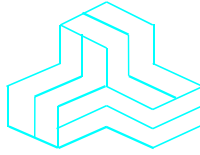


# ENGINEERING TEST REPORT



**NOIRE510**

**Model: NOIRE510W**

**FCC ID: COL-NOIRE510W**

*Applicant:*

**NBS Payment Solutions Inc.**

703 Evans Ave., Suite 400

Toronto, Ontario

Canada M9C 5E9

**In Accordance With**

**Federal Communications Commission (FCC)**

**Part 15, Subpart C, Section 15.247 Digital Modulation Systems (DTS)**

**UltraTech's File No.: MIS-090F15C247**

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

Date: July 24, 2012

Report Prepared by: Dan Huynh

Tested by: Mr. Hung Trinh

Issued Date: July 24, 2012

Test Dates: March 6 - 30, 2012

*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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FCC

91038



1309



46390-2049



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.
<b>Test Procedures:</b>	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
<b>Environmental Classification:</b>	<input checked="" type="checkbox"/> Commercial, industrial or business environment <input type="checkbox"/> Residential environment

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

None.

### 1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2011	Code of Federal Regulations (CFR), Title 47 – Telecommunication
ANSI C63.4	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 D01 DTS Meas Guidance v01	2012	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

APPLICANT	
<b>Name:</b>	NBS Payment Solutions Inc.
<b>Address:</b>	703 Evans Ave., Suite 400 Toronto, ON Canada M9C 5E9
<b>Contact Person:</b>	Mr. Eric Babbitt Phone #: 416-621-7410 x567 Fax #: 416-621-2450 Email Address: ebabbitt@nbsps.com

MANUFACTURER	
<b>Name:</b>	NBS Payment Solutions Inc.
<b>Address:</b>	703 Evans Ave., Suite 400 Toronto, ON Canada M9C 5E9
<b>Contact Person:</b>	Mr. Eric Babbitt Phone #: 416-621-7410 x567 Fax #: 416-621-2450 Email Address: ebabbitt@nbsps.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>	NBS Payment Solutions Inc.
<b>Product Name:</b>	NOIRE510
<b>Model Name or Number:</b>	NOIRE510W
<b>Serial Number:</b>	Test sample
<b>Type of Equipment:</b>	Digital Transmission System (DTS)
<b>Input Power Supply Type:</b>	Lithium Battery 3.7V/2600mAh or AC adapter 9 VDC/3.33A
<b>Primary User Functions of EUT:</b>	Point of Sale credit/debit financial transactions

## 2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	Lithium Battery 3.7V/2600mAh or AC adapter 9 VDC/3.33A
RF Output Power Rating:	802.11g: 24.66 dBm peak conducted 802.11n: 24.44 dBm peak conducted
Operating Frequency Range:	2412 – 2462 MHz
RF Output Impedance:	50 $\Omega$
Modulation Type:	OFDM
Antenna Connector Type:	Integral
Antenna Description:	Manufacturer: Airgain Type: PCB Antenna Model No.: N2420 Freq. Range: 2.4 to 2.49 GHz Gain: 3.8 dBi

## 2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	*USB Port	1	Mini USB Type B	Shielded
2	*Serial RS232 Port	1	Hirose MQ172-3PA	Shielded
3	Power Input	1	Hirose: MQ172X-4PA	1m, Non-shielded

\* Not used in normal operation.

## 2.5. 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:	AC/DC Power Adapter
Brand name:	FSP Group Inc.
Model Name or Number:	FSP030-DGAA2
Connected to EUT's Port:	Power Port

### 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:	AC adapter 9 VDC/3.33A

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

<b>Operating Modes:</b>	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
<b>Special Test Software:</b>	Special software provided by the Applicant to operate the EUT at each channel frequency continuously and in the range of typical modes of operation.
<b>Special Hardware Used:</b>	N/A
<b>Transmitter Test Antenna:</b>	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

<b>Transmitter Test Signals</b>	
<b>Frequency Band(s):</b>	2412 -2462 MHz
<b>Frequency(ies) Tested:</b>	2412 MHz, 2437 MHz and 2462 MHz
<b>RF Power Output:</b> (measured maximum output power at antenna terminals)	802.11g: 24.66 dBm peak conducted 802.11n: 24.44 dBm peak conducted
<b>Normal Test Modulation:</b>	OFDM
<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	RF Exposure	Yes

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

None.

#### ULTRATECH GROUP OF LABS

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## EXHIBIT 5. TEST DATA

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

#### 5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

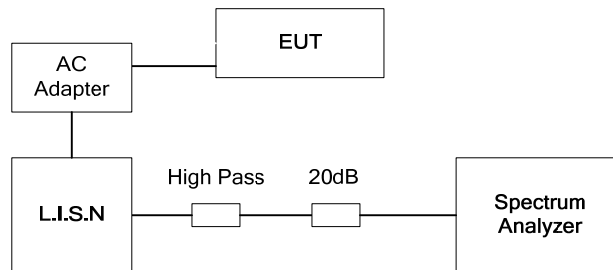
Frequency of emission (MHz)	Conducted Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15–0.5 .....	66 to 56* .....	56 to 46*
0.5–5 .....	56 .....	46
5–30 .....	60 .....	50

\*Decreases linearly with the logarithm of the frequency

#### 5.1.2. Method of Measurements

ANSI C63.4-2009

#### 5.1.3. Test Arrangement

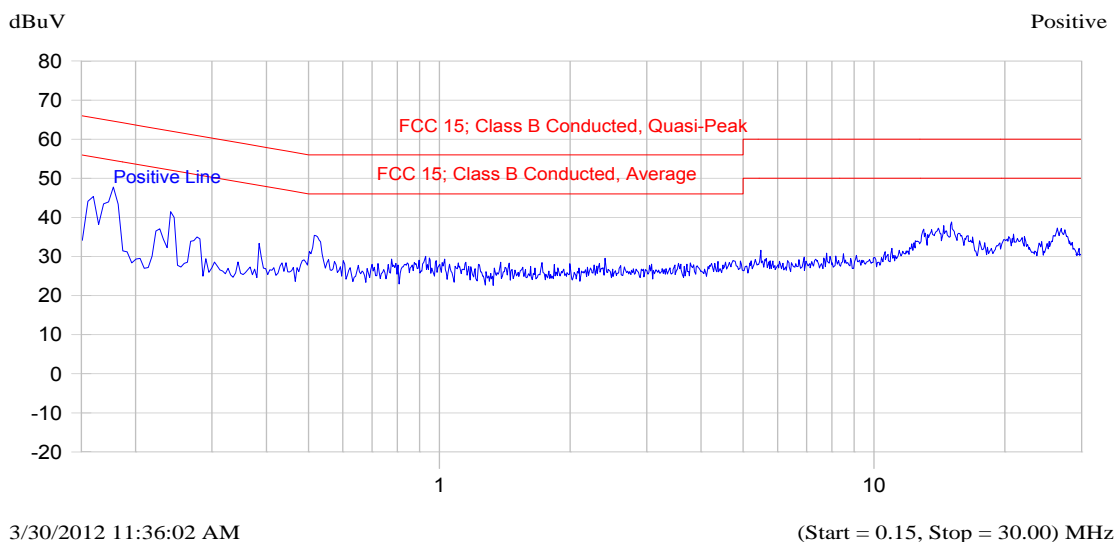




#### 5.1.4. Test Data

Plot 5.1.4.1. Power Line Conducted Emissions; Line Voltage: 120 VAC; Line Tested: Hot

##### Current Graph

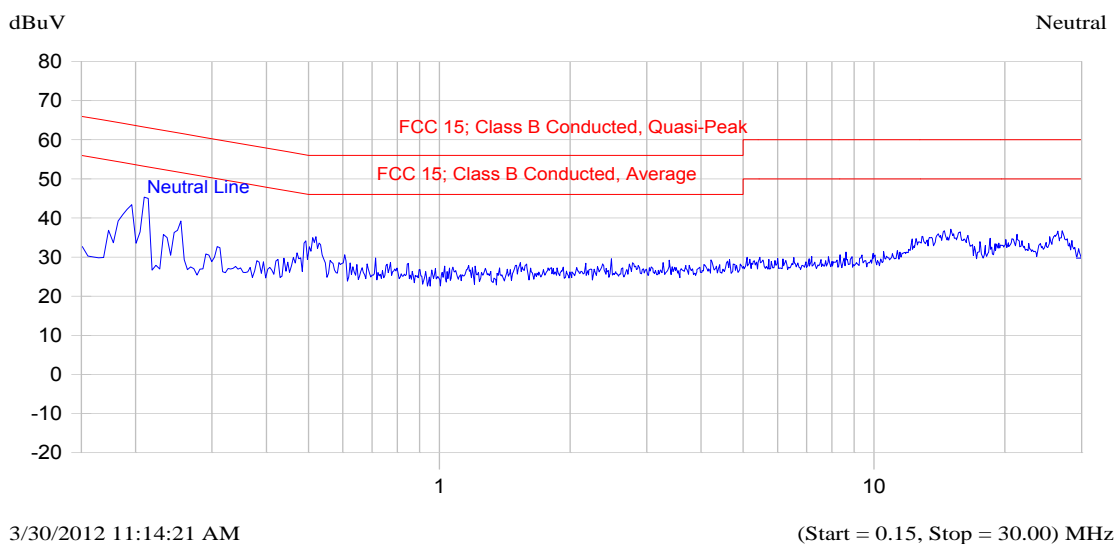


##### Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta dB	QP-QP Limit dB	Avg dBuV	Delta dB	Avg-Avg Limit dB	Trace Name
0.169	51.6	43.1	-22.3		25.4	-30.1		Positive Line
0.237	44.7	35.6	-27.9		20.6	-32.9		Positive Line
0.514	36.0	32.9	-23.1		26.6	-19.4		Positive Line
26.379	38.4	33.3	-26.7		28.2	-21.8		Positive Line

Plot 5.1.4.2. Power Line Conducted Emissions; Line Voltage: 120 VAC; Line Tested: Neutral

### Current Graph



### Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.204	45.3	37.2	-27.2	22.3	-32.1	Neutral Line
0.251	40.0	33.8	-29.3	20.9	-32.2	Neutral Line
0.512	35.9	32.6	-23.4	26.5	-19.5	Neutral Line
27.070	35.8	32.2	-27.8	27.2	-22.8	Neutral Line

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

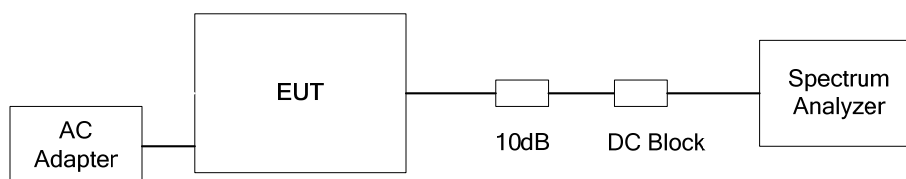
### 5.2.1. Limit(s)

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 5.2.2. Method of Measurements

KDB Publication No. 558074 D01 Section 5.1.1 EBW Measurement Procedure.

### 5.2.3. Test Arrangement

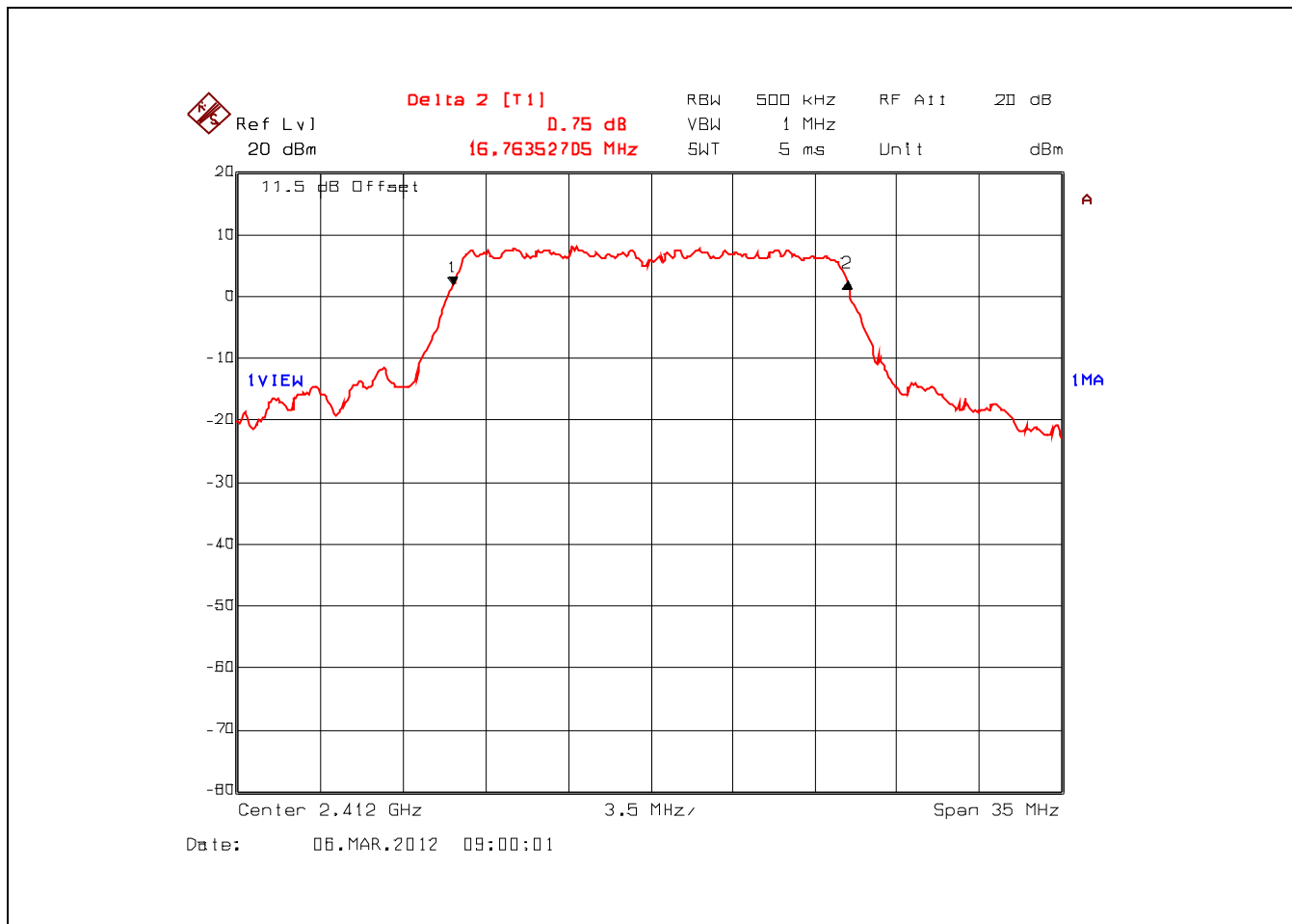


### 5.2.4. Test Data

Modulation	Data Rate (Mbps)	6 dB Bandwidth (MHz)			99% Occupied Bandwidth (MHz)		
		Ch 01 2412 MHz	Ch 06 2437 MHz	Ch 11 2462 MHz	Ch 01 2412 MHz	Ch 06 2437 MHz	Ch 11 2462 MHz
		802.11g					
BPSK	9	16.76	16.76	16.83	17.75	19.64	23.36
QPSK	18	16.76	16.69	16.76	17.46	18.72	22.45
16-QAM	36	16.76	16.76	16.83	17.18	17.54	17.75
64-QAM	54	16.41	16.41	16.41	16.83	16.97	16.97
802.11n							
BPSK 1/2	6.5	17.80	17.80	17.86	18.76	21.56	25.85
QPSK 3/4	19.5	17.88	17.80	17.80	18.52	19.96	23.85
16-QAM 3/4	39	17.56	17.72	17.64	18.04	18.28	18.60
64-QAM 5/6	65	17.80	17.80	17.80	18.04	18.04	18.20

See the following plots for detailed measurements.

Plot 5.2.4.1. 6 dB Bandwidth, 2412 MHz, 802.11g, BPSK @ 9 Mbps



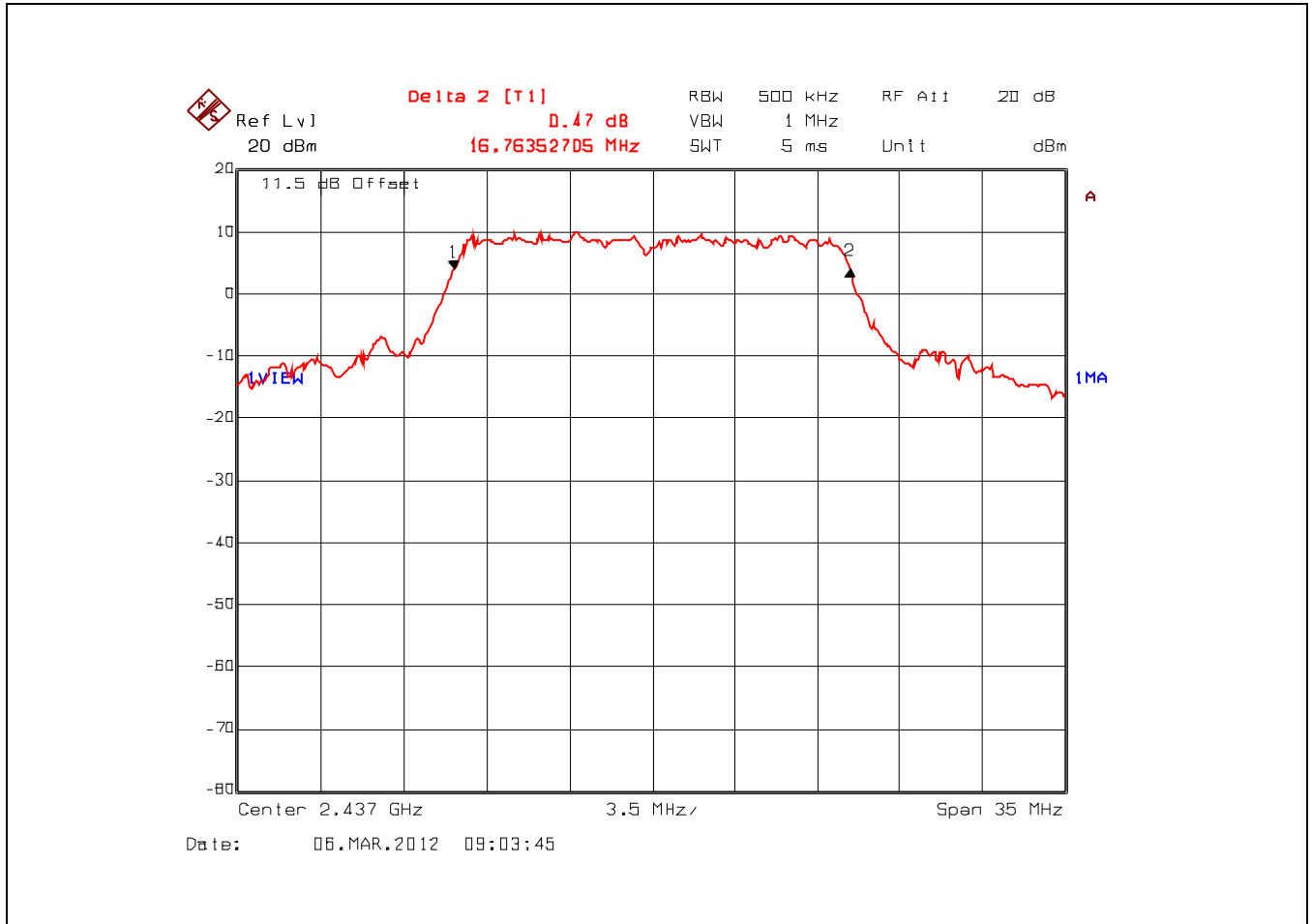
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Plot 5.2.4.2. 6 dB Bandwidth, 2437 MHz, 802.11g, BPSK @ 9 Mbps



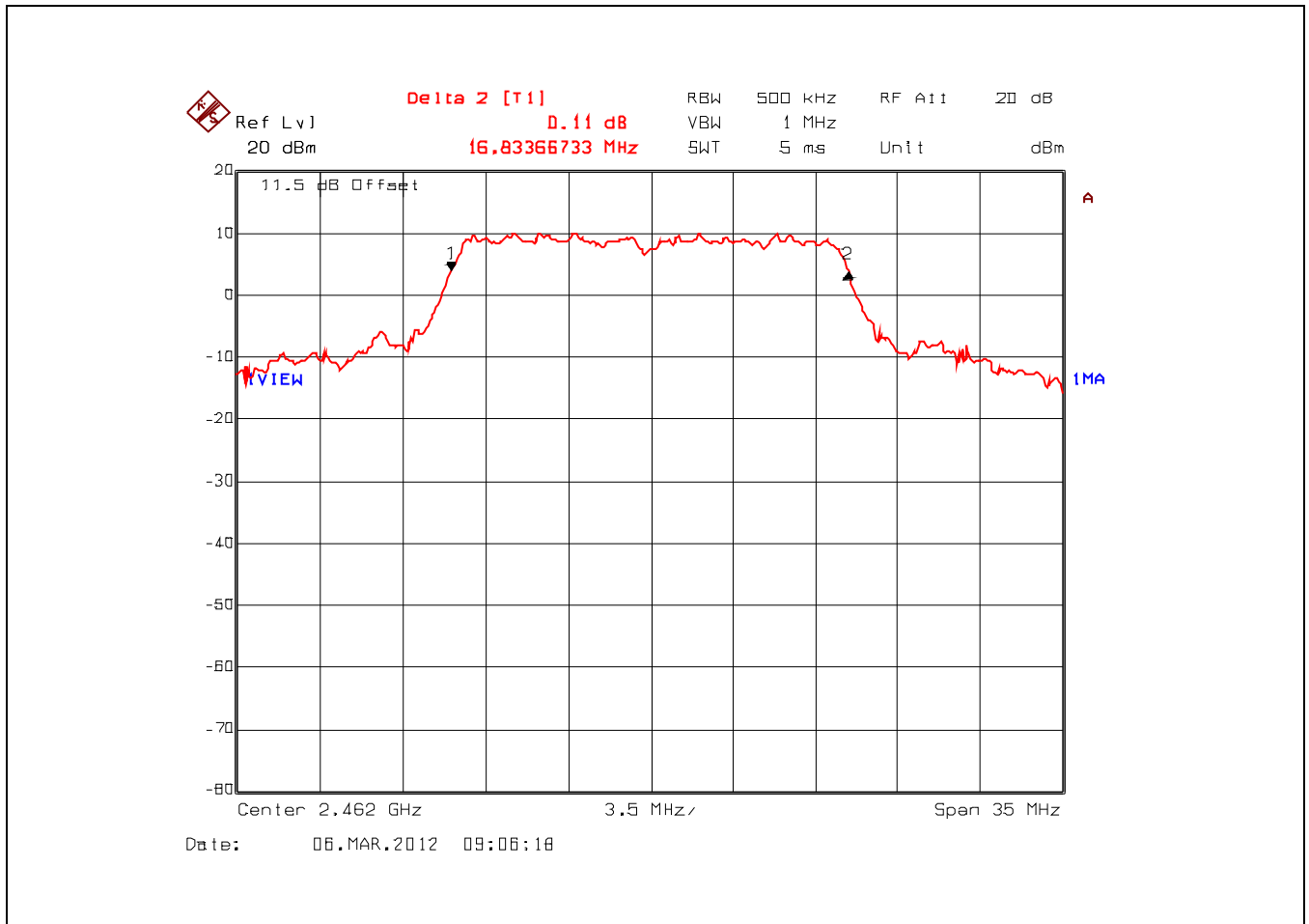
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Plot 5.2.4.3. 6 dB Bandwidth, 2462 MHz, 802.11g, BPSK @ 9 Mbps



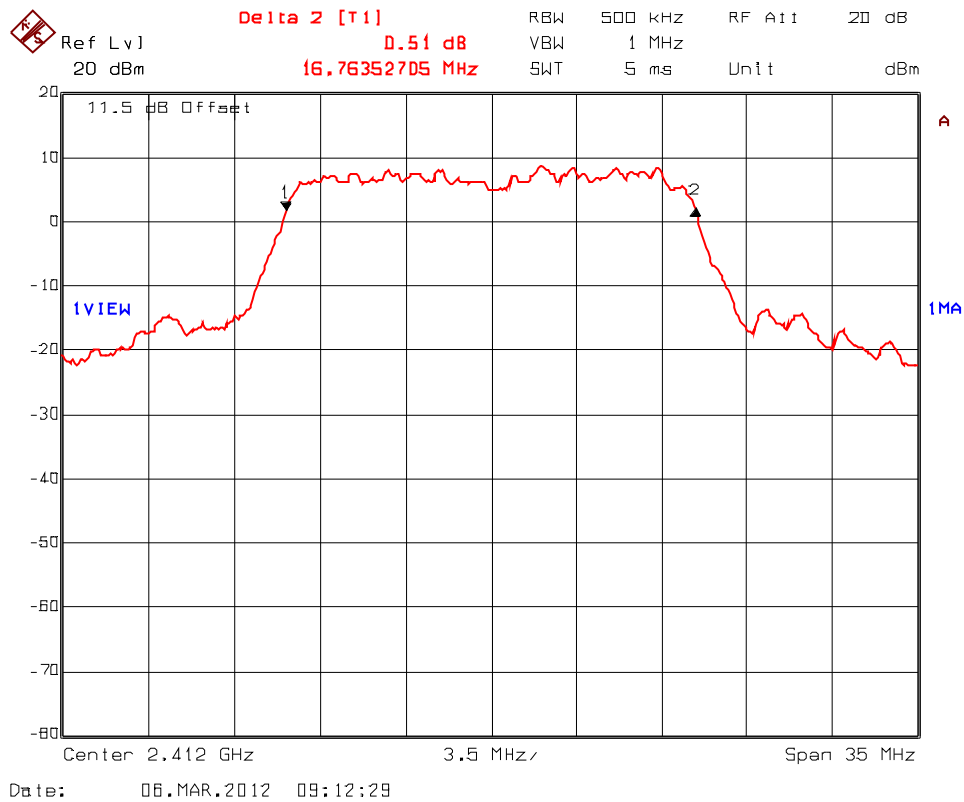
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Plot 5.2.4.4. 6 dB Bandwidth, 2412 MHz, 802.11g, QPSK 18 Mbps



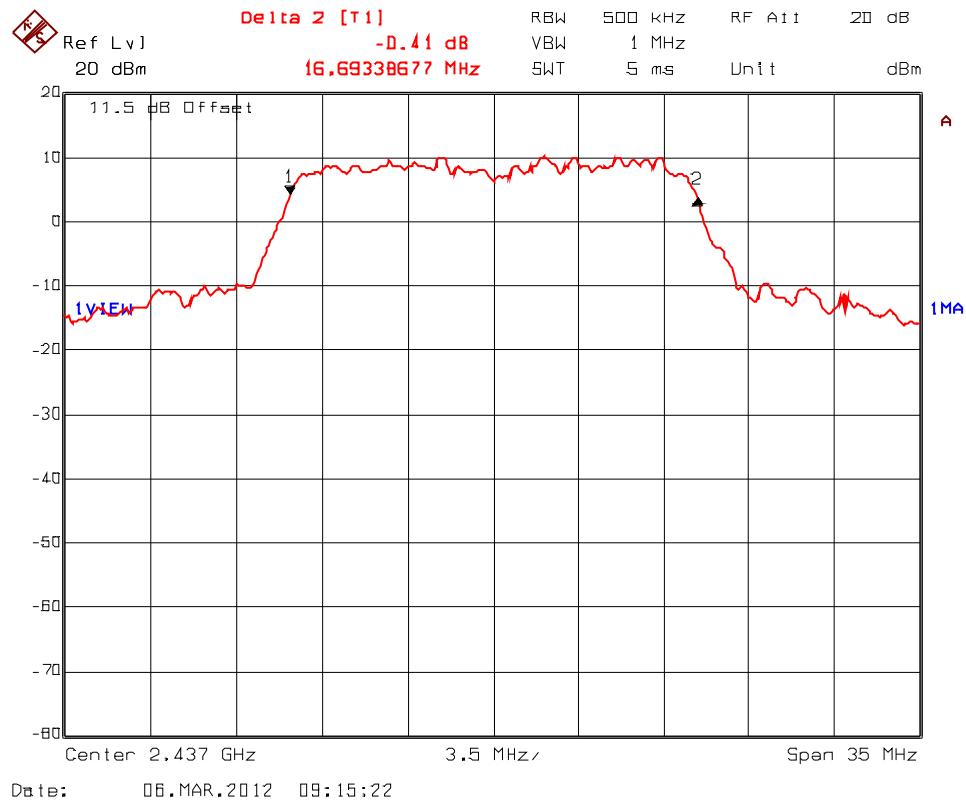
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Plot 5.2.4.5. 6 dB Bandwidth, 2437 MHz, 802.11g, QPSK 18 Mbps



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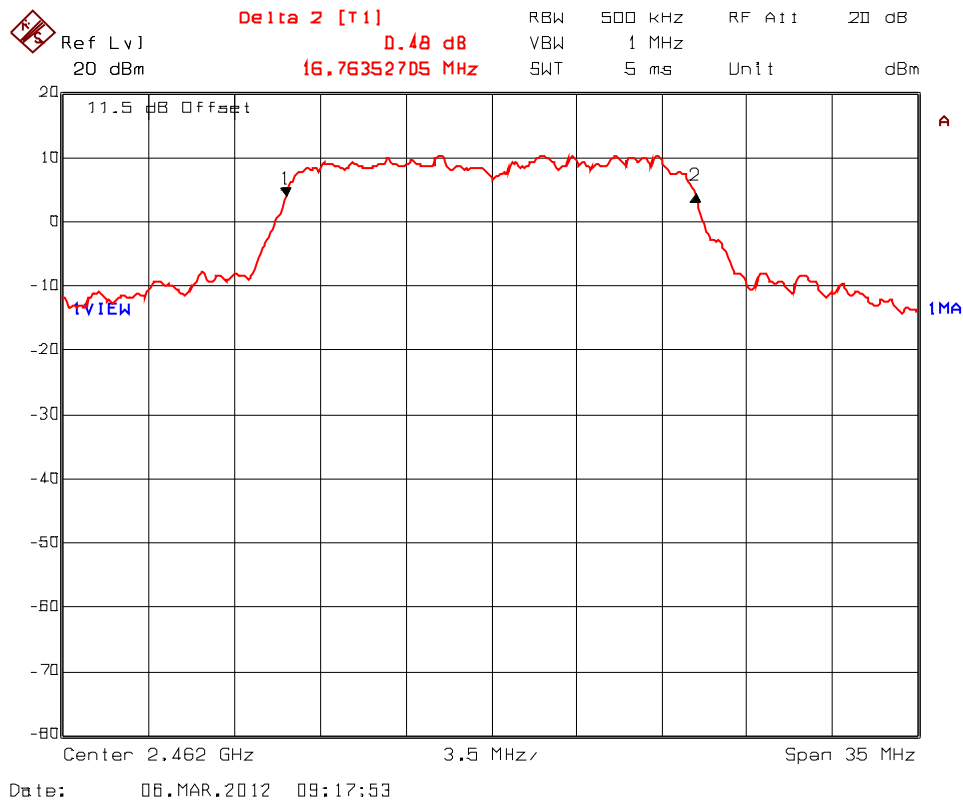
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Plot 5.2.4.6. 6 dB Bandwidth, 2462 MHz, 802.11g, QPSK, 18 Mbps



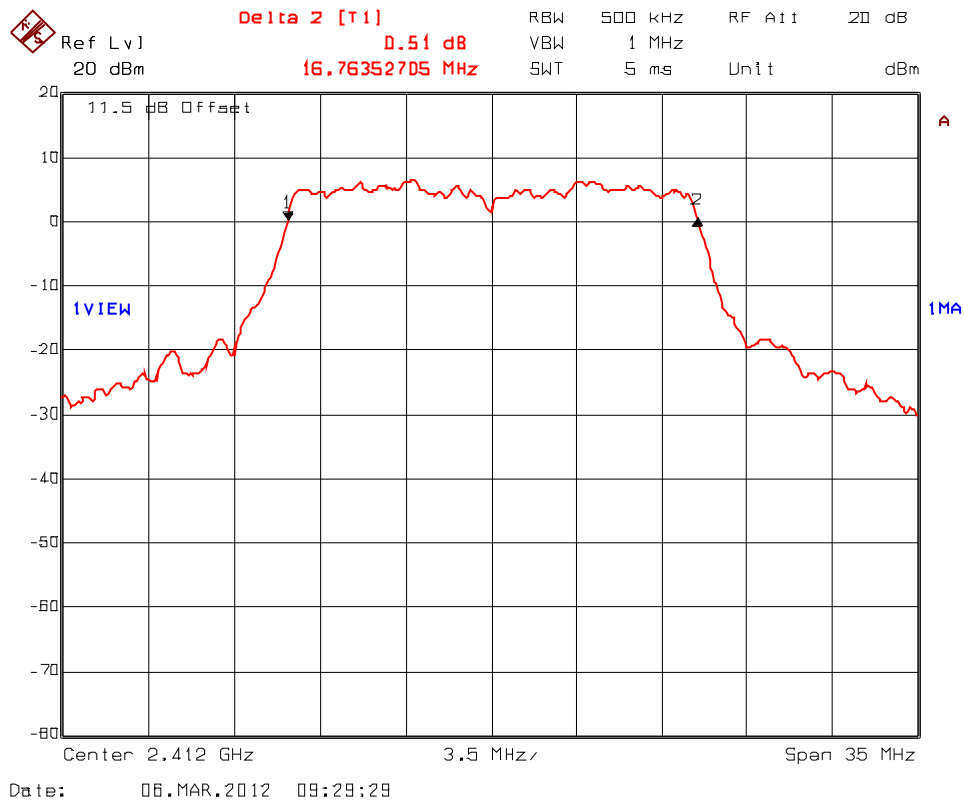
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Plot 5.2.4.7. 6 dB Bandwidth, 2412 MHz, 802.11g, 16-QAM, 36 Mbps



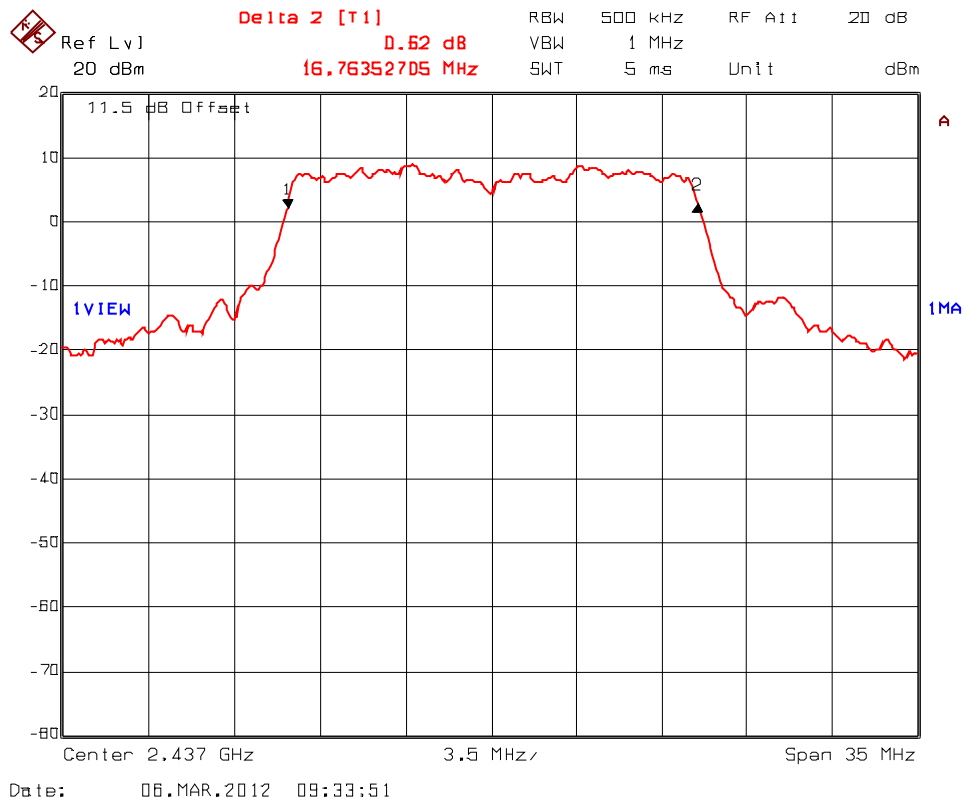
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Plot 5.2.4.8. 6 dB Bandwidth, 2437 MHz, 802.11g, 16-QAM, 36 Mbps



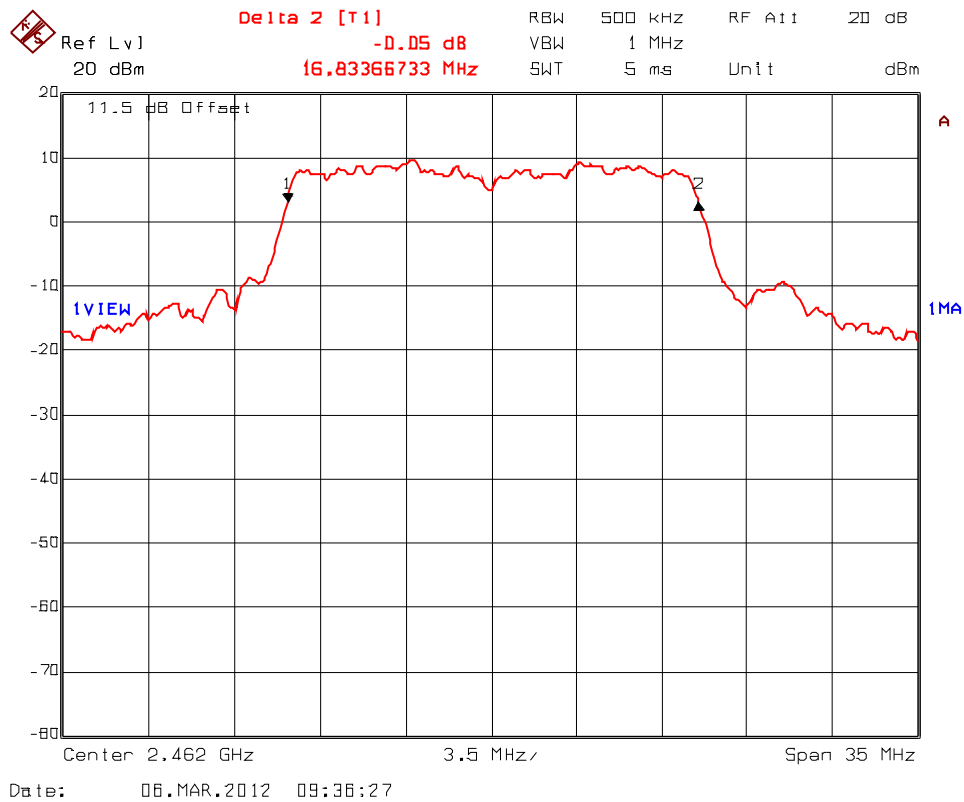
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Plot 5.2.4.9. 6 dB Bandwidth, 2462 MHz, 802.11g, 16-QAM, 36 Mbps



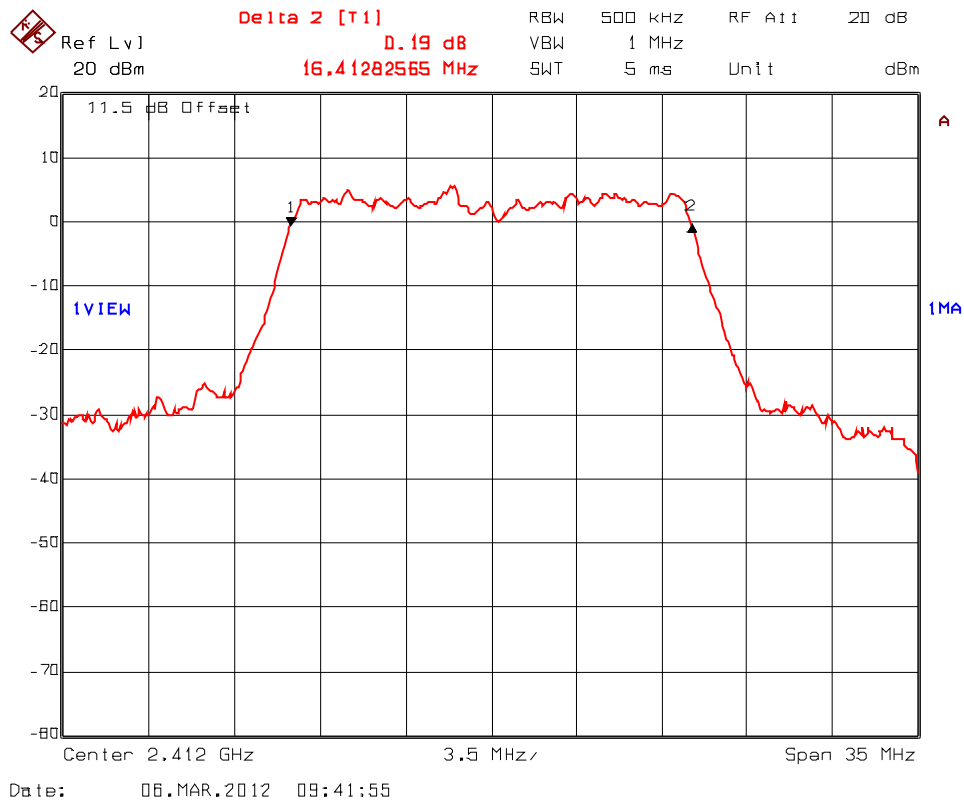
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Plot 5.2.4.10. 6 dB Bandwidth, 2412 MHz, 802.11g, 64-QAM, 54 Mbps



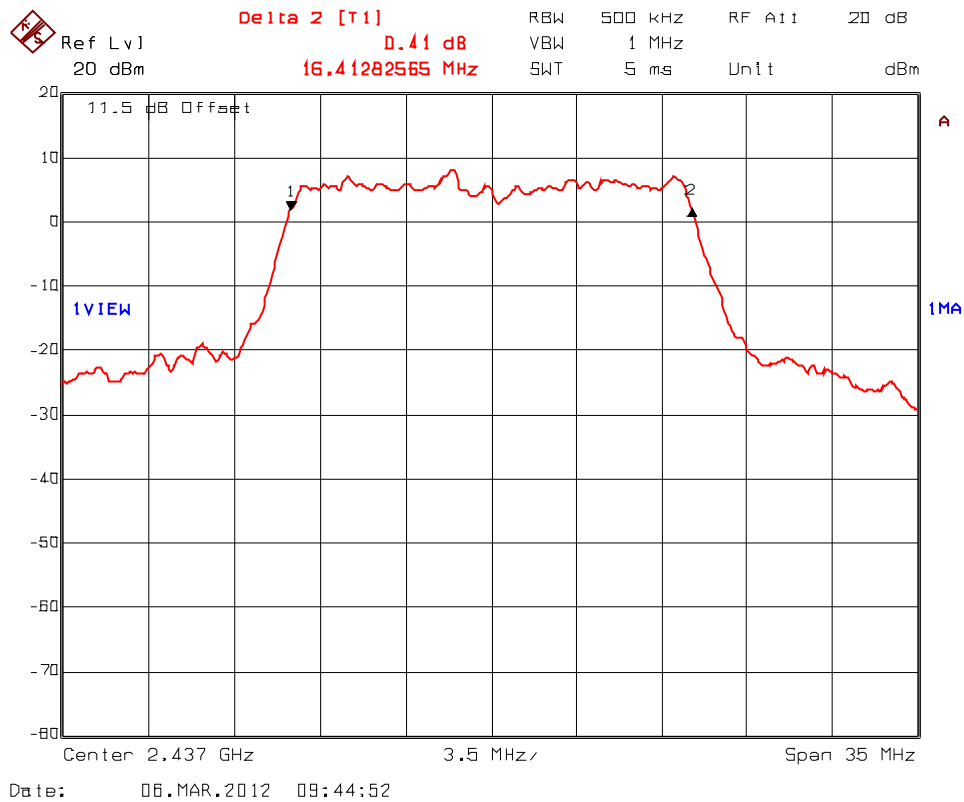
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Plot 5.2.4.11. 6 dB Bandwidth, 2437 MHz, 802.11g, 64-QAM, 54 Mbps



**ULTRATECH GROUP OF LABS**

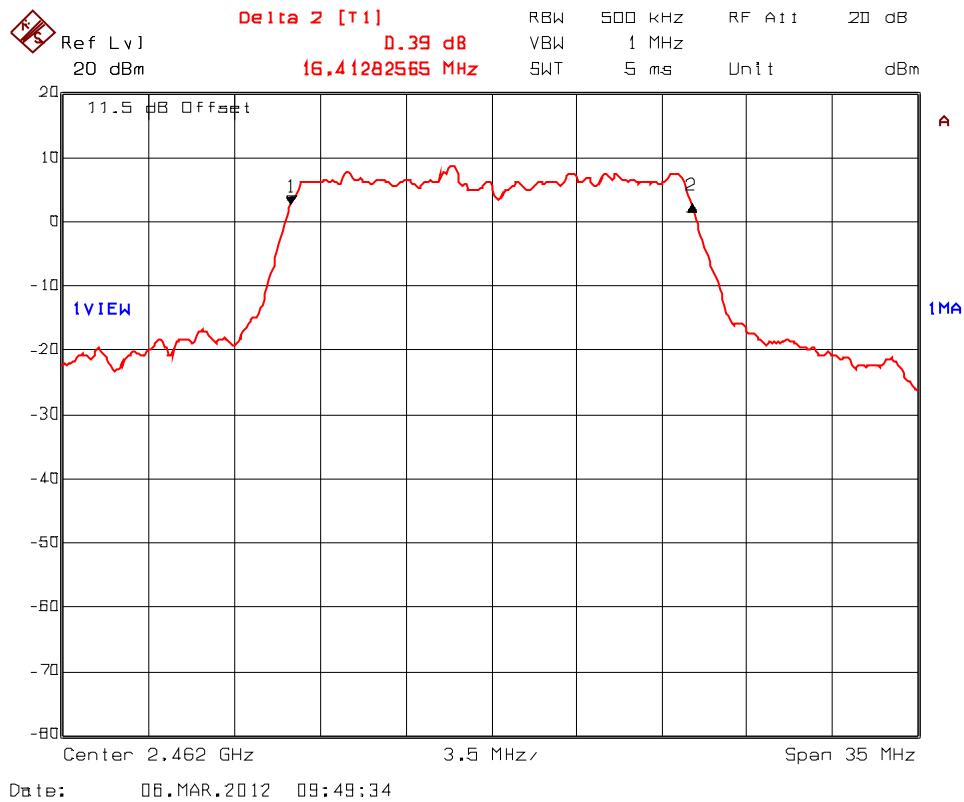
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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Plot 5.2.4.12. 6 dB Bandwidth, 2462 MHz, 802.11g, 64-QAM, 54 Mbps



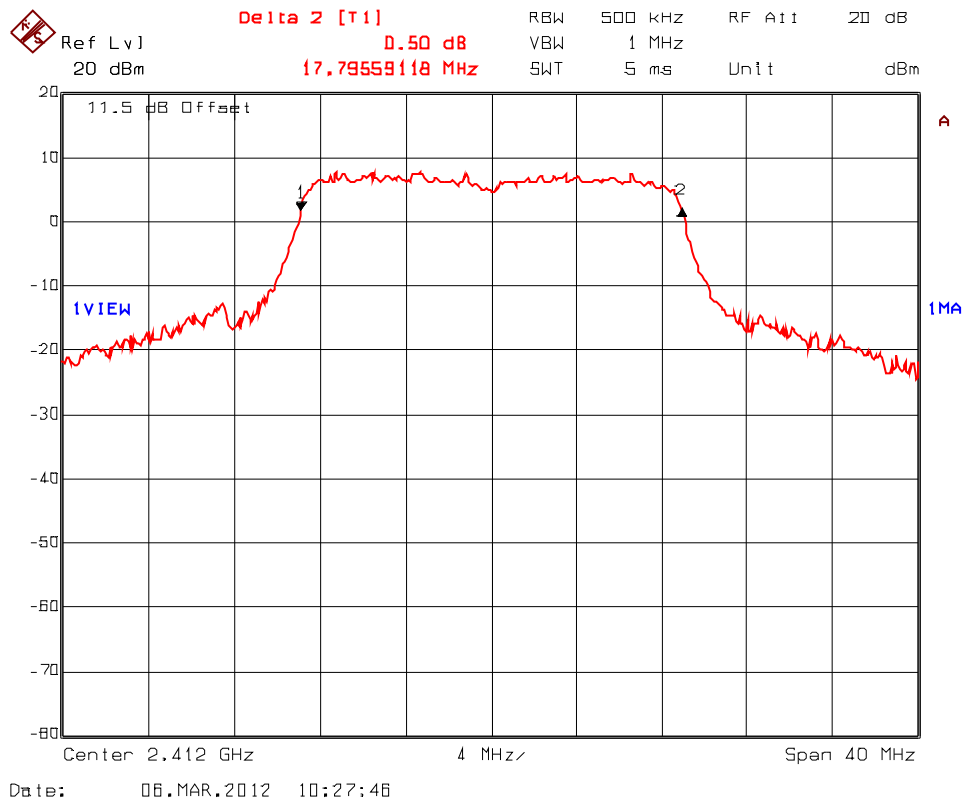
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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Plot 5.2.4.13. 6 dB Bandwidth, 2412 MHz, 802.11n, BPSK 1/2 @ 6.5 Mbps



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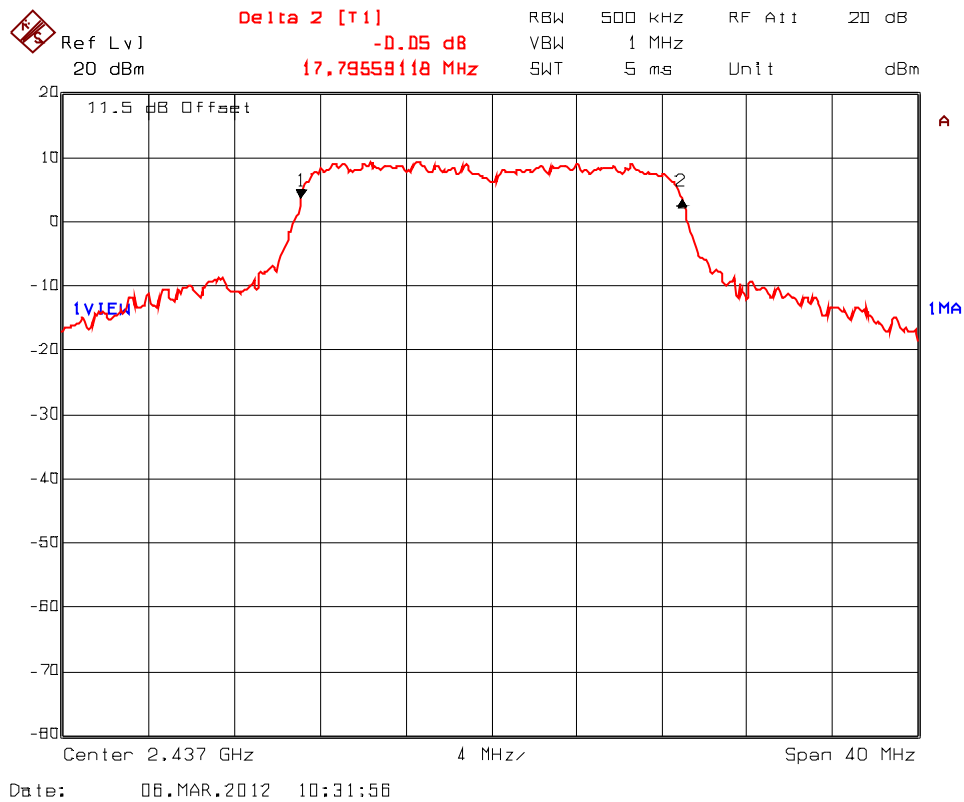
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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Plot 5.2.4.14. 6 dB Bandwidth, 2437 MHz, 802. 11n, BPSK 1/2 @ 6.5 Mbps



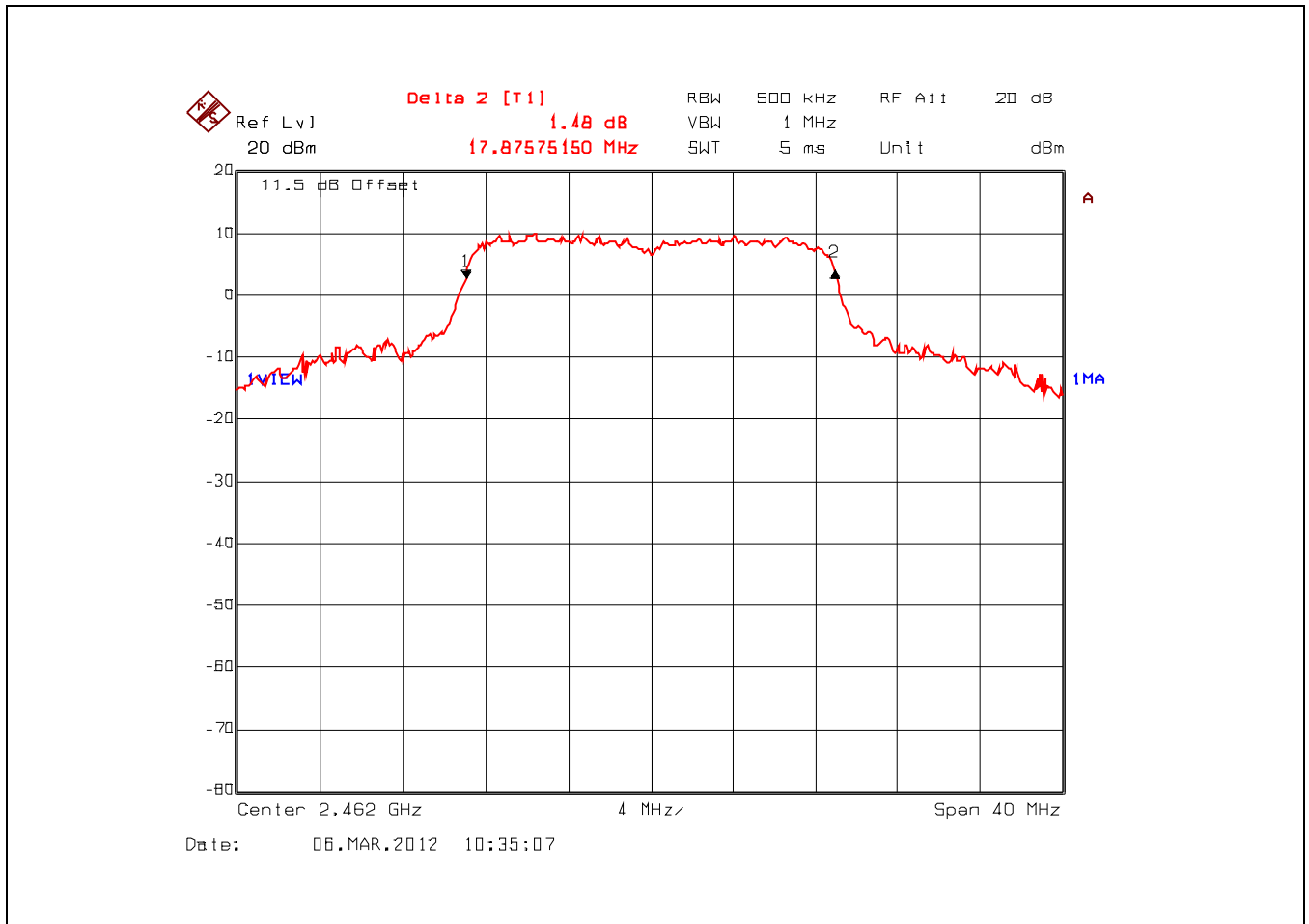
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.15. 6 dB Bandwidth, 2462 MHz, 802. 11n, BPSK 1/2 @ 6.5 Mbps**



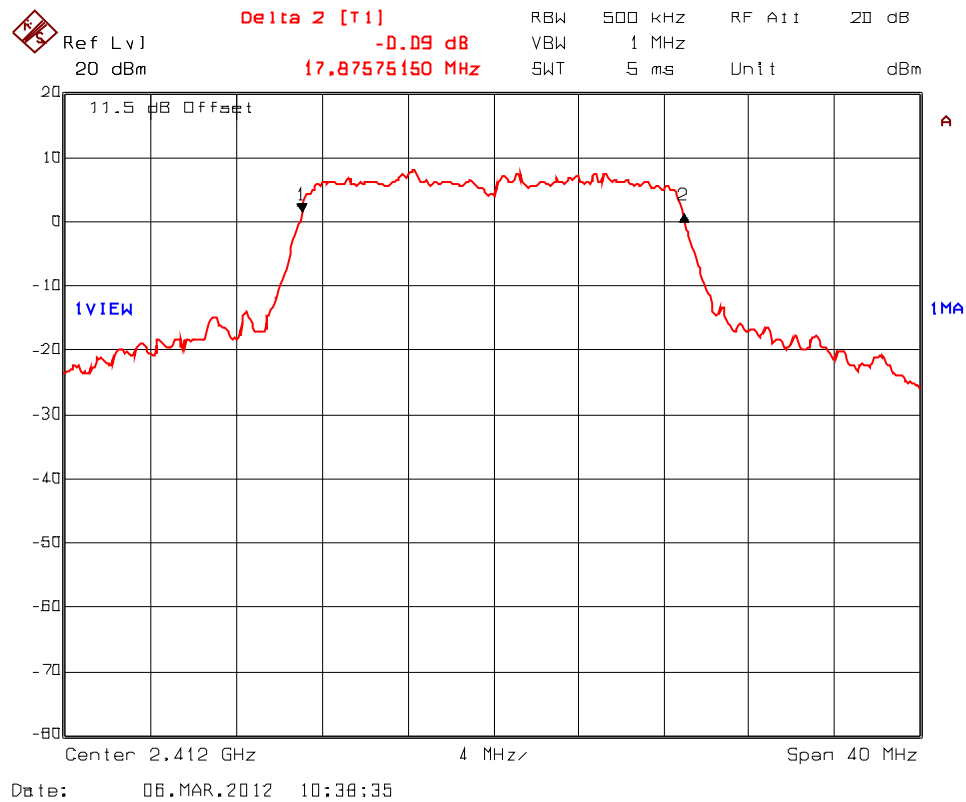
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.16.** 6 dB Bandwidth, 2412 MHz, 802. 11n, QPSK 3/4 19.5 Mbps



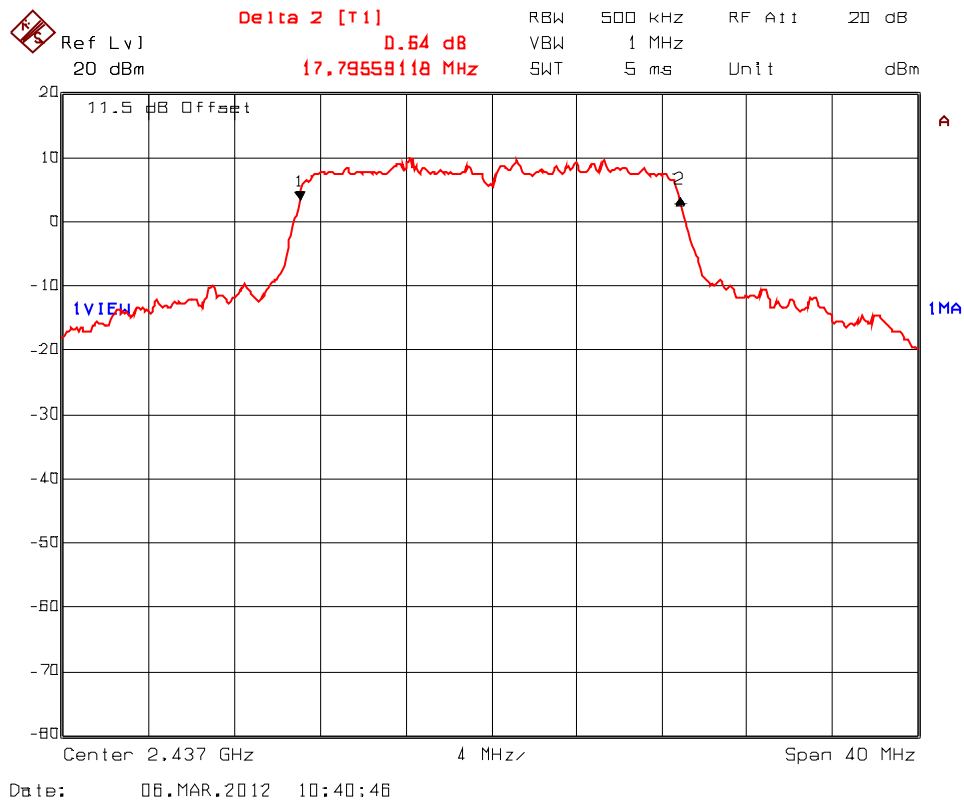
**ULTRATECH GROUP OF LABS**

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 5.2.4.17. 6 dB Bandwidth, 2437 MHz, 802. 11n, QPSK 3/4 19.5 Mbps



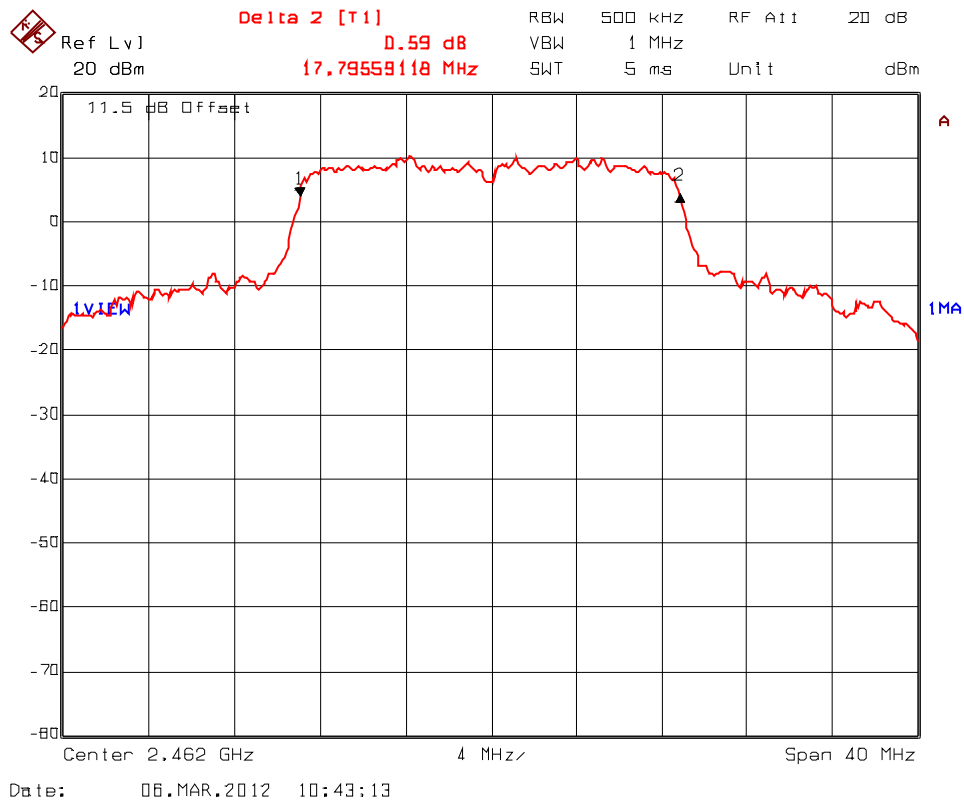
**ULTRATECH GROUP OF LABS**

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 5.2.4.18. 6 dB Bandwidth, 2462 MHz, 802. 11n, QPSK 3/4 19.5 Mbps



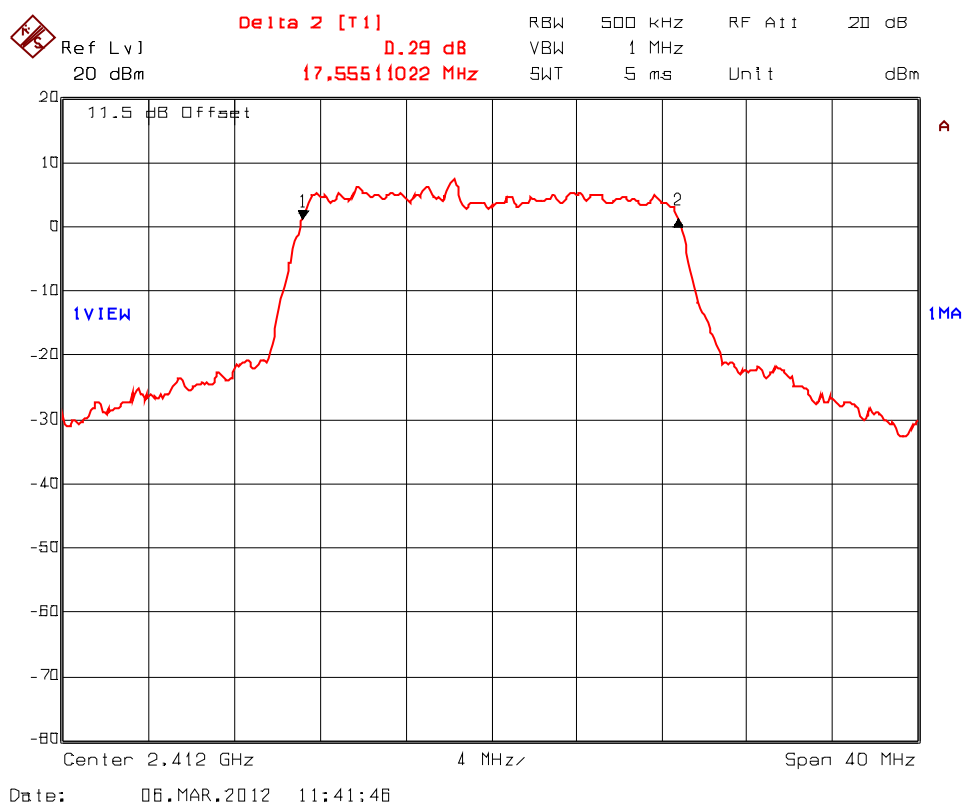
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.19. 6 dB Bandwidth, 2412 MHz, 802. 11n, 16-QAM 3/4 39 Mbps**



**ULTRATECH GROUP OF LABS**

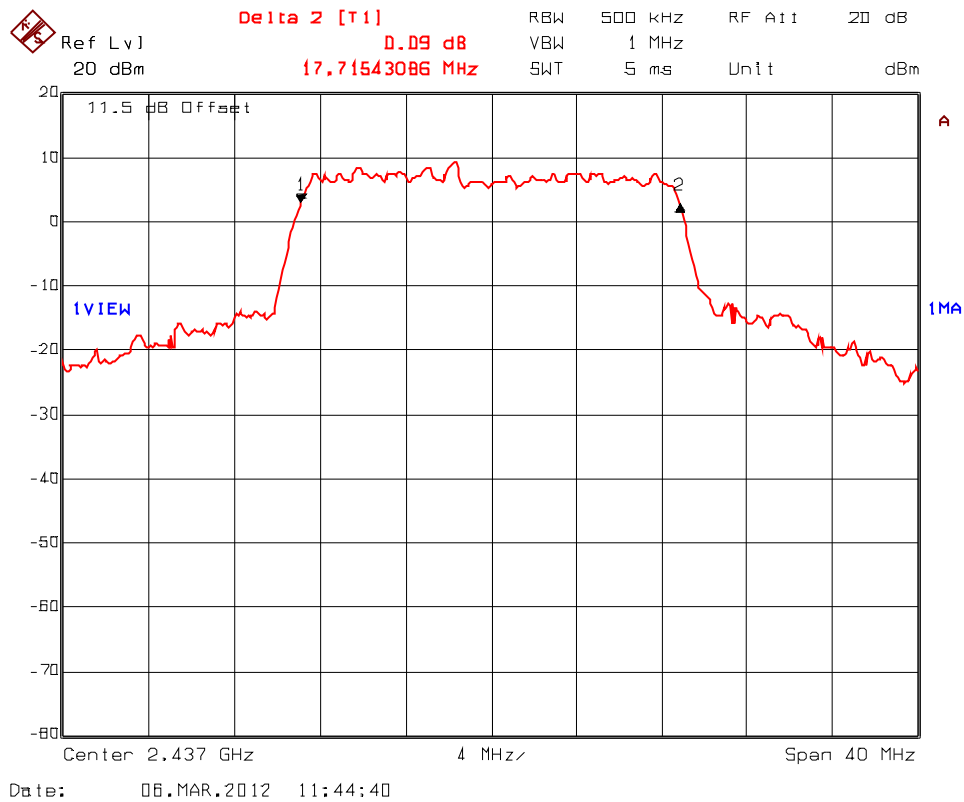
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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Plot 5.2.4.20. 6 dB Bandwidth, 2437 MHz, 802. 11n, 16-QAM 3/4 39 Mbps



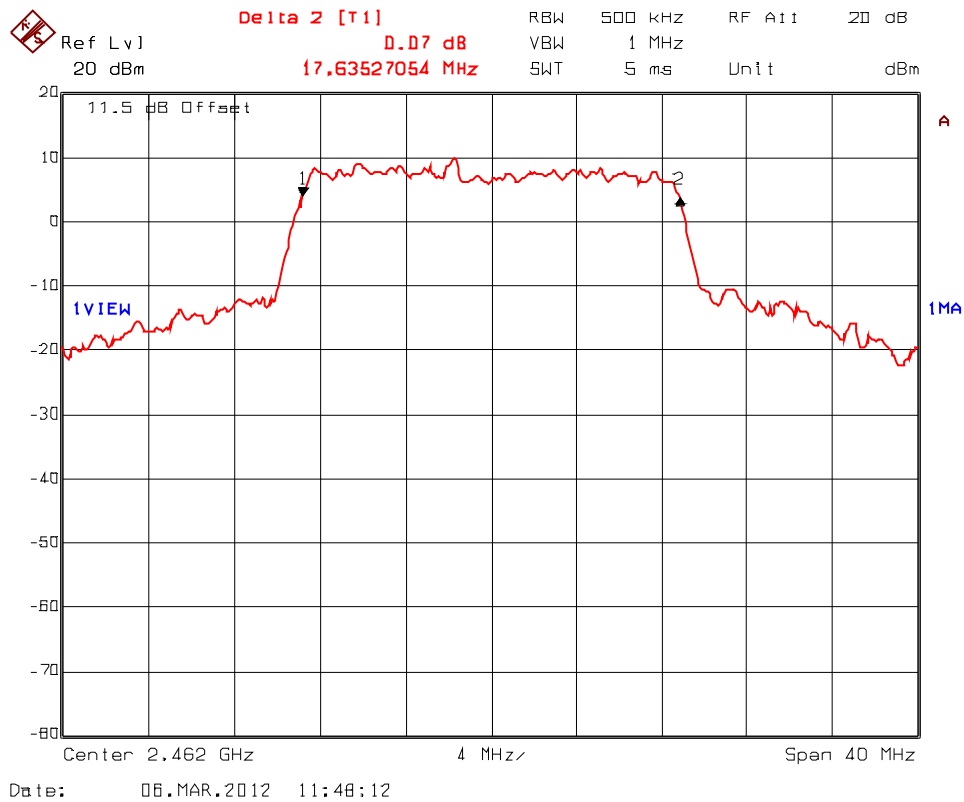
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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Plot 5.2.4.21. 6 dB Bandwidth, 2462 MHz, 802. 11n, 16-QAM 3/4 39 Mbps



**ULTRATECH GROUP OF LABS**

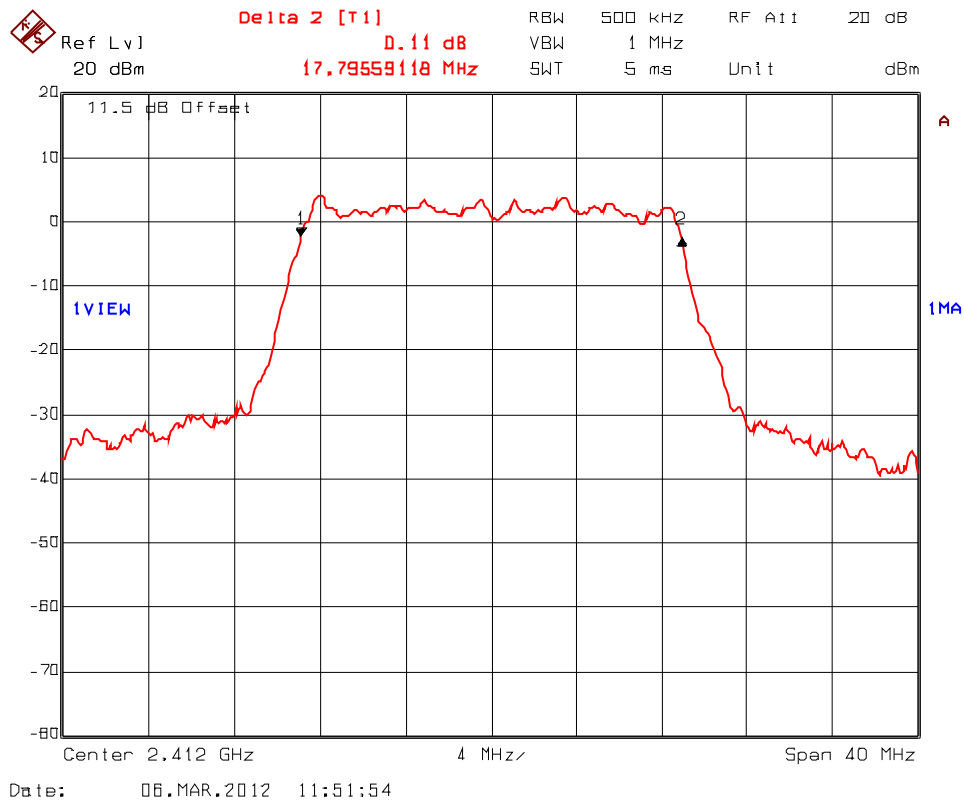
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.22. 6 dB Bandwidth, 2412 MHz, 802. 11n, 64-QAM 5/6 65 Mbps**



**ULTRATECH GROUP OF LABS**

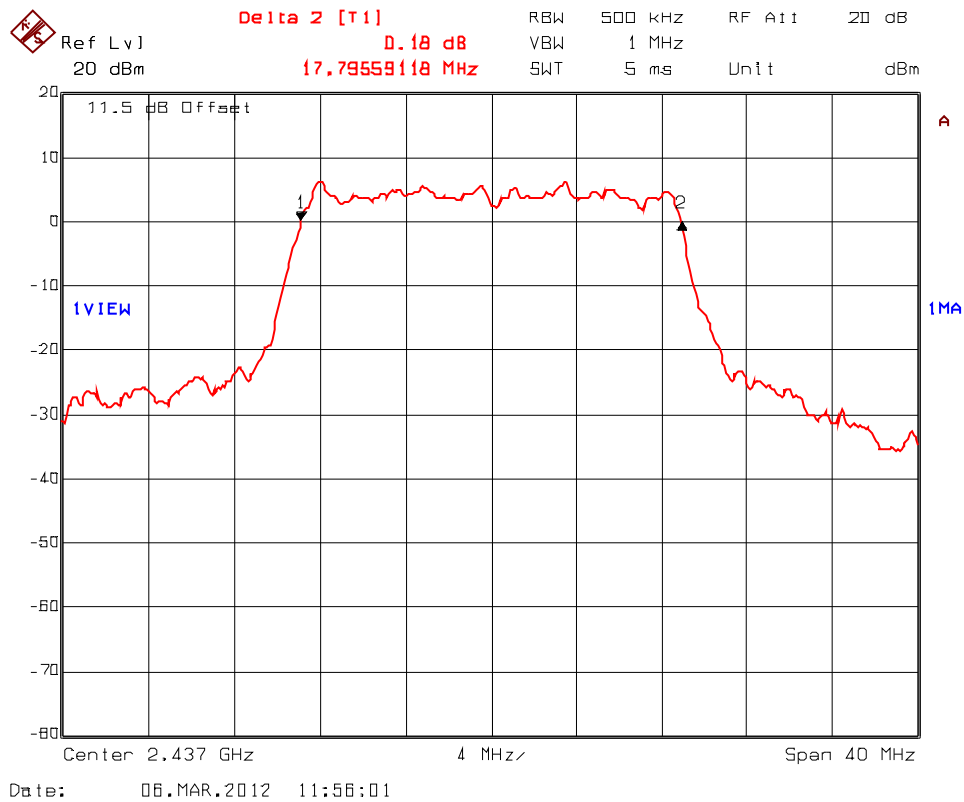
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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Plot 5.2.4.23. 6 dB Bandwidth, 2437 MHz, 802. 11n, 64-QAM 5/6 65 Mbps



ULTRATECH GROUP OF LABS

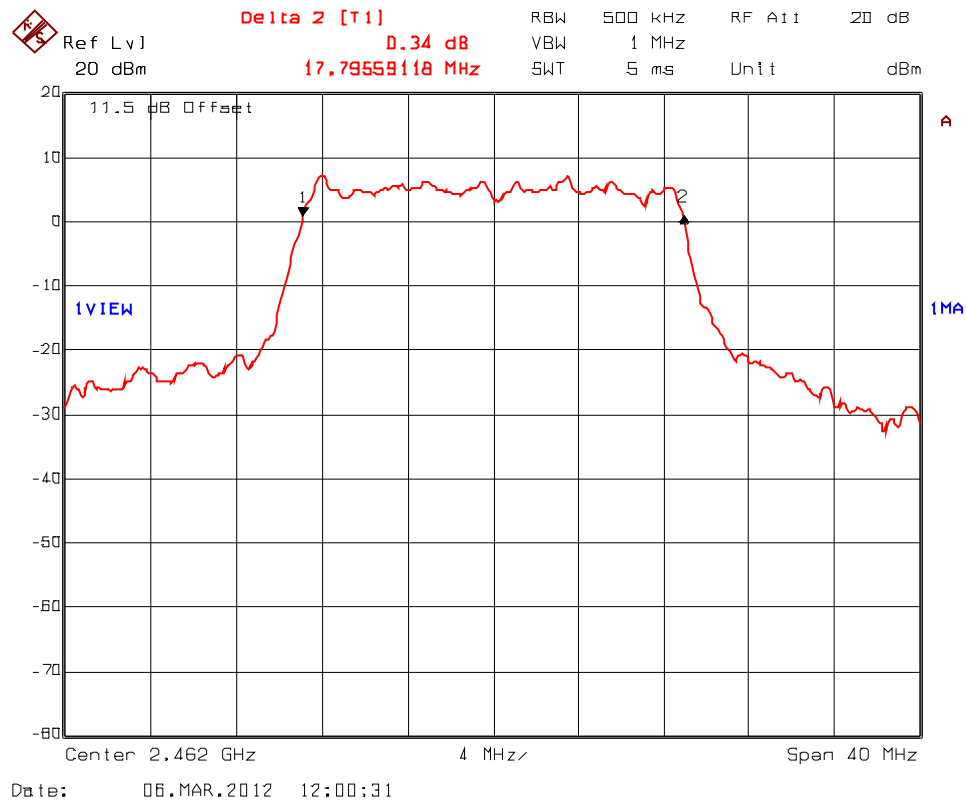
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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Plot 5.2.4.24. 6 dB Bandwidth, 2462 MHz, 802. 11n, 64-QAM 5/6 65 Mbps



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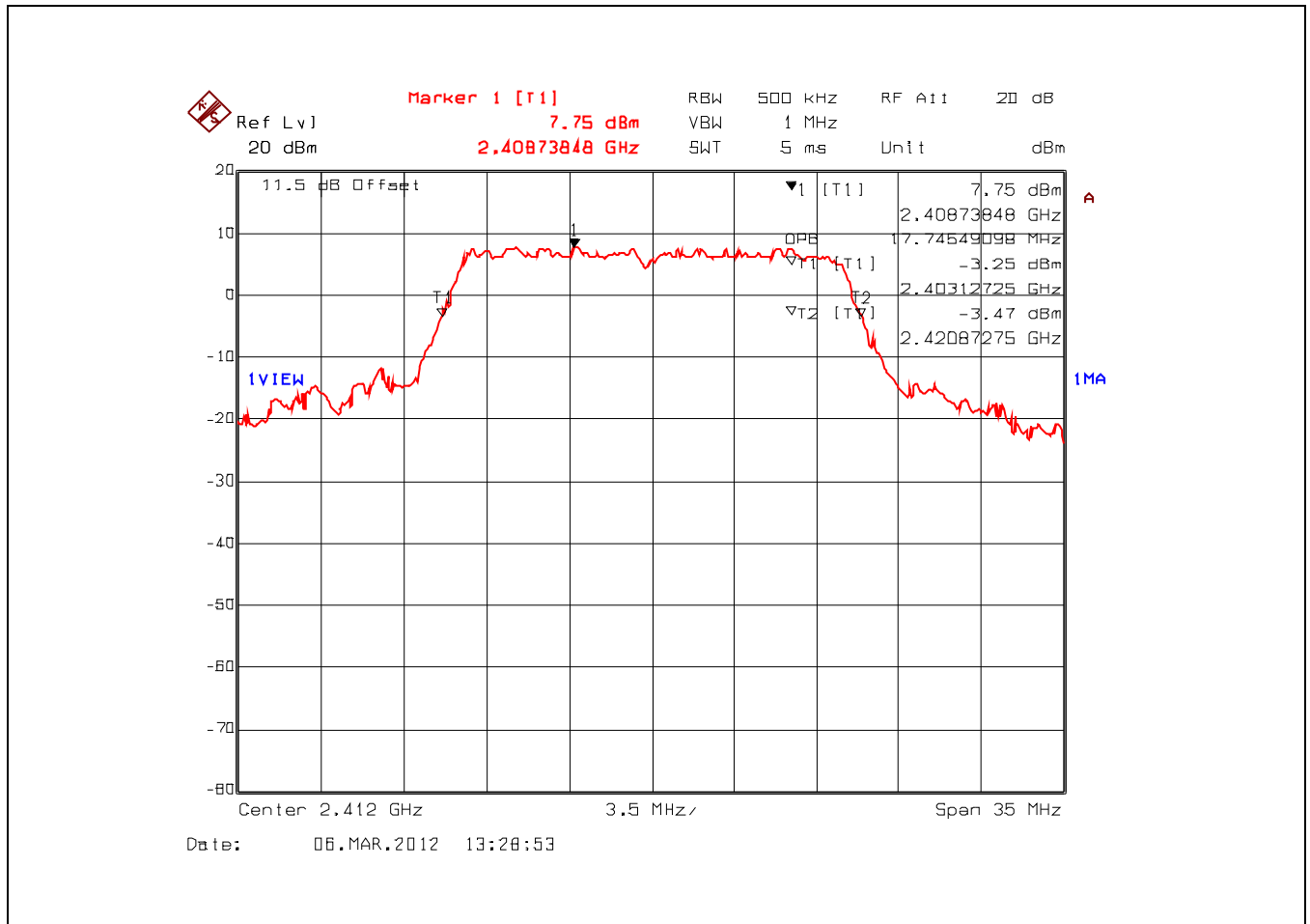
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.25. 99% Occupied Bandwidth, 2412 MHz, 802.11g, BPSK @ 9 Mbps**



**ULTRATECH GROUP OF LABS**

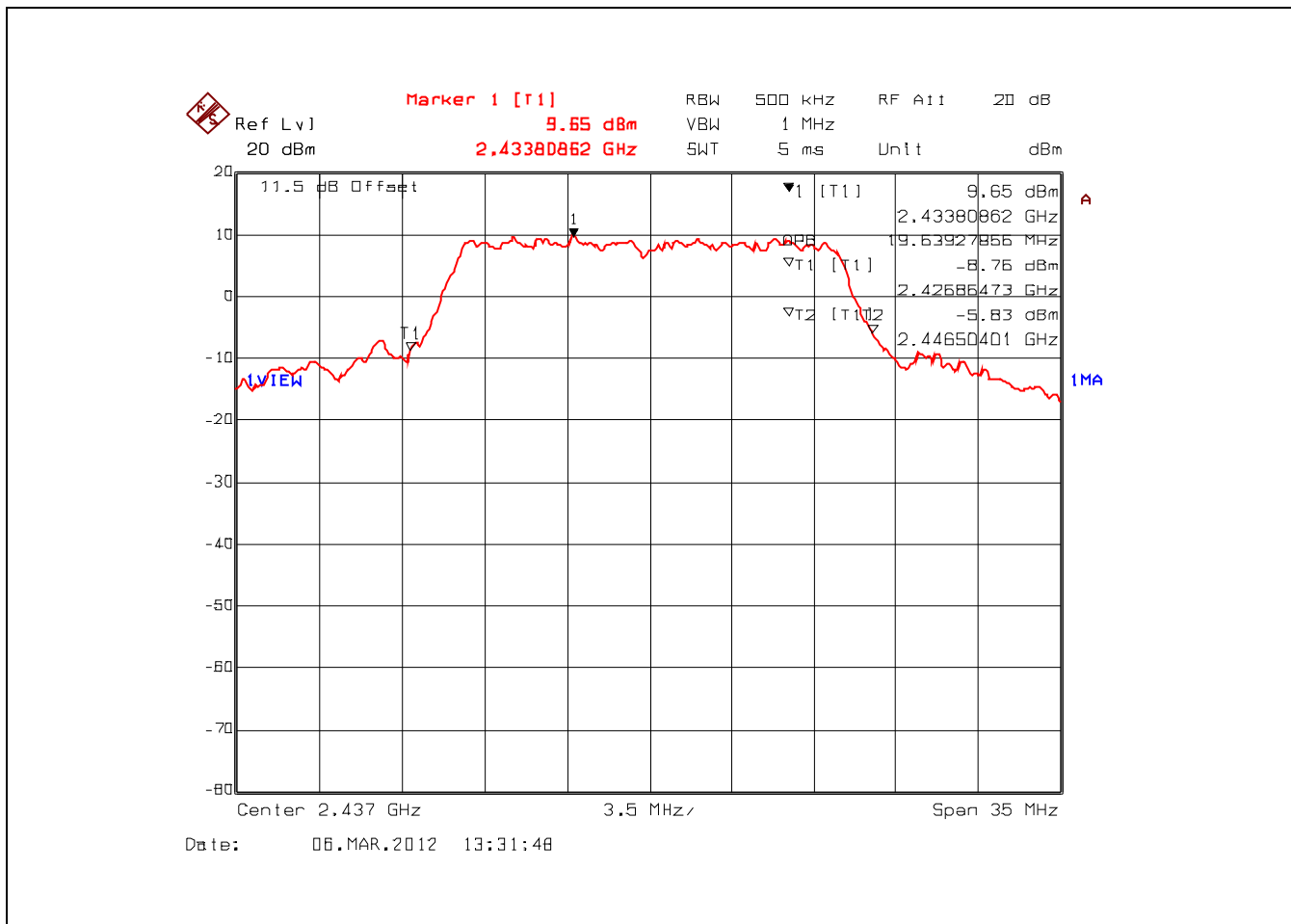
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.26. 99% Occupied Bandwidth, 2437 MHz, 802.11g, BPSK @ 9 Mbps**



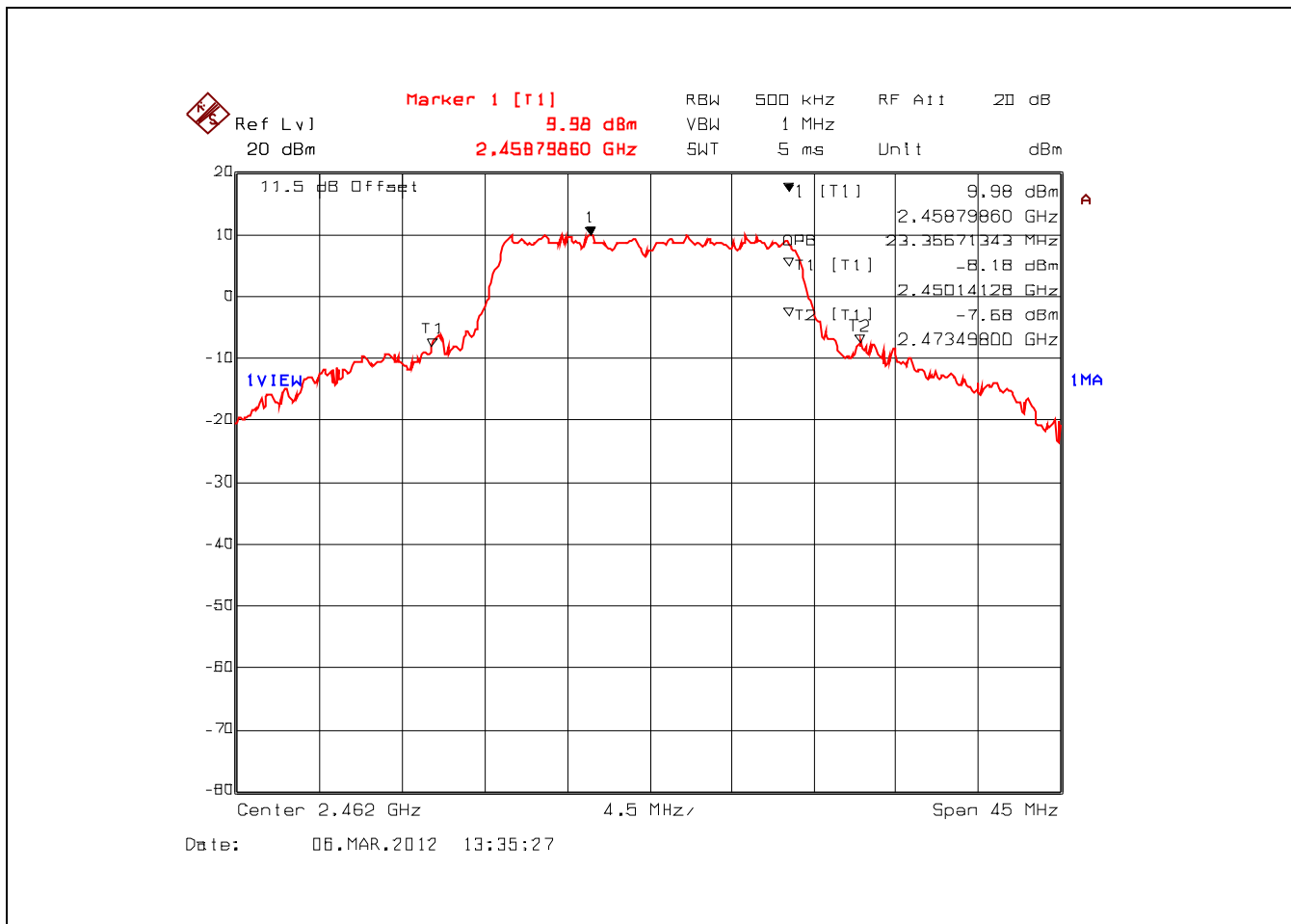
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.27. 99% Occupied Bandwidth, 2462 MHz, 802.11g, BPSK @ 9 Mbps**



**ULTRATECH GROUP OF LABS**

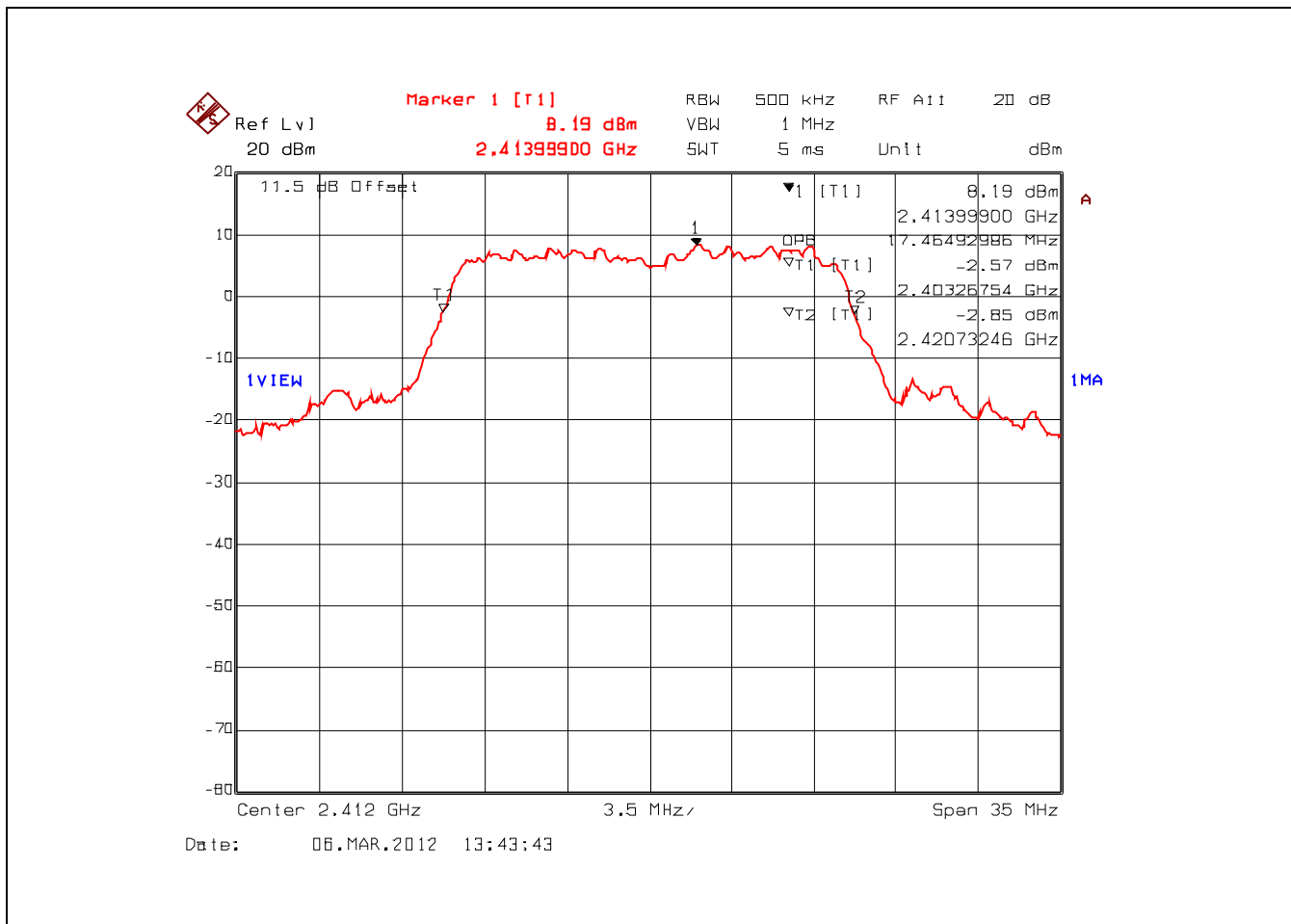
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.28. 99% Occupied Bandwidth, 2412 MHz, 802.11g, QPSK 18 Mbps**



**ULTRATECH GROUP OF LABS**

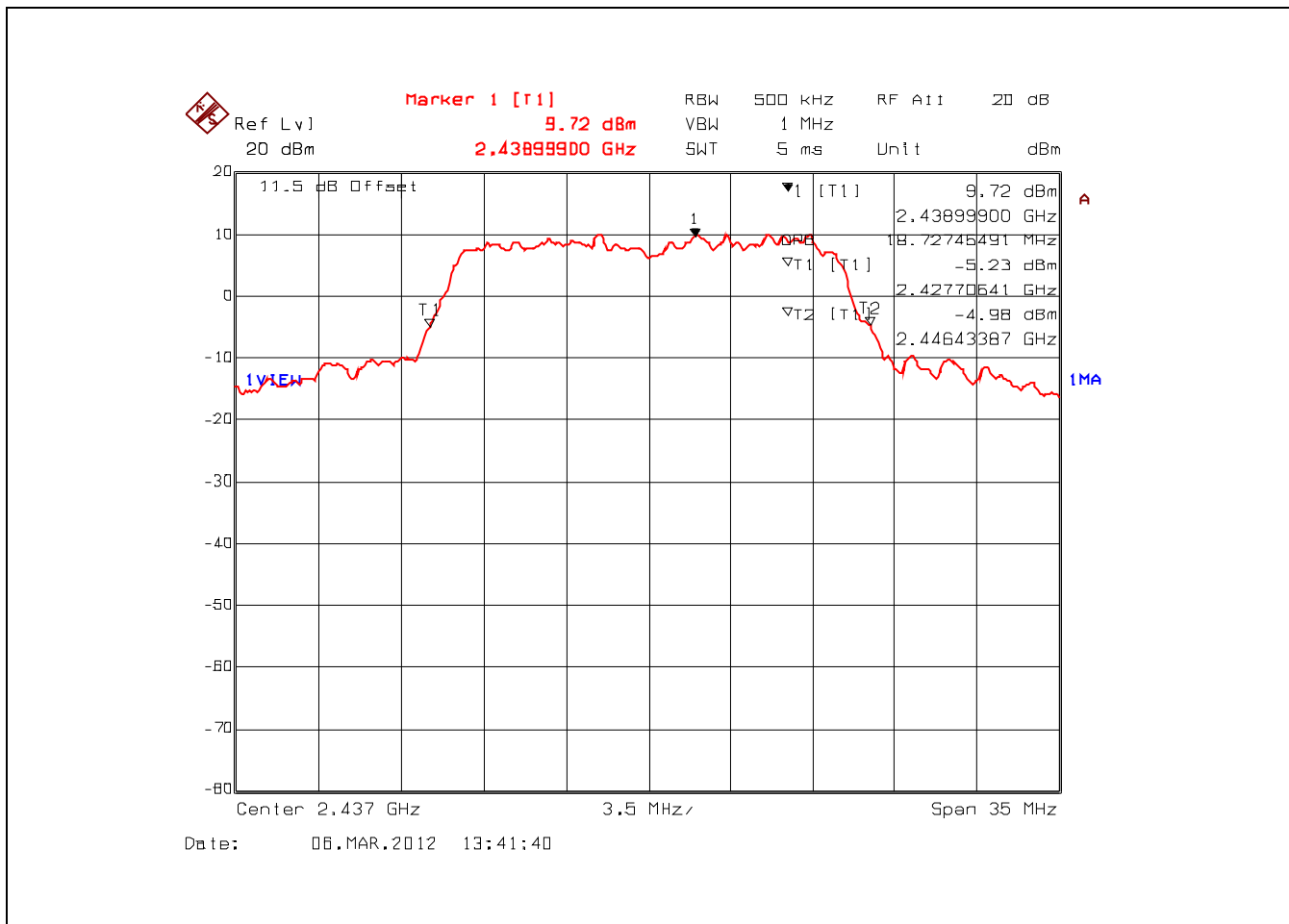
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.29. 99% Occupied Bandwidth, 2437 MHz, 802.11g, QPSK 18 Mbps**



**ULTRATECH GROUP OF LABS**

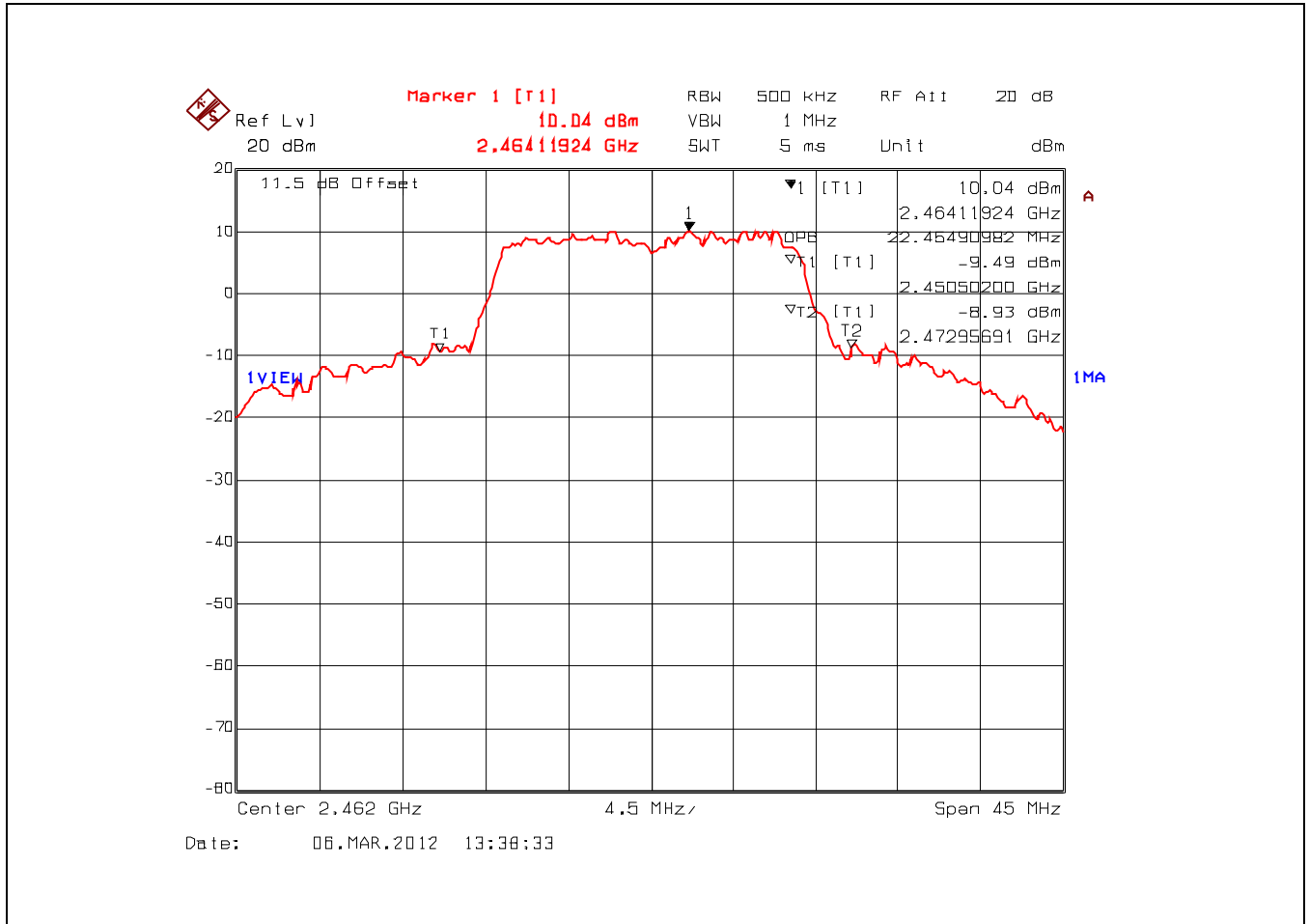
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.30. 99% Occupied Bandwidth, 2462 MHz, 802.11g, QPSK, 18 Mbps**



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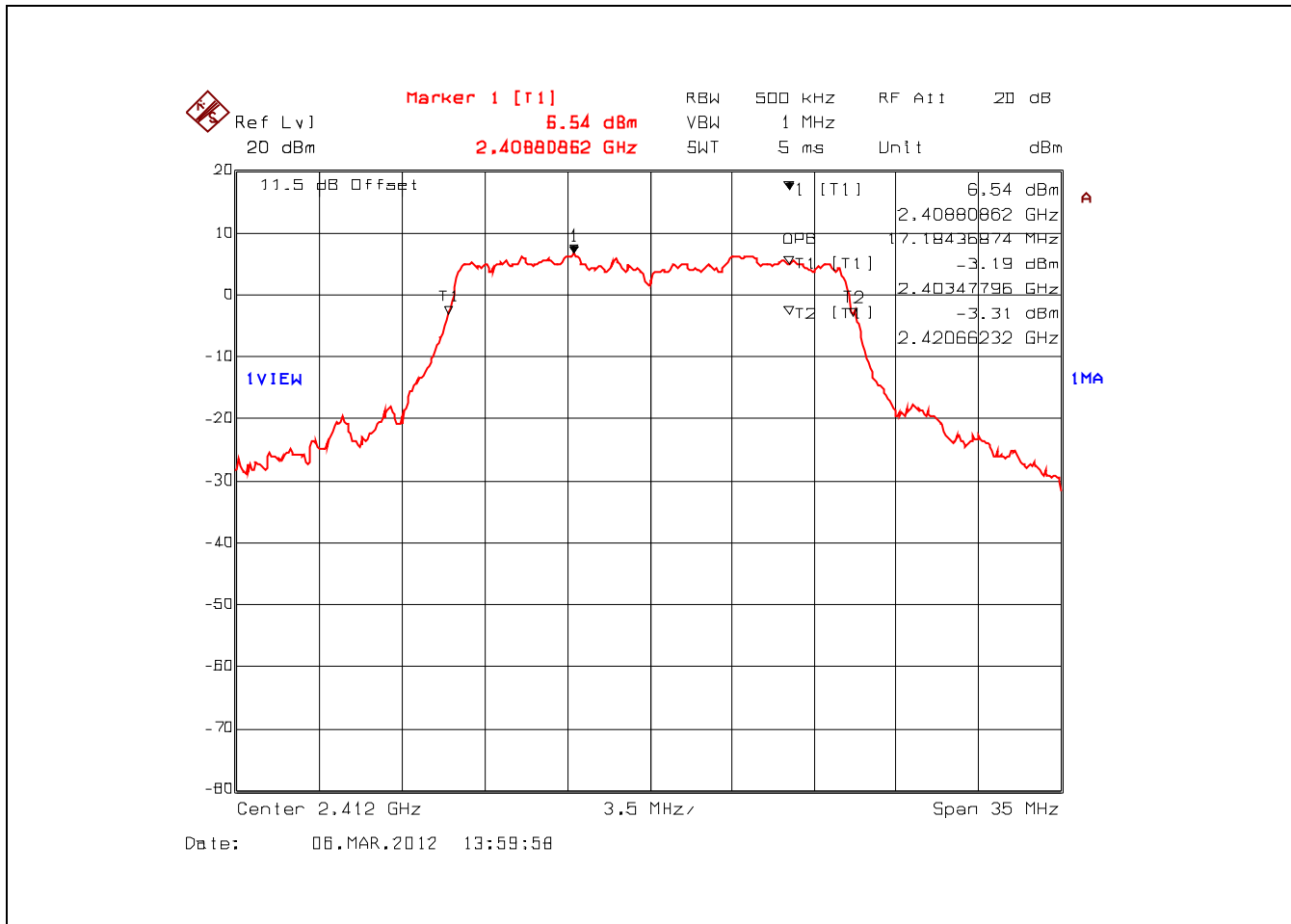
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.31. 99% Occupied Bandwidth, 2412 MHz, 802.11g, 16-QAM, 36 Mbps**



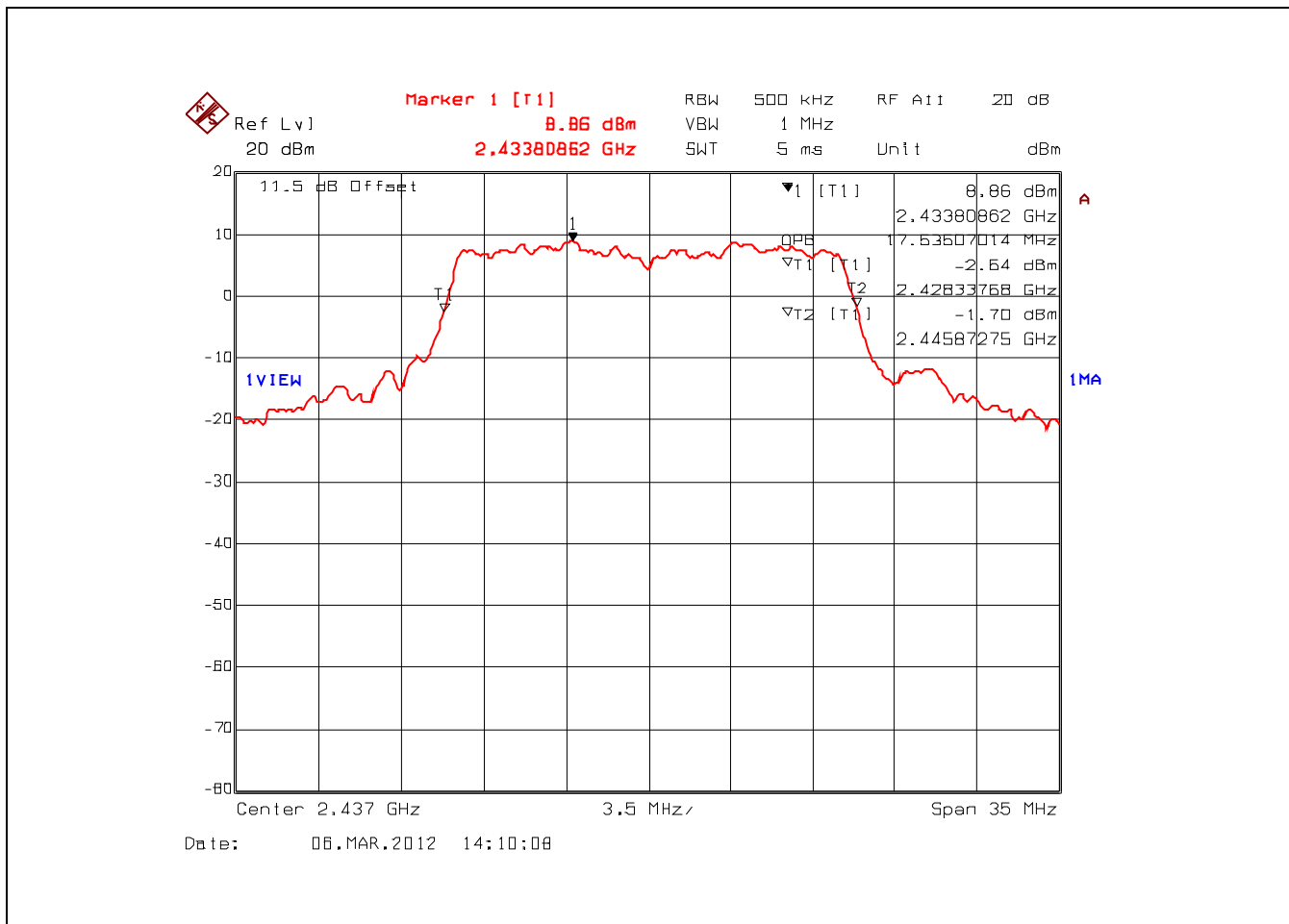
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 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.32. 99% Occupied Bandwidth, 2437 MHz, 802.11g, 16-QAM, 36 Mbps**



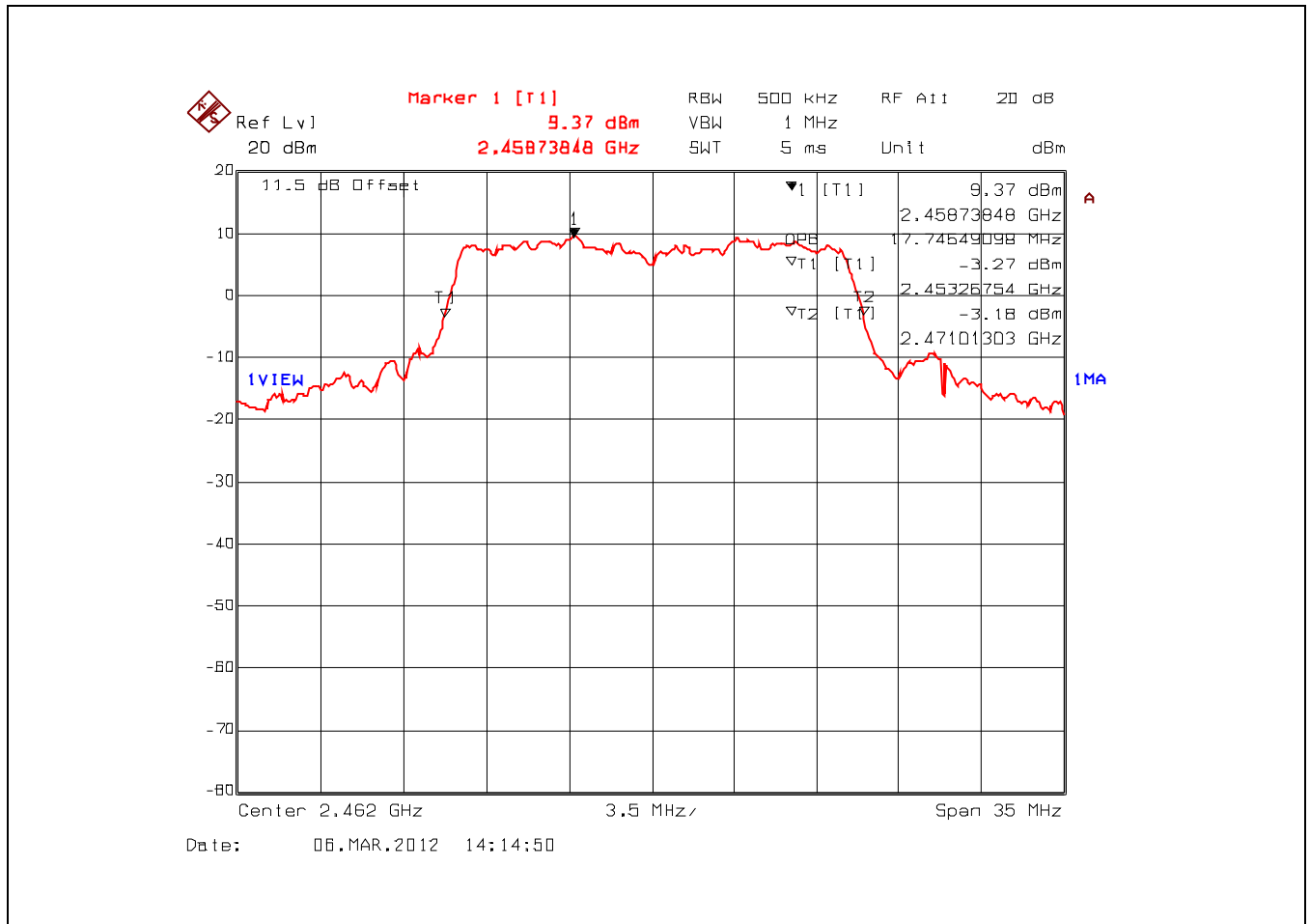
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.33. 99% Occupied Bandwidth, 2462 MHz, 802.11g, 16-QAM, 36 Mbps**



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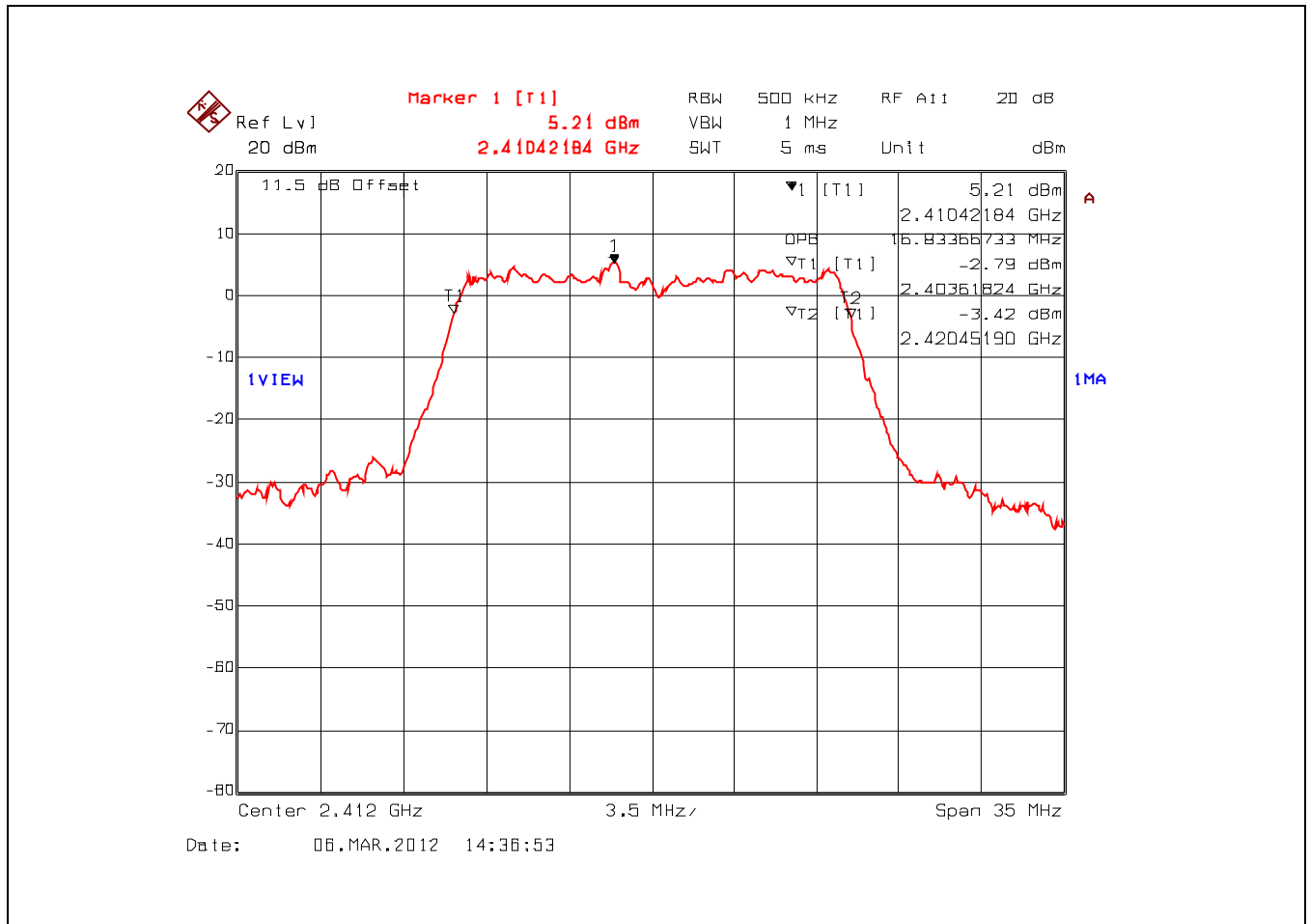
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.34. 99% Occupied Bandwidth, 2412 MHz, 802.11g, 64-QAM, 54 Mbps**



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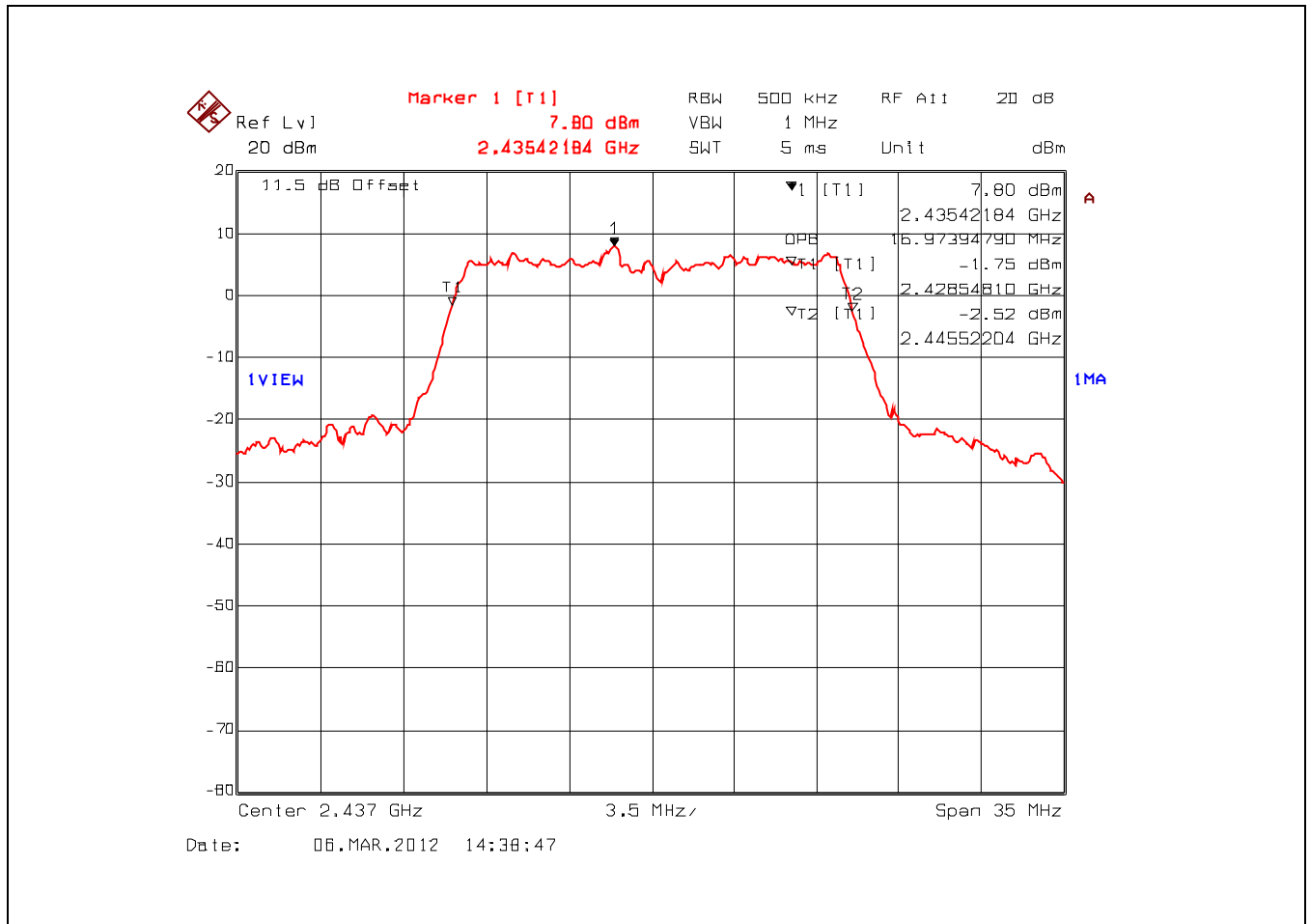
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.35. 99% Occupied Bandwidth, 2437 MHz, 802.11g, 64-QAM, 54 Mbps**



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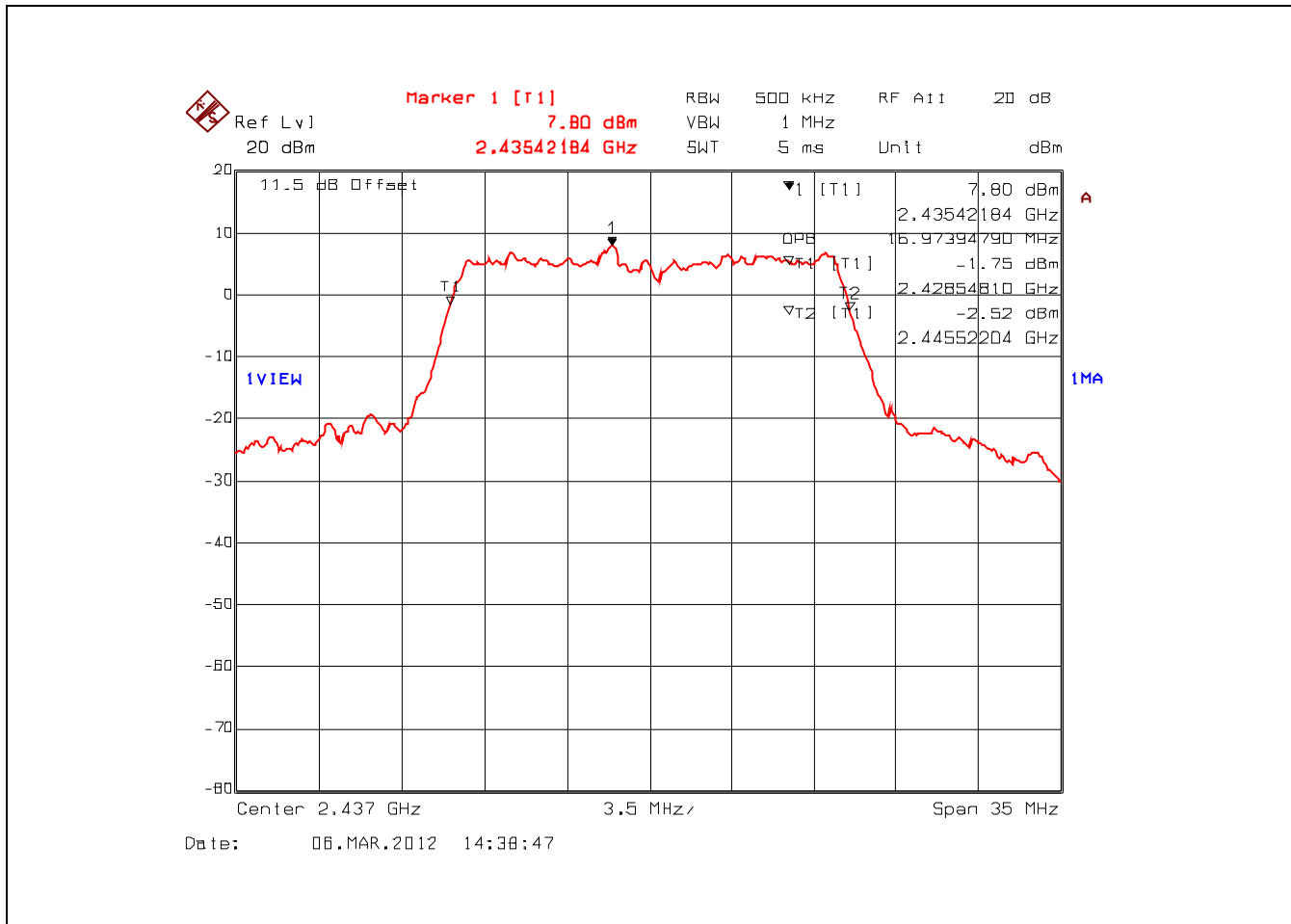
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.36. 99% Occupied Bandwidth, 2462 MHz, 802.11g, 64-QAM, 54 Mbps**



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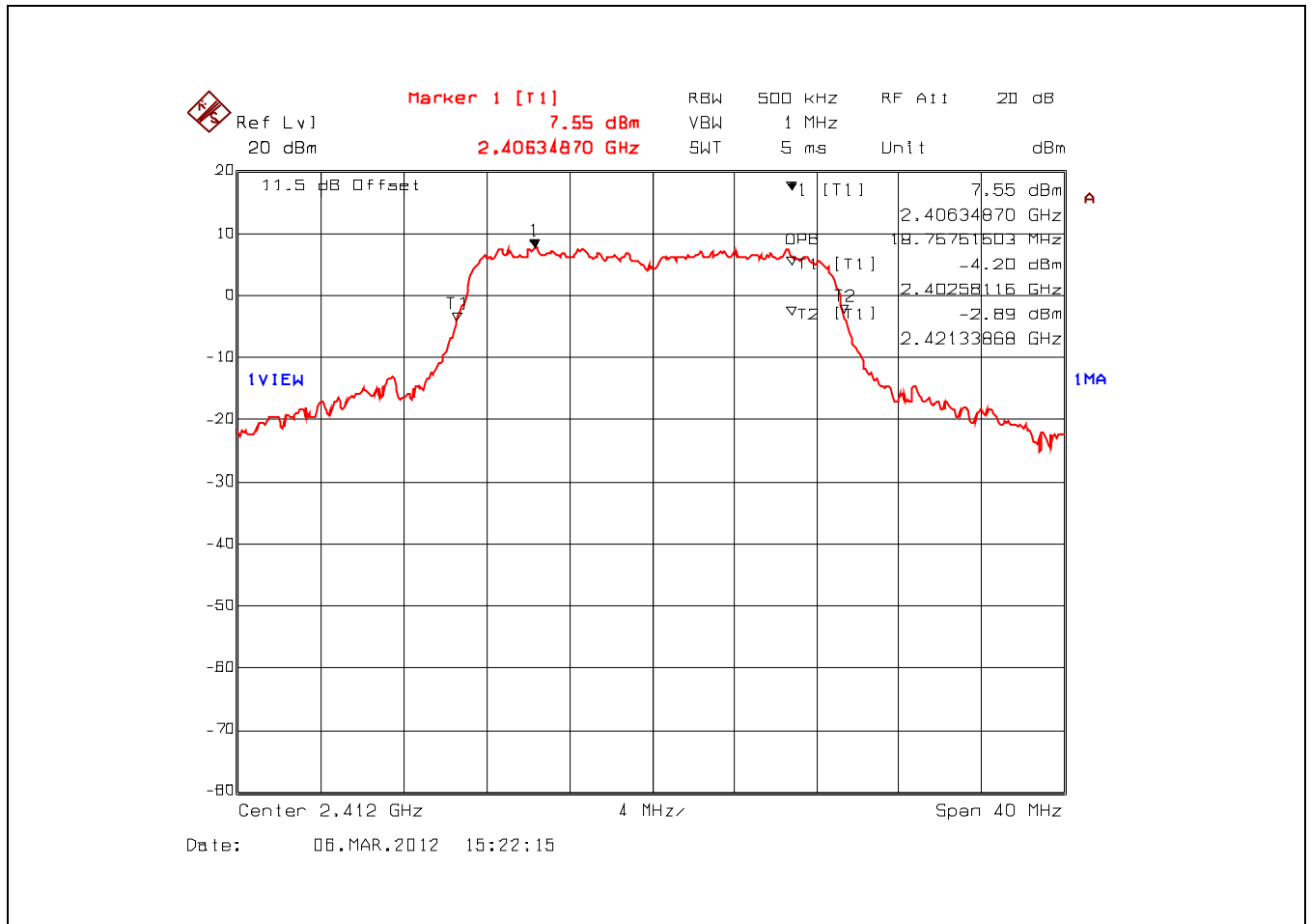
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.37. 99% Occupied Bandwidth, 2412 MHz, 802.11n, BPSK 1/2 @ 6.5 Mbps**



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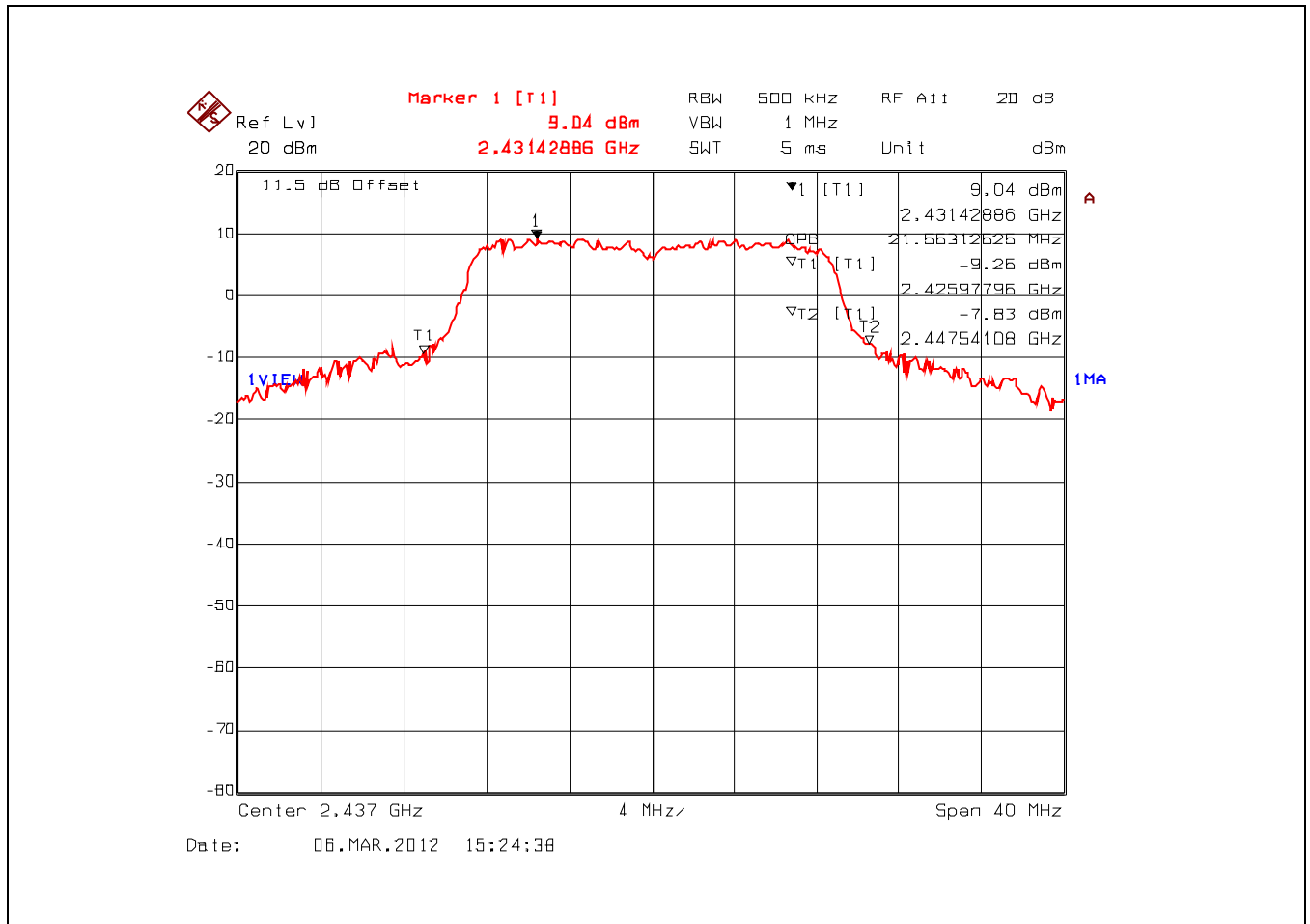
File #: MIS-090F15C247

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



**Plot 5.2.4.38. 99% Occupied Bandwidth, 2437 MHz, 802. 11n, BPSK 1/2 @ 6.5 Mbps**



**ULTRATECH GROUP OF LABS**

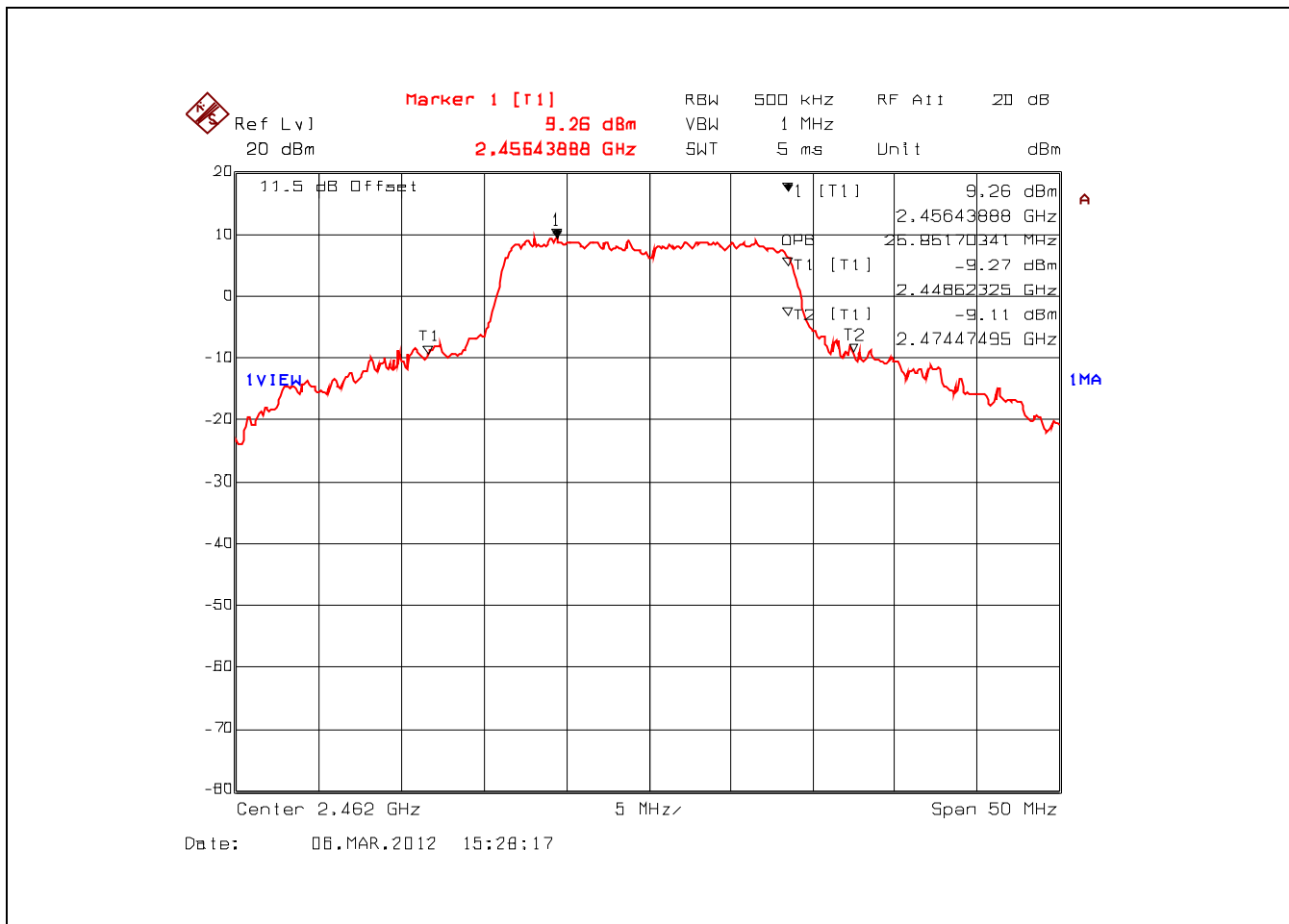
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.39. 99% Occupied Bandwidth, 2462 MHz, 802. 11n, BPSK 1/2 @ 6.5 Mbps**



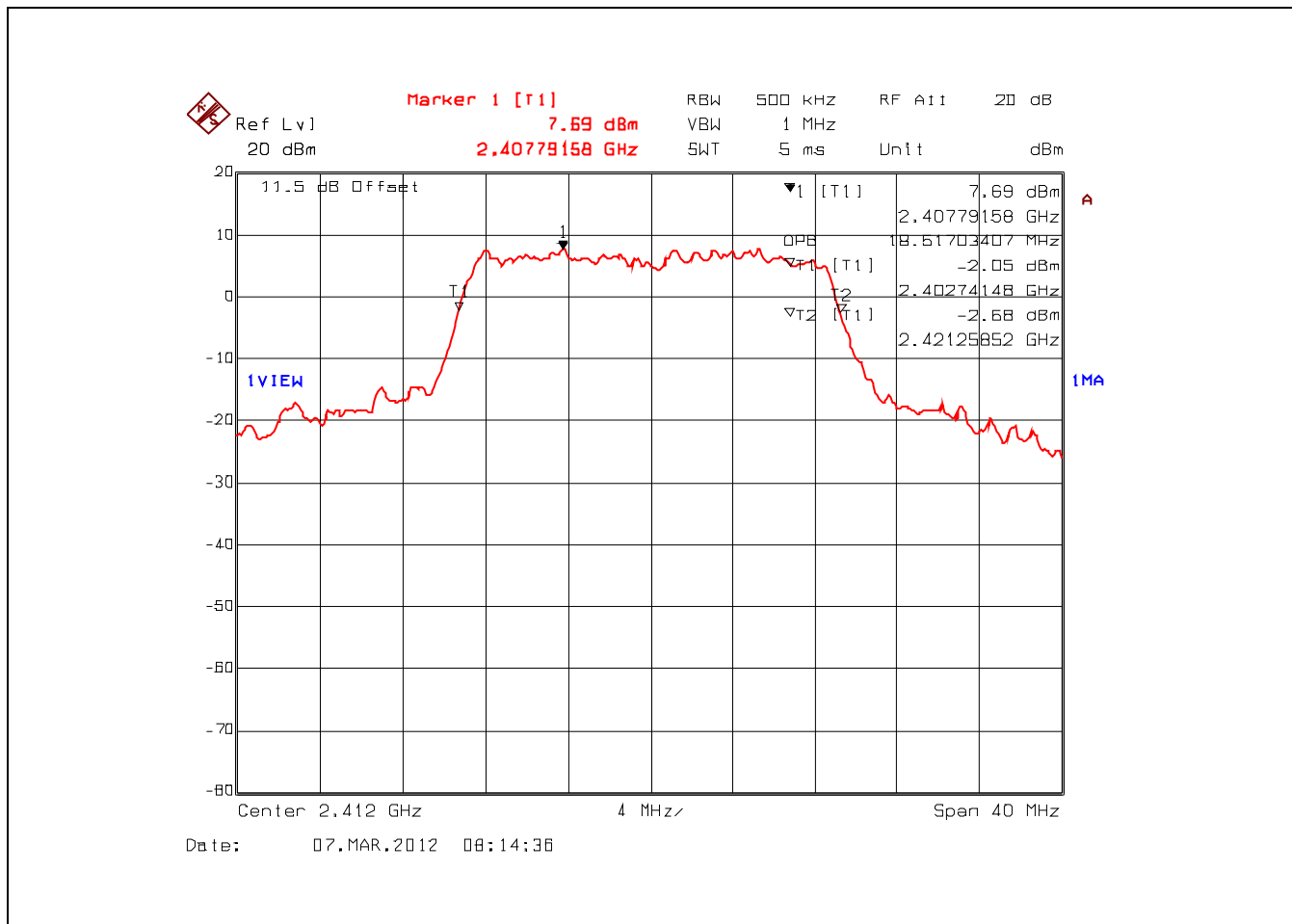
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: MIS-090F15C247  
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**Plot 5.2.4.40. 99% Occupied Bandwidth, 2412 MHz, 802. 11n, QPSK 3/4 19.5 Mbps**



**ULTRATECH GROUP OF LABS**

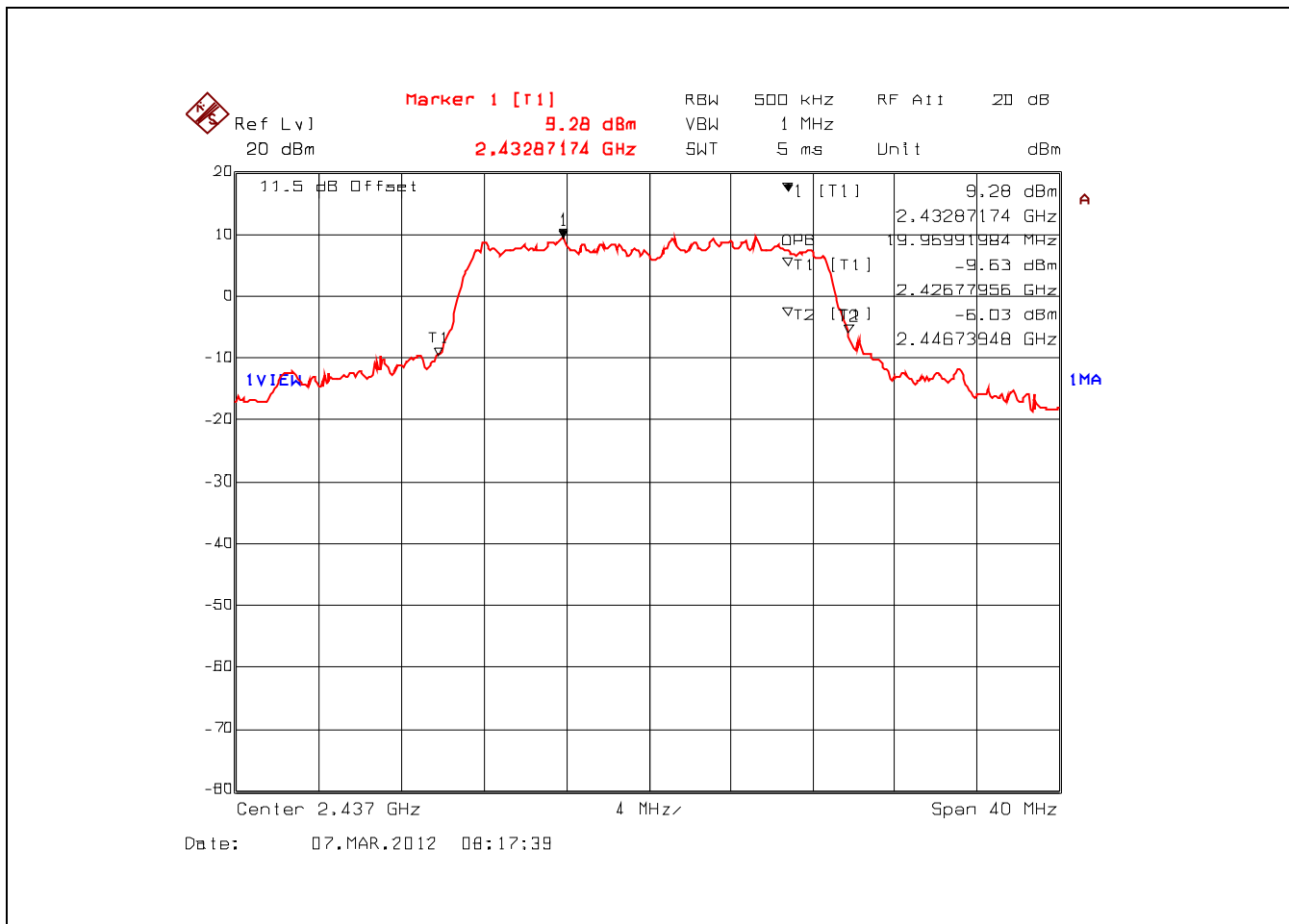
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: MIS-090F15C247

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**Plot 5.2.4.41. 99% Occupied Bandwidth, 2437 MHz, 802. 11n, QPSK 3/4 19.5 Mbps**



**ULTRATECH GROUP OF LABS**

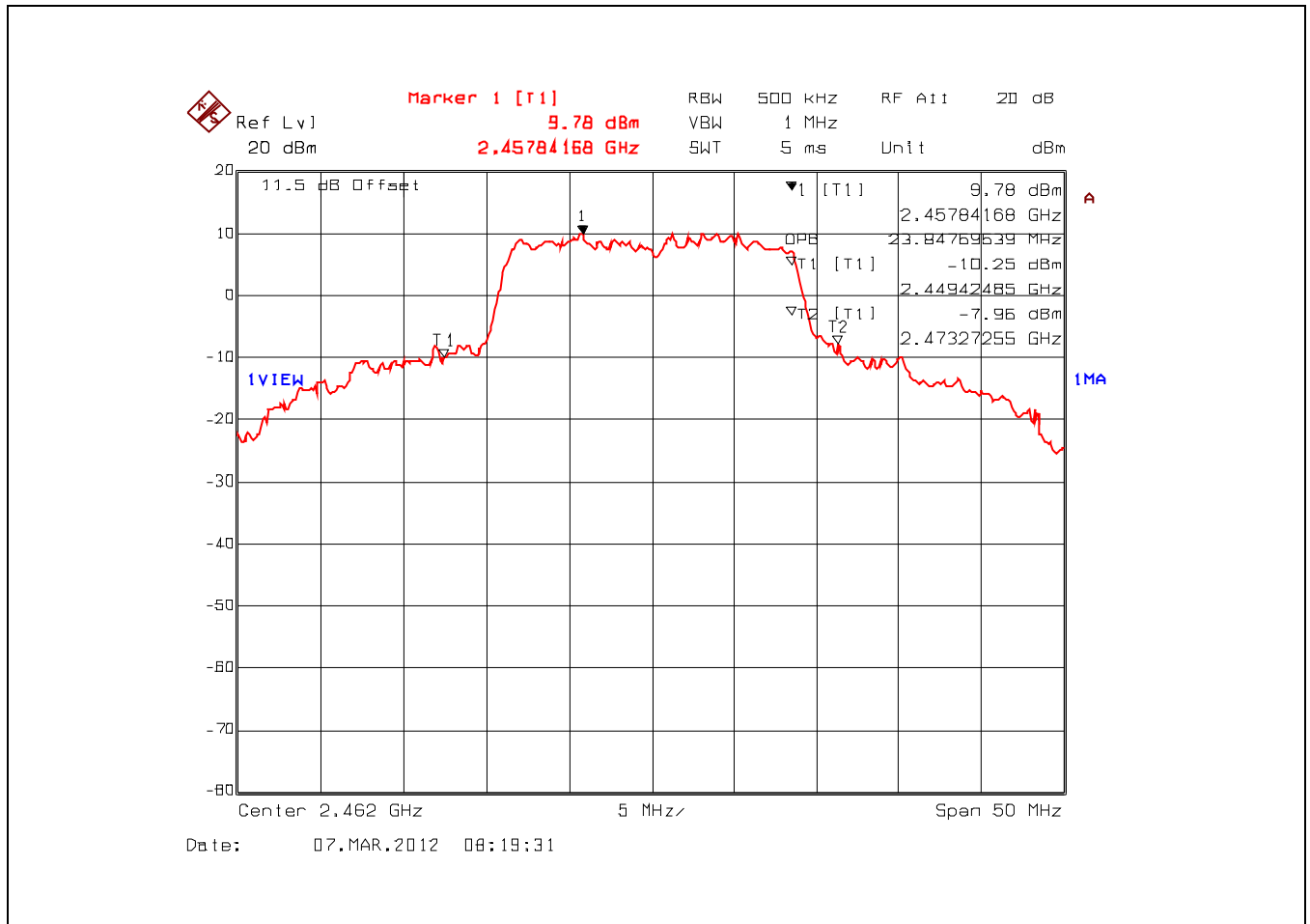
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.42. 99% Occupied Bandwidth, 2462 MHz, 802. 11n, QPSK 3/4 19.5 Mbps**



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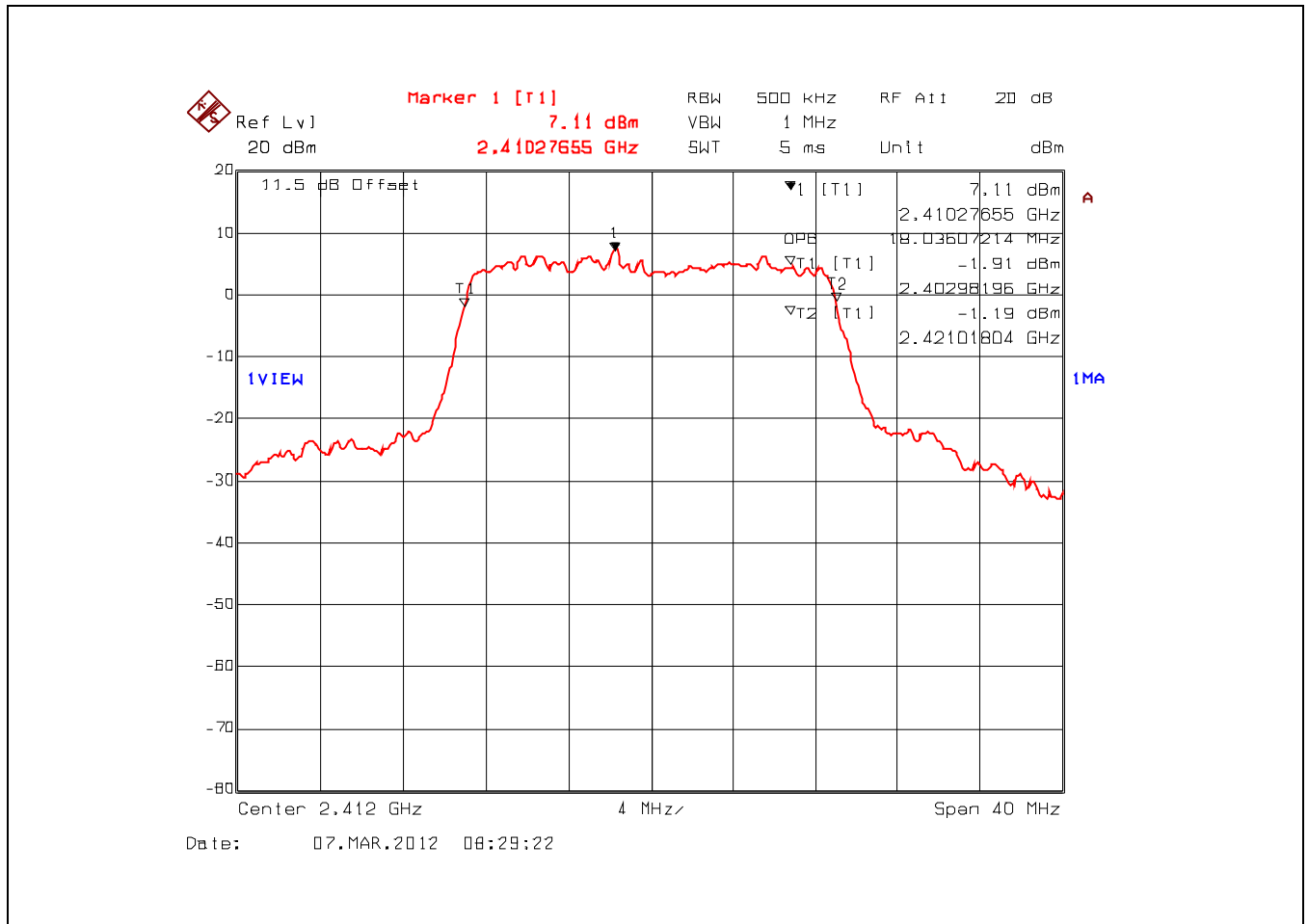
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.43. 99% Occupied Bandwidth, 2412 MHz, 802. 11n, 16-QAM 3/4 39 Mbps**



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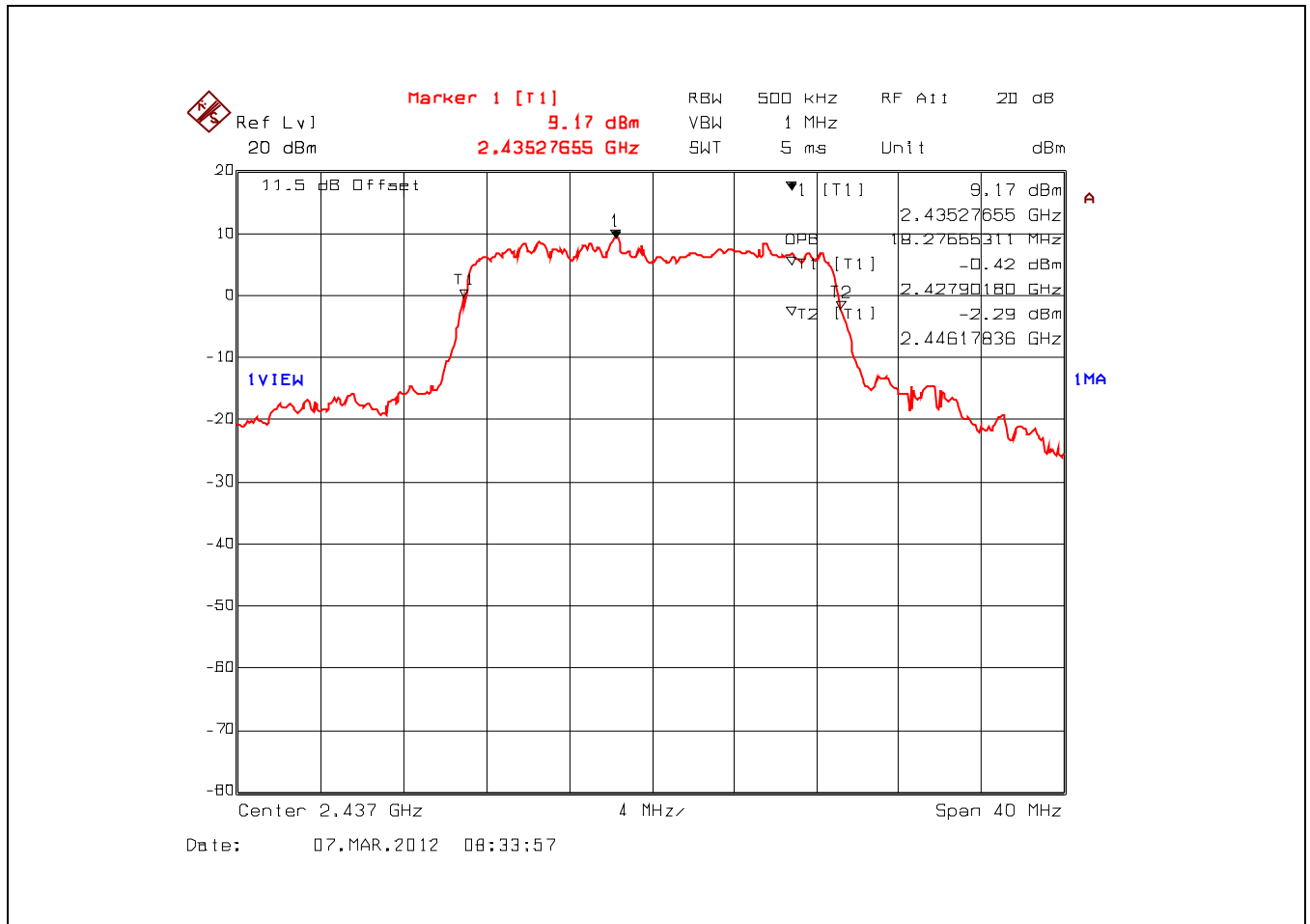
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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July 24, 2012

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**Plot 5.2.4.44. 99% Occupied Bandwidth, 2437 MHz, 802. 11n, 16-QAM 3/4 39 Mbps**



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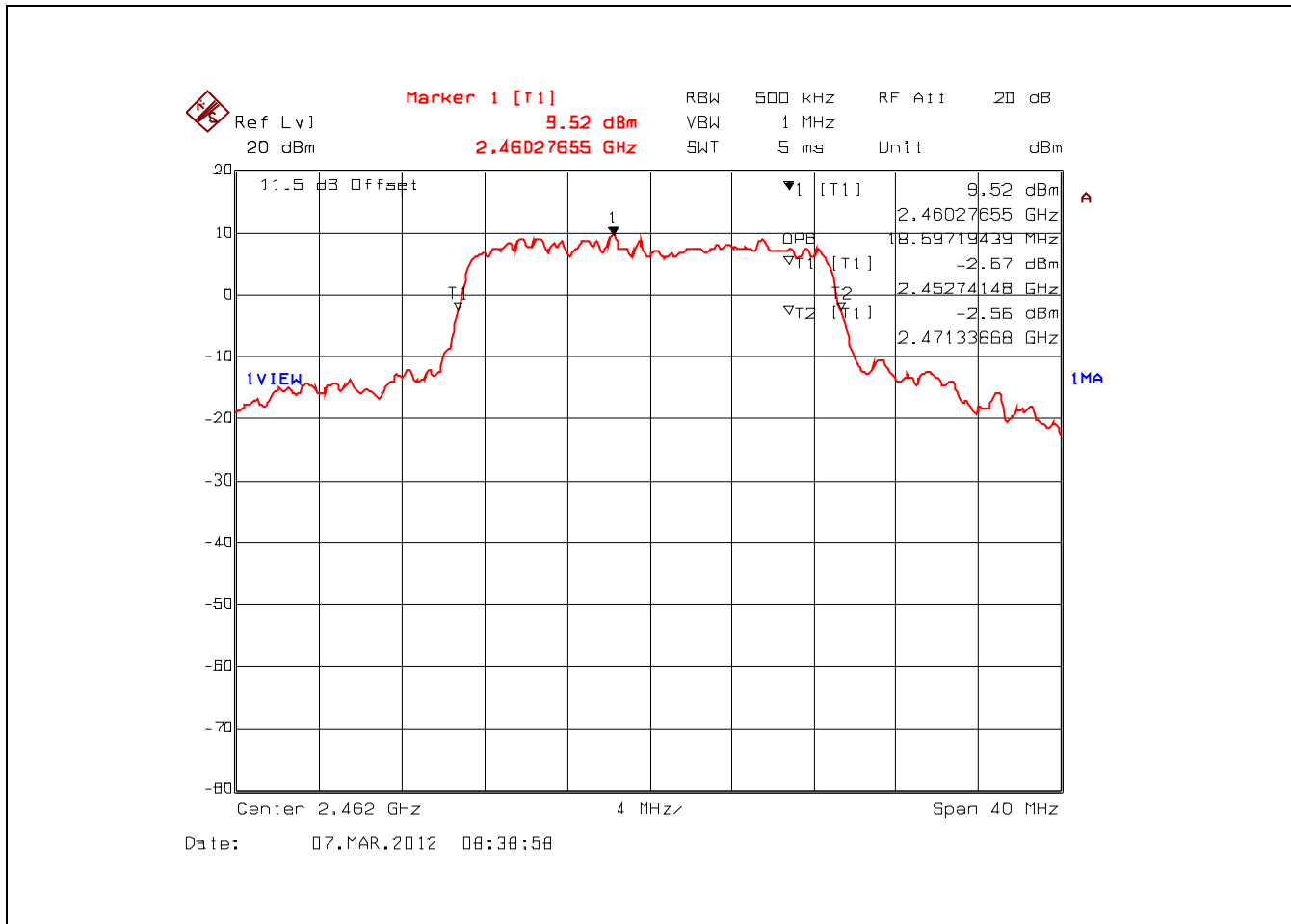
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.45. 99% Occupied Bandwidth, 2462 MHz, 802. 11n, 16-QAM 3/4 39 Mbps**



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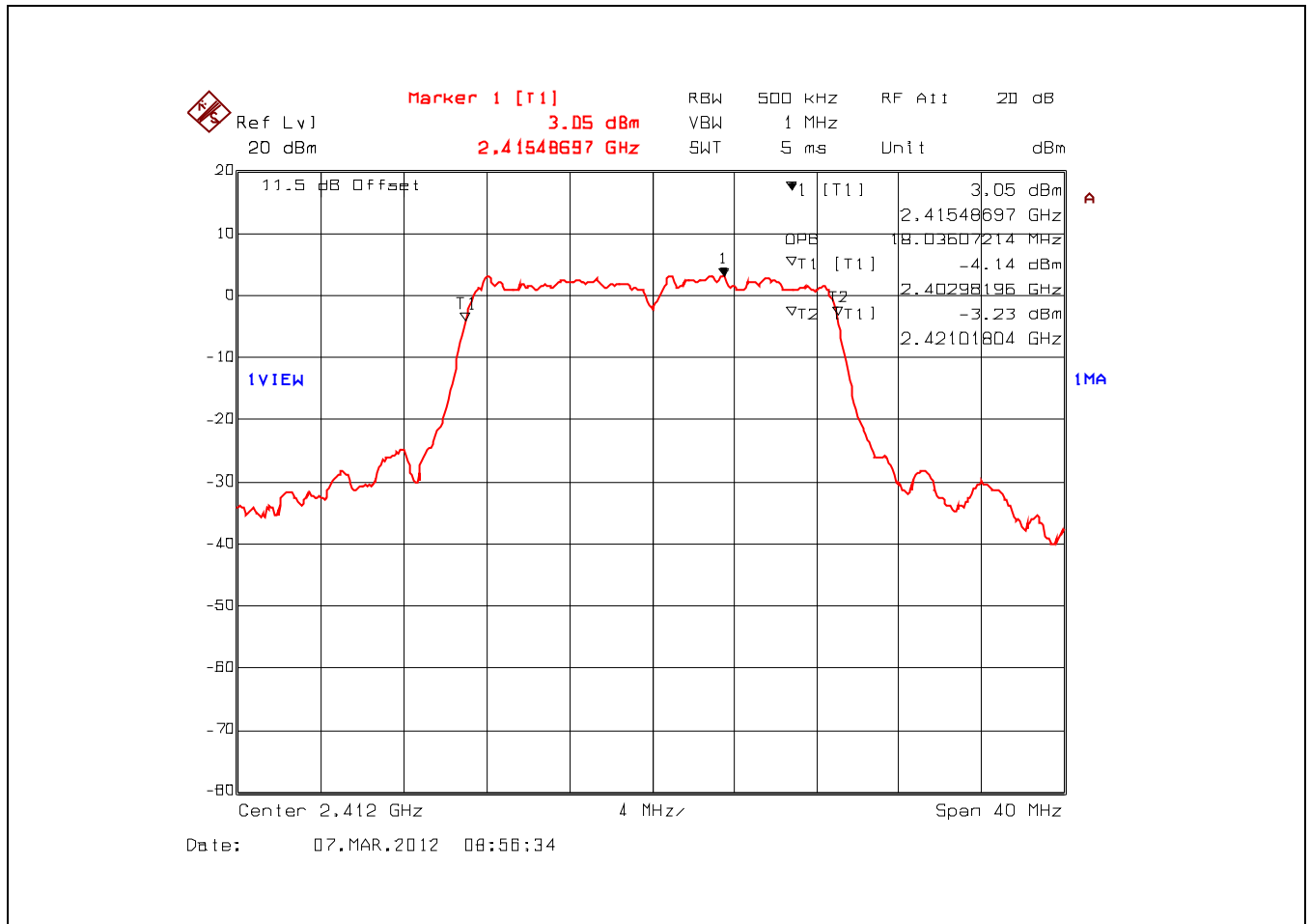
File #: MIS-090F15C247

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**Plot 5.2.4.46. 99% Occupied Bandwidth, 2412 MHz, 802. 11n, 64-QAM 5/6 65 Mbps**



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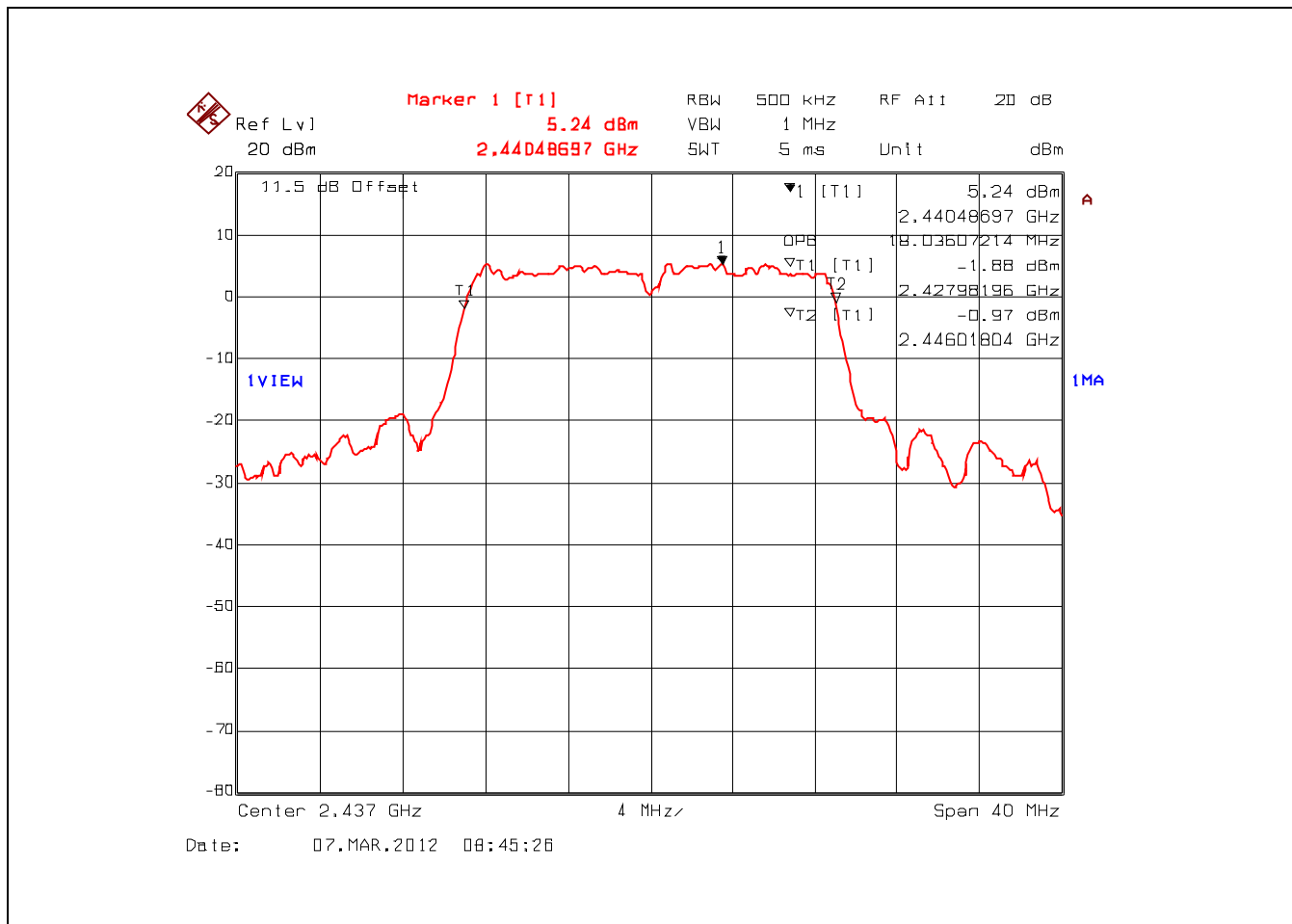
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.2.4.47. 99% Occupied Bandwidth, 2437 MHz, 802. 11n, 64-QAM 5/6 65 Mbps**



**ULTRATECH GROUP OF LABS**

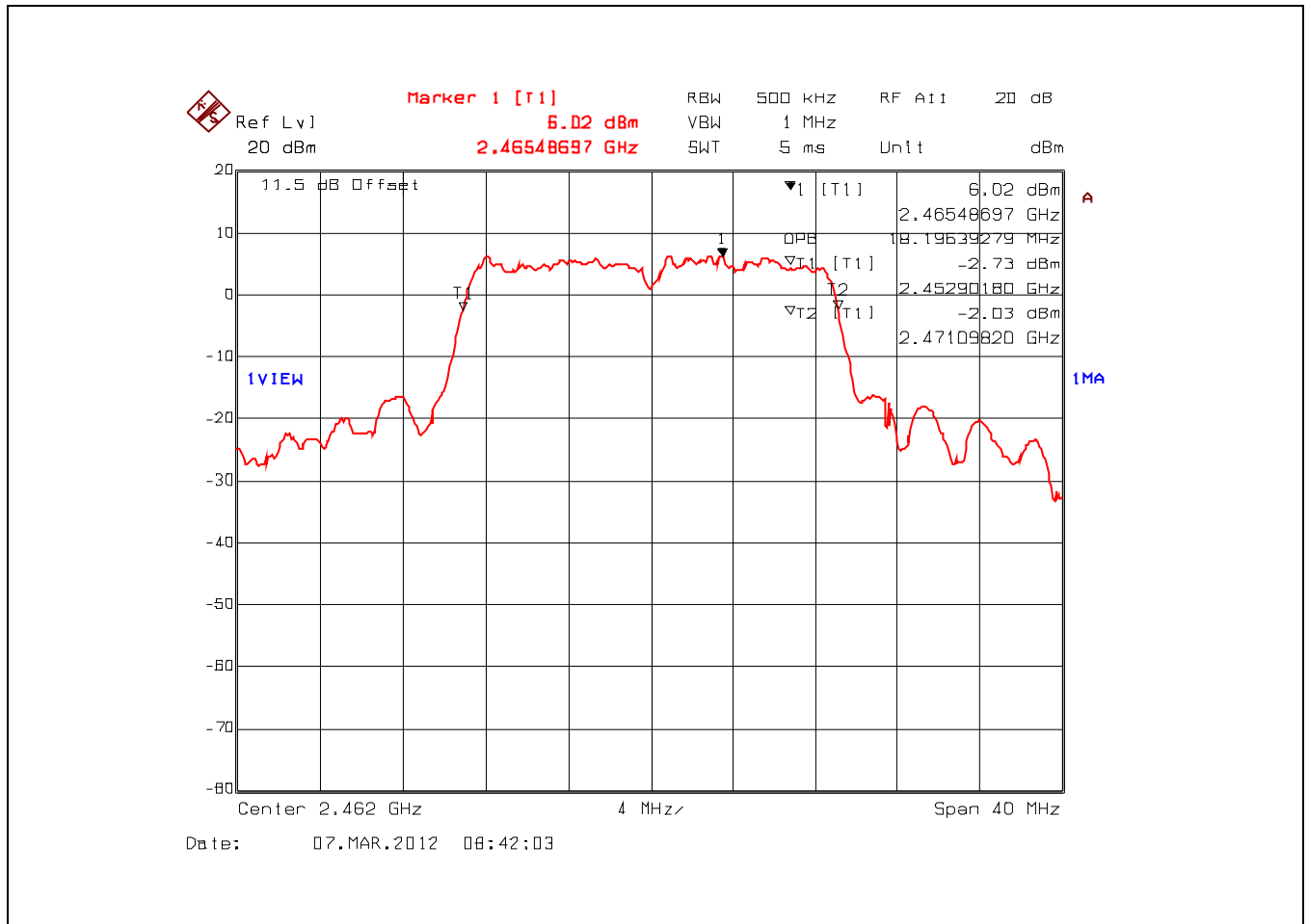
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: MIS-090F15C247

July 24, 2012

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**Plot 5.2.4.48. 99% Occupied Bandwidth, 2462 MHz, 802. 11n, 64-QAM 5/6 65 Mbps**



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File #: MIS-090F15C247

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

#### 5.3.1. Limit(s)

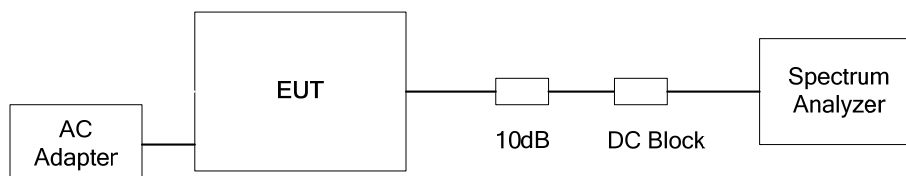
**§ 15.247(b)(3):** For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output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

#### 5.3.2. Method of Measurements & Test Arrangement

KDB Publication No. 558074 D01 Section 5.2.1.2 Measurement Procedure PK2.

#### 5.3.3. Test Arrangement



#### 5.3.4. Test Data

Operation Mode	Frequency (MHz)	Modulation	Data Rate (Mbps)	Peak Conducted Power (dBm)	Peak EIRP (dBm)	Peak Conducted Power Limit (dBm)	EIRP Limit (dBm)
802.11g	2412	BPSK	9	22.48	26.28	30	36
		QPSK	18	22.08	25.88	30	36
		16-QAM	36	20.31	24.11	30	36
		64-QAM	54	18.06	21.86	30	36
	2437	BPSK	9	24.38	28.18	30	36
		QPSK	18	23.67	27.47	30	36
		16-QAM	36	22.38	26.18	30	36
		64-QAM	54	20.36	24.16	30	36
	2462	BPSK	9	24.66	28.46	30	36
		QPSK	18	24.08	27.88	30	36
		16-QAM	36	23.01	26.81	30	36
		64-QAM	54	21.10	24.90	30	36
802.11n	2412	BPSK 1/2	6.5	22.45	26.25	30	36
		QPSK 3/4	19.5	22.09	25.89	30	36
		16-QAM 3/4	39	20.38	24.18	30	36
		64-QAM 5/6	65	17.62	21.42	30	36
	2437	BPSK 1/2	6.5	24.14	27.94	30	36
		QPSK 3/4	19.5	23.81	27.61	30	36
		16-QAM 3/4	39	22.51	26.31	30	36
		64-QAM 5/6	65	19.64	23.44	30	36
	2462	BPSK 1/2	6.5	24.44	28.24	30	36
		QPSK 3/4	19.5	24.15	27.95	30	36
		16-QAM 3/4	39	23.15	26.95	30	36
		64-QAM 5/6	65	20.44	24.24	30	36

Notes:

- The EIRP shall be calculated based on the transmitter peak output power at antenna terminal ( $P_{dBm}$ ) and antenna assembly gain ( $G_{dBi}$ ). Calculated EIRP =  $P_{dBm} + G_{dBi}$ .
- Antenna assembly gain of EUT is 3.8 dBi max.

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

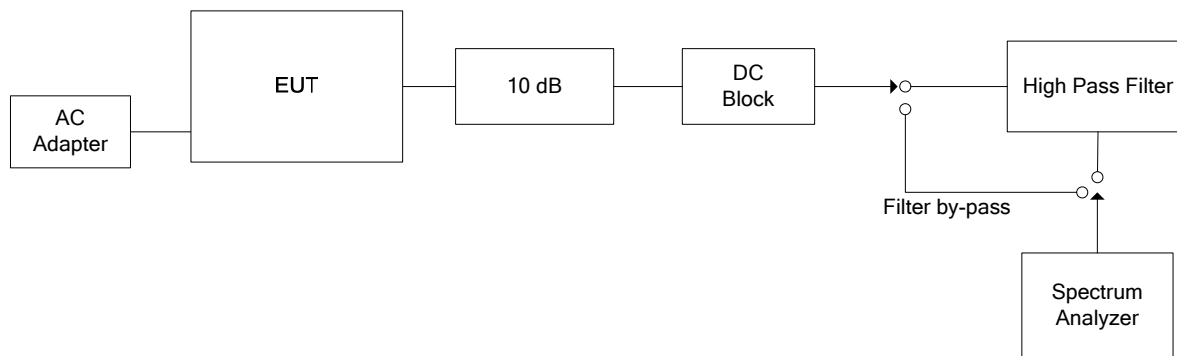
### 5.4.1. Limit(s)

**§ 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.

### 5.4.2. Method of Measurements

KDB Publication No. 558074 D01, Sections 5.4.2.2.4 Band-Edge Measurements, 5.4.1 Unwanted Emissions into Non-Restricted Bands, 5.4.2 Unwanted Emissions into Restricted Frequency Bands, 5.4.2.2.1.1 Peak Power Procedure, 5.4.2.2.2.1 Measurement Procedure RBAVG1 (Power Averaging) and 5.4.2.2.3 Applicability of §15.35(b) and §15.35(c).

### 5.4.3. Test Arrangement

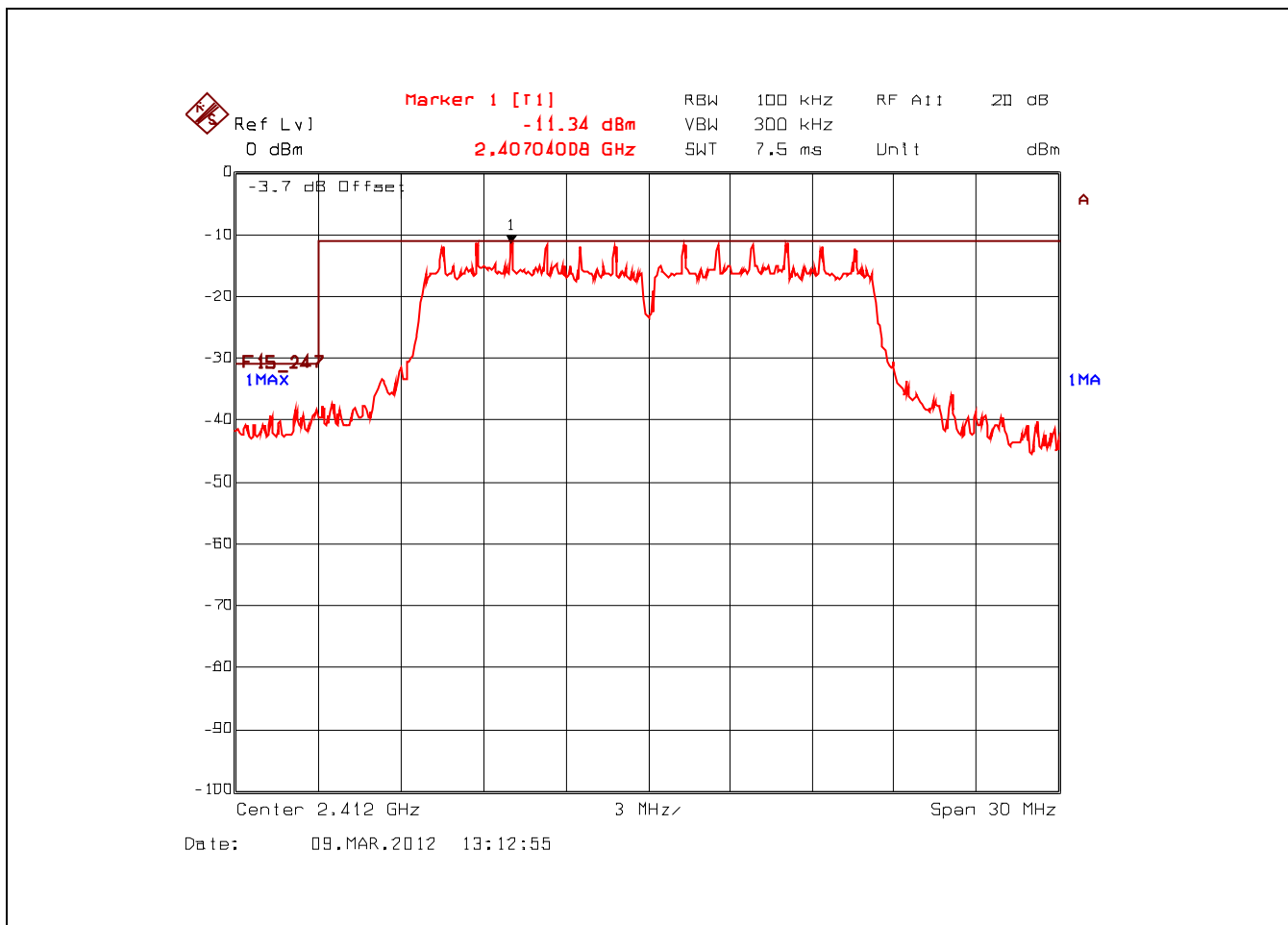


#### 5.4.4. Test Data

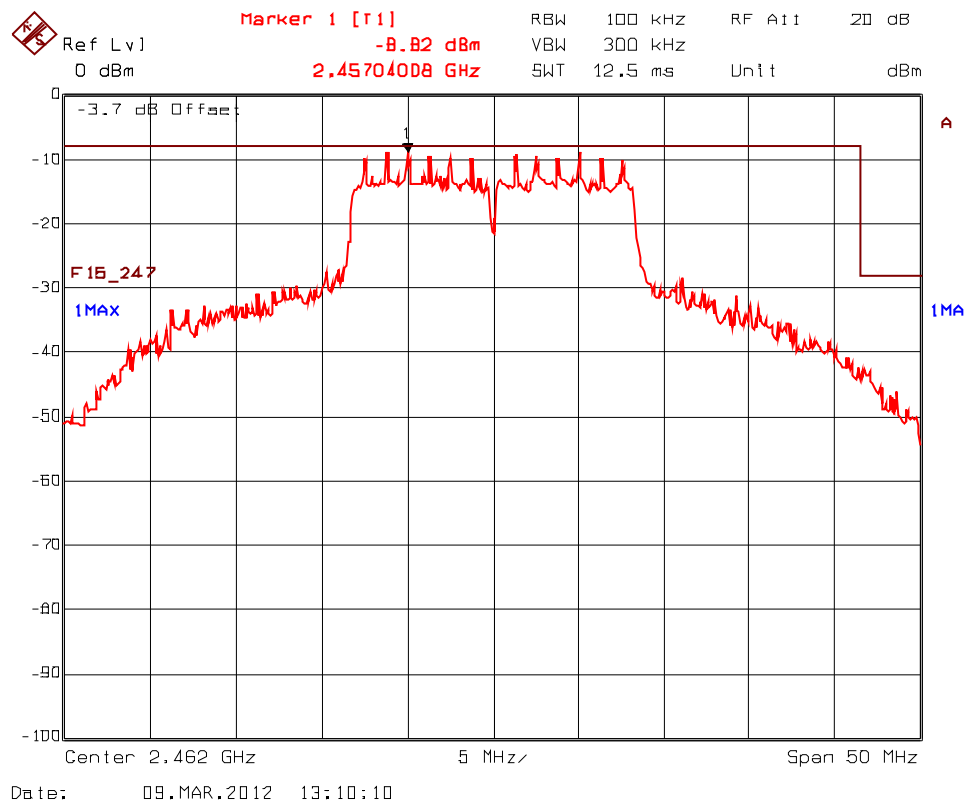
Remark(s): Based on the power measurements, the highest power observed in 802.11g, BPSK @ 9 Mbps and 802.11n, BPSK 1/2 @ 6.5 Mbps were selected as the final test configurations to represent the worst-case.

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

**Plot 5.4.4.1.1. Band-Edge RF Conducted Emissions**  
Low End of Frequency Band, 802.11g, 2412 MHz, BPSK @ 9 Mbps



**Plot 5.4.4.1.2. Band-Edge RF Conducted Emissions**  
High End of Frequency Band, 802.11g, 2462 MHz, BPSK @ 9 Mbps



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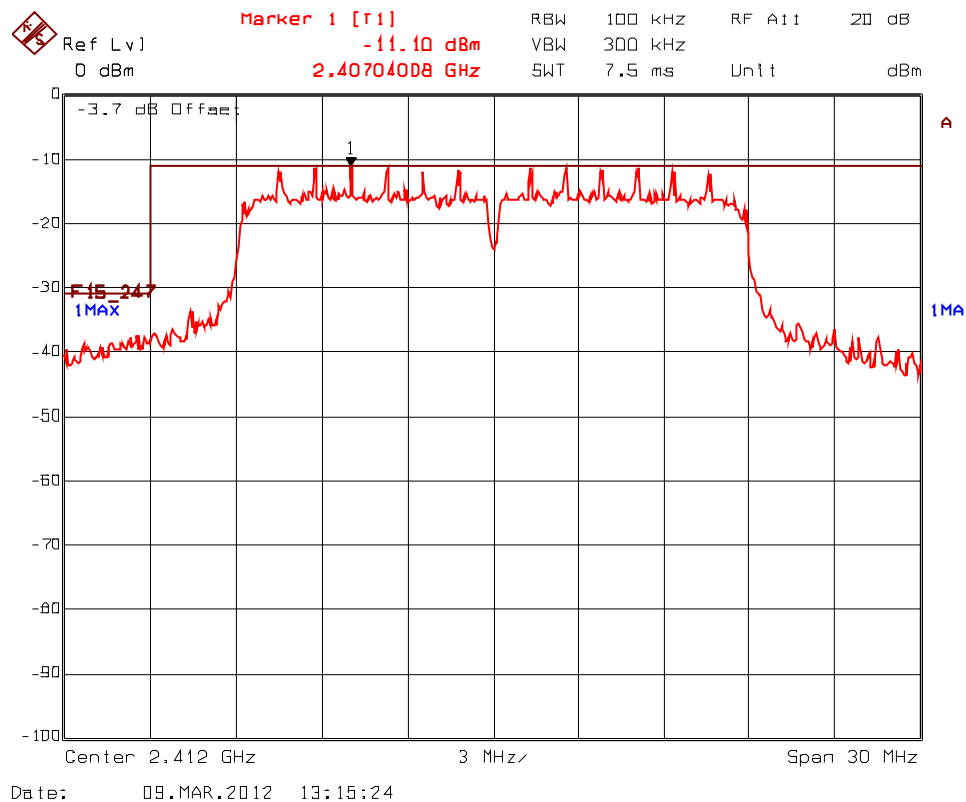
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.4.4.1.3. Band-Edge RF Conducted Emissions**  
Low End of Frequency Band, 802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps



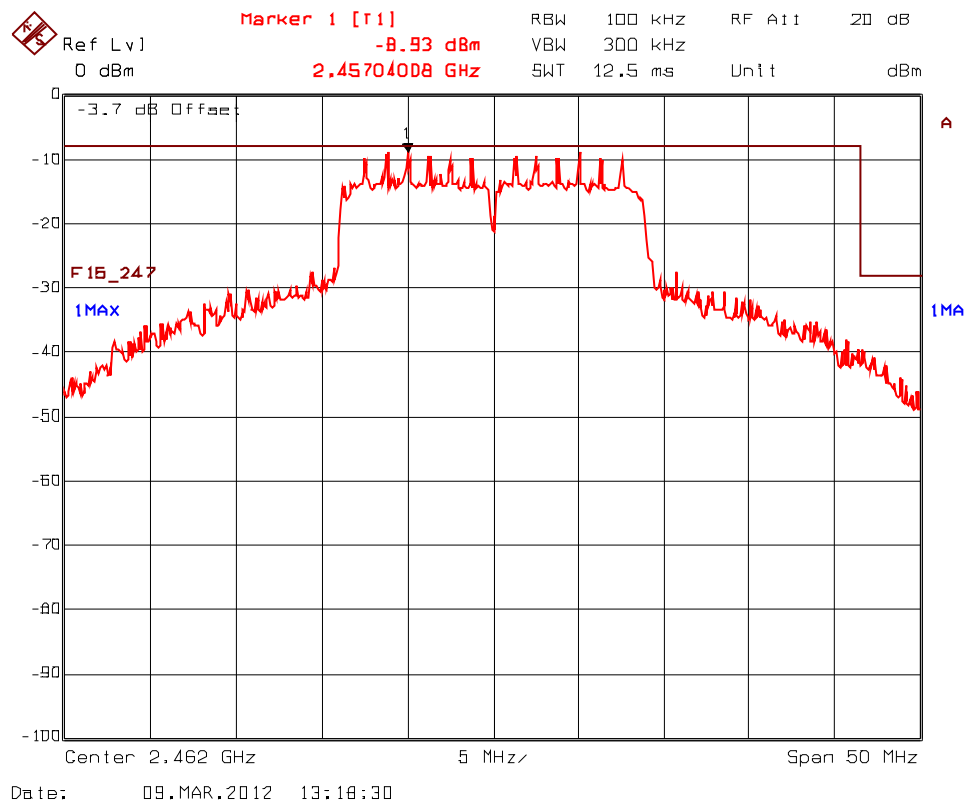
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**Plot 5.4.4.1.4. Band-Edge RF Conducted Emissions**  
High End of Frequency Band, 802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps



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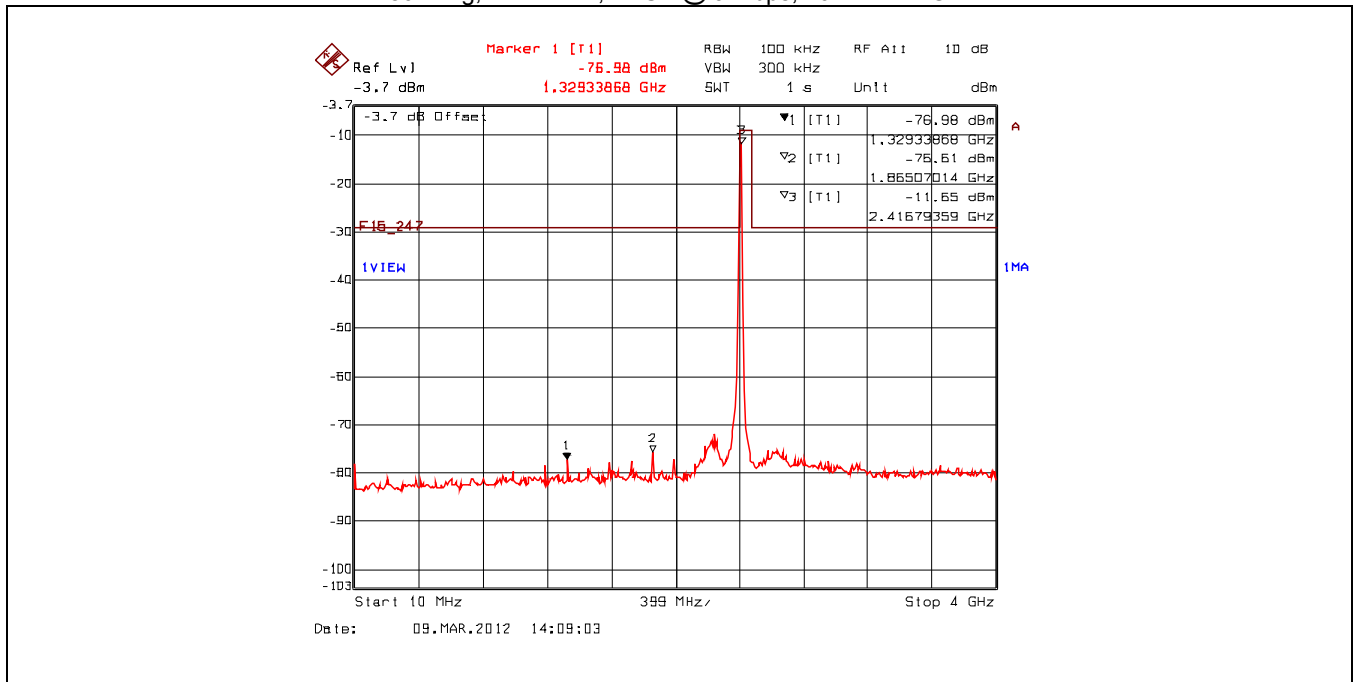
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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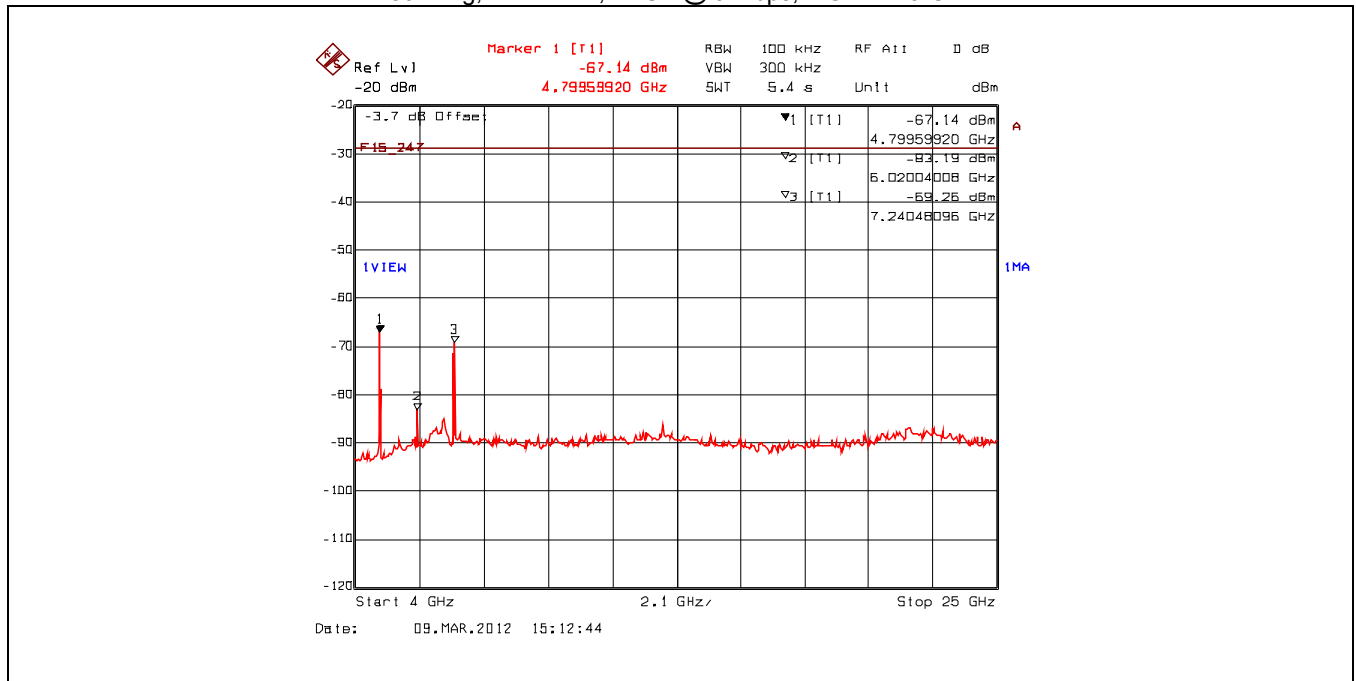
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#### 5.4.4.2. Conducted Spurious Emissions – Non Restricted Frequency Bands

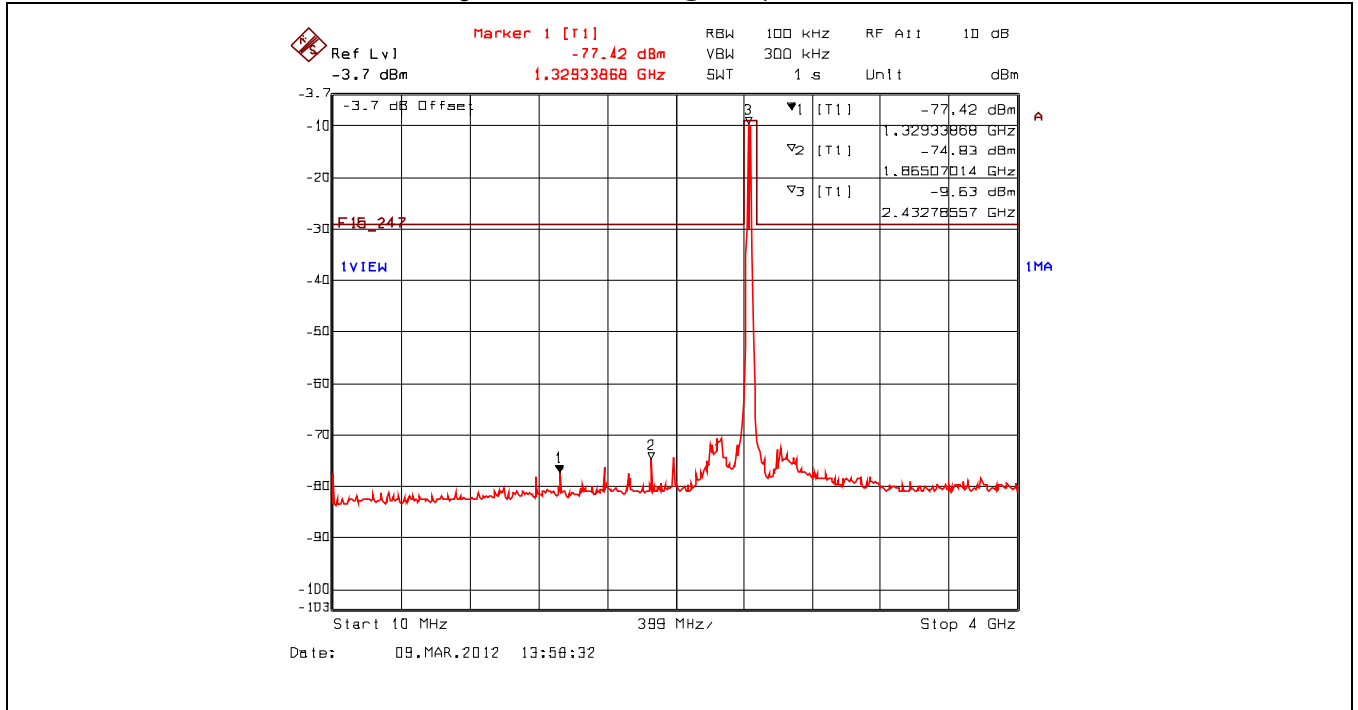
**Plot 5.4.4.2.1. Conducted Spurious Emissions - Non Restricted Frequency Bands**  
802.11g, 2412 MHz, BPSK @ 9 Mbps, 10 MHz - 4 GHz



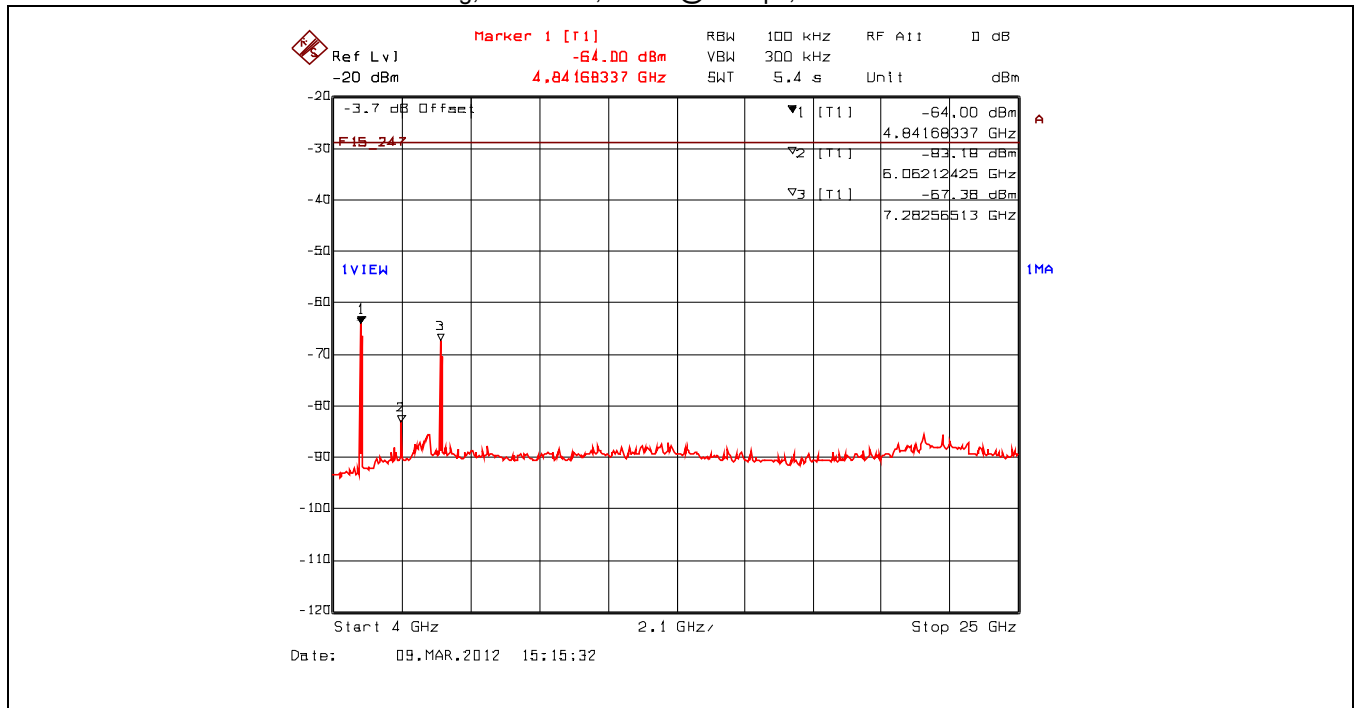
**Plot 5.4.4.2.2. Conducted Spurious Emissions - Non Restricted Frequency Bands**  
802.11g, 2412 MHz, BPSK @ 9 Mbps, 4 GHz - 25 GHz



**Plot 5.4.4.2.3. Conducted Spurious Emissions – Non Restricted Frequency Bands**  
802.11g, 2437 MHz, BPSK @ 9 Mbps, 10 MHz - 4 GHz



**Plot 5.4.4.2.4. Conducted Spurious Emissions – Non Restricted Frequency Bands,**  
802.11g, 2437 MHz, BPSK @ 9 Mbps, 4 GHz - 25 GHz



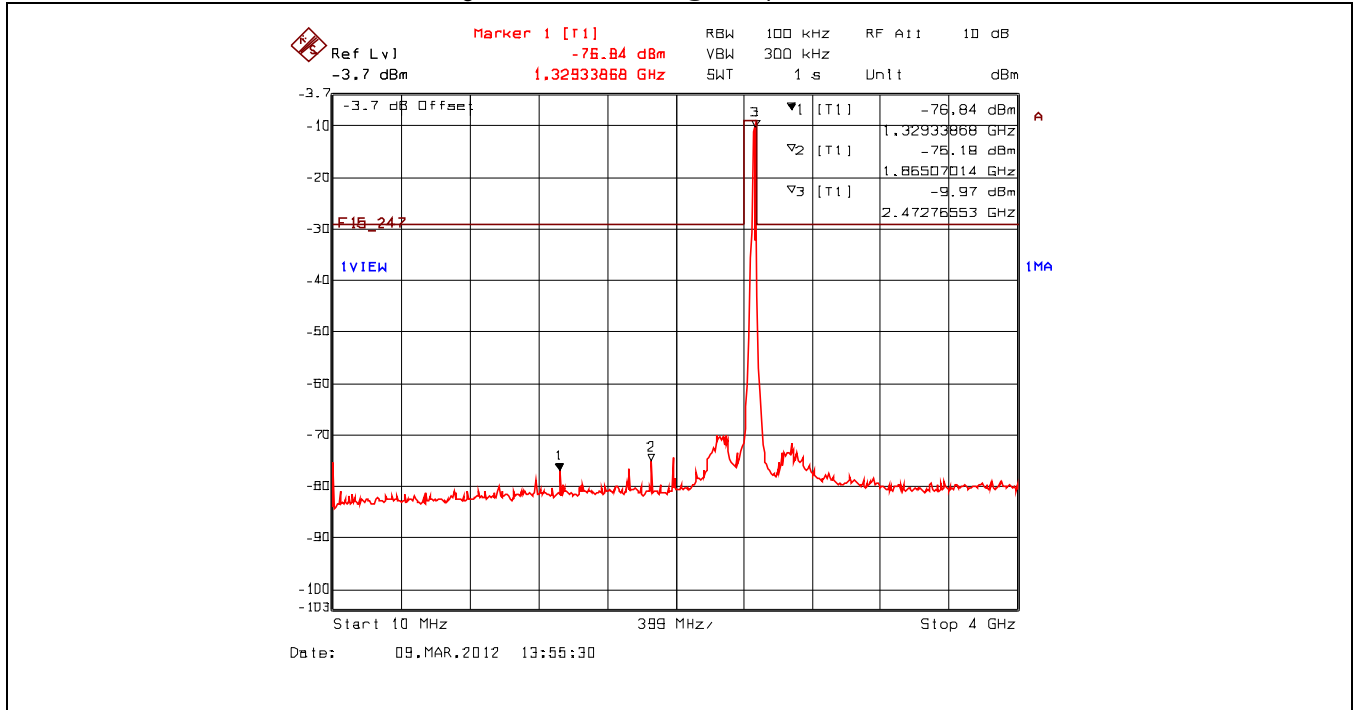
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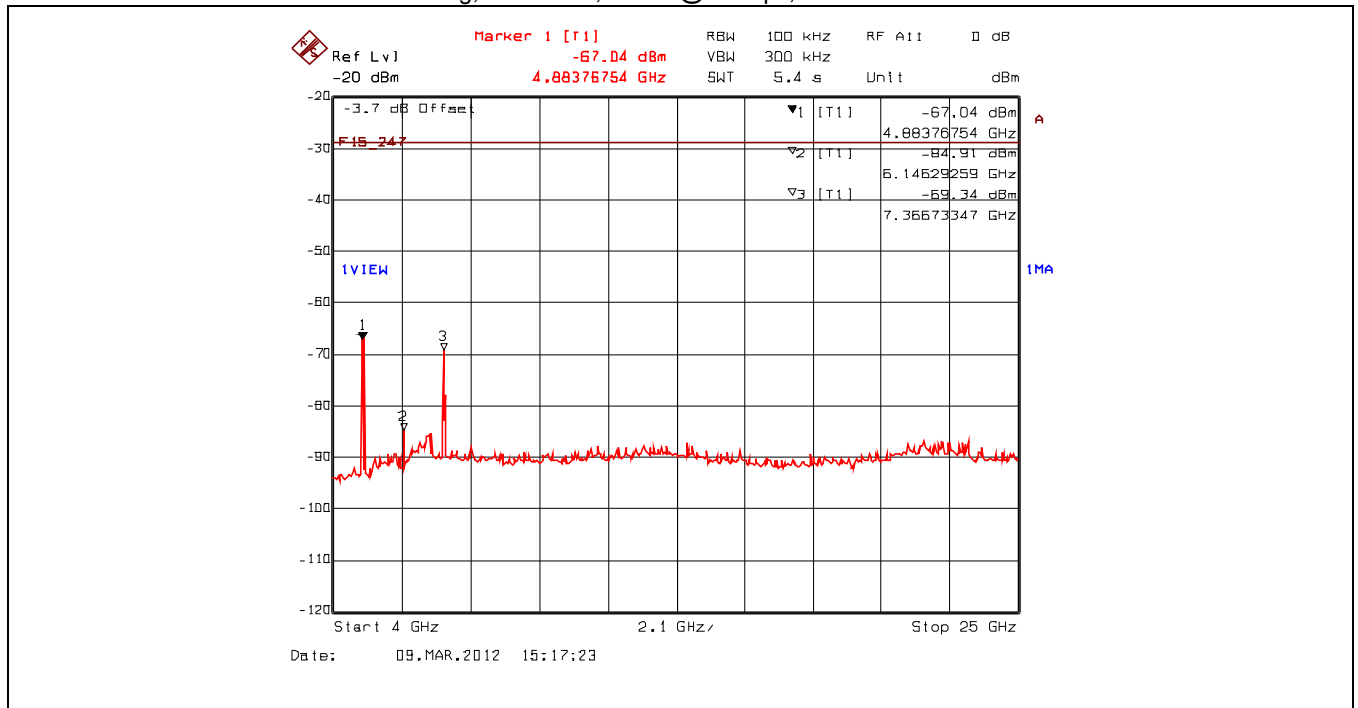
File #: MIS-090F15C247  
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**Plot 5.4.4.2.5. Conducted Spurious Emissions – Non Restricted Frequency Bands**  
802.11g, 2462 MHz, BPSK @ 9 Mbps, 10 MHz - 4 GHz



**Plot 5.4.4.2.6. Conducted Spurious Emissions – Non Restricted Frequency Bands**  
802.11g, 2462 MHz, BPSK @ 9 Mbps, 4 GHz - 25 GHz



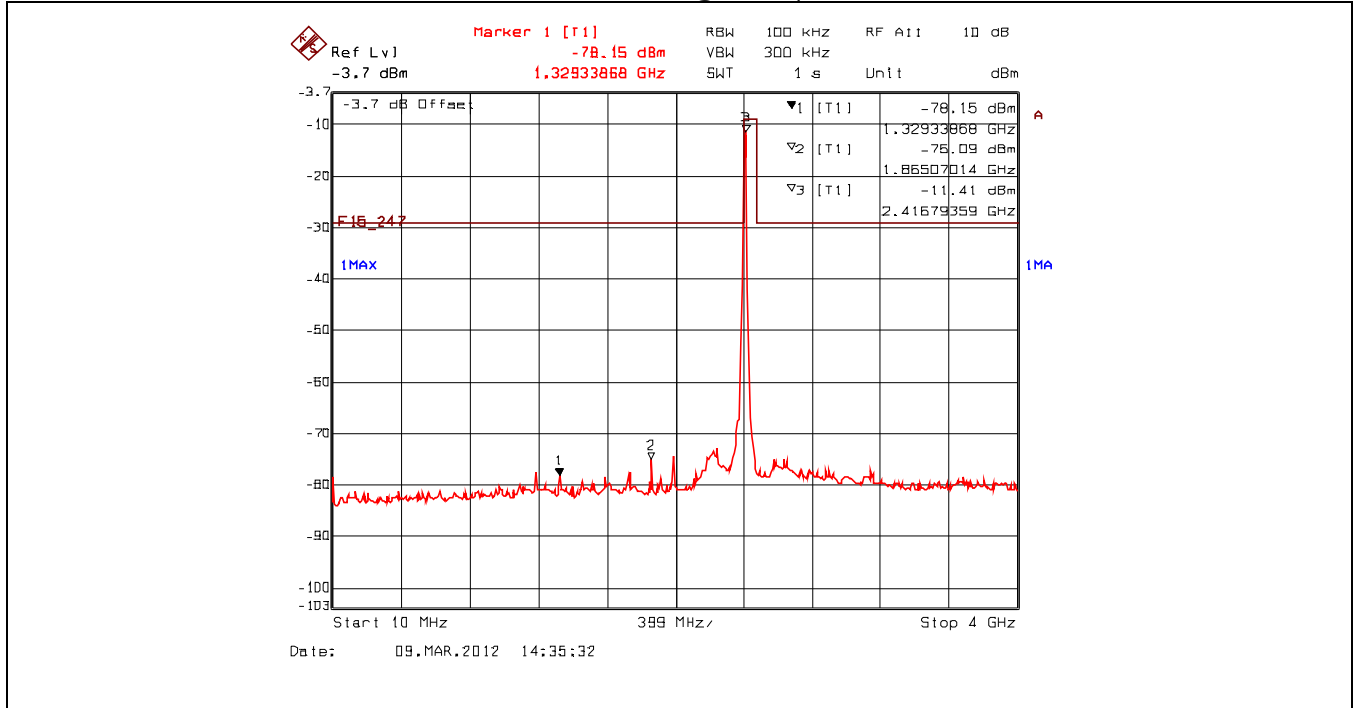
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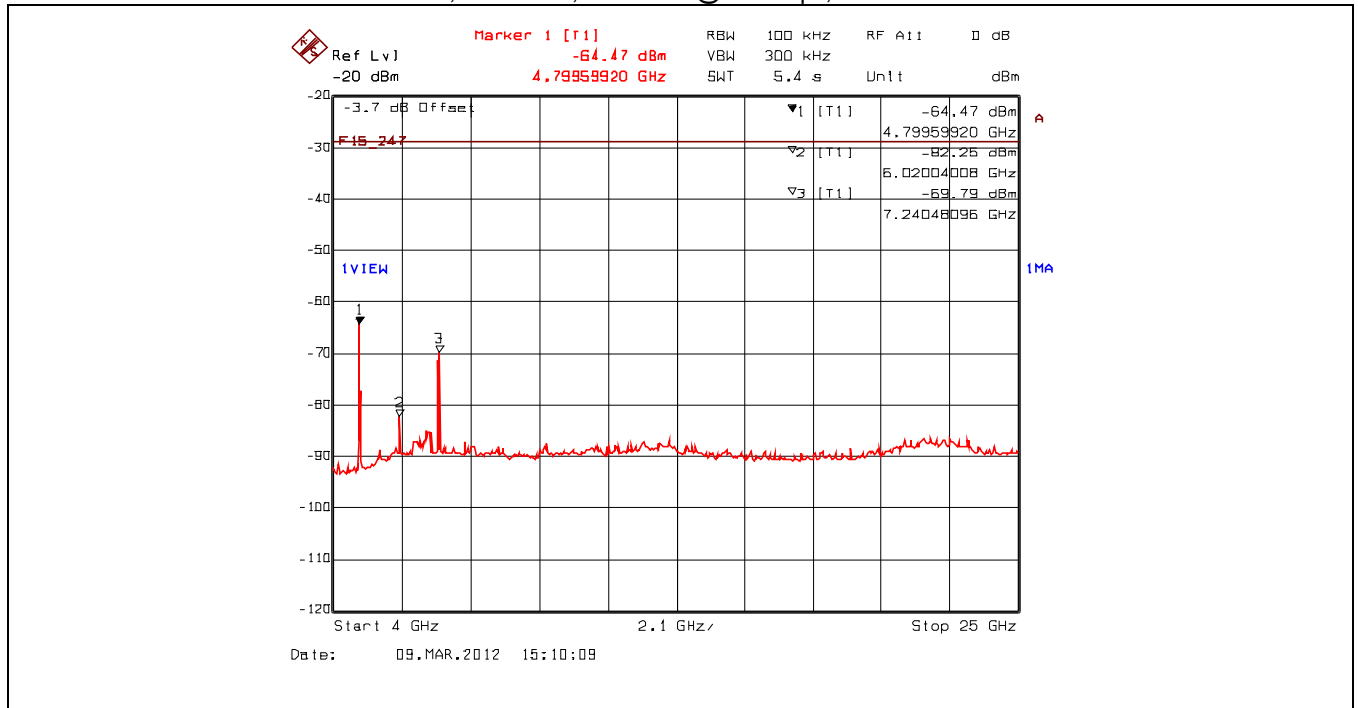
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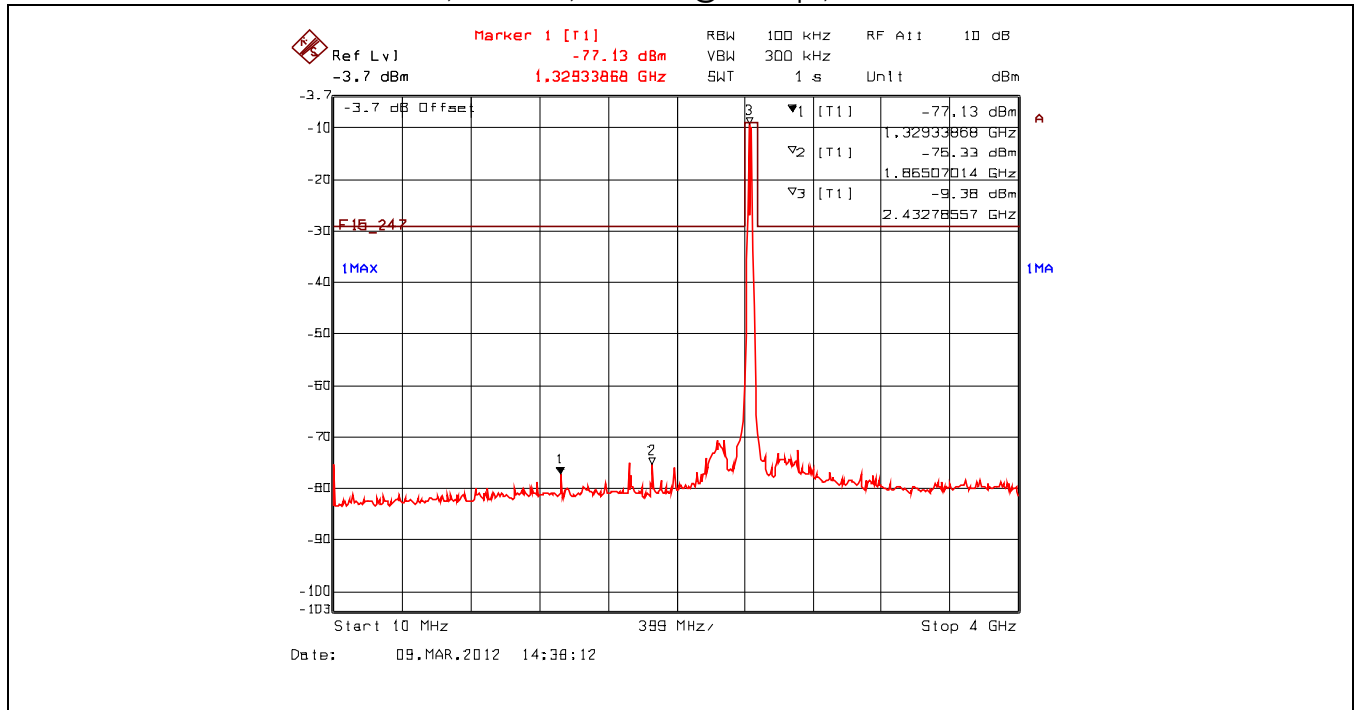
**Plot 5.4.4.2.7. Conducted Spurious Emissions - Non Restricted Frequency Bands**  
802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, 10 MHz - 4 GHz



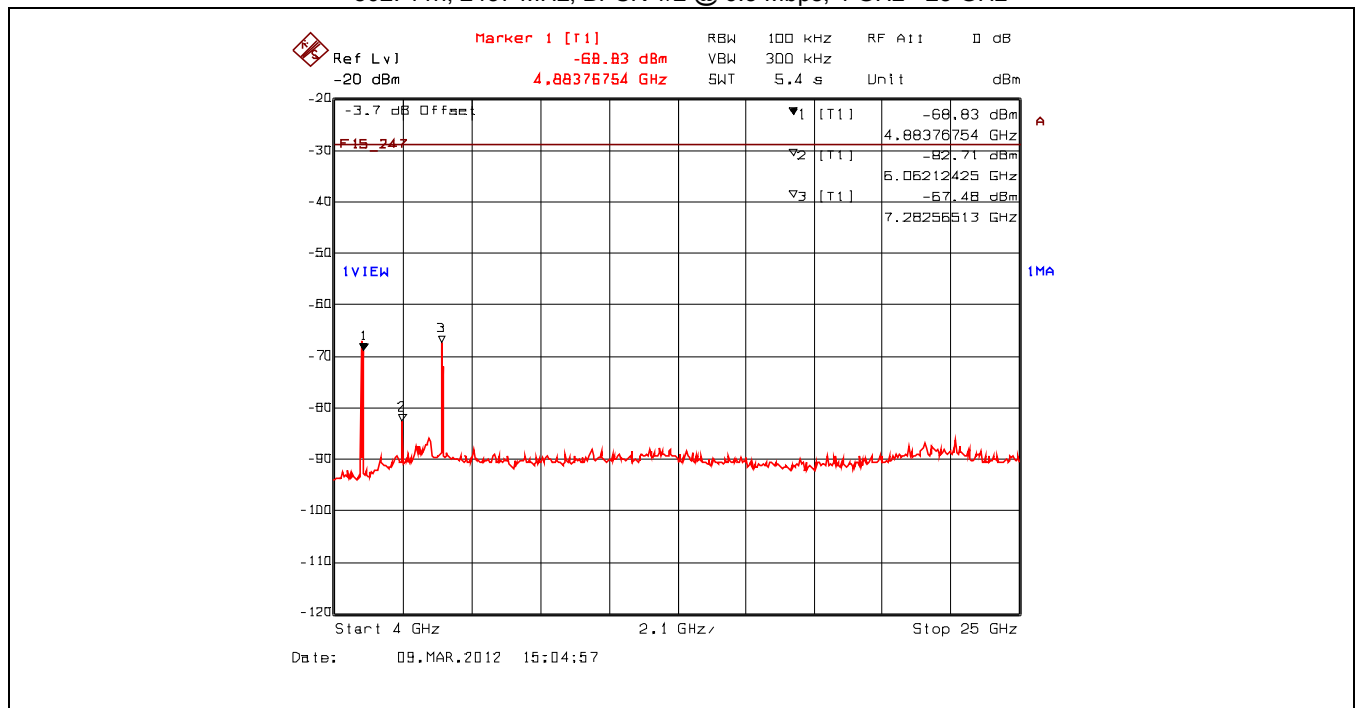
**Plot 5.4.4.2.8. Conducted Spurious Emissions - Non Restricted Frequency Bands**  
802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, 4 GHz - 25 GHz



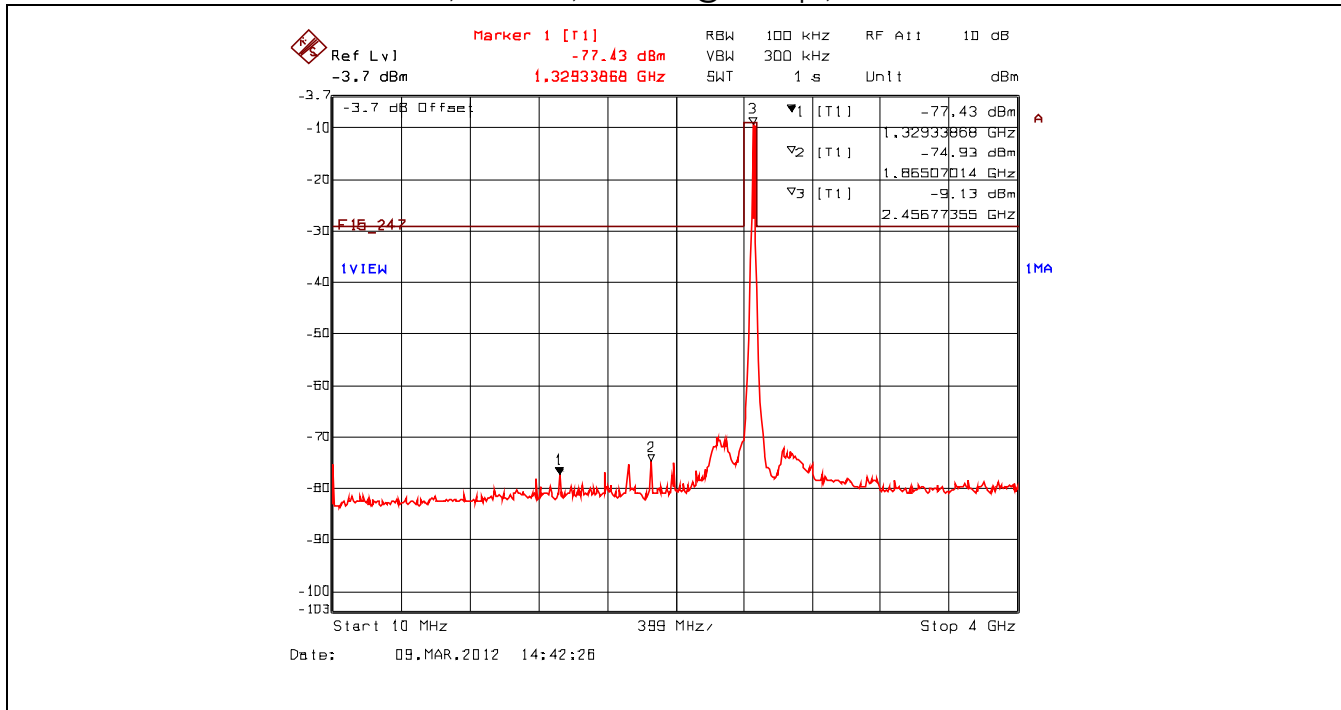
**Plot 5.4.4.2.9. Conducted Spurious Emissions – Non Restricted Frequency Bands**  
802. 11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, 10 MHz - 4 GHz



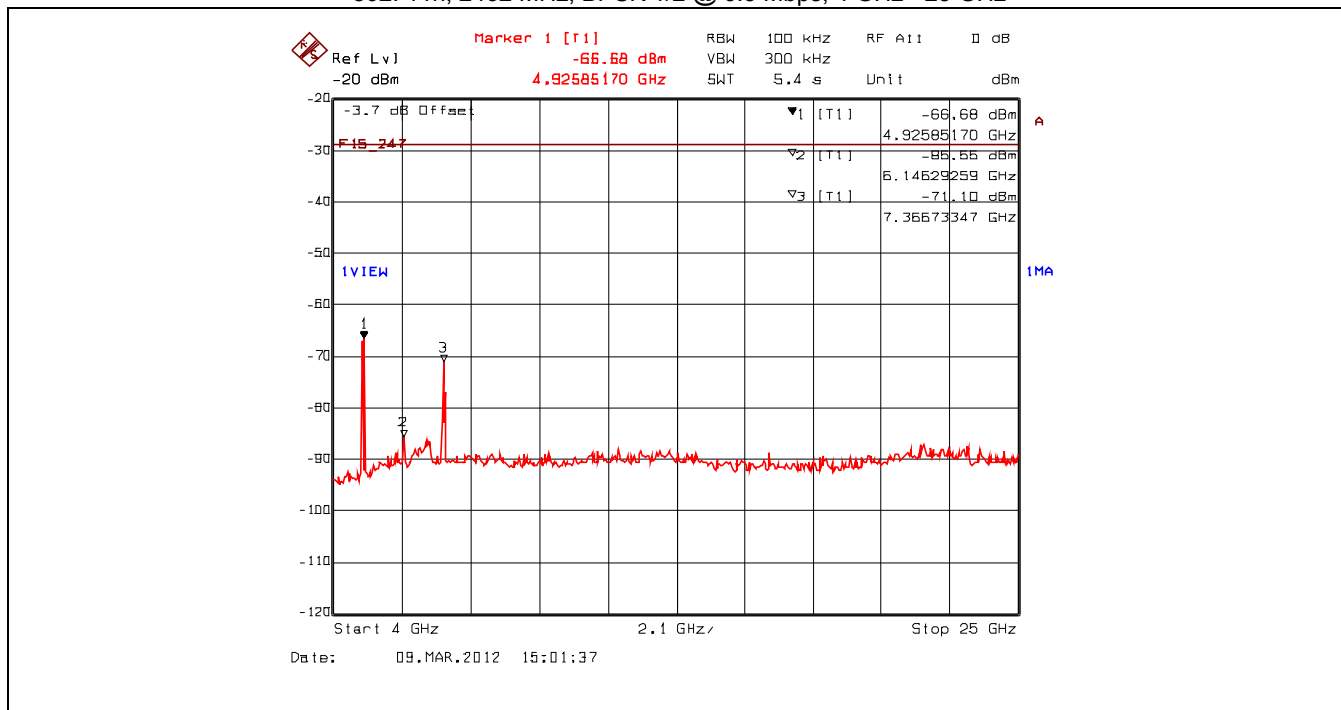
**Plot 5.4.4.2.10. Conducted Spurious Emissions – Non Restricted Frequency Bands,**  
802. 11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, 4 GHz - 25 GHz



**Plot 5.4.4.2.11. Conducted Spurious Emissions – Non Restricted Frequency Bands**  
802. 11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, 10 MHz - 4 GHz



**Plot 5.4.4.2.12. Conducted Spurious Emissions – Non Restricted Frequency Bands**  
802. 11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, 4 GHz - 25 GHz

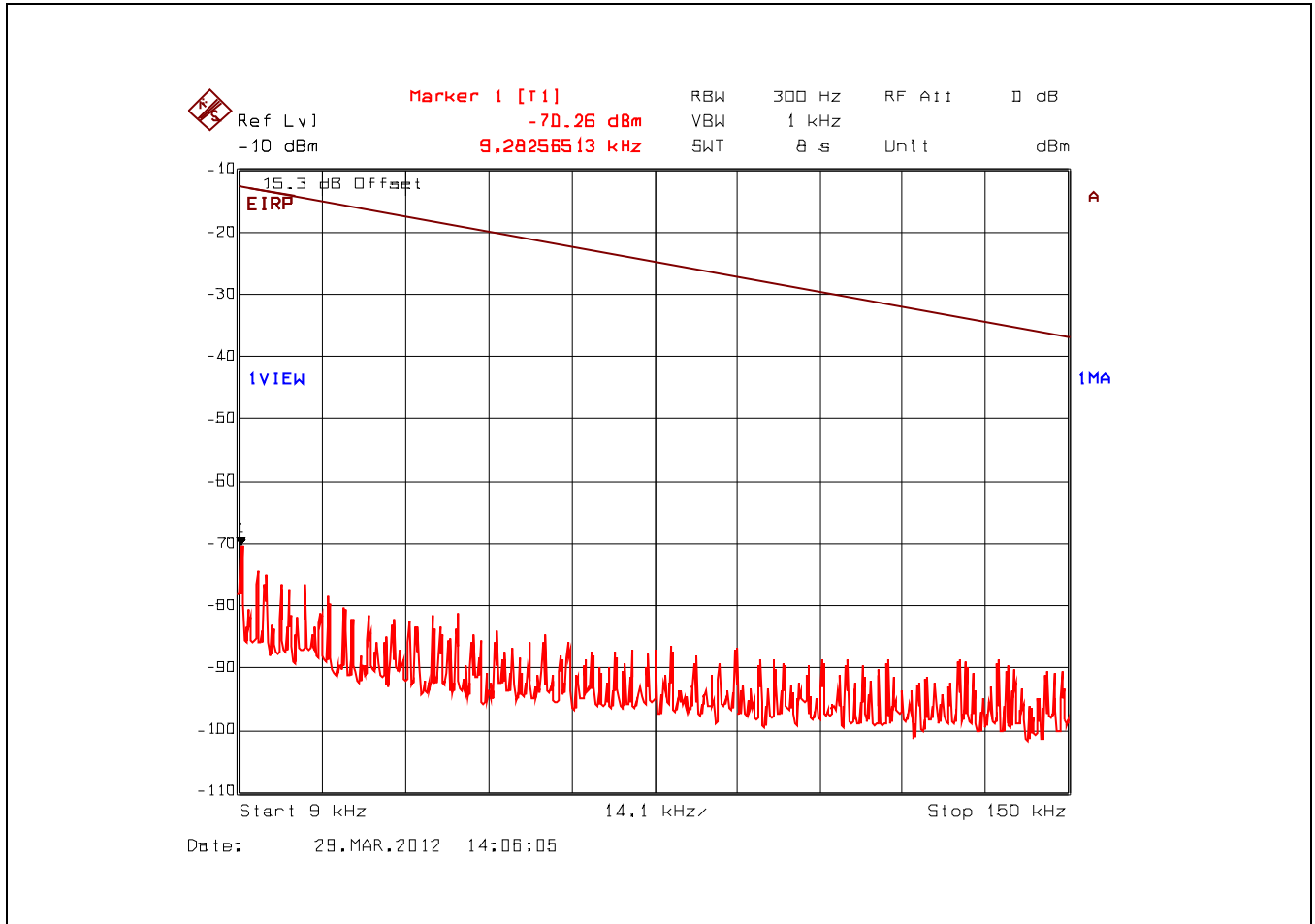




#### 5.4.4.3. Conducted Spurious Emissions – Restricted Bands

**Remark:** Offset = Insertion Loss (11.49 dB) + Antenna Gain (3.8 dBi) = 15.3 dB

**Plot 5.4.4.3.1. Conducted Spurious Emissions – Restricted Bands**  
802.11g, 2412 MHz, BPSK @ 9 Mbps, 9 kHz - 150 kHz, Peak Detector



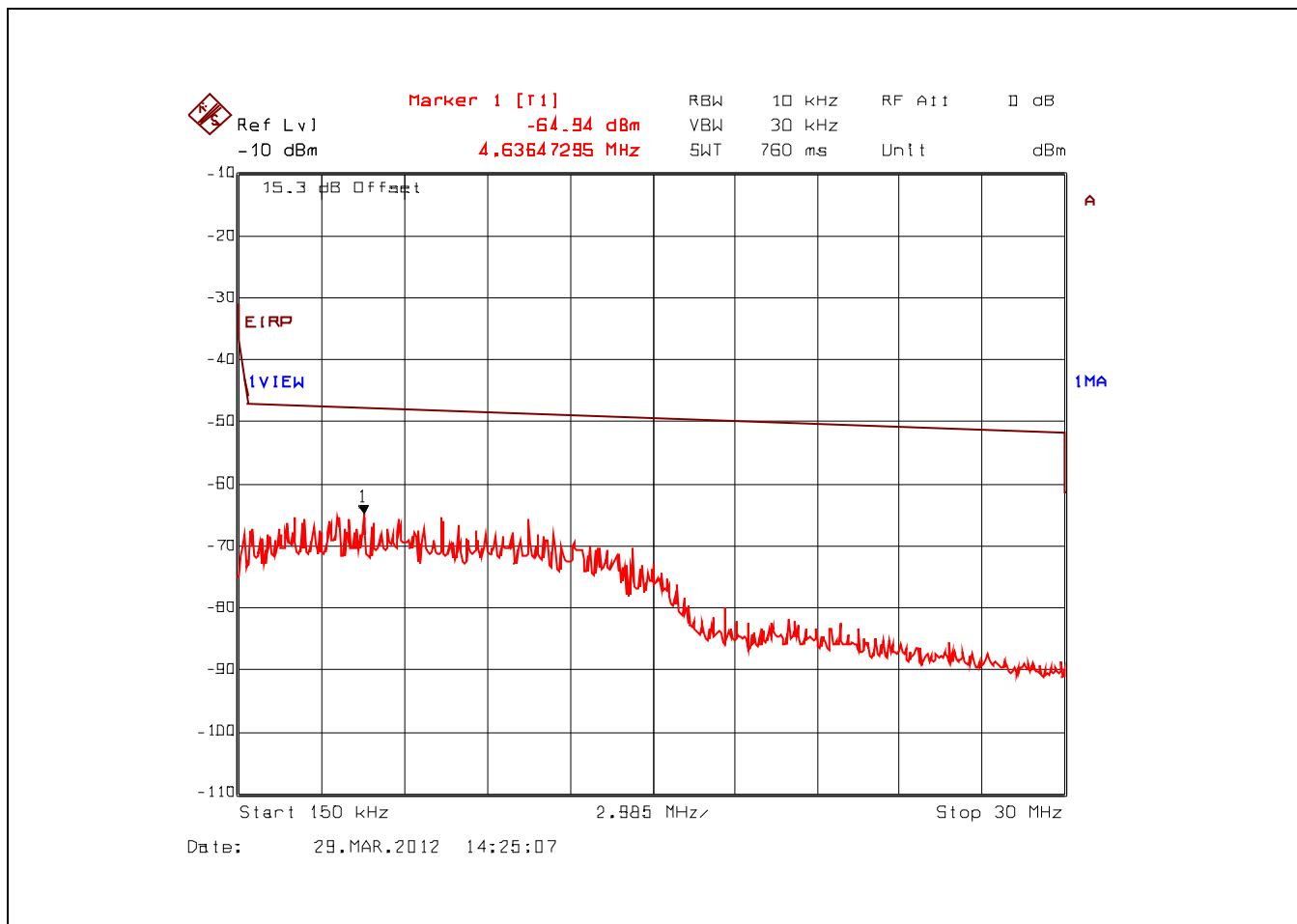
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**Plot 5.4.4.3.2. Conducted Spurious Emissions – Restricted Bands**  
 802.11g, 2412 MHz, BPSK @ 9 Mbps, 150 kHz - 30 MHz, Peak Detector



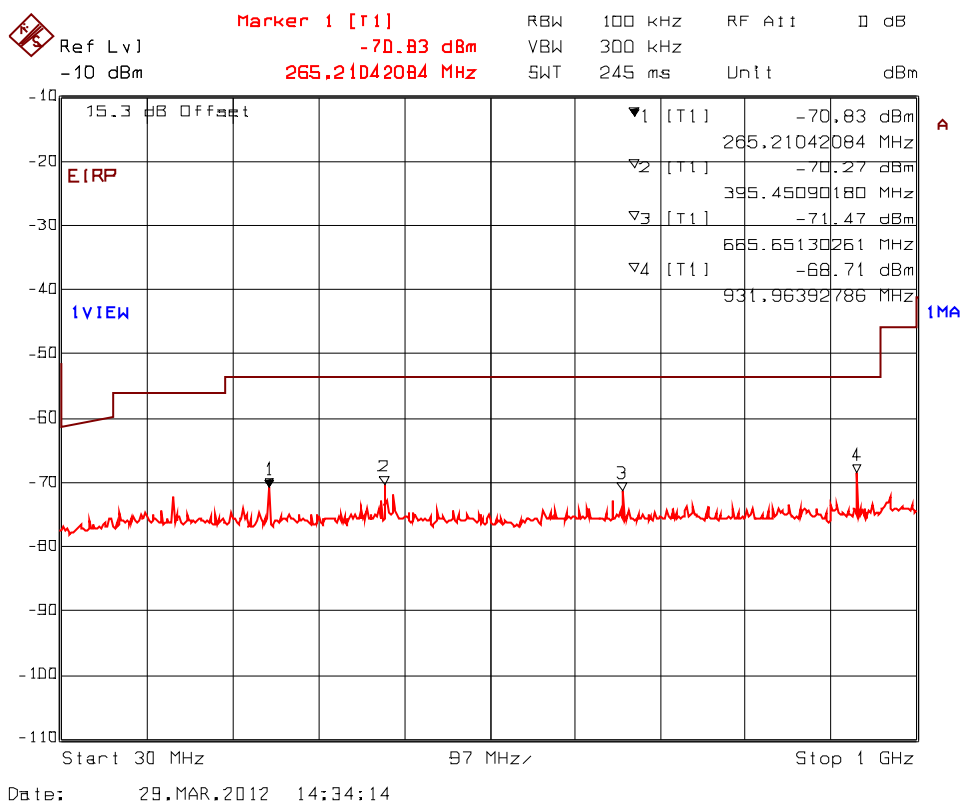
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**Plot 5.4.4.3.3. Conducted Spurious Emissions – Restricted Bands**  
802.11g, 2412 MHz, BPSK @ 9 Mbps, 30 MHz - 1 GHz, Peak Detector



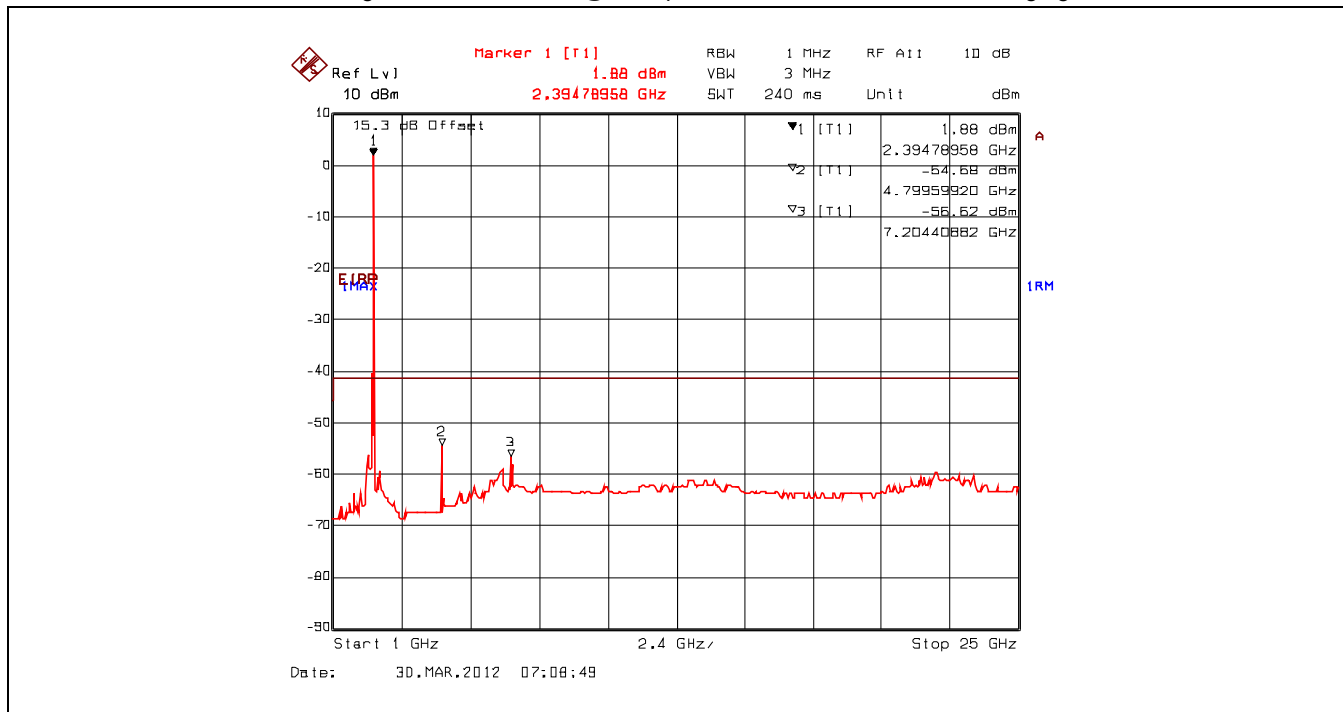
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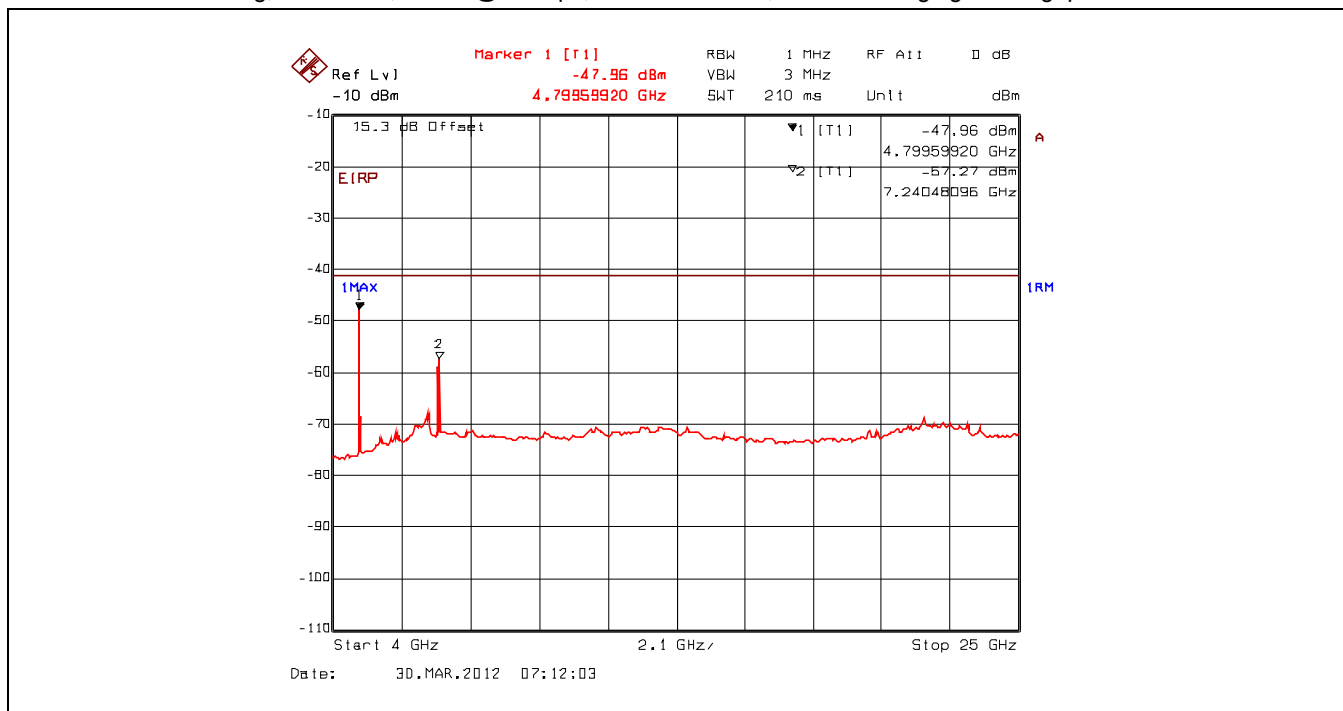
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**Plot 5.4.4.3.4. Conducted Spurious Emissions – Restricted Bands**  
802.11g, 2412 MHz, BPSK @ 9 Mbps, 1 GHz - 25 GHz, Power Averaging



**Plot 5.4.4.3.5. Conducted Spurious Emissions – Restricted Bands**  
802.11g, 2412 MHz, BPSK @ 9 Mbps, 4 GHz - 25 GHz, Power Averaging with Highpass Filter



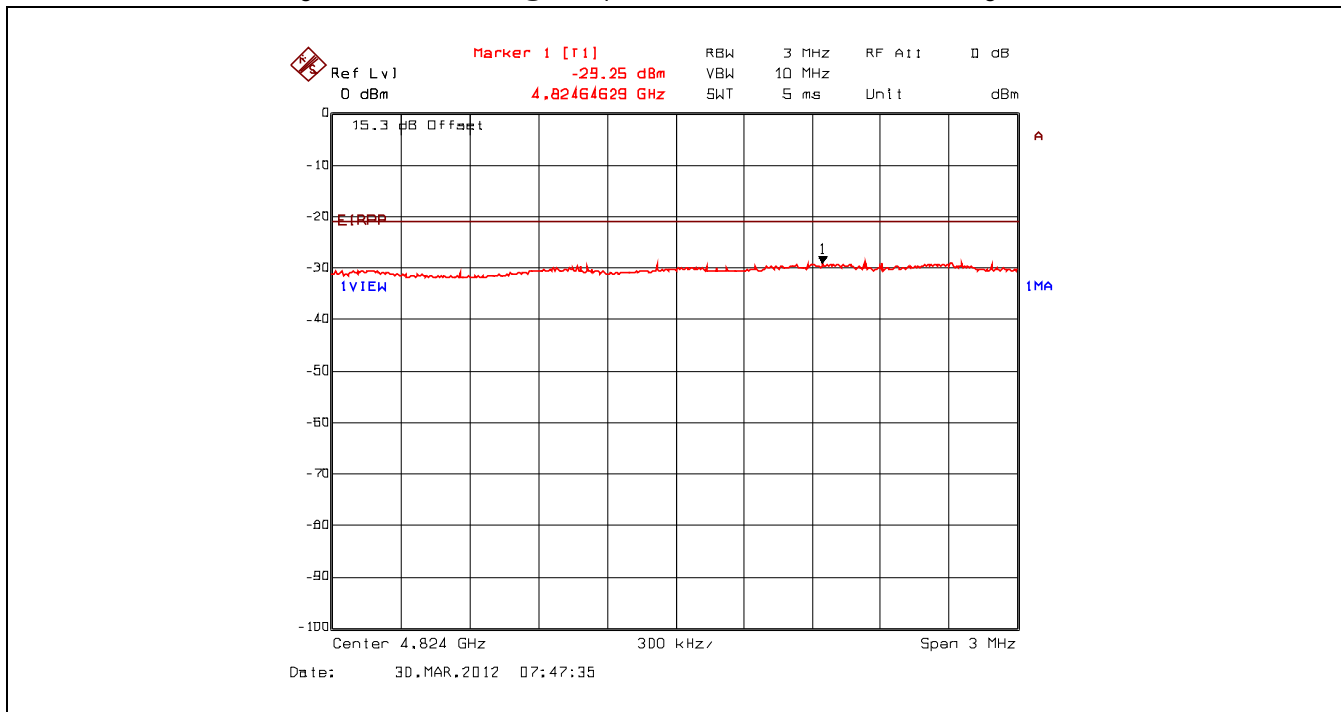
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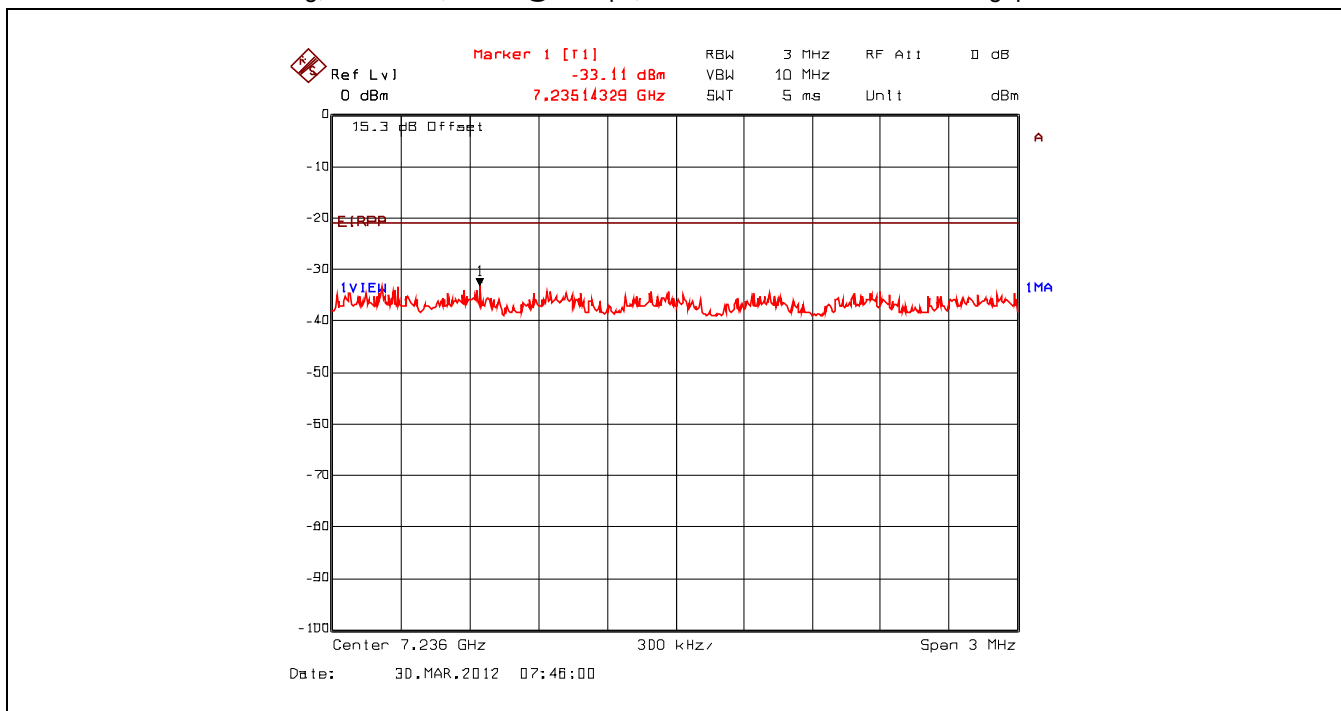
File #: MIS-090F15C247  
July 24, 2012

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**Plot 5.4.4.3.6. Conducted Spurious Emissions – Restricted Bands**  
 802.11g, 2412 MHz, BPSK @ 9 Mbps, Peak Power at 4.82 GHz with High Pass Filter



**Plot 5.4.4.3.7. Conducted Spurious Emissions – Restricted Bands**  
 802.11g, 2412 MHz, BPSK @ 9 Mbps, Peak Power at 7.24 GHz with Highpass Filter



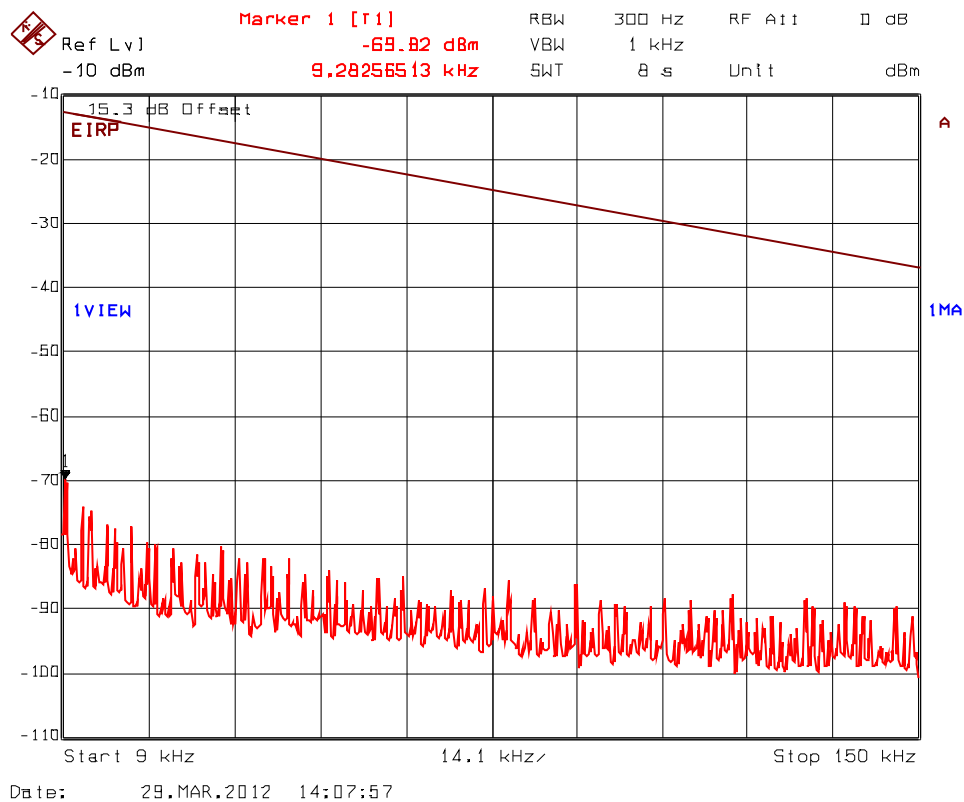
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File #: MIS-090F15C247  
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**Plot 5.4.4.3.8. Conducted Spurious Emissions – Restricted Bands**  
802.11g, 2437 MHz, BPSK @ 9 Mbps, 9 kHz - 150 kHz, Peak Detector



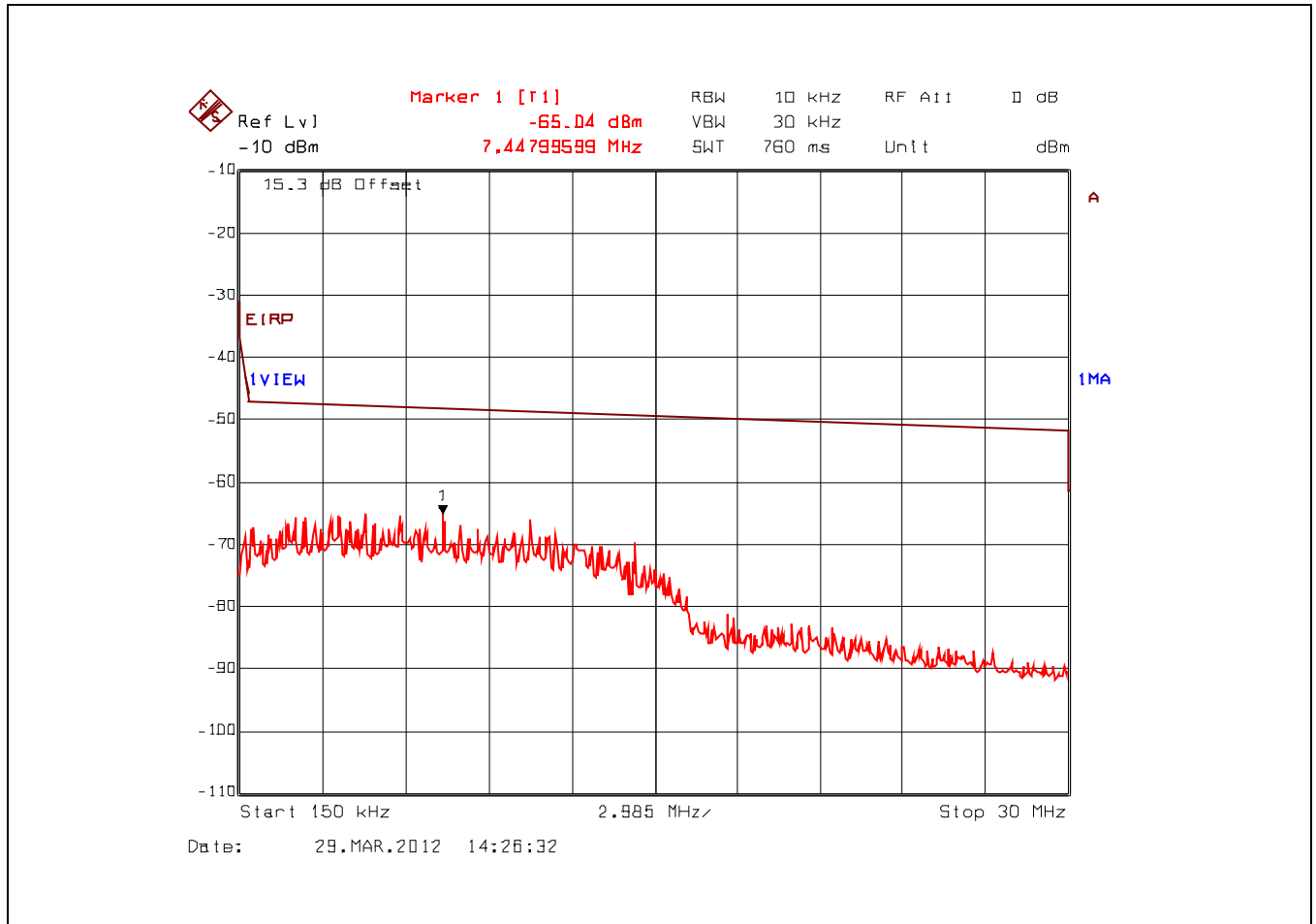
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File #: MIS-090F15C247  
July 24, 2012

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**Plot 5.4.4.3.9. Conducted Spurious Emissions – Restricted Bands**  
 802.11g, 2437 MHz, BPSK @ 9 Mbps, 150 kHz - 30 MHz, Peak Detector



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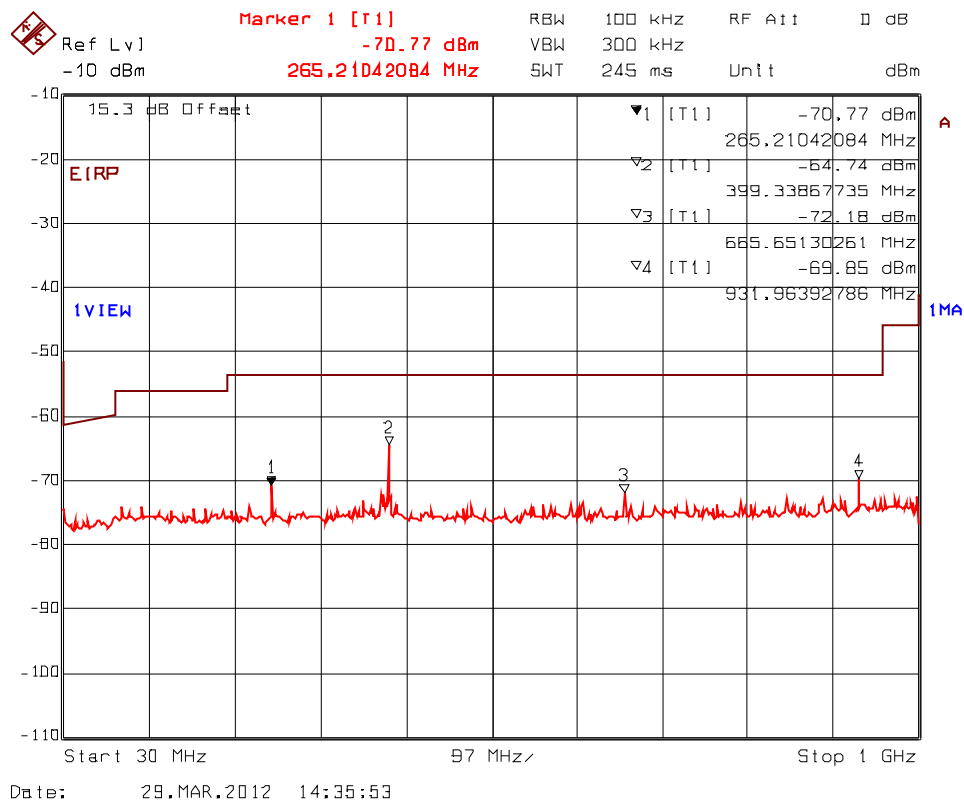
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.4.4.3.10. Conducted Spurious Emissions – Restricted Bands**  
 802.11g, 2437 MHz, BPSK @ 9 Mbps, 30 MHz - 1 GHz, Peak Detector



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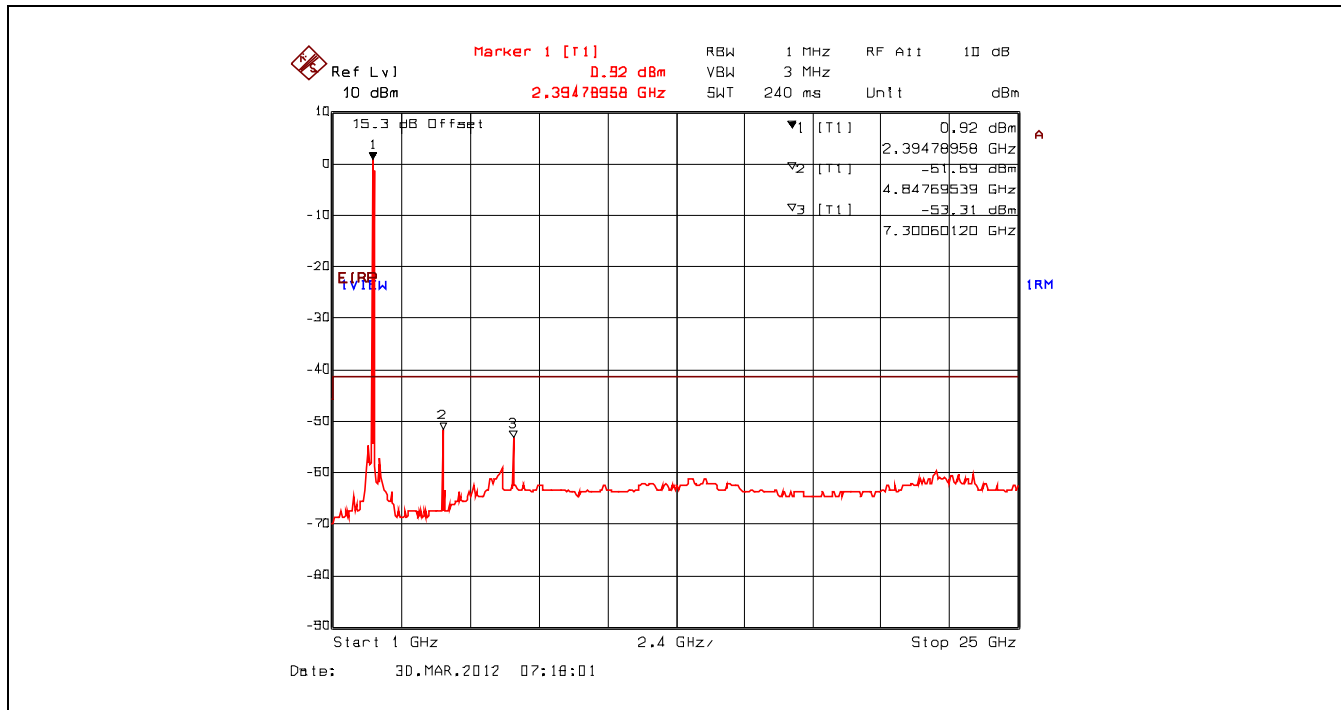
File #: MIS-090F15C247

July 24, 2012

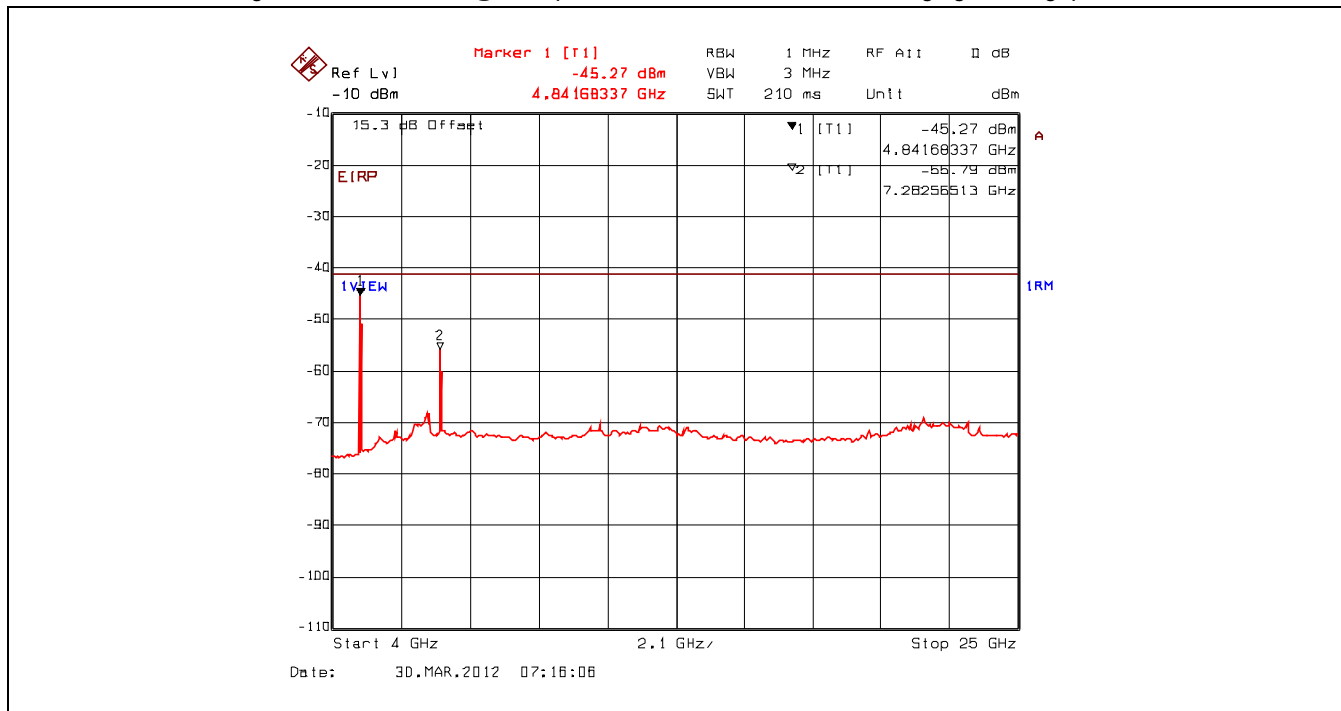
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)



**Plot 5.4.4.3.11. Conducted Spurious Emissions – Restricted Bands**  
802.11g, 2437 MHz, BPSK @ 9 Mbps, 1 GHz - 25 GHz, Power Averaging



**Plot 5.4.4.3.12. Conducted Spurious Emissions – Restricted Bands**  
802.11g, 2437 MHz, BPSK @ 9 Mbps, 4 GHz - 25 GHz, Power Averaging with Highpass Filter



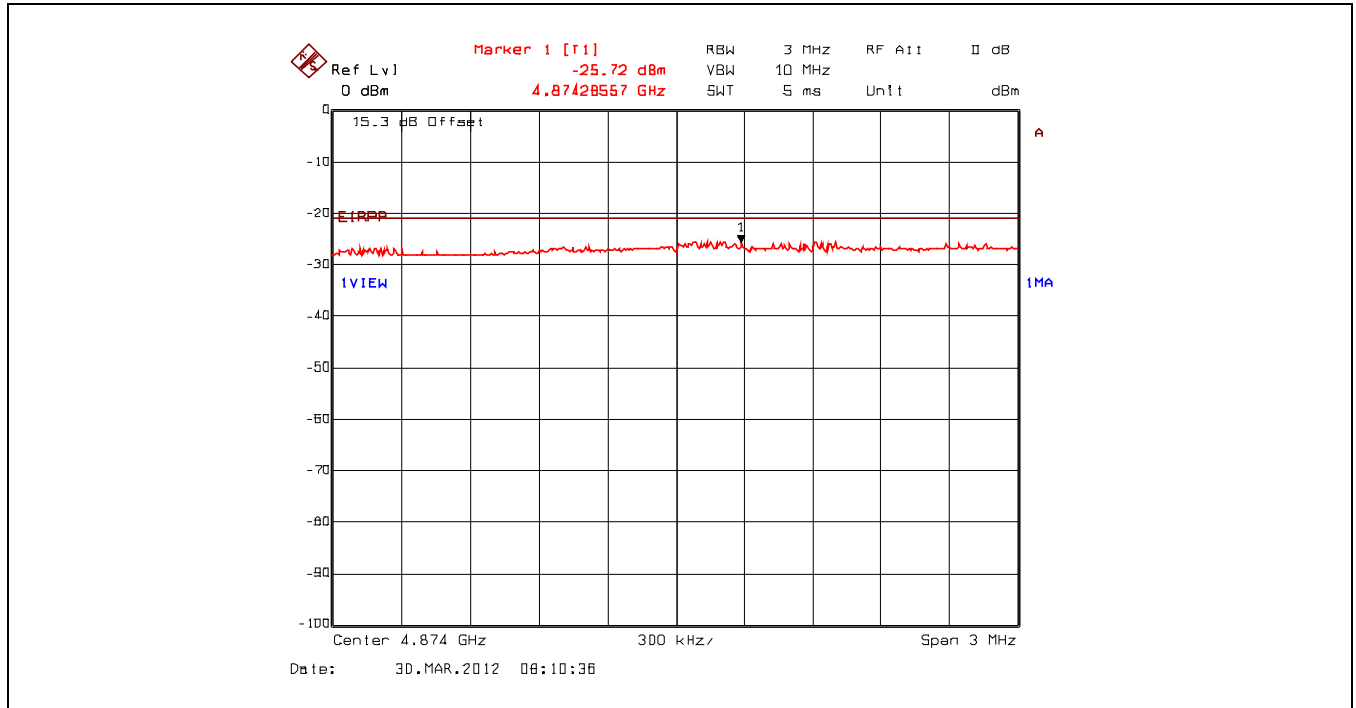
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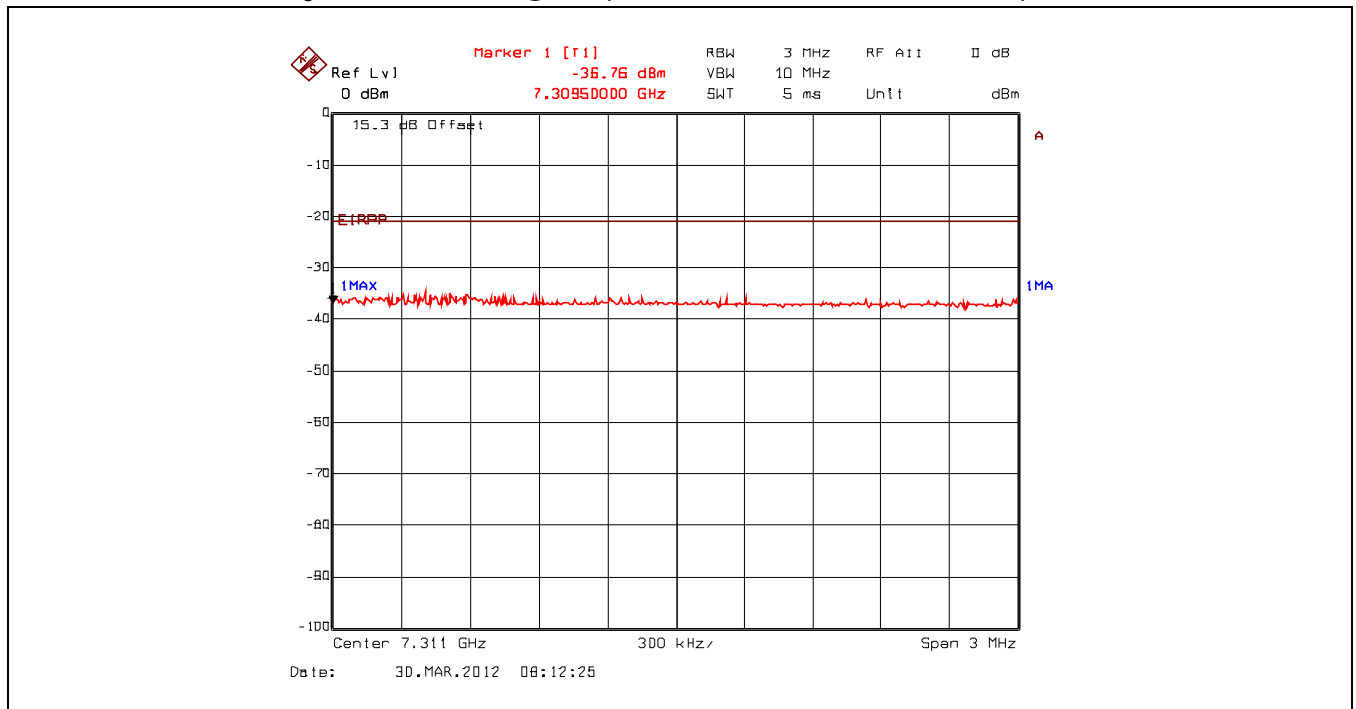
File #: MIS-090F15C247  
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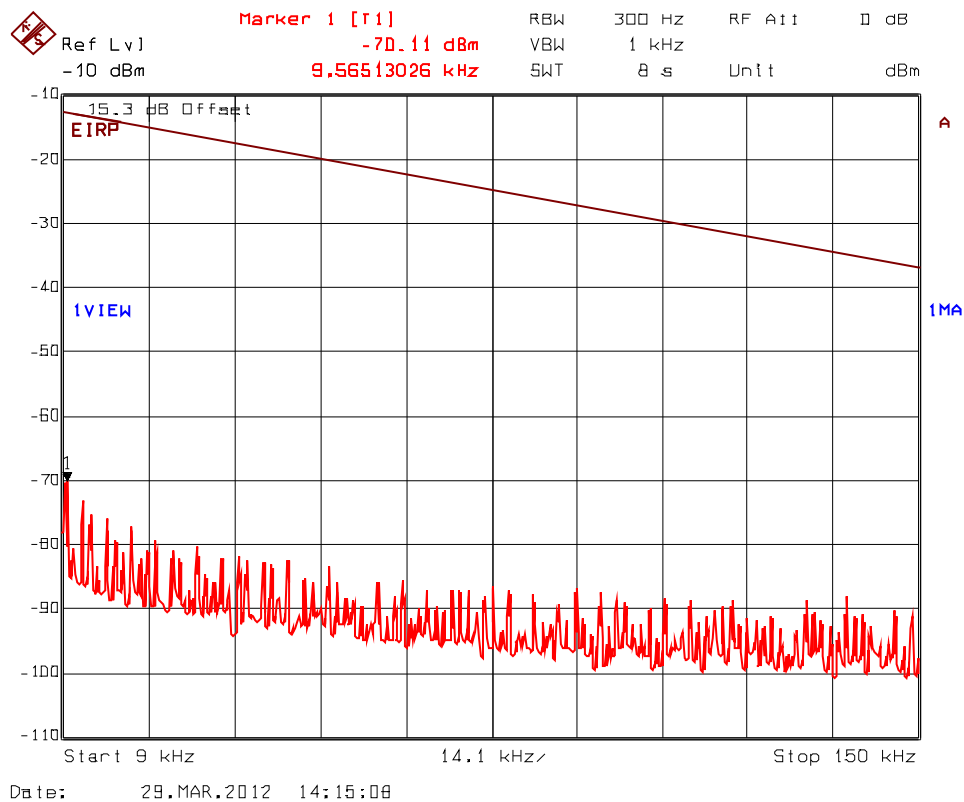
**Plot 5.4.4.3.13.** Conducted Spurious Emissions – Restricted Bands  
802.11g, 2437 MHz, BPSK @ 9 Mbps, Peak Power at 4.87 GHz with Bandpass Filter



**Plot 5.4.4.3.14.** Conducted Spurious Emissions – Restricted Bands  
802.11g, 2437 MHz, BPSK @ 9 Mbps, Peak Power at 7.31 GHz with Bandpass Filter



**Plot 5.4.4.3.15.** Conducted Spurious Emissions – Restricted Bands  
802.11g, 2462 MHz, BPSK @ 9 Mbps, 9 kHz - 150 kHz, Peak Detector



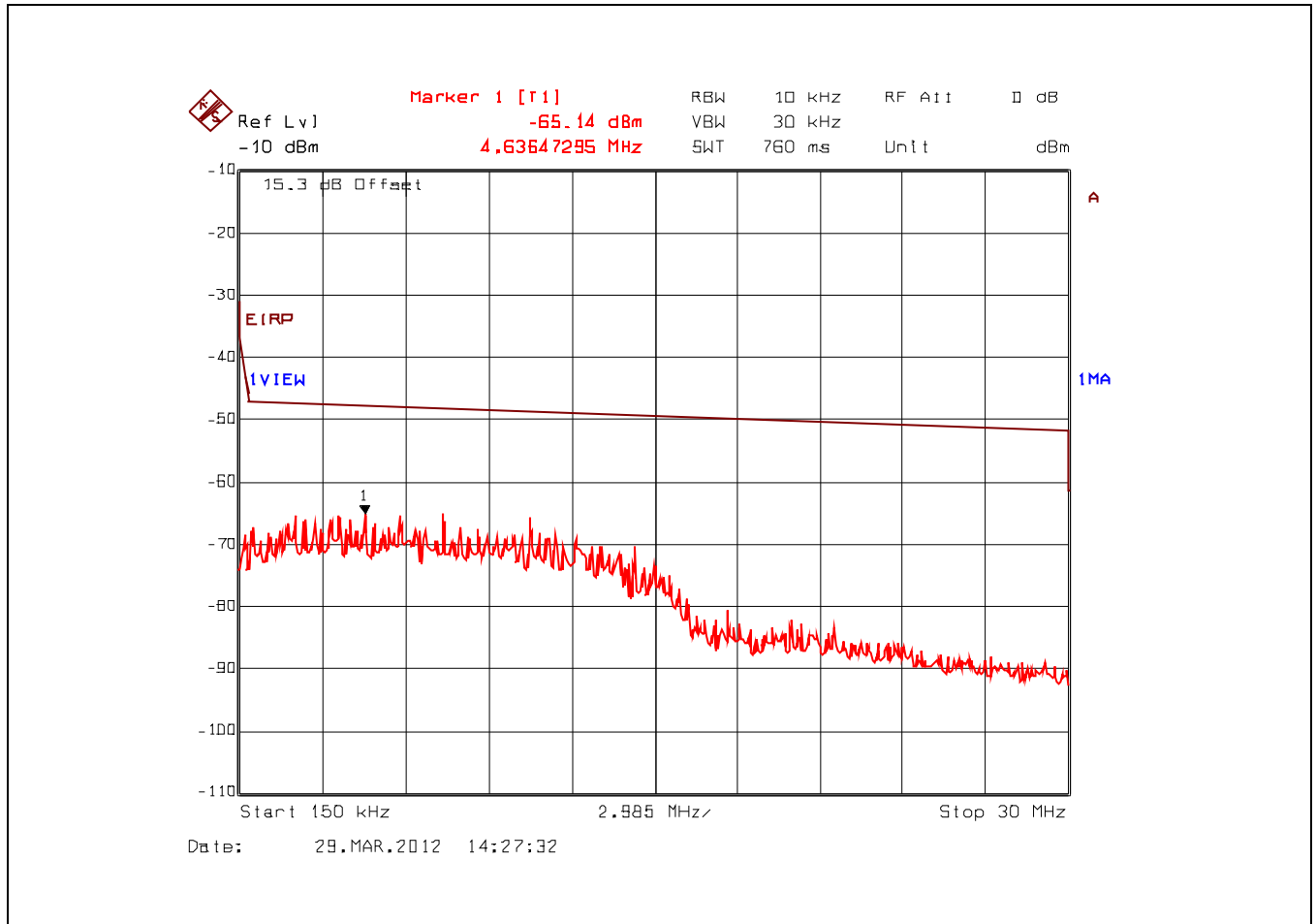
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**Plot 5.4.4.3.16.** Conducted Spurious Emissions – Restricted Bands  
 802.11g, 2462 MHz, BPSK @ 9 Mbps, 150 kHz - 30 MHz, Peak Detector



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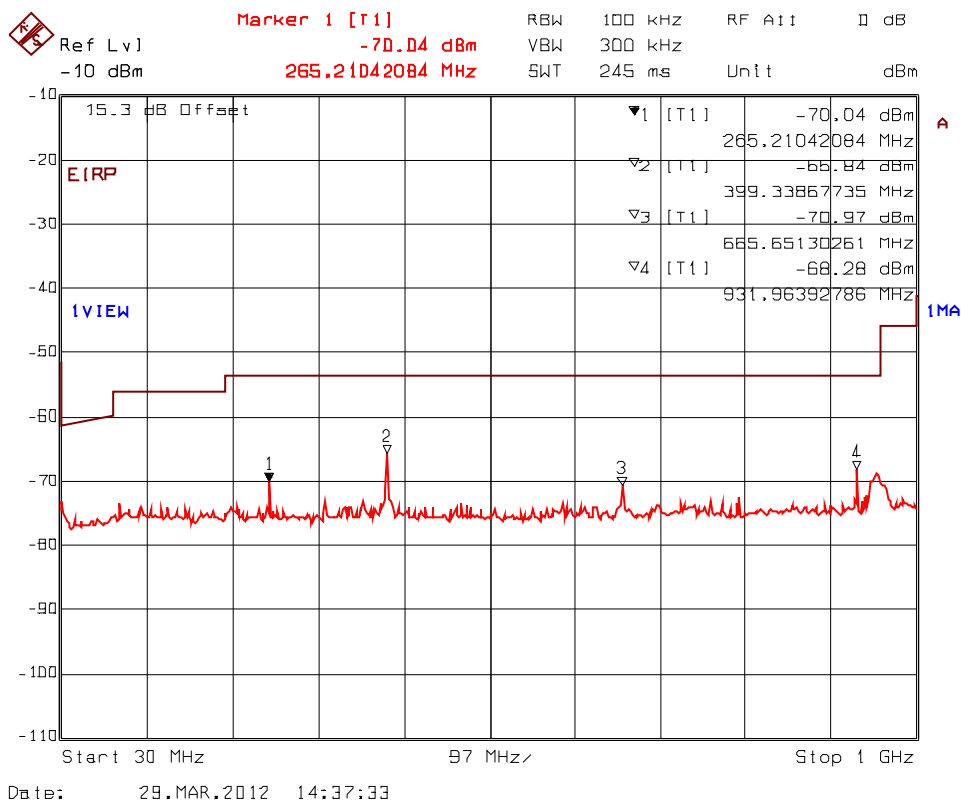
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.4.4.3.17. Conducted Spurious Emissions – Restricted Bands**  
 802.11g, 2462 MHz, BPSK @ 9 Mbps, 30 MHz - 1 GHz, Peak Detector



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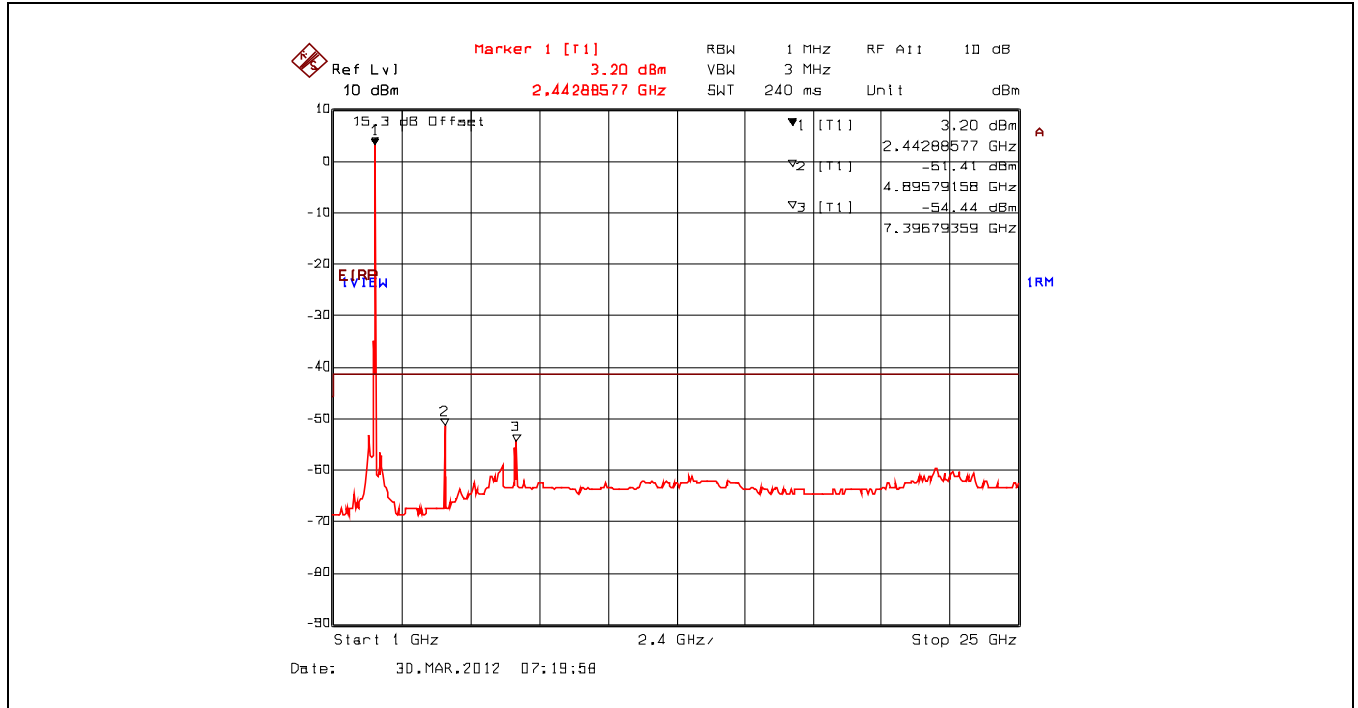
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 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: MIS-090F15C247

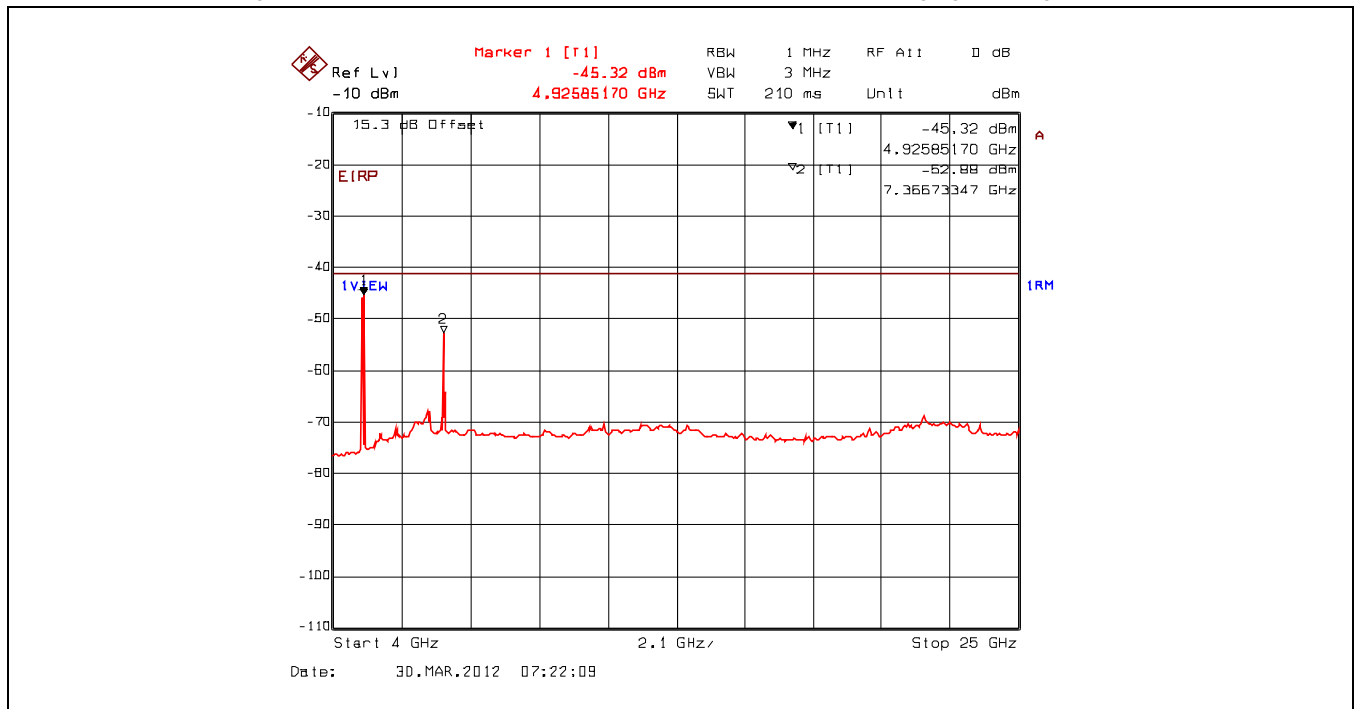
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**Plot 5.4.4.3.18.** Conducted Spurious Emissions – Restricted Bands  
802.11g, 2462 MHz, BPSK @ 9 Mbps, 1 GHz - 25 GHz, Power Averaging



**Plot 5.4.4.3.19.** Conducted Spurious Emissions – Restricted Bands  
802.11g, 2462 MHz, BPSK @ 9 Mbps, 4 GHz - 25 GHz, Power Averaging with Highpass Filter



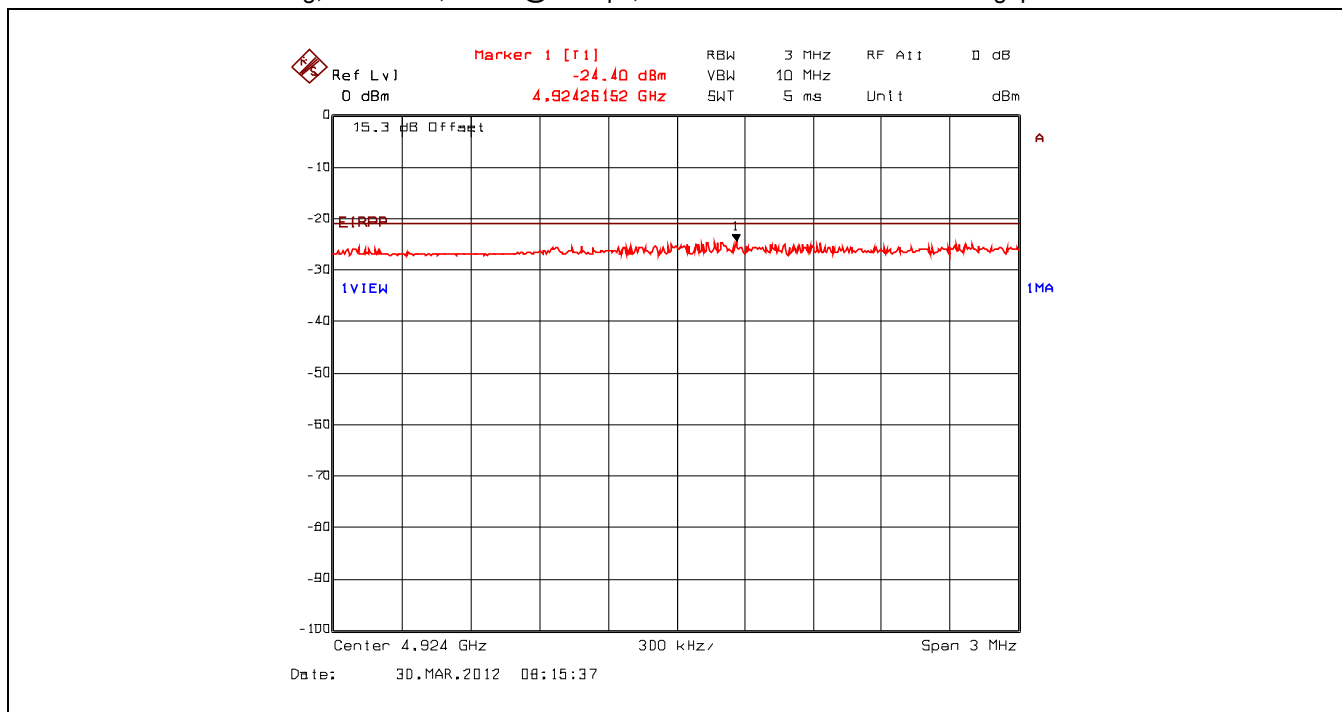
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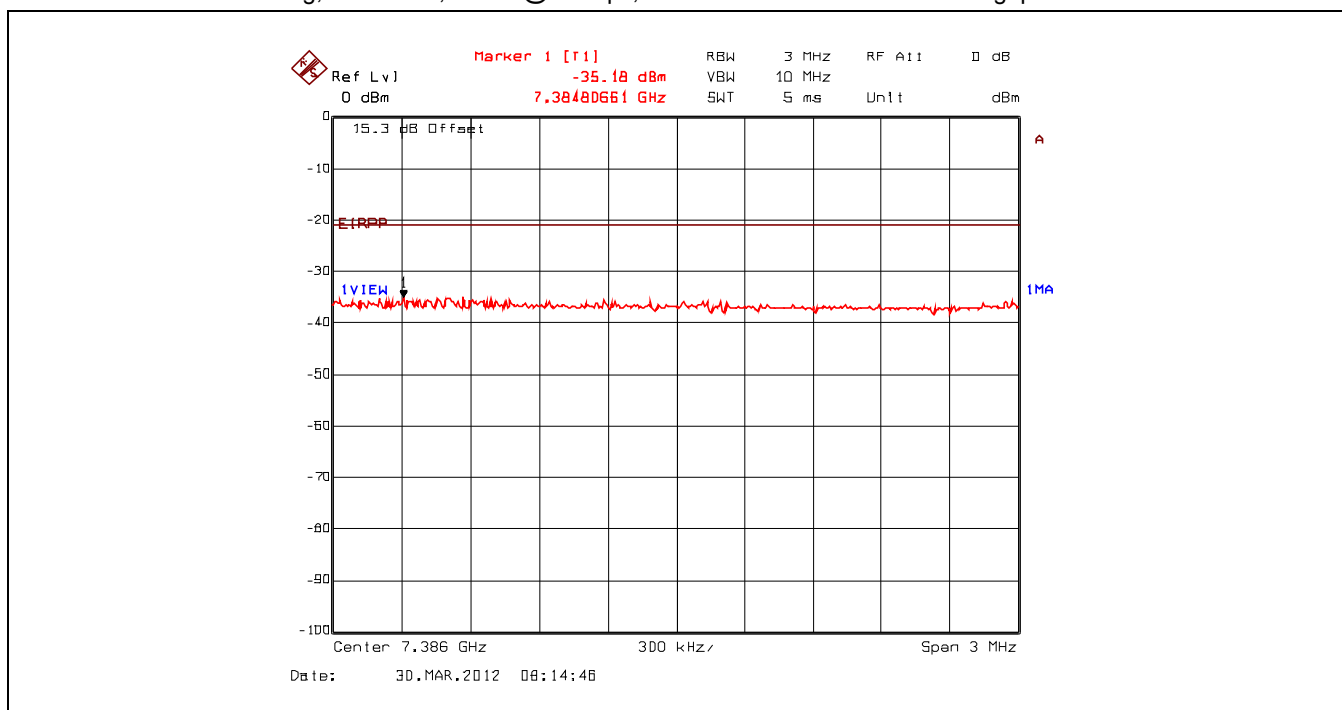
File #: MIS-090F15C247  
July 24, 2012

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

**Plot 5.4.4.3.20.** Conducted Spurious Emissions – Restricted Bands  
802.11g, 2462 MHz, BPSK @ 9 Mbps, Peak Power at 4.92 GHz with Highpass Filter



**Plot 5.4.4.3.21.** Conducted Spurious Emissions – Restricted Bands  
802.11g, 2462 MHz, BPSK @ 9 Mbps, Peak Power at 7.38 GHz with Highpass Filter



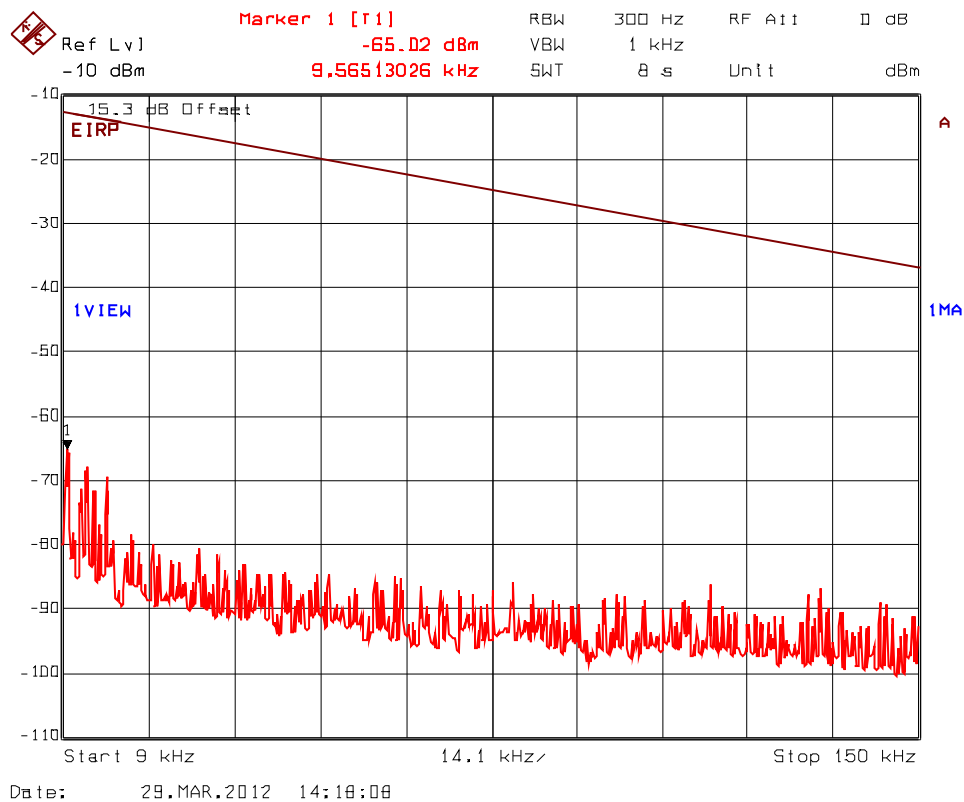
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**Plot 5.4.4.3.22.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, 9 kHz - 150 kHz, Peak Detector



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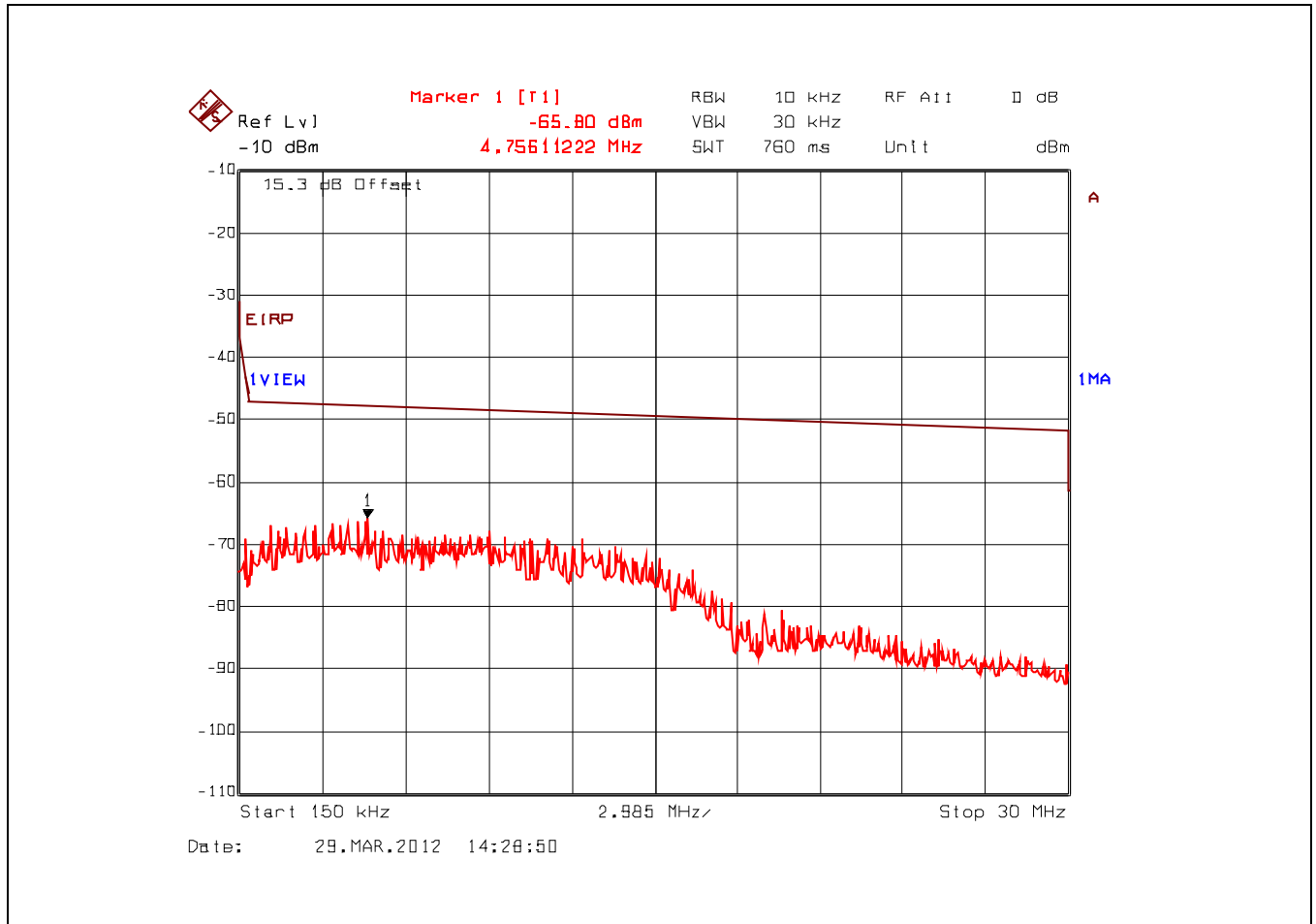
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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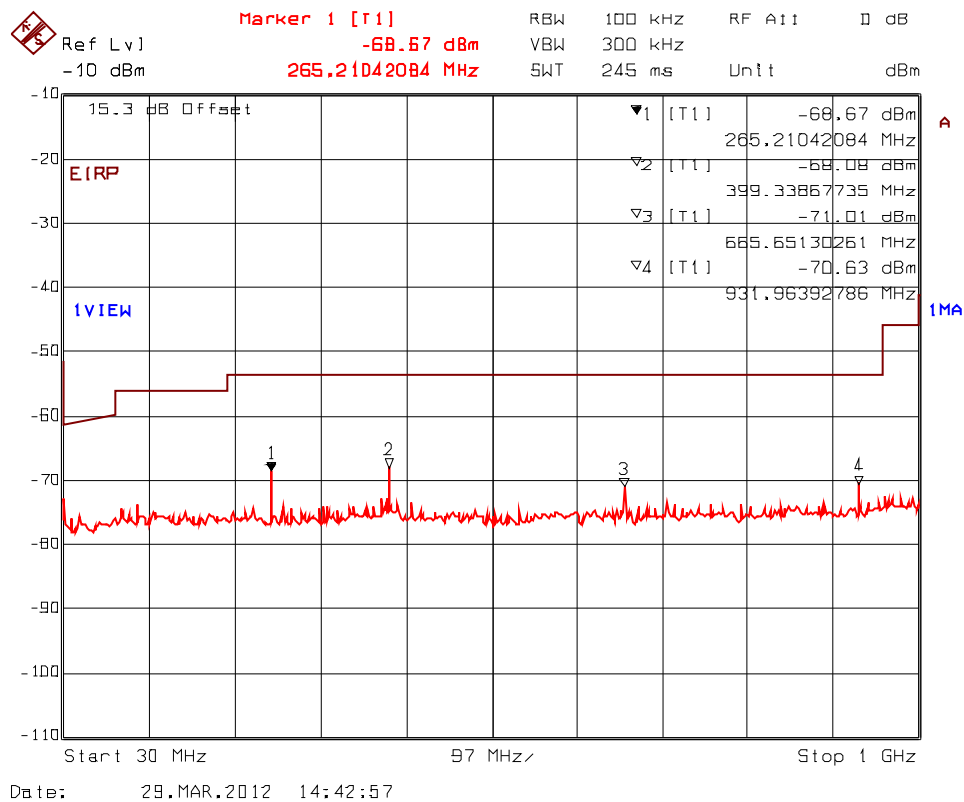
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)



**Plot 5.4.4.3.23. Conducted Spurious Emissions – Restricted Bands**  
 802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, 150 kHz - 30 MHz, Peak Detector



**Plot 5.4.4.3.24. Conducted Spurious Emissions – Restricted Bands**  
802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, 30 MHz - 1 GHz, Peak Detector



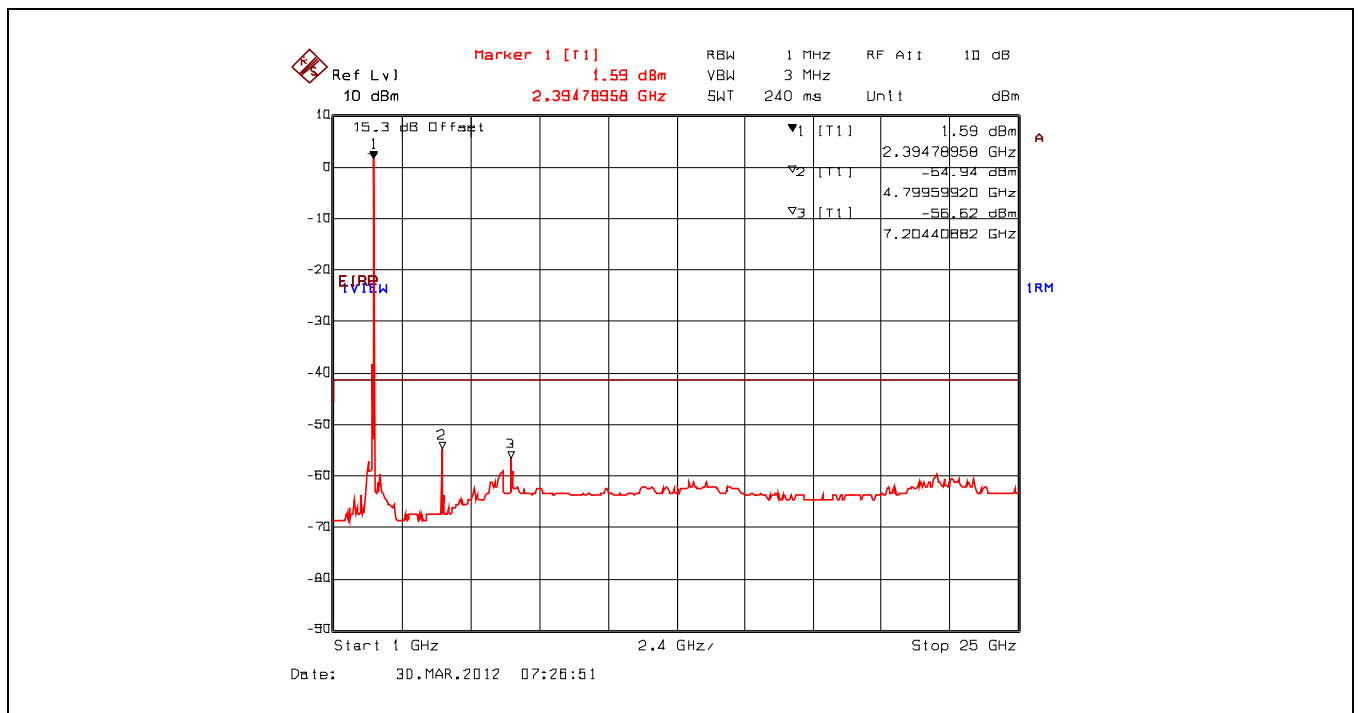
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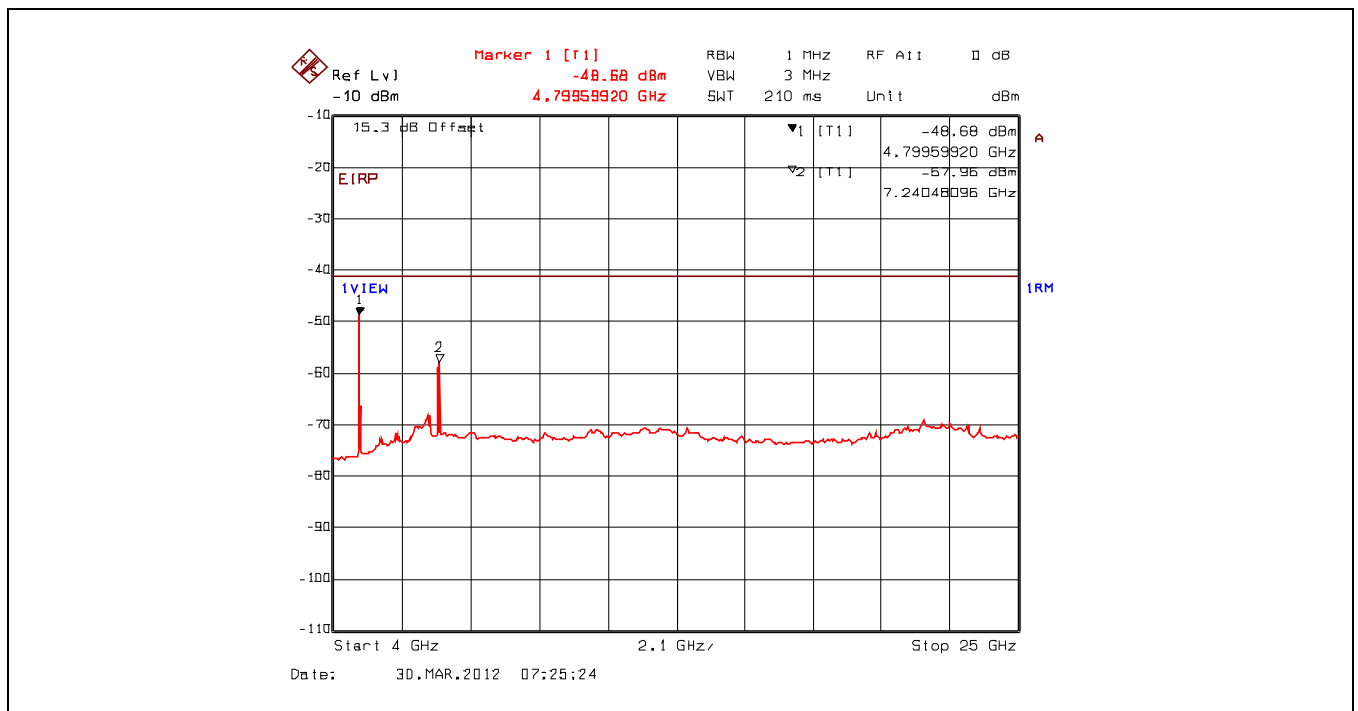
File #: MIS-090F15C247  
July 24, 2012

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

**Plot 5.4.4.3.25. Conducted Spurious Emissions – Restricted Bands**  
802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, 1 GHz - 25 GHz, Power Averaging



**Plot 5.4.4.3.26. Conducted Spurious Emissions – Restricted Bands**  
802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, 4 GHz - 25 GHz, Power Averaging with Highpass Filter



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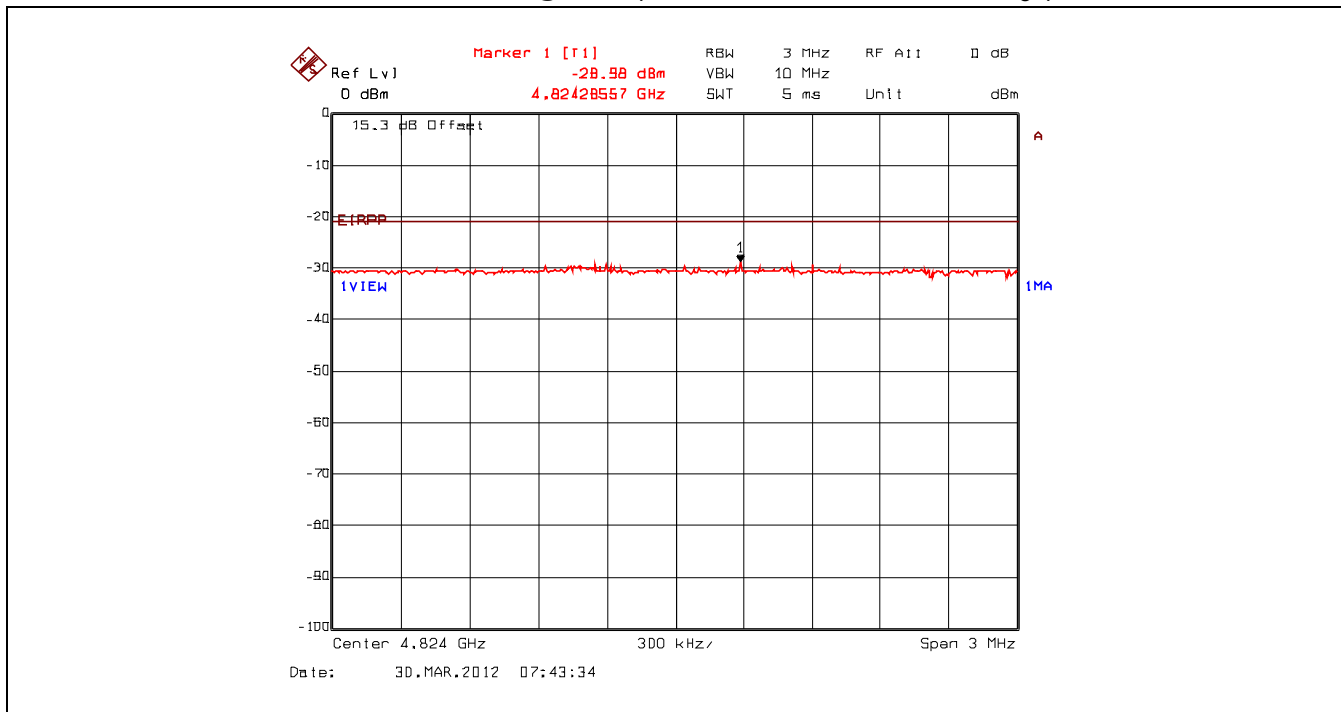
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: MIS-090F15C247

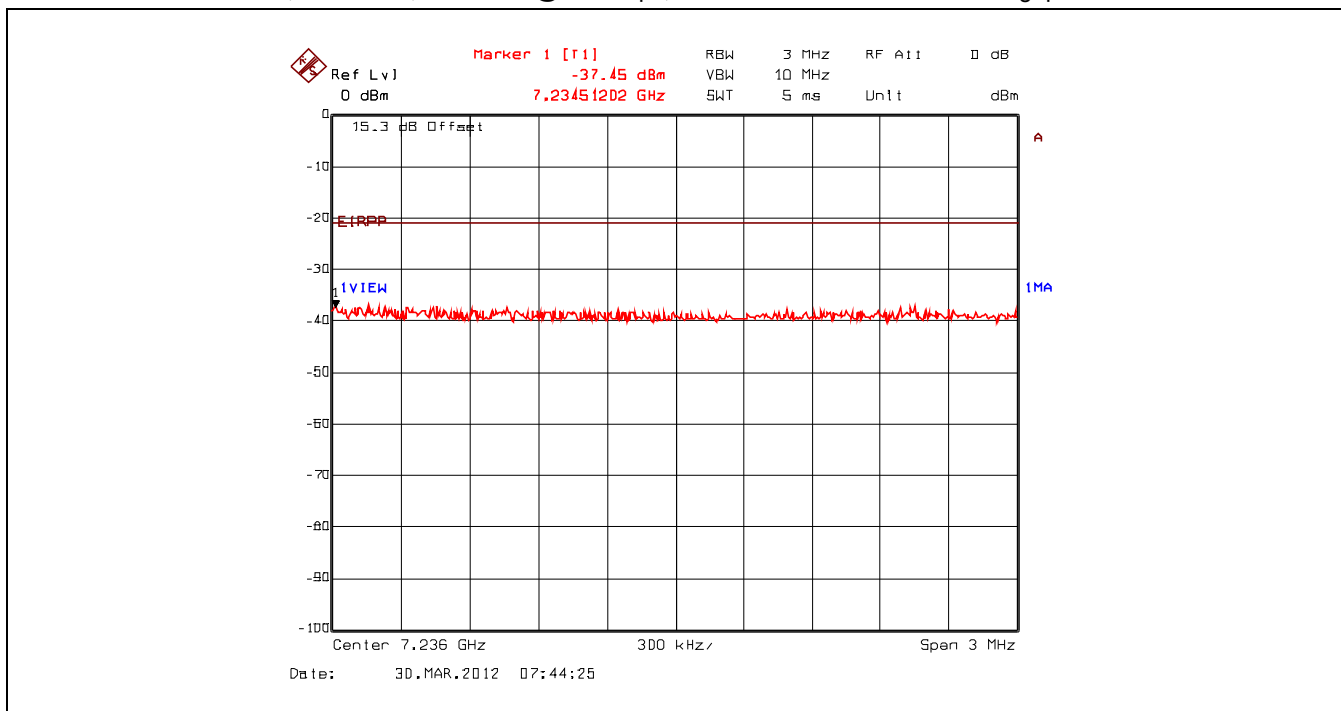
July 24, 2012

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

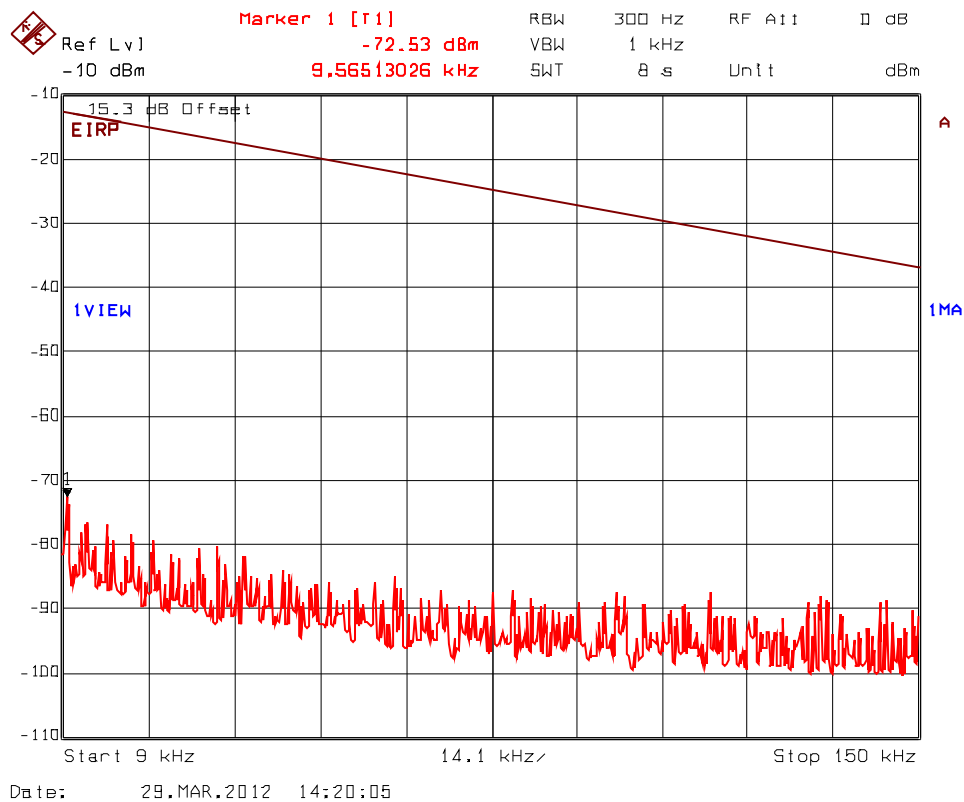
**Plot 5.4.4.3.27.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, Peak Power at 4.82 GHz with Highpass Filter



**Plot 5.4.4.3.28.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps, Peak Power at 7.23 GHz with Highpass Filter



**Plot 5.4.4.3.29.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, 9 kHz - 150 kHz, Peak Detector



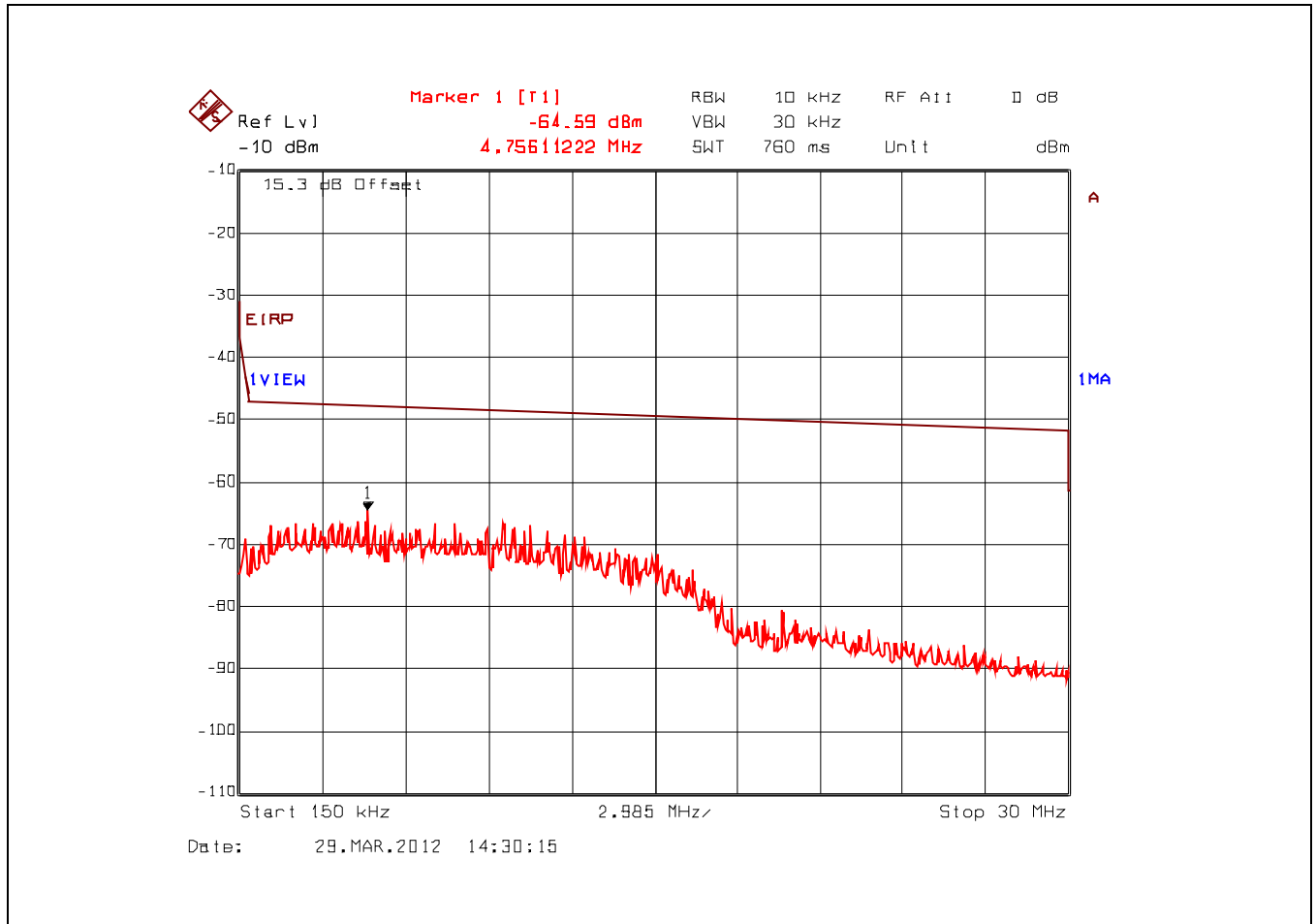
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**Plot 5.4.4.3.30.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, 150 kHz - 30 MHz, Peak Detector



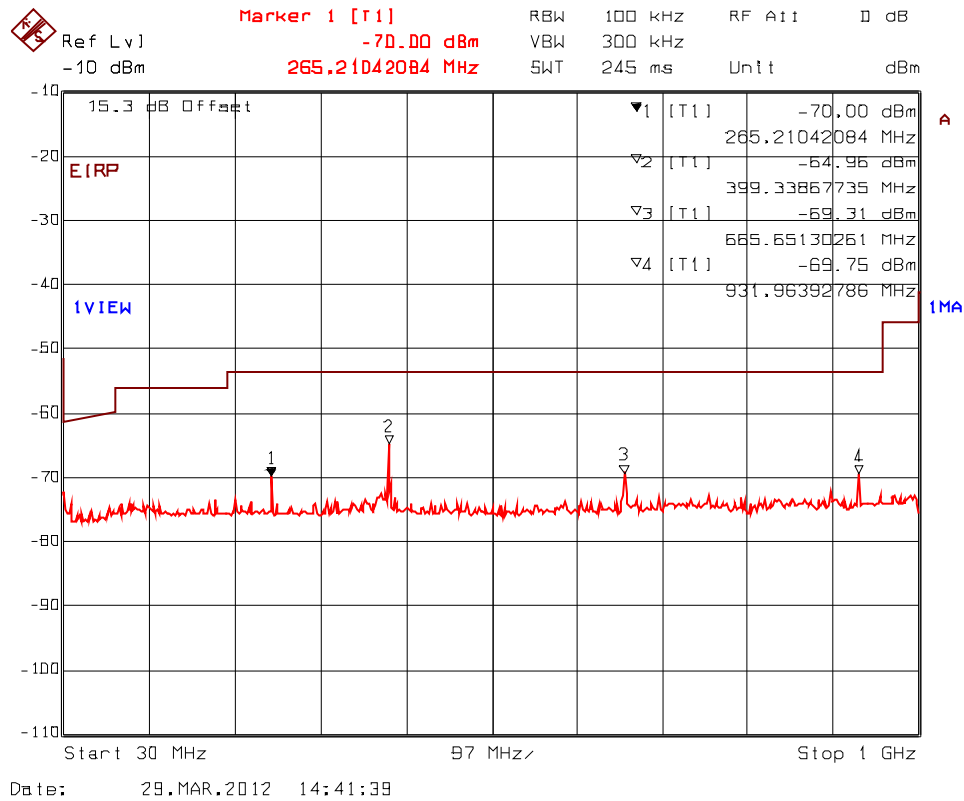
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July 24, 2012

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**Plot 5.4.4.3.31. Conducted Spurious Emissions – Restricted Bands**  
802.11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, 30 MHz - 1 GHz, Peak Detector



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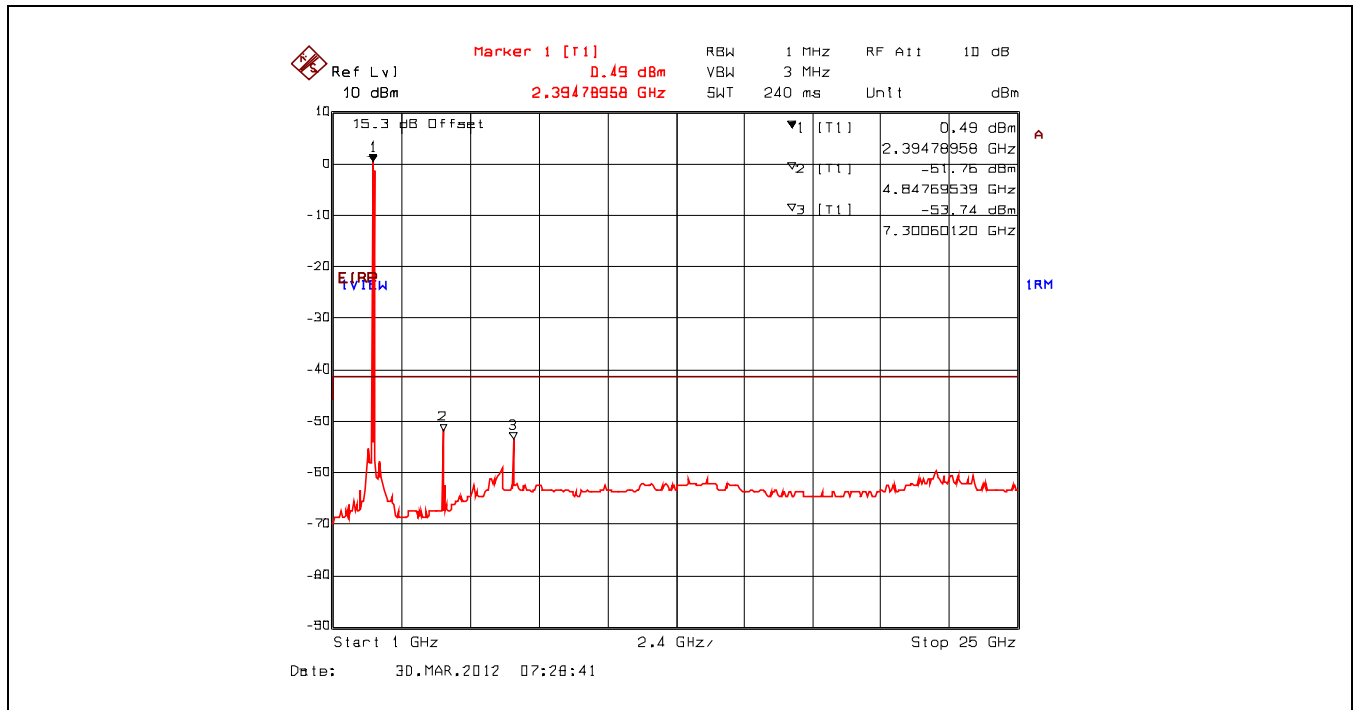
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: MIS-090F15C247

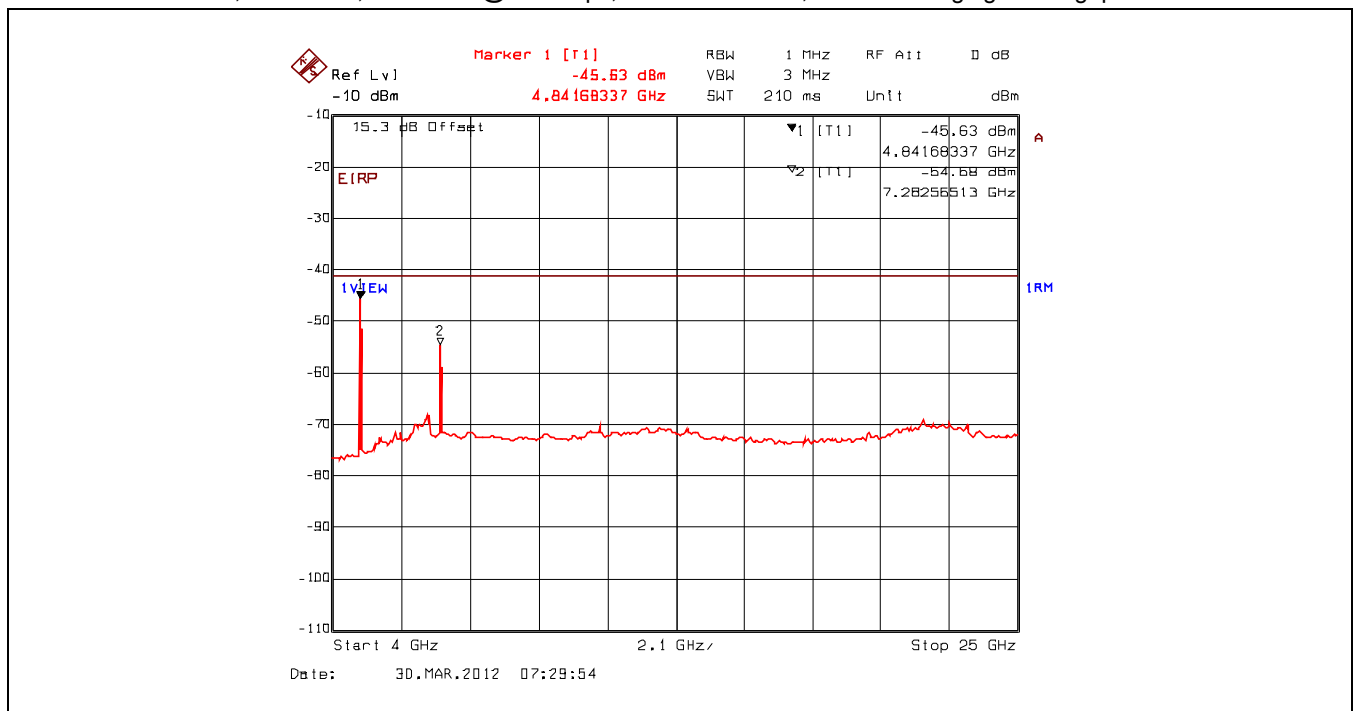
July 24, 2012

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

**Plot 5.4.4.332. Conducted Spurious Emissions – Restricted Bands**  
802.11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, 1 GHz - 25 GHz, Power Averaging

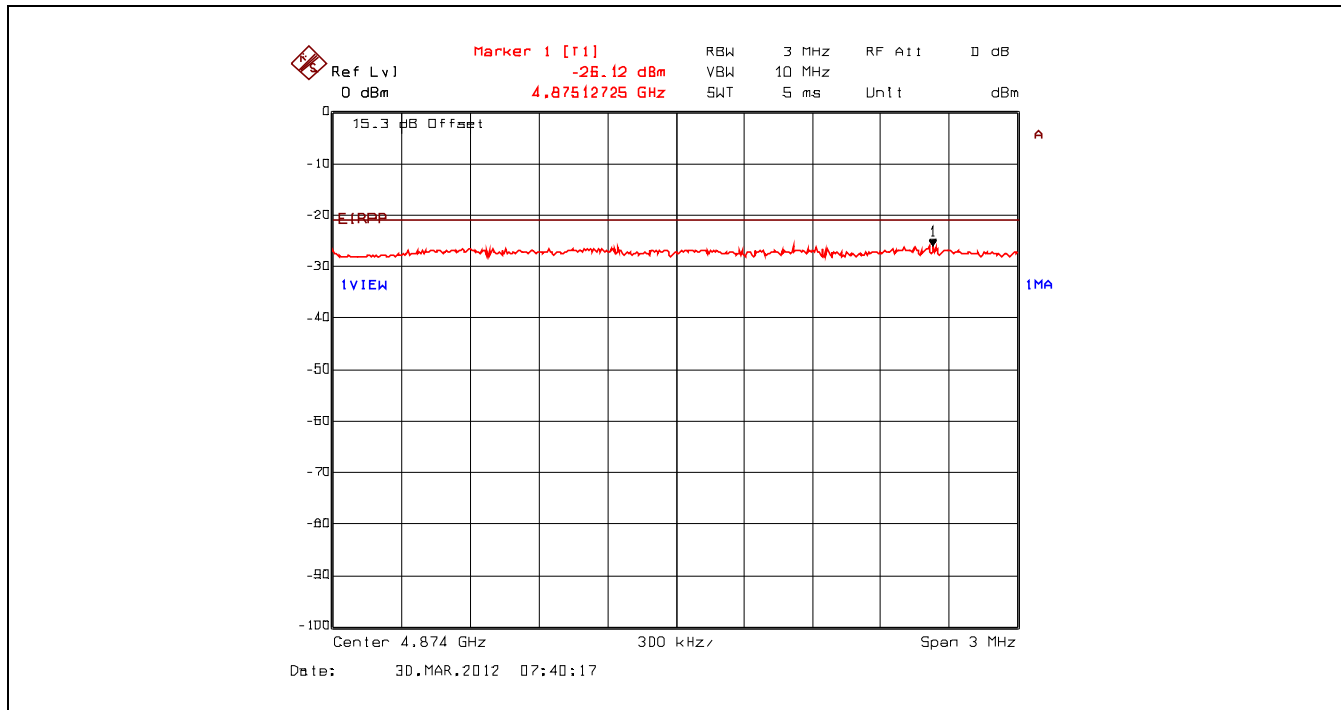


**Plot 5.4.4.333. Conducted Spurious Emissions – Restricted Bands**  
802.11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, 4 GHz - 25 GHz, Power Averaging with Highpass Filter

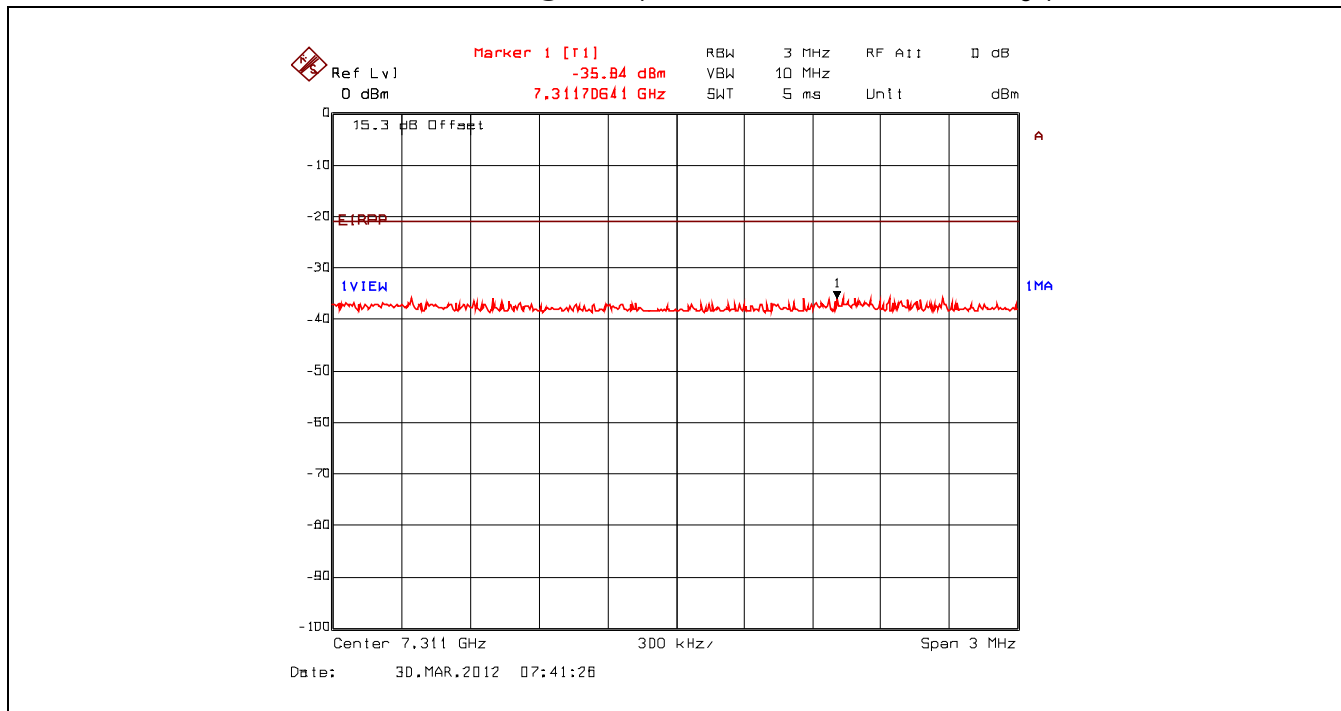




**Plot 5.4.4.3.34.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, Peak Power at 4.88 GHz with Highpass Filter



**Plot 5.4.4.3.35.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps, Peak Power at 7.31 GHz with Highpass Filter



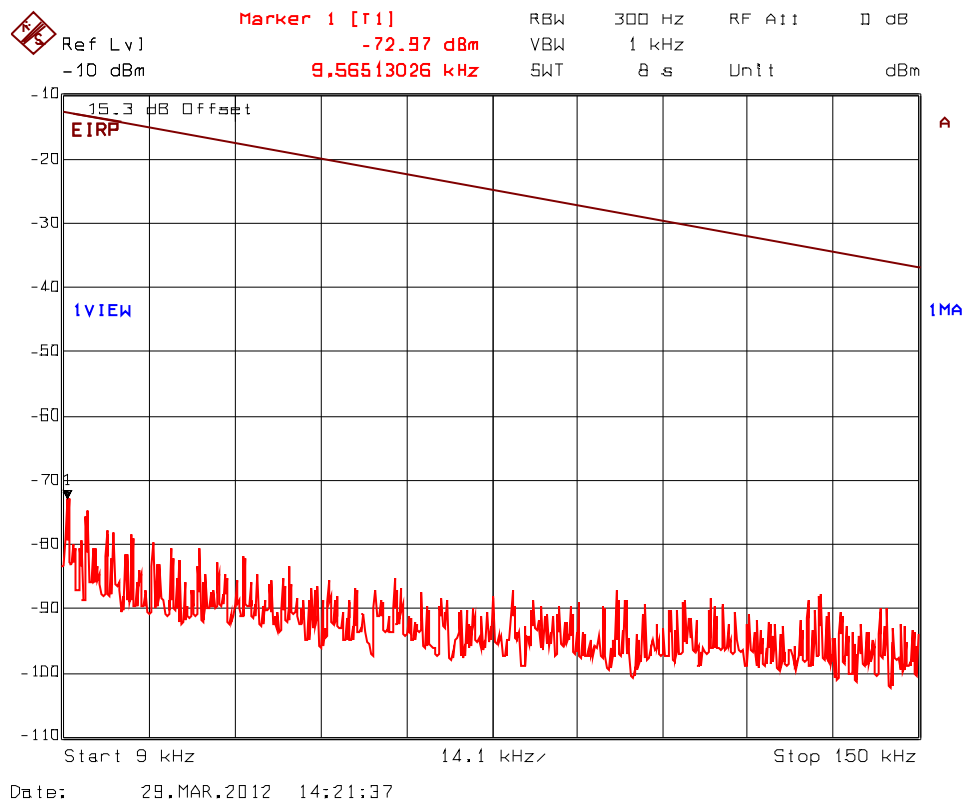
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**Plot 5.4.4.3.36.** Conducted Spurious Emissions – Restricted Bands  
 802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, 9 kHz - 150 kHz, Peak Detector



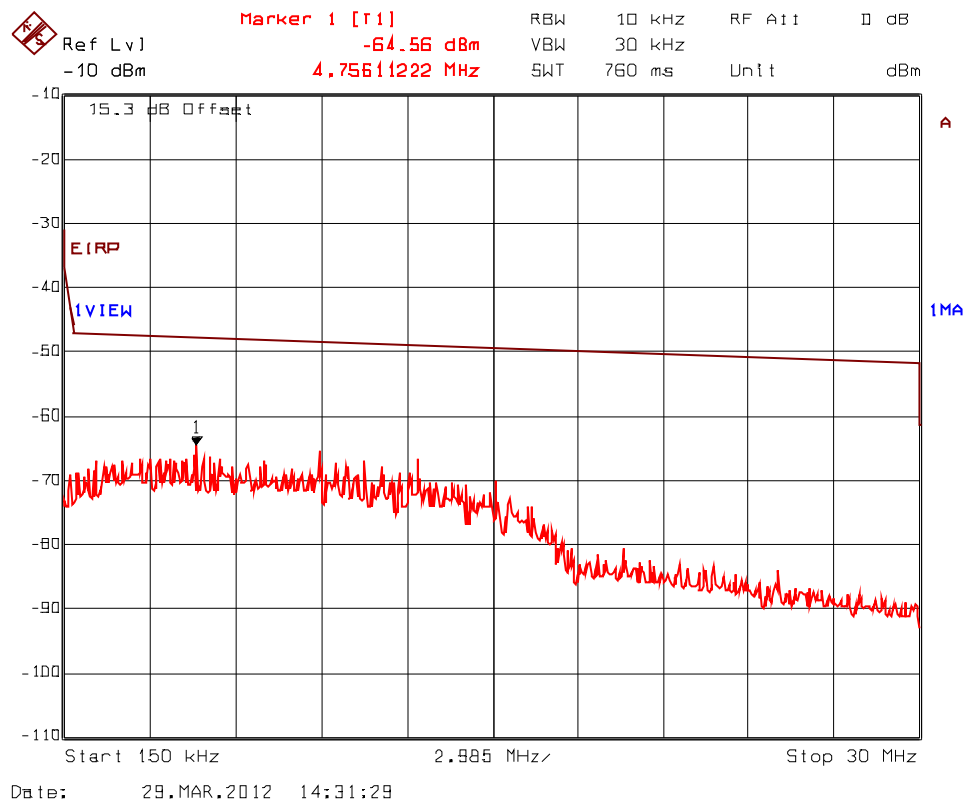
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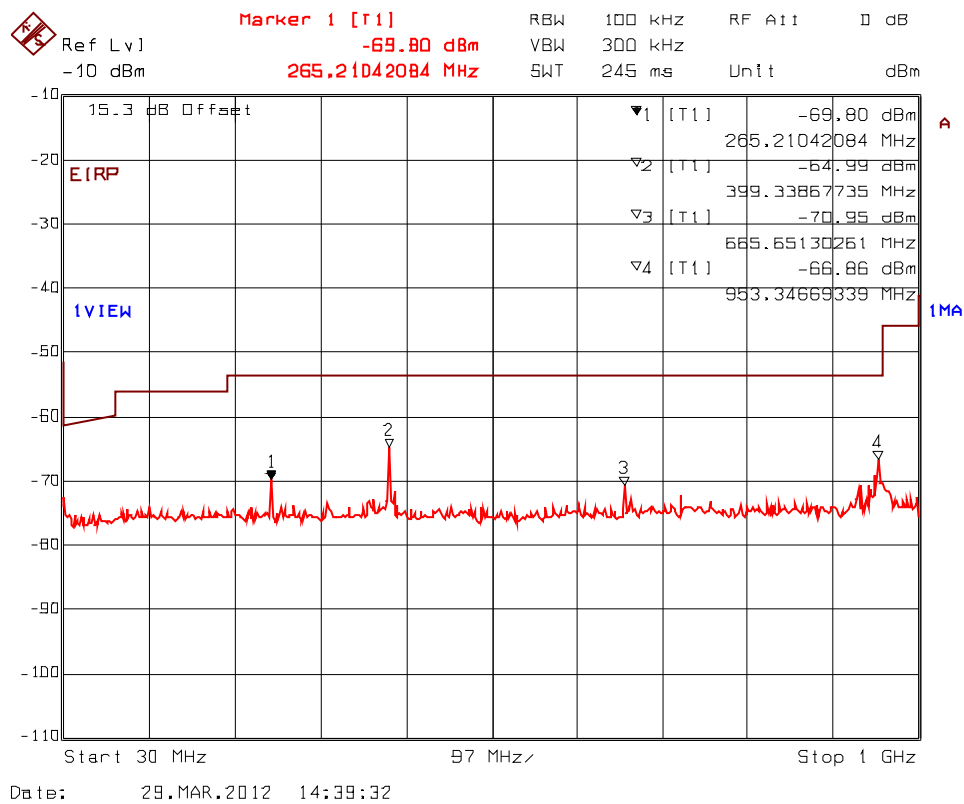
File #: MIS-090F15C247  
 July 24, 2012

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

**Plot 5.4.4.3.37. Conducted Spurious Emissions – Restricted Bands**  
 802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, 150 kHz - 30 MHz, Peak Detector



**Plot 5.4.4.3.38.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, 30 MHz - 1 GHz, Peak Detector



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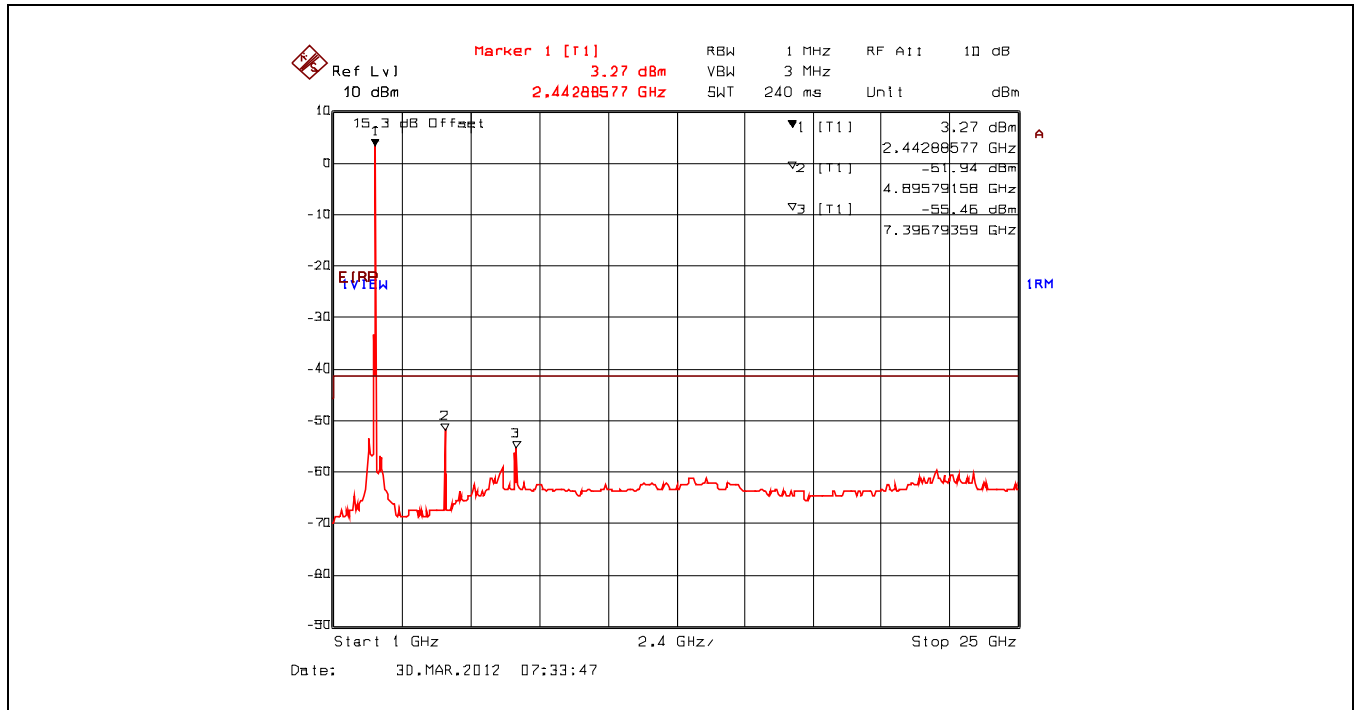
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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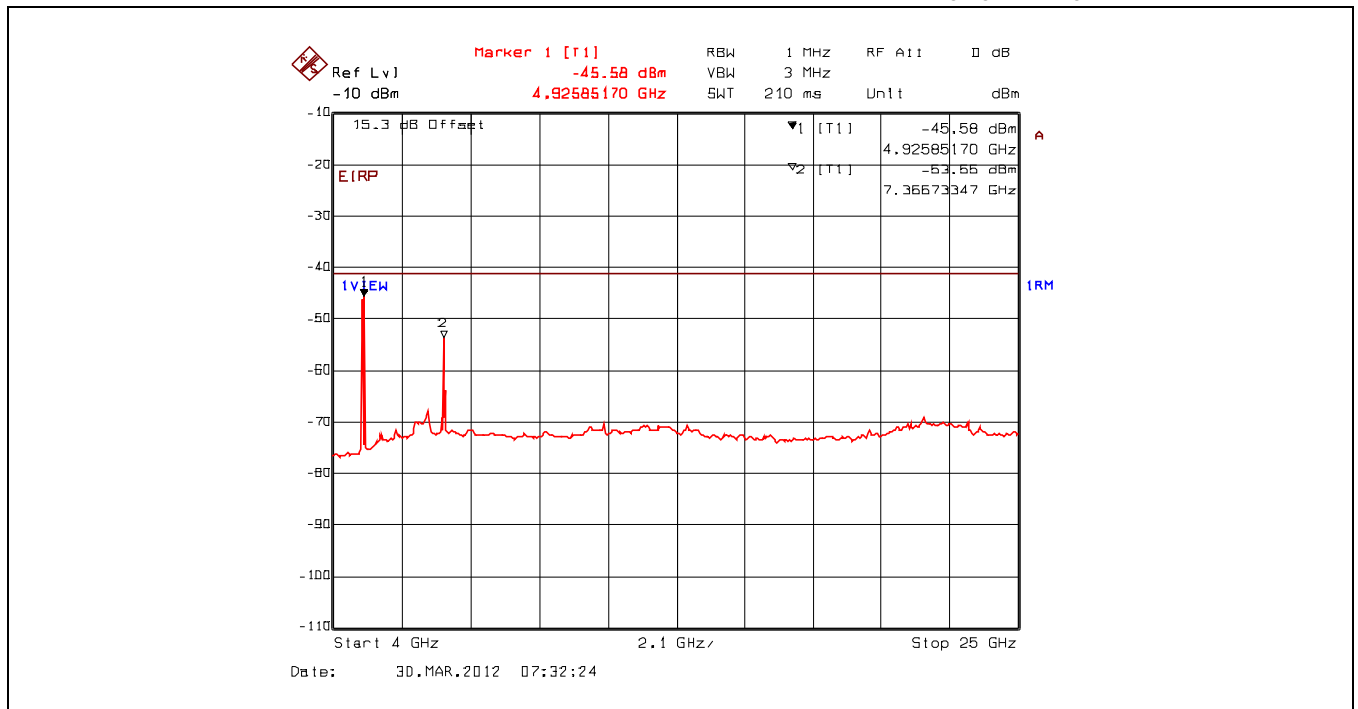
July 24, 2012

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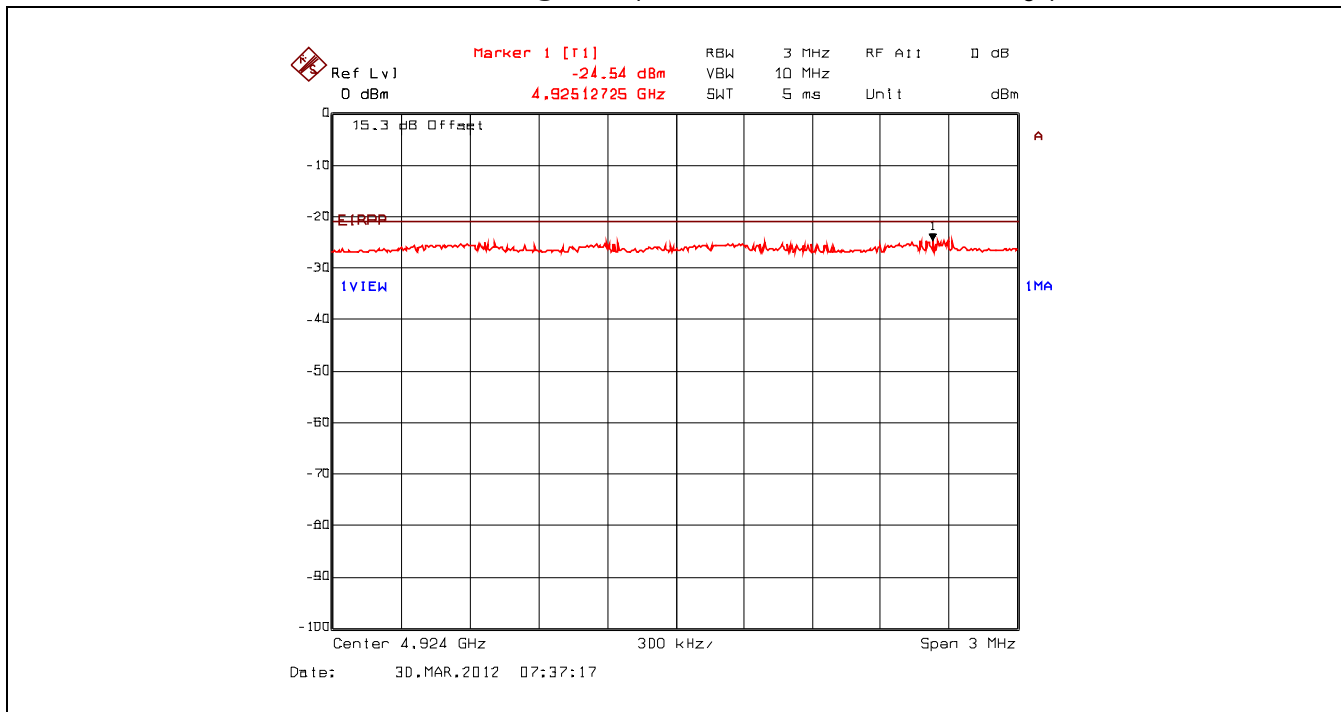
**Plot 5.4.4.3.39.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, 1 GHz - 25 GHz, Power Averaging



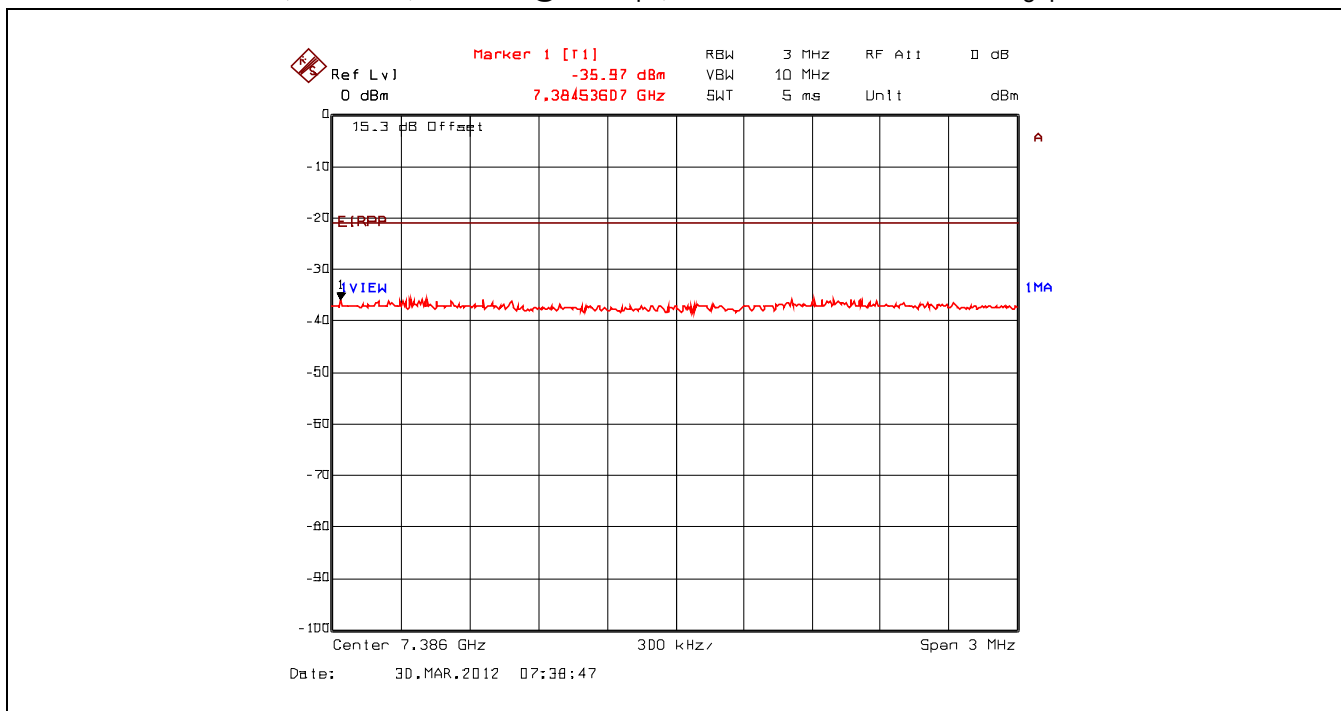
**Plot 5.4.4.3.40.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, 4 GHz - 25 GHz, Power Averaging with Highpass Filter



**Plot 5.4.4.3.41.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, Peak Power at 4.93 GHz with Highpass Filter



**Plot 5.4.4.3.42.** Conducted Spurious Emissions – Restricted Bands  
802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps, Peak Power at 7.38 GHz with Highpass Filter



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

### 5.5.1. Limit

**§ 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

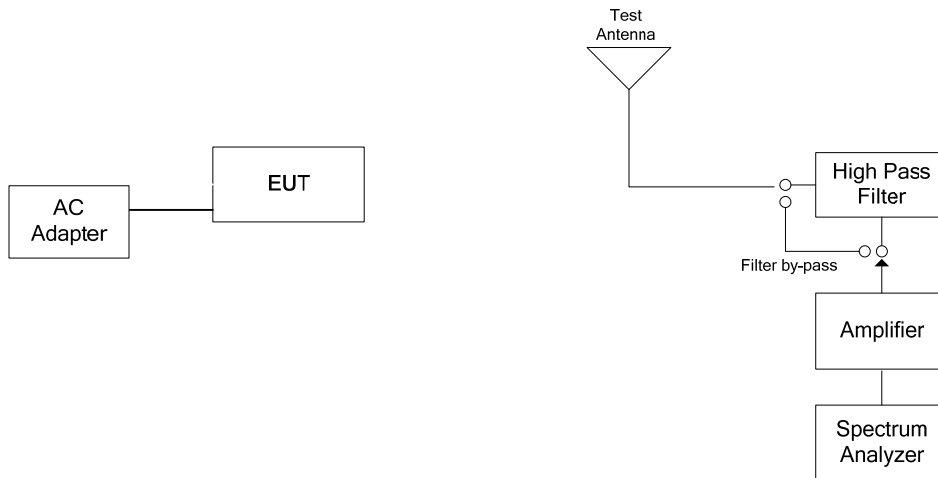
#### Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

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

### 5.5.2. Method of Measurements

KDB Publication No. 558074 D01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

### 5.5.3. Test Arrangement





#### 5.5.4. Test Data

##### Remark(s):

- 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.
- § 15.247 (d) spurious emission limit:  $E = (EIRP - 20\log(d) + 104.8) - 20 = (EIRP - 20\log(3) + 104.8) - 20$
- Based on the power measurements, the highest power observed in 802.11g, BPSK @ 9 Mbps and 802.11n, BPSK 1/2 @ 6.5 Mbps were selected as the final test configurations to represent the worst-case.

##### 5.5.4.1. 802.11g Mode, BPSK @ 9 Mbps

Fundamental Frequency:		2412 MHz					
Output Power:		22.48 dBm conducted, 26.28 dBm EIRP					
Frequency Test Range		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
4824	53.55	38.68	V	54.0	101.5	-15.3	Pass*
4824	51.95	36.37	H	54.0	101.5	-17.6	Pass*

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

Fundamental Frequency:		2437 MHz					
Output Power:		24.38 dBm conducted, 28.18 dBm EIRP					
Frequency Test Range		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
4874	58.68	41.01	V	54.00	103.4	-13.0	Pass*
4874	54.73	38.61	H	54.00	103.4	-15.4	Pass*

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

Fundamental Frequency:		2462 MHz					
Output Power:		24.66 dBm conducted, 28.46 dBm EIRP					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
4924	61.94	42.85	V	54.0	103.7	-11.2	Pass*
4924	58.20	40.99	H	54.0	103.7	-13.0	Pass*

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

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#### 5.5.4.2. 802.11n Mode, BPSK 1/2 @ 6.5 Mbps

Fundamental Frequency:		2412 MHz					
Output Power:		22.45 dBm conducted, 26.25 dBm EIRP					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
4824	53.65	37.95	V	54.0	101.5	-16.1	Pass*
4824	51.15	36.51	H	54.0	101.5	-17.5	Pass*

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

Fundamental Frequency:		2437 MHz					
Output Power:		24.14 dBm conducted, 27.94 dBm EIRP					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
4874	55.20	40.40	V	54.0	103.2	-13.6	Pass*
4874	52.83	38.23	H	54.0	103.2	-15.8	Pass*

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

Fundamental Frequency:		2462 MHz					
Output Power:		24.44 dBm conducted, 28.24 dBm EIRP					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
4924	56.51	40.65	V	54.0	103.5	-13.4	Pass*
4924	59.52	41.77	H	54.0	103.5	-12.2	Pass*

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

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

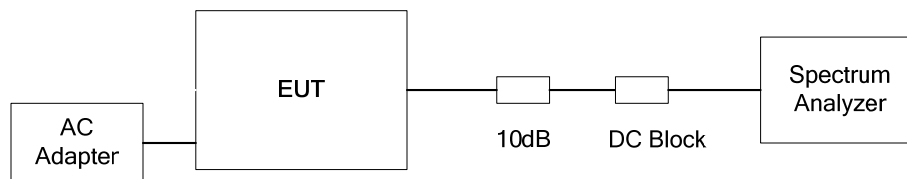
### 5.6.1. Limit(s)

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.

### 5.6.2. Method of Measurements

KDB Publication No. 558074 D01 Section 5.3.1 Measurement Procedure PKPSD.

### 5.6.3. Test Arrangement



### 5.6.4. Test Data

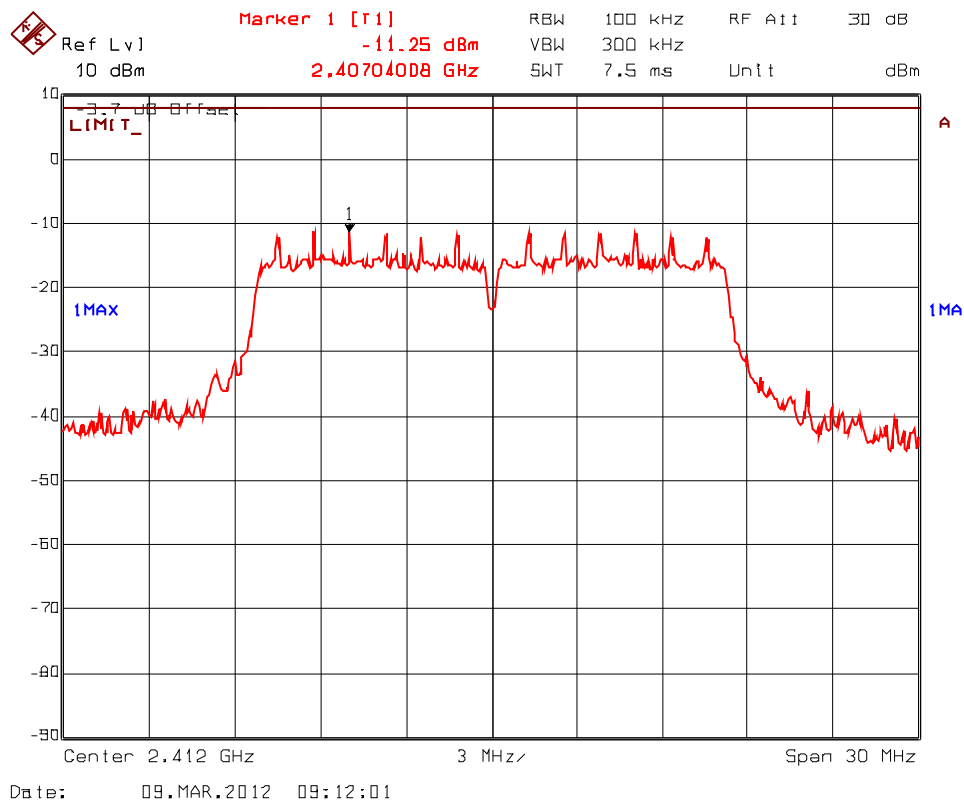
**Remark:** Measurement method: Section 5.3.1 Measurement Procedure PKPSD

Operation Mode	Frequency (MHz)	Modulation	Data Rate (Mbps)	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)
802.11g	2412	BPSK	9	-11.25	8	-19.25
		QPSK	18	-11.09	8	-19.09
		16-QAM	36	-12.79	8	-20.79
		64-QAM	54	-14.96	8	-22.96
	2437	BPSK	9	-9.42	8	-17.42
		QPSK	18	-9.05	8	-17.05
		16-QAM	36	-10.36	8	-18.36
		64-QAM	54	-11.90	8	-19.90
	2462	BPSK	9	-8.43	8	-16.43
		QPSK	18	-8.48	8	-16.48
		16-QAM	36	-9.66	8	-17.66
		64-QAM	54	-9.41	8	-17.41

Operation Mode	Frequency (MHz)	Modulation	Data Rate (Mbps)	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)
802.11n	2412	BPSK 1/2	6.5	-11.02	8	-19.02
		QPSK 3/4	19.5	-8.76	8	-16.76
		16-QAM 3/4	39	-12.85	8	-20.85
		64-QAM 5/6	65	-13.06	8	-21.06
	2437	BPSK 1/2	6.5	-9.19	8	-17.19
		QPSK 3/4	19.5	-7.82	8	-15.82
		16-QAM 3/4	39	-10.26	8	-18.26
		64-QAM 5/6	65	-13.20	8	-21.20
	2462	BPSK 1/2	6.5	-8.72	8	-16.72
		QPSK 3/4	19.5	-8.25	8	-16.25
		16-QAM 3/4	39	-9.45	8	-17.45
		64-QAM 5/6	65	-12.42	8	-20.42

See the following plots for measurement details.

**Plot 5.6.4.1.** Power Spectral Density, 802.11g, 2412 MHz, BPSK @ 9 Mbps  
 Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



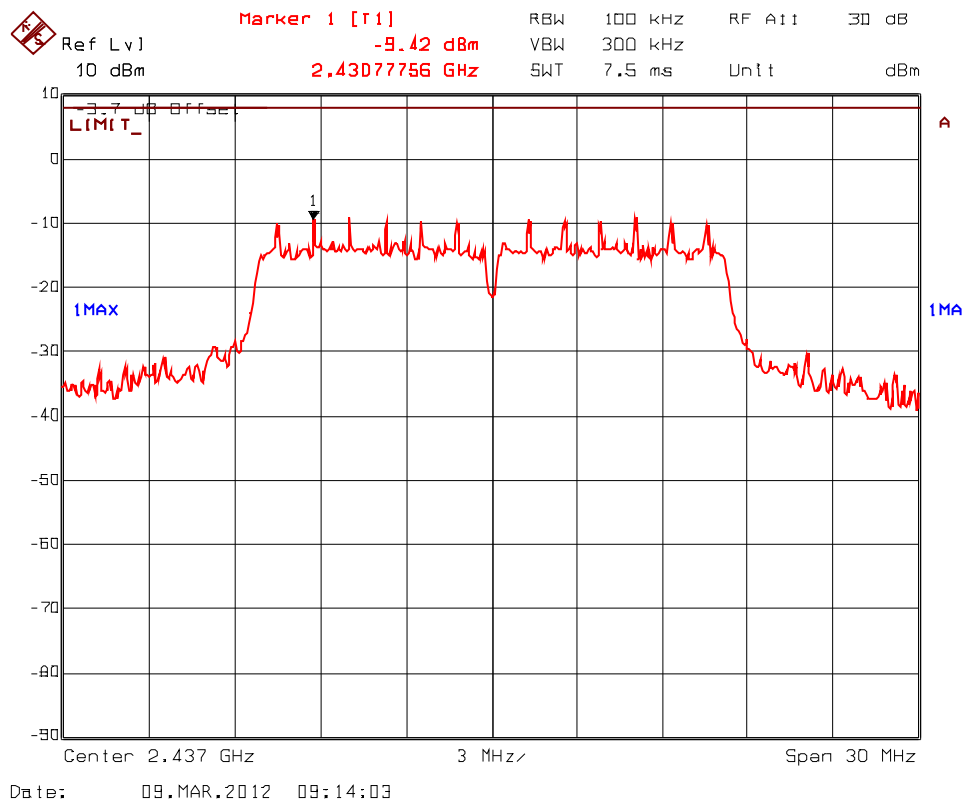
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**Plot 5.6.4.2.** Power Spectral Density, 802.11g, 2437 MHz, BPSK @ 9 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



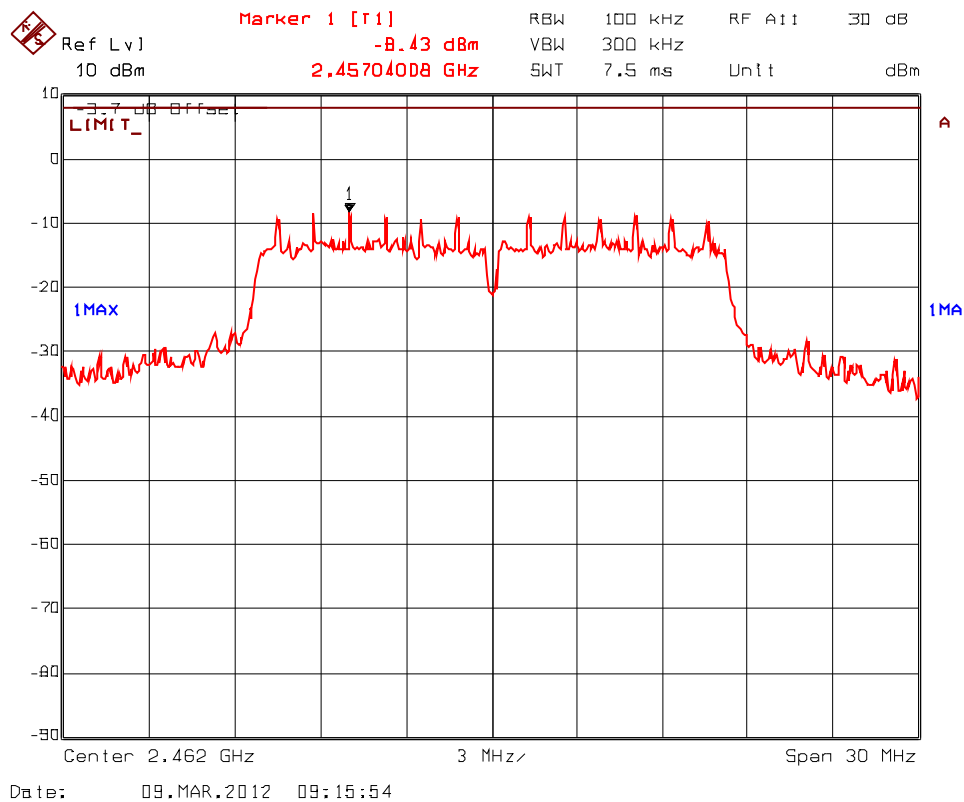
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**Plot 5.6.4.3.** Power Spectral Density, 802.11g, 2462 MHz, BPSK @ 9 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



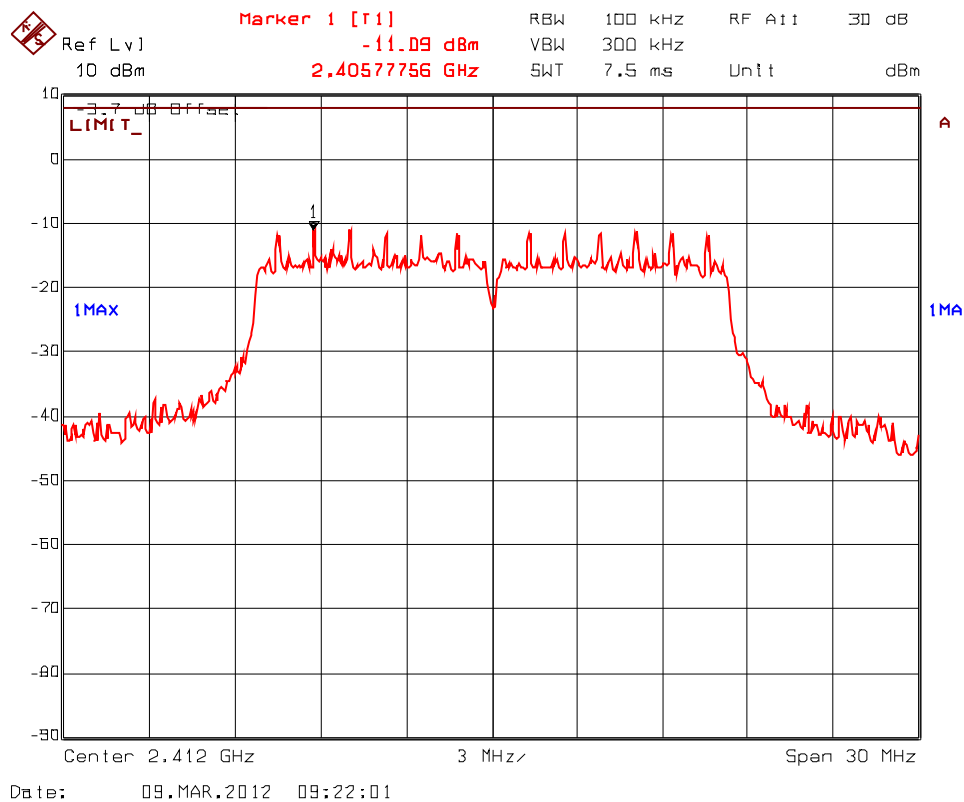
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**Plot 5.6.4.4.** Power Spectral Density, 802.11g, 2412 MHz, QPSK @ 18 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



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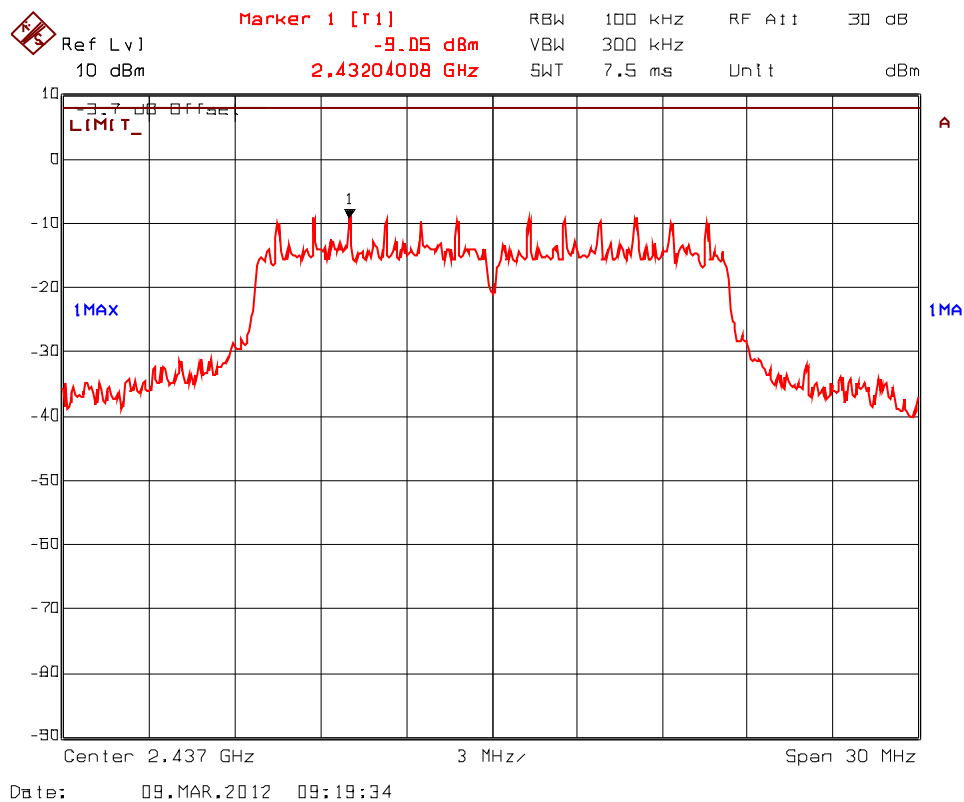
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**Plot 5.6.4.5.** Power Spectral Density, 802.11g, 2437 MHz, QPSK @ 18 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



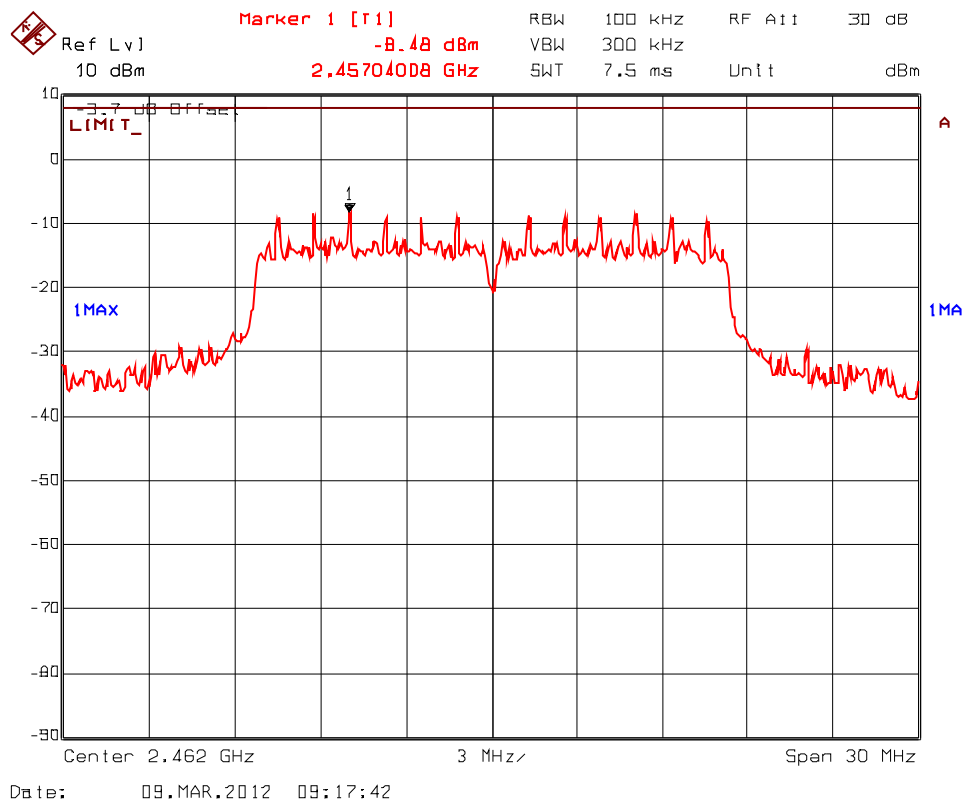
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**Plot 5.6.4.6.** Power Spectral Density, 802.11g, 2462 MHz, QPSK @ 18 Mbps  
 Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



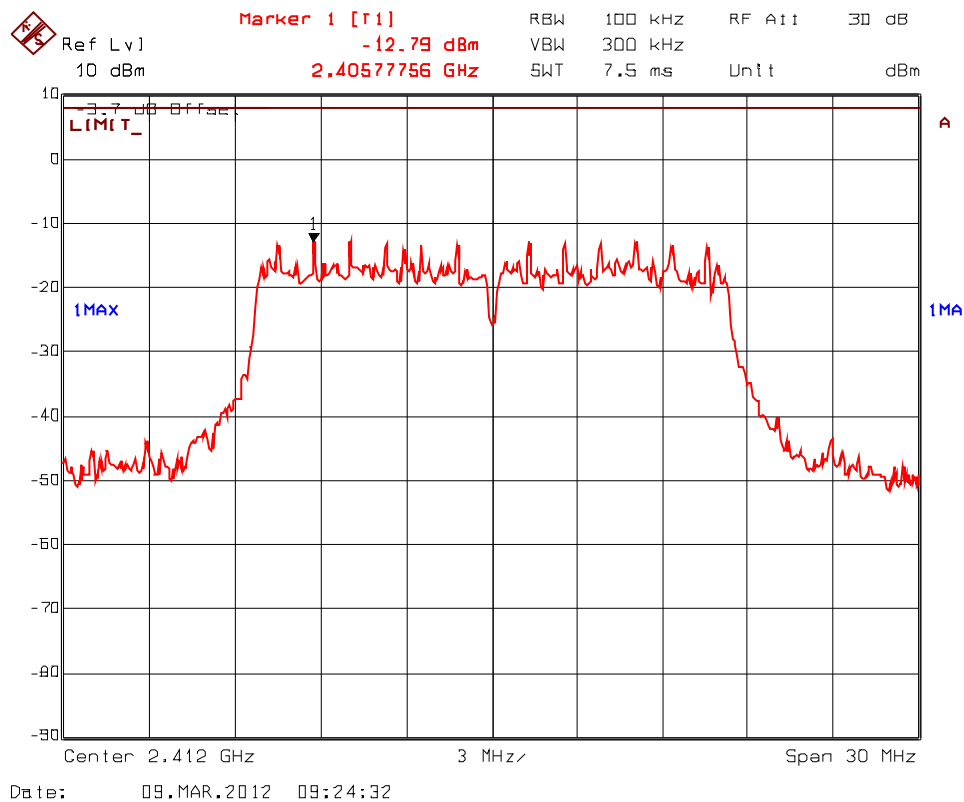
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**Plot 5.6.4.7. Power Spectral Density, 802.11g, 2412 MHz, 16-QAM @ 36 Mbps**  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



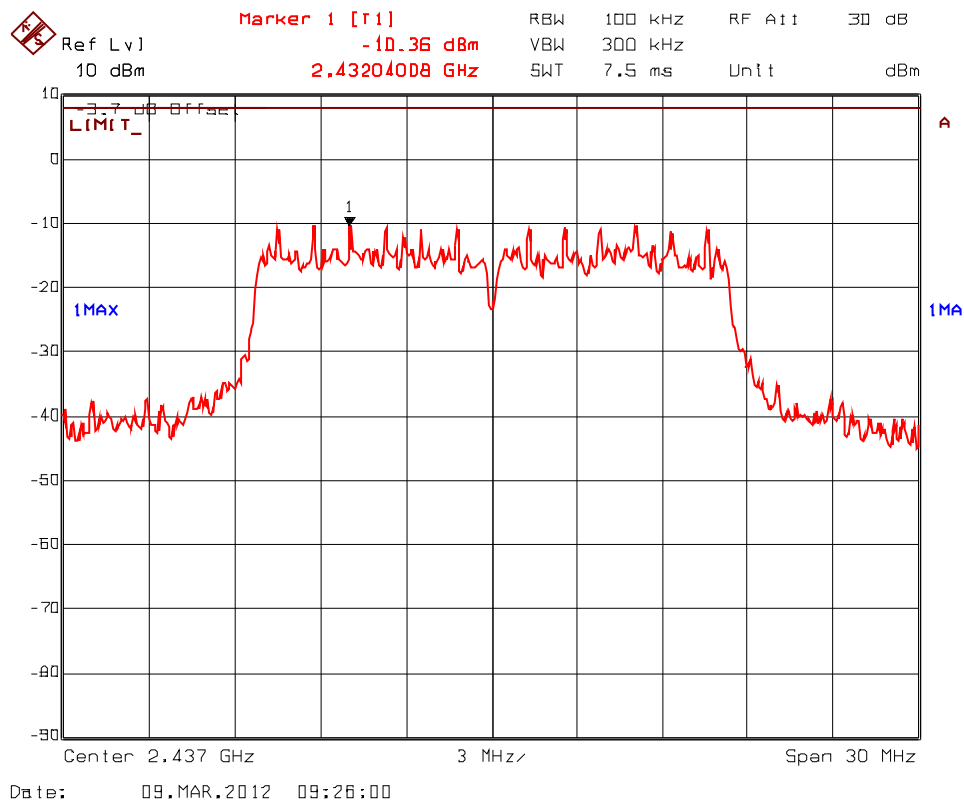
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**Plot 5.6.4.8. Power Spectral Density, 802.11g, 2437 MHz, 16-QAM @ 36 Mbps**  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



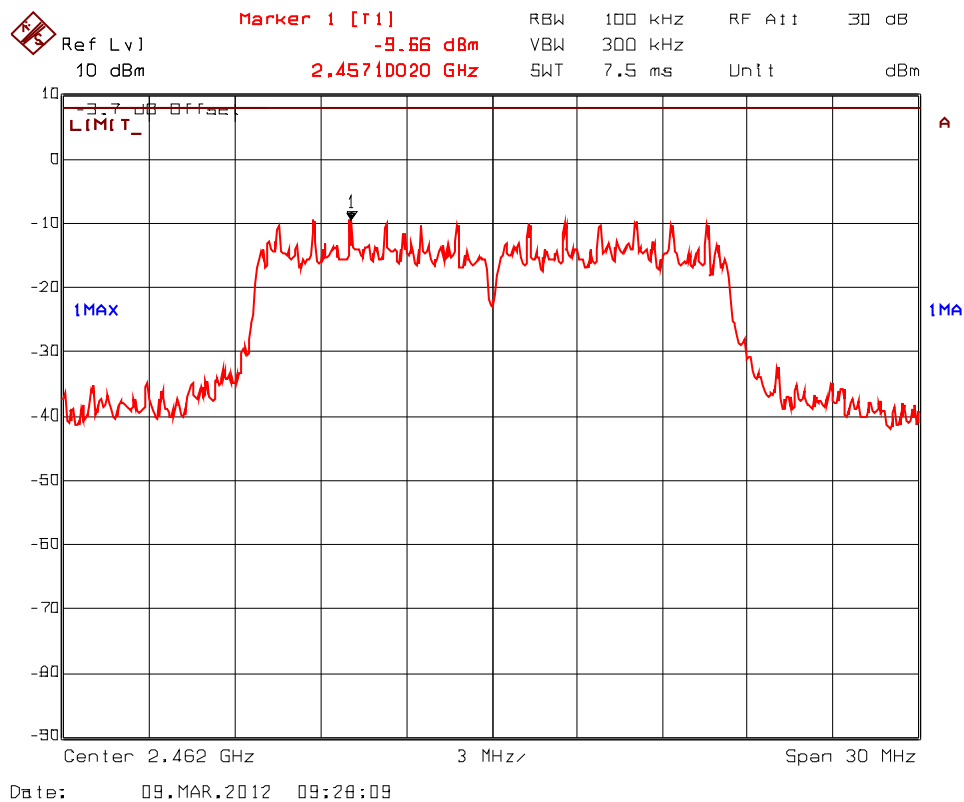
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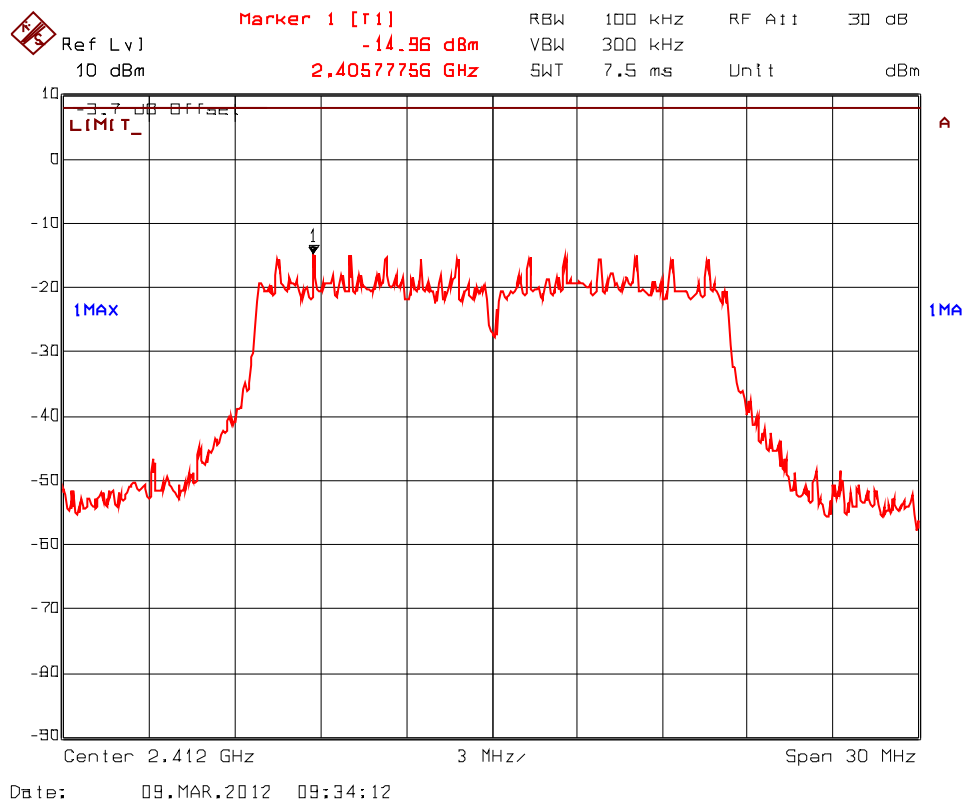
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**Plot 5.6.4.9.** Power Spectral Density, 802.11g, 2462 MHz, 16-QAM @ 36 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



**Plot 5.6.4.10.** Power Spectral Density, 802.11g, 2412 MHz, 64-QAM @ 54 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



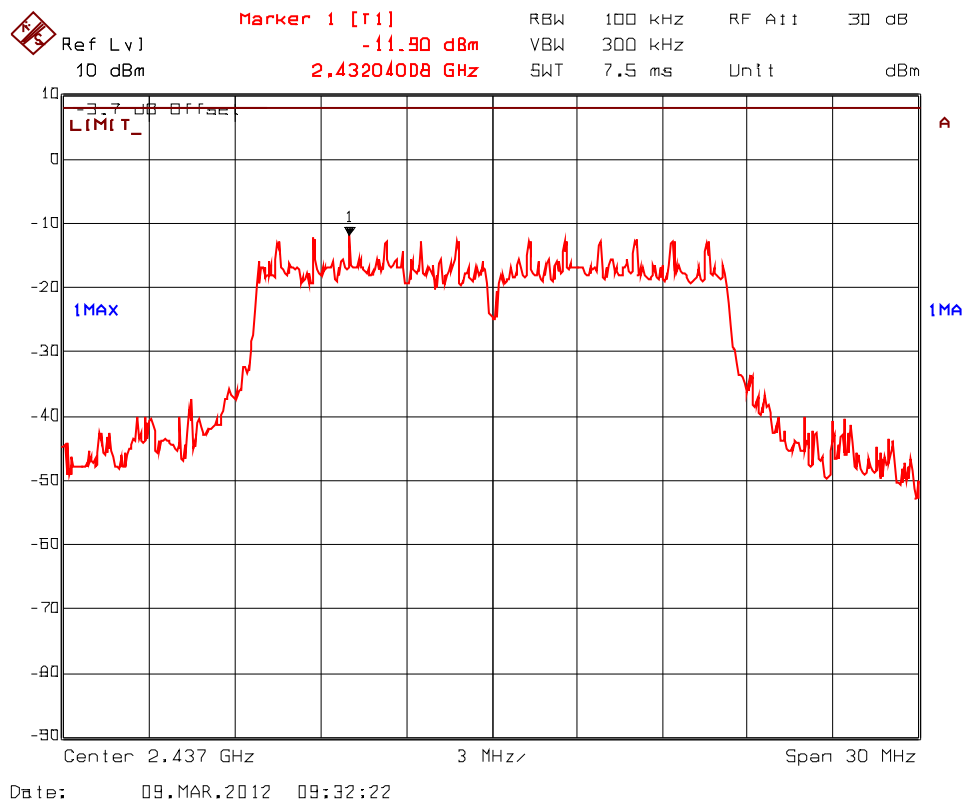
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**Plot 5.6.4.11.** Power Spectral Density, 802.11g, 2437 MHz, 64-QAM @ 54 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



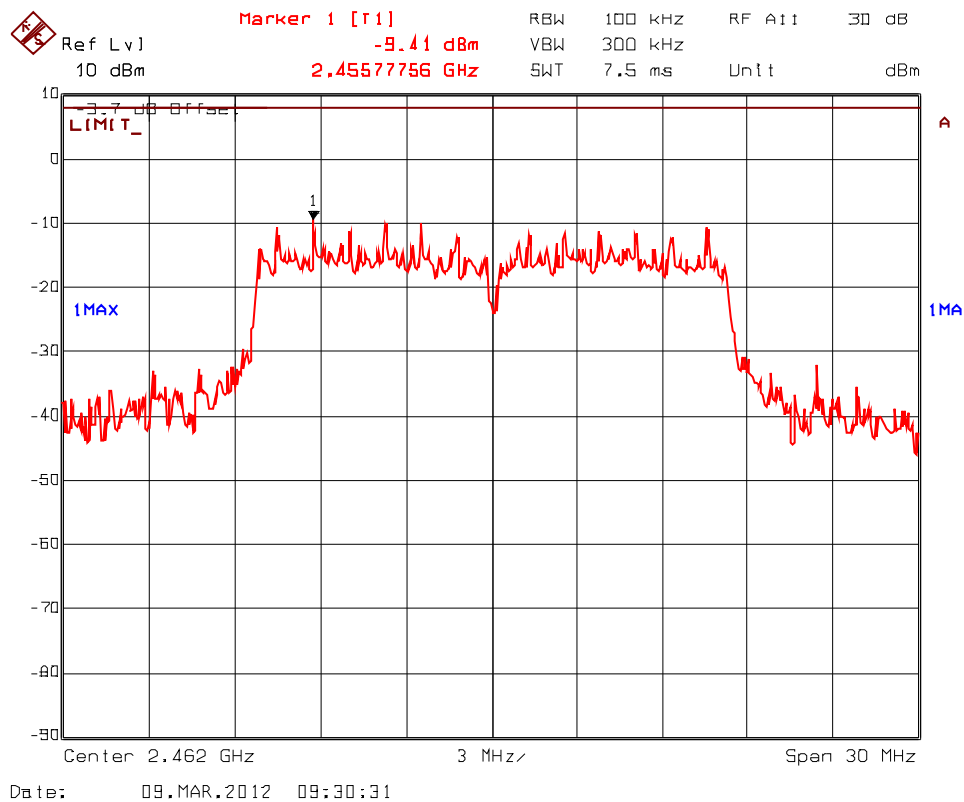
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**Plot 5.6.4.12.** Power Spectral Density, 802.11g, 2462 MHz, 64-QAM @ 54 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



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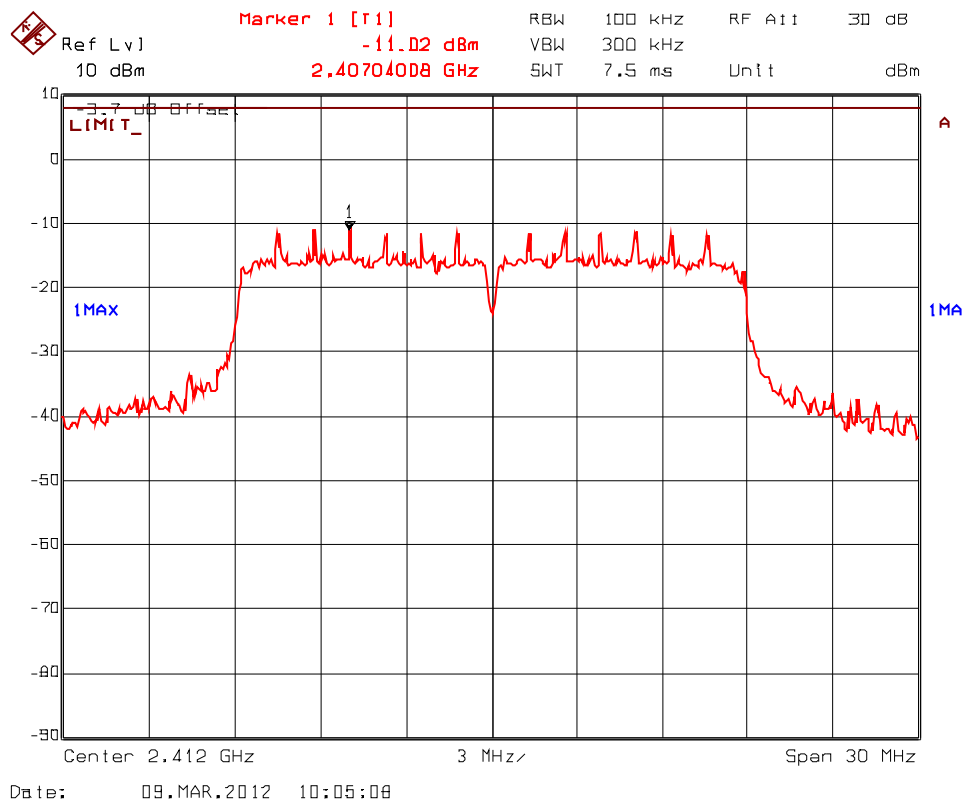
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**Plot 5.6.4.13.** Power Spectral Density, 802.11n, 2412 MHz, BPSK 1/2 @ 6.5 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



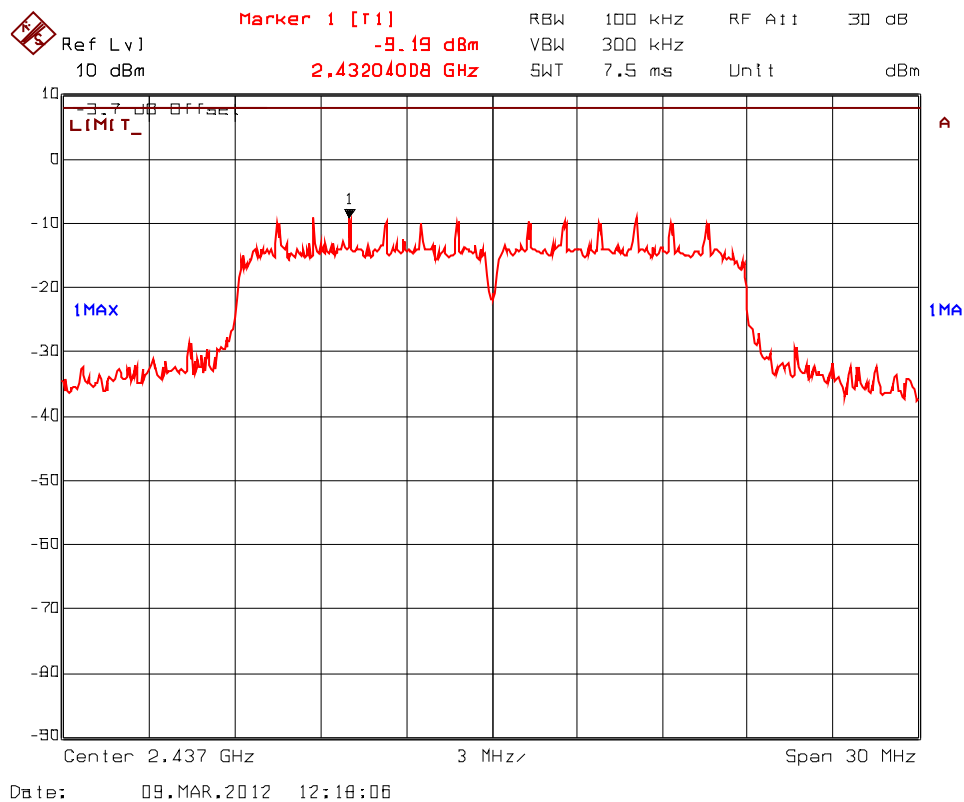
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**Plot 5.6.4.14.** Power Spectral Density, 802.11n, 2437 MHz, BPSK 1/2 @ 6.5 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



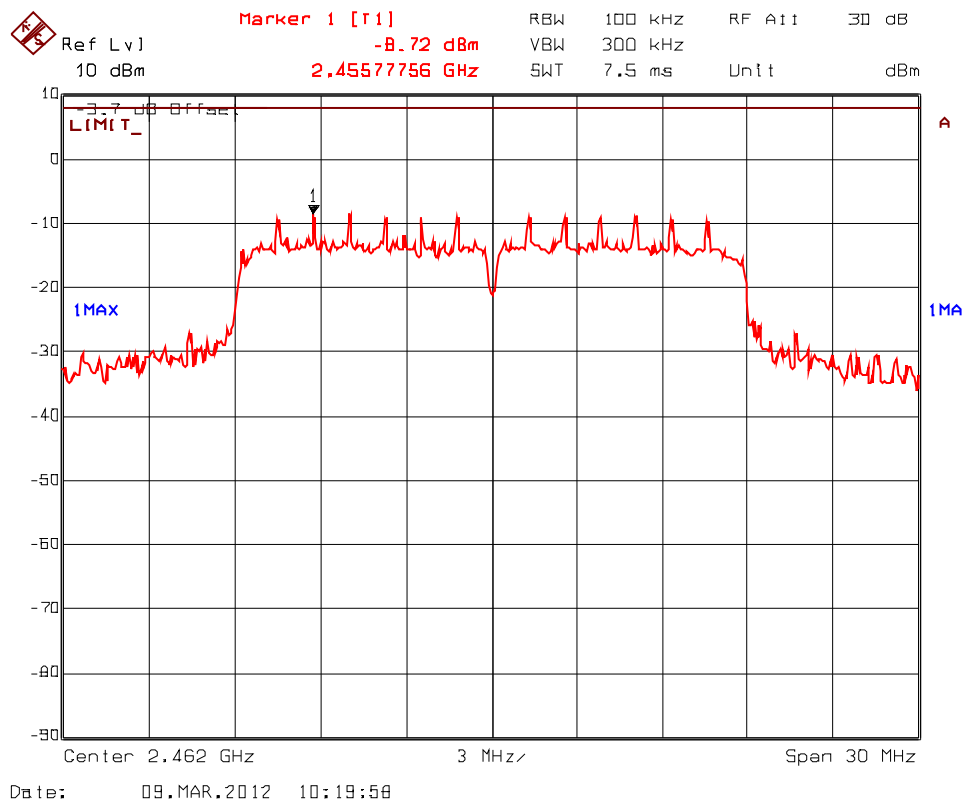
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**Plot 5.6.4.15.** Power Spectral Density, 802.11n, 2462 MHz, BPSK 1/2 @ 6.5 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



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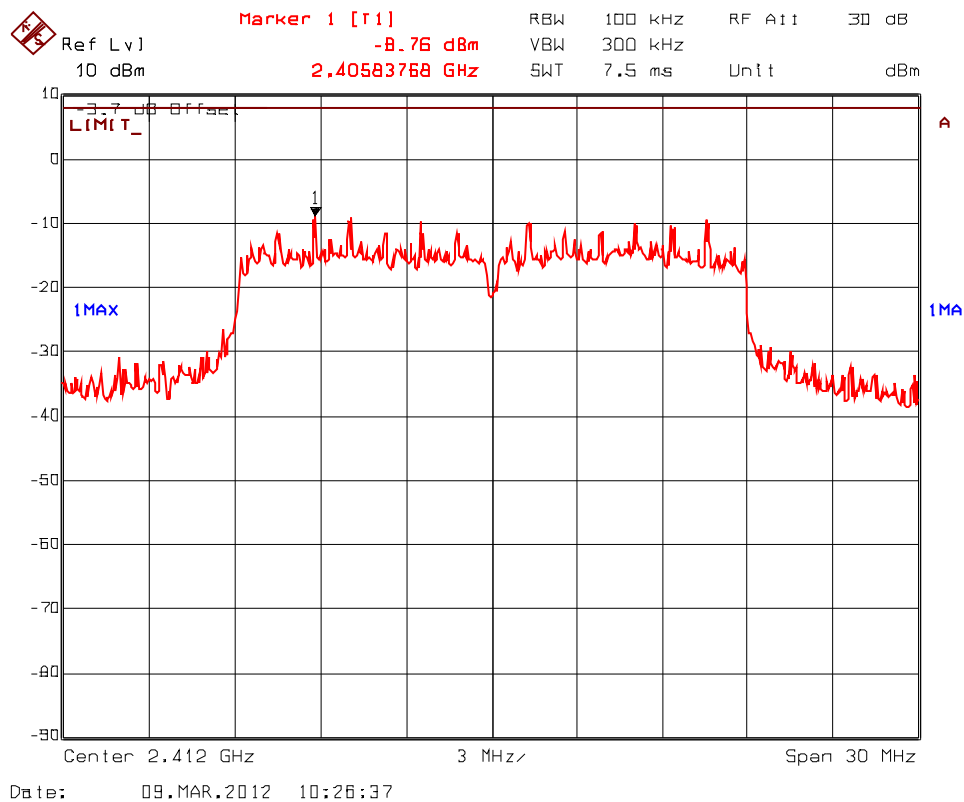
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**Plot 5.6.4.16.** Power Spectral Density, 802.11n, 2412 MHz, QPSK 3/4 @ 19.5 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



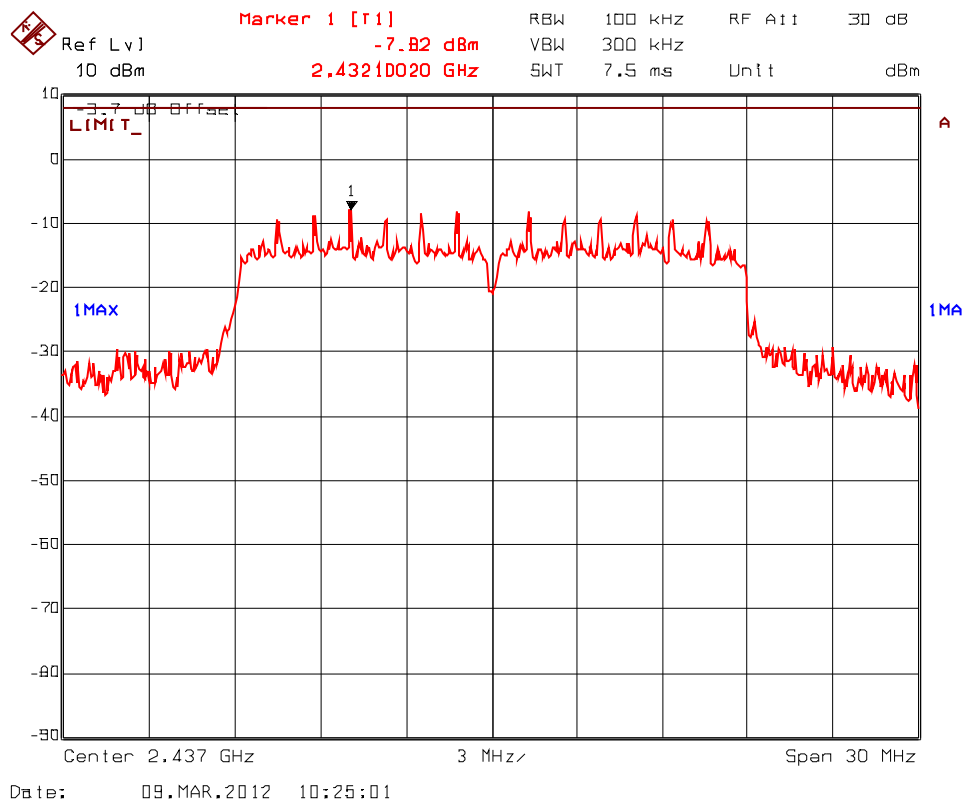
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**Plot 5.6.4.17.** Power Spectral Density, 802.11n, 2437 MHz, QPSK 3/4 @ 19.5 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



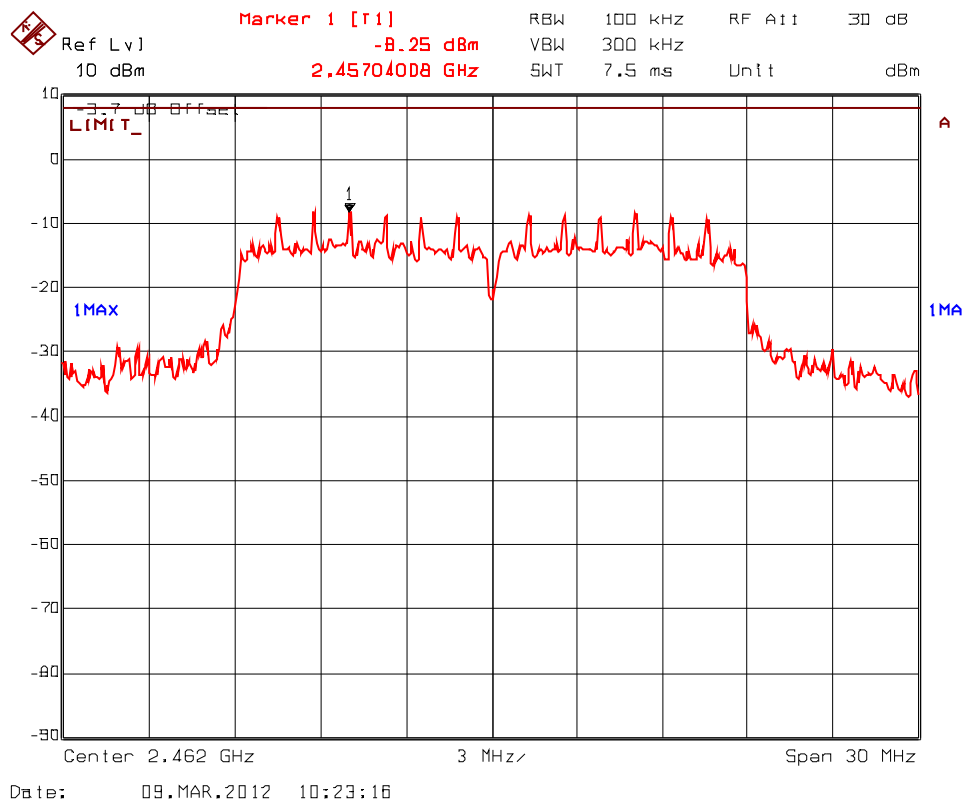
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**Plot 5.6.4.18.** Power Spectral Density, 802.11n, 2462 MHz, QPSK 3/4 @ 19.5 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



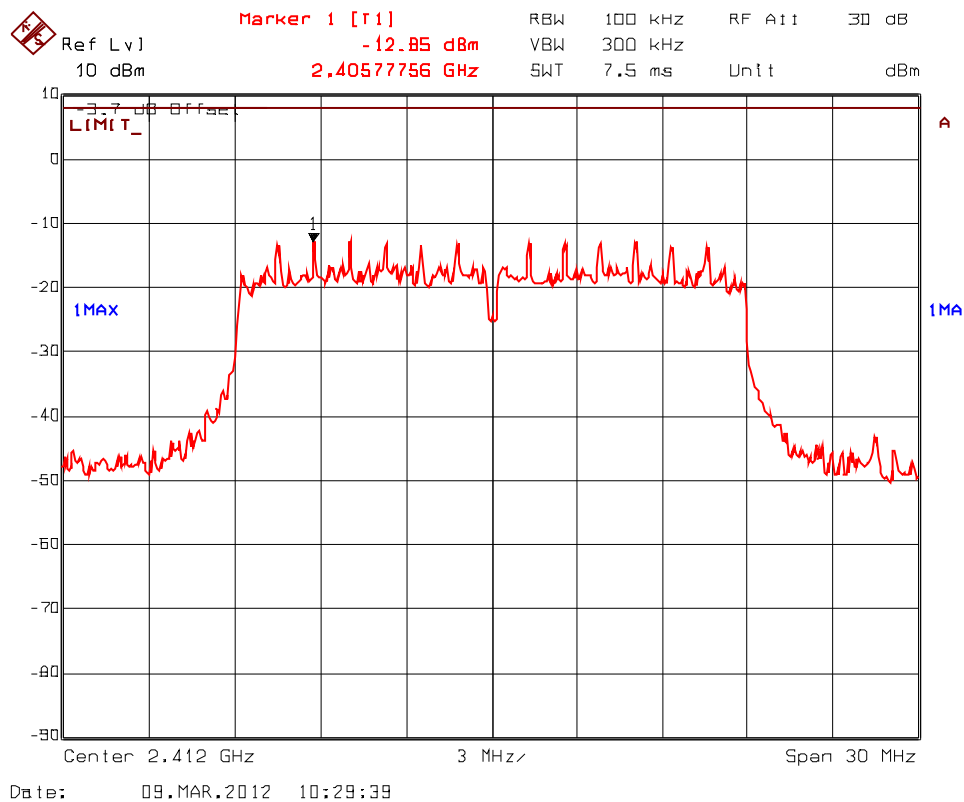
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**Plot 5.6.4.19.** Power Spectral Density, 802.11n, 2412 MHz, 16-QAM 3/4 @ 39 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



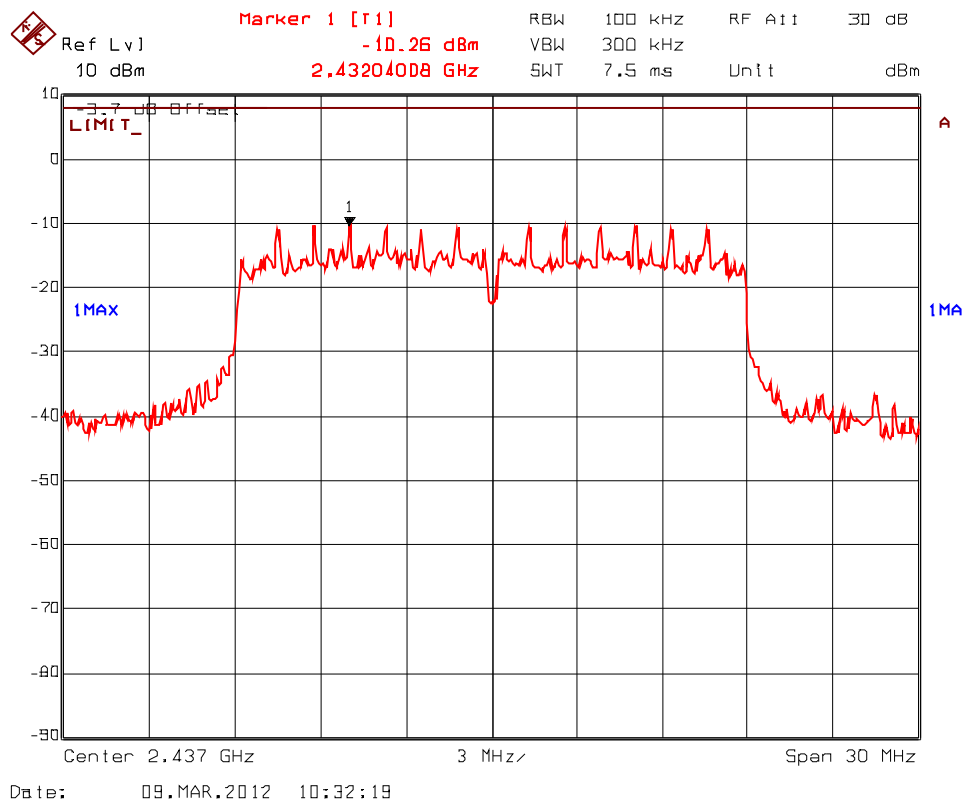
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**Plot 5.6.4.20.** Power Spectral Density, 802.11n, 2437 MHz, 16-QAM 3/4 @ 39 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



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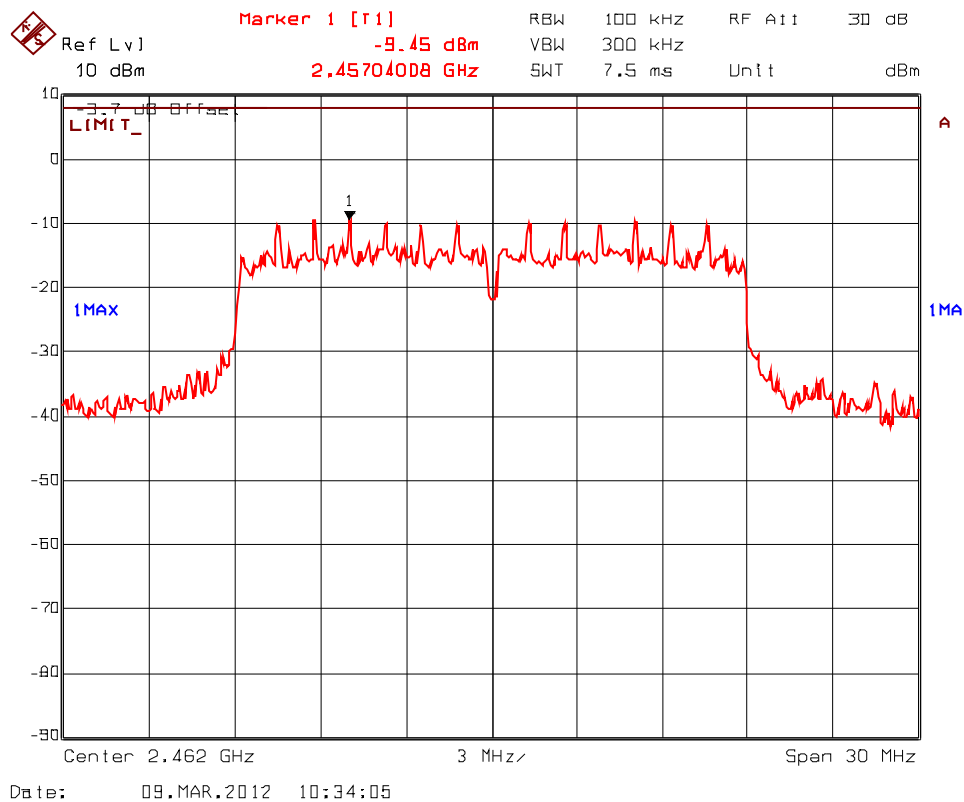
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [yic@ultratech-labs.com](mailto:yic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

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**Plot 5.6.4.21.** Power Spectral Density, 802.11n, 2462 MHz, 16-QAM 3/4 @ 39 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



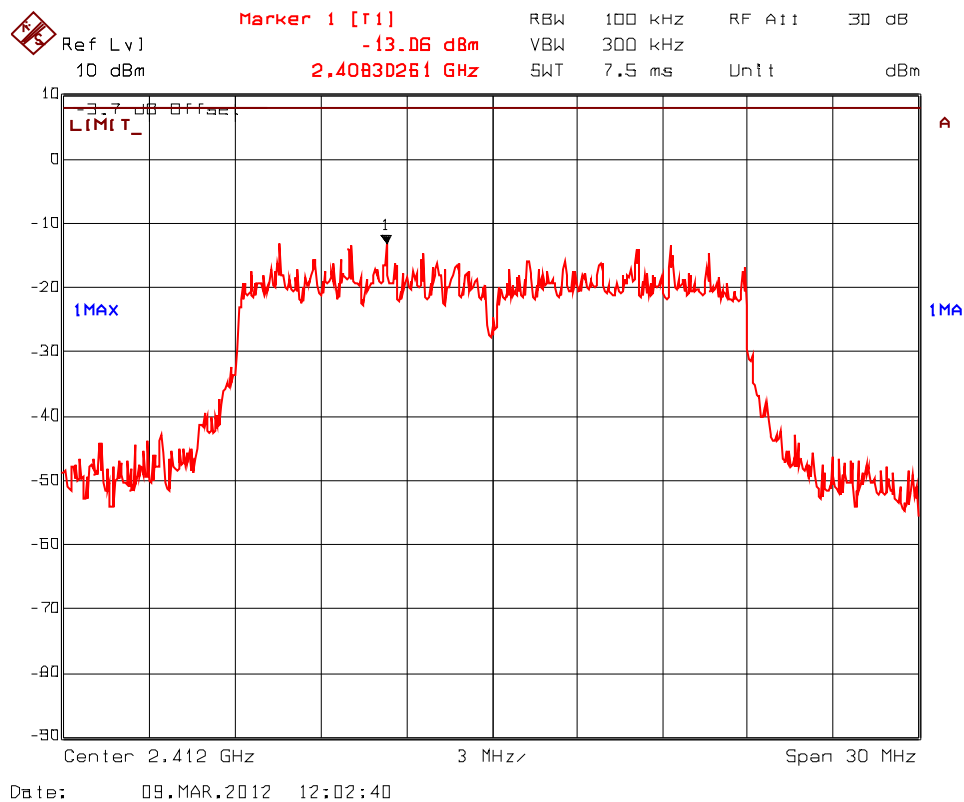
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**Plot 5.6.4.22.** Power Spectral Density, 802.11n, 2412 MHz, 64-QAM 5/6 @ 65 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



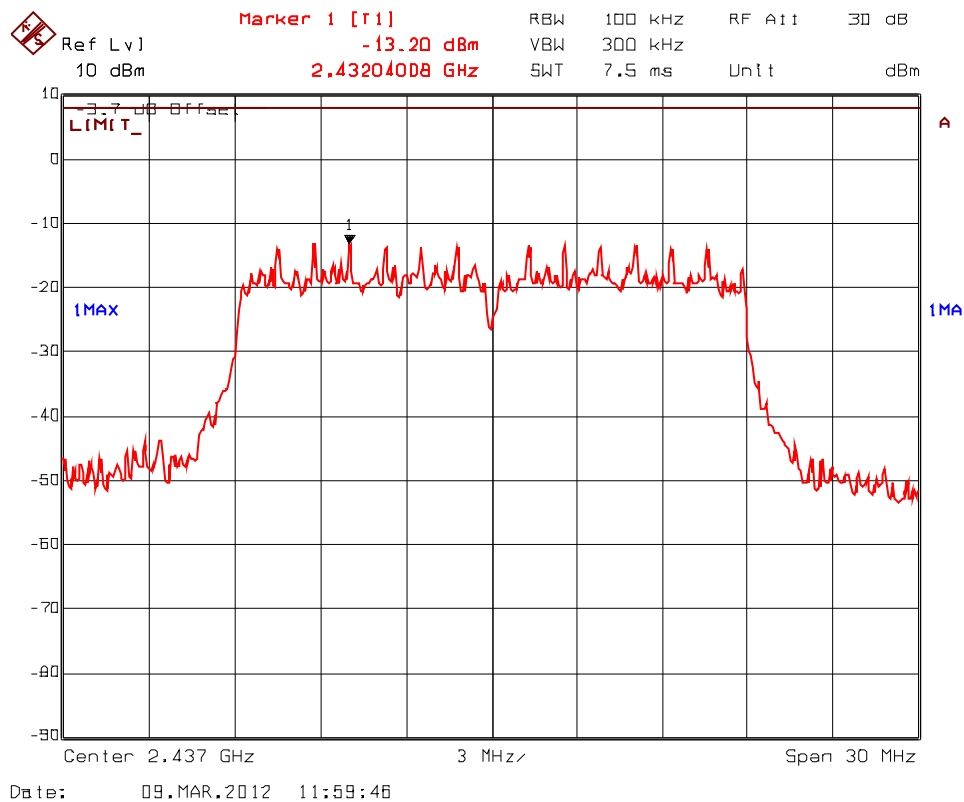
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**Plot 5.6.4.23.** Power Spectral Density, 802.11n, 2437 MHz, 64-QAM 5/6 @ 65 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



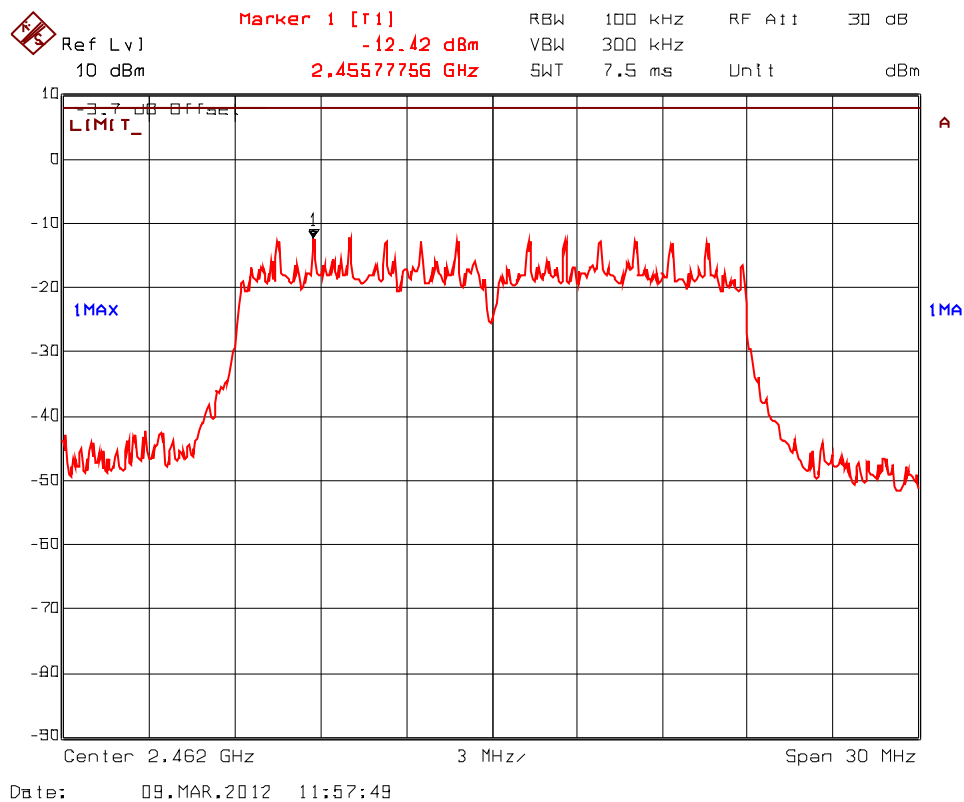
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**Plot 5.6.4.24.** Power Spectral Density, 802.11n, 2462 MHz, 64-QAM 5/6 @ 65 Mbps  
Offset: Insertion Loss + BWCF = 11.49 dB + 10\*log(3 kHz/ 100 kHz) = -3.7 dB



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**EXHIBIT 6. TEST EQUIPMENT**

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3412A00103	9 kHz–26.5 GHz	30 Jan 2013
L.I.S.N	ULT AC LISN	--	ULT-01;-02;-03;-04	10 kHz – 30 MHz	21 Feb 2013
Attenuator	Pasternack	PE7010-20	-	DC – 2 GHz	09 Jan 2013
Bandpass Filter	Telemeter Electronics	MTA-HPF-150	2110465-007	-	17 Aug 2013
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	27 Sep 2012
Attenuator	Pasternack	PE7024-10	-	DC–26.5 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045–26.5 GHz	Cal on use
Highpass Filter	K & L	11SH10-4000/T12000	4	Cut off 2400 MHz	Cal. on use
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	19 Mar 2013
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	01 Dec 2012
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	16 Mar 2013
Horn Antenna	EMCO	3155	5955	1 – 18 GHz	20 Feb 2013
Biconi-Log Antenna	EMCO	3142C	00034792	26 – 3000 MHz	04 May 2013
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 2400 MHz	Cal on use

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## 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