



*Testing Tomorrow's Technology*

**Cirronet Corporation  
FCC Part 15, Certification Application  
ZMN2400HP-A**

**UST Project: 06-0176  
Issue Date: September 25, 2006**

**3505 Francis Circle Alpharetta, GA 30004  
PH: 770-740-0717 Fax: 770-740-1508  
[www.ustech-lab.com](http://www.ustech-lab.com)**



*Testing Tomorrow's Technology*

I certify that I am authorized to sign for the manufacturer and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

**UNITED STATES TECHNOLOGIES, INC. (AGENT RESPONSIBLE FOR TEST):**

By: 

Name: Louis A. Feudi

Title: VP / Operations and Engineering

Date: September 25, 2006

**Cirronet Corporation  
5375 Oakbrook Parkway  
Norcross, GA 30093**

By: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

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## MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: Cirronet Corporation

MODEL: ZMN2400HP-A

FCC ID: HSW-ZMN240HA

DATE: September 25, 2006

This report concerns (check one): Original grant ☒ X  
Class II change ☐ \_\_\_\_\_

Equipment type: 2.4 GHz Zigbee RadioDeferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes ☐ No ☒ XIf yes, defer until: \_\_\_\_\_  
dateN.A. agrees to notify the Commission by N.A.  
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

United States Technologies, Inc.  
3505 Francis Circle  
Alpharetta, GA 30004

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## **TABLE OF CONTENTS**

### **AGENCY AGREEMENT CONFIDENTIALITY REQUEST**

#### **SECTION 1**

##### **GENERAL INFORMATION**

- 1.1 Product Description
- 1.2 Related Submittal(s)

#### **SECTION 2**

##### **TESTS AND MEASUREMENTS**

- 2.1 Configuration of Tested EUT
- 2.2 Test Facility
- 2.3 Test Equipment
- 2.4 Modifications
- 2.5 Antenna Description
- 2.6 Peak Power (Bandedge Antenna Conducted at Antenna Terminal)
- 2.7 Antenna Conducted Spurious Emissions
- 2.8 Peak Radiated Spurious Emissions
- 2.9 Average Radiated Spurious Emissions
- 2.10 Bandedge Requirements
- 2.11 Minimum 20 dB Bandwidth
- 2.12 Power Line Conducted for Digital Device & Receiver
- 2.13 Power Line Conducted Emissions for Transmitter
- 2.14 Radiated Emissions for Digital Device & Receiver
- 2.16 Peak Power Spectral Density

#### **SECTION 3**

##### **LABELING INFORMATION**

#### **SECTION 4**

##### **BLOCK DIAGRAM(S)/ SCHEMATIC(S)**

#### **SECTION 5**

##### **PHOTOGRAPHS**

#### **SECTION 6**

##### **THEORY OF OPERATION**

#### **SECTION 7**

##### **USER'S MANUAL**

## **LIST OF FIGURES AND TABLES**

### **FIGURES**

- 1) Test Configuration
- 2) Photograph(s) for Spurious and Conducted Emissions
- 3) Peak Output Power
- 4) Conducted Spurious Emissions
- 5) Peak Radiated Spurious Emissions
- 6) Bandedge Compliance Antenna Conducted
- 7) 6 dB Bandwidth
- 8) Power Spectral Density

### **TABLES**

- 1) EUT and Peripherals
- 2) Test Instruments
- 3) Peak Power Output
- 4) Peak Radiated Spurious Emissions
- 5) Average Radiated Spurious Emissions
- 6) 6 dB Bandwidth
- 7) Conducted Emissions
- 8) Radiated Emissions for Digital Device and Receiver

# SECTION 1

## GENERAL INFORMATION

## **GENERAL INFORMATION**

### **1.1 Product Description**

The Equipment Under Test (EUT) is a Cirronet Corporation, Model ZMN2400HP-A modular 2.4 GHz spread spectrum transceiver. The EUT will be used with integrated antenna.

## **1.2 Related Submittal(s)/Grant(s)**

The EUT will be used to send/receive data. The transceiver presented in this report will be used with other like transceivers:

The EUT is subject to the following authorizations:

- a) Certification as a transceiver (modular approval)
- b) Verification as a digital device

The information contained in this report is presented for the certification & verification authorization(s) for the EUT. The manufacturer desires to seek a modular approval on this device.

## SECTION 2

# TESTS AND MEASUREMENTS

## **TEST AND MEASUREMENTS**

### **2.1 Configuration of Tested System**

The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (1992). Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Block diagrams of the tested systems are shown in Figures 1a and 16. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2a -g.

The sample used for testing was received by U.S. Technologies on August 25, 2006 in good condition.

### **2.2 Test Facility**

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

### **2.3 Test Equipment**

Table 2 describes test equipment used to evaluate this product.

### **2.4 Modifications**

No modifications were made by US Tech, to bring the EUT into compliance with FCC Part 15, Class B Limits for the transmitter portion of the EUT or the Class B Digital Device Requirements.

**FIGURE 1  
TEST CONFIGURATION**

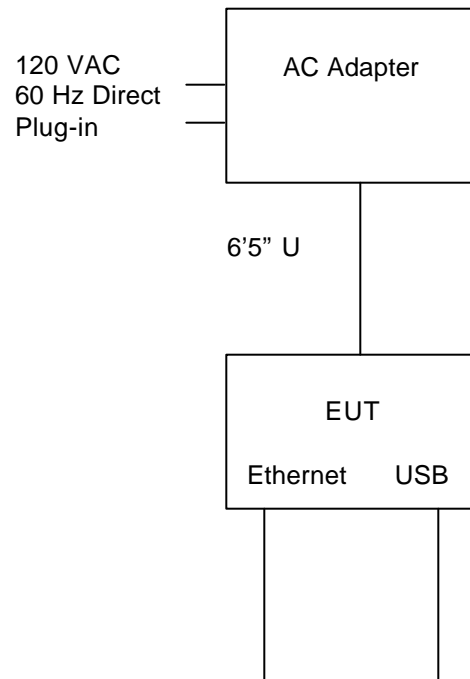


TABLE 1

Test Date: September 4, 2006  
UST Project: 06-0176  
Customer: Cirronet Corporation  
Model: ZMN2400HP-A

EUT and Peripherals

PERIPHERAL MANU.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
(EUT) Cirronet Corporation	ZMN2400HP-A	008517	HSW- ZMN240HA	7' U Ethernet 6'8" U USB
AC Adapter Volgen	SPU10R-1	None	None	6'5" U 120 VAC/ 60 Hz Direct Plug-in

**TABLE 2**  
**TEST INSTRUMENTS**

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A10055	3/21/06
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	7/03/06
SIGNAL GENERATOR	8648B	HEWLETT-PACKARD	3642U01679	9/15/05
RF PREAMP	8447D	HEWLETT-PACKARD	2944A06291	5/24/06
BICONICAL ANTENNA	BIA-25	ELECTRO-METRICS	2451	5/25/06
LOG PERIODIC	3146	EMCO	3110-3236	9/19/05 (2 Year)
LISN (x 2) 8028-50-TS24-BNC	8028	SOLAR ELE.	910494 & 910495	3/29/06
HORN ANTENNA	SAS-571	A. H. SYSTEMS	605	04/1/05 (2 Year)
PREAMP	8449B	HEWLETT PACKARD	3008A00480	08/10/06
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

**2.5 Antenna Description (Paragraph 15.203)**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Cirronet Corporation will sell the ZMN2400HP-A with the following integral antenna.

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB	TYPE OR CONNECTOR
Fractus	patch	FR05-S1-NO-1-004	0 dBi	Integral, mounted on PCB

**2.6 Peak power within the band 2400 – 2483.5 GHz per FCC Section 15.247(b)**

Peak power within the band 2400-2483.5 GHz has been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. The spectrum analyzer was set for a 50  $\Omega$  impedance with the VBW  $\geq$  RBW >6 dB bandwidth. The results of the measurements are given in Table 3 and Figure 3a through Figure 3c.

Fundamental Frequencies were measured at Low Channel, Mid Channel, and High Channel.

**TABLE 3**  
**PEAK POWER OUTPUT**

Test Date: September 4, 2006  
 UST Project: 06-0176  
 Customer: Cirronet Corporation  
 Model: ZMN2400HP-A

Frequency of Fundamental (MHz)	Measurement (dBm)*	Measurement (mW)*	FCC Limit (Watt)
2405.43	17.86	61.09	1.0
2444.30	17.67	58.48	1.0
2475.50	17.62	57.81	1.0

\* Measurement includes 0.1 dB for cable loss

Tester  
Signature:



Name: Austin Thonpson

Figure 3a.  
Peak Power per FCC Section 15.247(b) Low Channel

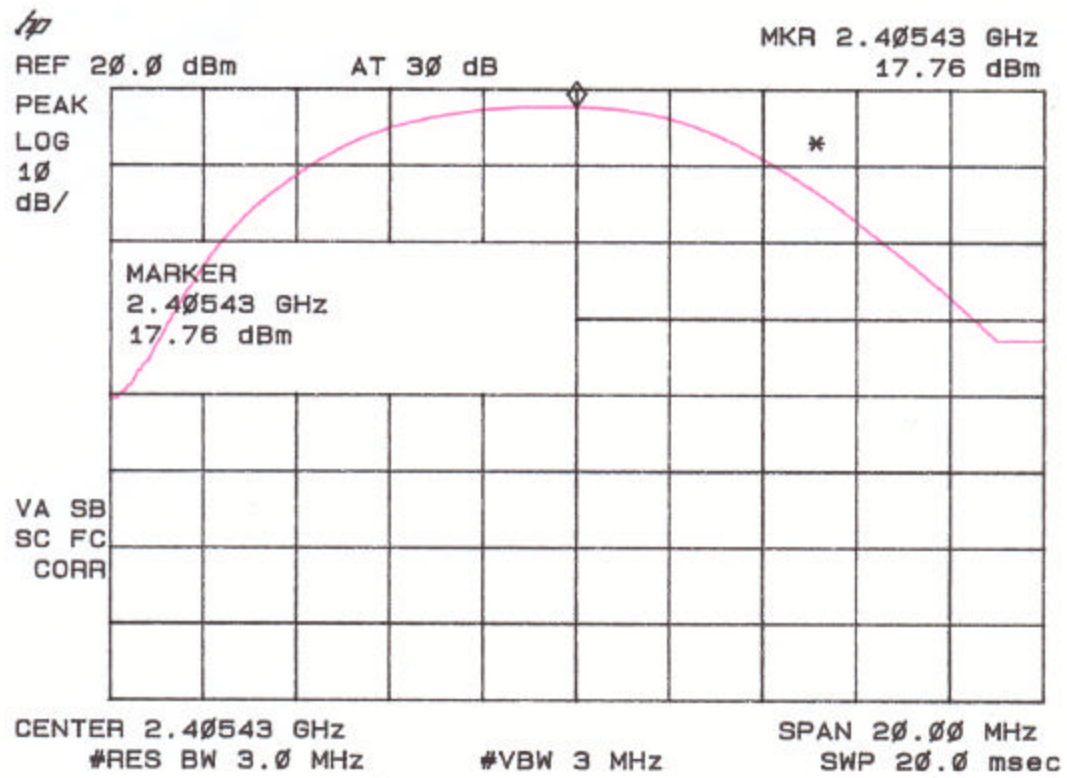


Figure 3b.  
Peak Power per FCC Section 15.247( b) Mid Channel

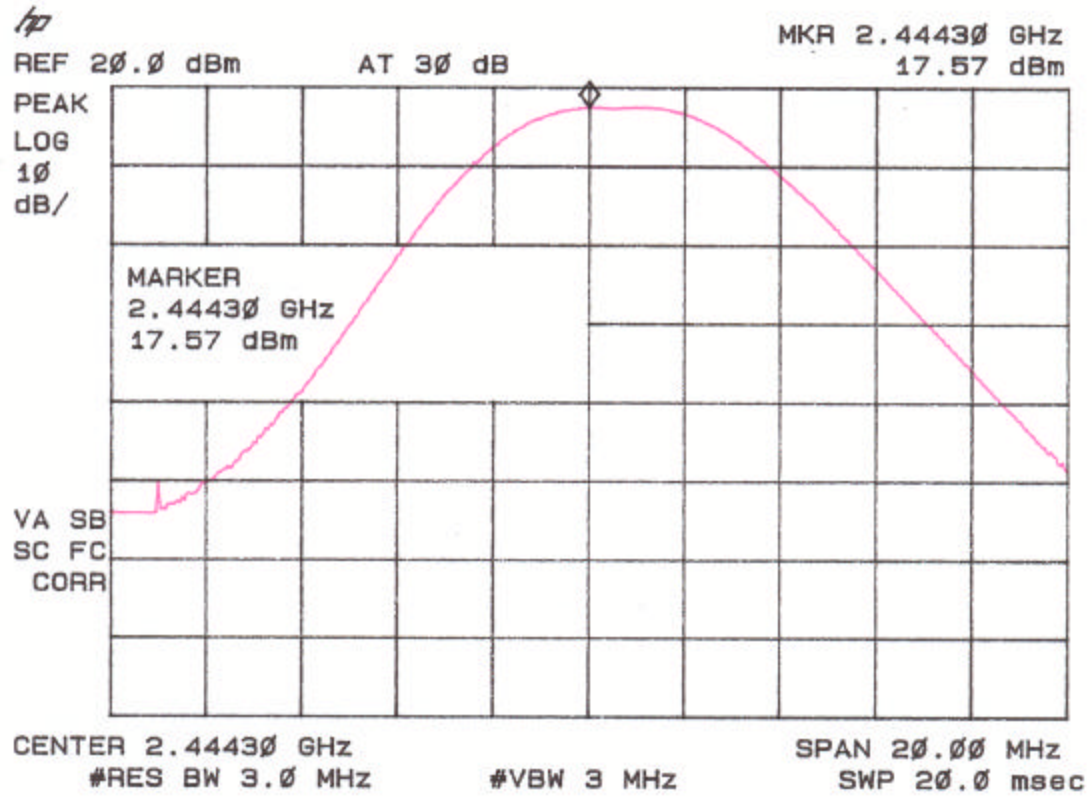
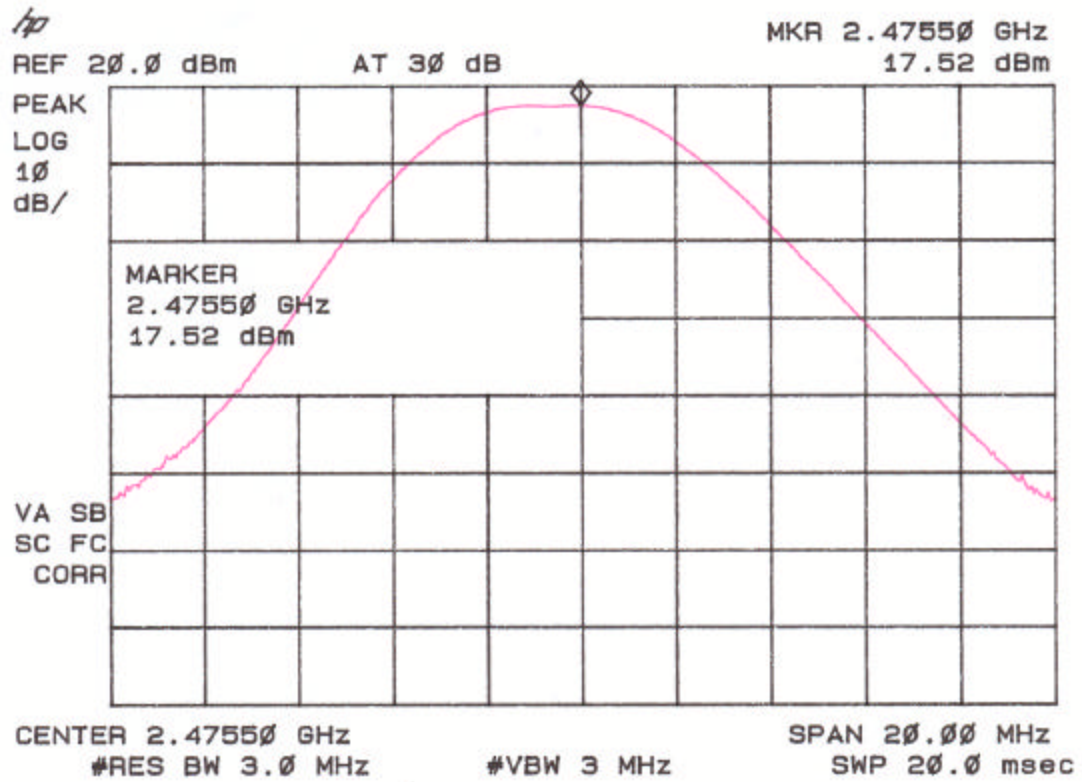


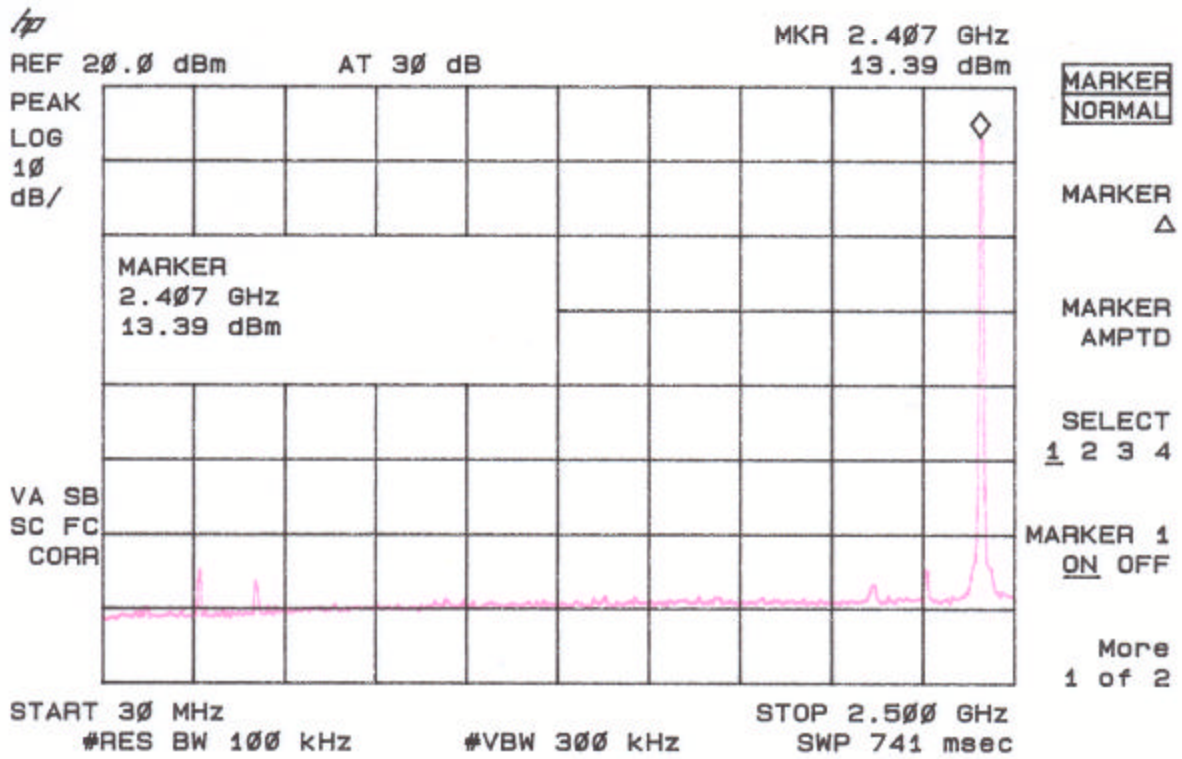
Figure 3c.  
Peak Power per FCC Section 15.247( b) High Channel



**2.7 Antenna Conducted Spurious Emission the Frequency Range 30 – 25000 MHz (FCC Section 15.247(c))**

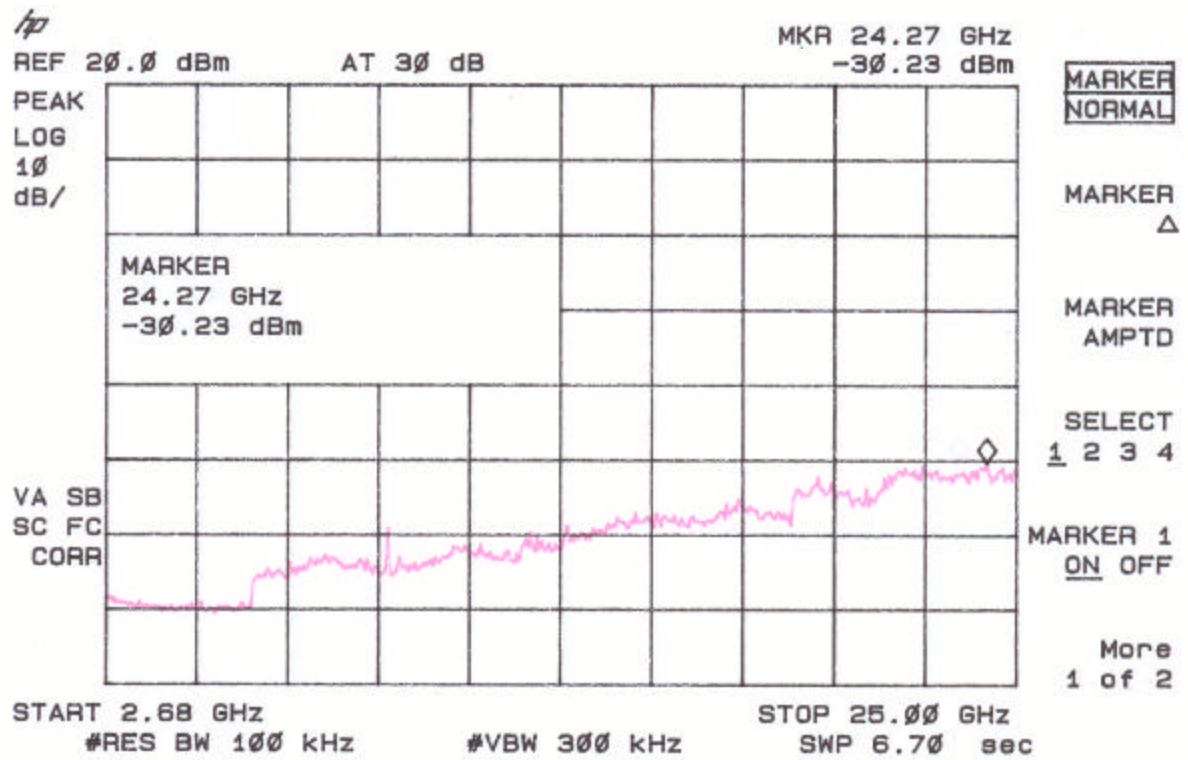
Spurious emissions in the frequency range 30 – 25000 MHz have been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. The spectrum analyzer was set for a 50  $\Omega$  impedance with the RBW = 100 kHz & VBW > RBW. All spurious emissions were measured to be greater than 20 dB down from the fundamental. The results of conducted spurious emissions are given in Figure 4a through 4l.

**Figure 4a**  
**Antenna Conducted Spurious Emissions 15.247(c) Low**

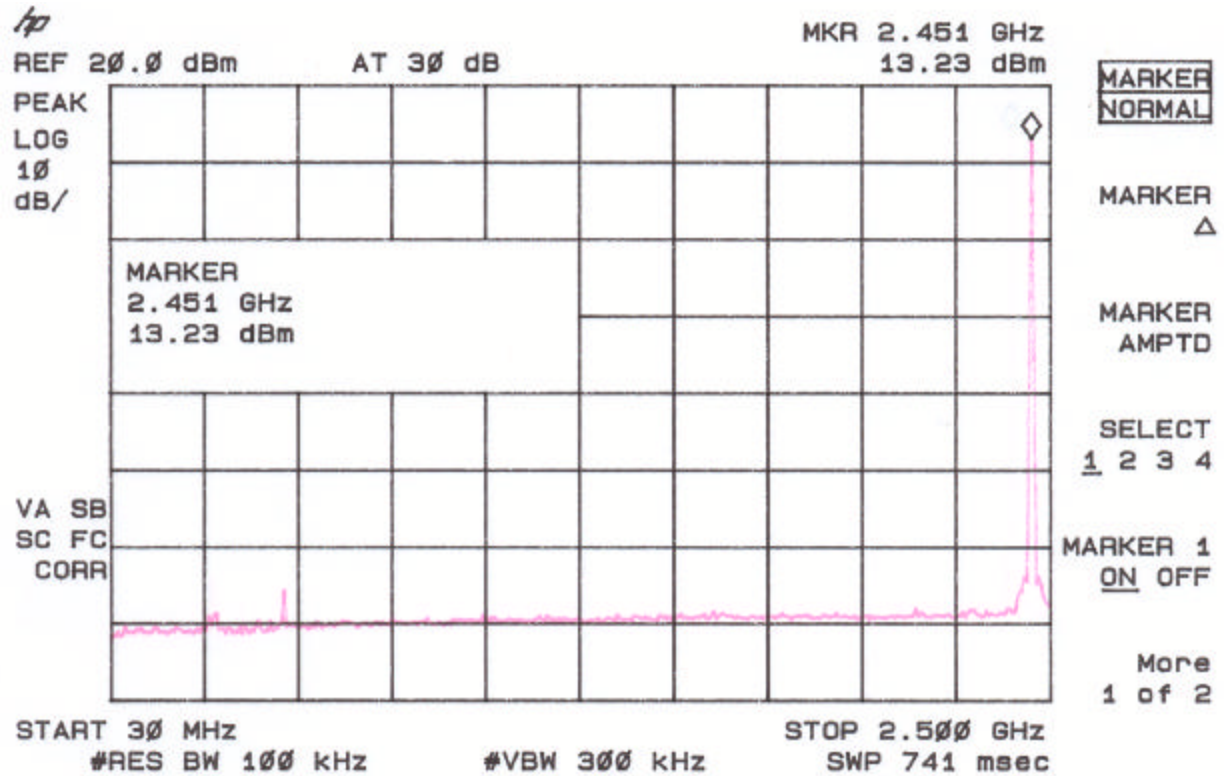


Note: Signal shown represents Fundamental Frequency

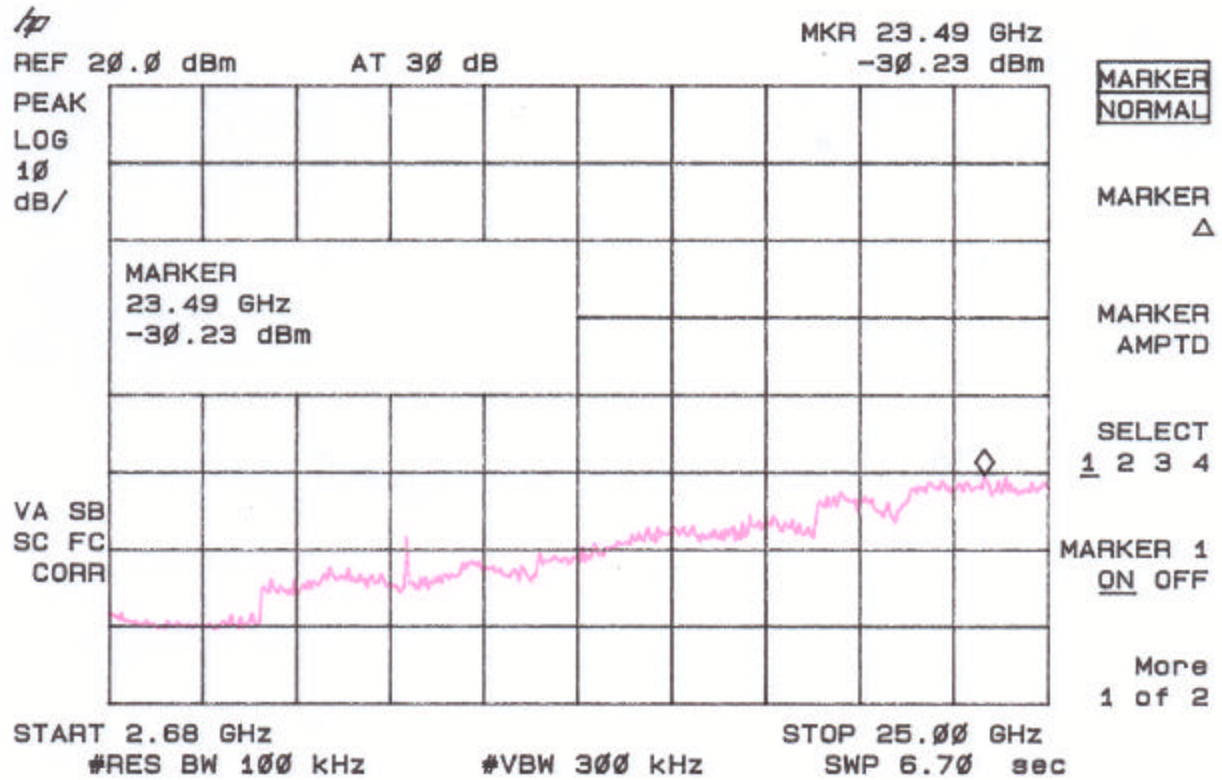
**Figure 4b**  
**Antenna Conducted Spurious Emissions 5.247(c) Low**



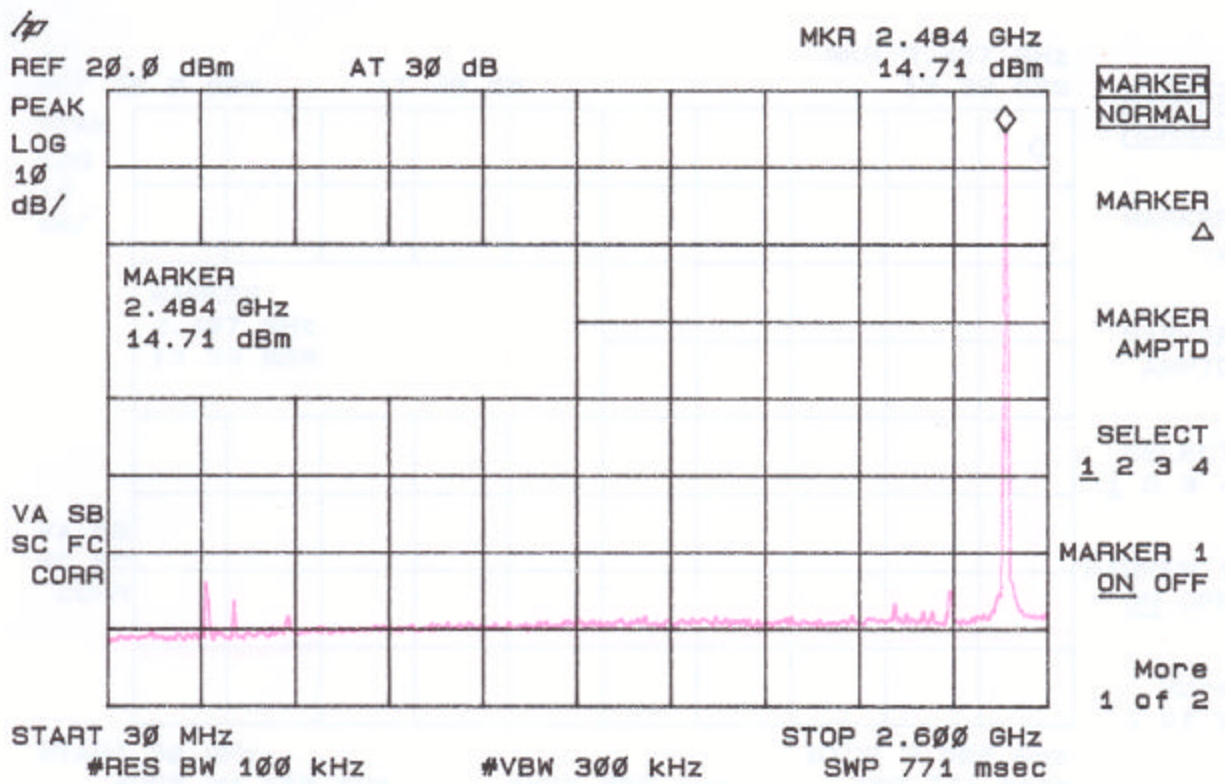
**Figure 4c**  
**Antenna Conducted Spurious Emissions 15.247(c) Mid**



Note: Signal shown represents Fundamental Frequency.

**Figure 4d****Antenna Conducted Spurious Emissions 15.247(c) Mid**

**Figure 4e**  
**Antenna Conducted Spurious Emissions 15.247(c) High**



Note: Signal shown represents Fundamental Frequency.



## **2.8 Peak Radiated Spurious Emission in the Frequency Range 30 -25000 MHz (FCC Section 15.247(c))**

The EUT was placed into a continuous transmit mode of operation. A preliminary scan was performed on the EUT to determine frequencies that were caused by the transmitter portion of the product. Significant emissions that fell within restricted bands were then measured on an OAT's site. Radiated measurements below 1 GHz were tested with a RBW = 120 kHz. Radiated measurements above 1 GHz were measured using a RBW = VBW = 1 MHz. The results of peak radiated spurious emissions falling within restricted bands are given in Table 4a –4c and Figure 5a – Figure 5c.

Table 4a. PEAK RADIATED SPURIOUS EMISSIONS (Low)

Radiated Emissions									
Test By:	Test:	FCC Part 15 Low Channel				Client:	Cirronet		
	Project:	06-0176		Class:	B	Model:	ZMN2400HP-A		
Frequency	Test Data	AF	Test Data	AF+CA-AMP	Results	Limits	Distance /	Margin	PK = n
(MHz)	(dBm)	Table	(dBuV)	(dB)	(uV/m)	(uV/m)	Polarity	(dB)	/ QP
2404.78	-29.3	1HN3mV	77.7	31.9	301011.2		3m./VERT		PK
4809.61	-52.1	1HN3mV	54.9	5.1	1002.5	5000.0	3m./VERT	14.0	PK
7214.44	-54.6	1HN1mV	52.4	10.5	1388.4	30101.1	1m./VERT	26.7	PK
9619.27	-55.2	1HN1mV	51.8	13.4	1809.4	30101.1	1m./VERT	24.4	PK

Data corrected by 0.1 dB for loss of high pass filter, except to fundamental

\*\* Conversion from 1 meter to 3 meters = -9.54 dB

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog  $((-52.1 + 5.1 + 107)/20)$  = 1002.5

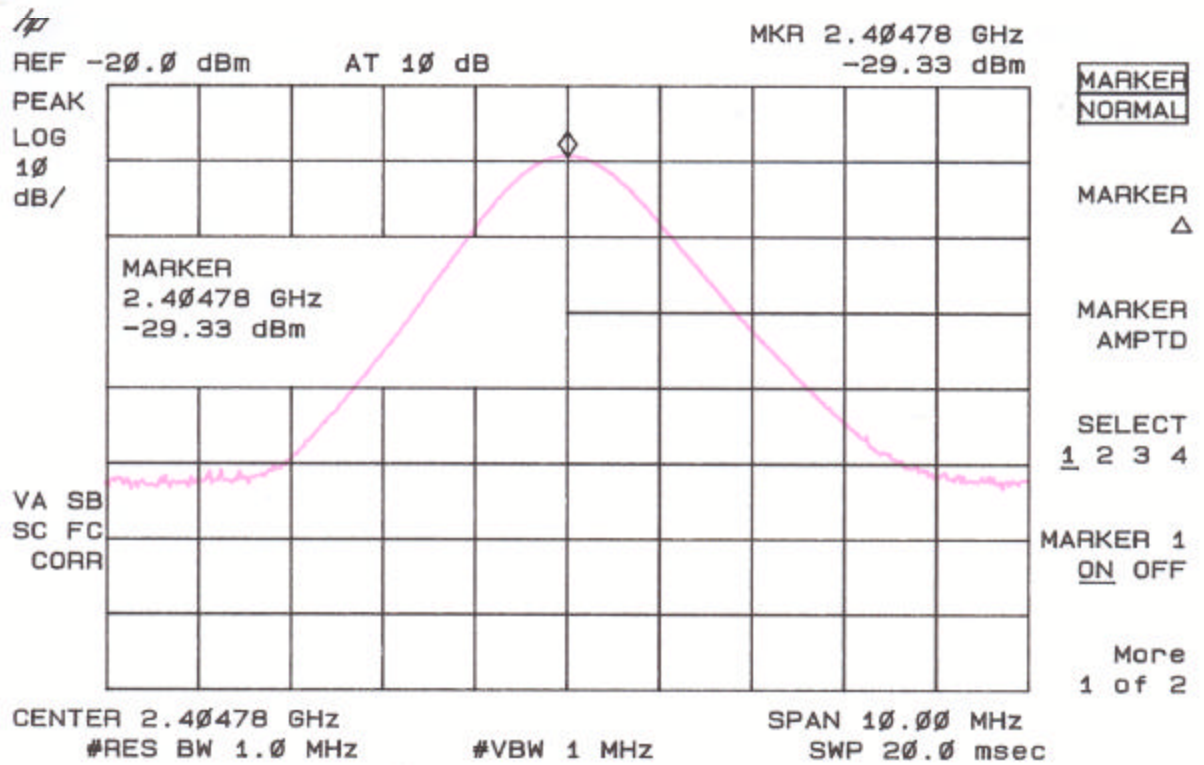
CONVERSION FROM dBm TO dBuV = 107 dB

Tester

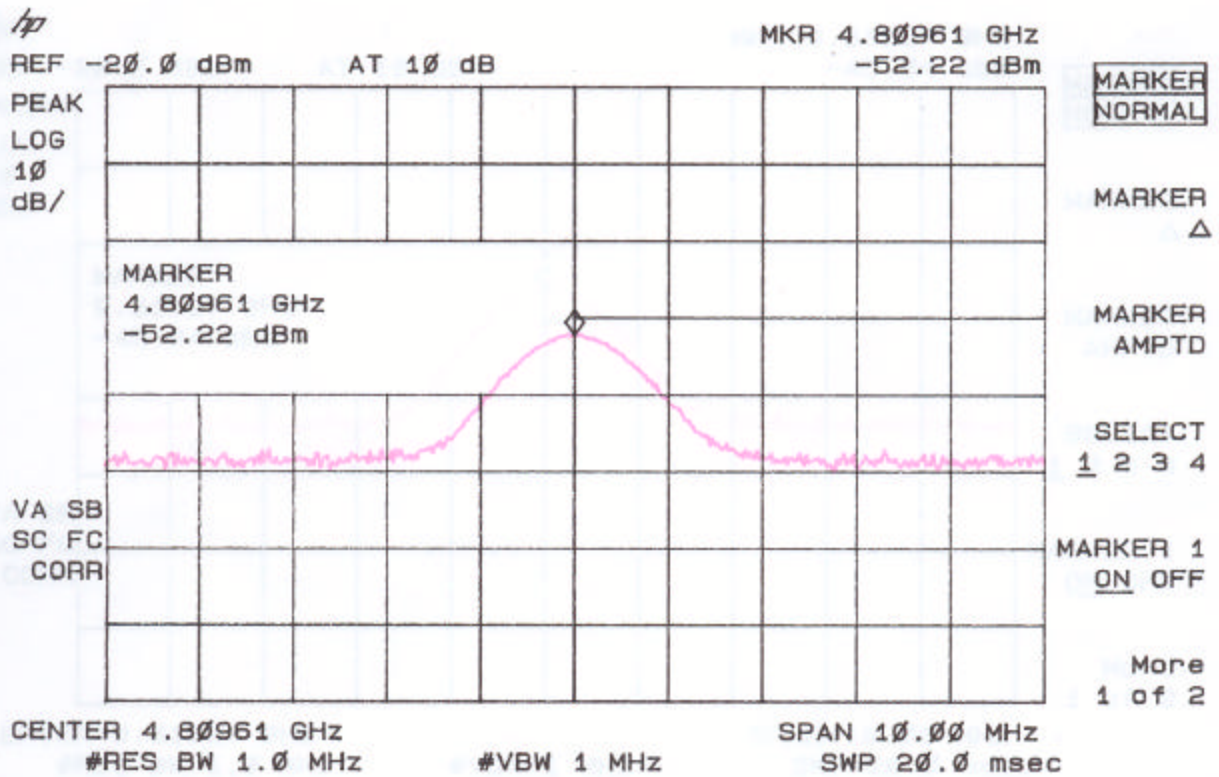
Signature: 

Name: Austin Thompson

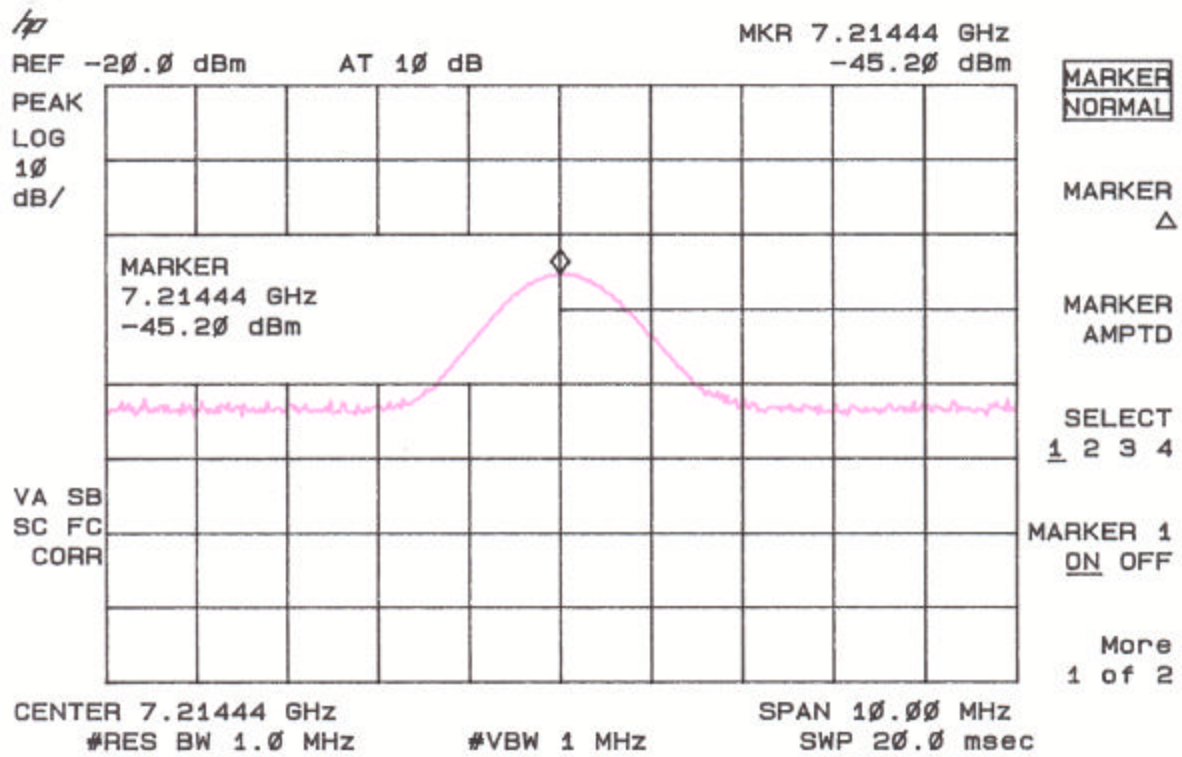
**Figure 4a - 1**  
**Peak Radiated Spurious Emission 15.247(c) Fundamental Low**



**Figure 4a - 2**  
**Peak Radiated Spurious Emission 15.247(c) Low**



**Figure 4a - 3**  
**Peak Radiated Spurious Emission 15.247(c) Low**



**Figure 4a - 4**  
**Peak Radiated Spurious Emission 15.247(c) Low**

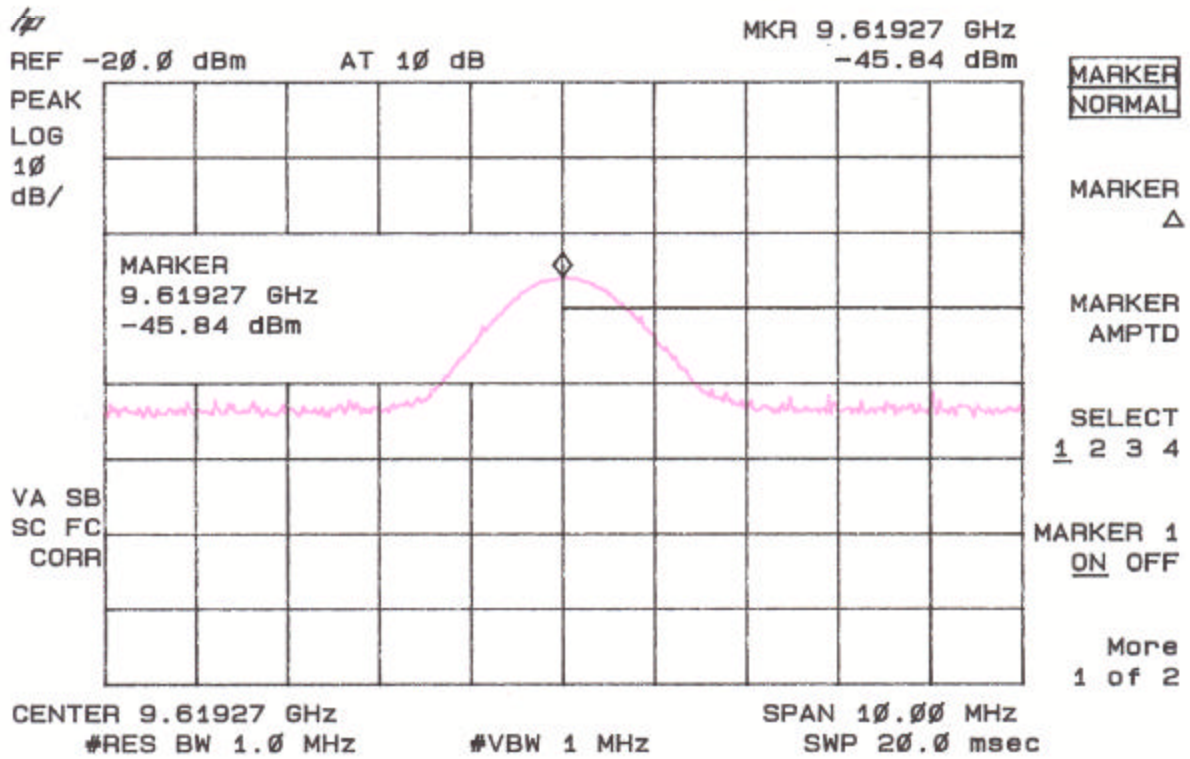


Table 4b. PEAK RADIATED SPURIOUS EMISSIONS (Mid)

Radiated Emissions									
Test By:	Test:	FCC Part 15 Mid Channel				Client:	Cirronet		
	Project:	06-0176		Class:	B	Model:	ZMN2400HP-A		
Frequency	Test Data	AF	Test Data	AF+CA-AMP	Results	Limits	Distance /	Margin	PK = n
(MHz)	(dBm)	Table	(dBuV)	(dB)	(uV/m)	(uV/m)	Polarity	(dB)	/ QP
2439.75	-29.3	1HN3mV	77.7	31.9	303366.6		3m./VERT		PK
4879.63	-51.9	1HN3mV	55.1	5.4	1053.6	5000.0	3m./VERT	13.5	PK
7319.38	-55.5	1HN1mV	51.5	10.8	1295.1	5000.0	1m./VERT	11.7	PK
9759.2	-54.5	1HN1mV	52.5	13.6	2004.1	30336.7	1m./VERT	23.6	PK
12199.03	-68.3	1HN1mV	38.7	18.1	685.6	5000.0	1m./VERT	17.3	PK

Data corrected by 0.1 dB for loss of high pass filter, except to fundamental


\*\* Conversion from 1 meter to 3 meters = -9.54 dB

SAMPLE CALCULATION:

RESULTS (uV/m @ 3m) = Antilog  $((-51.9 + 5.4 + 107)/20)$  = 1053.6

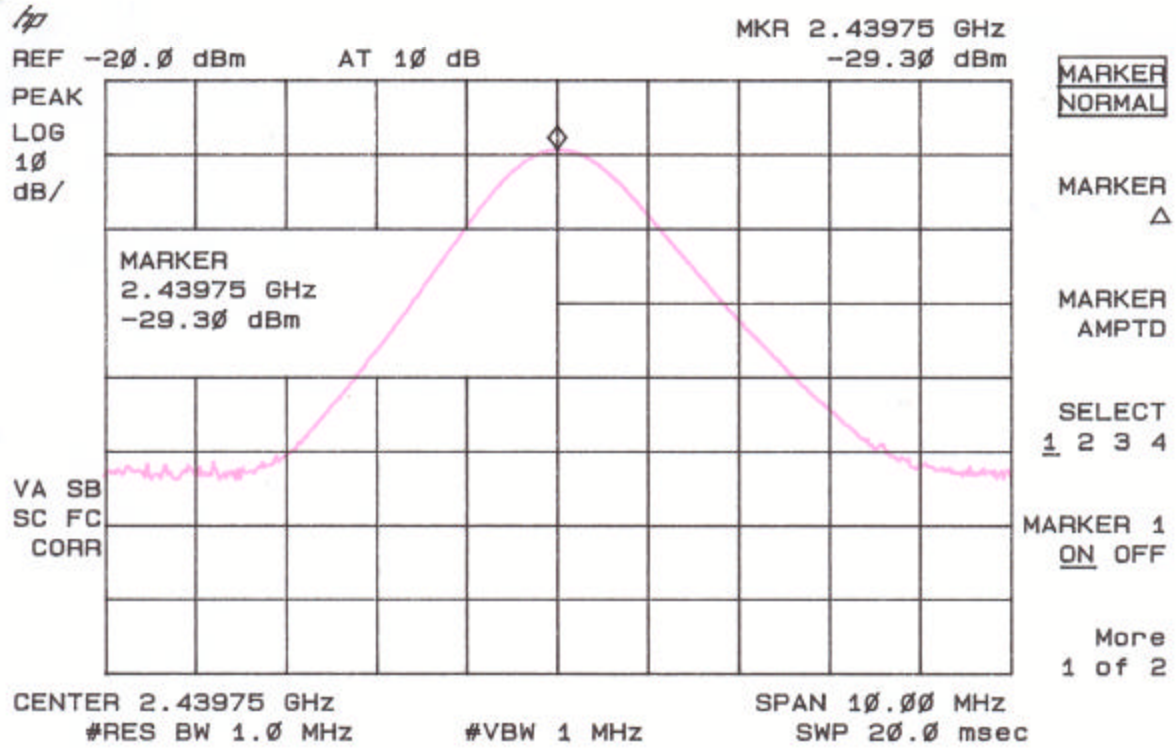
CONVERSION FROM dBm TO dBuV = 107 dB

Tester

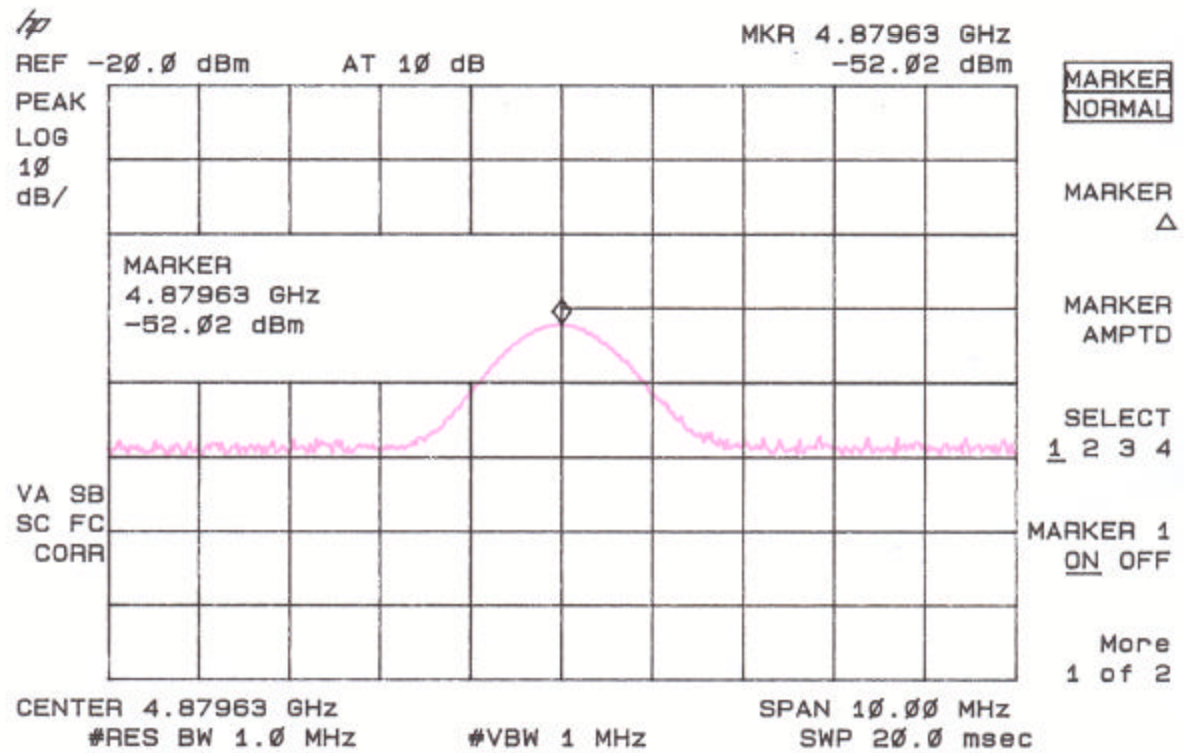
Signature: 

Name: Austin Thompson

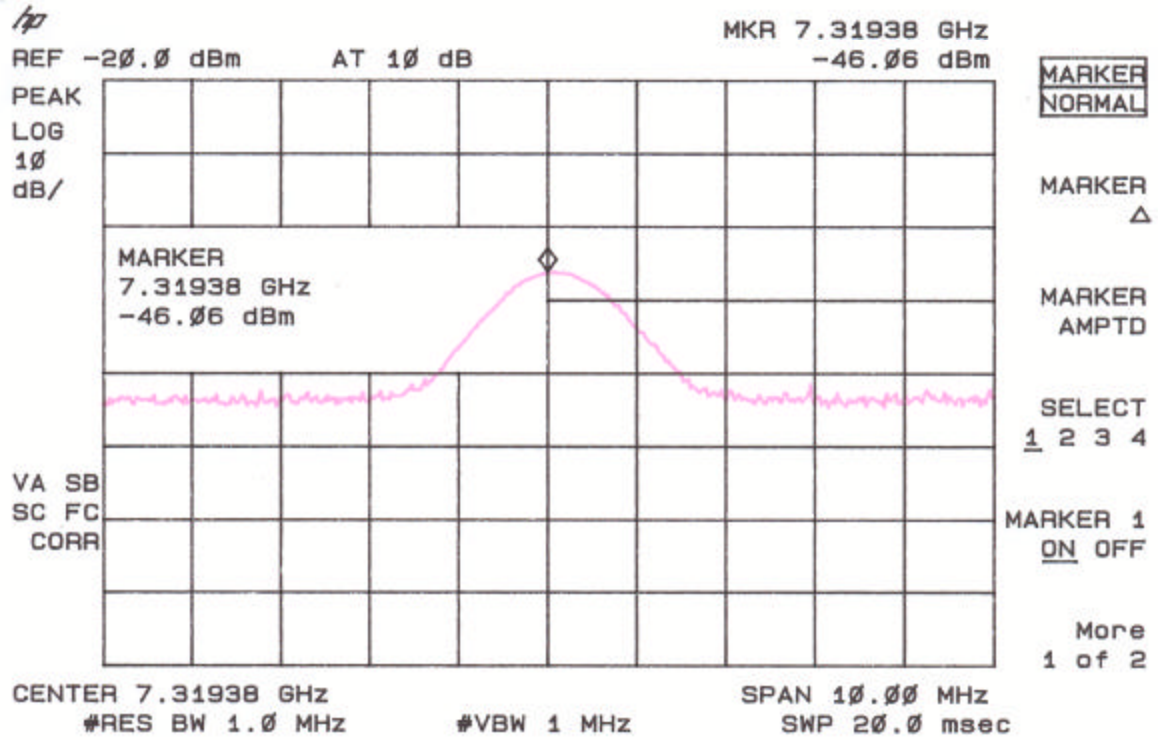
**Figure 5b - 1**  
**Peak Radiated Spurious Emission 15.247(c) Fundamental Mid**



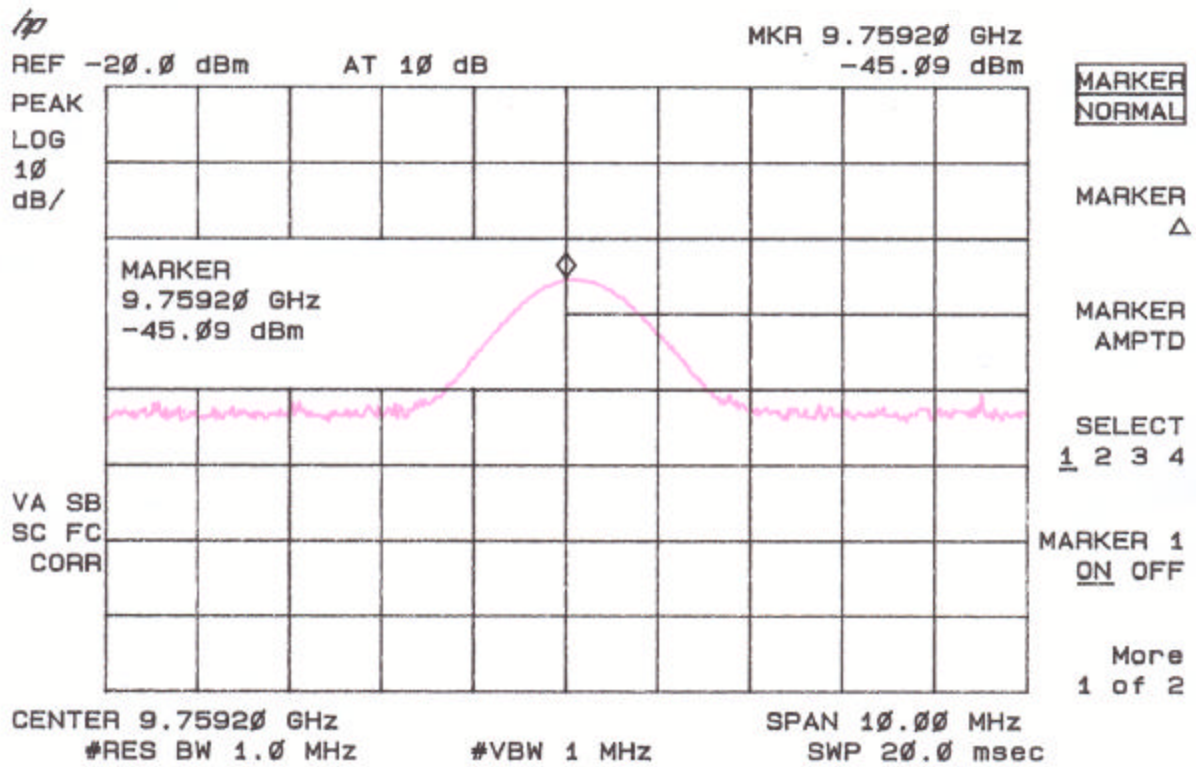
**Figure 5b - 2**  
**Peak Radiated Spurious Emission 15.247(c) Mid**



**Figure 5b - 3**  
**Peak Radiated Spurious Emission 15.247(c) Mid**



**Figure 5b - 4**  
**Peak Radiated Spurious Emission 15.247(c) Mid**



**Figure 5b - 5**  
**Peak Radiated Spurious Emission 15.247(c) Mid**

