



Testing Tomorrow's Technology

**Application
For**

**Cirronet Corporation
FCC Part 15, Subparts B and C, Certification
ZMN2430 ZigBee Module**

FCC ID: HSW - Z2430

**UST Project: 08-0007
Issue Date: January 31, 2008**

**3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
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:

US TECH (AGENT RESPONSIBLE FOR TEST):

By: Alan Ghasiani

Name: Alan Ghasiani

Title: Operations & Engineering

Date: January 31, 2008

**Cirronet Corporation
3079 Premiere Parkway
Duluth, GA 30097**

By: _____

Name: _____

Title: _____

Date: _____

This report shall not be reproduced except in full. This report may be copied in part only with the prior written approval of US Tech. The results contained in this report are subject to the adequacy and representative character of the sample provided.

**3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com**

US Tech
Test Report Number:
Test Specification:
Customer:
Model:

FCC ID: HSW-Z2430
08-0007
CFR 15, Subpart B and C
Cirronet, Inc.
ZMN2430

MEASUREMENT TECHNICAL REPORT

COMPANY NAME: **Cirronet Corporation**

MODEL: **ZMN2430**

FCC ID: **HSW- Z2430**

DATE: **January 31, 2008**

This report concerns (check one): Original grant X
Class II change _____

Equipment type: 2.4 GHz Zigbee Radio

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes _____ No X

If yes, defer until: _____
date

N.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:

US Tech
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

Table of Contents

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
	Agency Agreement	7
	Confidentiality	8
1	General Information	9
1.1	Product Description	9
1.2	Related Submittal(s)	9
2	Tests and Measurements	10
2.1	Configuration of Tested EUT	10
2.2	Test Facility	10
2.3	Test Equipment	10
2.4	Modifications	10
2.5	Antenna Description (CFR 15.203)	21
2.6	Peak Power within the band 2400 MHz to 2483.5 MHz (CFR 15.247(b)(3))	22
2.7	Radiated Spurious Emissions (CFR 15.247 (b)(3))	27
2.8	Peak Radiated Spurious Emissions and Average Radiated Spurious Emissions (CFR 15.247 (d))	34
2.9	Band Edge Requirements (CFR15.247 (d))	53
2.10	Minimum 6 dB Bandwidth (CFR 15.247(a)(2))	56
2.11	Worst Case transmit Duty Cycle	61
2.12	Power Line Conducted for Digital Device & Receiver (CFR 15.107)	62
2.13	Power Line Conducted Emissions for Transmitter (CFR 15.207)	63
2.14	Radiated Emissions for Digital Device & Receiver (CFR 15.109)	65
2.15	Peak Power Spectral Density (CFR 15.247 (e))	67
2.16	Maximum Public Exposure to RF Radiation (MPE) (CFR 15.247 (i))	68
3	Labeling Information	71
4	Block Diagram(S)/ Schematic(S)	72
5	Photographs	73
6	Theory of Operation	77
7	User's Manual	78

List of Figures

<u>Figures</u>	<u>Title</u>	<u>Page</u>
1	Test Configuration	11
2	Photograph(s) for Spurious Emissions Corner Antenna (Front)	14
3	Photograph of Spurious Emissions Corner Antenna (Rear View)	15
4	Photograph of Spurious Emissions Omni Antenna (Front View)	16
5	Photograph of Spurious Emissions Omni Antenna (Rear View)	17
6	Photograph of Spurious Emissions Patch (Front View)	18
7	Photograph of Spurious Emissions Patch (Rear View)	19
8	Photograph of Conducted Emissions	20
9	Peak Power per CFR 15.247(b) Low Channel	24
10	Peak Power CFR 15.247(b) Mid Channel	25
11	Peak Power, CFR 15.247(b) High Channel	26
12	Antenna Conducted Spurious Emissions-CFR 15.247(c) Low	27
13	Antenna Conducted Spurious Emissions- CFR 15.247(c) Low Cont'd	29
14	Antenna Conducted Spurious Emissions- CFR 15.247(c) Mid	30
15	Antenna Conducted Spurious Emissions- CFR 15.247(c) Mid Cont'd	31
16	Antenna Conducted Spurious Emissions – CFR 15.247(c) High	32
17	Antenna Conducted Spurious Emissions - CFR 15.247(c) High Cont'd	33
18	Peak Radiated Spurious Emissions, 15.247(c) Fundamental Low Corner Antenna	37
19	Peak Radiated Spurious Emissions 15.247(c) Fundamental Mid Corner Antenna	38
20	Peak Radiated Spurious Emissions 15.247(c) Fundamental High Corner Antenna	39
21	Peak Radiated Spurious Emissions 15.247(c) Representative Harmonic Plot Corner Antenna	40
22	Peak Radiated Spurious Emissions, 15.247(c). Fundamental Low Omni Antenna	43
23	Peak Radiated Spurious Emissions, 15.247(c). Fundamental Mid Omni Antenna	44
24	Peak Radiated Spurious Emissions, 15.247(c). Fundamental High Omni Antenna	45
25	Peak Radiated Spurious Emissions, 15.247(c). Representative Harmonic Plot Omni Antenna	46
26	Peak Radiated Spurious Emissions, 15.247(c). Fundamental Low Patch Antenna.	49
27	Peak Radiated Spurious Emissions 15.247(c). Fundamental Mid Patch Antenna	50
28	Peak Radiated Spurious Emissions 15.247(c). Fundamental High Patch Antenna.	51

List of Figures

<u>Figures</u>	<u>Title</u>	<u>Page</u>
29	Peak Radiated Spurious Emissions 15.247(c). Representative Harmonic, Patch Antenna.	52
30	Band Edge Compliance Antenna Conducted, High Channel	54
31	Band Edge Compliance Antenna Conducted, Low Channel	55
32	Six dB Bandwidth per FCC Section 15.247(a)(1)(ii) Low	58
33	Six dB Bandwidth per FCC Section 15.247(a)(1)(ii) Mid	59
34	Six dB Bandwidth per FCC Section 15.247(a)(1)(ii) High	60
35	Peak Power Spectral Density (15.247(e)) Low Channel	68
36	Peak Power Spectral Density (15.247(e)) Mid Channel	69
37	Peak Power Spectral Density (15.247(e)) High Channel	70

List Of Tables

1	EUT and Peripherals	11
2	Test Instruments	13
3	Antennas Allowed	21
4	Peak Power Output	23
5	Peak Radiated Spurious Emissions, Corner Antenna	35
6	Average Radiated Spurious Emissions Corner Antenna	36
7	Average Radiated Spurious Emissions Corner Antenna	36
8	Peak Radiated Spurious Emissions, 15.247(c). Representative Harmonic Plot Omni Antenna	47
9	Average Radiated Spurious Emissions, Patch Antenna	48
10	Six dB Bandwidth	57
11	Power Line Conducted Emissions Data, Class B	64
12	Radiated Emissions Data (Digital Device and Receiver)	66

1 General Information

1.1 Product Description

The Equipment under Test (EUT) is a Cirronet, Incorporated, Model ZMN2430 modular 2.4 GHz spread spectrum transceiver. The EUT will be used with an 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) of the EUT. The manufacturer desires to seek a modular approval on this device.

2 Tests and Measurements

2.1 Configuration of Tested System

The sample was tested per ANSI C63.4, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2003). 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. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figures 2 through 8.

The sample used for testing was received by US Tech on January 4, 2008 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 registered with the FCC, designation number US5117. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

2.3 Test Equipment

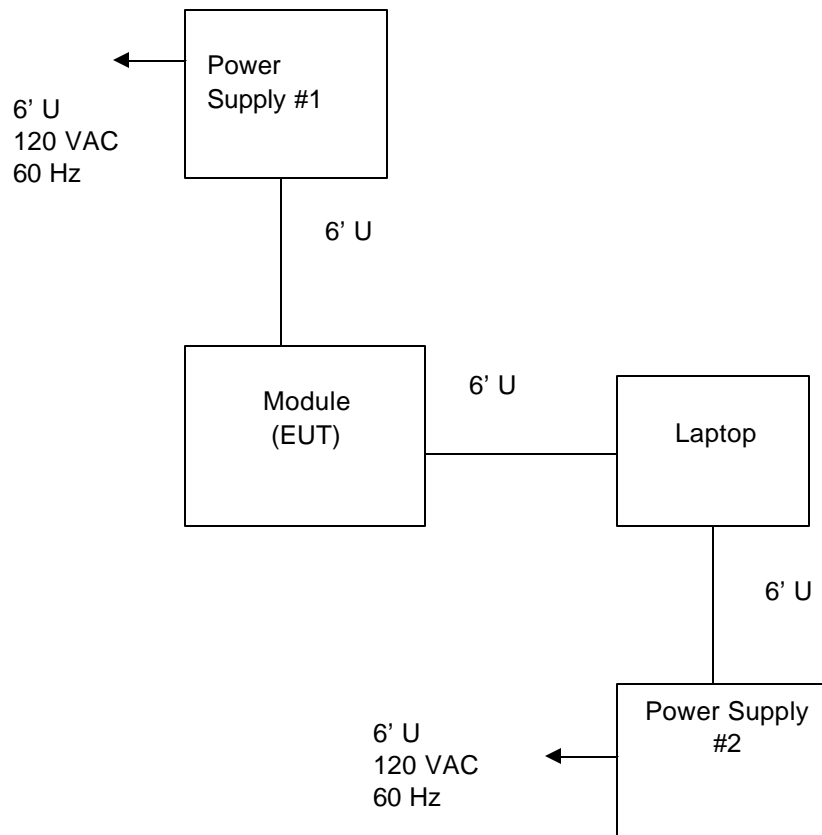
Table 2 describes test equipment used to evaluate this product.

2.4 Modifications

No modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator (Digital Device) Requirements.

2 Test and Measurements (Cont'd)

Figure 1. Test Configuration



US Tech
 Test Report Number:
 Test Specification:
 Customer:
 Model:

FCC ID: HSW-Z2430
 08-0007
 CFR 15, Subpart B and C
 Cirronet, Inc.
 ZMN2430

2 Test and Measurements (Cont'd)

Test Date: January 23, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

Table 1 . EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
(EUT) Cirronet Corporation	ZMN2430	None	Pending: HSW-Z2430	6' U
Antenna Various, see antenna descriptions			None	Varied from 0.2 to 1 meter
Power Supply GlobTek Inc.	GT-410-52-1509	None	None	6' U 120 VAC/ 60 Hz
Laptop Computer Hewlett Packard	None	None	None	6' U
Power Supply Hewlett Packard	HPP181a	00629710	None	6' U 120 VAC/ 60 Hz

US Tech
 Test Report Number:
 Test Specification:
 Customer:
 Model:

FCC ID: HSW-Z2430
 08-0007
 CFR 15, Subpart B and C
 Cirronet, Inc.
 ZMN2430

2 Test and Measurements (Cont'd)

Table 2. Test Instruments

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A10055	3/28/07
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	1/15/08
SIGNAL GENERATOR	8648B	HEWLETT-PACKARD	3642U01679	10/30/07
RF PREAMP	8447D	HEWLETT-PACKARD	2944A06291	6/14/07
BICONICAL ANTENNA	3110B	EMCO	9307-1431	11/15/07
LOG PERIODIC	3146	EMCO	3110-3236	11/21/07
LISN (x 2) 9247-50-TS-50-N	9247	SOLAR ELE.	955824 & 955826	3/29/07
HORN ANTENNA	3115	EMCO	9107-3723	10/16/06 2 Year
PREAMP	8449B	HEWLETT PACKARD	3008A00480	8/21/07
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

2 Test and Measurements (Cont'd)

Test Date: January 22, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

Figure 2

Photograph(s) for Spurious Emissions Corner Antenna (Front)



2 Test and Measurements (Cont'd)

Test Date: January 22, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

Figure 3

Photograph of Spurious Emissions Corner Antenna (Rear View)

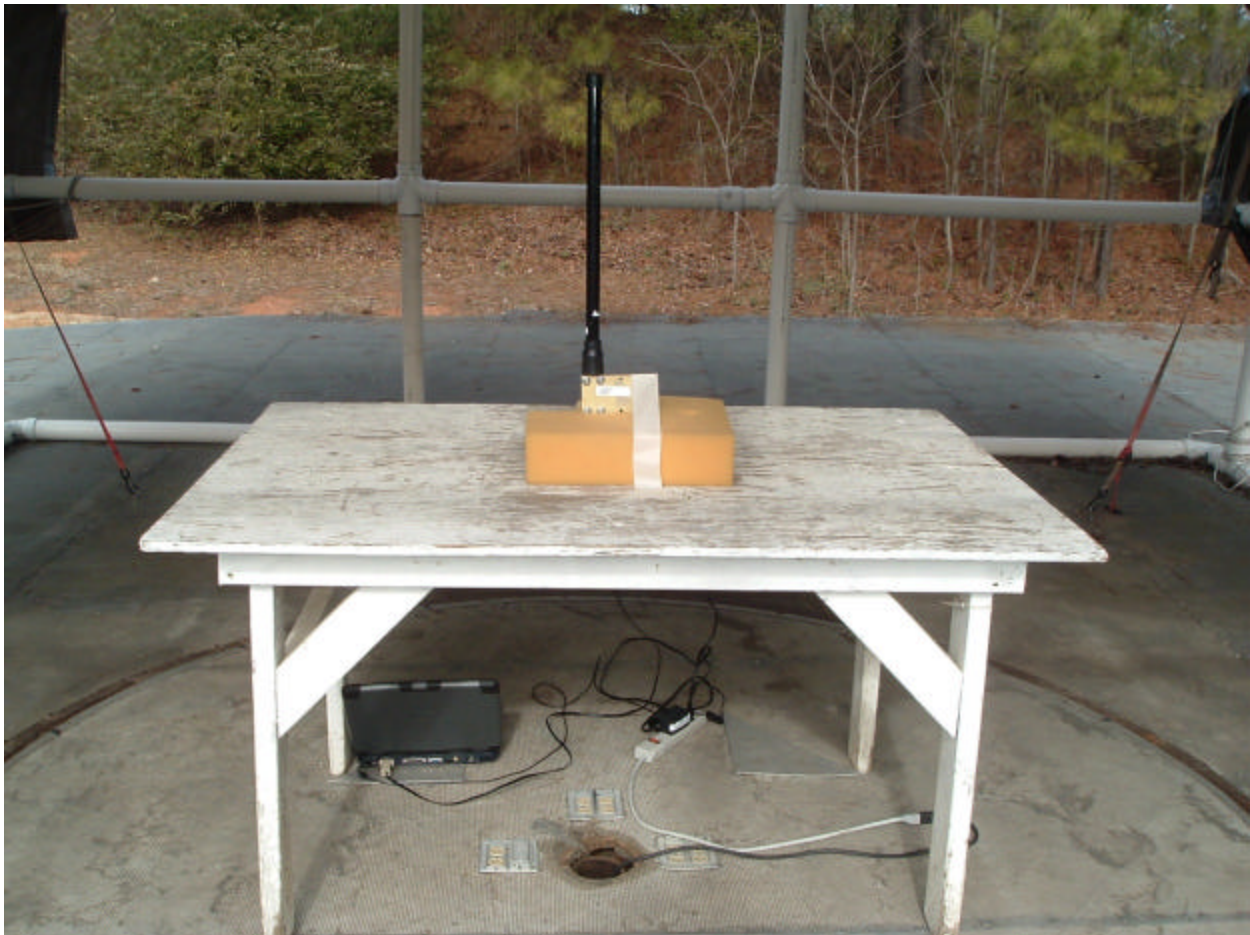


2 Test and Measurements (Cont'd)

Test Date: January 22, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

Figure 4.

Photograph of Spurious Emissions Omni Antenna (Front View)



2 Test and Measurements (Cont'd)

Test Date: January 22, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

Figure 5.

Photograph of Spurious Emissions Omni Antenna (Rear View)



2 Test and Measurements (Cont'd)

Test Date: January 22, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

Figure 6.

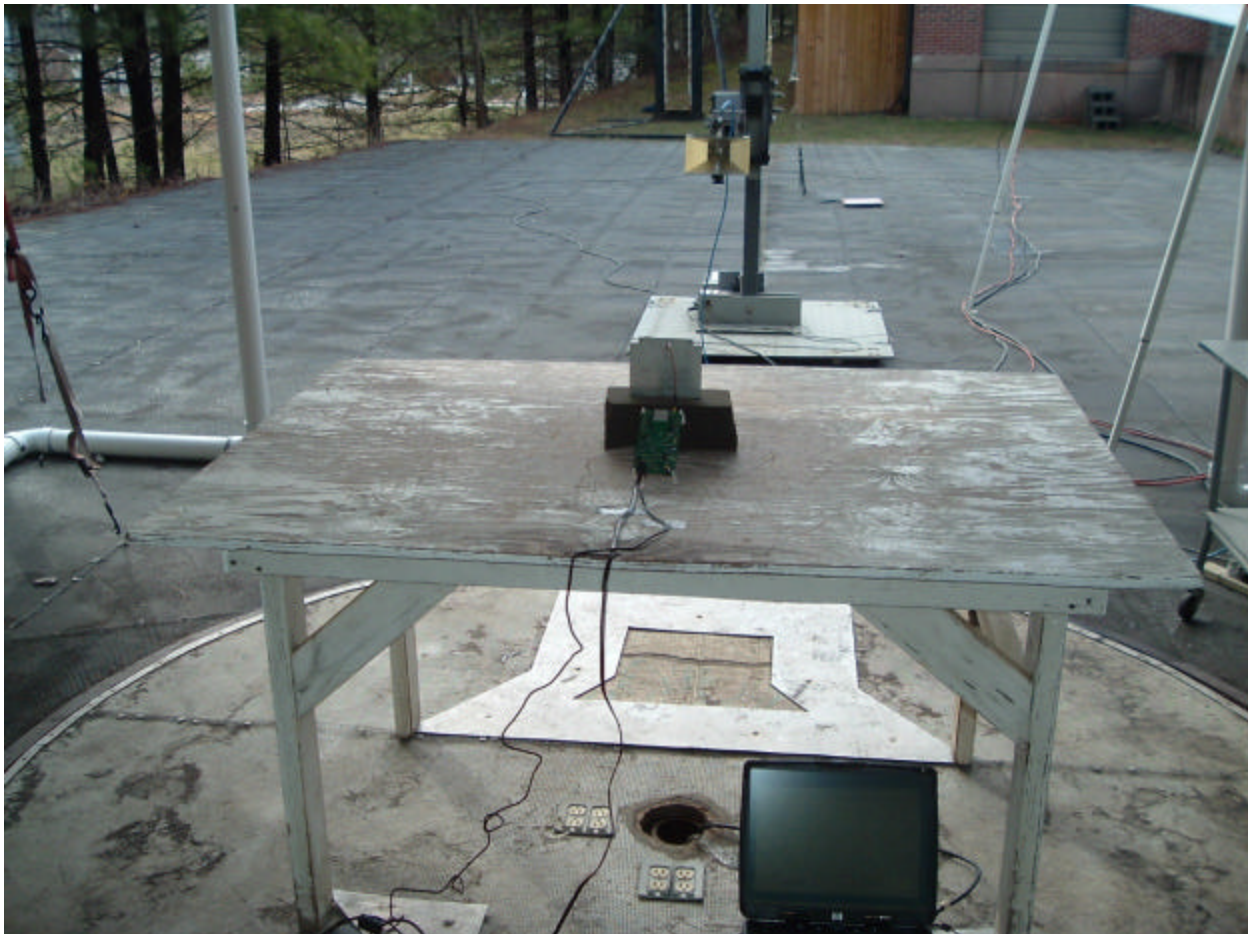
Photograph of Spurious Emissions Patch (Front View)



2 Test and Measurements (Cont'd)

Test Date: January 22, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

Figure 7.
Photograph of Spurious Emissions Patch (Rear View)



2 Test and Measurements (Cont'd)

Test Date: January 22, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

Figure 8.

Photograph of Conducted Emissions



2 Test and Measurements (Cont'd)

2.5 Antenna Description (CFR 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 ZMN2430 with the following antennas.

Table 3. Antennas Allowed

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB	TYPE OF CONNECTOR
Mobile Mark	Corner Reflector	SCR14-2400	14 dBi	Type N
Mobile Mark	Omni-Directional	OD9-2400	9 dBi	Type N
Cirronet Corporation	Patch	PA12	12 dBi	MMCX

To ensure compliance with 15.203, Cirronet Corporation attaches reverse-threaded TNC or N connectors to all antennas.

Cirronet Corporation has arranged for the manufacturers of the antennas to provide reverse-threaded TNC or N connectors for these antennas. OEM customers wanting to use one of these antennas in their product will first need to obtain a special part number from Cirronet Corporation to give to the antenna manufacturer. The manufacturer, upon receipt of this number, will know to attach the reverse-threaded TNC or N connector to the end of the antenna cable before shipping.

The customer then purchases an adapter cable from Cirronet Corporation that will connect the MMCX port on the module to the reverse-threaded connector on the antenna. No other type of commercially available antenna will attach to this reverse-threaded TNC or N connector. Given the nonstandard nature of the interconnect between module and antenna and the difficulty involved in circumventing that connection, Cirronet Corporation feel that this procedure meets the requirements of CFR 15.203.

2 Test and Measurements (Cont'd)

2.6 Peak Power within the band 2400 MHz – 2483.5 MHz per CFR 15.247(b)(3) (IC RSS 210, A84(4))

For the ZMN2430 (Low power), the transmitter was programmed to operate at 0 dBm. Peak power within the band 2400 MHz to 2483.5 MHz was measured per FCC KDB Publication 558074 as a conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short cable, to the antenna output terminals on the PCB. The spectrum analyzer was set for a 50 Ω impedance with the VBW = RBW = 3 MHz. The results of the measurements are given in Table 4 and Figure 9 through Figures 9 through 11. Figures 9-11 should be corrected by 4.23 dB for cable loss.

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

US Tech
Test Report Number:
Test Specification:
Customer:
Model:

FCC ID: HSW-Z2430
08-0007
CFR 15, Subpart B and C
Cirronet, Inc.
ZMN2430

2 Test and Measurements (Cont'd)

Table 4.
Peak Power Output per CFR 15.247(b)(3)

Test Date: January 21, 2008
UST Project: 08-0007
Customer: Cirronet Corporation
Model: ZMN2430

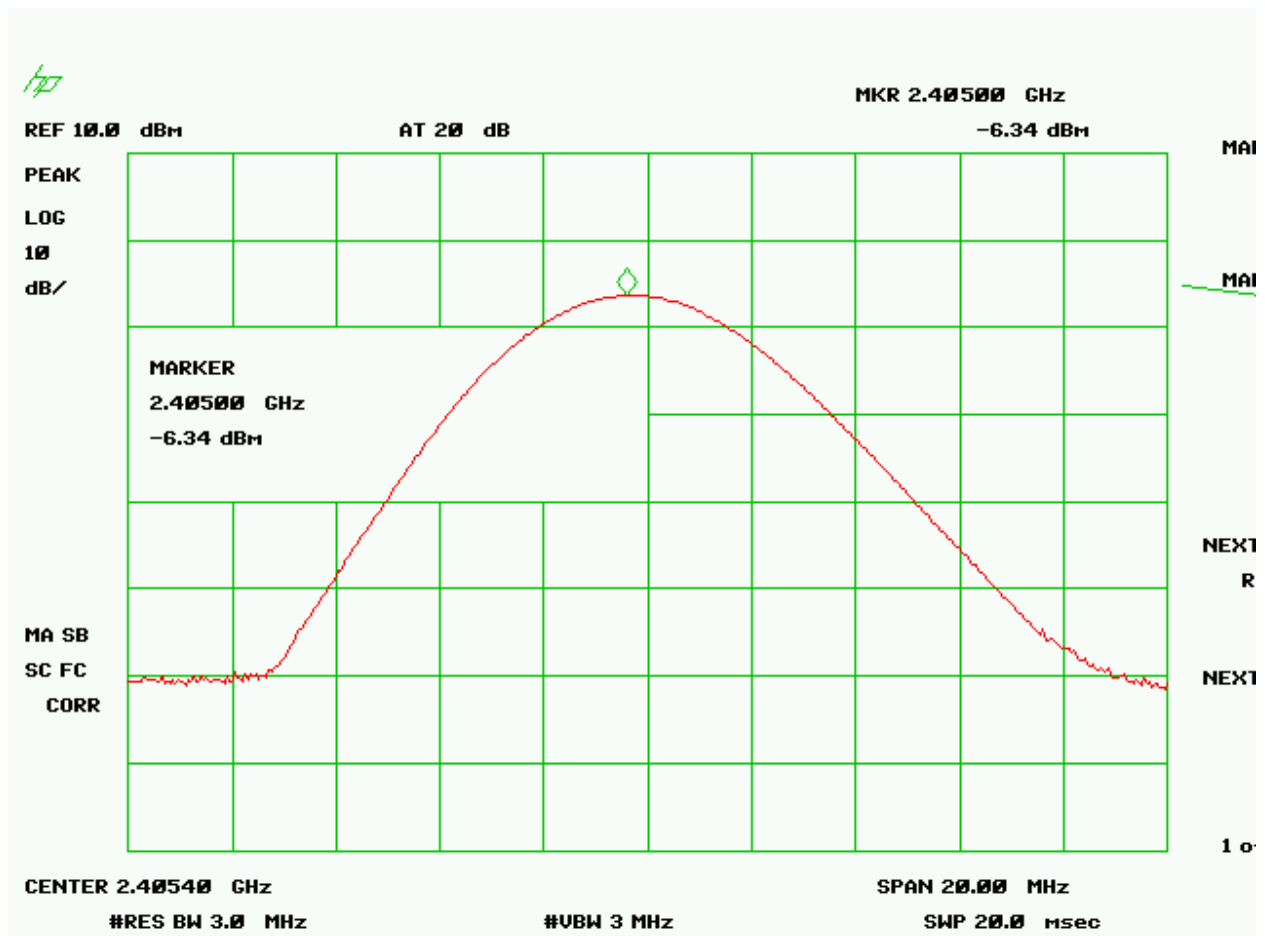
Frequency of Fundamental (MHz)	Measurement (dBm)*	Measurement (mW)*	FCC Limit (Watt)
2405.00	-2.11	0.615	1.0
2440.05	-3.79	0.417	1.0
2475.05	-4.44	0.359	1.0

* Measurement includes 4.23 dB for cable loss

Tester Signature: *Daniel Aparaschivei* Name: Daniel Aparaschivei

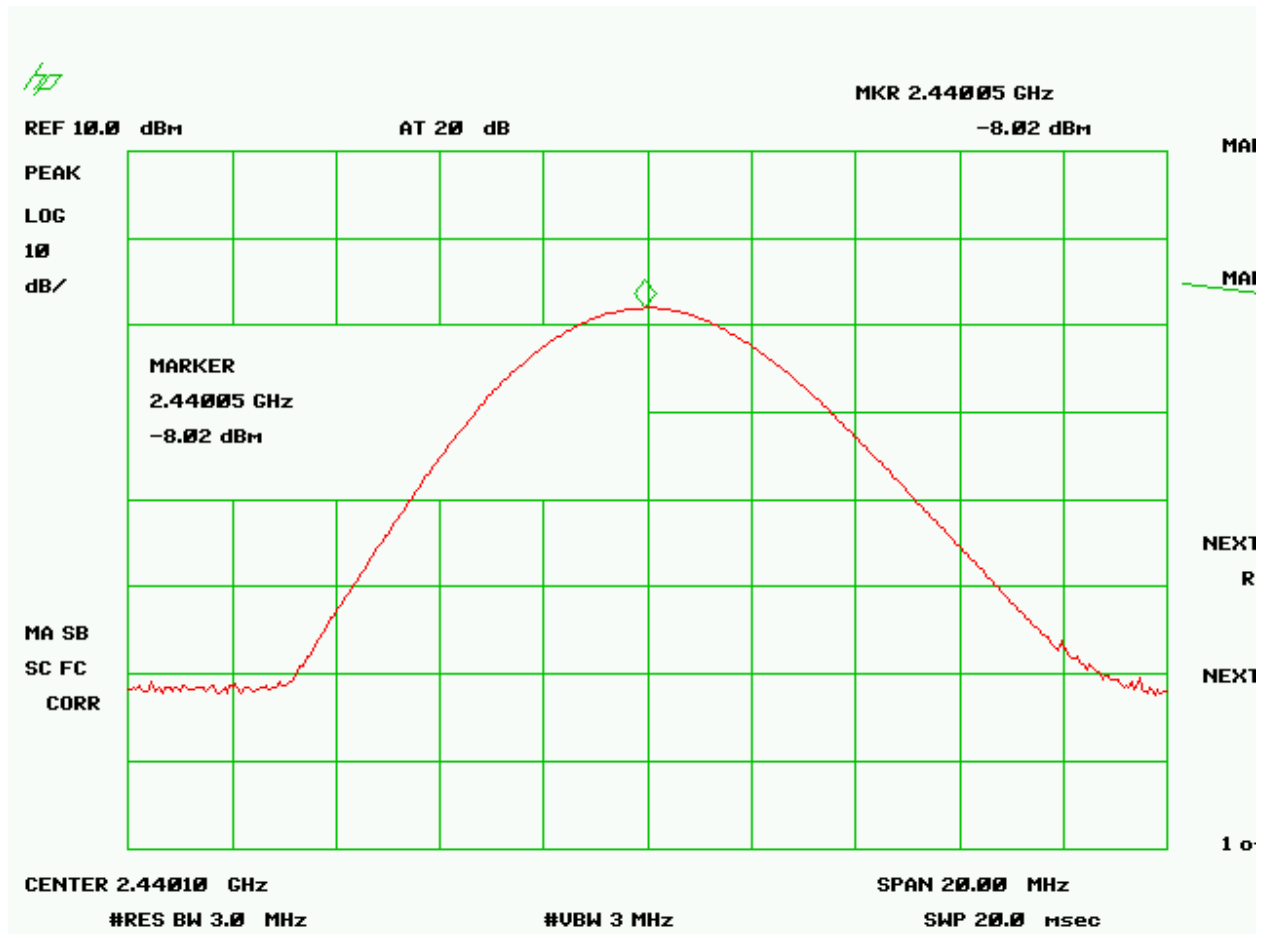
2 Test and Measurements (Cont'd)

Figure 9.
Peak Power per CFR 15.247(b)(3), Low Channel



2 Test and Measurements (Cont'd)

Figure 10.
Peak Power per CFR 15.247(b)(3), Mid Channel



2 Test and Measurements (Cont'd)

Figure 11.
Peak Power per CFR 15.247(b)(3), High Channel

