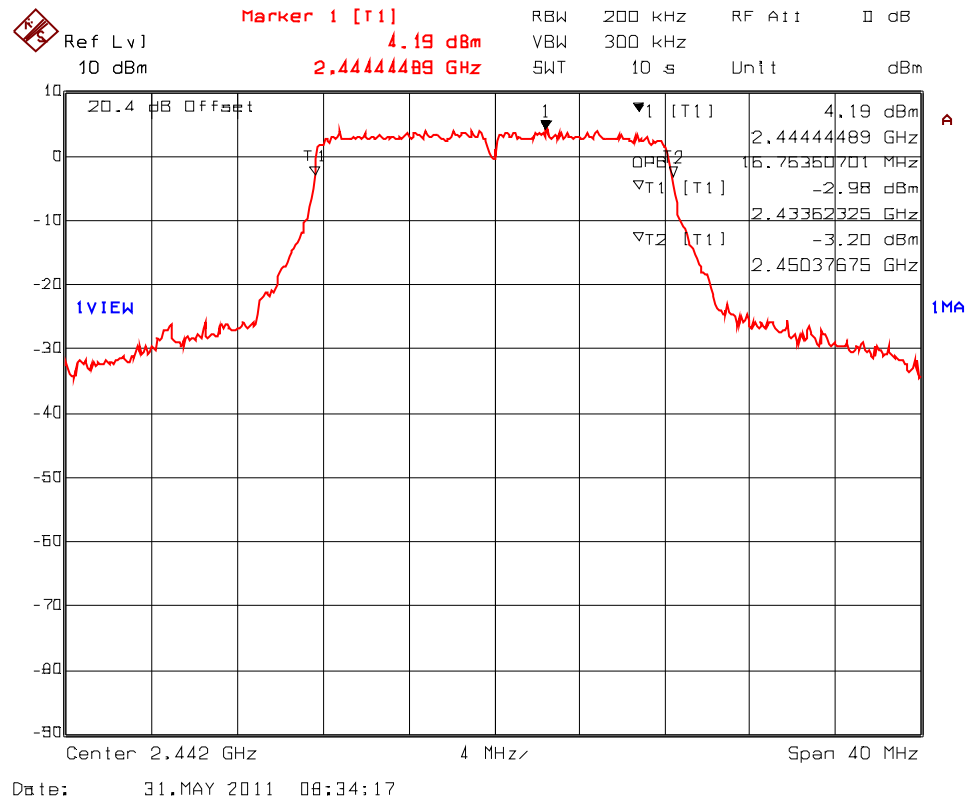
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.47. 99% Occupied Bandwidth, 802.11g, QPSK 18 Mbps**  
Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

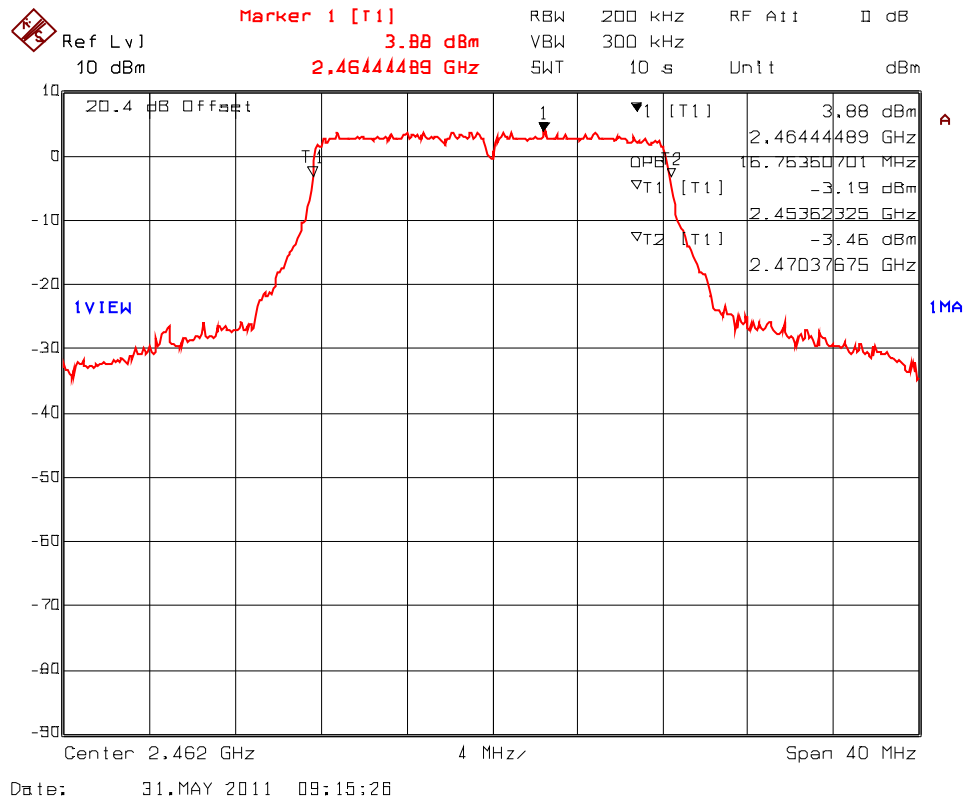
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.48. 99% Occupied Bandwidth, 802.11g, QPSK 18 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

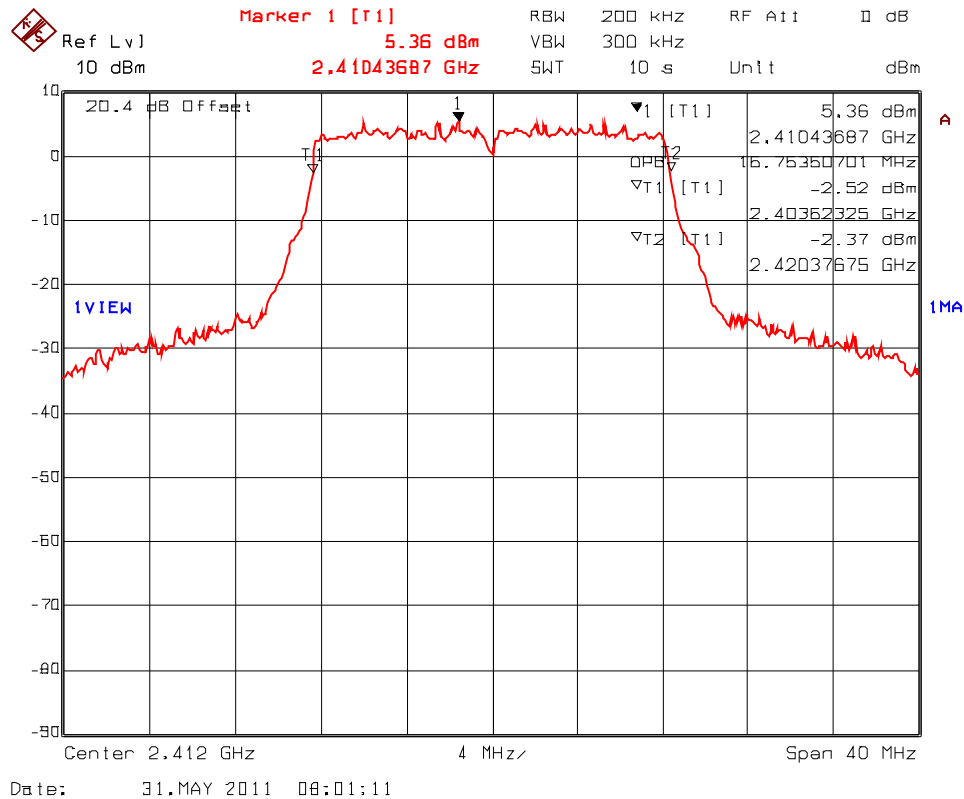
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.49. 99% Occupied Bandwidth, 802.11g, 16-QAM 36 Mbps**  
Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

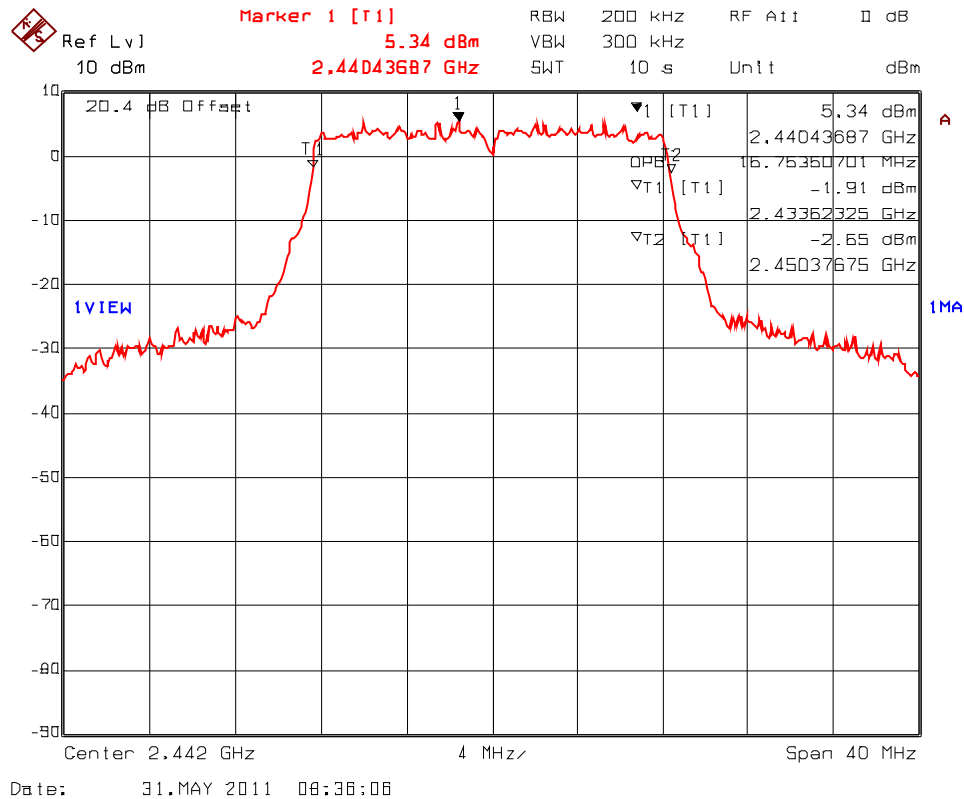
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.50. 99% Occupied Bandwidth, 802.11g, 16-QAM 36 Mbps**  
 Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

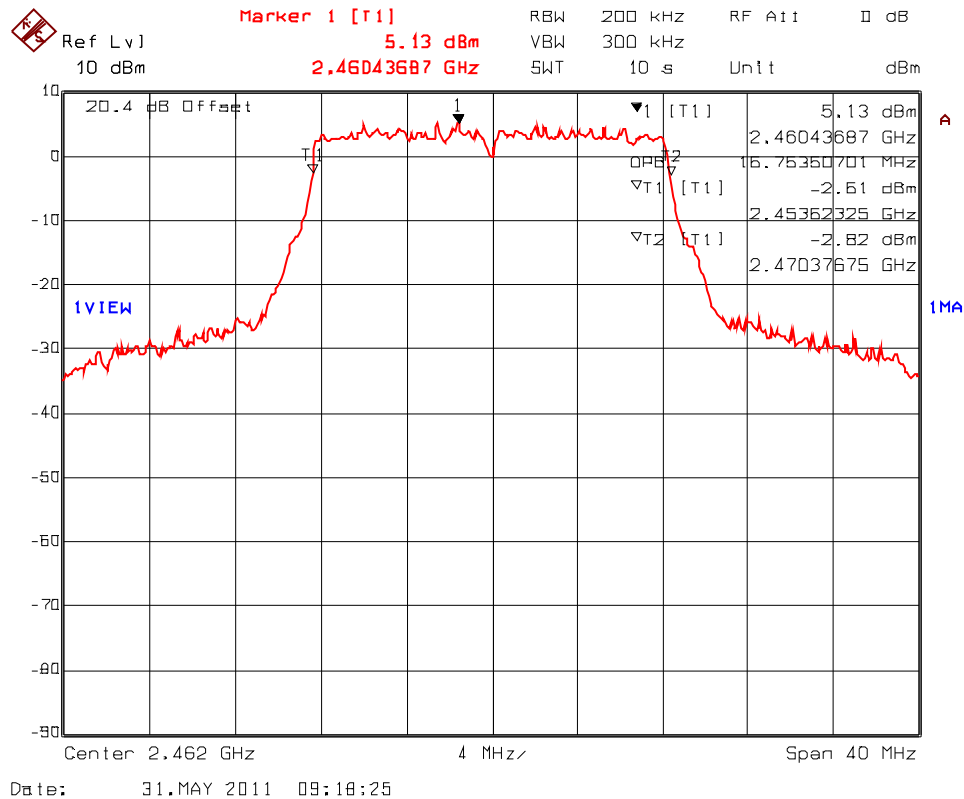
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.51. 99% Occupied Bandwidth, 802.11g, 16-QAM 36 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

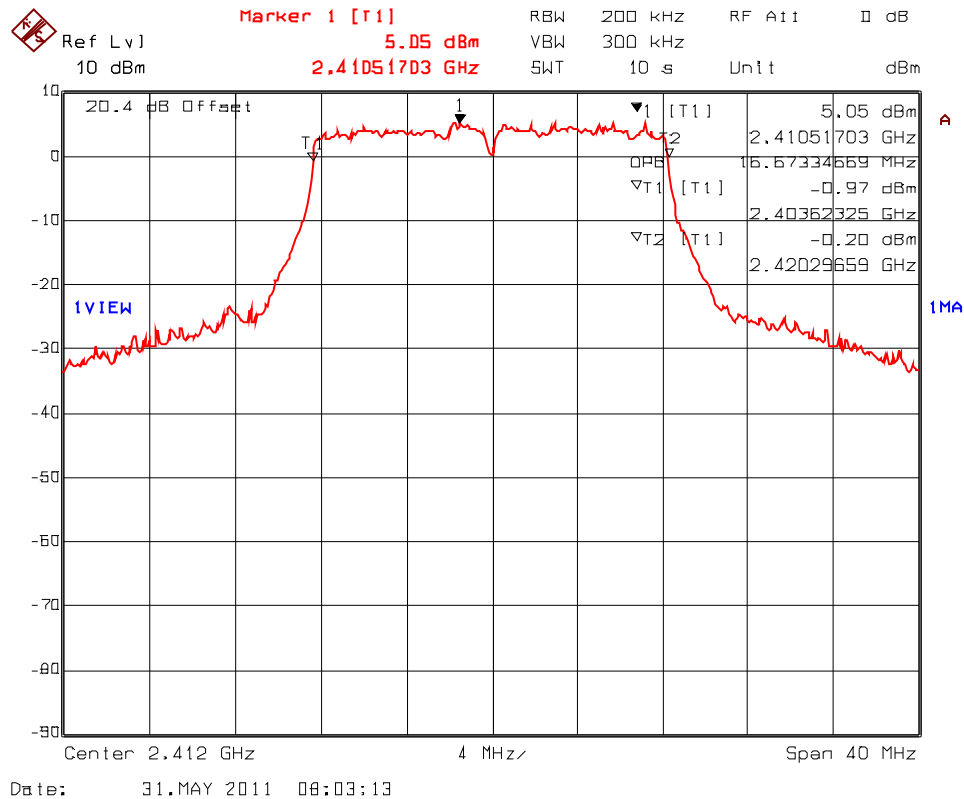
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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**Plot 5.6.4.52. 99% Occupied Bandwidth, 802.11g, 64-QAM 54 Mbps**  
Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

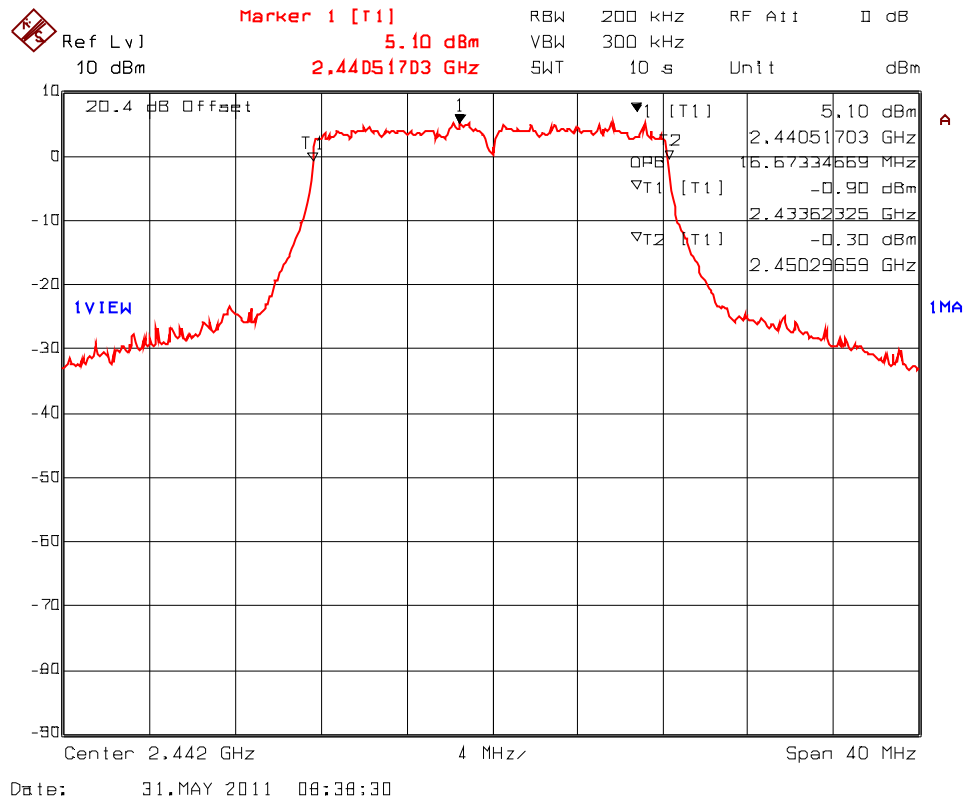
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.53. 99% Occupied Bandwidth, 802.11g, 64-QAM 54 Mbps**  
Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

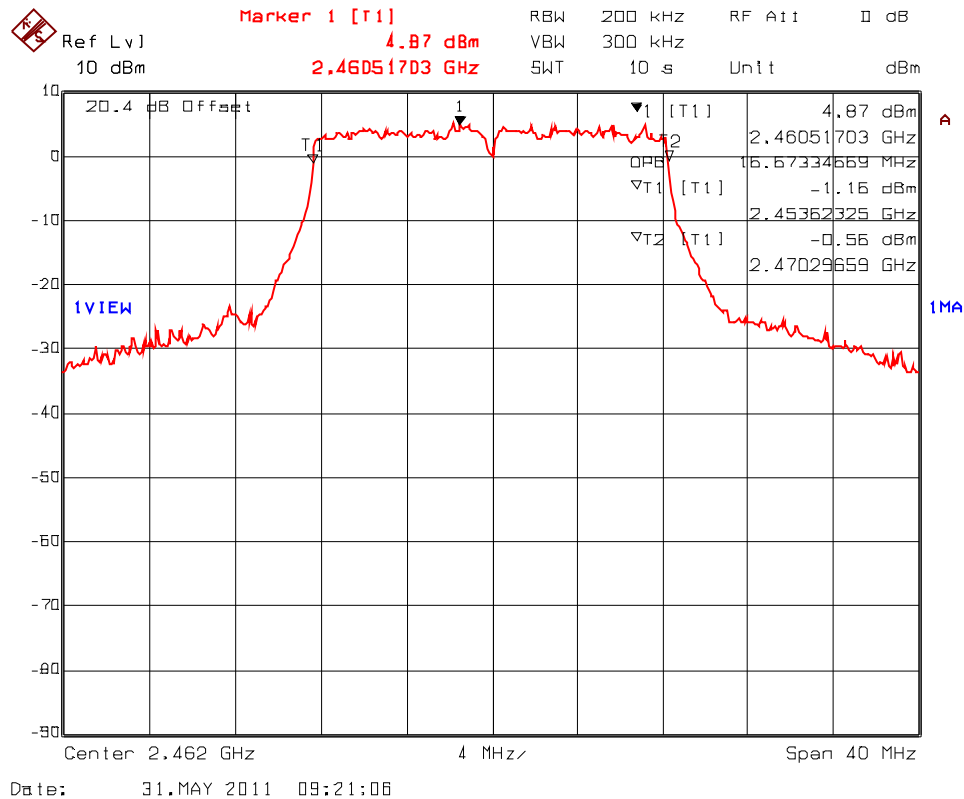
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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**Plot 5.6.4.54. 99% Occupied Bandwidth, 802.11g, 64-QAM 54 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

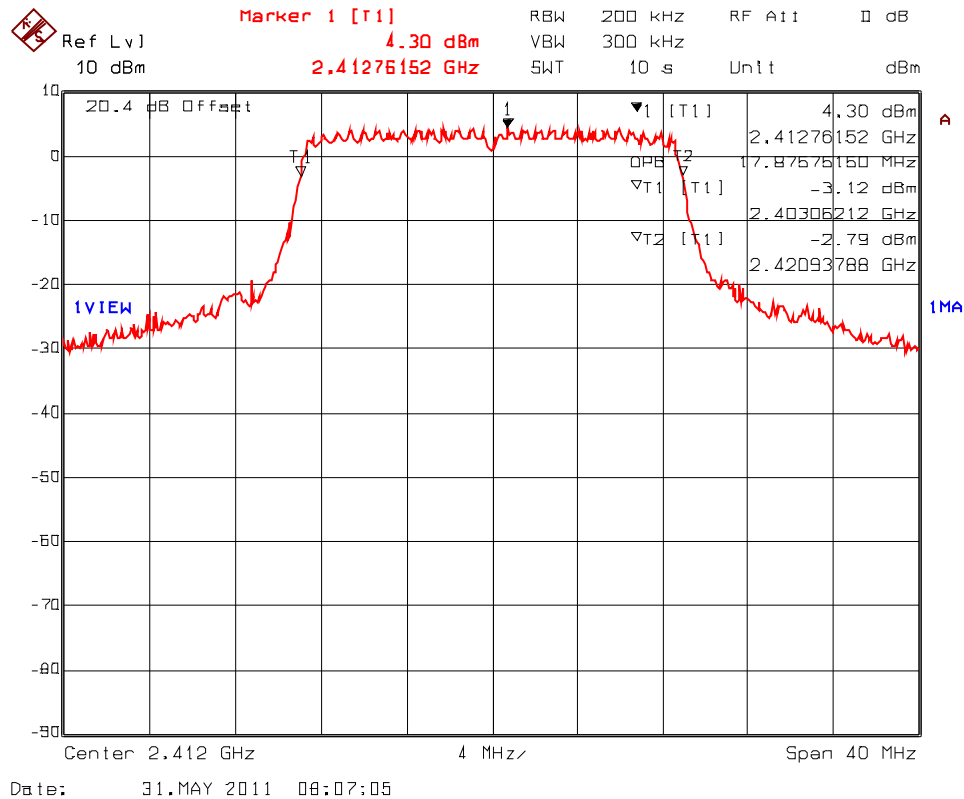
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.55. 99% Occupied Bandwidth, 802.11n MCS0 BPSK1/2 6.5 Mbps**  
Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

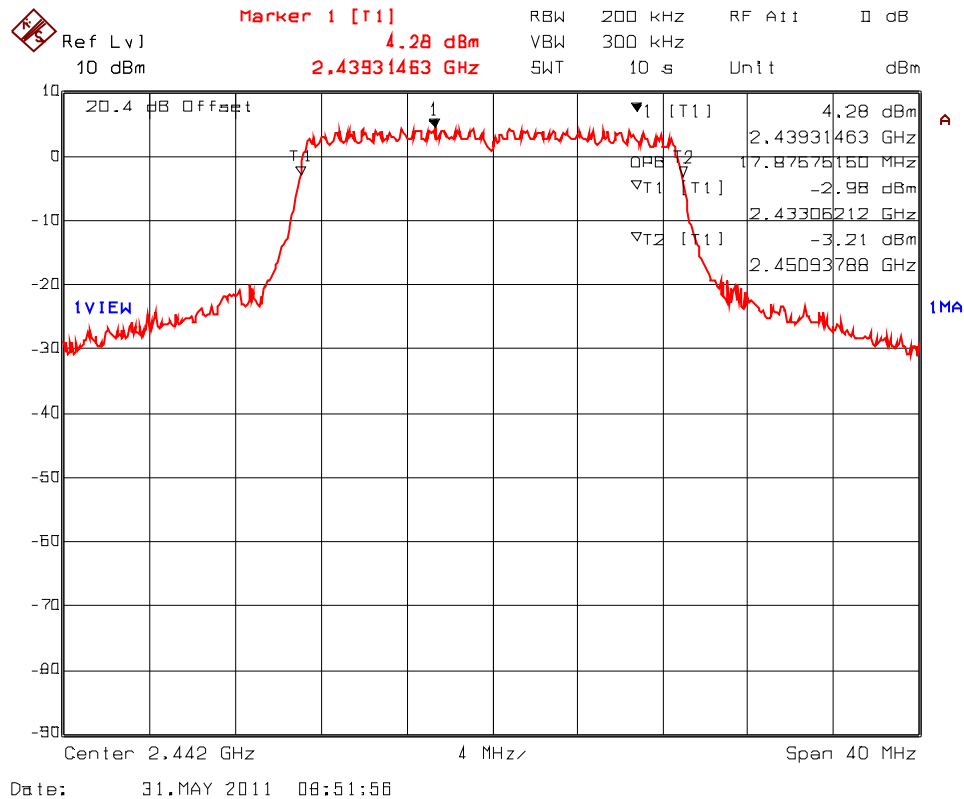
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.56. 99% Occupied Bandwidth, 802.11n MCS0 BPSK1/2 6.5 Mbps**  
Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

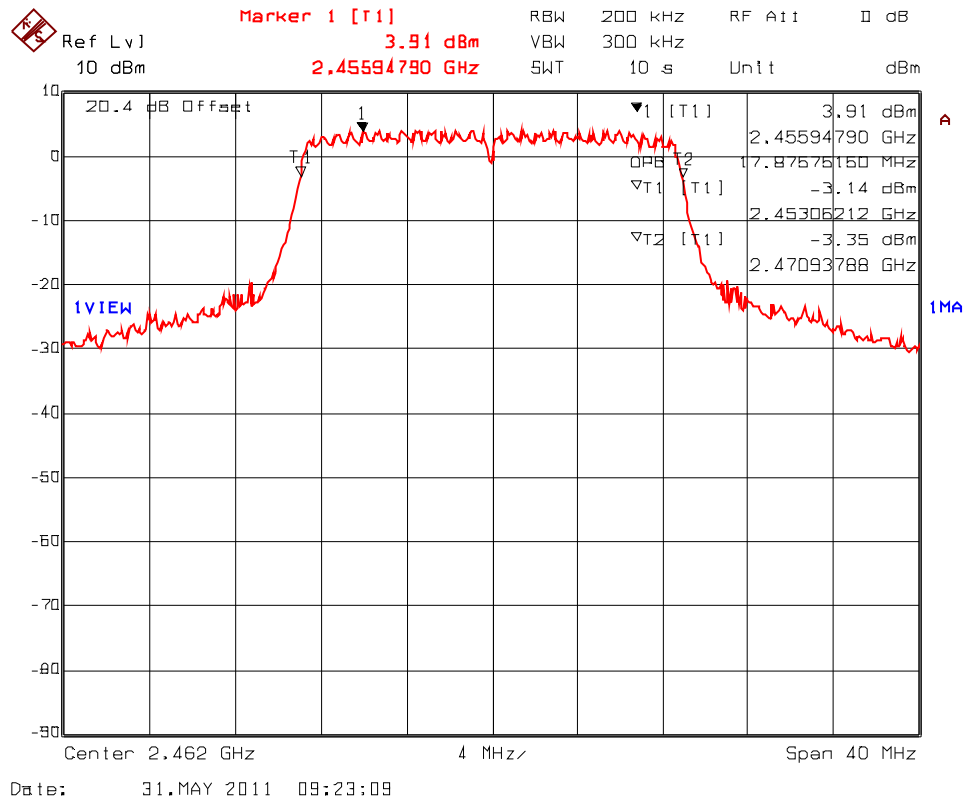
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.57. 99% Occupied Bandwidth, 802.11n MCS0 BPSK1/2 6.5 Mbps**  
Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

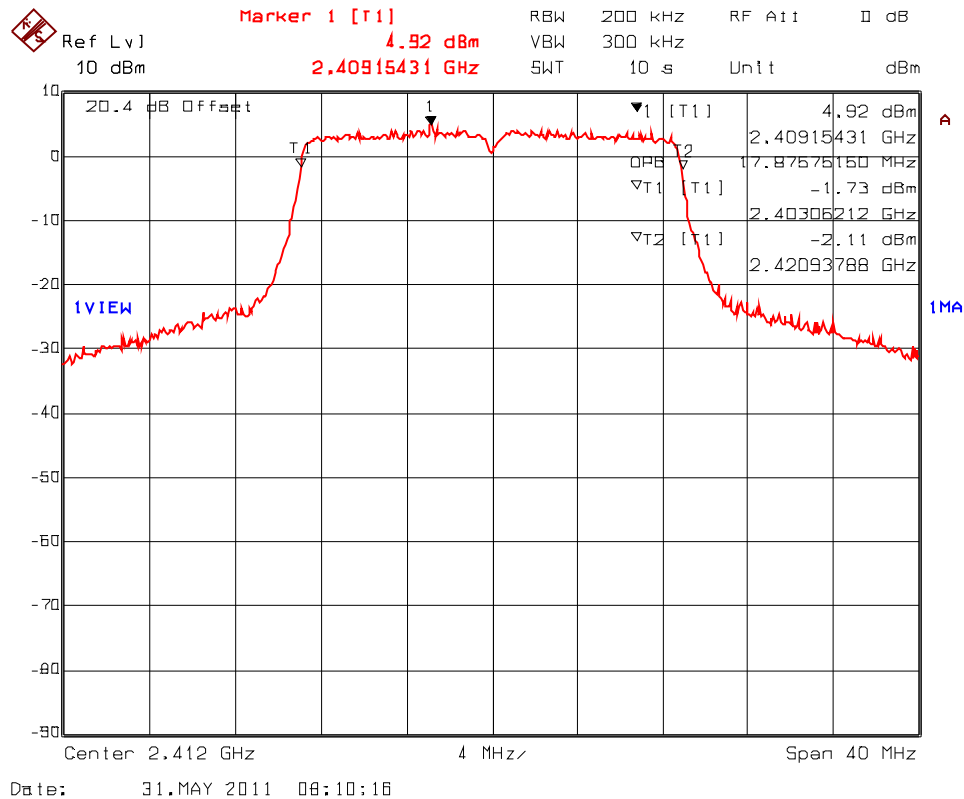
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.58.** 99% Occupied Bandwidth, 802.11n, MCS2 QPSK3/4 19.5 Mbps  
Test Frequency: 2412 MHz



**ULTRATECH GROUP OF LABS**

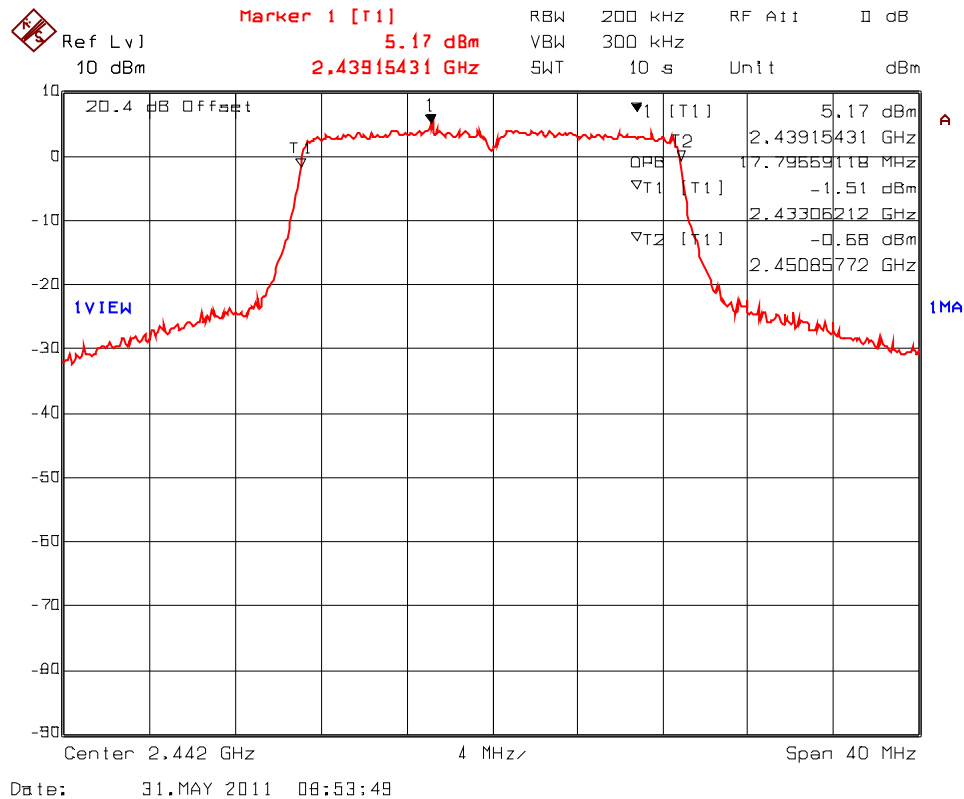
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

July 6, 2011

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

**Plot 5.6.4.59.** 99% Occupied Bandwidth, 802.11n, MCS2 QPSK3/4 19.5 Mbps  
 Test Frequency: 2442 MHz



**ULTRATECH GROUP OF LABS**

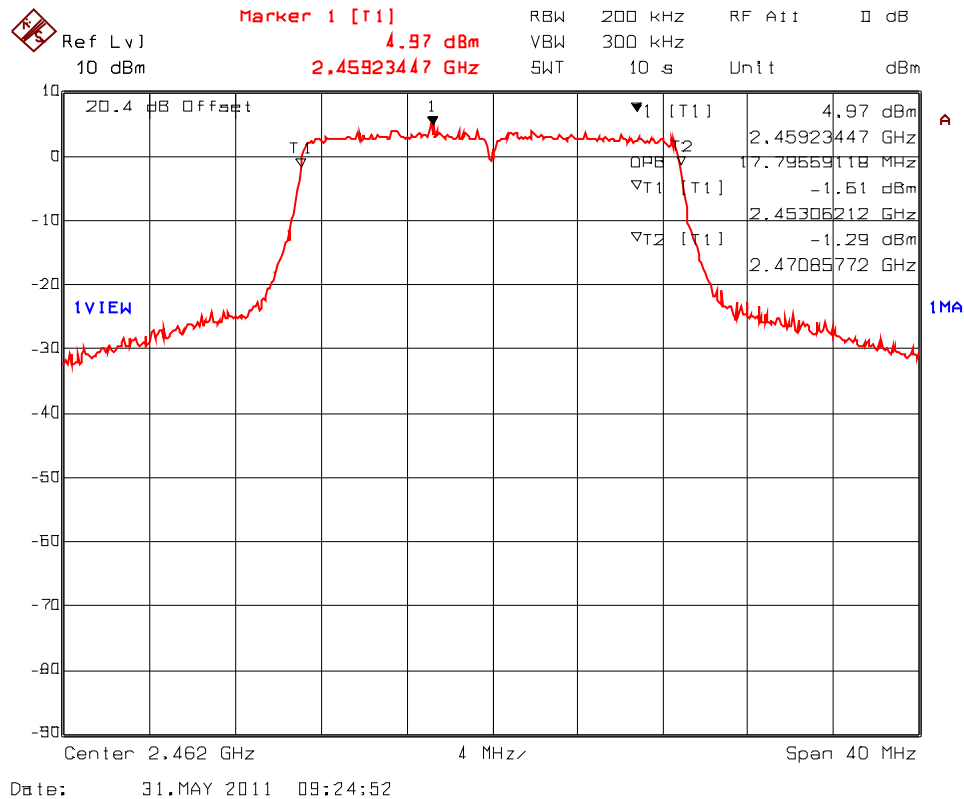
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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

**Plot 5.6.4.60. 99% Occupied Bandwidth, 802.11n, MCS2 QPSK3/4 19.5 Mbps**  
 Test Frequency: 2462 MHz



**ULTRATECH GROUP OF LABS**

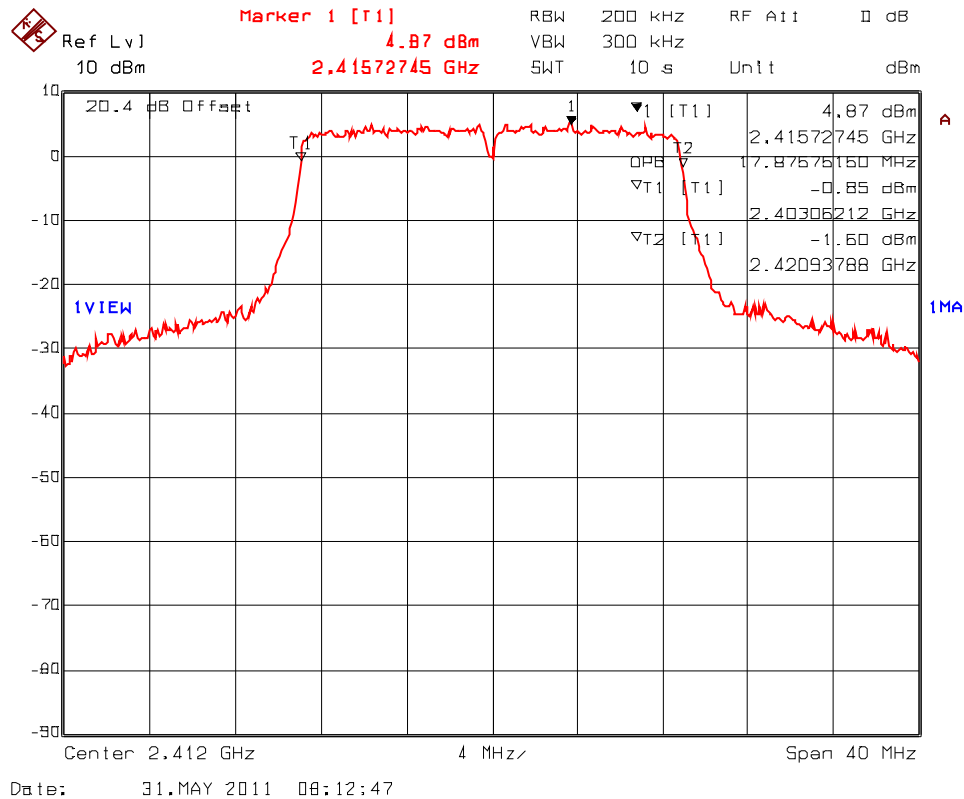
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
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File #: DIGI-043QF15C247

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

**Plot 5.6.4.61.** 99% Occupied Bandwidth, 802.11n, MCS4 16QAM3/4 39 Mbps  
Test Frequency: 2412 MHz



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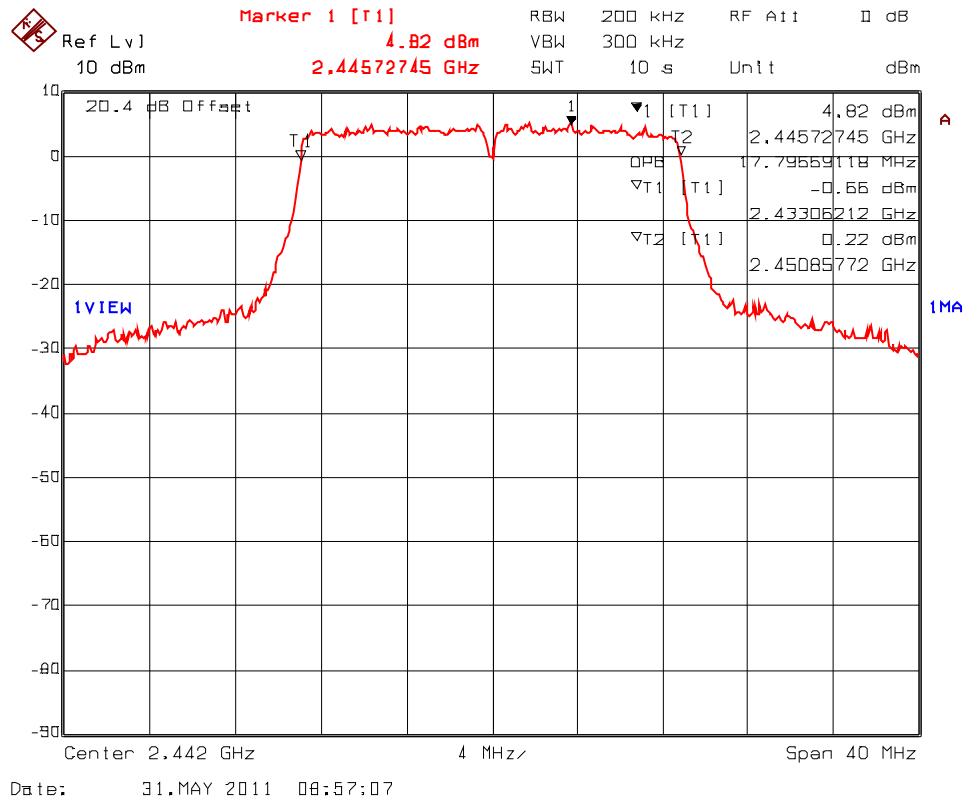
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.62.** 99% Occupied Bandwidth, 802.11n, MCS4 16QAM3/4 39 Mbps  
Test Frequency: 2442 MHz



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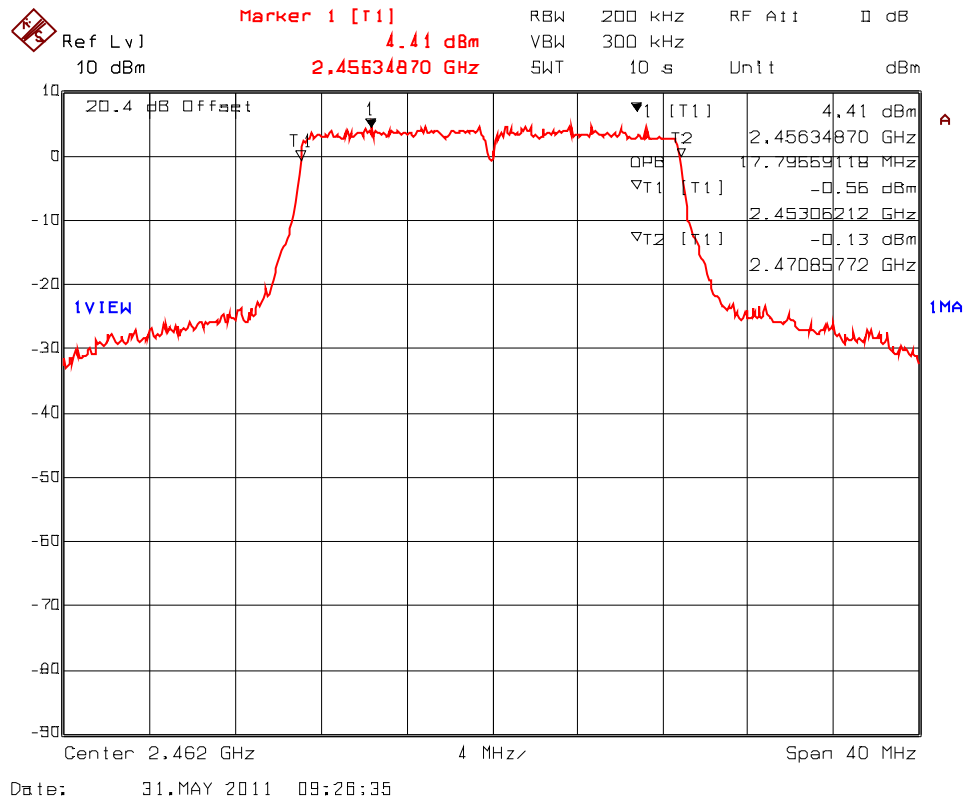
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

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**Plot 5.6.4.63.** 99% Occupied Bandwidth, 802.11n, MCS4 16QAM3/4 39 Mbps  
Test Frequency: 2462 MHz



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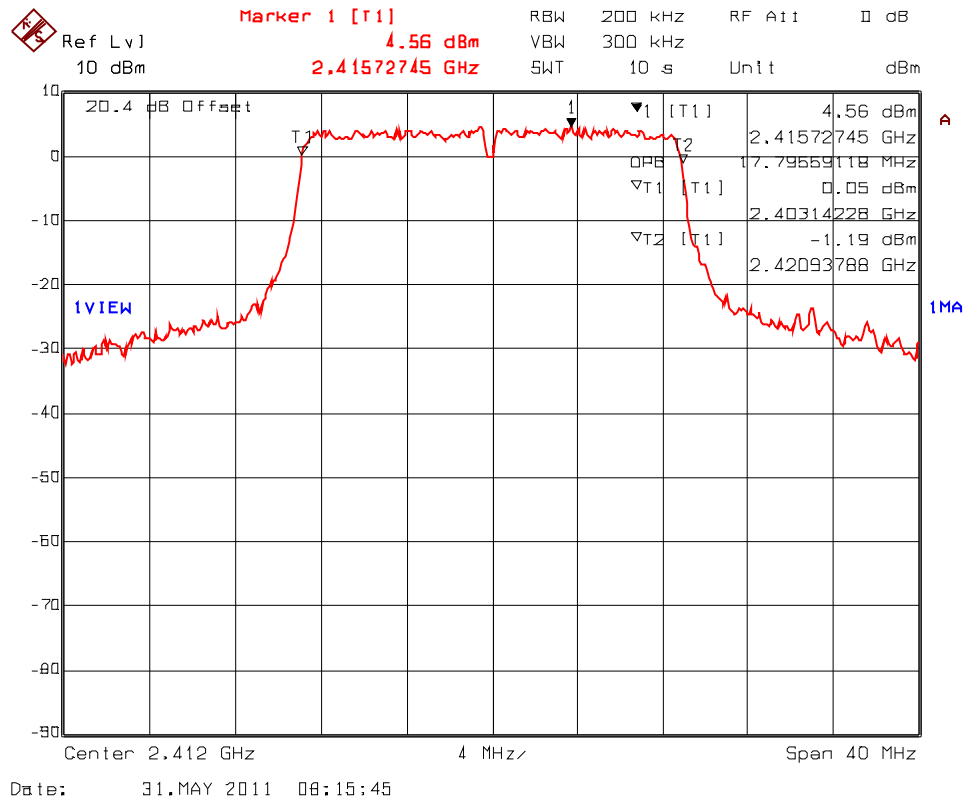
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.64.** 99% Occupied Bandwidth, 802.11n, MCS7 64QAM5/6 65 Mbps  
Test Frequency: 2412 MHz



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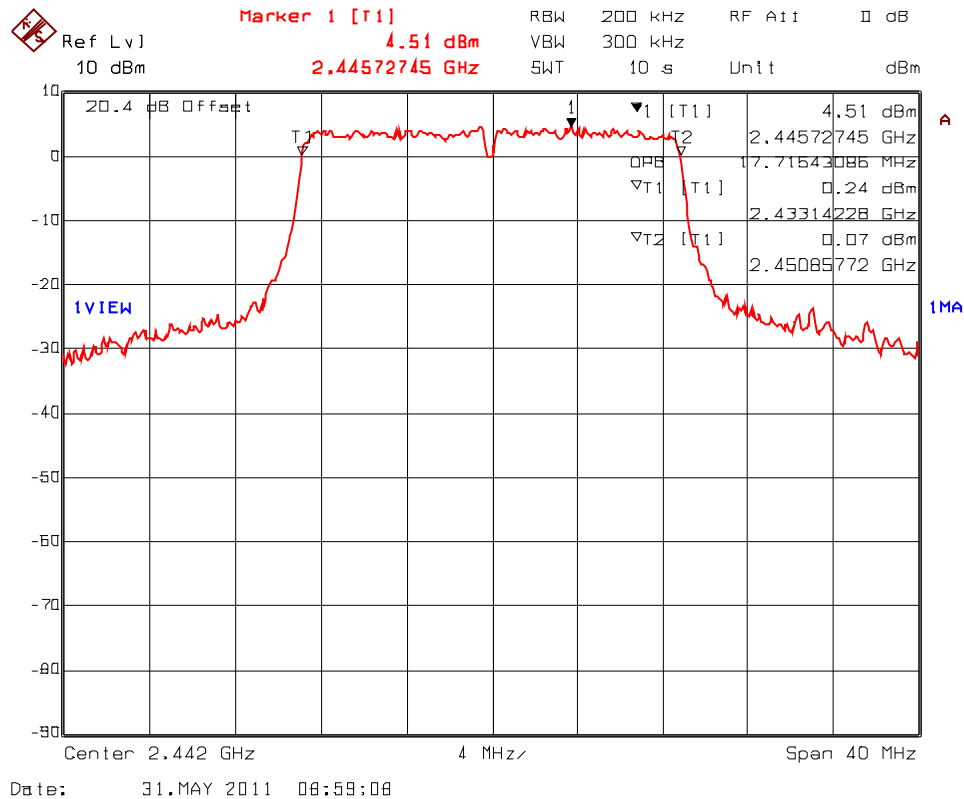
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.65. 99% Occupied Bandwidth, 802.11n, MCS7 64QAM5/6 65 Mbps**  
 Test Frequency: 2442 MHz



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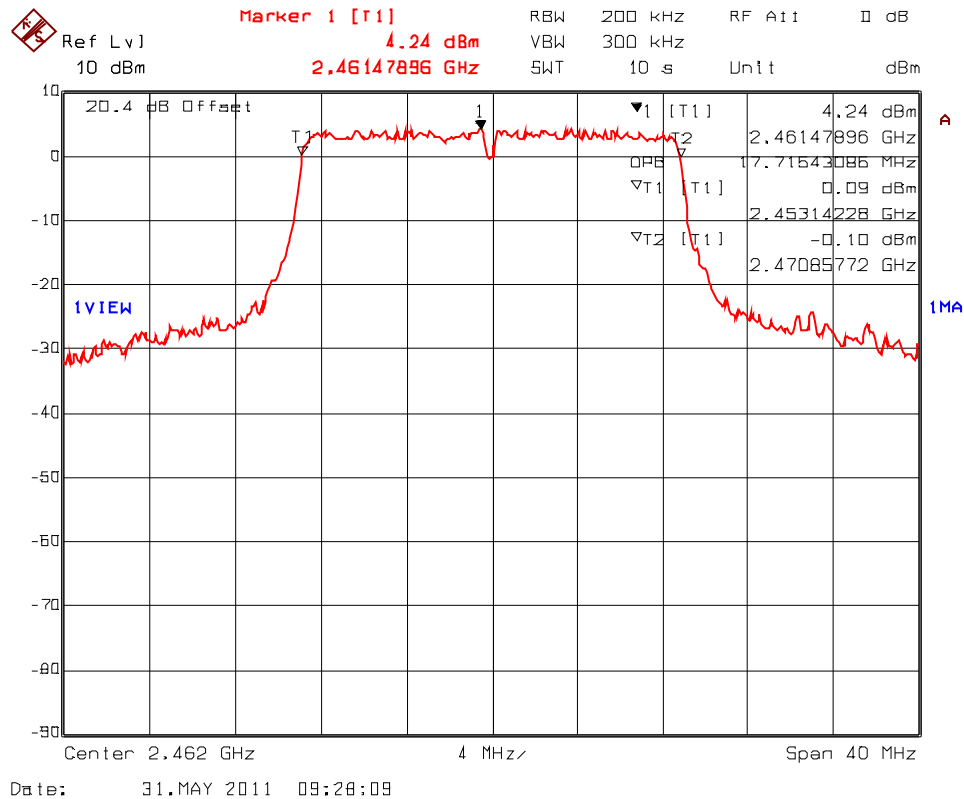
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.66.** 99% Occupied Bandwidth, 802.11n, MCS7 64QAM5/6 65 Mbps  
Test Frequency: 2462 MHz



## 5.7. PEAK CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)(3)]

### 5.7.1. Limit(s)

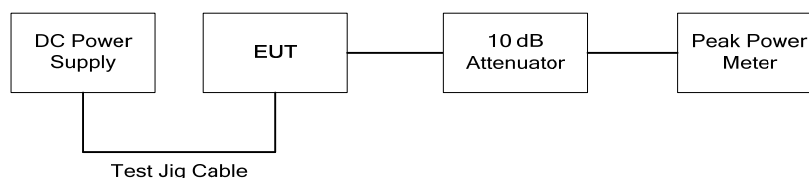
**§ 15.247(b)(3):** For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output 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.

### 5.7.2. Method of Measurements & Test Arrangement

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

### 5.7.3. Test Arrangement



#### 5.7.4. Test Data

Remark(s): Test method used: Power output option 1, peak measurement.						
Frequency (MHz)	Modulation	Data Rate (Mbps)	Peak Conducted Power (dBm)	Peak EIRP (dBm) <sup>(Note 1, 2)</sup>	Peak Conducted Power Limit (dBm)	EIRP Limit (dBm)
<b>802.11b Mode (High Power)</b>						
2412	DBPSK	1	19.21	34.09	30	36
	DQPSK	2	19.12	34.00	30	36
	CCK	11	19.12	34.00	30	36
2442	DBPSK	1	19.03	33.91	30	36
	DQPSK	2	19.03	33.91	30	36
	CCK	11	19.03	33.91	30	36
2462	DBPSK	1	18.76	33.64	30	36
	DQPSK	2	18.76	33.64	30	36
	CCK	11	18.76	33.64	30	36
<b>802.11g Mode (High Power)</b>						
2412	BPSK	9	20.70	29.20	30	36
	QPSK	18	20.52	29.02	30	36
	16-QAM	36	20.46	28.96	30	36
	64-QAM	54	20.33	28.83	30	36
2442	BPSK	9	20.64	29.14	30	36
	QPSK	18	20.46	28.96	30	36
	16-QAM	36	20.46	28.96	30	36
	64-QAM	54	20.39	28.89	30	36
2462	BPSK	9	20.46	28.96	30	36
	QPSK	18	20.26	28.76	30	36
	16-QAM	36	20.26	28.76	30	36
	64-QAM	54	20.19	28.69	30	36
<b>802.11n Mode (High Power)</b>						
2412	(MCS0) BPSK	6.5	20.39	25.27	30	36
	(MCS2) QPSK	19.5	20.33	25.21	30	36
	(MCS4) 16-QAM	39	20.39	25.27	30	36
	(MCS7) 64-QAM	65	20.19	25.07	30	36
2442	(MCS0) BPSK	6.5	20.46	25.34	30	36
	(MCS2) QPSK	19.5	20.39	25.27	30	36
	(MCS4) 16-QAM	39	20.46	25.34	30	36
	(MCS7) 64-QAM	65	20.33	25.21	30	36
2462	(MCS0) BPSK	6.5	20.26	25.14	30	36
	(MCS2) QPSK	19.5	20.26	25.14	30	36
	(MCS4) 16-QAM	39	20.33	25.21	30	36
	(MCS7) 64-QAM	65	20.12	25.00	30	36

Note 1: The Peak EIRP is calculated as the sum of Peak Conducted Power in dBm and antenna assembly gain of EUT in dBi (antenna gain – cable loss).

Note 2: The maximum assembly antenna gain: 14.88 dB (802.11b), 8.50 dB (802.11g) and 4.88 dB (802.11n)

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Remark(s): Test method used: Power output option 1, peak measurement.						
Frequency (MHz)	Modulation	Data Rate (Mbps)	Peak Conducted Power (dBm)	Peak EIRP (dBm) (Note 1, 2)	Peak Conducted Power Limit (dBm)	EIRP Limit (dBm)
<b>802.11b Mode (Low Power)</b>						
2412	DBPSK	1	11.67	26.55	30	36
	DQPSK	2	11.67	26.55	30	36
	CCK	11	11.67	26.55	30	36
2442	DBPSK	1	11.67	26.55	30	36
	DQPSK	2	11.67	26.55	30	36
	CCK	11	11.67	26.55	30	36
2462	DBPSK	1	11.16	26.04	30	36
	DQPSK	2	11.16	26.04	30	36
	CCK	11	11.16	26.04	30	36
<b>802.11g Mode (Low Power)</b>						
2412	BPSK	9	14.92	23.42	30	36
	QPSK	18	14.92	23.42	30	36
	16-QAM	36	14.43	22.93	30	36
	64-QAM	54	14.17	22.67	30	36
2442	BPSK	9	14.92	23.42	30	36
	QPSK	18	14.68	23.18	30	36
	16-QAM	36	14.43	22.93	30	36
	64-QAM	54	14.17	22.67	30	36
2462	BPSK	9	14.68	23.18	30	36
	QPSK	18	14.43	22.93	30	36
	16-QAM	36	14.17	22.67	30	36
	64-QAM	54	13.89	22.39	30	36
<b>802.11n Mode (Low Power)</b>						
2412	(MCS0) BPSK	6.5	14.43	19.31	30	36
	(MCS2) QPSK	19.5	14.43	19.31	30	36
	(MCS4) 16-QAM	39	14.43	19.31	30	36
	(MCS7) 64-QAM	65	14.17	19.05	30	36
2442	(MCS0) BPSK	6.5	14.68	19.56	30	36
	(MCS2) QPSK	19.5	14.43	19.31	30	36
	(MCS4) 16-QAM	39	14.68	19.56	30	36
	(MCS7) 64-QAM	65	14.43	19.31	30	36
2462	(MCS0) BPSK	6.5	14.43	19.31	30	36
	(MCS2) QPSK	19.5	14.17	19.05	30	36
	(MCS4) 16-QAM	39	14.17	19.05	30	36
	(MCS7) 64-QAM	65	14.17	19.05	30	36

Note 1: The Peak EIRP is calculated as the sum of Peak Conducted Power in dBm and antenna assembly gain of EUT in dBi (antenna gain – cable loss).

Note 2: The maximum assembly antenna gain: 14.88 dB (802.11b), 8.50 dB (802.11g) and 4.88 dB (802.11n)

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

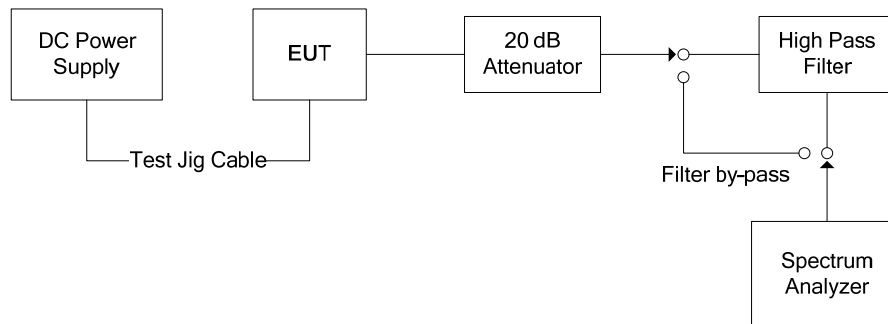
### 5.8.1. Limit(s)

**§ 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.

### 5.8.2. Method of Measurements

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

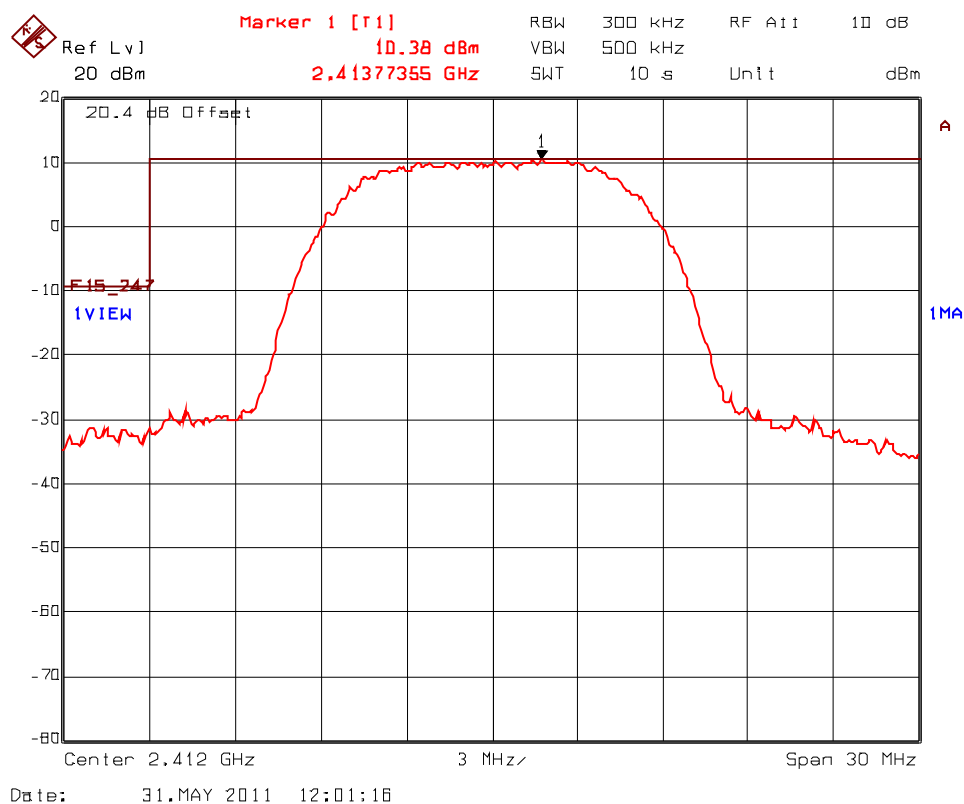
### 5.8.3. Test Arrangement



## 5.8.4. Test Data

### 5.8.4.1. Band-Edge RF Conducted Emissions

**Plot 5.8.4.1.1.** Band-Edge RF Conducted Emissions, 802.11b, CCK 11 Mbps  
Low End of Frequency Band (2412 MHz)



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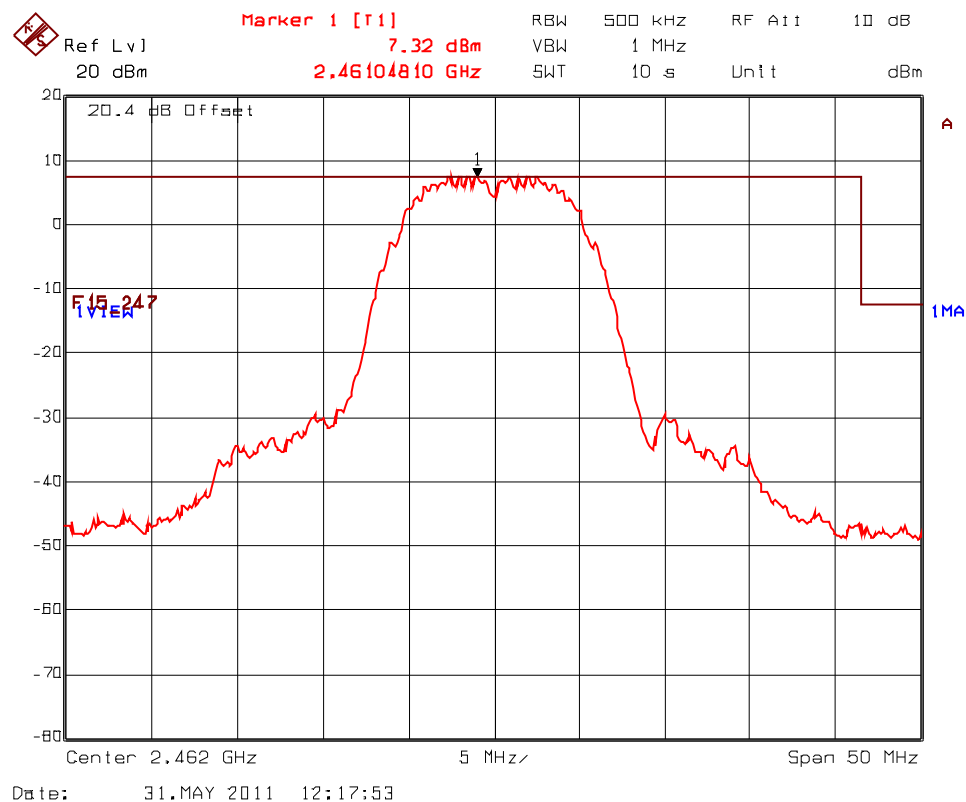
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

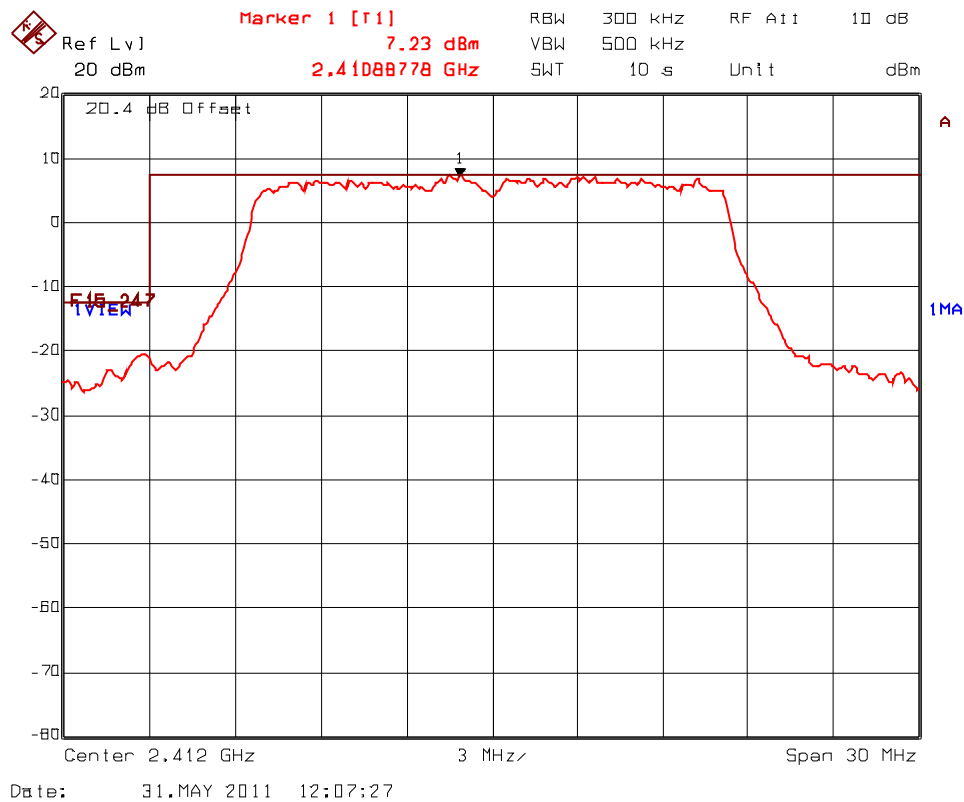
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**Plot 5.8.4.1.2.** Band-Edge RF Conducted Emissions, 802.11b, CCK 11 Mbps  
High End of Frequency Band (2462 MHz)



**Plot 5.8.4.1.3.** Band-Edge RF Conducted Emissions, 802.11g, 64-QAM 54 Mbps  
Low End of Frequency Band (2412 MHz)



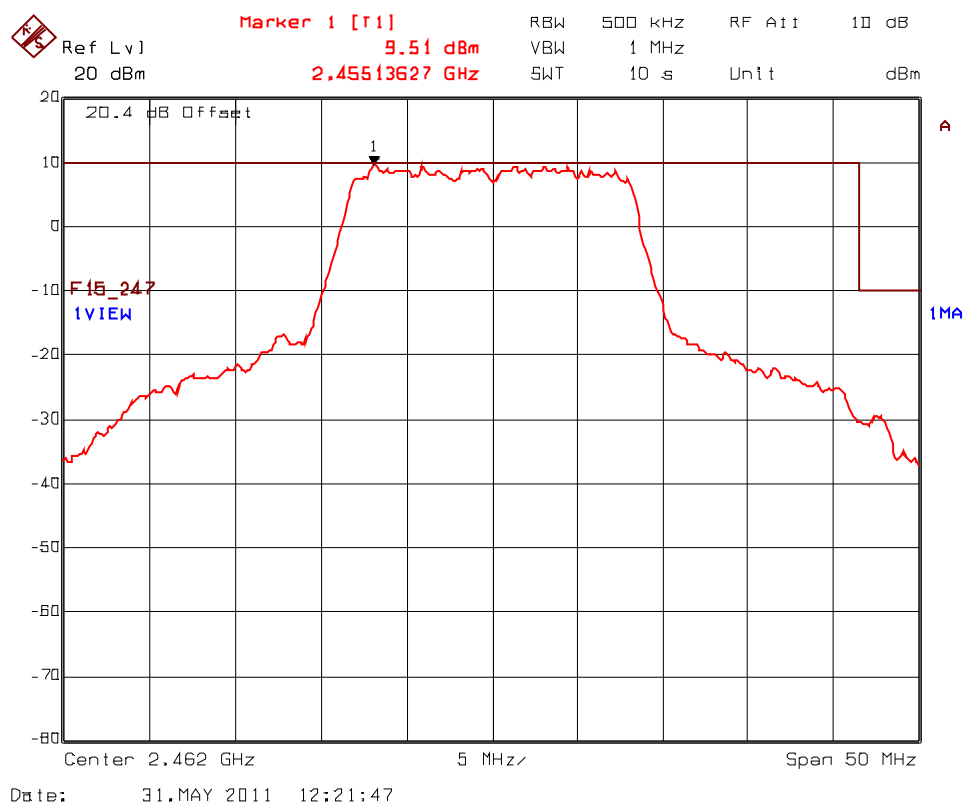
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.8.4.1.4.** Band-Edge RF Conducted Emissions, 802.11g, 64-QAM 54 Mbps  
High End of Frequency Band (2462 MHz)



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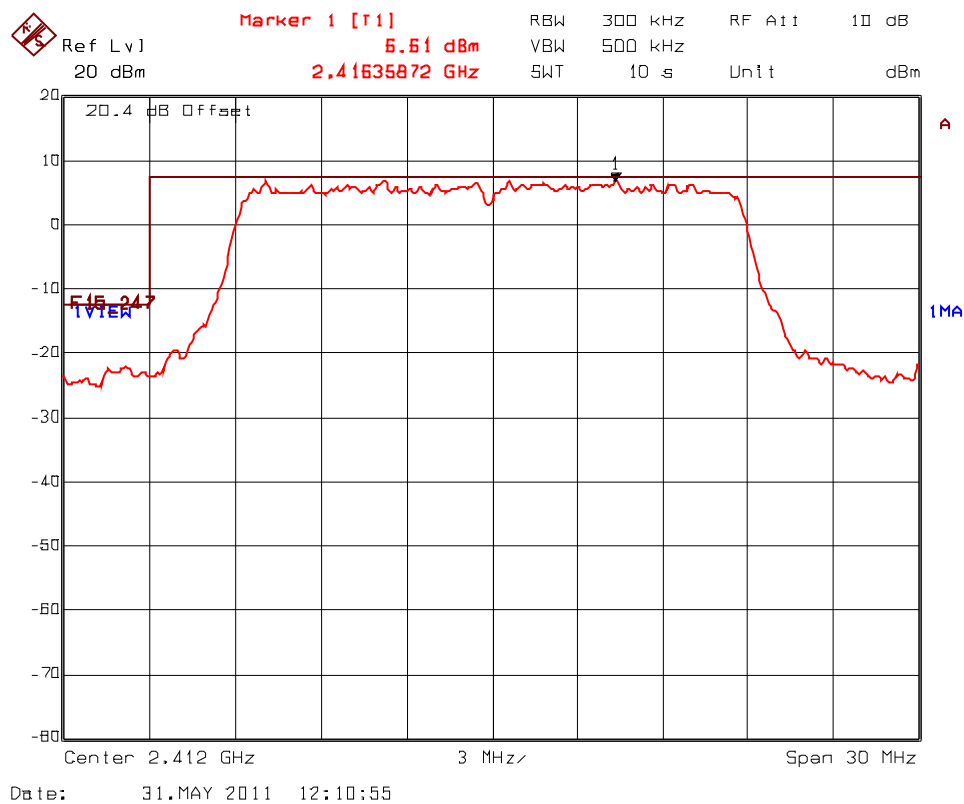
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

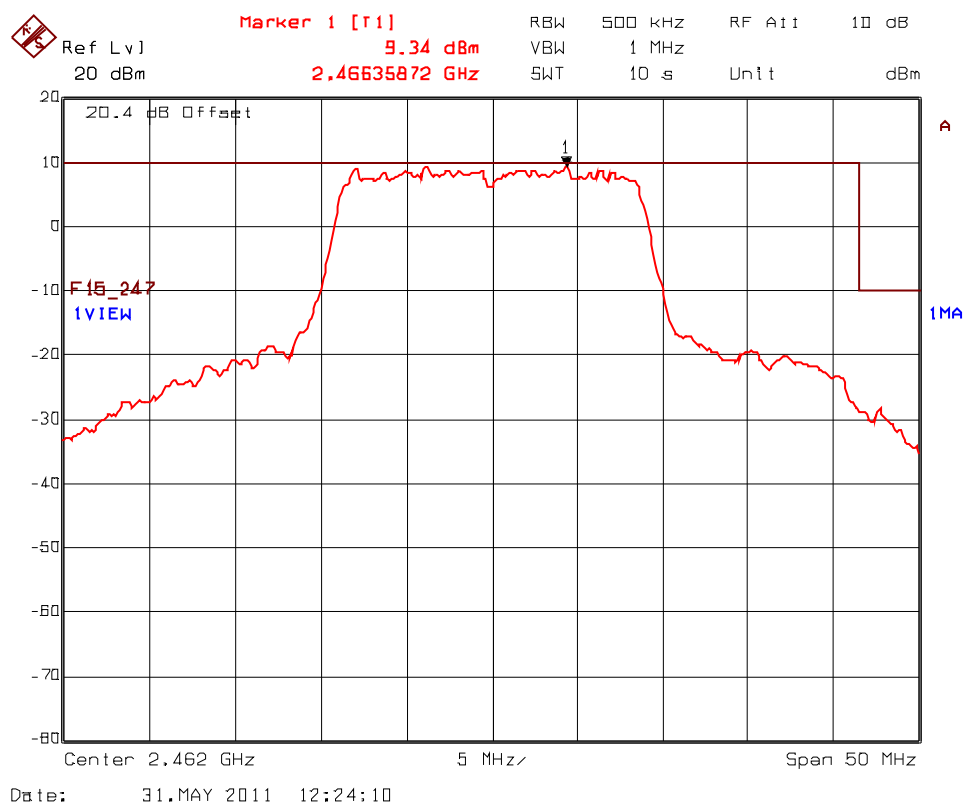
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*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

**Plot 5.8.4.1.5.** Band-Edge RF Conducted Emissions, 802.11n, MCS7 65 Mbps  
Low End of Frequency Band (2412 MHz)

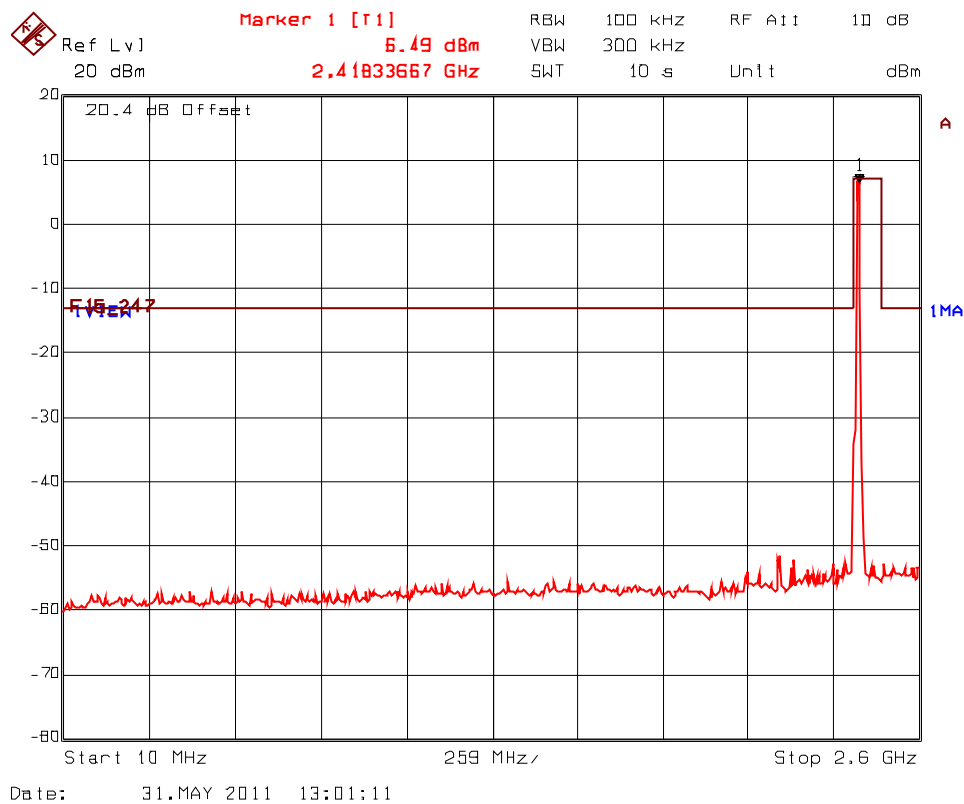


**Plot 5.8.4.1.6. Band-Edge RF Conducted Emissions, 802.11n, MCS7 65 Mbps  
High End of Frequency Band (2462 MHz)**



### 5.8.4.2. Spurious RF Conducted Emissions

**Plot 5.8.4.2.1.** Spurious RF Conducted Emissions, 802.11b, 10 MHz – 2.6 GHz  
2412 MHz, High Power, CCK 11 Mbps



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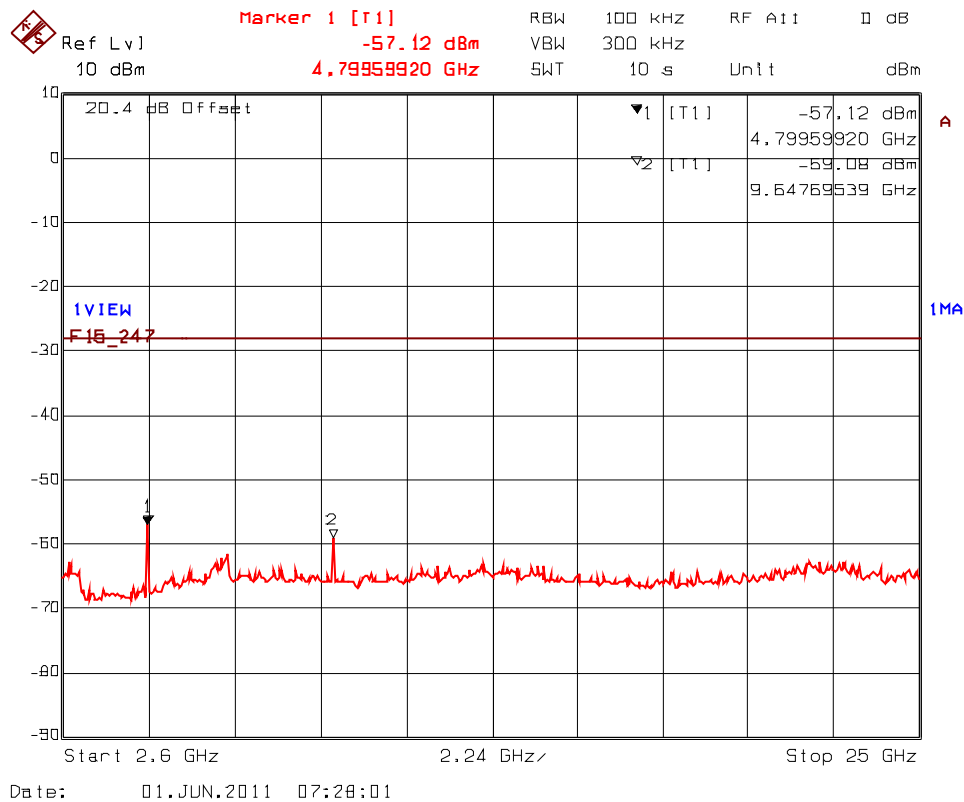
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.8.4.2.2.** Spurious RF Conducted Emissions, 802.11b, 2.6 GHz – 25 GHz  
2412 MHz, High Power, CCK 11 Mbps



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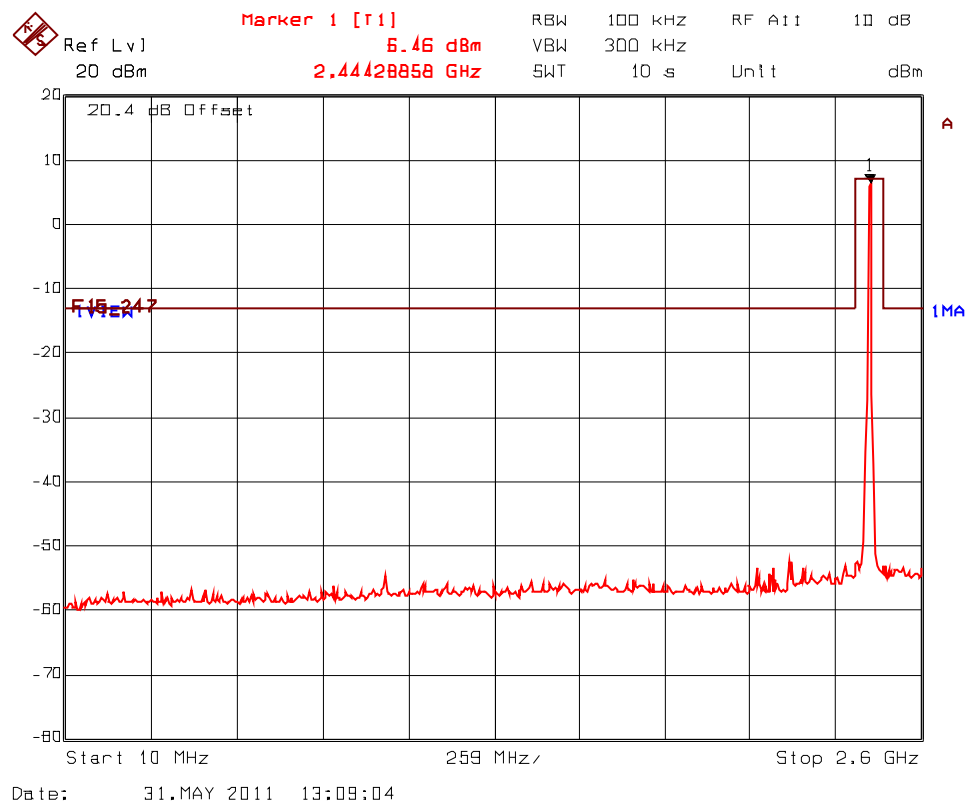
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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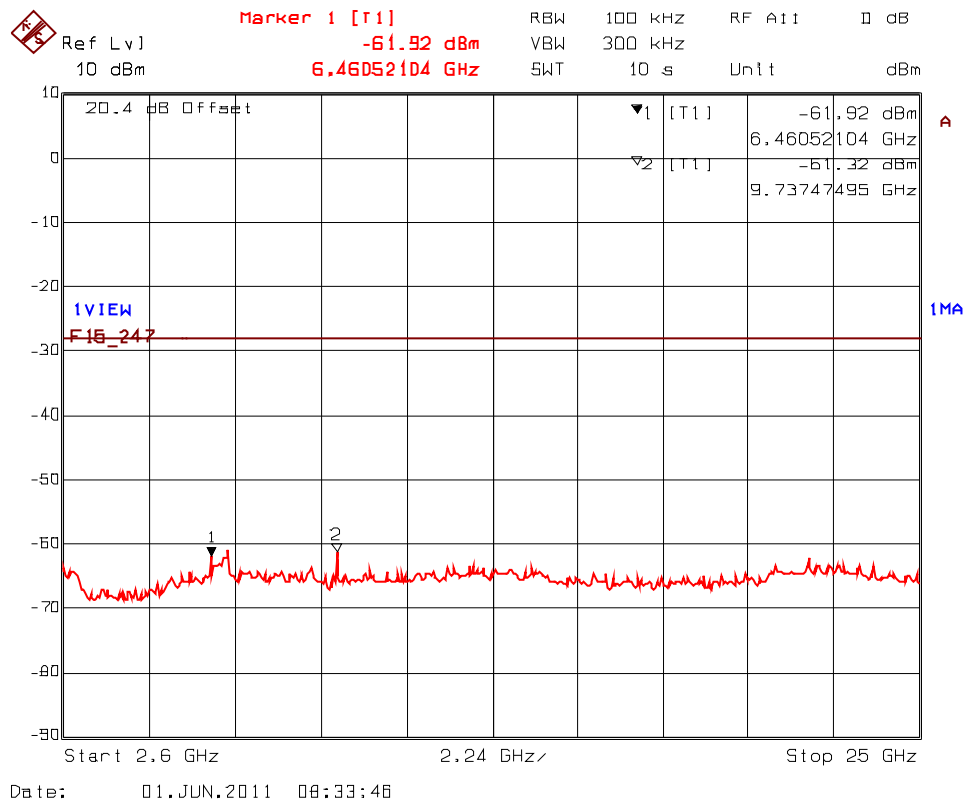
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*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

**Plot 5.8.4.2.3.** Spurious RF Conducted Emissions, 802.11b, 10 MHz – 2.6 GHz  
2442 MHz, High Power, CCK 11 Mbps



**Plot 5.8.4.2.4. Spurious RF Conducted Emissions, 802.11b, 2.6 GHz – 25 GHz  
2442 MHz, High Power, CCK 11 Mbps**



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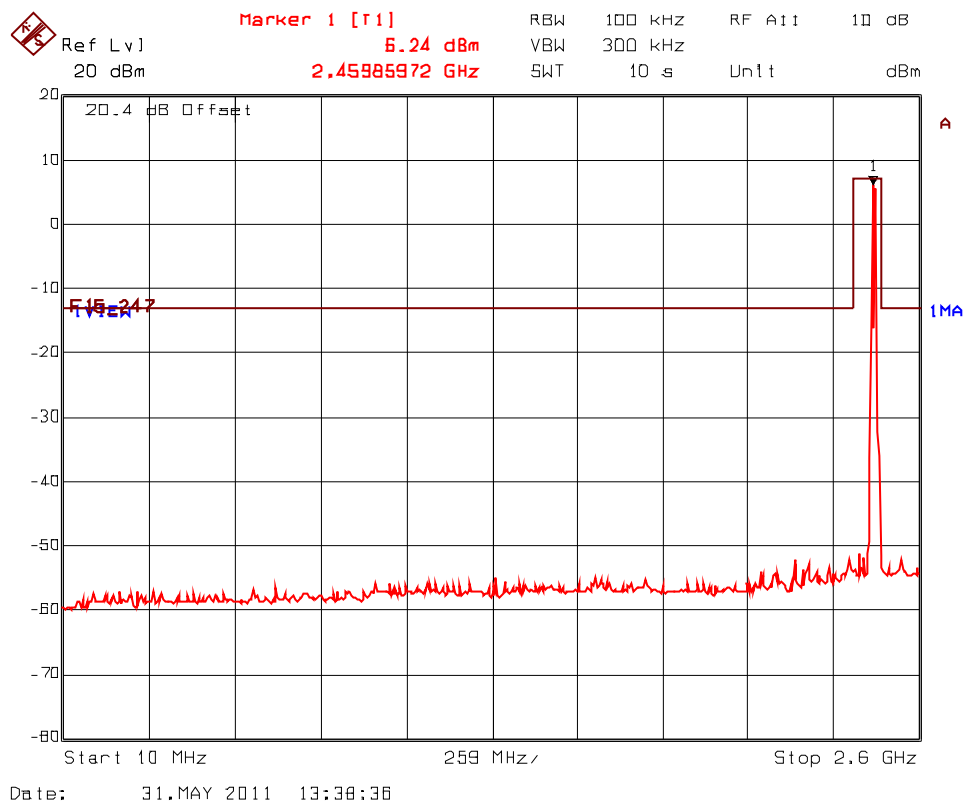
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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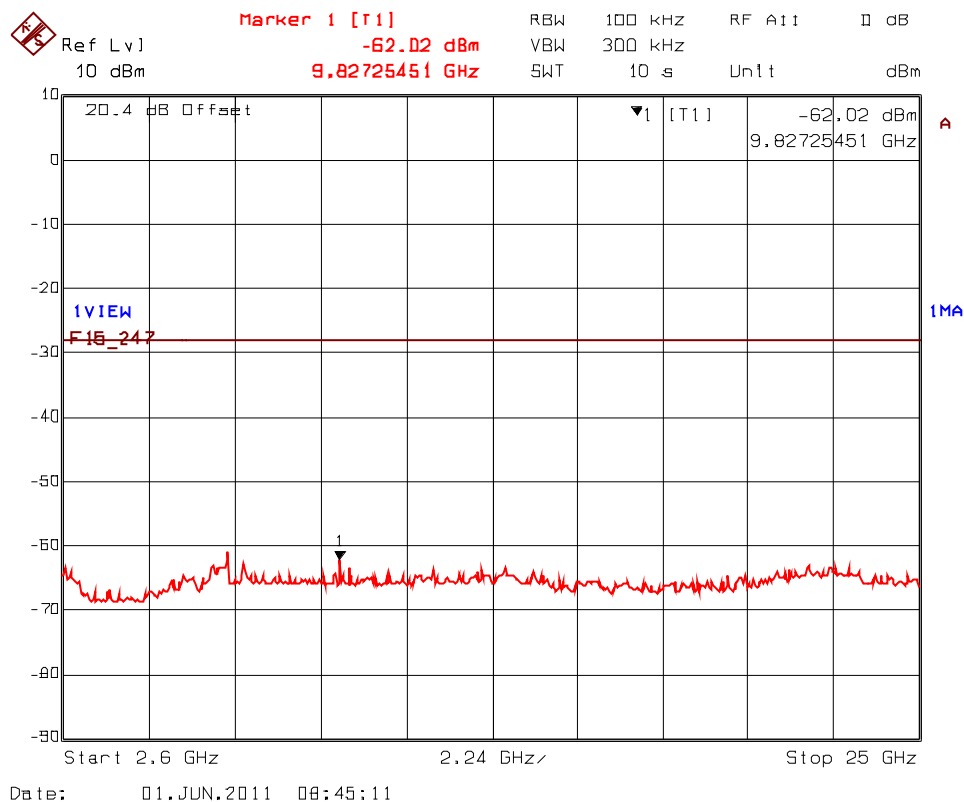
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**Plot 5.8.4.2.5.** Spurious RF Conducted Emissions, 802.11b, 10 MHz – 2.6 GHz  
2462 MHz, High Power, CCK 11 Mbps



**Plot 5.8.4.2.6. Spurious RF Conducted Emissions, 802.11b, 2.6 GHz – 25 GHz**  
2462 MHz, High Power, CCK 11 Mbps



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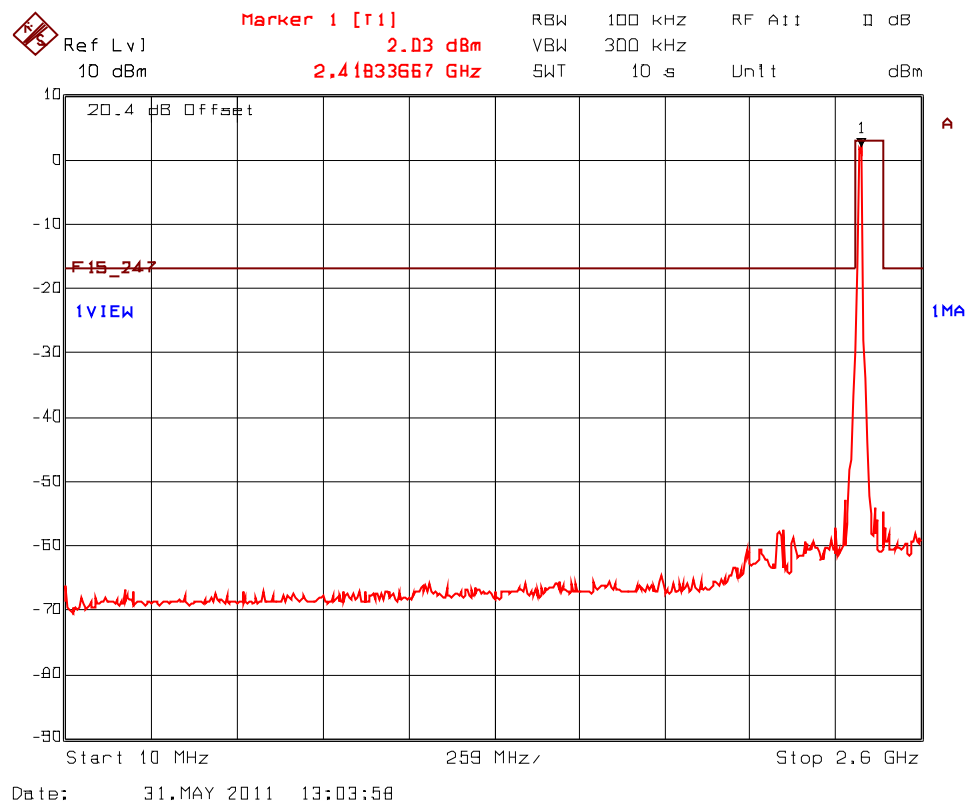
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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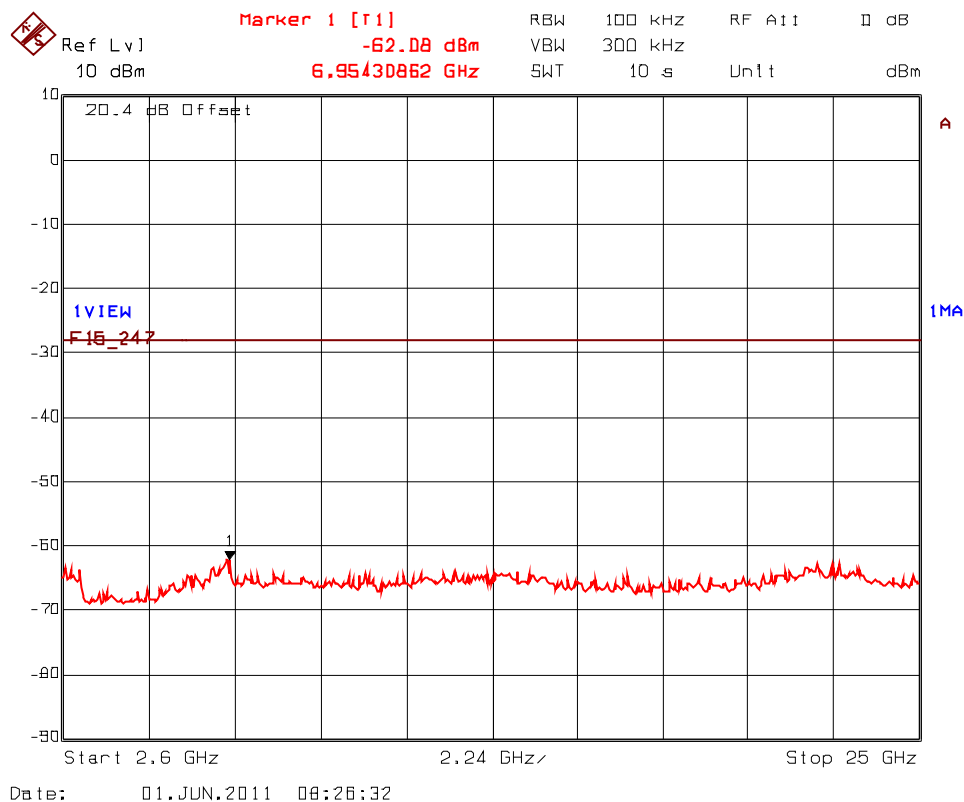
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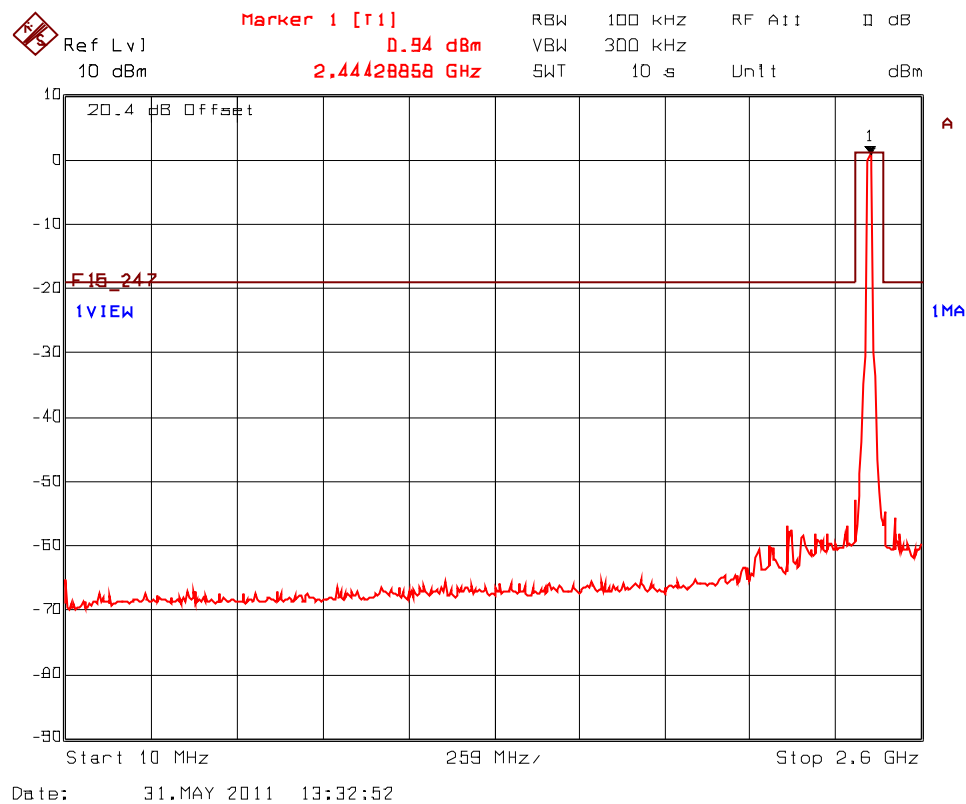
**Plot 5.8.4.2.7.** Spurious RF Conducted Emissions, 802.11g, 10 MHz – 2.6 GHz  
2412 MHz, High Power, 64-QAM 54 Mbps



**Plot 5.8.4.2.8.** Spurious RF Conducted Emissions, 802.11g, 2.6 GHz – 25 GHz  
2412 MHz, High Power, 64-QAM 54 Mbps



**Plot 5.8.4.2.9.** Spurious RF Conducted Emissions, 802.11g, 10 MHz – 2.6 GHz  
2442 MHz, High Power, 64-QAM 54 Mbps



Ref Lvl 10 dBm

Marker 1 [F1] -61.29 dBm

6.90941884 GHz

RBW 100 kHz

VBW 300 kHz

SWT 10 s

RF Att 1

Unit dB

20.4 dB Offset

1VIEW

F15\_247

1

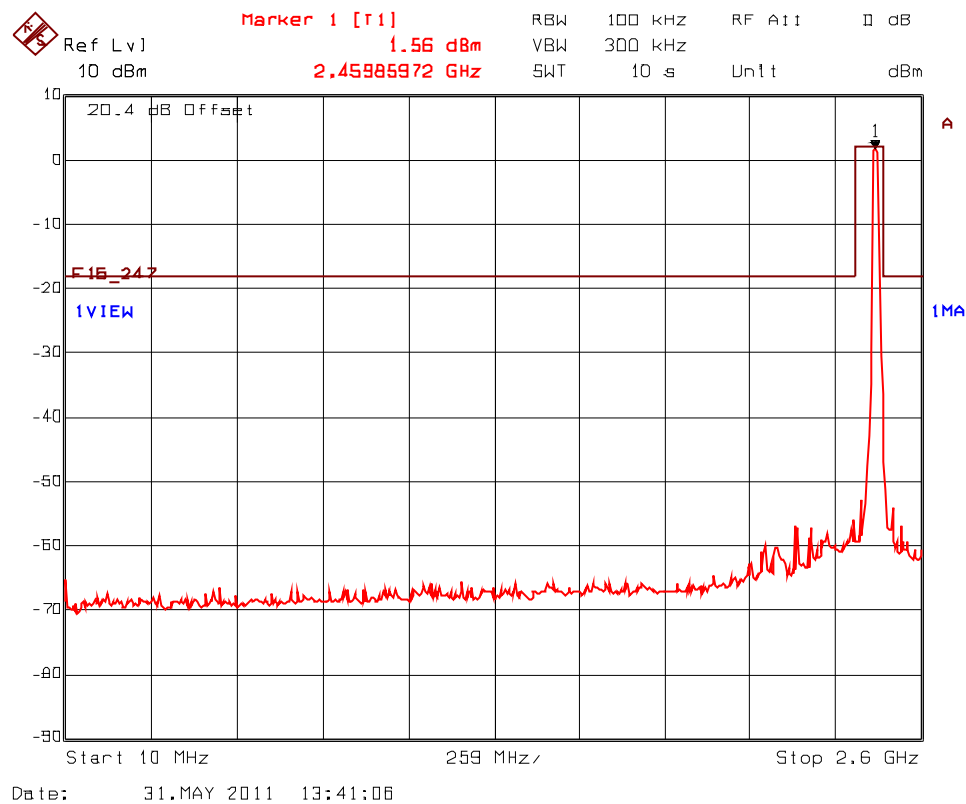
Start 2.6 GHz

2.24 GHz

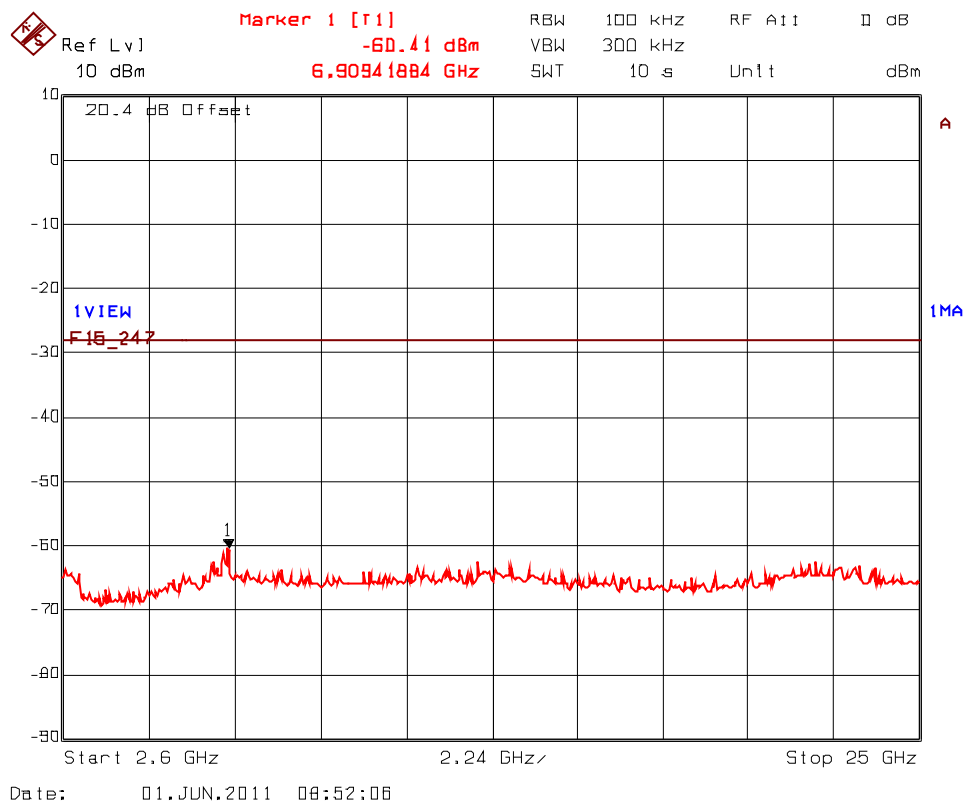
Stop 25 GHz

Date: 01.JUN.2011 08:37:09

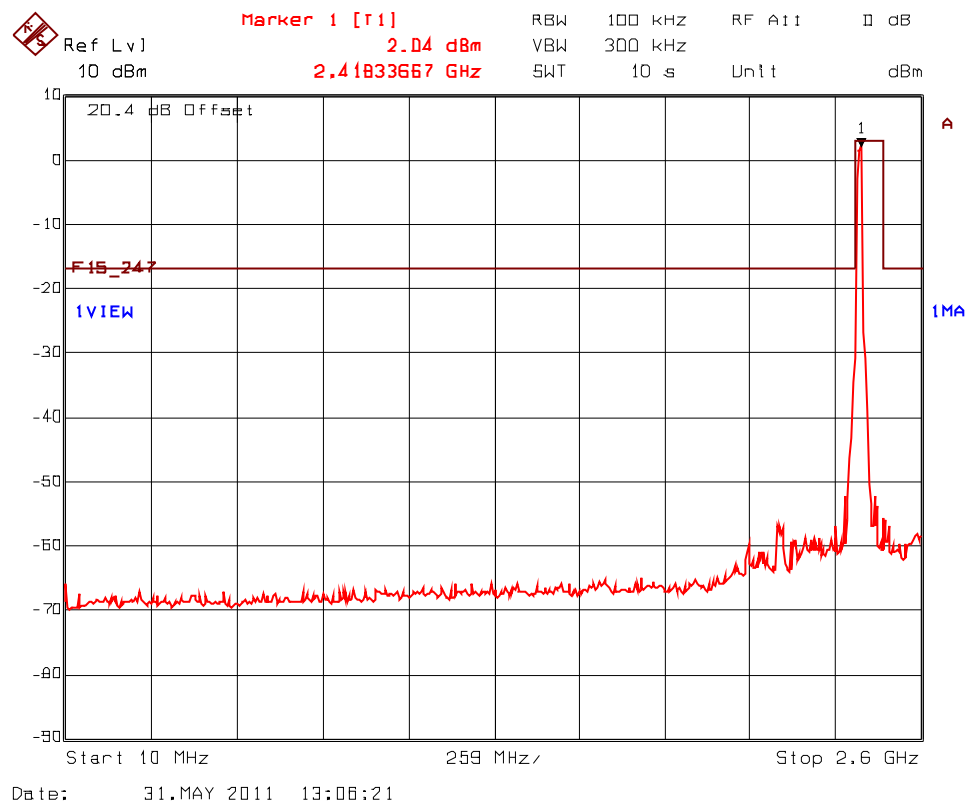
**Plot 5.8.4.2.11.** Spurious RF Conducted Emissions, 802.11g, 10 MHz – 2.6 GHz  
2462 MHz, High Power, 64-QAM 54 Mbps



**Plot 5.8.4.2.12.** Spurious RF Conducted Emissions, 802.11g, 2.6 GHz – 25 GHz  
2462 MHz, High Power, 64-QAM 54 Mbps



**Plot 5.8.4.2.13.** Spurious RF Conducted Emissions, 802.11n, 10 MHz – 2.6 GHz  
2412 MHz, High Power, MCS7 65 Mbps



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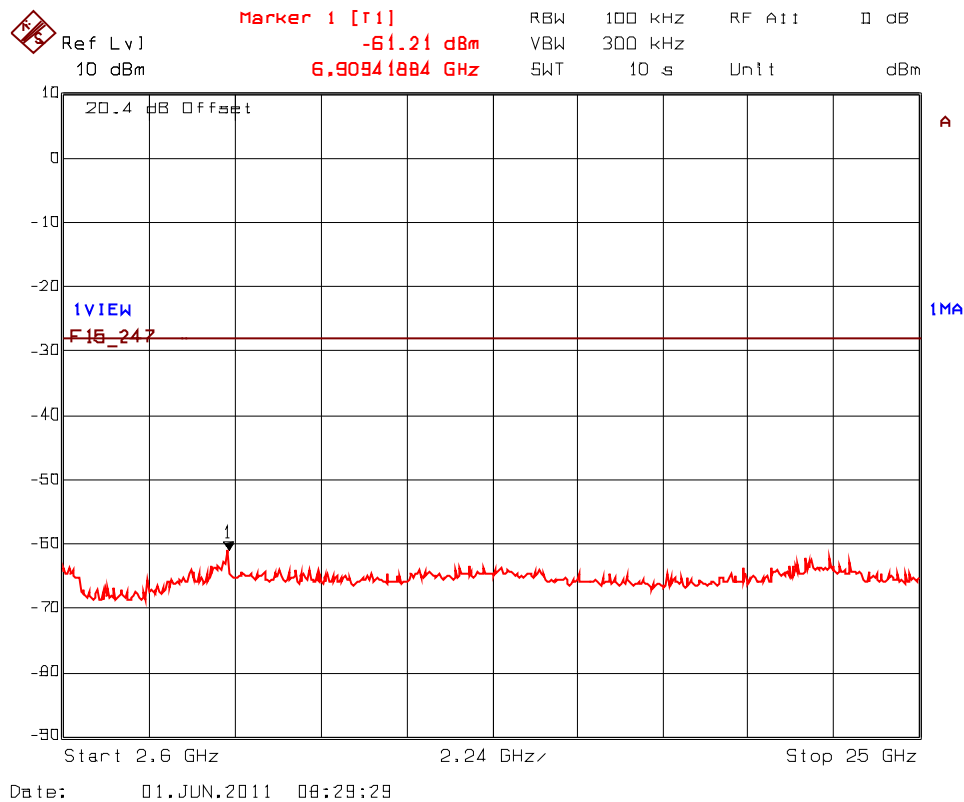
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

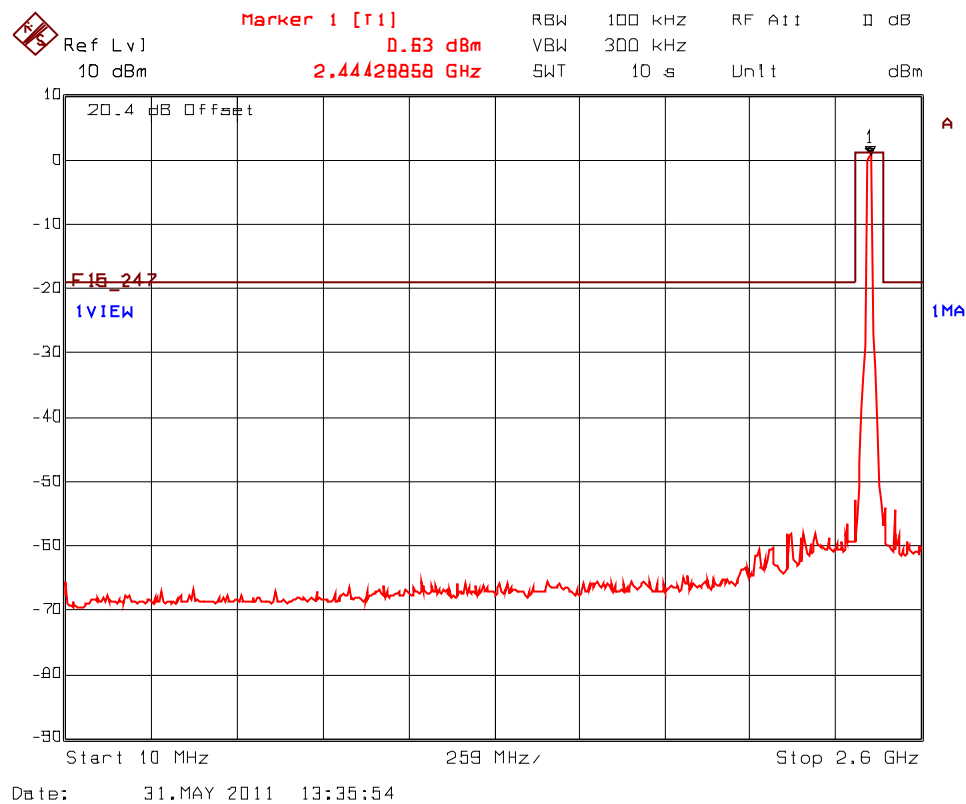
July 6, 2011

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

**Plot 5.8.4.2.14.** Spurious RF Conducted Emissions, 802.11n, 2.6 GHz – 25 GHz  
2412 MHz, High Power, MCS7 65 Mbps



**Plot 5.8.4.2.15.** Spurious RF Conducted Emissions, 802.11n, 10 MHz – 2.6 GHz  
2442 MHz, High Power, MCS7 65 Mbps



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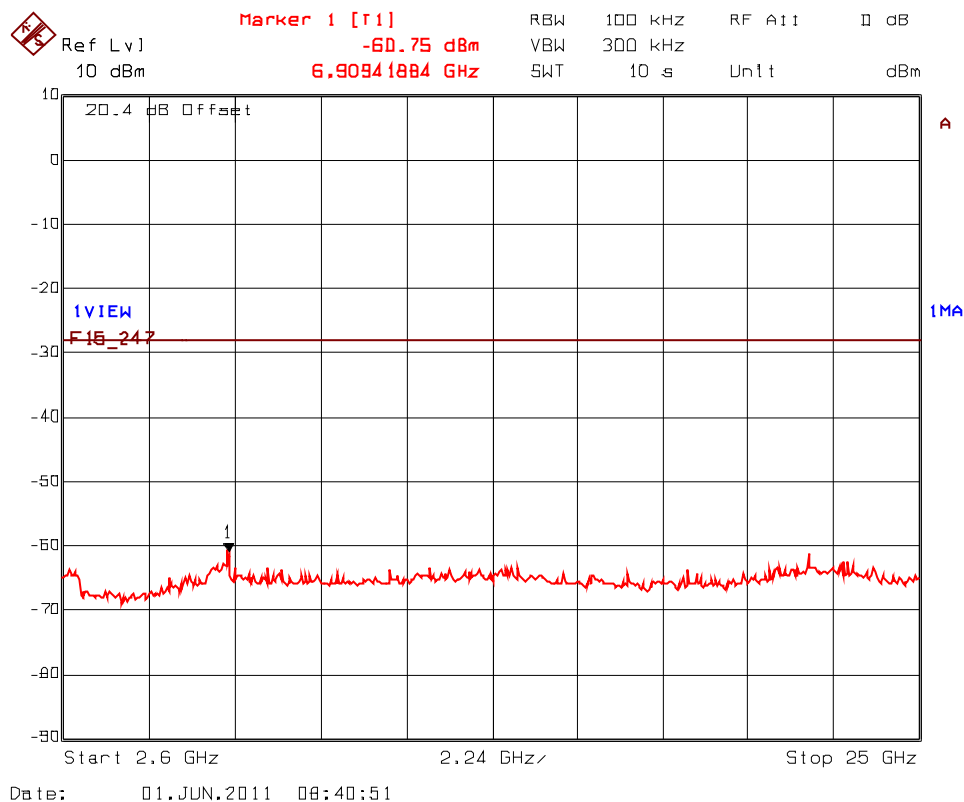
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.8.4.2.16.** Spurious RF Conducted Emissions, 802.11n, 2.6 GHz – 25 GHz  
2442 MHz, High Power, MCS7 65 Mbps



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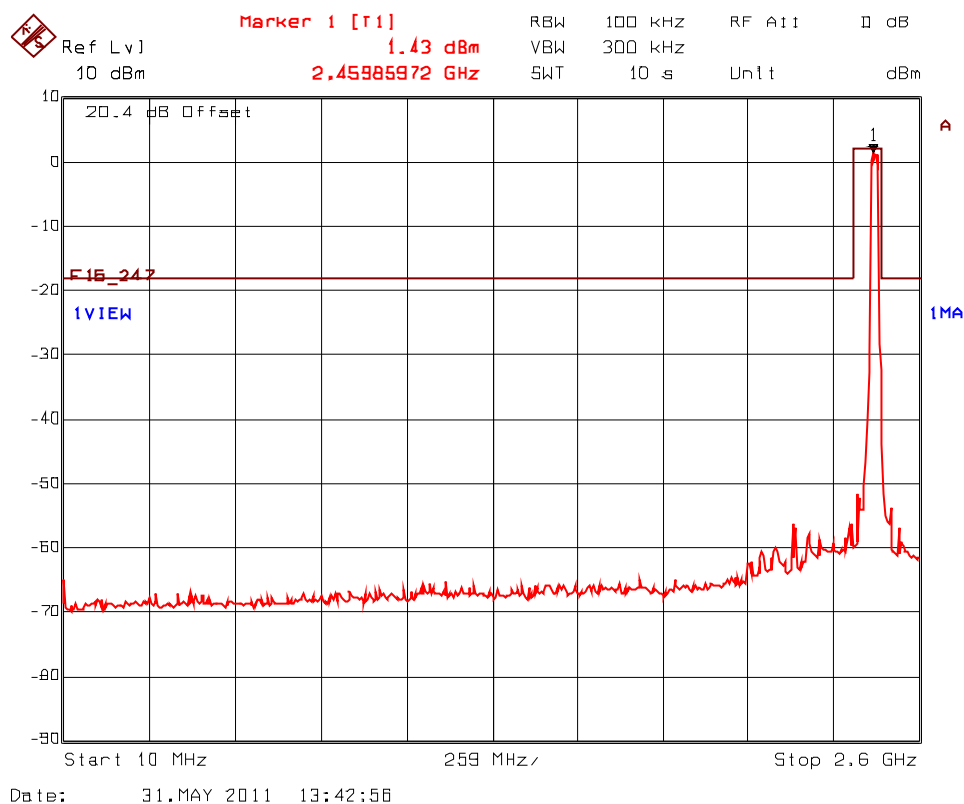
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

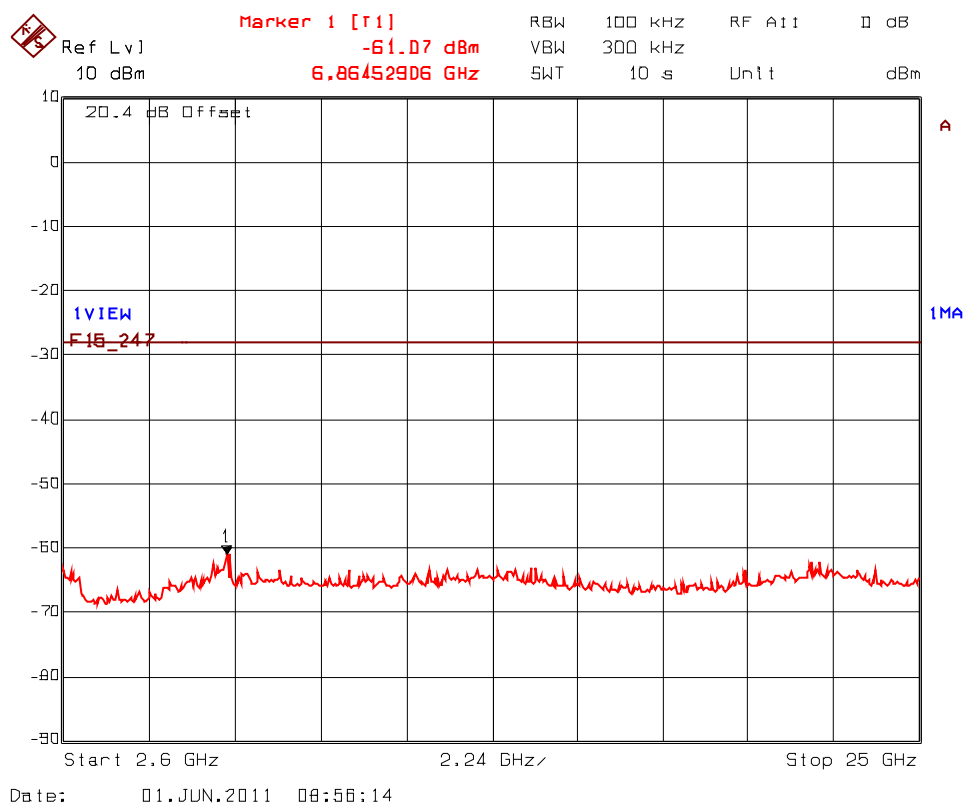
July 6, 2011

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

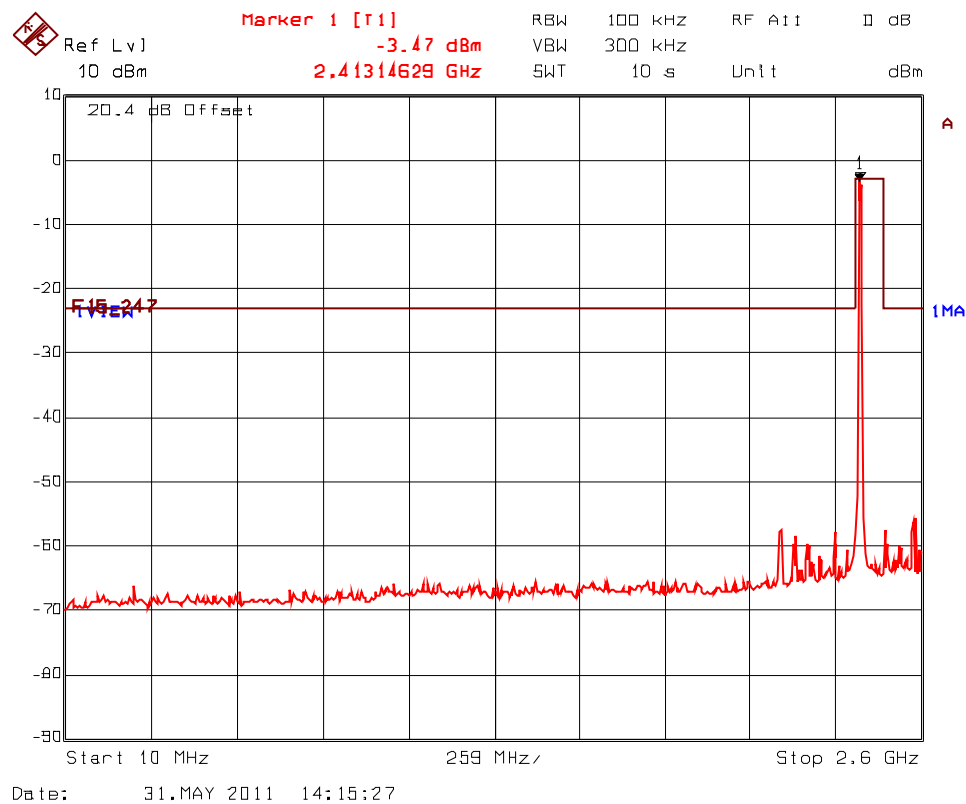
**Plot 5.8.4.2.17.** Spurious RF Conducted Emissions, 802.11n, 10 MHz – 2.6 GHz  
2462 MHz, High Power, MCS7 65 Mbps



**Plot 5.8.4.2.18.** Spurious RF Conducted Emissions, 802.11n, 2.6 GHz – 25 GHz  
2462 MHz, High Power, MCS7 65 Mbps



**Plot 5.8.4.2.19.** Spurious RF Conducted Emissions, 802.11b, 10 MHz – 2.6 GHz  
2412 MHz, Low Power, CCK 11 Mbps



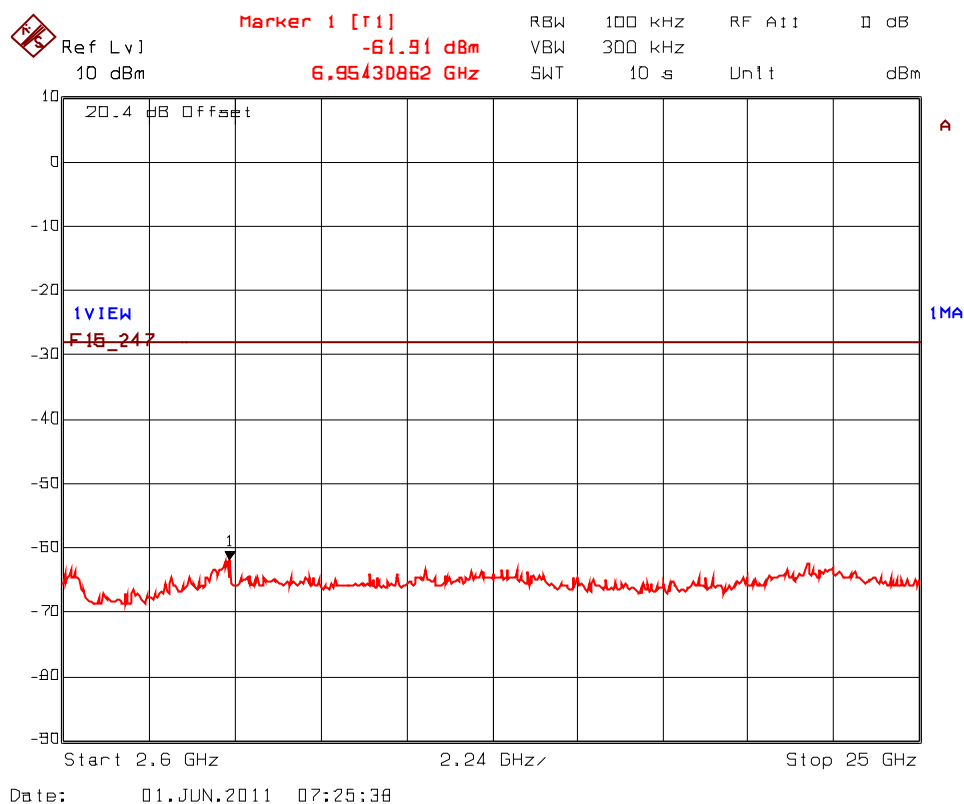
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

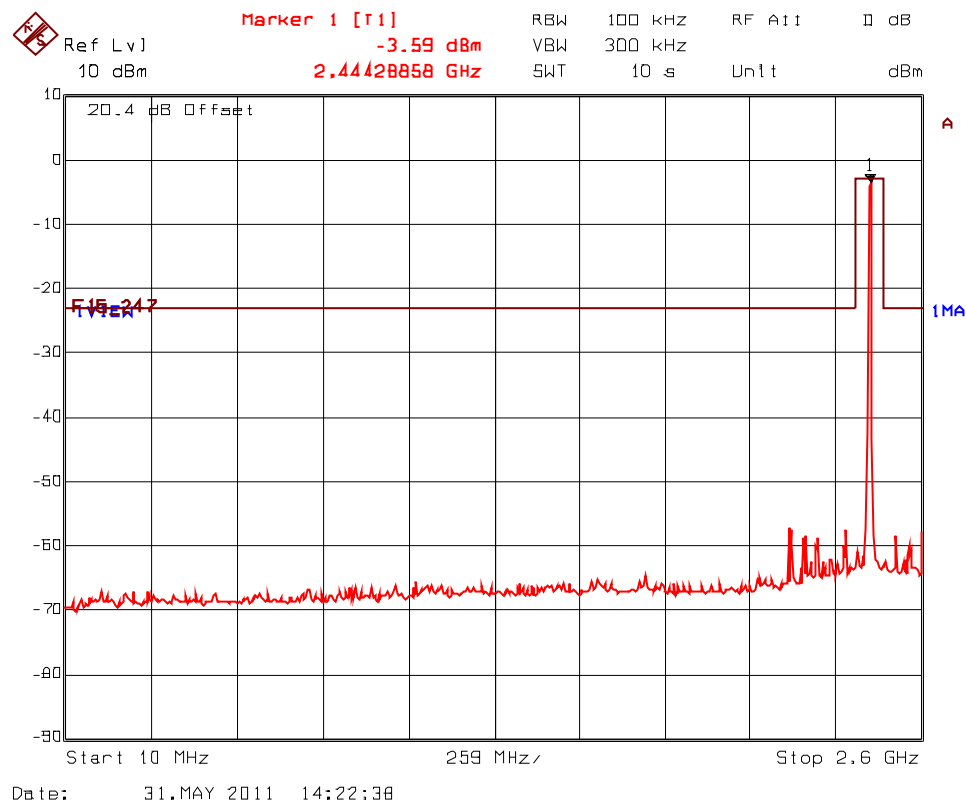
File #: DIGI-043QF15C247  
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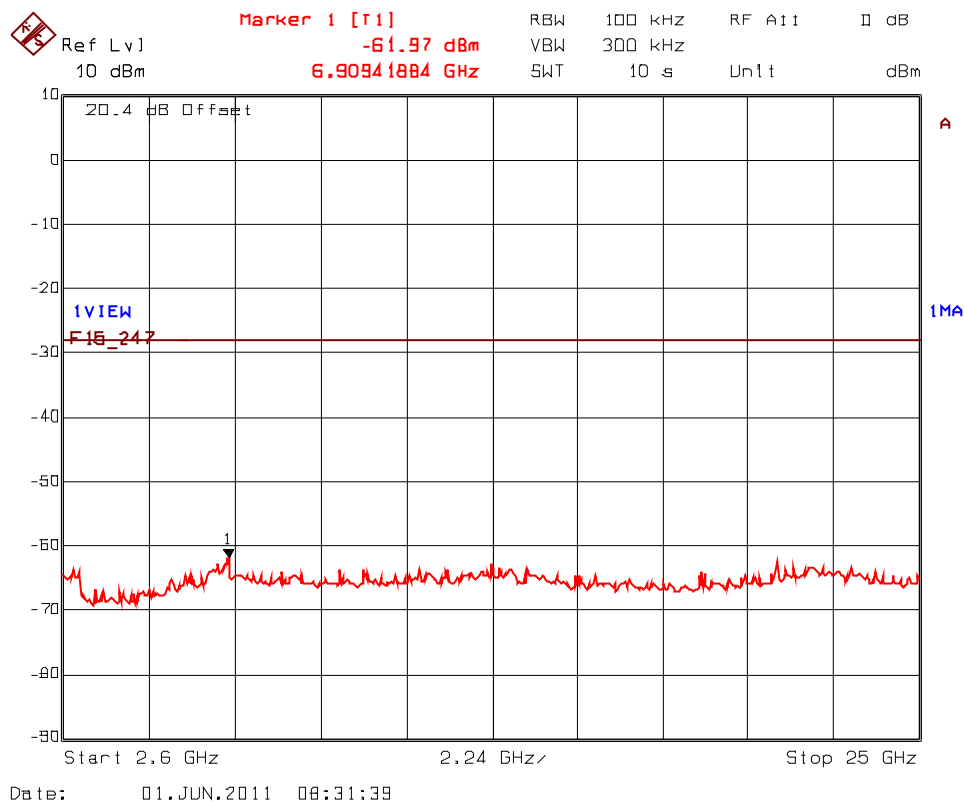
**Plot 5.8.4.2.20.** Spurious RF Conducted Emissions, 802.11b, 2.6 GHz – 25 GHz  
2412 MHz, Low Power, CCK 11 Mbps



**Plot 5.8.4.2.21.** Spurious RF Conducted Emissions, 802.11b, 10 MHz – 2.6 GHz  
2442 MHz, Low Power, CCK 11 Mbps



**Plot 5.8.4.2.22.** Spurious RF Conducted Emissions, 802.11b, 2.6 GHz – 25 GHz  
2442 MHz, Low Power, CCK 11 Mbps



Ref Lvl  
10 dBm

Marker 1 [11]  
-3.88 dBm  
2.46505010 GHz

RBW 100 kHz  
VBW 300 kHz  
SWT 10 s

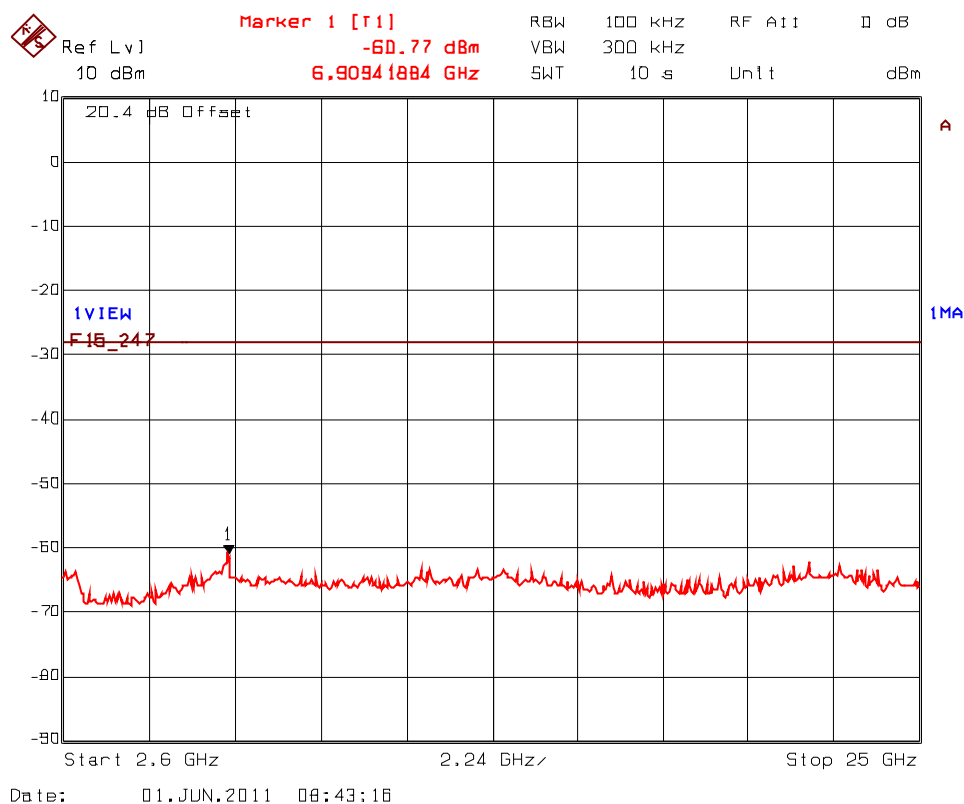
RF Att 0 dB  
Unit 1  
dBm

20.4 dB Offset

Start 10 MHz  
259 MHz  
Stop 2.6 GHz

Date: 31.MAY 2011 14:29:20

**Plot 5.8.4.2.24.** Spurious RF Conducted Emissions, 802.11b, 2.6 GHz – 25 GHz  
 2462 MHz, Low Power, CCK 11 Mbps



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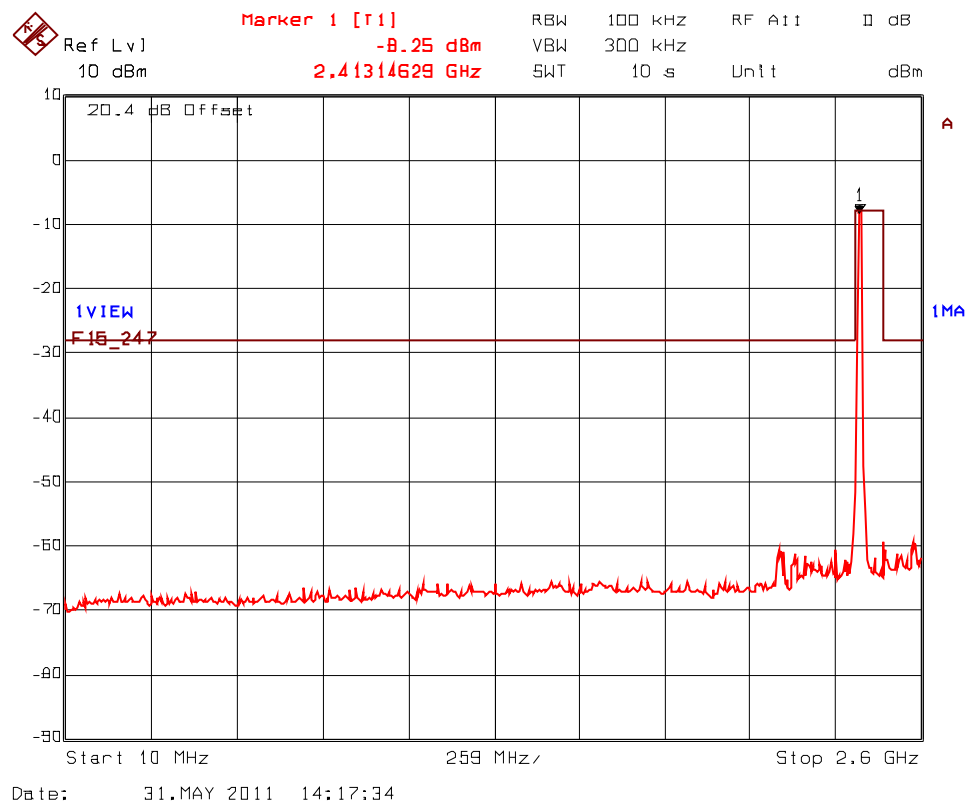
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

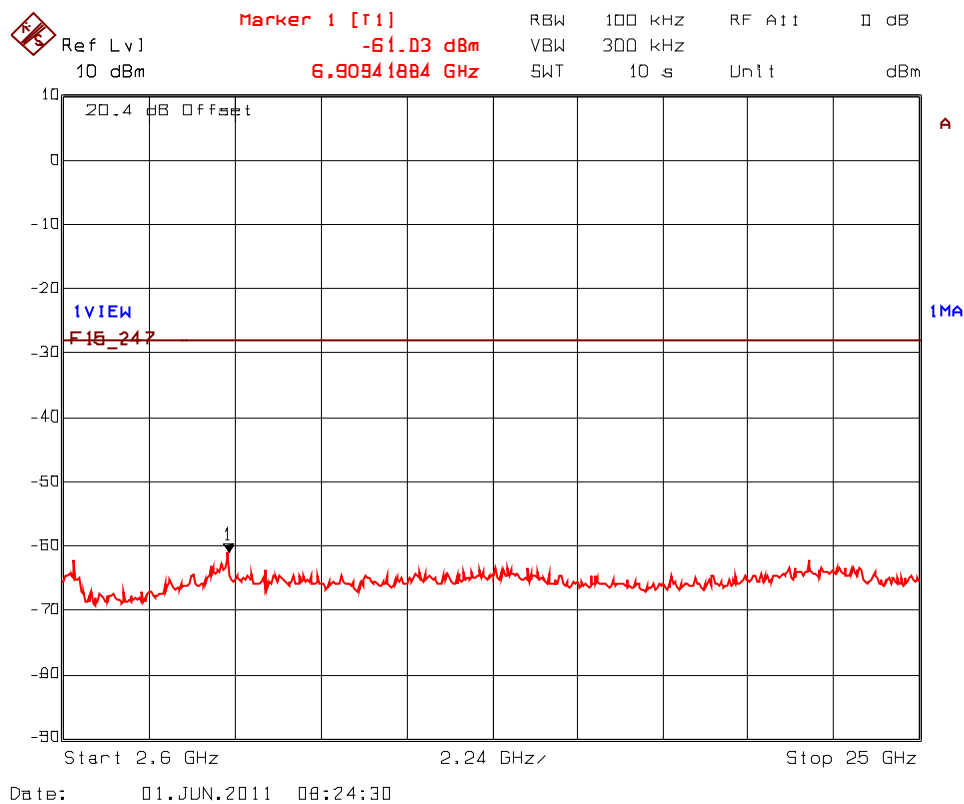
July 6, 2011

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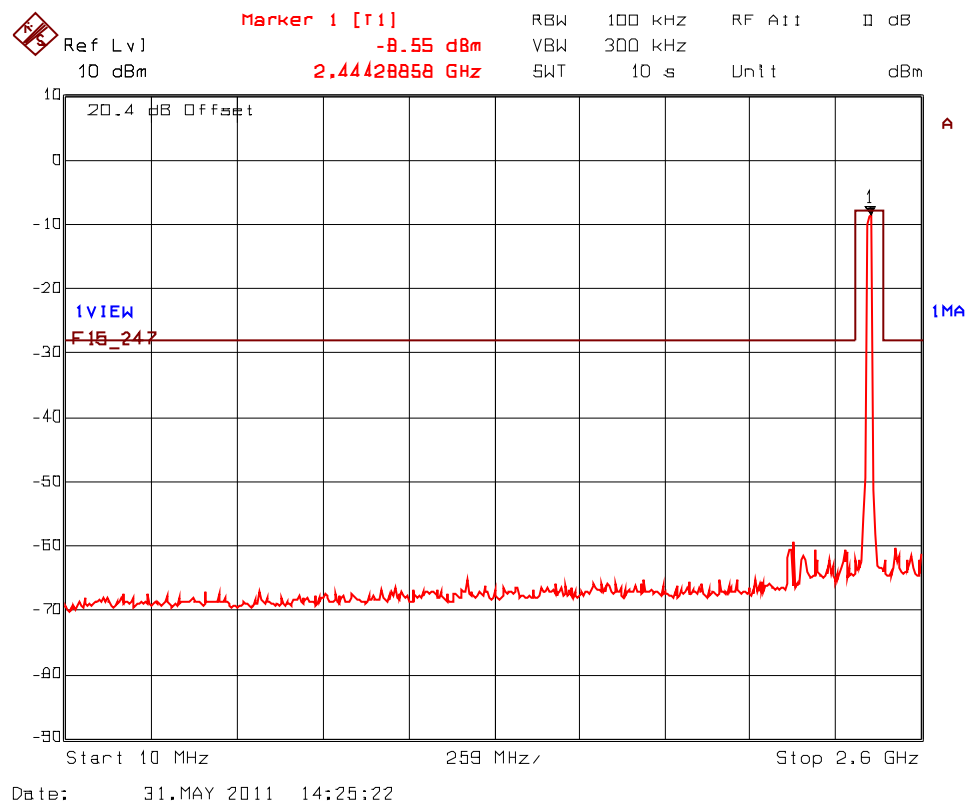
**Plot 5.8.4.2.25.** Spurious RF Conducted Emissions, 802.11g, 10 MHz – 2.6 GHz  
2412 MHz, Low Power, 64-QAM 54 Mbps



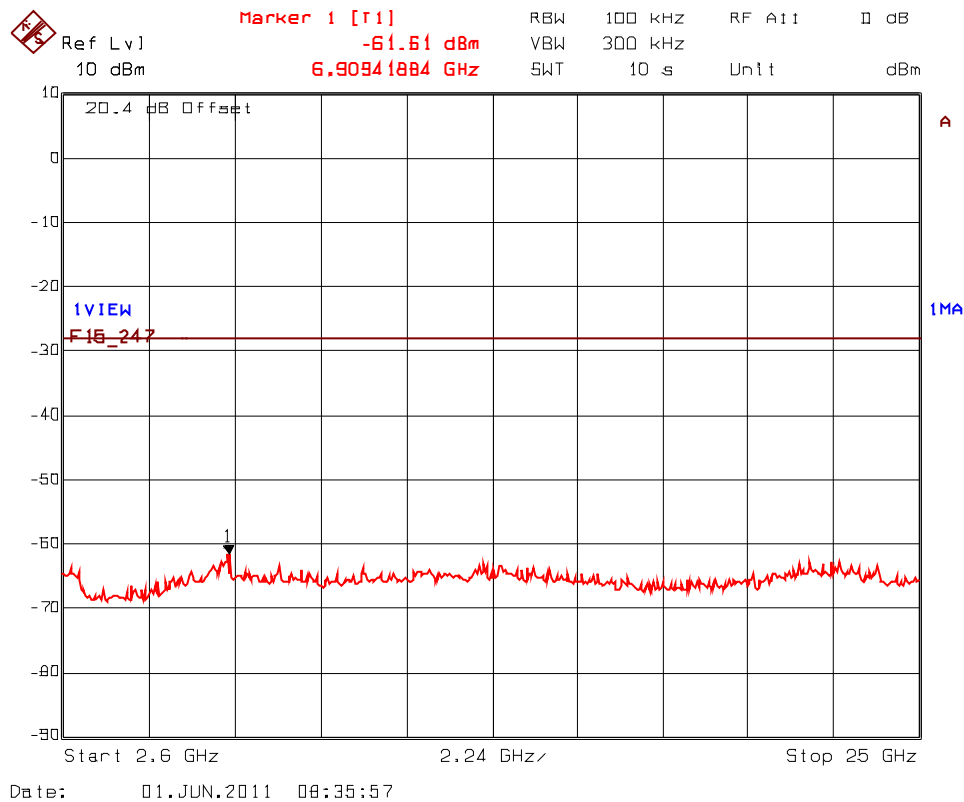
**Plot 5.8.4.2.26.** Spurious RF Conducted Emissions, 802.11g, 2.6 GHz – 25 GHz  
2412 MHz, Low Power, 64-QAM 54 Mbps



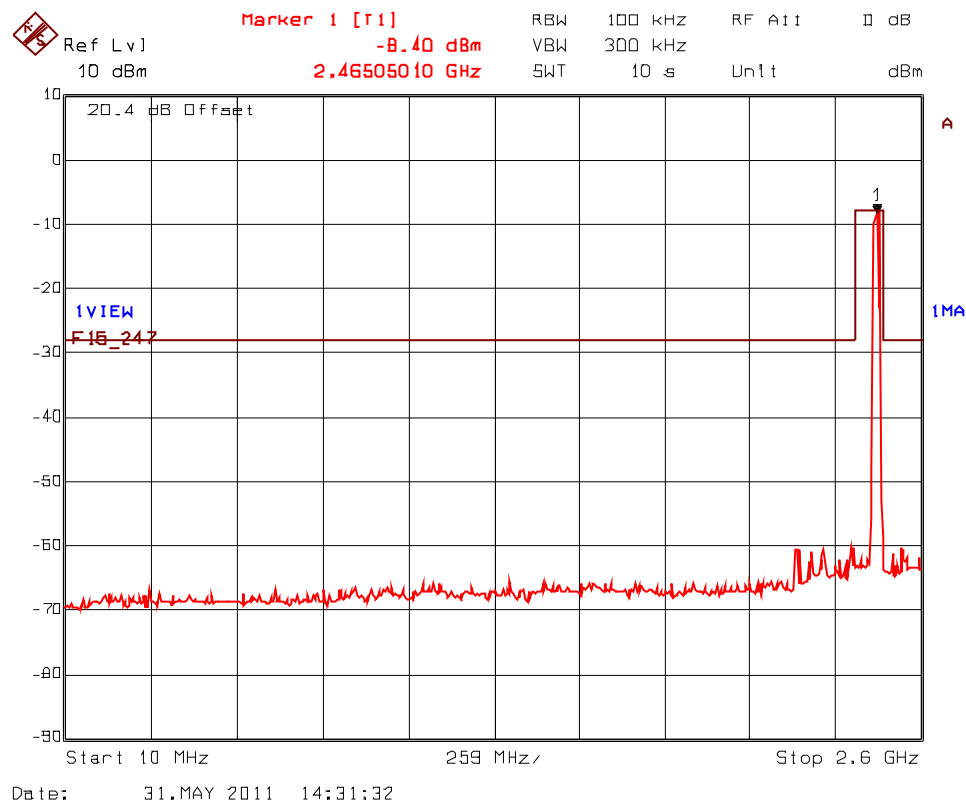
**Plot 5.8.4.2.27.** Spurious RF Conducted Emissions, 802.11g, 10 MHz – 2.6 GHz  
2442 MHz, Low Power, 64-QAM 54 Mbps



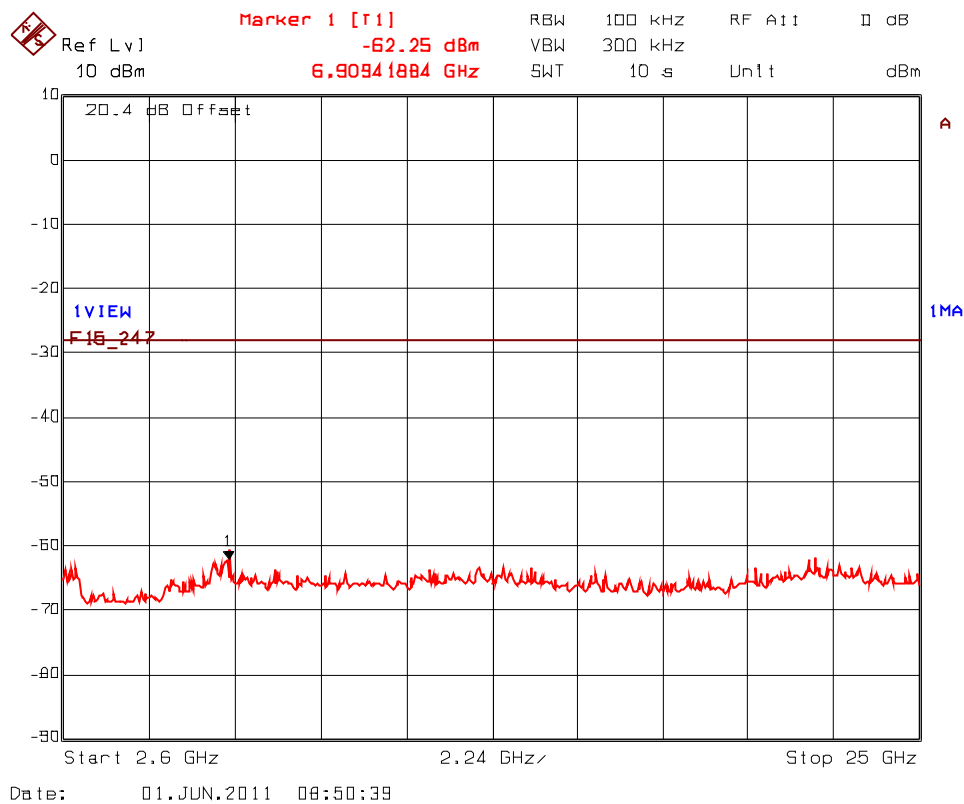
**Plot 5.8.4.2.28.** Spurious RF Conducted Emissions, 802.11g, 2.6 GHz – 25 GHz  
2442 MHz, Low Power, 64-QAM 54 Mbps



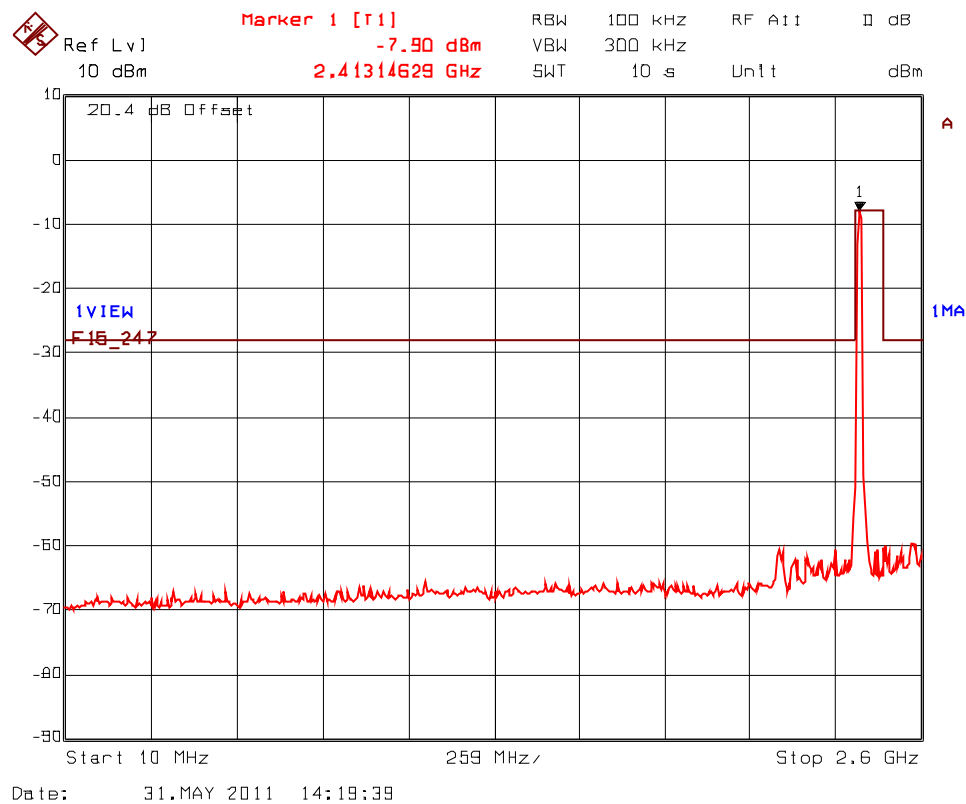
**Plot 5.8.4.2.29.** Spurious RF Conducted Emissions, 802.11g, 10 MHz – 2.6 GHz  
2462 MHz, Low Power, 64-QAM 54 Mbps



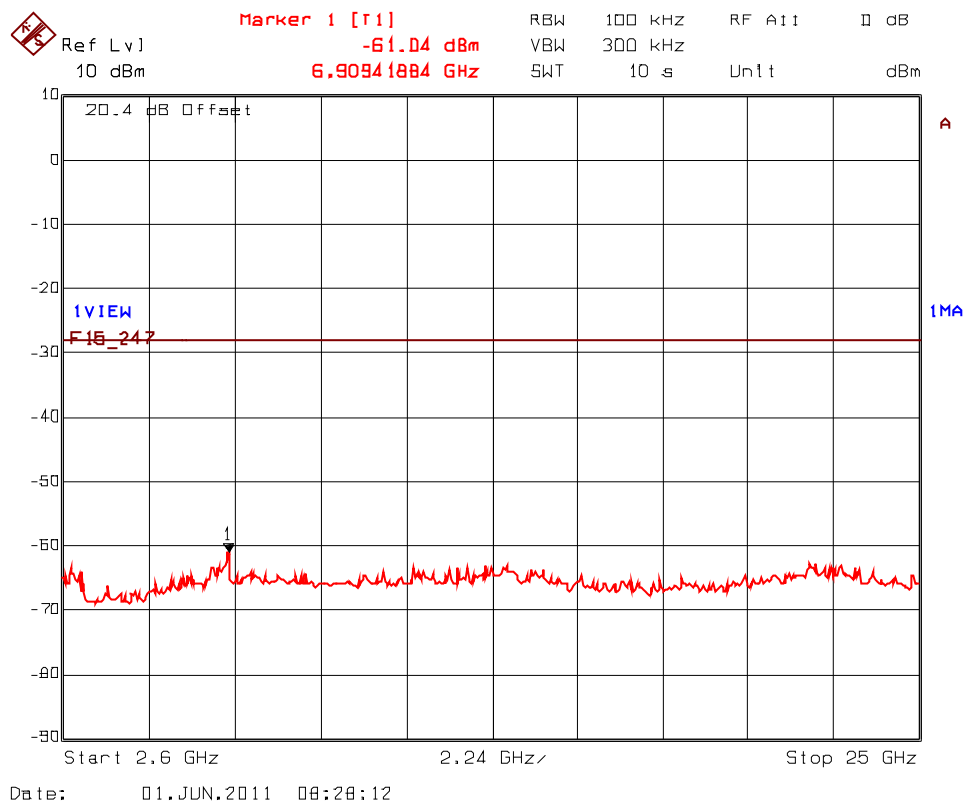
**Plot 5.8.4.2.30.** Spurious RF Conducted Emissions, 802.11g, 2.6 GHz – 25 GHz  
2462 MHz, Low Power, 64-QAM 54 Mbps



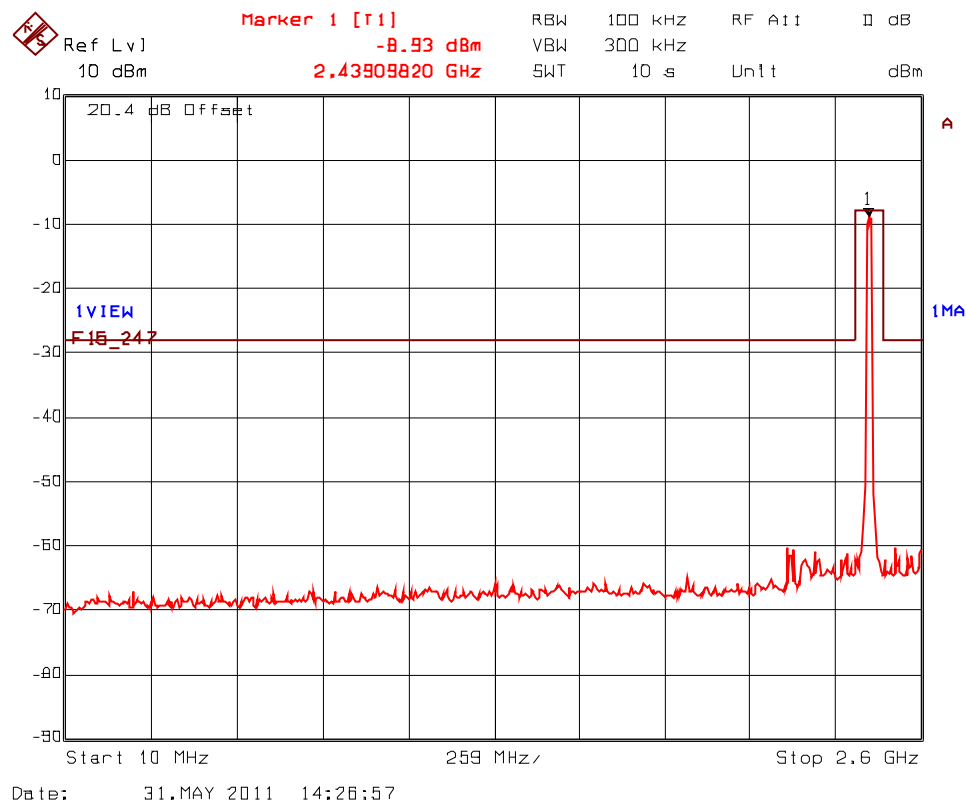
**Plot 5.8.4.231.** Spurious RF Conducted Emissions, 802.11n, 10 MHz – 2.6 GHz  
2412 MHz, Low Power, MCS7 65 Mbps



**Plot 5.8.4.2.32.** Spurious RF Conducted Emissions, 802.11n, 2.6 GHz – 25 GHz  
2412 MHz, Low Power, MCS7 65 Mbps



**Plot 5.8.4.2.33.** Spurious RF Conducted Emissions, 802.11n, 10 MHz – 2.6 GHz  
2442 MHz, Low Power, MCS7 65 Mbps



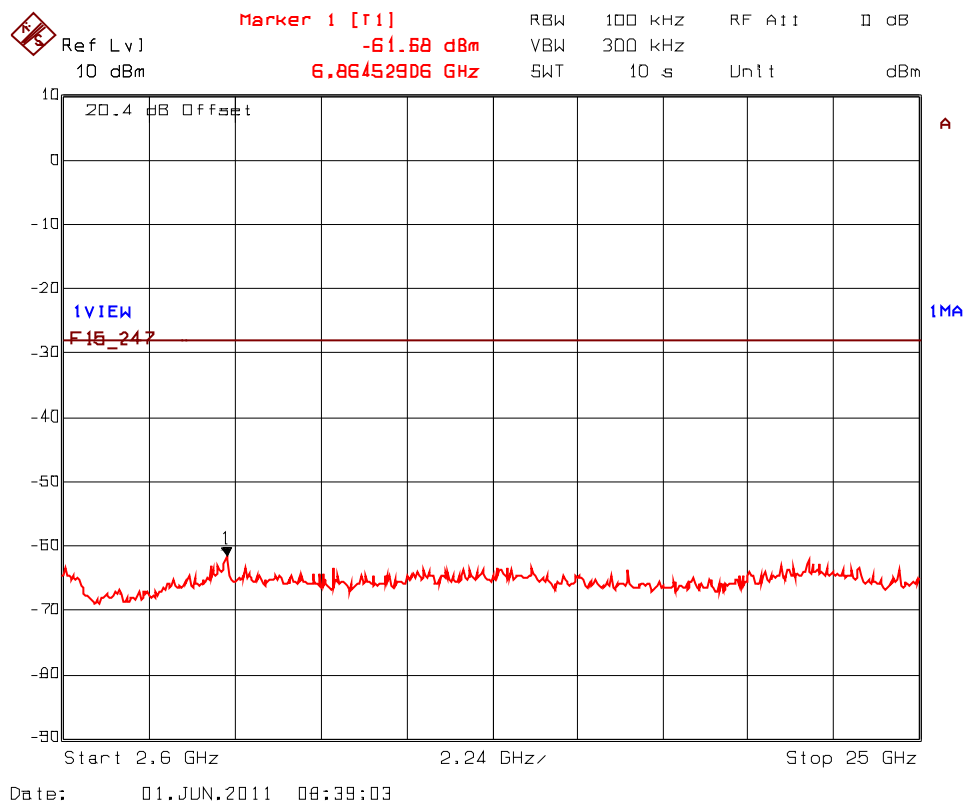
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

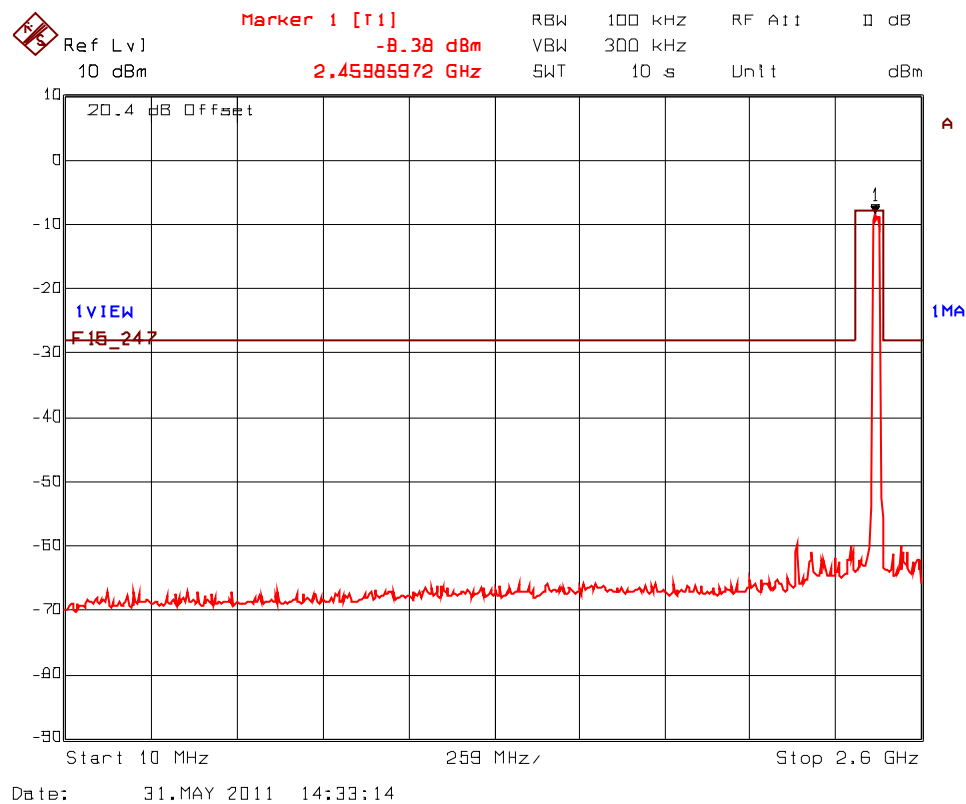
File #: DIGI-043QF15C247  
July 6, 2011

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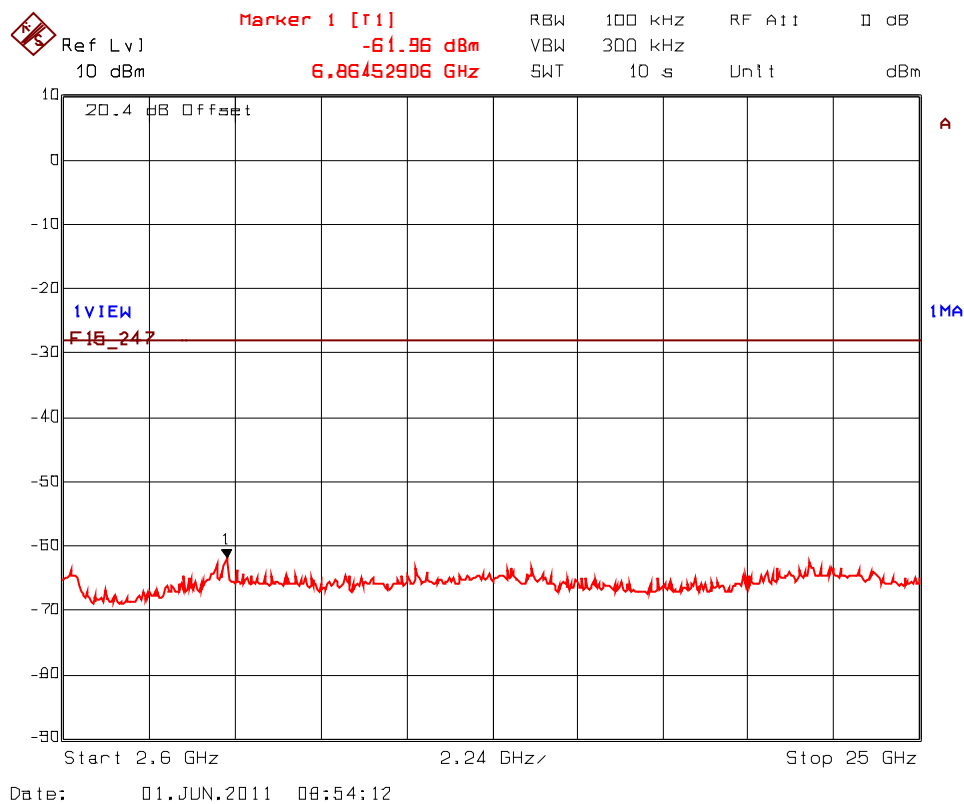
**Plot 5.8.4.2.34.** Spurious RF Conducted Emissions, 802.11n, 2.6 GHz – 25 GHz  
2442 MHz, Low Power, MCS7 65 Mbps



**Plot 5.8.4.2.35.** Spurious RF Conducted Emissions, 802.11n, 10 MHz – 2.6 GHz  
2462 MHz, Low Power, MCS7 65 Mbps



**Plot 5.8.4.2.36.** Spurious RF Conducted Emissions, 802.11n, 2.6 GHz – 25 GHz  
2462 MHz, Low Power, MCS7 65 Mbps



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

### 5.9.1. 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

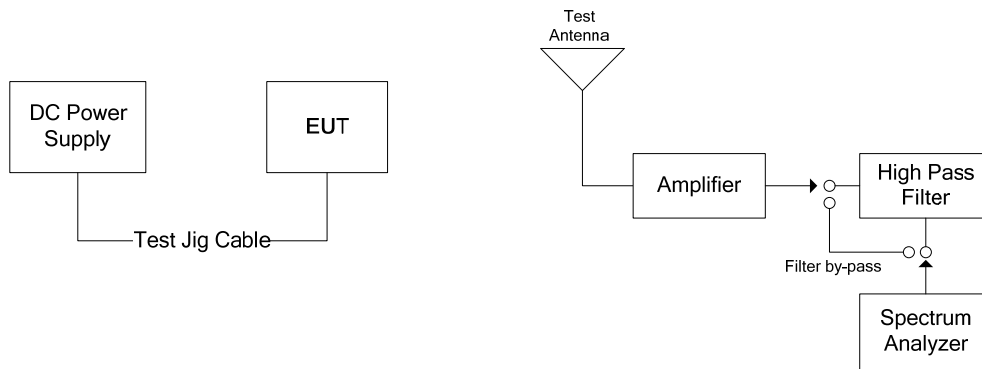
### Section 15.209(a) -- Field Strength Limits within Restricted Frequency Bands --

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

### 5.9.2. Method of Measurements

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

### 5.9.3. Test Arrangement



#### 5.9.4. Test Data

##### Remarks:

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- The following test results are the worst-case measurements; only the highest levels are recorded.
- Band-edges compliance condition: EUT connected to antennas via antenna feedline must have a minimum cable loss as specified in the test configurations of the following table.

Antenna Type	Power Setting (dBm)	Maximum Antenna Gain (dBi)	Minimum Cable Loss (dB)			Maximum Antenna Assembly Gain (dBi)		
			802.11					
			b	g	n	b	g	n
Dipole Antenna	20	2.1	n/a	n/a	n/a	2.10	2.10	2.10
Omni Directional Antenna	20	15	0.56	6.50	10.12	14.44	8.50	4.88
Panel Antenna	20	19	4.12	16.46	20.54	14.88	2.54	-1.54
Yagi Antenna	20	15	0.56	11.78	13.72	14.44	3.22	1.28
Integrated Whip Monopole Antenna	20	1.5	n/a	n/a	n/a	1.50	1.50	1.50

##### 5.9.4.1. EUT with 2.1 dBi Dipole Antenna

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2412 MHz							
Test Frequency 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	109.64	--	V	--	--	--	--
2412	108.41	--	H	--	--	--	--
30 - 25000	*	*	V/H	*	89.6	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency:				2442 MHz			
Test Frequency 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
2442	110.15	--	V	--	--	--	--
2442	108.95	--	H	--	--	--	--
30 - 25000	*	*	V/H	*	90.2	*	Pass

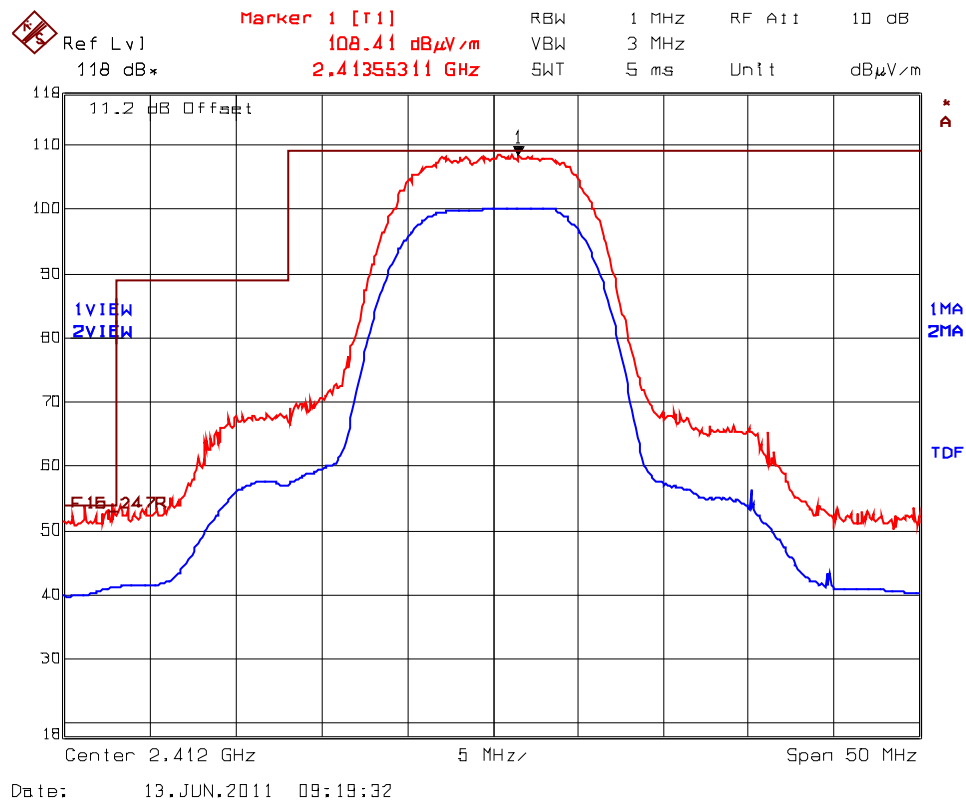
\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency:				2462 MHz			
Test Frequency 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	109.00	--	V	--	--	--	--
2462	108.53	--	H	--	--	--	--
30 - 25000	*	*	V/H	*	89.0	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

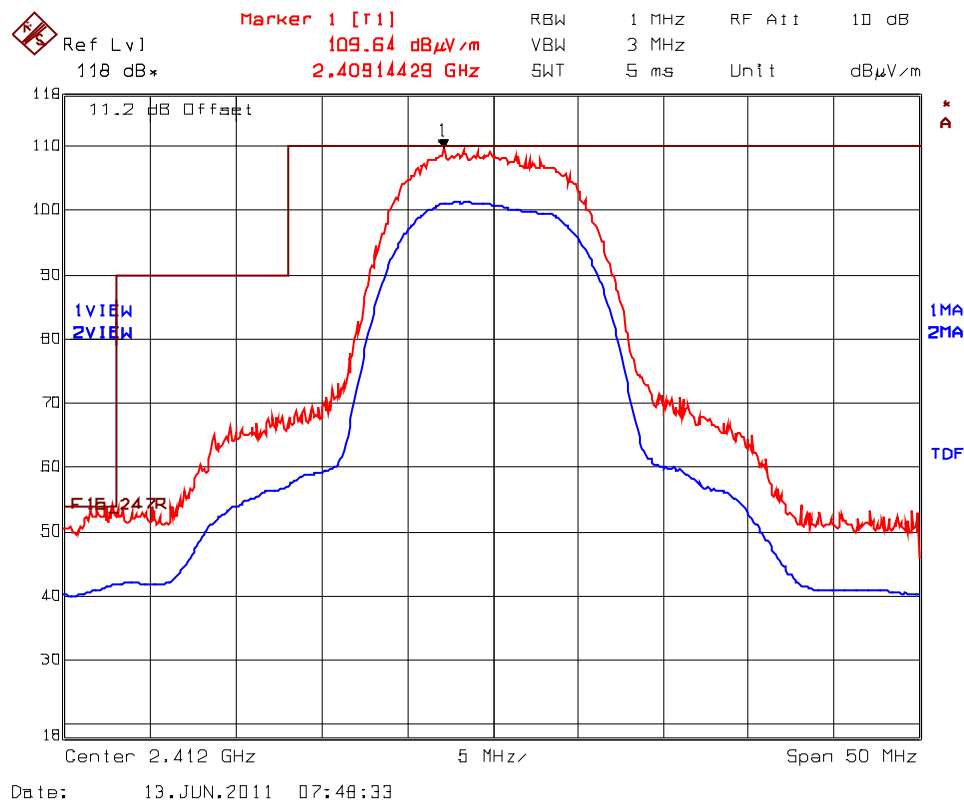
See the following test data plots for band-edge emissions.

**Plot 5.9.4.1.1. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



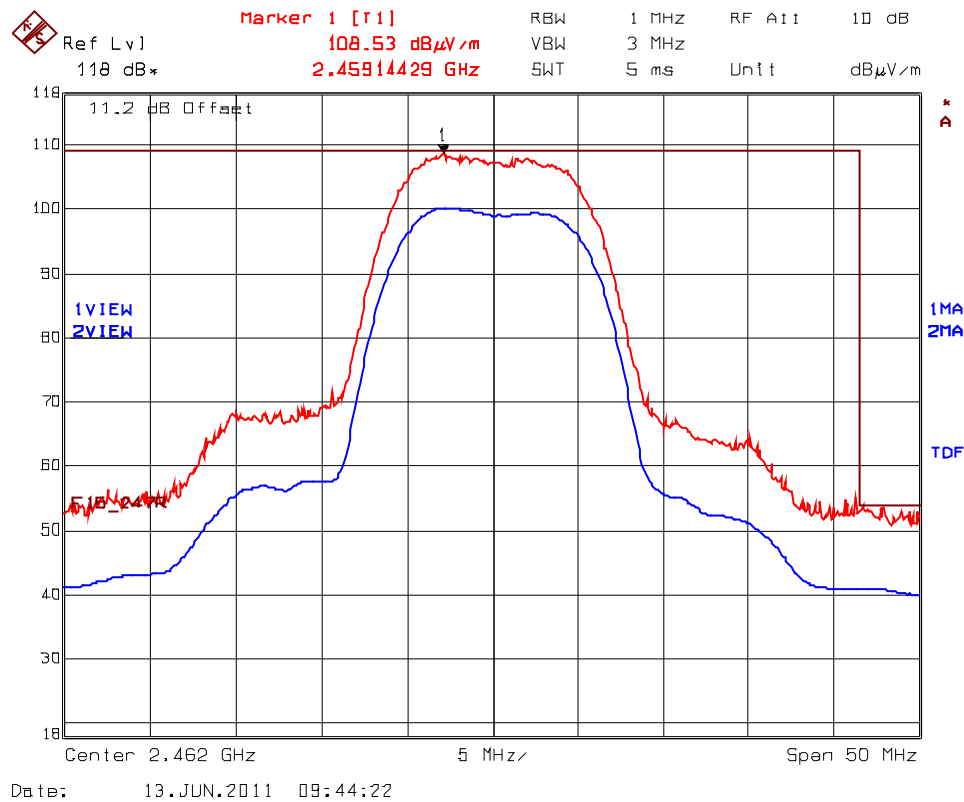
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.1.2. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical



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

**Plot 5.9.4.1.3. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



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

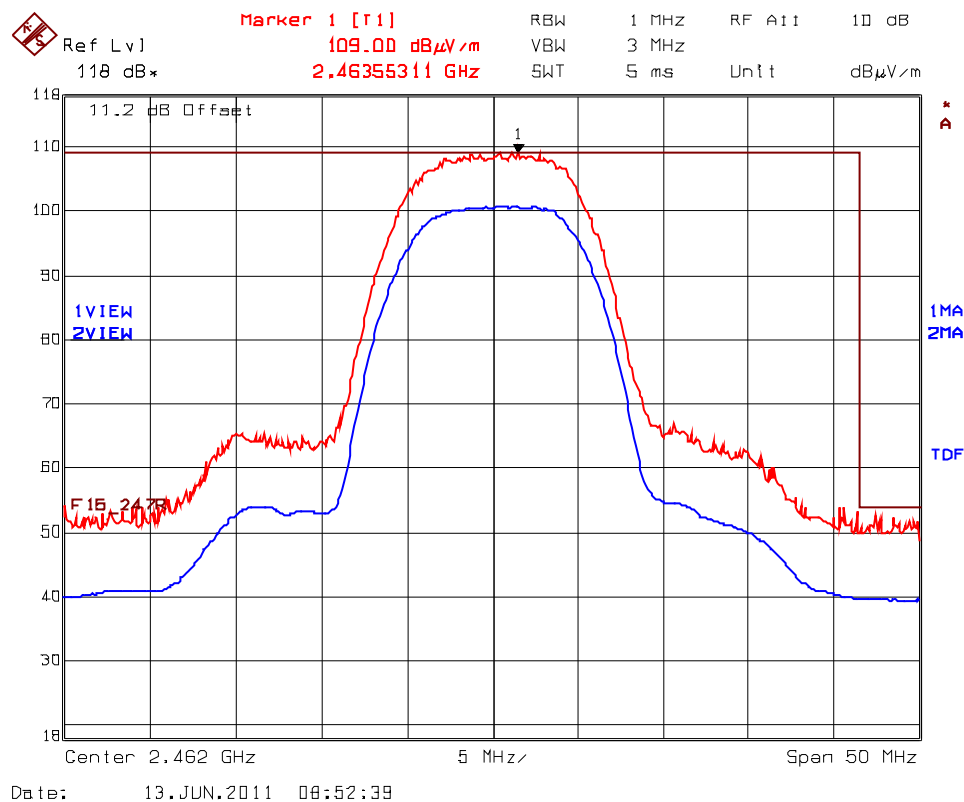
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247  
July 6, 2011

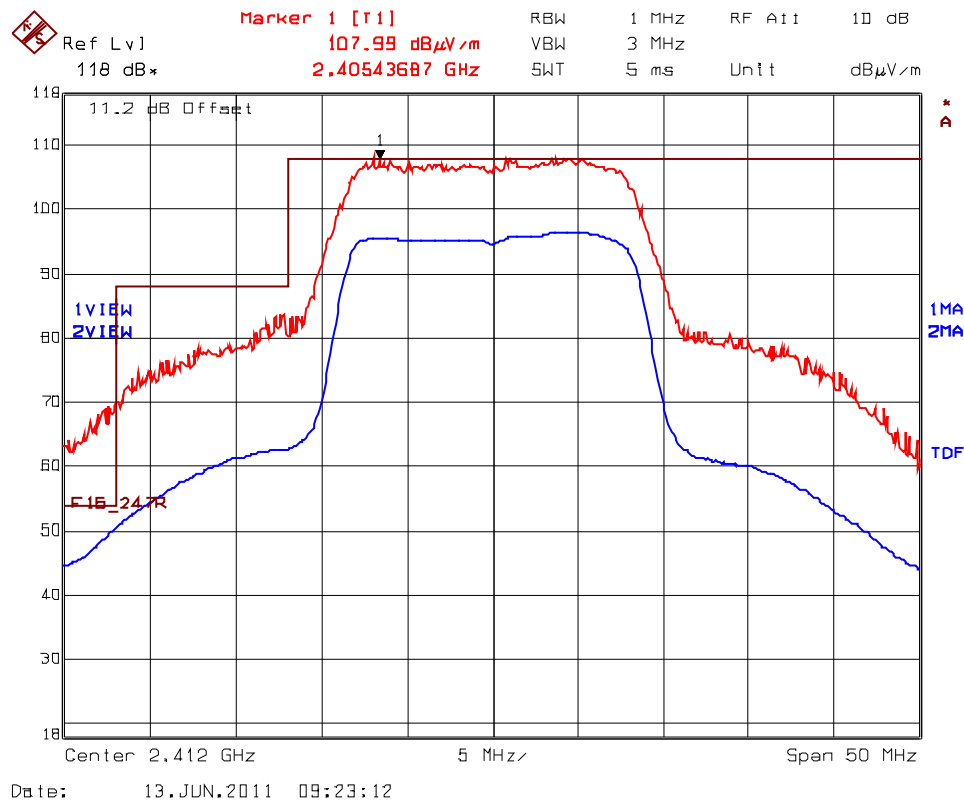
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**Plot 5.9.4.1.4.** Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical



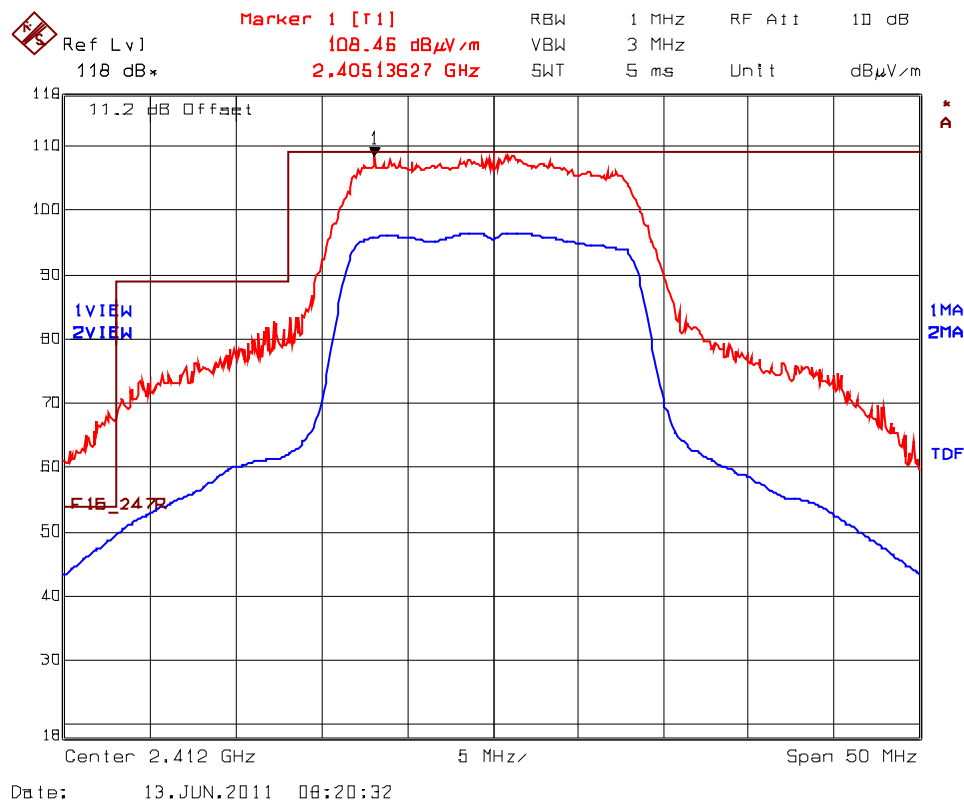
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.1.5. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps  
Rx Antenna Orientation: Horizontal



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

**Plot 5.9.4.1.6. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps  
Rx Antenna Orientation: Vertical



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

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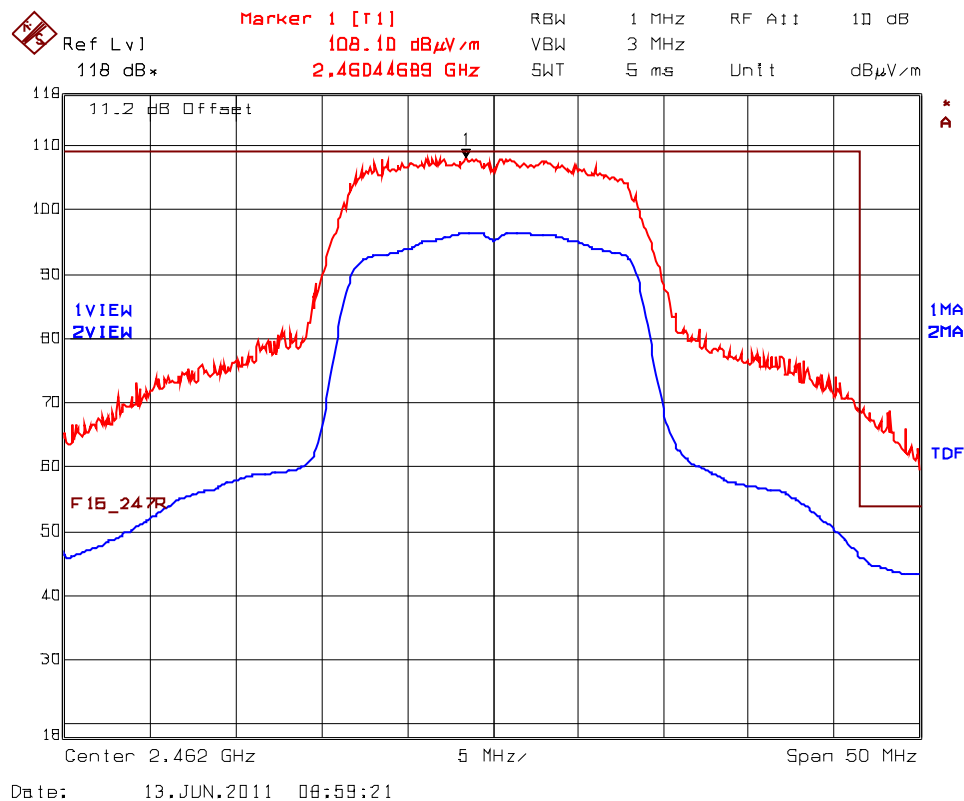
File #: DIGI-043QF15C247  
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Ref Lvl] 118 dB\*  
 11.2 dB Offset  
 Marker 1 [11] 107.68 dBμV/m  
 2.45874349 GHz  
 RBW 1 MHz RF Att 10 dB  
 VBW 3 MHz  
 SWT 5 ms Unit dBμV/m  
 1VIEW  
 2VIEW  
 F15\_247R  
 1MA  
 2MA  
 TDF  
 Center 2.462 GHz 5 MHz/ Span 50 MHz  
 Date: 13.JUN.2011 09:48:04

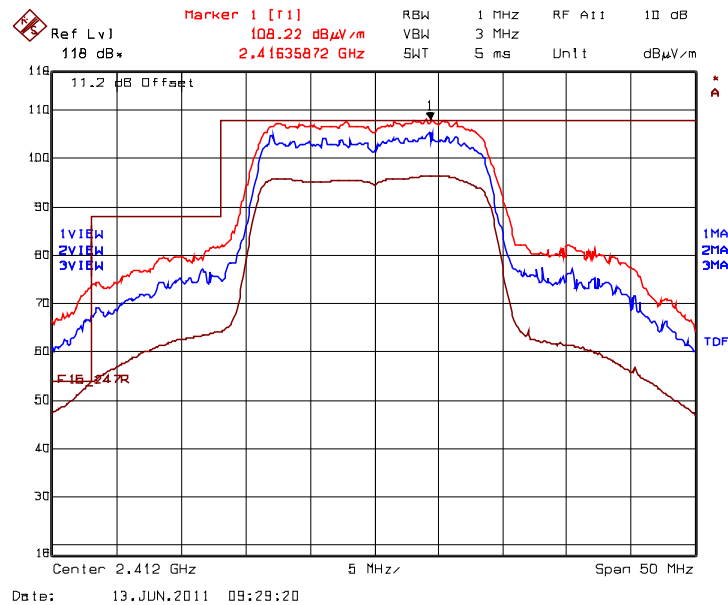
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.1.8.** Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps  
Rx Antenna Orientation: Vertical

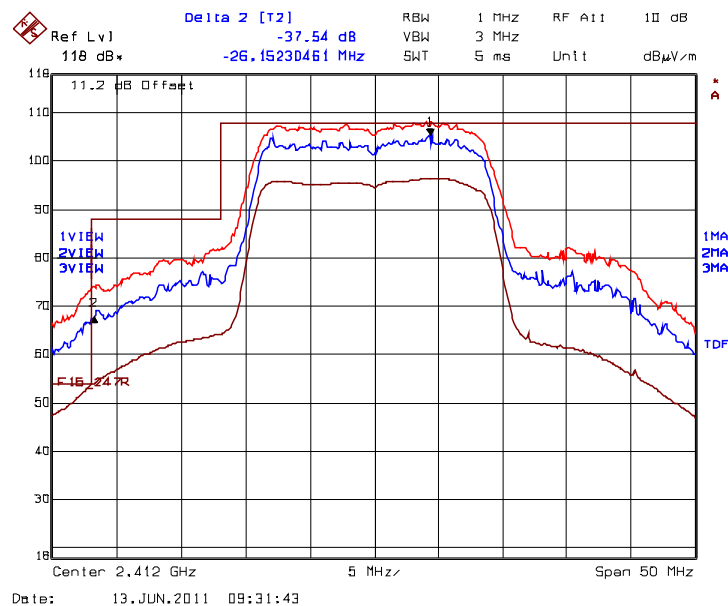


Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.1.9. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.1.10. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.54dB

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

Peak Band-Edge at 2390 MHz: Peak = 108.22 dBμV/m – 37.54dB = 70.68 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 53.54 dBμV/m (limit 54 dBμV/m)

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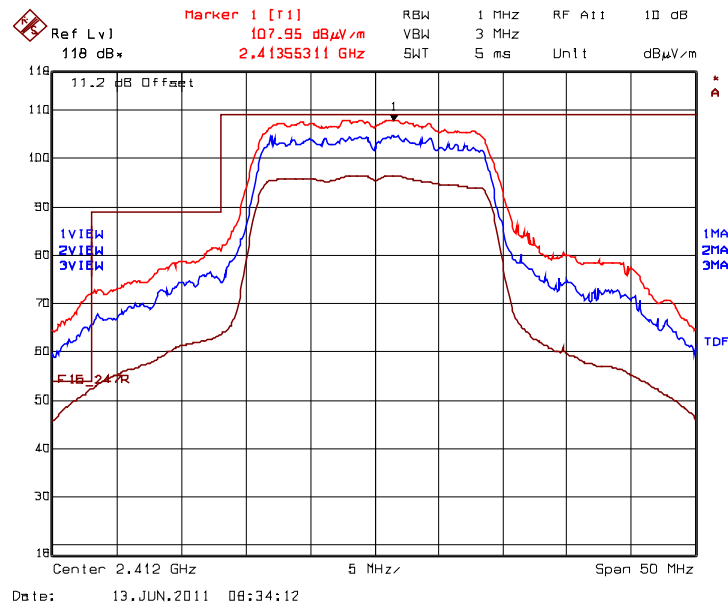
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

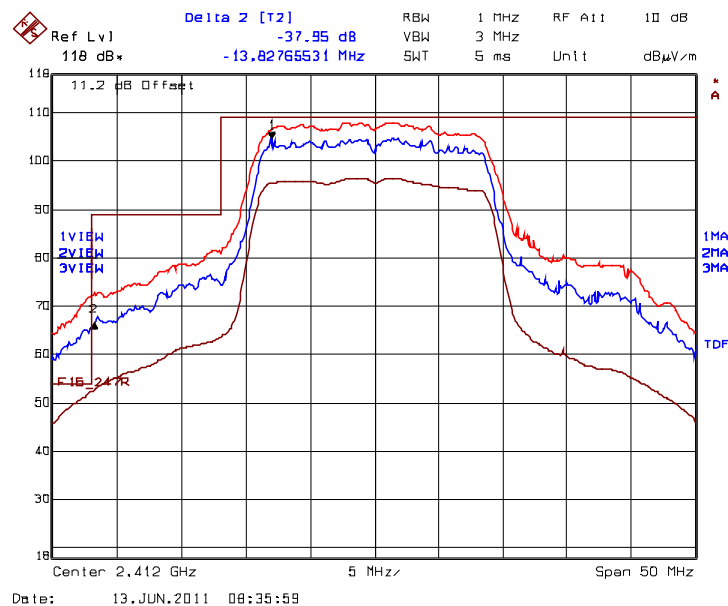
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**Plot 5.9.4.1.11. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.1.12. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.95dB

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

Peak Band-Edge at 2390 MHz: Peak = 107.95 dBμV/m – 37.95 dB = 70.00 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 52.26 dBμV/m (limit 54 dBμV/m)

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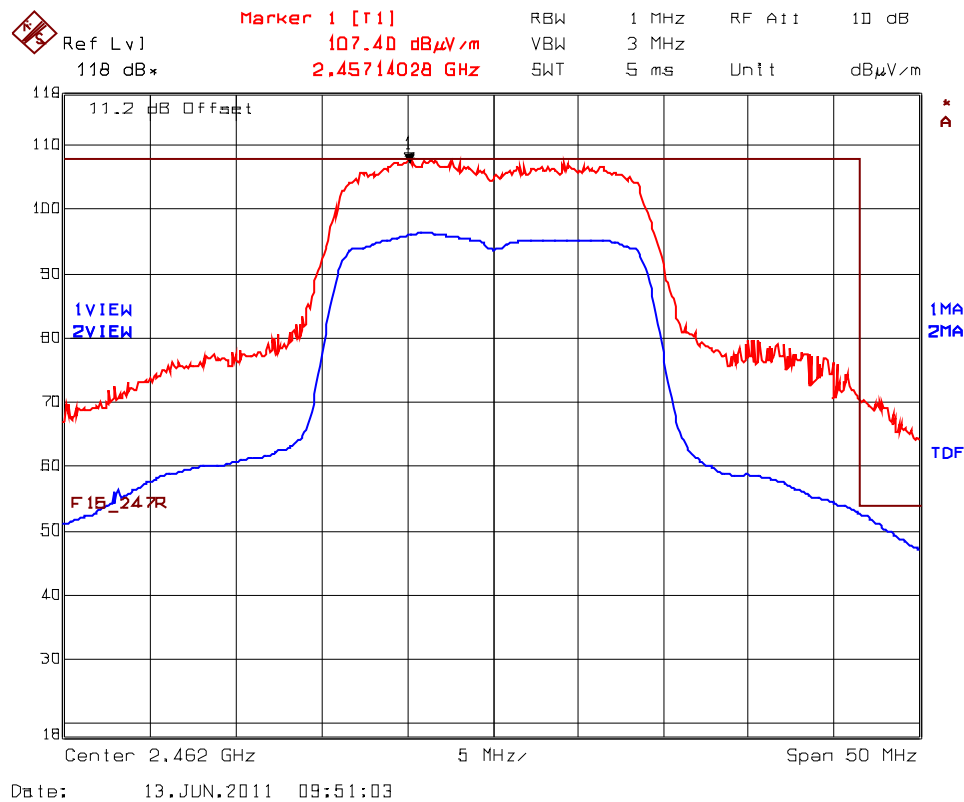
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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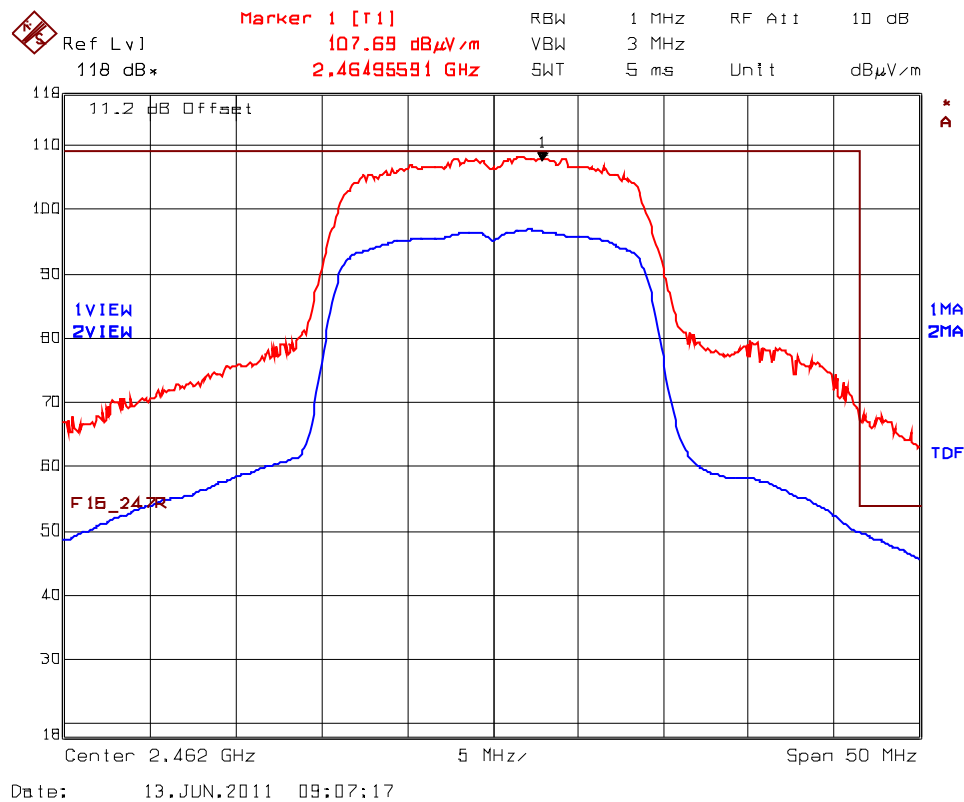
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

**Plot 5.9.4.1.13. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps  
Rx Antenna Orientation: Horizontal



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

**Plot 5.9.4.1.14. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps  
Rx Antenna Orientation: Vertical



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

#### 5.9.4.2. EUT with 15 dBi Omni Directional Antenna

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2412 MHz							
Test Frequency 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	117.90	--	V	--	--	--	--
2412	115.92	--	H	--	--	--	--
30 -25000	*	*	V/H	*	97.9	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2442 MHz							
Test Frequency 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
2442	119.10	--	V	--	--	--	--
2442	116.14	--	H	--	--	--	--
30 -25000	*	*	V/H	*	99.1	*	Pass

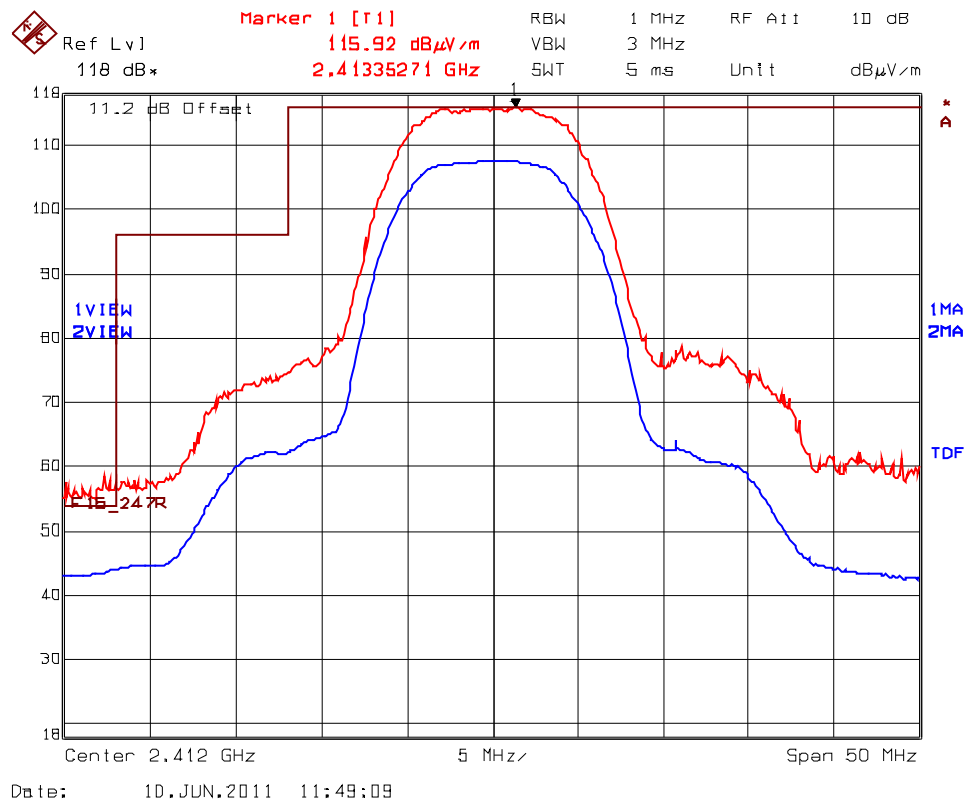
\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2462 MHz							
Test Frequency 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	119.12	--	V	--	--	--	--
2462	116.59	--	H	--	--	--	--
30 -25000	*	*	V/H	*	99.1	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

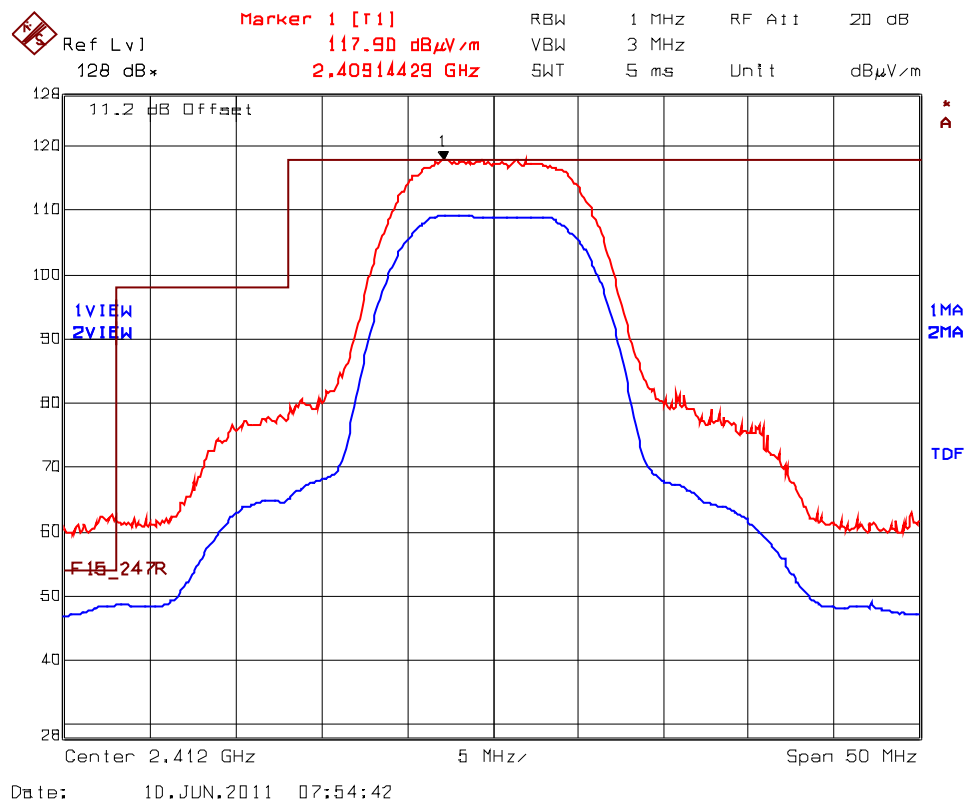
See the following test data plots for band-edge emissions.

**Plot 5.9.4.2.1. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



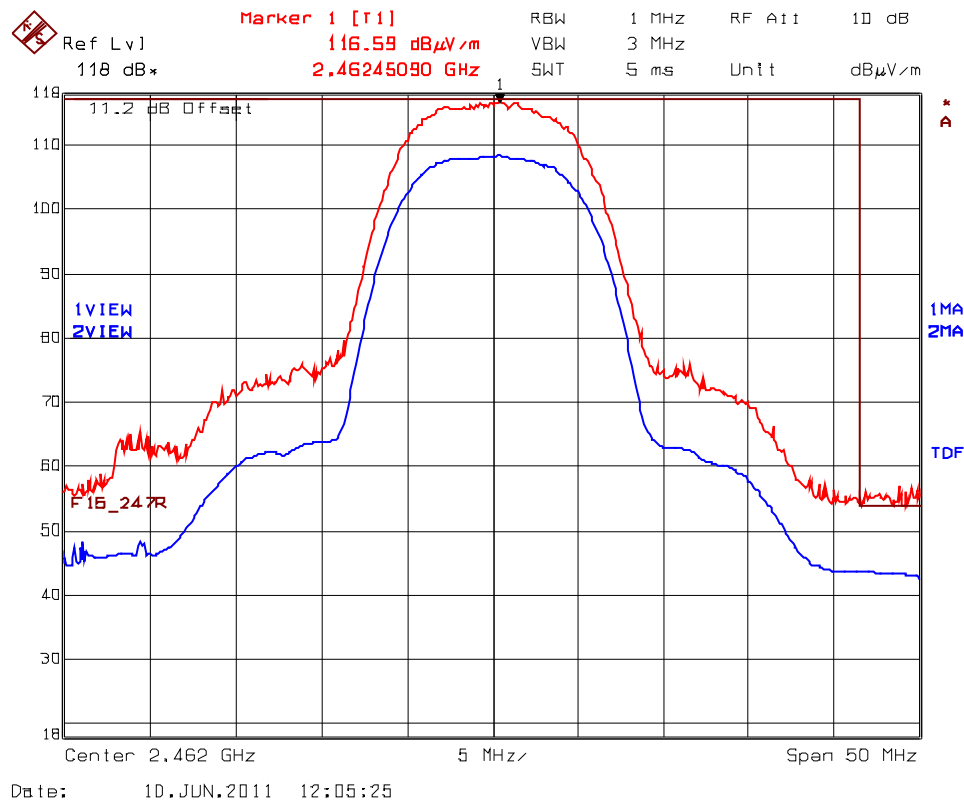
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.2.2. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical



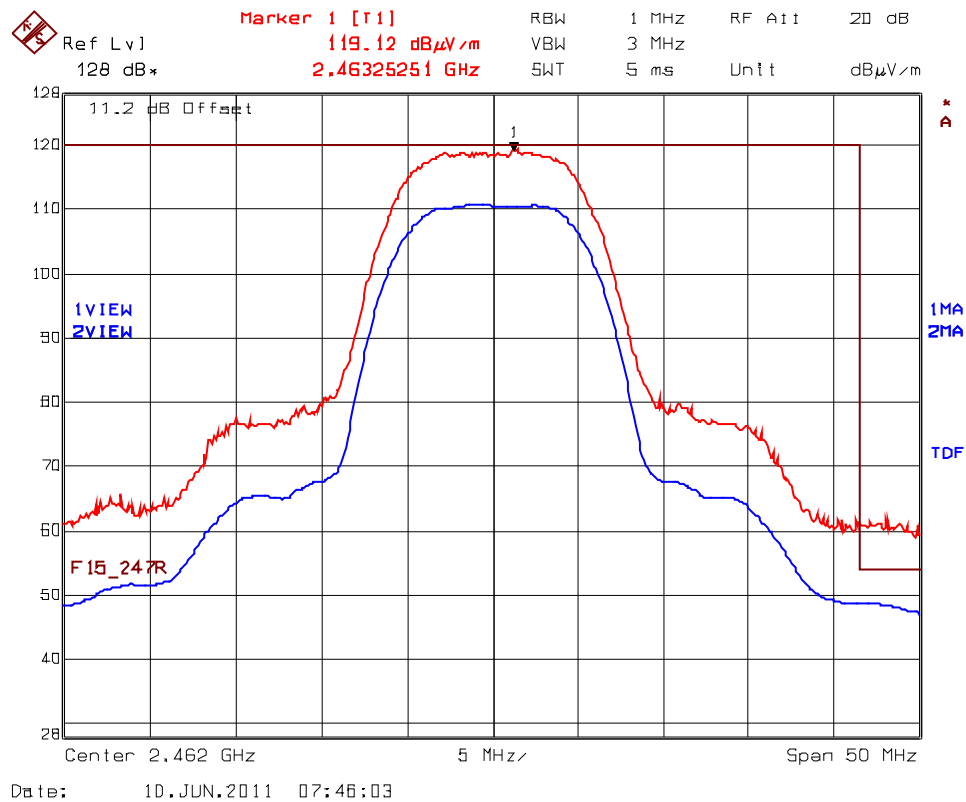
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.2.3. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



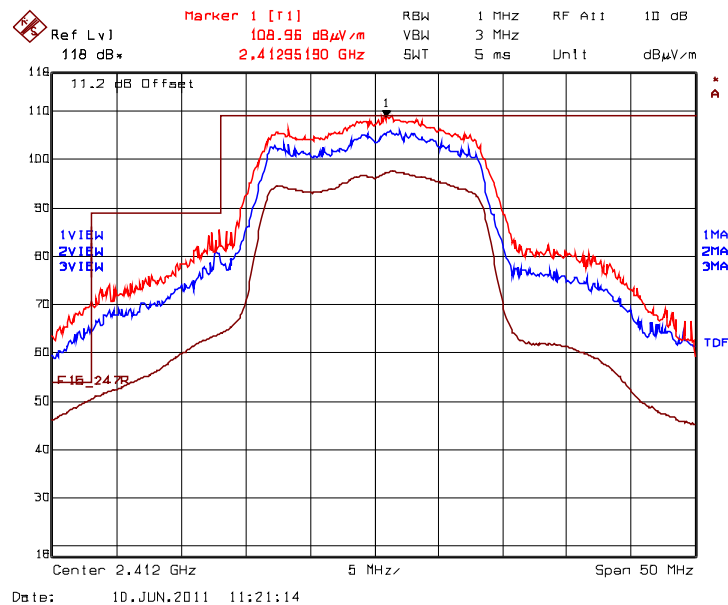
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.2.4. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical

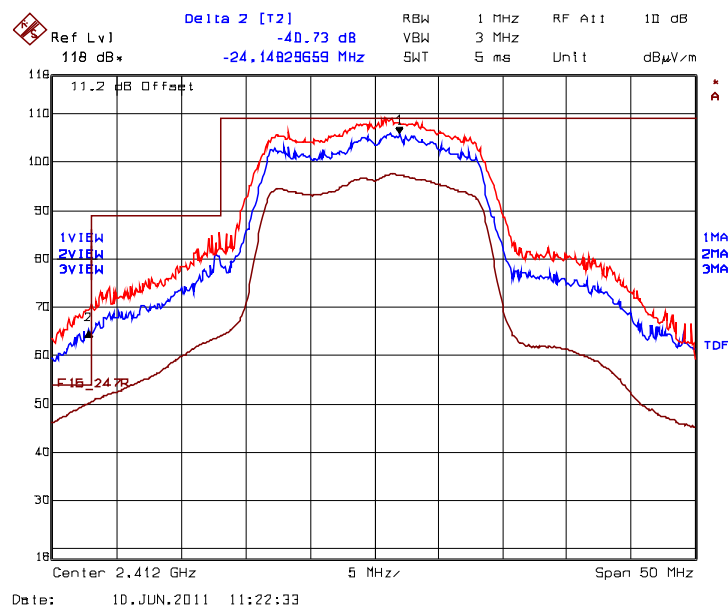


Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.2.5. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.2.6. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 40.73 dB

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

Peak Band-Edge at 2390 MHz: Peak = 108.96 dBμV/m – 40.73 dB = 68.23 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 50.30 dBμV/m (limit 54 dBμV/m)

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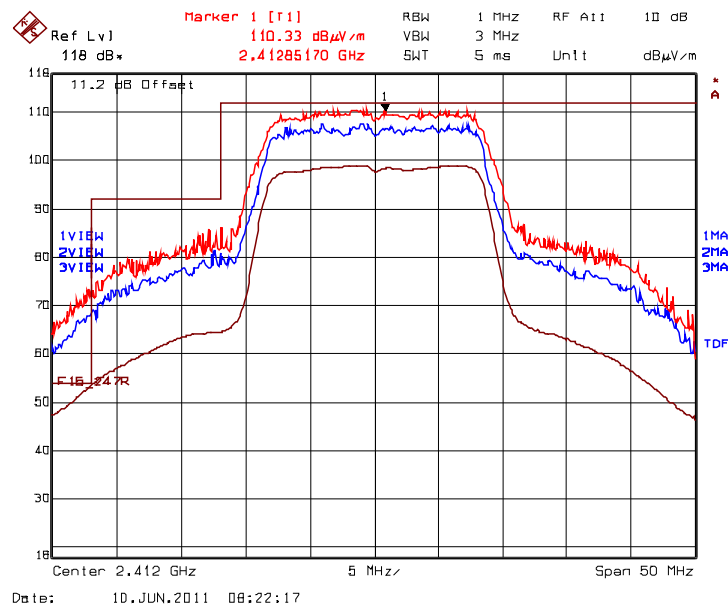
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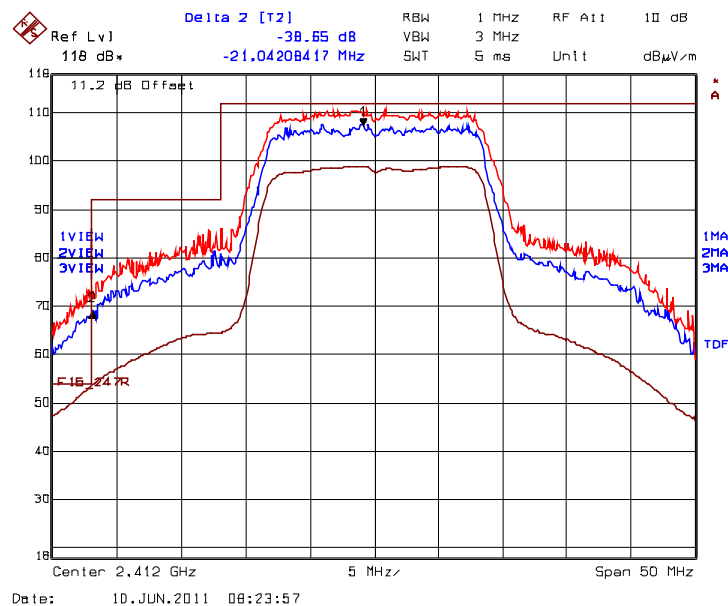
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**Plot 5.9.4.2.7. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.2.8. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 38.65 dB

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

Peak Band-Edge at 2390 MHz: Peak = 110.33 dBμV/m – 38.65 dB = 71.68 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 53.49 dBμV/m (limit 54 dBμV/m)

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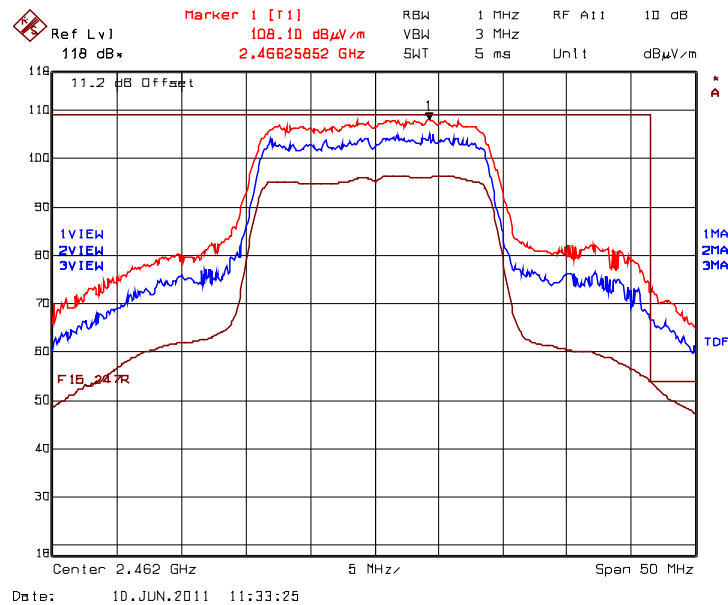
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File #: DIGI-043QF15C247

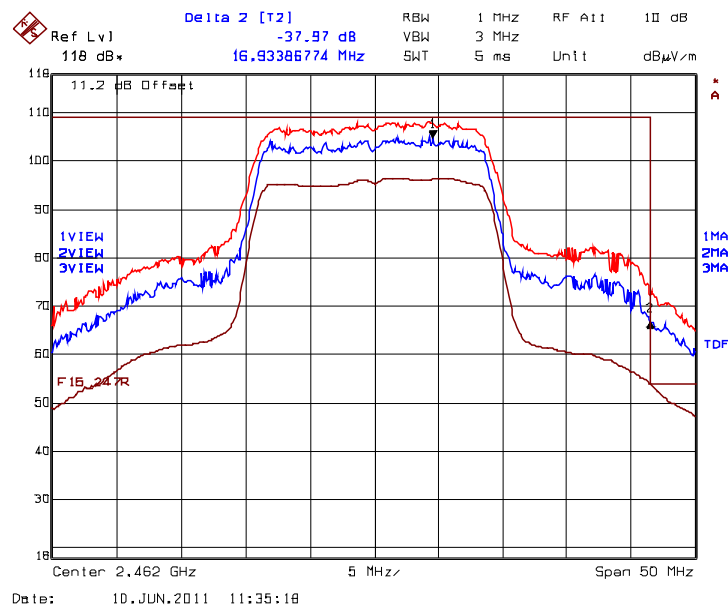
July 6, 2011

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**Plot 5.9.4.2.9. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.2.10. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.97 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 108.10 dBμV/m – 37.97 dB = 70.13 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 53.65 dBμV/m (limit 54 dBμV/m)

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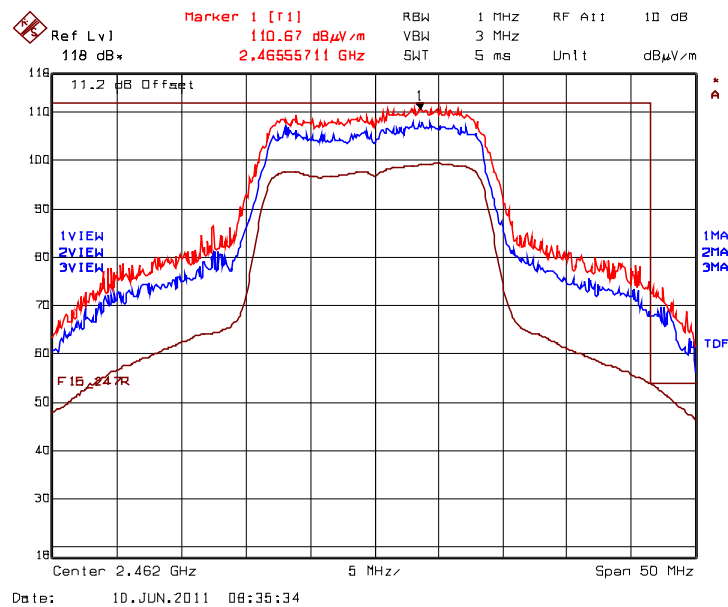
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File #: DIGI-043QF15C247

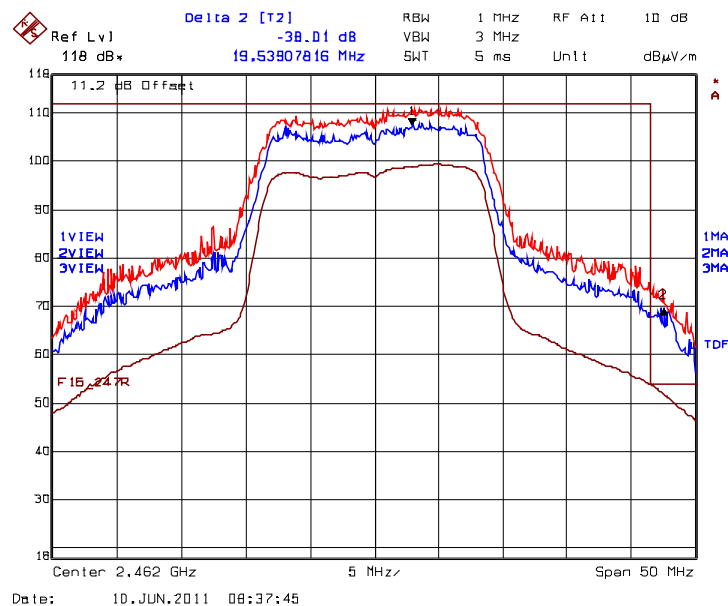
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**Plot 5.9.4.2.11. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.2.12. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 38.01 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 110.67 dBμV/m – 38.01 dB = 72.66 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 53.66 dBμV/m (limit 54 dBμV/m)

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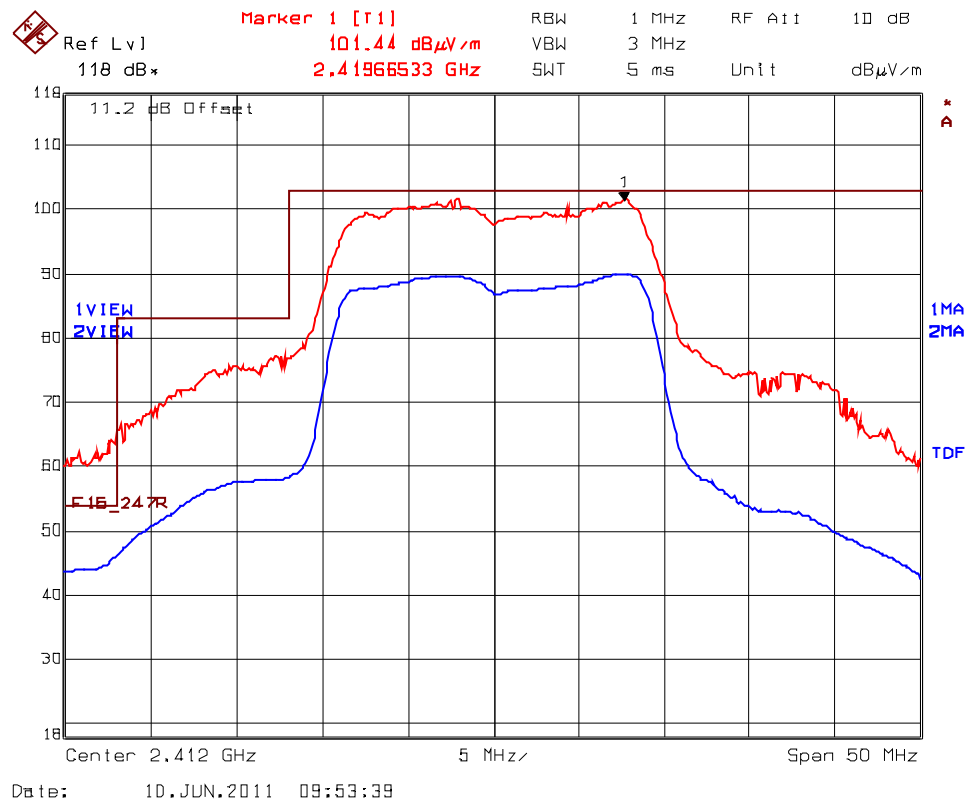
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File #: DIGI-043QF15C247

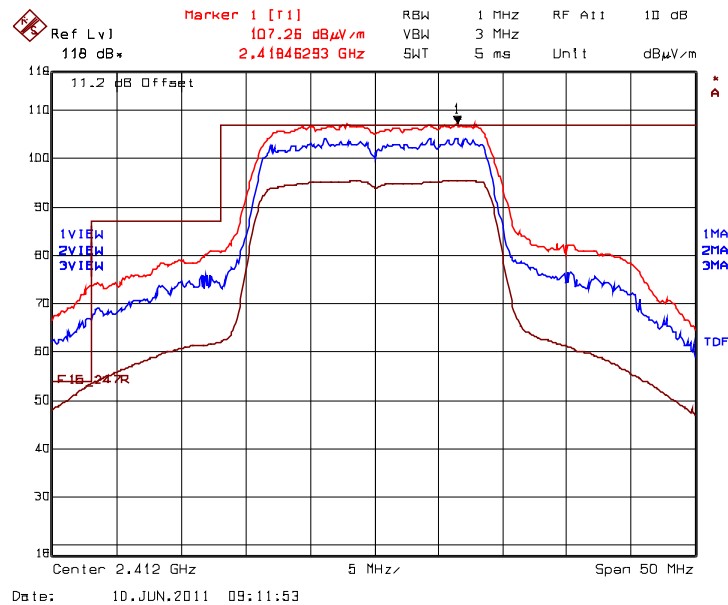
July 6, 2011

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

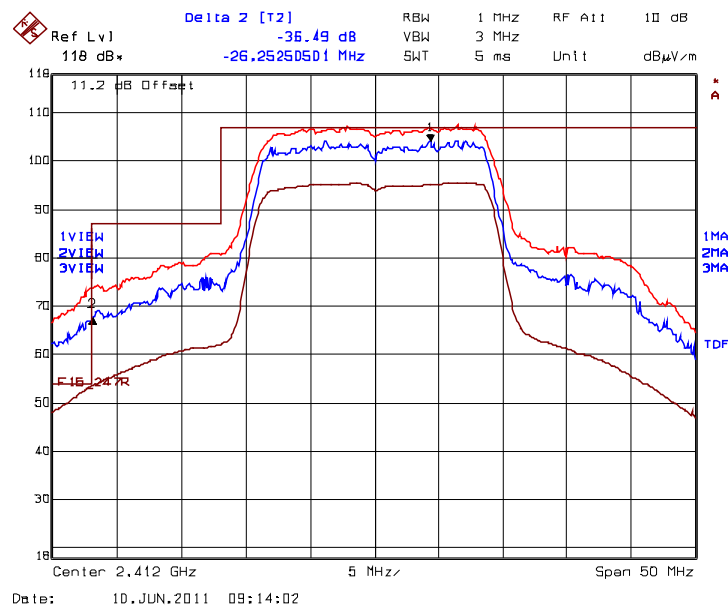
**Plot 5.9.4.2.13. Band-Edge RF Radiated Emissions @ 3 m, 802. 11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps  
Rx Antenna Orientation: Horizontal



**Plot 5.9.4.2.14. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.2.15. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 36.49 dB

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

Peak Band-Edge at 2390 MHz: Peak = 107.26 dBμV/m – 36.49 dB = 70.77 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 53.22 dBμV/m (limit 54 dBμV/m)

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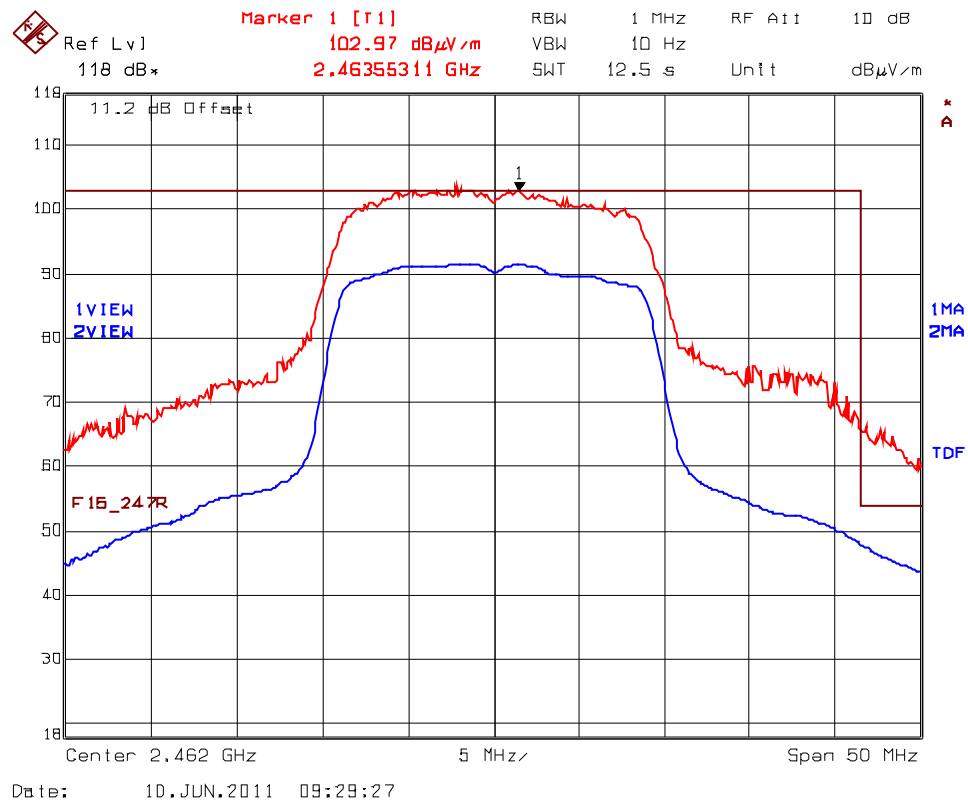
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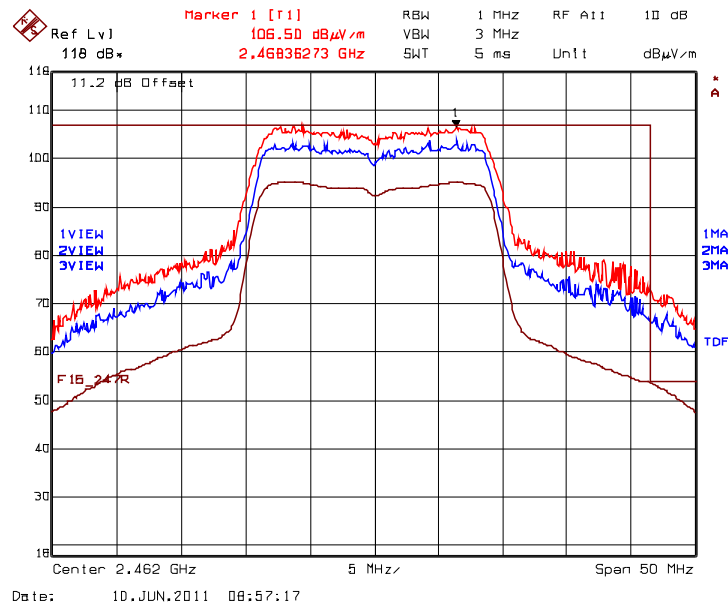
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

**Plot 5.9.4.2.16. Band-Edge RF Radiated Emissions @ 3 m, 802. 11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps  
Rx Antenna Orientation: Horizontal

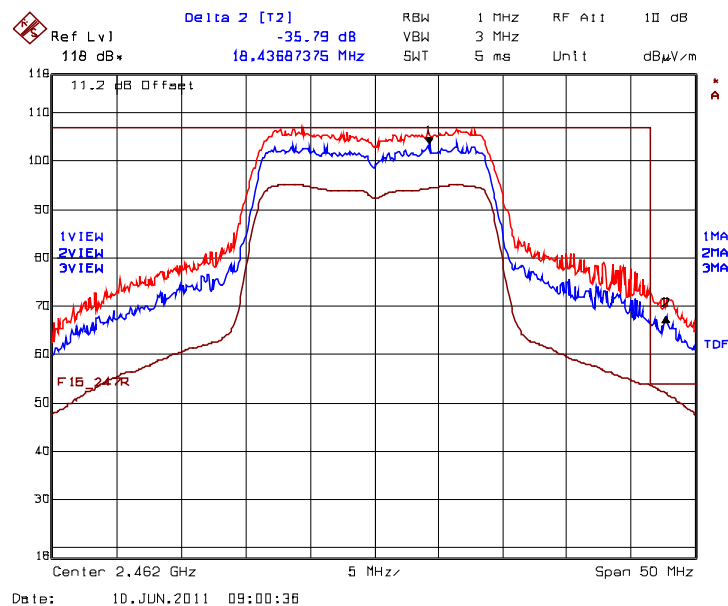


Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.2.17. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.2.18. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 36.79 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 106.50 dBμV/m – 35.79 dB = 70.71 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 53.47 dBμV/m (limit 54 dBμV/m)

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### 5.9.4.3. EUT with 19 dBi Panel Antenna

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2412 MHz							
Test Frequency 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	123.22	--	V	--	--	--	--
2412	122.61	--	H	--	--	--	--
30-25000	*	*	V/H	*	103.2	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2442 MHz							
Test Frequency 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
2442	123.54	--	V	--	--	--	--
2442	123.47	--	H	--	--	--	--
30-25000	*	*	V/H	*	103.5	*	Pass

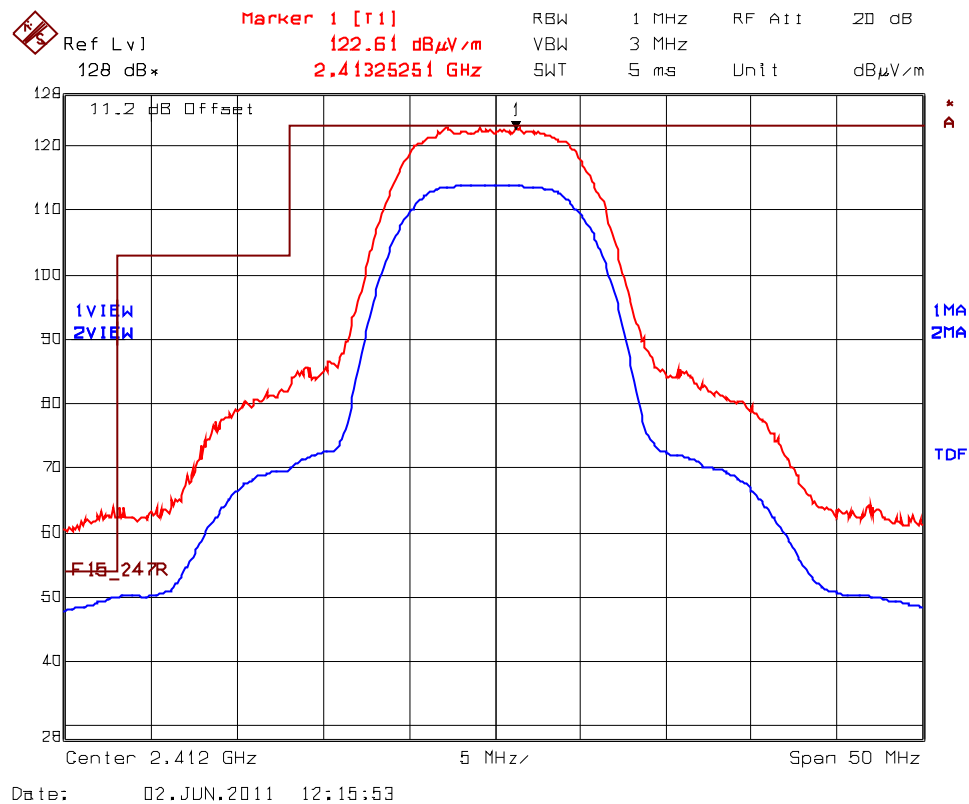
\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2462 MHz							
Test Frequency 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	124.15	--	V	--	--	--	--
2462	123.86	--	H	--	--	--	--
30-25000	*	*	V/H	*	104.2	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

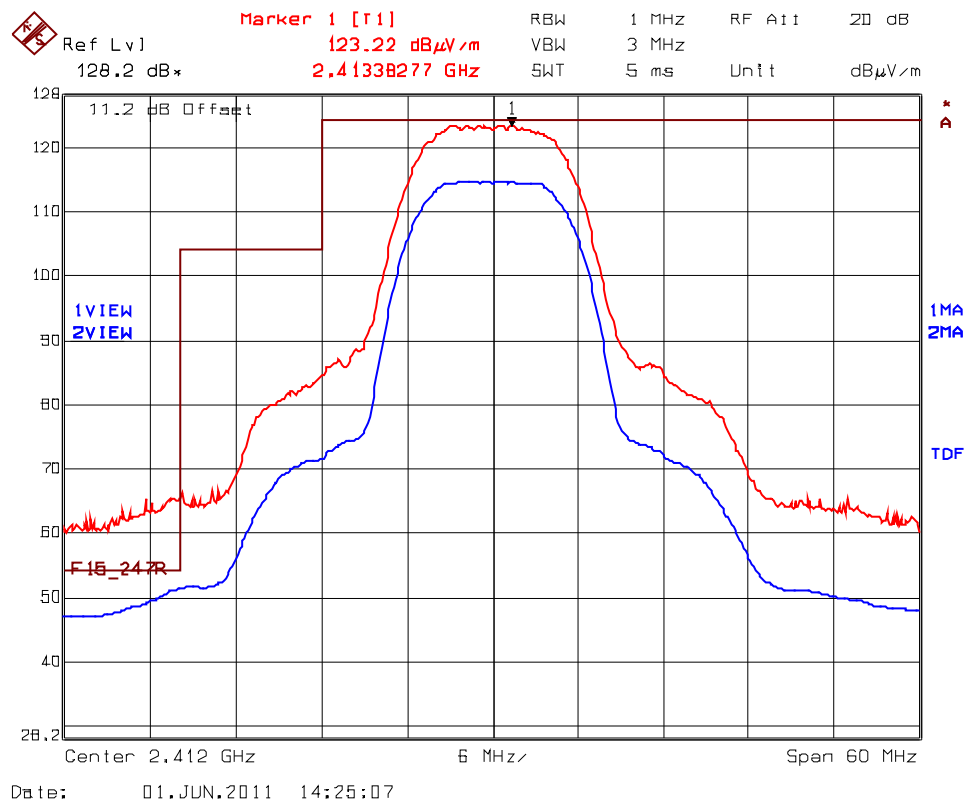
See the following test data plots for band-edge emissions.

**Plot 5.9.4.3.1. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



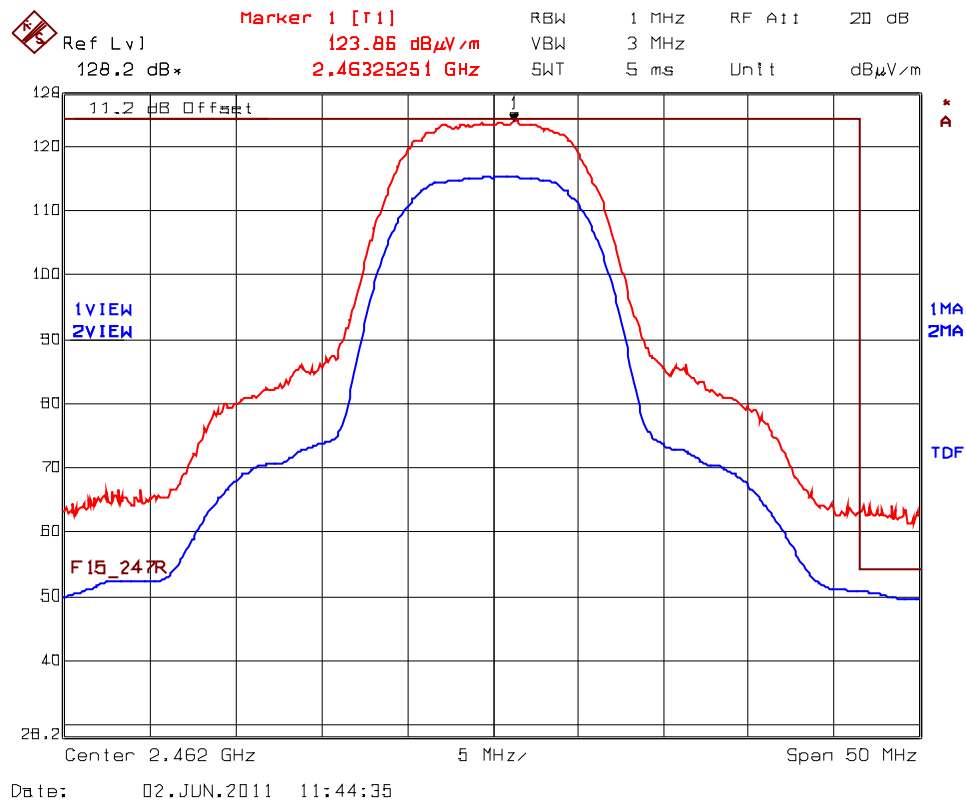
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.3.2. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical



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

**Plot 5.9.4.3.3.** Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



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

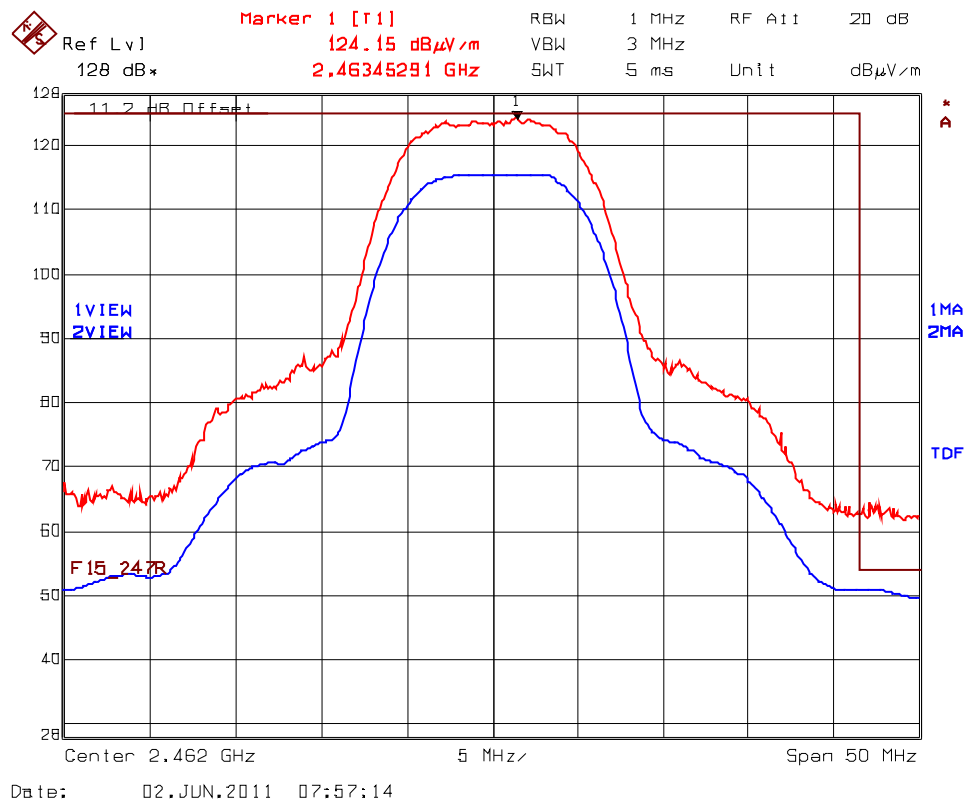
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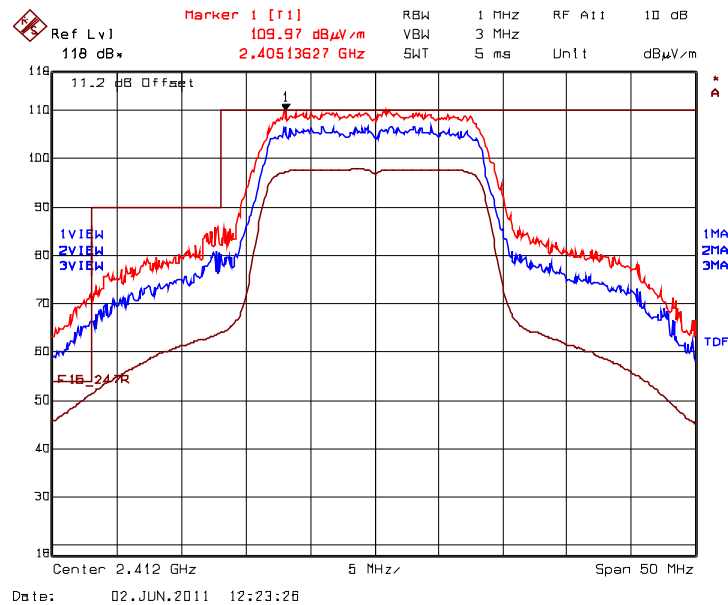
*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

**Plot 5.9.4.3.4.** Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical

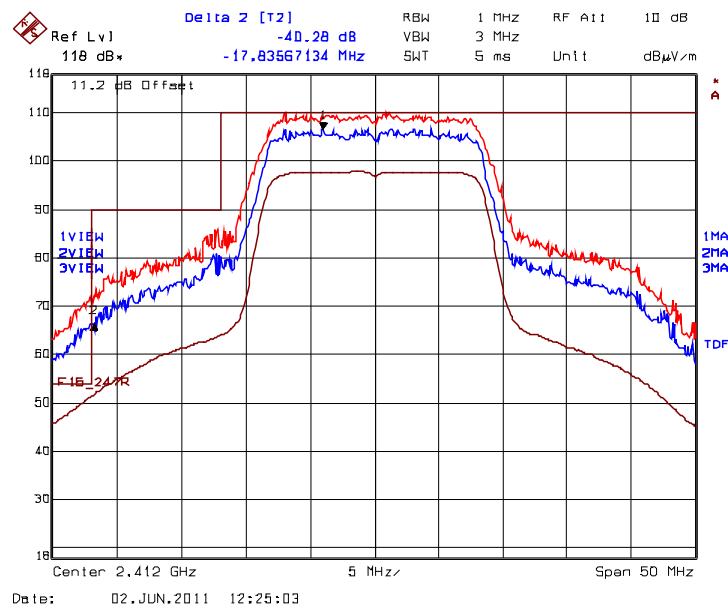


Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.3.5. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.3.6. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 40.28 dB

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

Peak Band-Edge at 2390 MHz: Peak = 109.97 dBμV/m – 40.28 dB = 69.69 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 51.27 dBμV/m (limit 54 dBμV/m)

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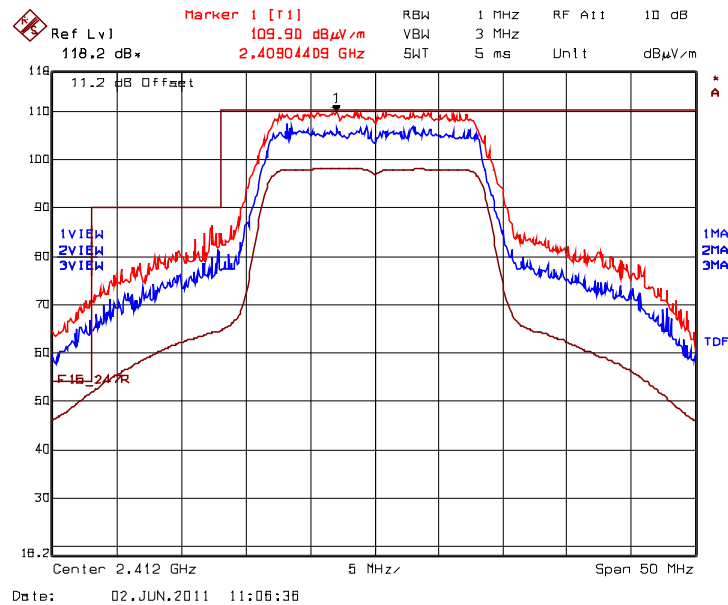
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

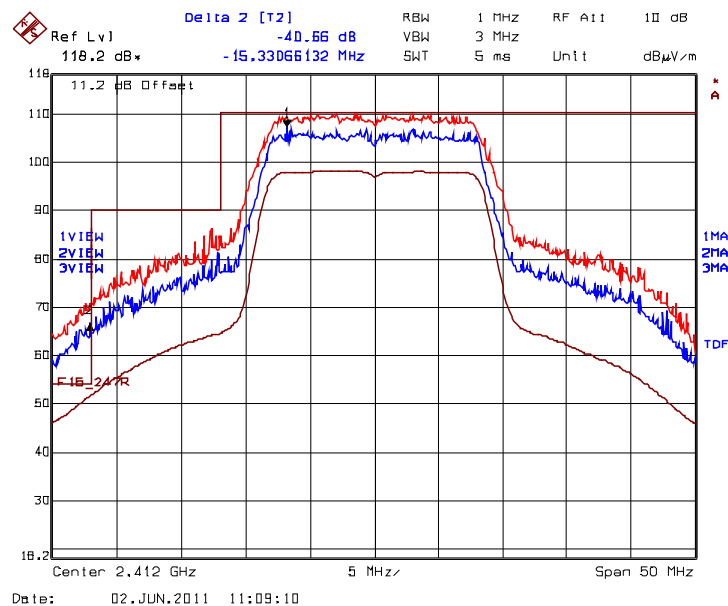
July 6, 2011

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

**Plot 5.9.4.3.7. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.3.8. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 40.66 dB

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

Peak Band-Edge at 2390 MHz: Peak = 109.90 dBμV/m – 40.66 dB = 69.24 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 51.75 dBμV/m (limit 54 dBμV/m)

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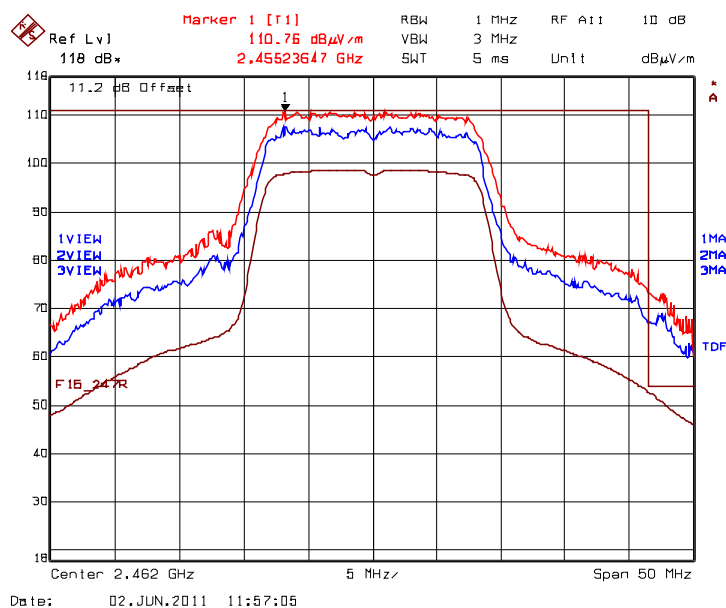
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

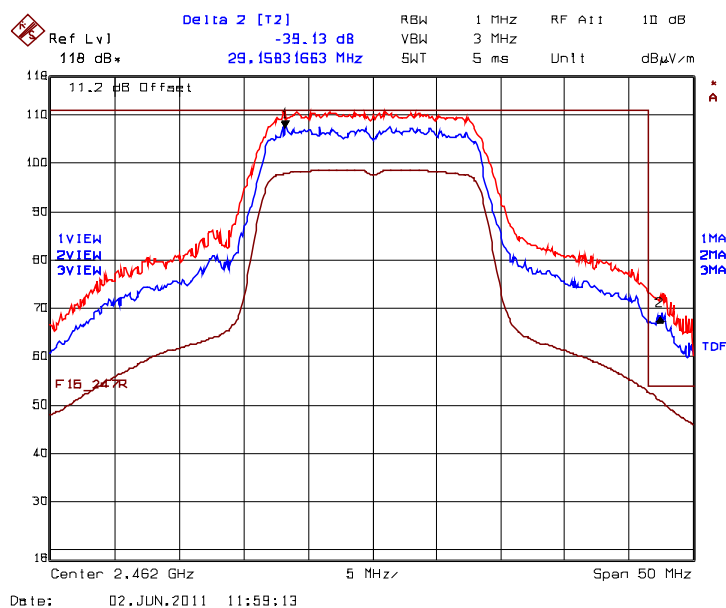
July 6, 2011

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

**Plot 5.9.4.3.9. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.3.10. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 39.13 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 110.76 dBμV/m – 39.13 dB = 71.63 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 52.55 dBμV/m (limit 54 dBμV/m)

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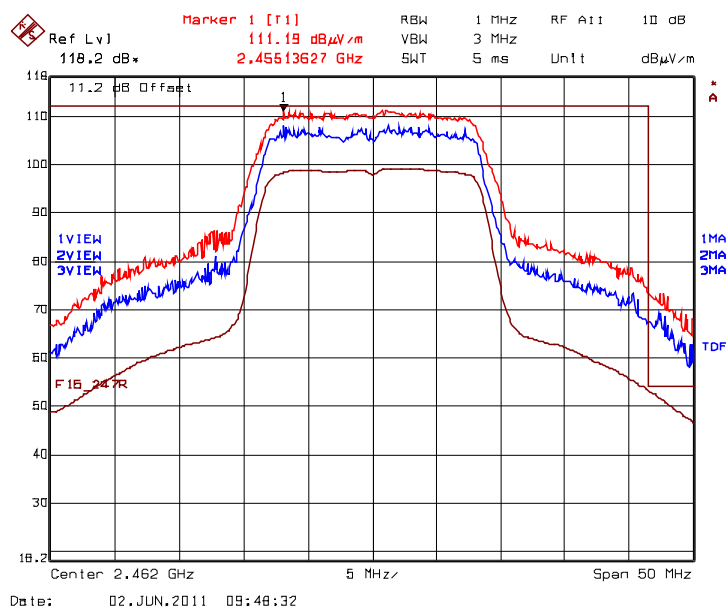
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File #: DIGI-043QF15C247

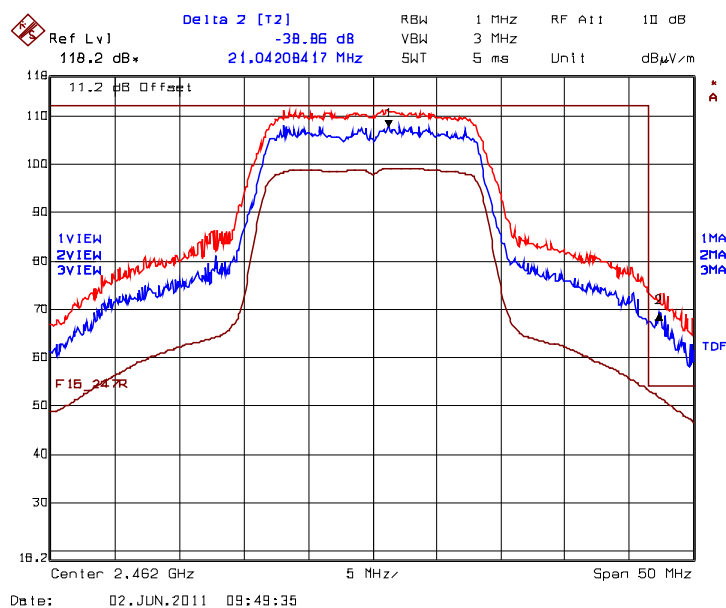
July 6, 2011

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

**Plot 5.9.4.3.11. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.3.12. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 38.86 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 111.19 dBμV/m – 38.86 dB = 72.33 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 53.10 dBμV/m (limit 54 dBμV/m)

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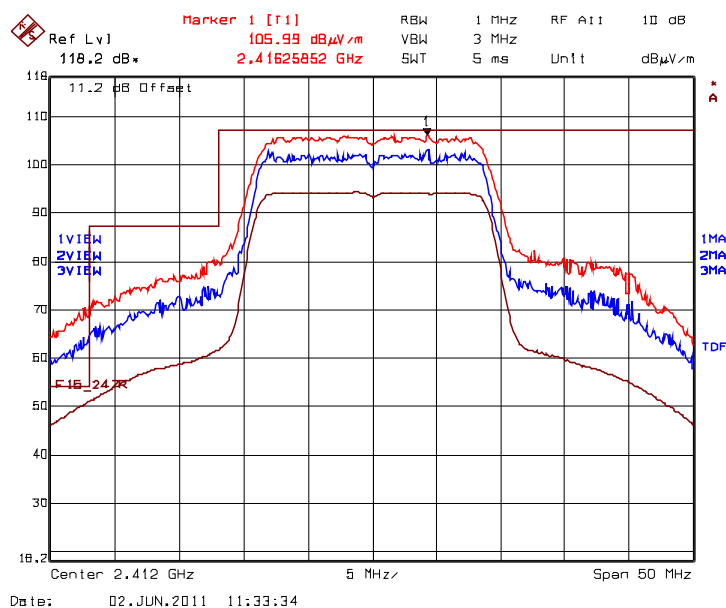
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File #: DIGI-043QF15C247

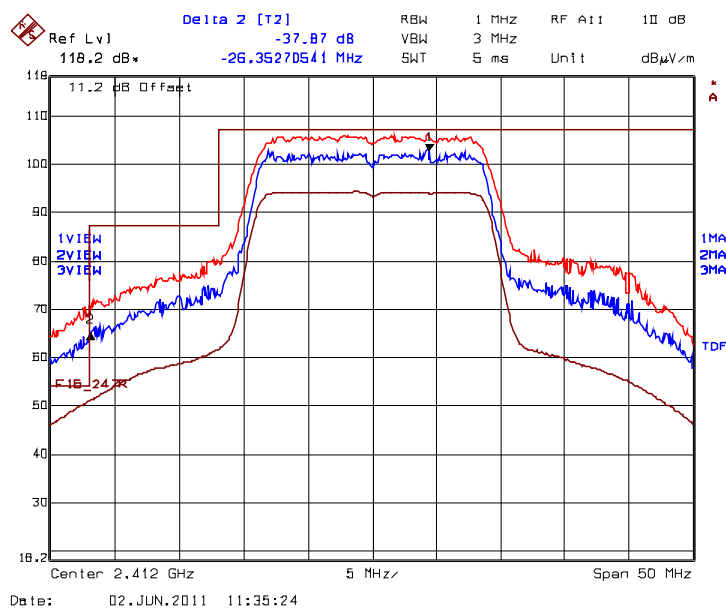
July 6, 2011

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

**Plot 5.9.4.3.13. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.3.14. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.87 dB

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

Peak Band-Edge at 2390 MHz: Peak = 105.99 dBμV/m – 37.87 dB = 68.12 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 50.87 dBμV/m (limit 54 dBμV/m)

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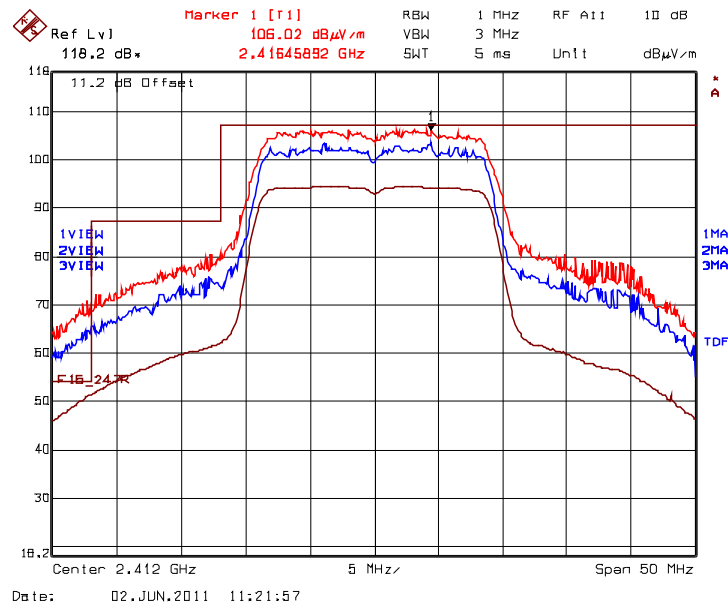
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File #: DIGI-043QF15C247

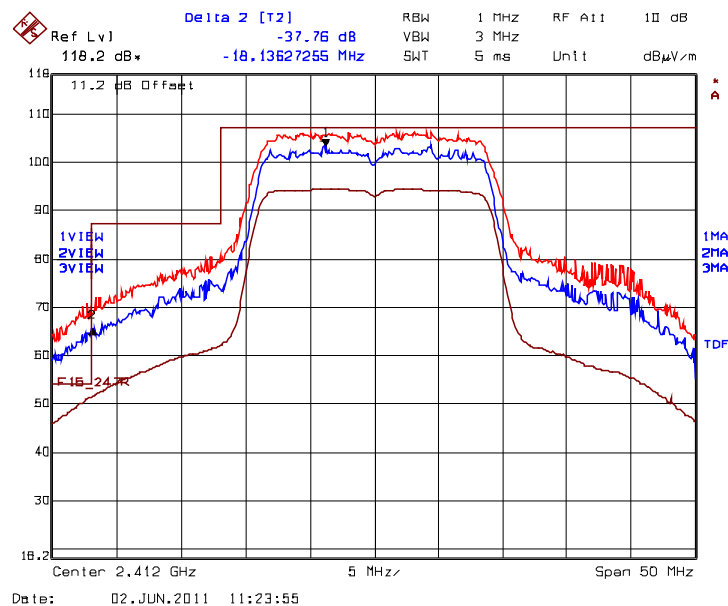
July 6, 2011

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**Plot 5.9.4.3.15. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.3.16. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.76 dB

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

Peak Band-Edge at 2390 MHz: Peak = 106.02 dBμV/m – 37.76 dB = 68.26 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 67.87 dBμV/m (limit 54 dBμV/m)

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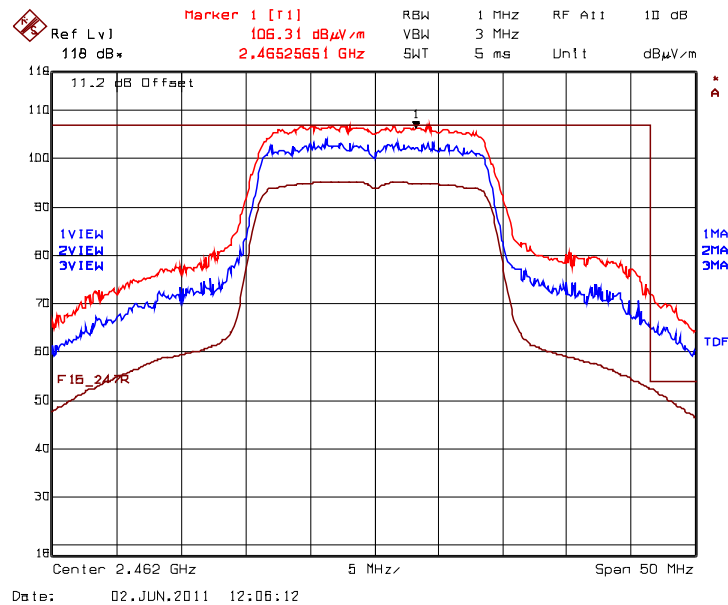
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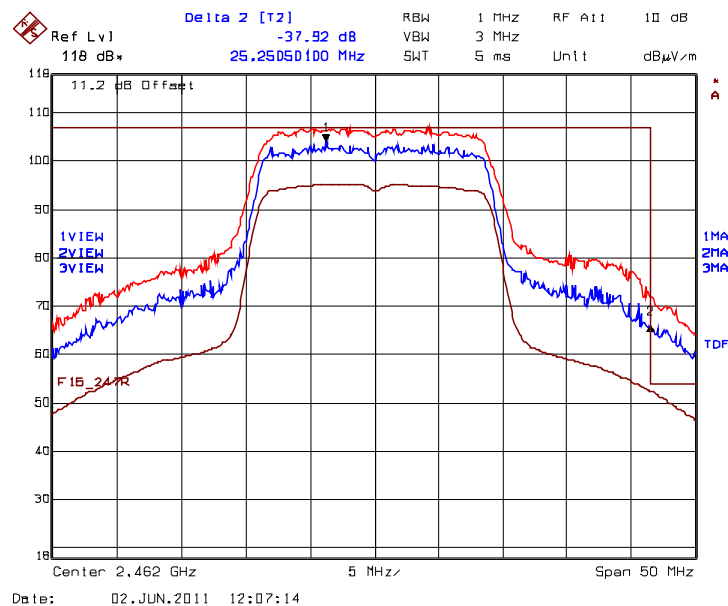
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All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

**Plot 5.9.4.3.17. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.3.18. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.92 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 106.31 dBμV/m – 37.92 dB = 68.39 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 52.28 dBμV/m (limit 54 dBμV/m)

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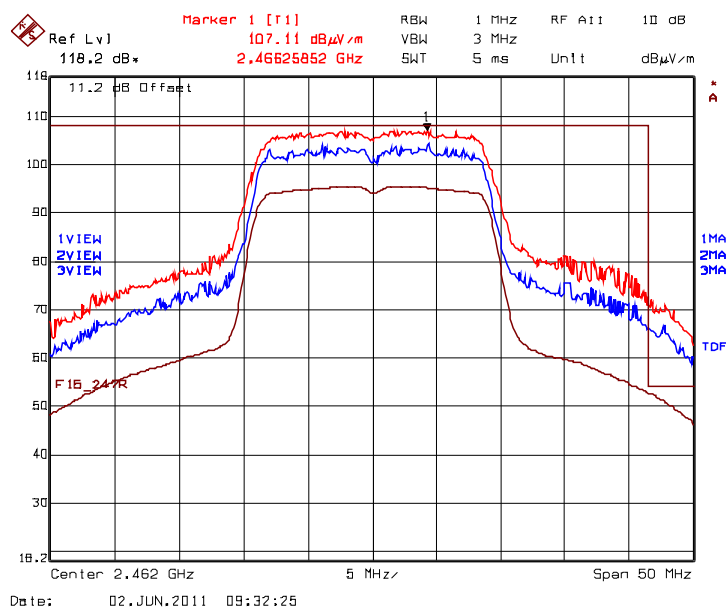
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File #: DIGI-043QF15C247

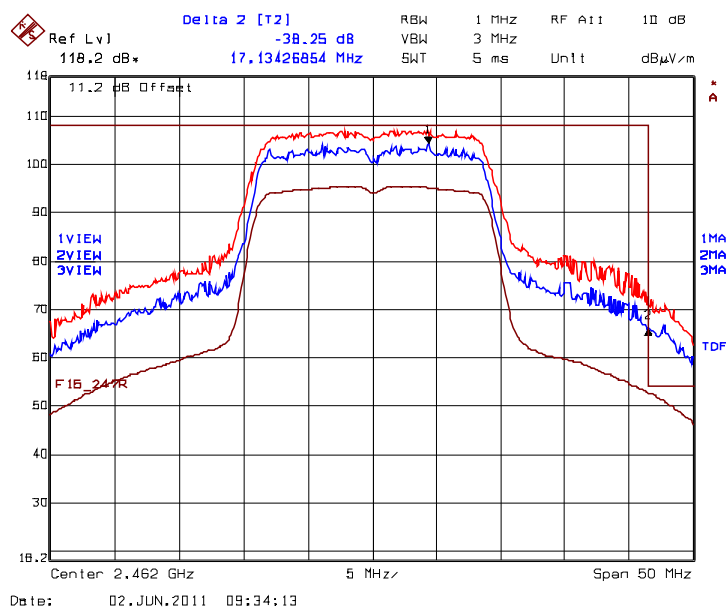
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**Plot 5.9.4.3.19. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.3.20. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 38.25 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 107.11 dBμV/m – 38.25 dB = 68.86 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 52.67 dBμV/m (limit 54 dBμV/m)

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#### 5.9.4.4. EUT with 15 dBi Yagi Antenna

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency:		2412 MHz					
Test Frequency 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	122.38	--	V	--	--	--	--
2412	121.88	--	H	--	--	--	--
30 -25000	*	*	H	*	102.4	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency:		2442 MHz					
Test Frequency 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
2442	122.49	--	V	--	--	--	--
2442	122.44	--	H	--	--	--	--
30 -25000	*	*	H	*	102.5	*	Pass

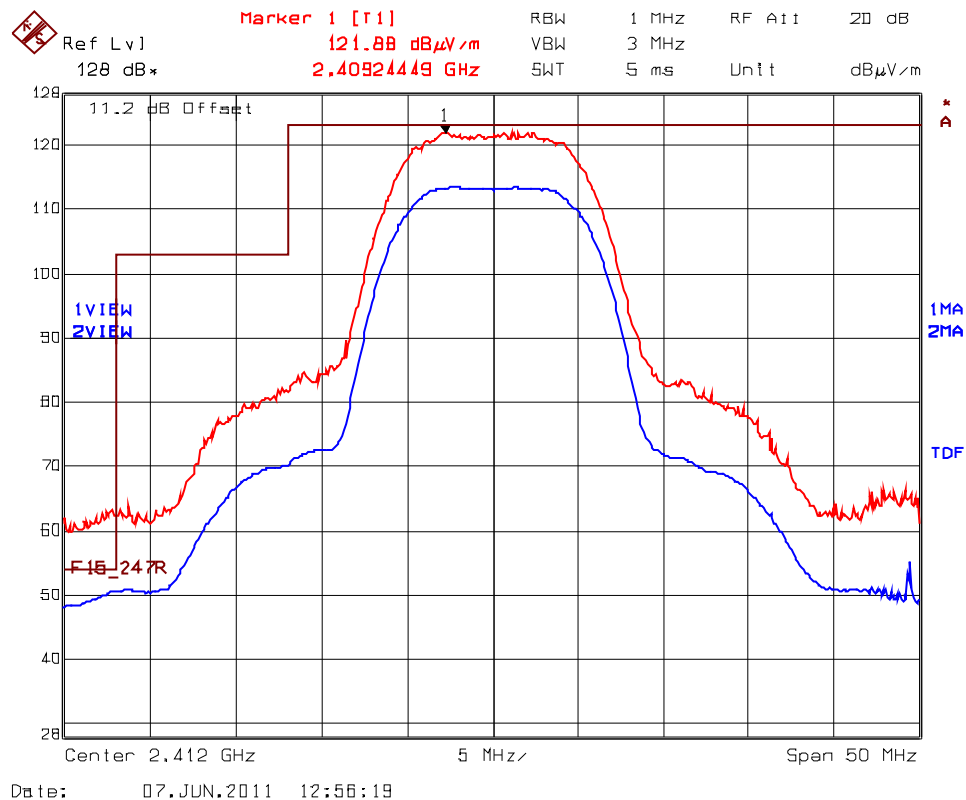
\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency:		2462 MHz					
Test Frequency 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	122.50	--	V	--	--	--	--
2462	123.13	--	H	--	--	--	--
30 -25000	*	*	H	*	103.1	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

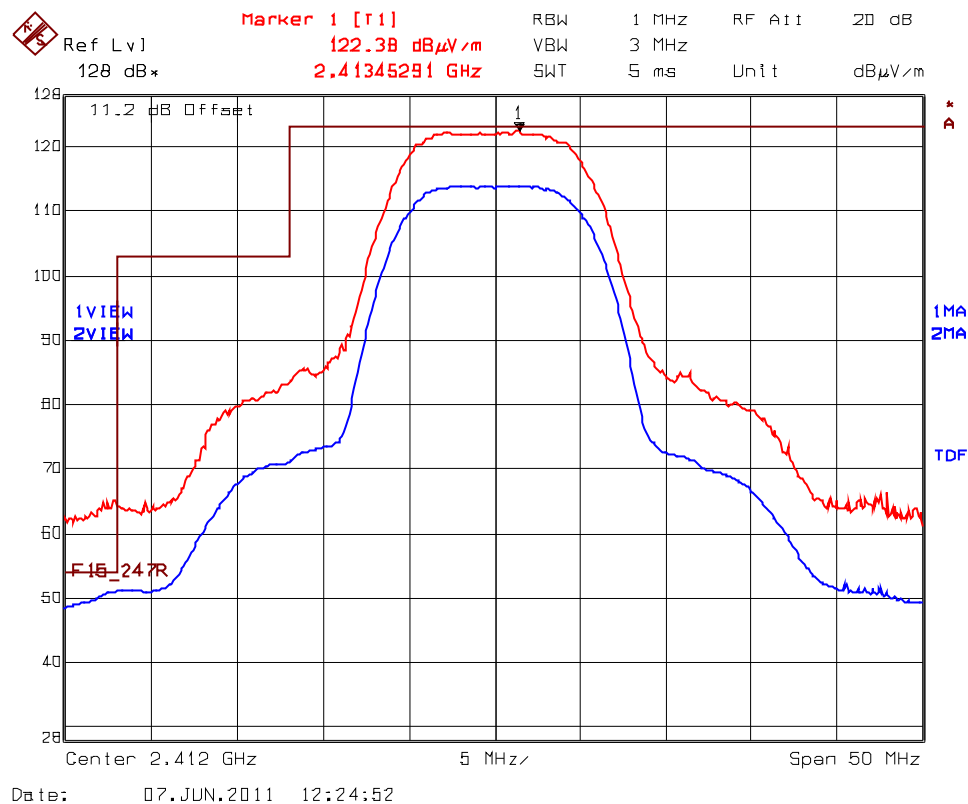
See the following test data plots for band-edge emissions.

**Plot 5.9.4.4.1. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



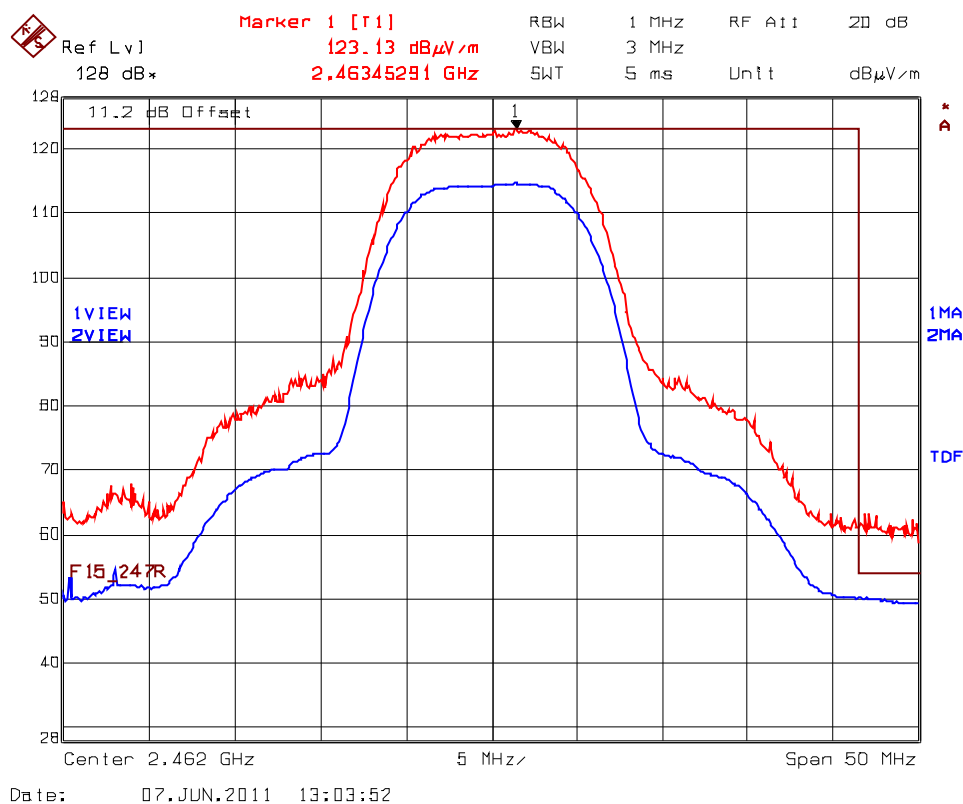
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.4.2. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical



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

**Plot 5.9.4.4.3. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



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

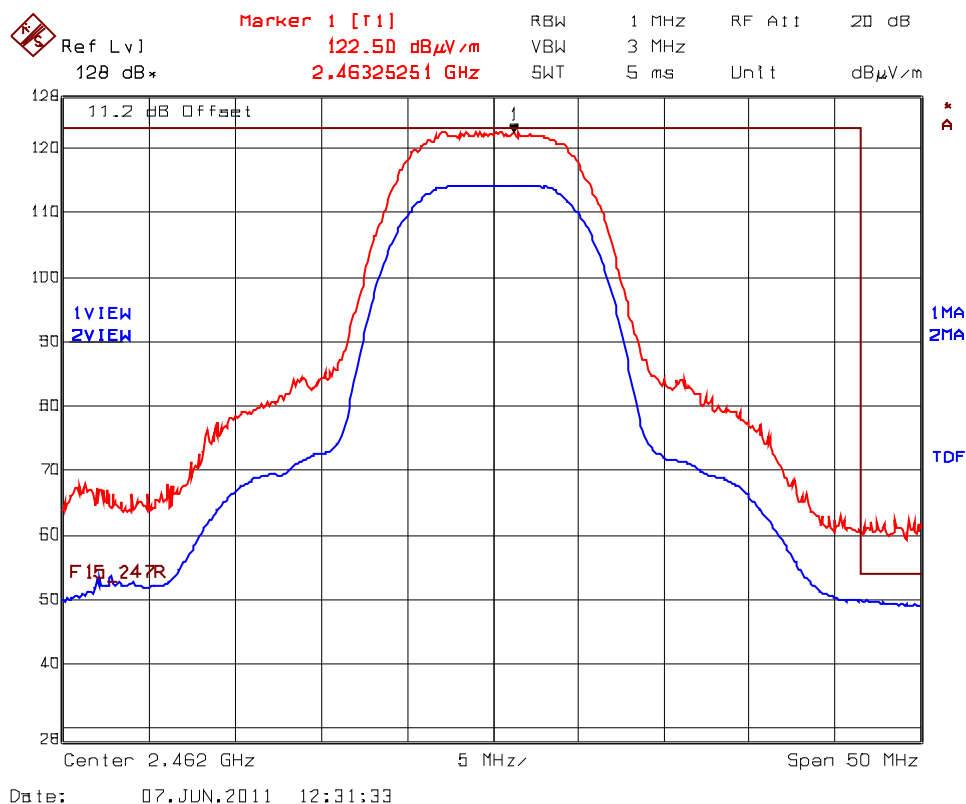
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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July 6, 2011

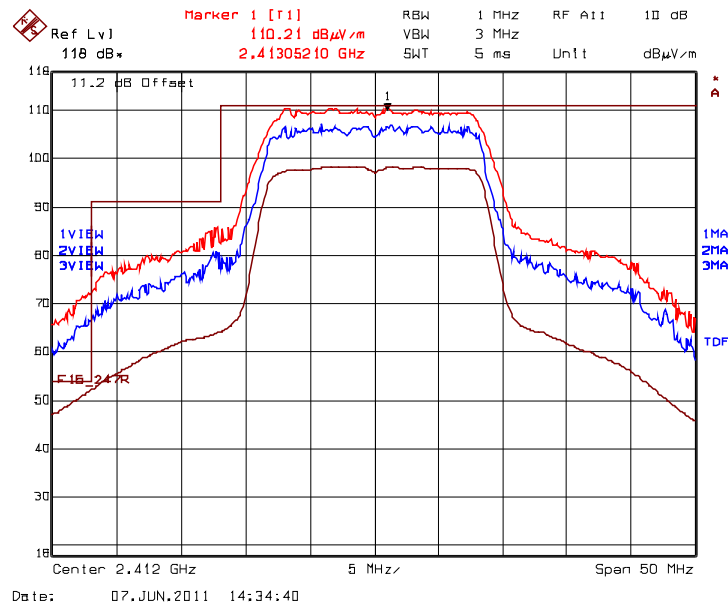
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

**Plot 5.9.4.4.4.** Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical

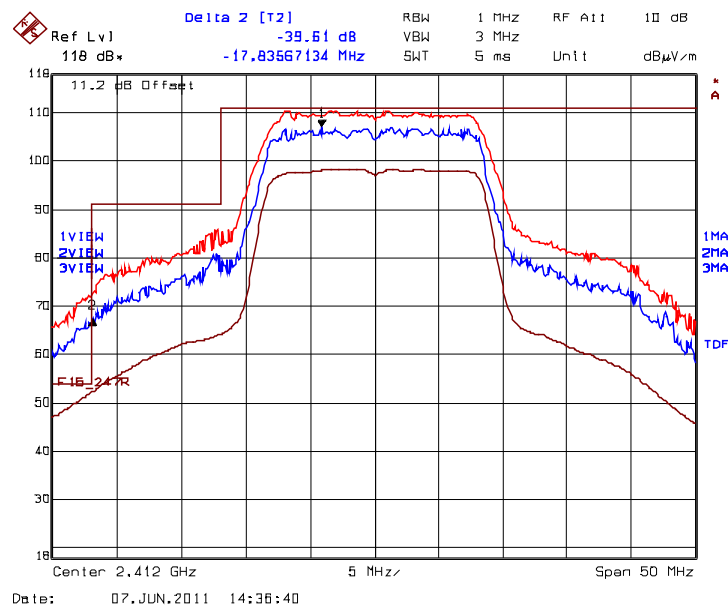


Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.4.5. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.4.6. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 39.61 dB

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

Peak Band-Edge at 2390 MHz: Peak = 110.21 dBμV/m – 39.61 dB = 70.60 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 52.08 dBμV/m (limit 54 dBμV/m)

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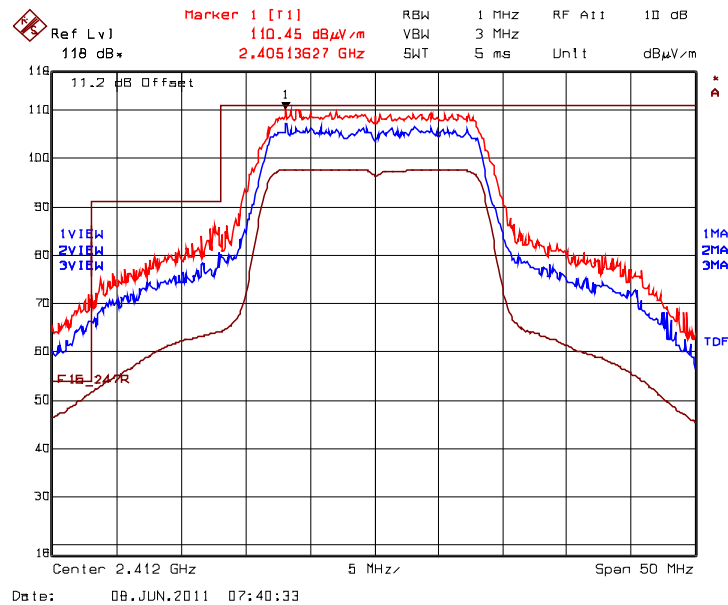
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: DIGI-043QF15C247

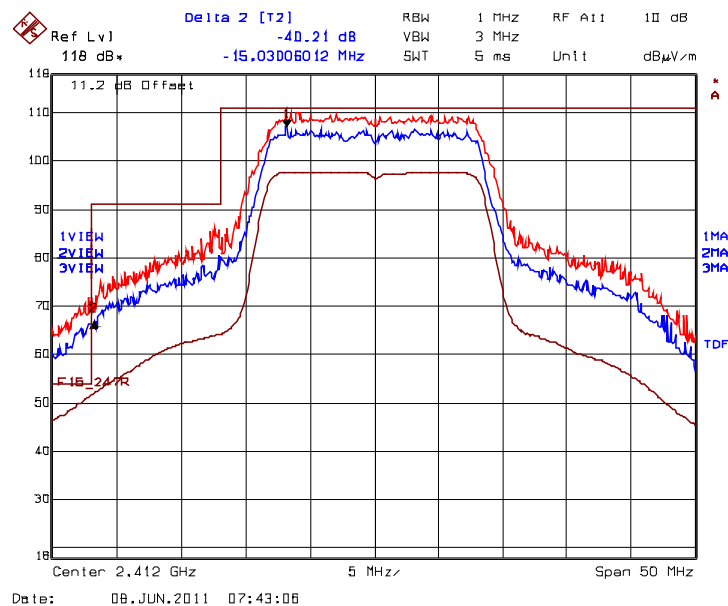
July 6, 2011

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

**Plot 5.9.4.4.7. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.4.8. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 40.21 dB

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

Peak Band-Edge at 2390 MHz: Peak = 110.45 dBμV/m – 40.21 dB = 70.24 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 51.50 dBμV/m (limit 54 dBμV/m)

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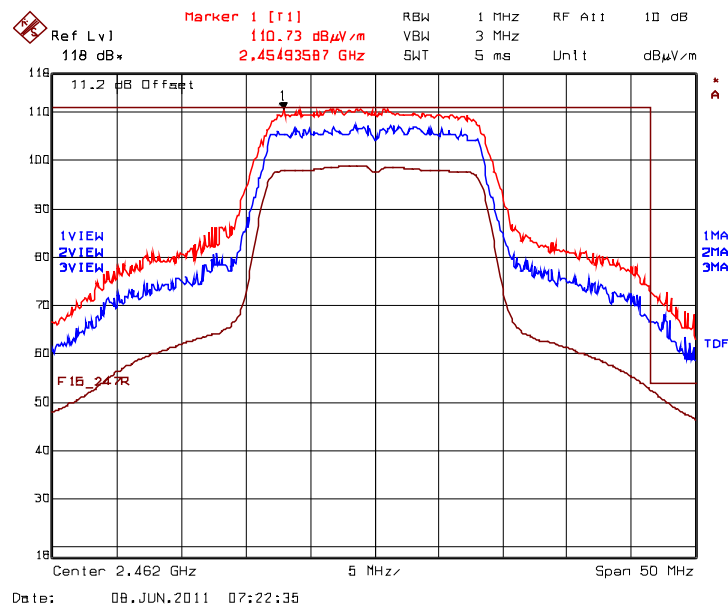
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File #: DIGI-043QF15C247

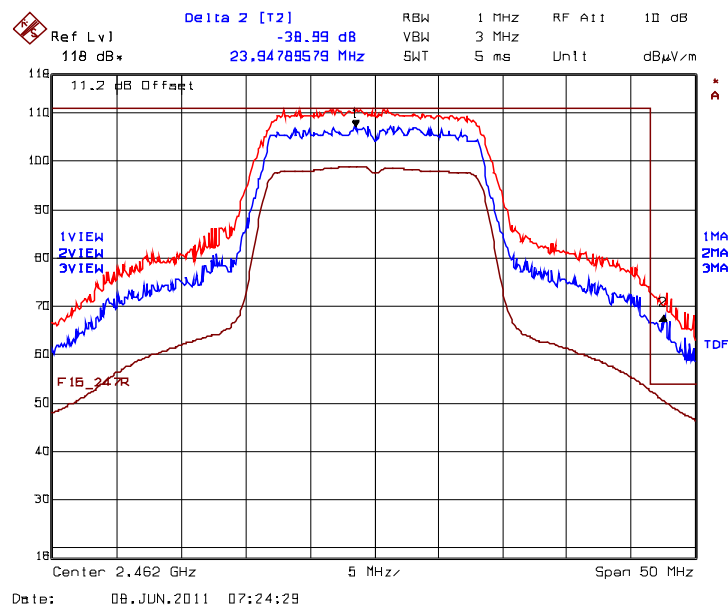
July 6, 2011

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

**Plot 5.9.4.4.9. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.4.10. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 38.99 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 110.73 dBμV/m – 38.99 dB = 71.74 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 52.39 dBμV/m (limit 54 dBμV/m)

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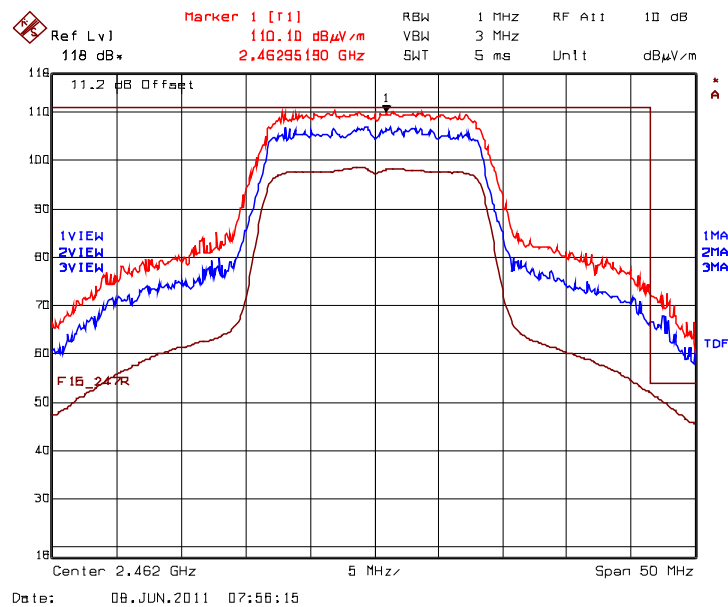
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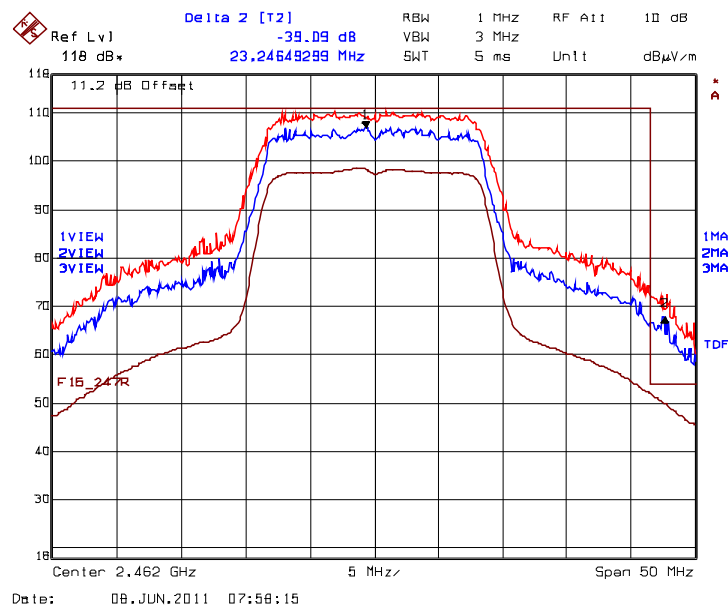
July 6, 2011

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

**Plot 5.9.4.4.11. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.4.12. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 39.09 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 110.10 dBμV/m – 39.09 dB = 71.01 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 52.08 dBμV/m (limit 54 dBμV/m)

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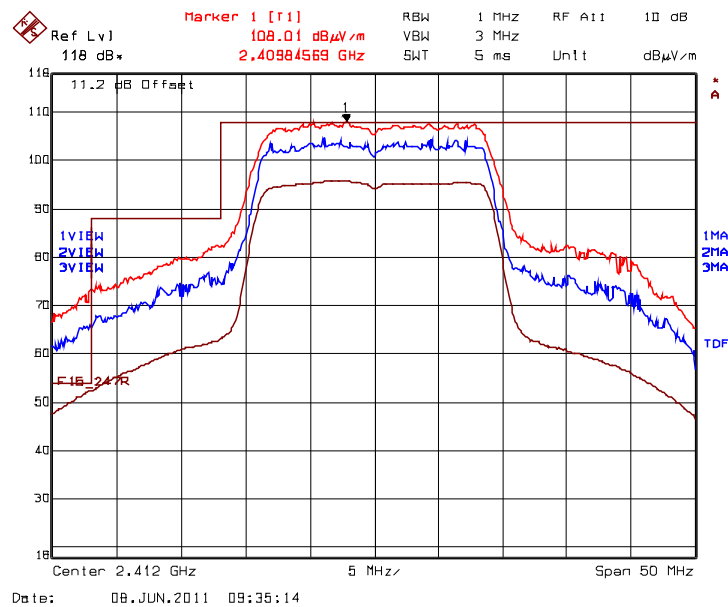
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File #: DIGI-043QF15C247

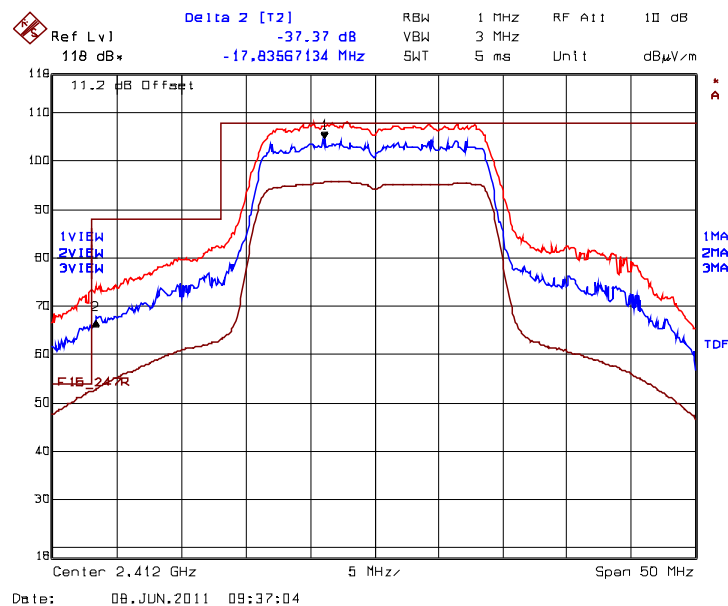
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**Plot 5.9.4.4.13. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.4.14. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.37 dB

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

Peak Band-Edge at 2390 MHz: Peak = 108.01 dBμV/m – 37.37 dB = 70.64 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 52.36 dBμV/m (limit 54 dBμV/m)

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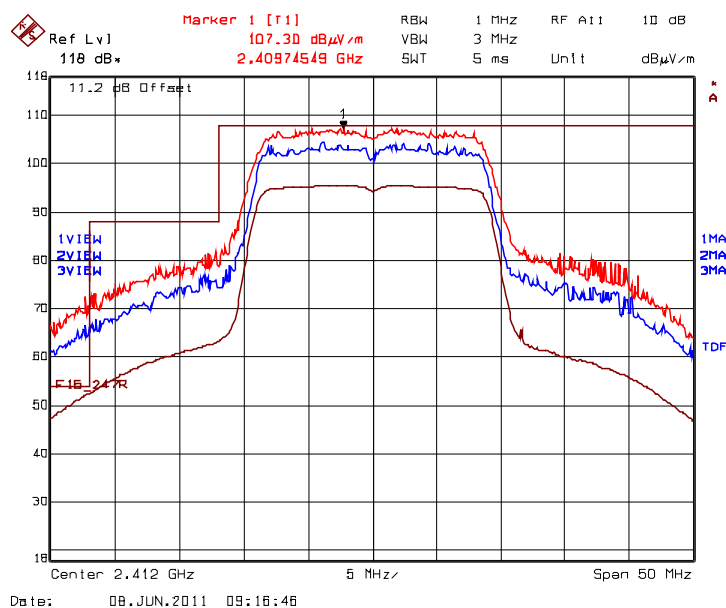
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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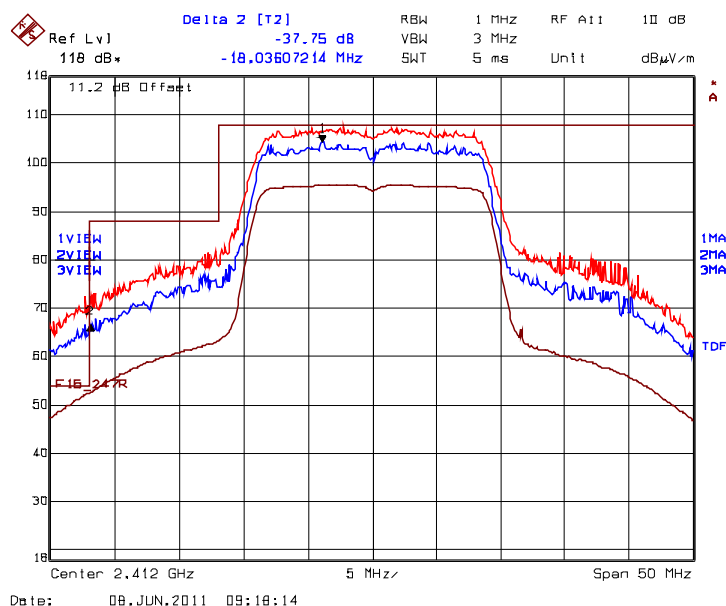
July 6, 2011

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**Plot 5.9.4.4.15. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.4.16. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.75 dB

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

Peak Band-Edge at 2390 MHz: Peak = 107.30 dBμV/m – 37.75 dB = 69.55 dBμV/m (limit 74 dBμV/m)

Average at 2390 MHz: 52.42 dBμV/m (limit 54 dBμV/m)

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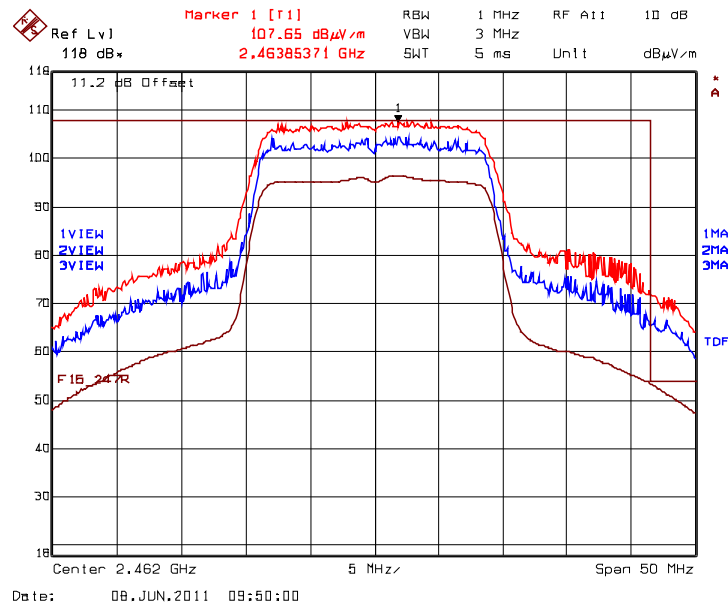
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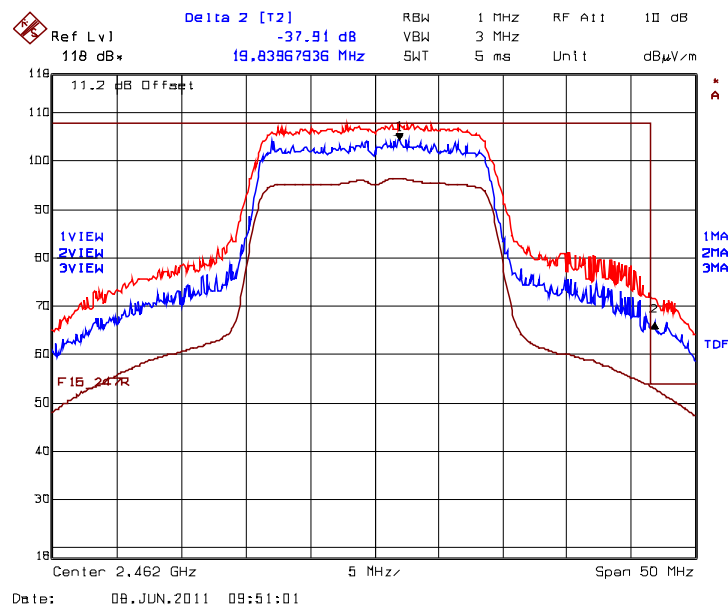
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**Plot 5.9.4.4.17. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



**Plot 5.9.4.4.18. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Horizontal



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.91 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 107.65 dBμV/m – 37.91 dB = 69.74 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 53.21 dBμV/m (limit 54 dBμV/m)

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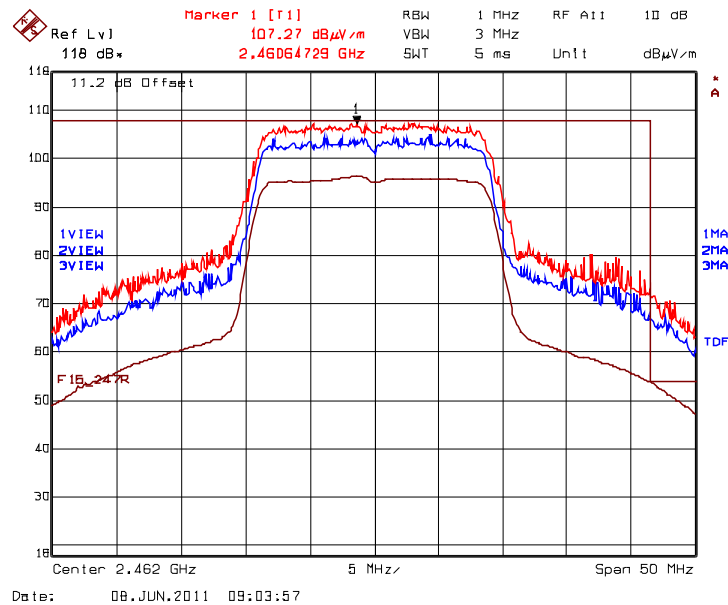
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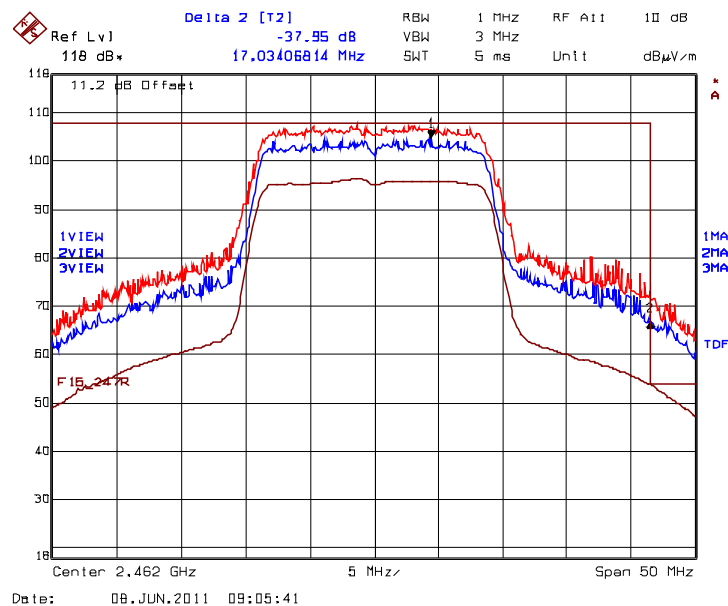
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**Plot 5.9.4.4.19. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



**Plot 5.9.4.4.20. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps, Rx Antenna Orientation: Vertical



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

Trace 2: RBW = 500 kHz, VBW = 1 MHz, Delta (Peak to Band-Edge): 37.95 dB

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

Peak Band-Edge at 2483.5 MHz: Peak = 107.27 dBμV/m – 37.95 dB = 69.32 dBμV/m (limit 74 dBμV/m)

Average at 2483.5 MHz: 53.53 dBμV/m (limit 54 dBμV/m)

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#### 5.9.4.5. EUT with 1.5 dBi Integrated Whip Monopole Antenna

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2412 MHz							
Test Frequency 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	87.41	--	V	--	--	--	--
2412	88.94	--	H	--	--	--	--
30-25000	*	*	V/H	*	68.9	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2442 MHz							
Test Frequency 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
2442	87.64	--	V	--	--	--	--
2442	88.00	--	H	--	--	--	--
30-25000	*	*	V/H	*	68.0	*	Pass

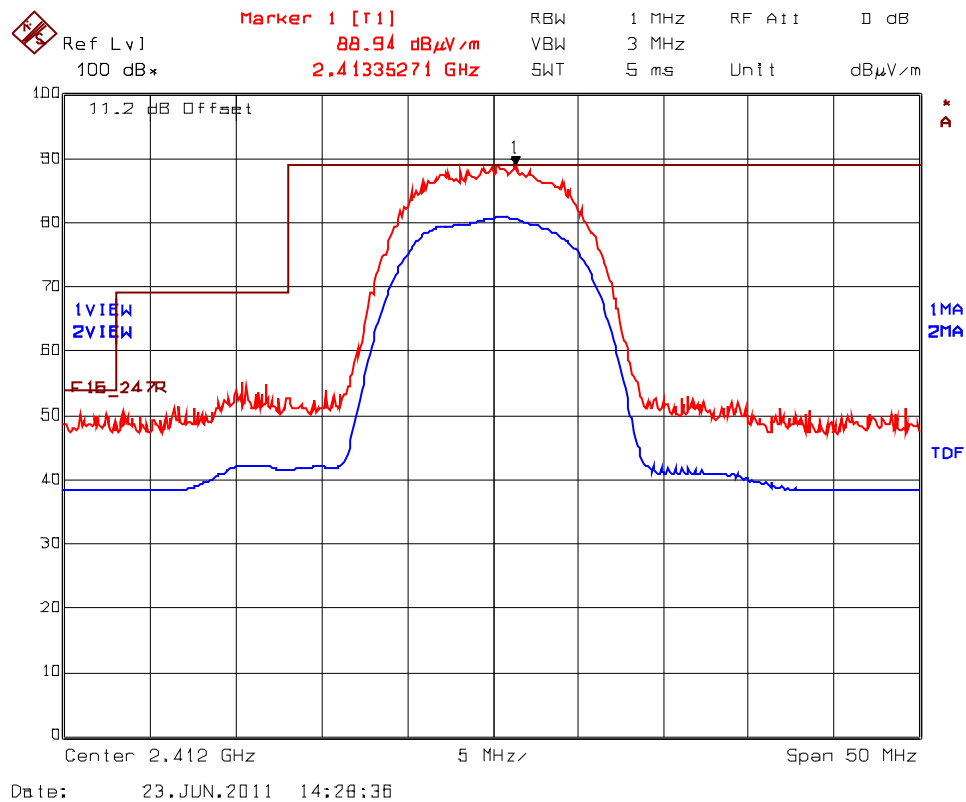
\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

802.11b Mode, CCK 11 Mbps							
Fundamental Frequency: 2462 MHz							
Test Frequency 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	87.89	--	V	--	--	--	--
2462	89.95	--	H	--	--	--	--
30-25000	*	*	V/H	*	70.0	*	Pass

\*The spurious emissions from intentional radiators are more than 20 dB below the specified limit.

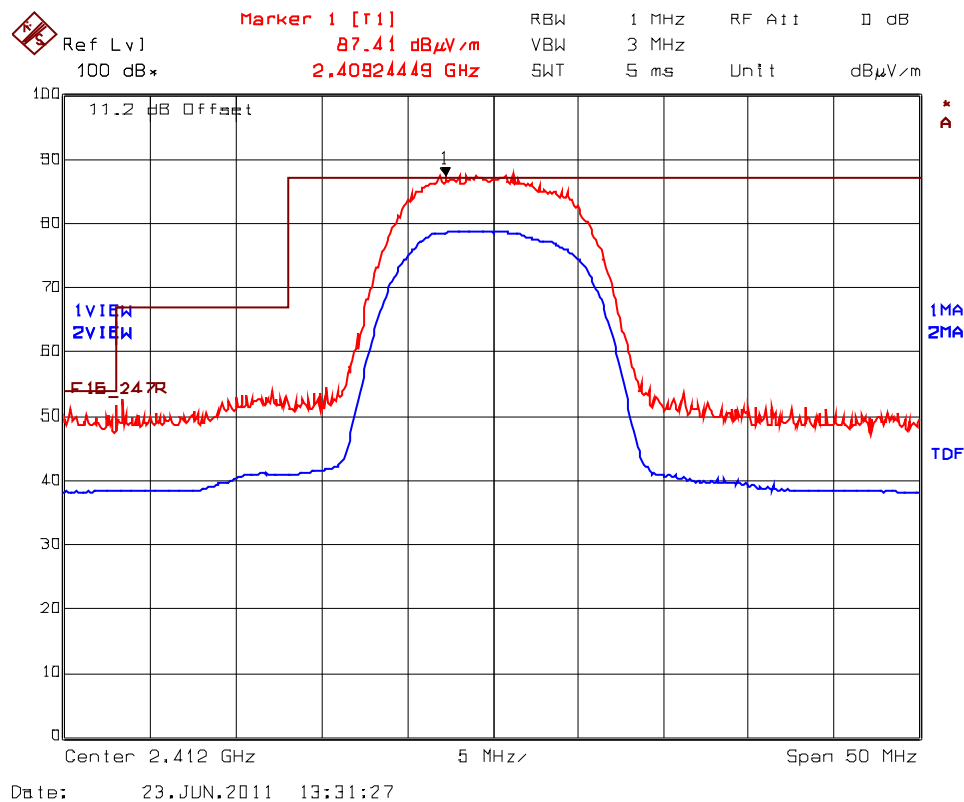
See the following test data plots for band-edge emissions.

**Plot 5.9.4.5.1. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



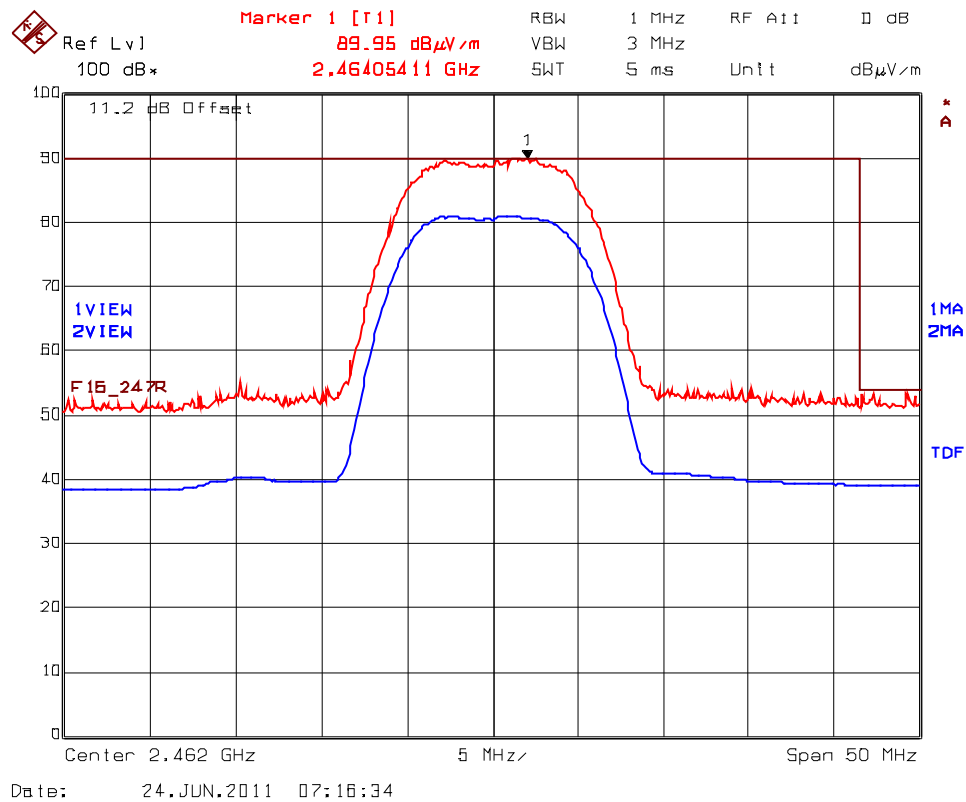
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.5.2. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
Low End of Frequency Band, 2412 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical



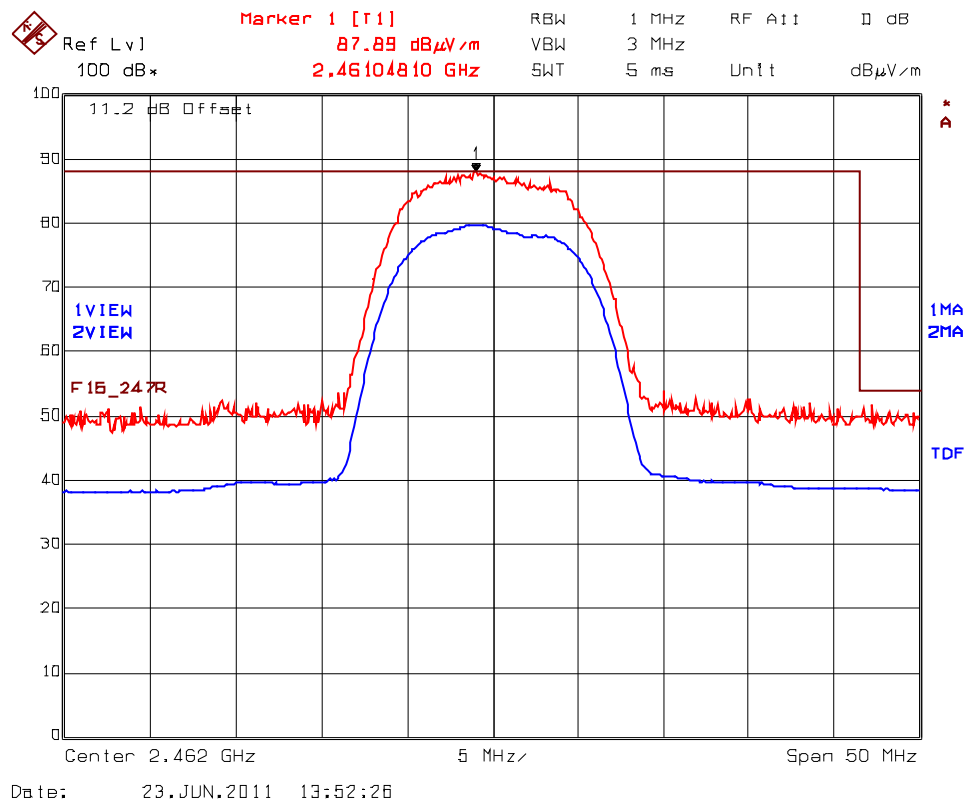
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.5.3. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Horizontal



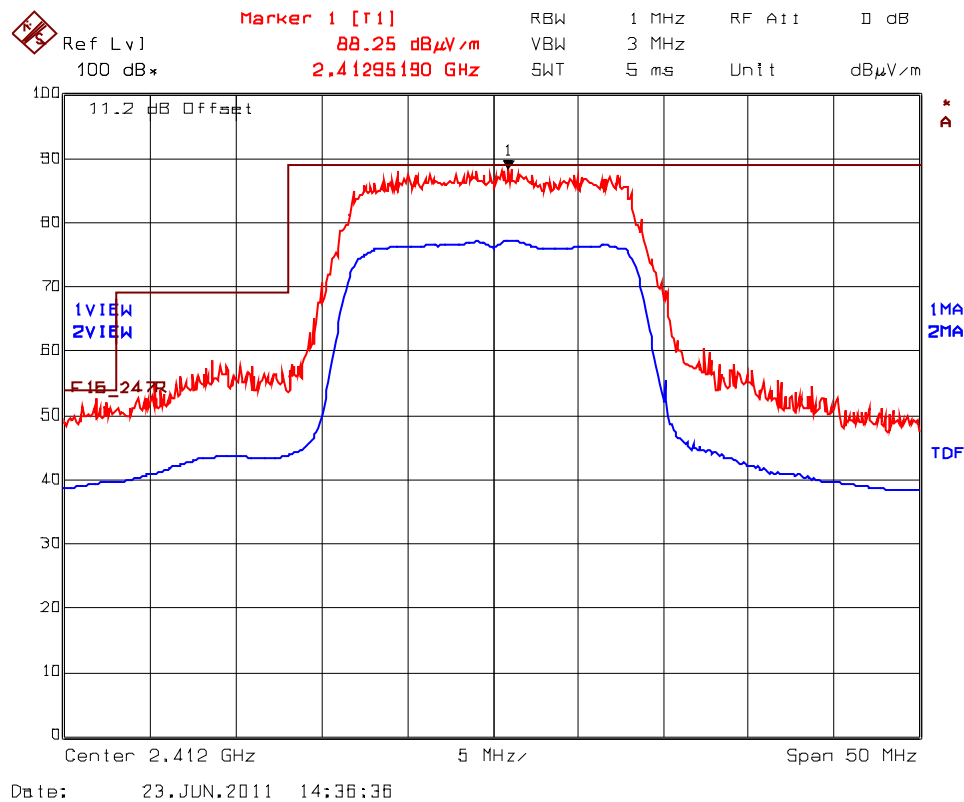
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.5.4. Band-Edge RF Radiated Emissions @ 3 m, 802.11b Mode**  
High End of Frequency Band, 2462 MHz, CCK 11 Mbps  
Rx Antenna Orientation: Vertical



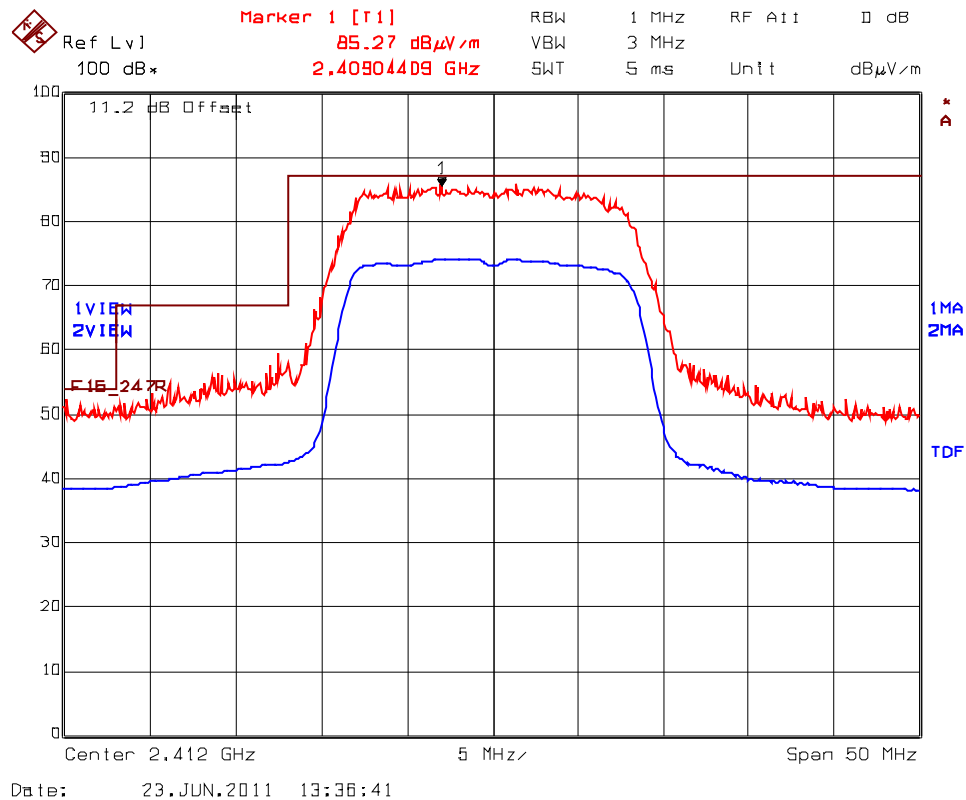
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.5.5. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps  
Rx Antenna Orientation: Horizontal



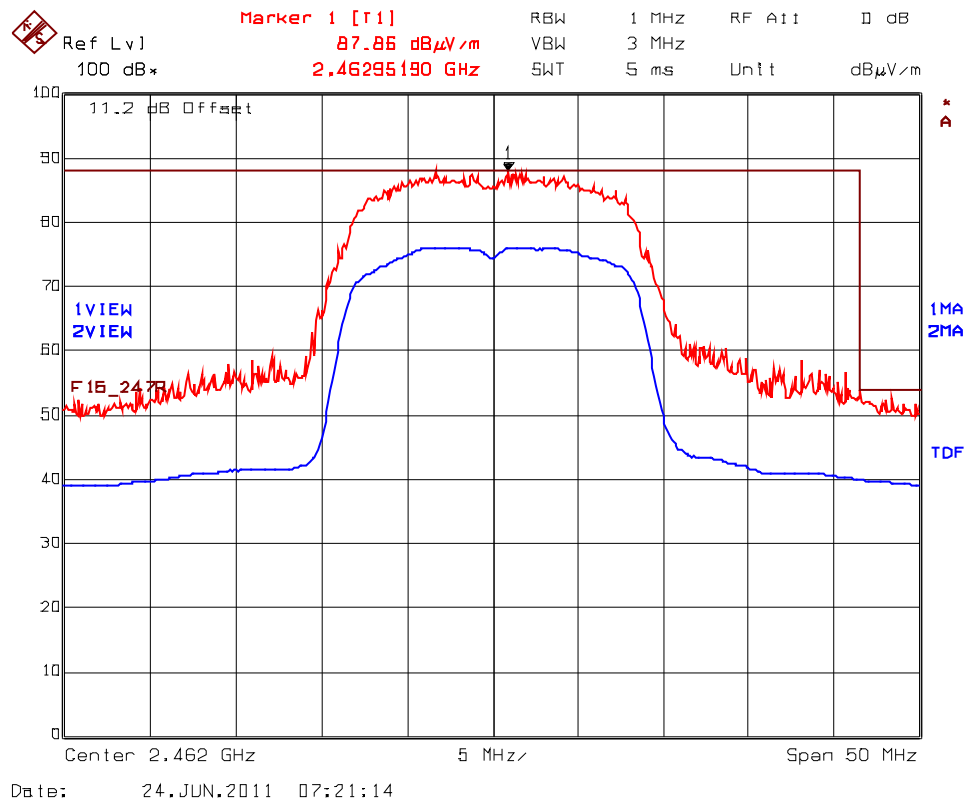
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.5.6. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
Low End of Frequency Band, 2412 MHz, 64-QAM 54 Mbps  
Rx Antenna Orientation: Vertical



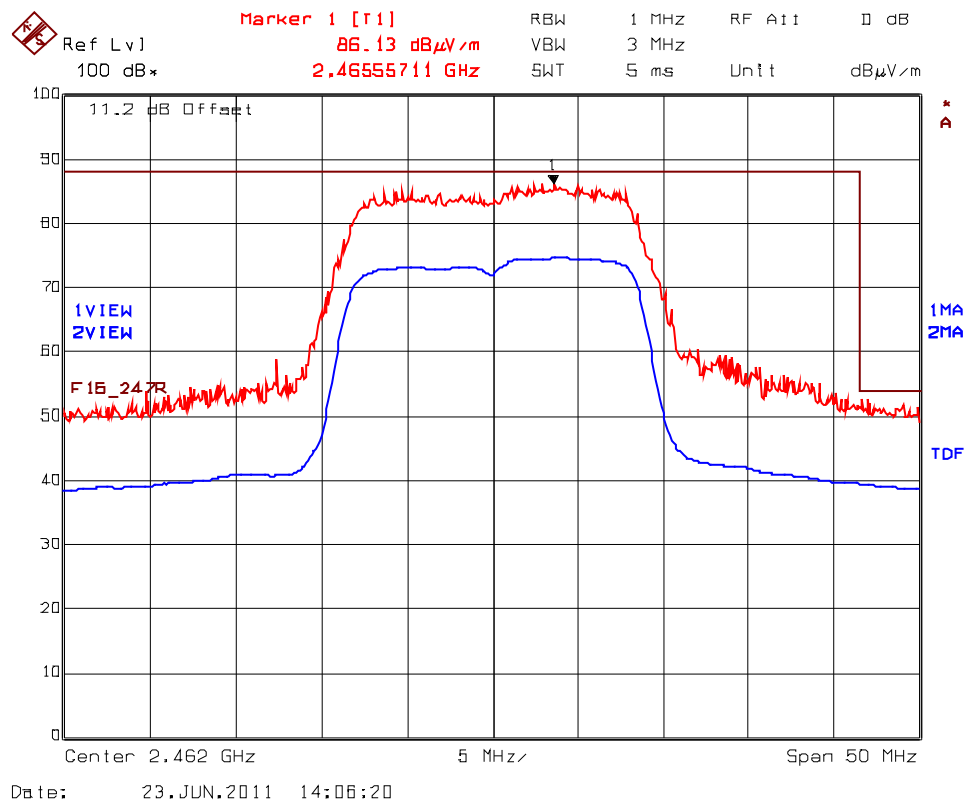
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.5.7. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps  
Rx Antenna Orientation: Horizontal



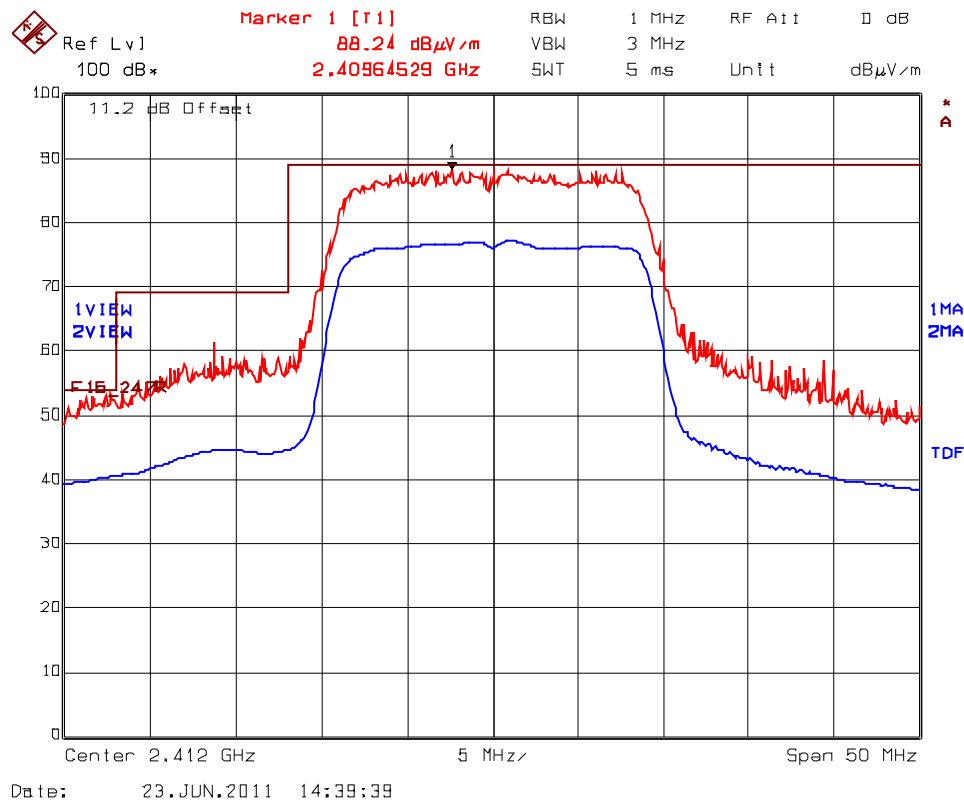
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.5.8. Band-Edge RF Radiated Emissions @ 3 m, 802.11g Mode**  
High End of Frequency Band, 2462 MHz, 64-QAM 54 Mbps  
Rx Antenna Orientation: Vertical



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

**Plot 5.9.4.5.9. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MCS7 65 Mbps  
Rx Antenna Orientation: Horizontal



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

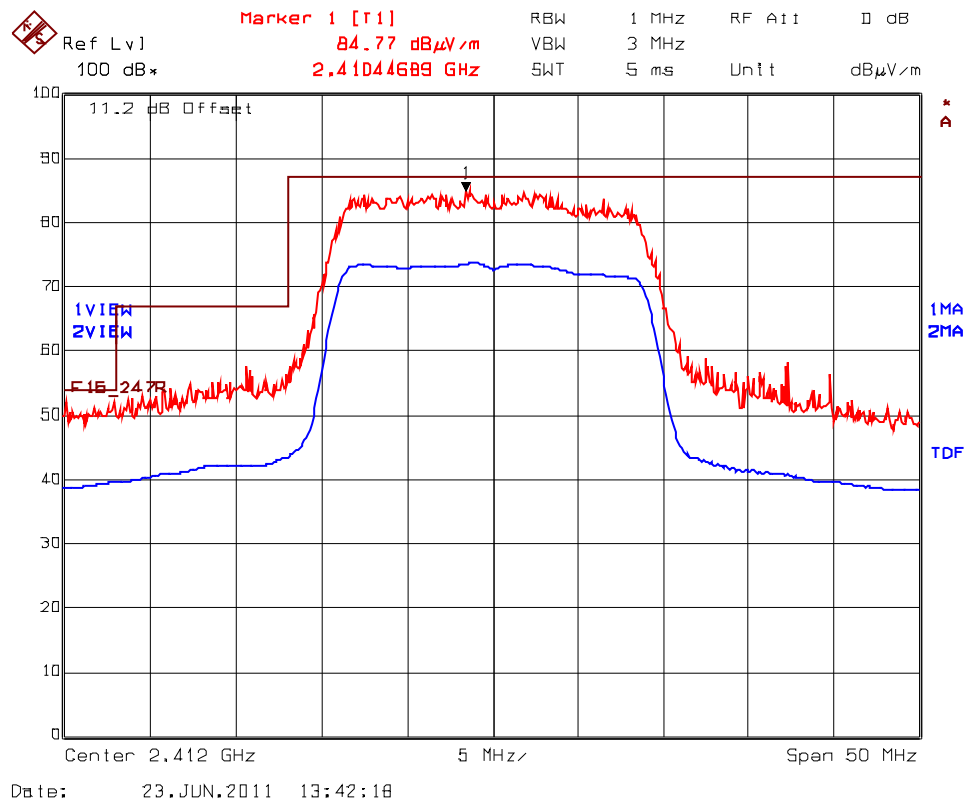
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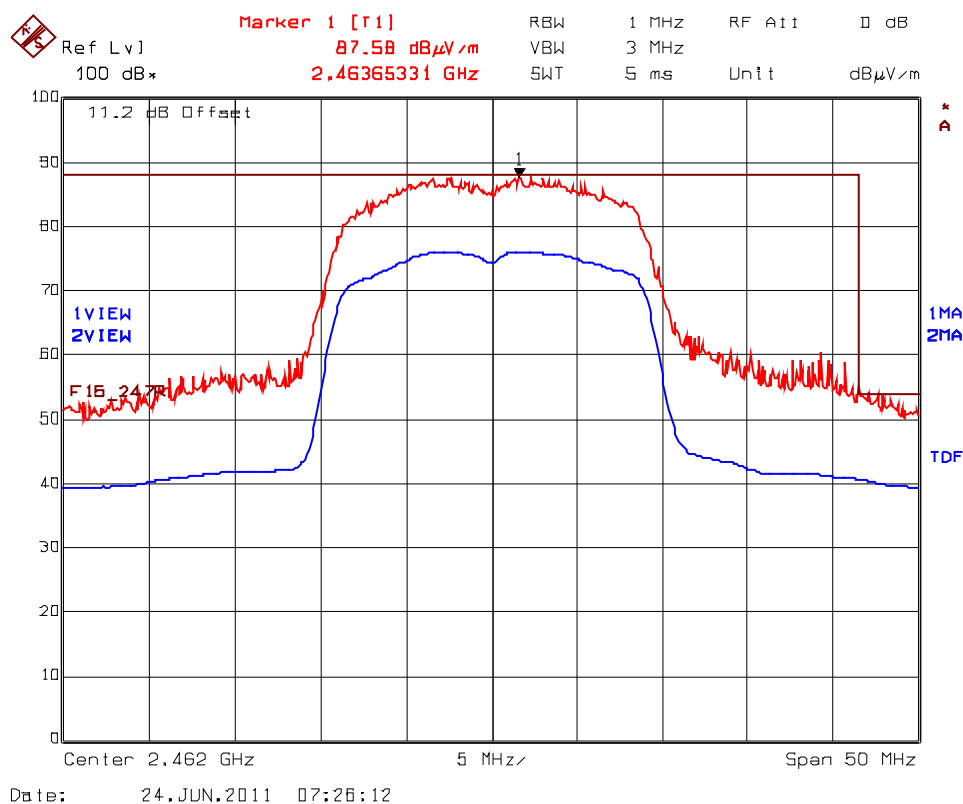
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**Plot 5.9.4.5.10. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
Low End of Frequency Band, 2412 MHz, MCS7 65 Mbps  
Rx Antenna Orientation: Vertical



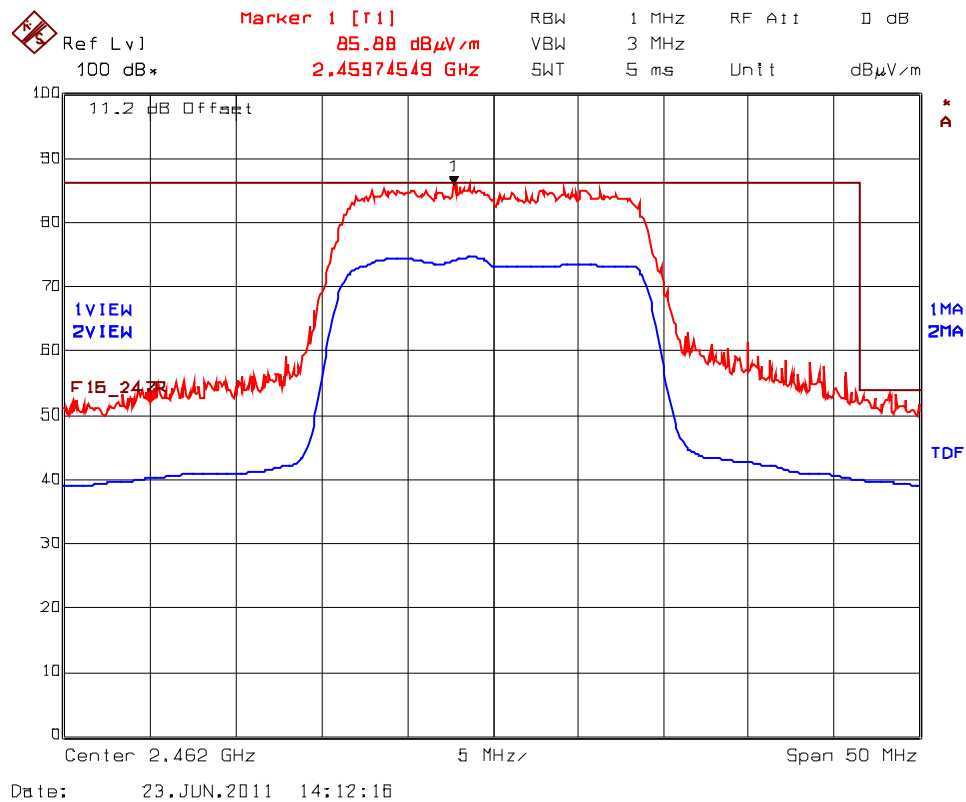
Trace 1: RBW = 1 MHz, VBW = 3 MHz  
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.9.4.5.11. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps  
Rx Antenna Orientation: Horizontal



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

**Plot 5.9.4.5.12. Band-Edge RF Radiated Emissions @ 3 m, 802.11n Mode**  
High End of Frequency Band, 2462 MHz, MSC7 65 Mbps  
Rx Antenna Orientation: Vertical



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

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

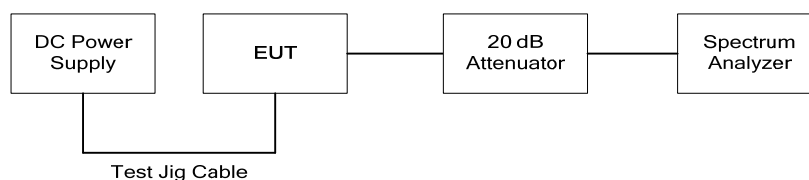
### 5.10.1. Limit(s)

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.

### 5.10.2. Method of Measurements

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

### 5.10.3. Test Arrangement



### 5.10.4. Test Data

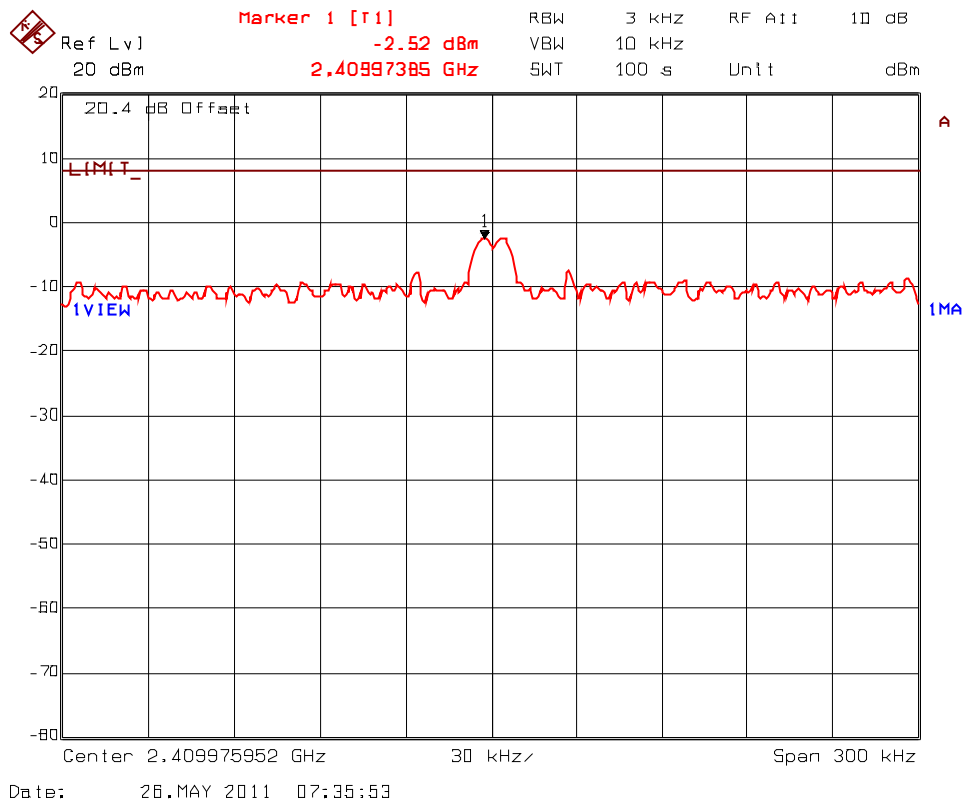
#### Remarks:

- Measurement method: Power spectral density (PSD) Option 1.
- Investigation of all combinations of modulations and data rates were carried out to determine the worst-case operation and the highest level is recorded in the following table.

Frequency (MHz)	Modulation	Data Rate (Mbps)	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)
802.11b Mode					
2412	DBPSK	1	-2.52	8	-10.52
2442	DBPSK	1	-2.43	8	-10.43
2462	DBPSK	1	-2.54	8	-10.54

\*See the following plots for measurement details.

**Plot 5.10.4.1. Power Spectral Density**  
2412 MHz, 802.11b, DBPSK 1 Mbps



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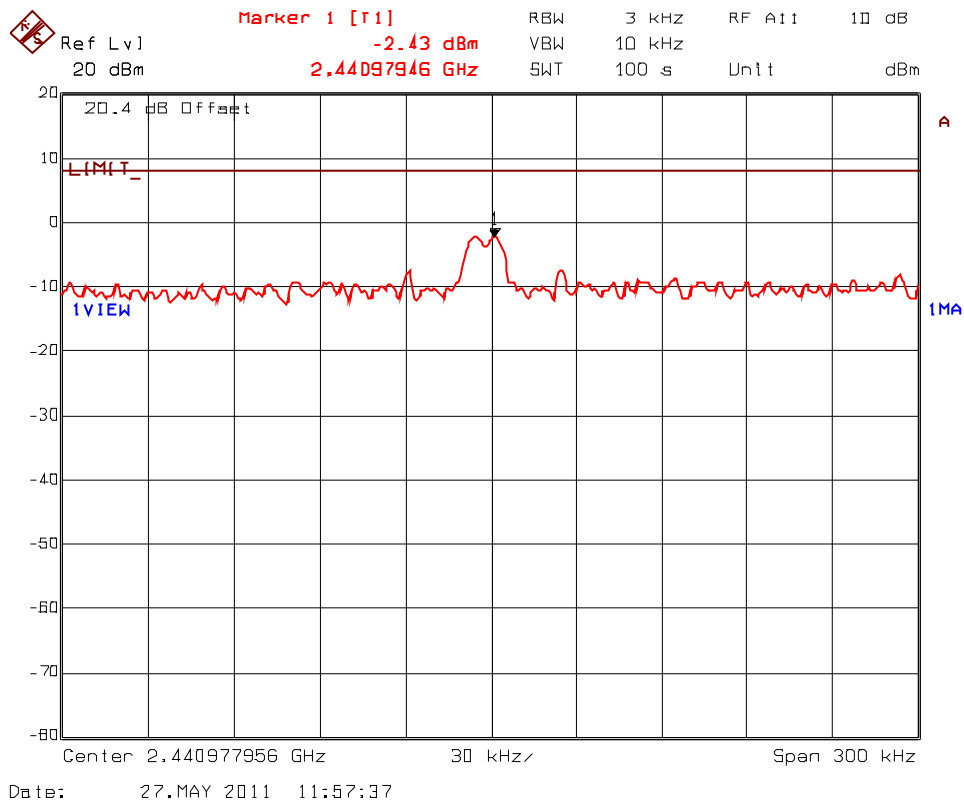
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.10.4.2. Power Spectral Density**  
2442 MHz, 802.11b, DBPSK 1 Mbps



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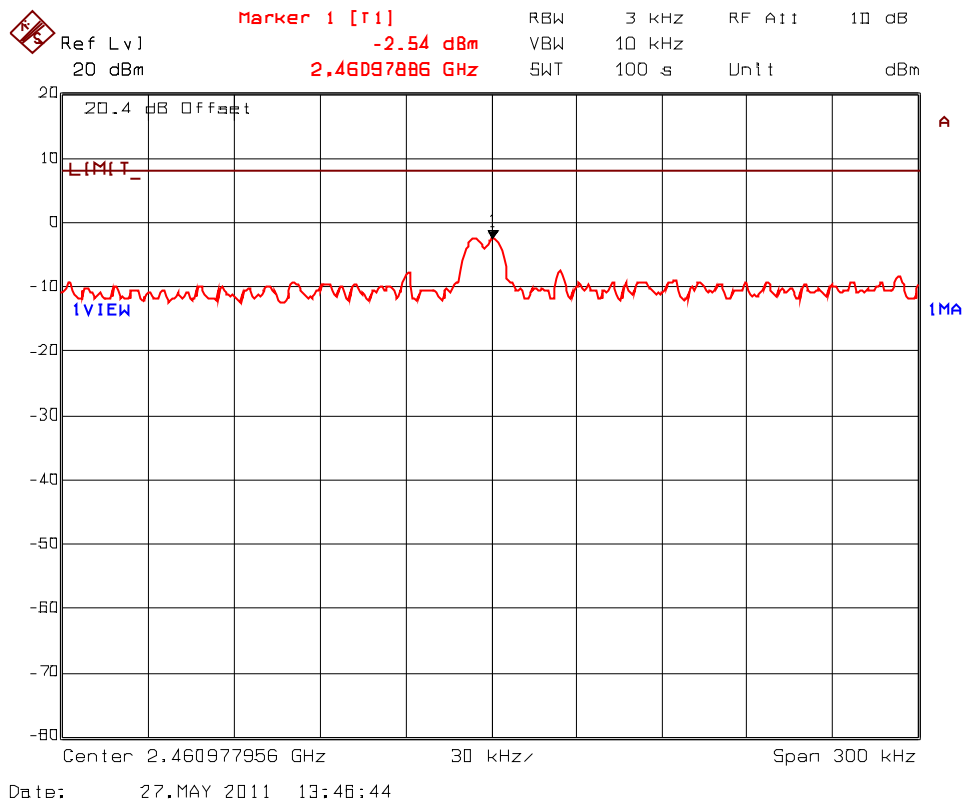
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.10.4.3. Power Spectral Density**  
2462 MHz, 802.11b, DBPSK 1 Mbps



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## 5.11. RF EXPOSURE REQUIRMENTS [§§ 15.247(e)(i), 1.1310 & 2.1091]

The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

### FCC 47 CFR § 1.1310:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(1800/f <sup>2</sup> )	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 TO TABLE 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 TO TABLE 1: 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 can not exercise control over their exposure.

### 5.11.1. Method of Measurements

Refer to Sections 1.1310, 2.1091

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

- (1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
- (2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
- (3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
- (4) Any other RF exposure related issues that may affect MPE compliance

### Calculation Method of RF Safety Distance:

$$S = \frac{P \cdot G}{4 \cdot \pi \cdot r^2} = \frac{EIRP}{4 \cdot \pi \cdot r^2}$$

Where: P: power input to the antenna in mW  
EIRP: Equivalent (effective) isotropic radiated power  
S: power density mW/cm<sup>2</sup>  
G: numeric gain of antenna relative to isotropic radiator  
r: distance to centre of radiation in cm

### 5.11.2. RF Evaluation

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
Minimum calculated separation distance between antenna and persons required: <b>*14.3 cm</b>	Manufacturer' instruction for separation distance between antenna and persons required: <b>20 cm.</b>
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Refer to user's manual for RF exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

\*The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

$$r = \sqrt{\frac{P \cdot G}{4 \cdot \pi \cdot S}} = \sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}}$$

S = 1.0 mW/cm<sup>2</sup>

EIRP = 34.09 dBm = 10<sup>(34.09/10)</sup> mW = 2564 mW (Worst Case)

$$(\text{Minimum Safe Distance, } r) = \sqrt{\frac{EIRP}{4 \cdot \pi \cdot S}} = \sqrt{\frac{2564}{4 \cdot \pi \cdot (1.0)}} \approx 14.3\text{cm}$$

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**EXHIBIT 6. TEST EQUIPMENT LIST**

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz	14 Aug 2011
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	15 Mar 2012
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	17 Feb 2012
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	15 Mar 2012
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 2.4 GHz	Cal. on use
Horn Antenna	Emco	3155	6570	1 – 18 GHz	22 Feb 2012
Biconi-Log Antenna	Emco	3142C	00034792	26 – 3000 MHz	26 Apr 2012
Horn Antenna	ETS Lindgren	3160-09	00118385	18 – 26.5 GHz	30 May 2012
Signal Generator	Hewlett Packard	8648C	3443U00391	100 kHz – 3200 MHz	16 Dec 2011
Attenuator	Narda	4768-20	-	DC – 40 GHz	Cal. on use
Attenuator	Narda	4768-10	-	DC – 40 GHz	Cal. on use
Power Divider	Mini-Circuits	15542	0235	DC – 18 GHz	Cal. on use
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3710A00223	9 kHz – 22 GHz	25 Apr 2012
LISN	EMCO	3825/2	8907-1531	10 kHz – 100 MHz	07 Apr 2012
Attenuator	Pasternack	PE7010-20	-	DC – 2 GHz	18 Jan 2012
Peak Power Meter	Hewlett Packard	8900D	2131A01044	01 – 18 GHz	13 Jul 2012
Power Sensor	Hewlett Packard	84811A	2551A01484	01 – 18 GHz	13 Jul 2012

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

## EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

### 7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (150 kHz – 30 MHz):	Measured	Limit
$u_c$	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 1.57$	$\pm 1.8$
$U$	Expanded uncertainty U: $U = 2u_c(y)$	$\pm 3.14$	$\pm 3.6$

### 7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured	Limit
$u_c$	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 2.15$	$\pm 2.6$
$U$	Expanded uncertainty U: $U = 2u_c(y)$	$\pm 4.30$	$\pm 5.2$

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured	Limit
$u_c$	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 2.39$	$\pm 2.6$
$U$	Expanded uncertainty U: $U = 2u_c(y)$	$\pm 4.78$	$\pm 5.2$

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured	Limit
$u_c$	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 1.87$	Under consideration
$U$	Expanded uncertainty U: $U = 2u_c(y)$	$\pm 3.75$	Under consideration