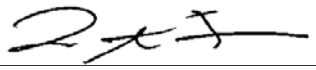
Cirronet Corporation
FCC Part 15, Certification Application
ZMN2400HP

UST Project: 07-0207
Issue Date: August 17, 2007

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

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 & Engineering

Date: August 17, 2007

Cirronet Corporation
5375 Oakbrook Parkway
Norcross, GA 30093

By: _____

Name: _____

Title: _____

Date: _____

3505 Francis Circle Alpharetta, GA 30004
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MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **Cirronet Corporation**

MODEL: **ZMN2400HP**

FCC ID: **HSW- Z2400HP**

DATE: **August 13, 2007**

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:

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

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

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GENERAL INFORMATION

GENERAL INFORMATION

1.1 Product Description

The Equipment Under Test (EUT) is a Cirronet Corporation, Model ZMN2400HP modular 2.4 GHz spread spectrum transceiver. The EUT will be used with three (3) antennas via a non standard connector.

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 (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. Bock 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 July 17, 2007 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 to the FCC, and under 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, 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

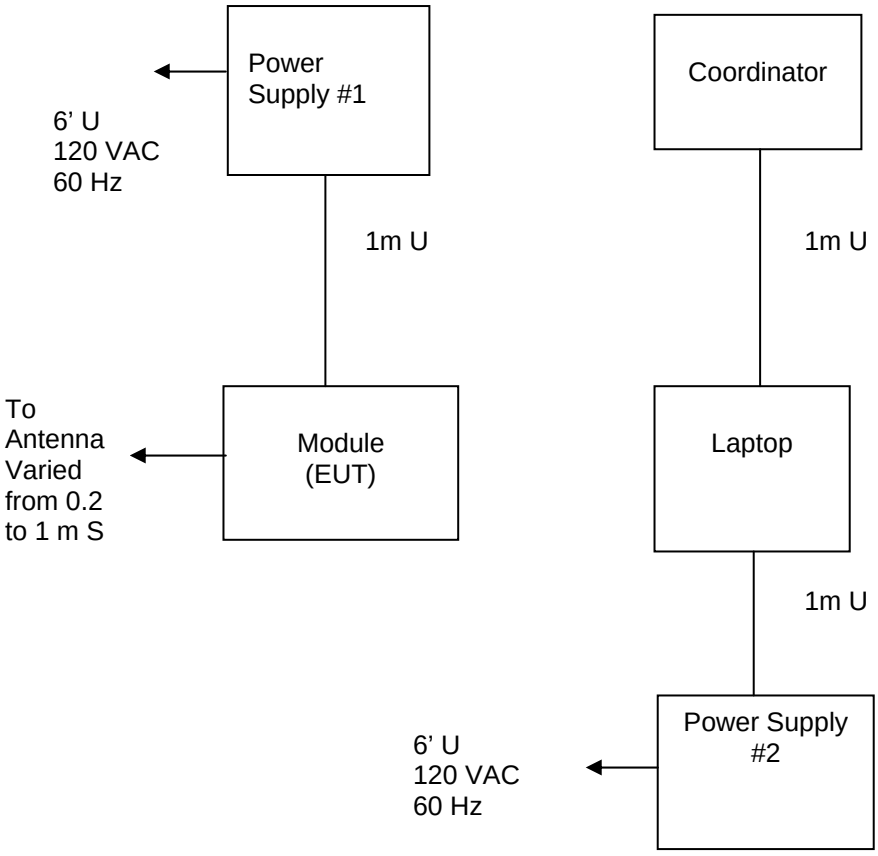


TABLE 1

Test Date: **August 8, 2007**
UST Project: **07-0207**
Customer: **Cirronet Corporation**
Model: **ZMN2400HP**

EUT and Peripherals

PERIPHERAL MANU.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
(EUT) Cirronet Corporation	ZMN2400HP	None	Pending: HSW-2400HP	1 m U
Antenna Various, see antenna descriptions			None	Varied from 0.2 to 1 m S
Power Supply TekPower	HY1803D	None	None	6' U 120 VAC/ 60 Hz
Coordinator Cirronet Corporation	None	None	None	1m U
Laptop Computer IBM	600X	78-WHPB3	None	1m U
Power Supply IBM	None	None	None	6' U 120 VAC/ 60 Hz

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	7/16/07
SIGNAL GENERATOR	8648B	HEWLETT-PACKARD	3642U01679	10/13/06
RF PREAMP	8447D	HEWLETT-PACKARD	2944A06291	6/14/07
BICONICAL ANTENNA	3110B	EMCO	9307-1431	10/11/06
LOG PERIODIC	3146	EMCO	3110-3236	9/15/05 2 yr.
LISN (x 2) 8028-50-TS24-BNC	8028	SOLAR ELE.	910494 & 910495	5/10/07
HORN ANTENNA	3115	EMCO	9107-3723	10/16/06 2 yr.
PREAMP	8449B	HEWLETT PACKARD	3008A00480	8/10/06
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 with the following antennas.

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB	TYPE OR CONNECTOR
Mobile Mark	Corner Reflector	SCR14-2400PTA-RTNC	14 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Omni-Directional	OD6-2400-RNTC	6 dBi	Reverse TNC to MMCX via adapter cable
Cirronet Corporation	Patch	GA Tech	12 dBi	Non-standard MMCX

To ensure compliance with 15.203, Cirronet Corporation attaches reverse-sex TNC or N connectors to all antennas except the 12 dBi Patch antenna.

Cirronet Corporation. has arranged for the manufacturers of the antennas to provide reverse-sex 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-sex 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-sex connector on the antenna. No other type of commercially available antenna will attach to this reverse-sex 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 called out in 15.203.

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 Ω impedance with the VBW ≥ RBW 6 dB bandwidth. The results of the measurements are given in Table 3 and Figure 3a through Figure 3d.

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

TABLE 3a
PEAK POWER OUTPUT

Test Date: August 8, 2007
UST Project: 07-0207
Customer: Cirronet Corporation
Model: ZMN2400HP Module #1

Frequency of Fundamental (MHz)	Measurement (dBm)*	Measurement (mW)*	FCC Limit (Watt)
2405.28	16.63	46.02	1.0
2439.35	15.51	35.56	1.0
2475.28	14.62	28.97	1.0

*** Measurement includes 0.1 dB for cable loss**

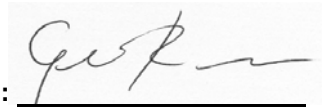
Tester Signature:  **Name: Gersop Riera**

Figure 3a1.
Peak Power per FCC Section 15.247(b) Low Channel Module #1

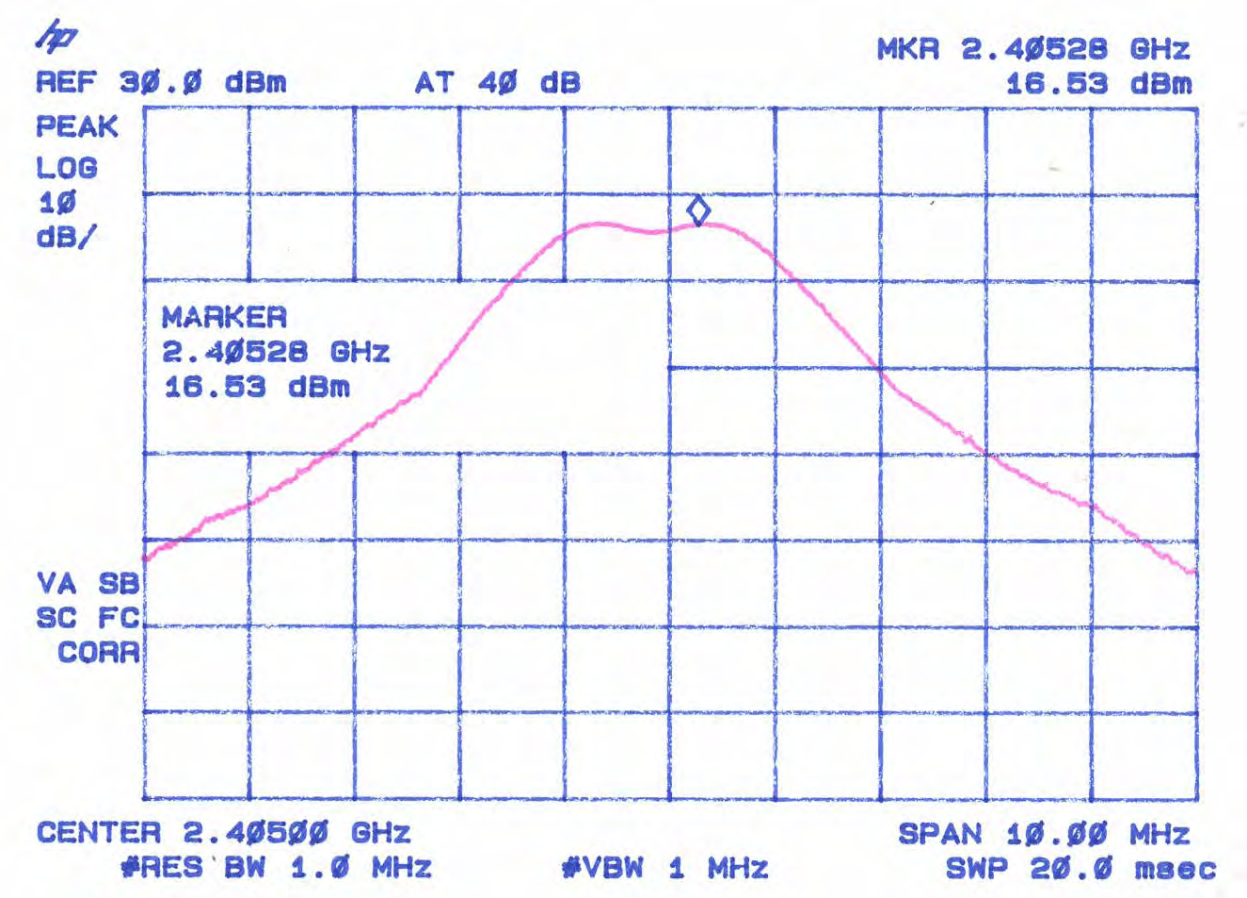


Figure 3a2.
Peak Power per FCC Section 15.247(b) Mid Channel Module #1

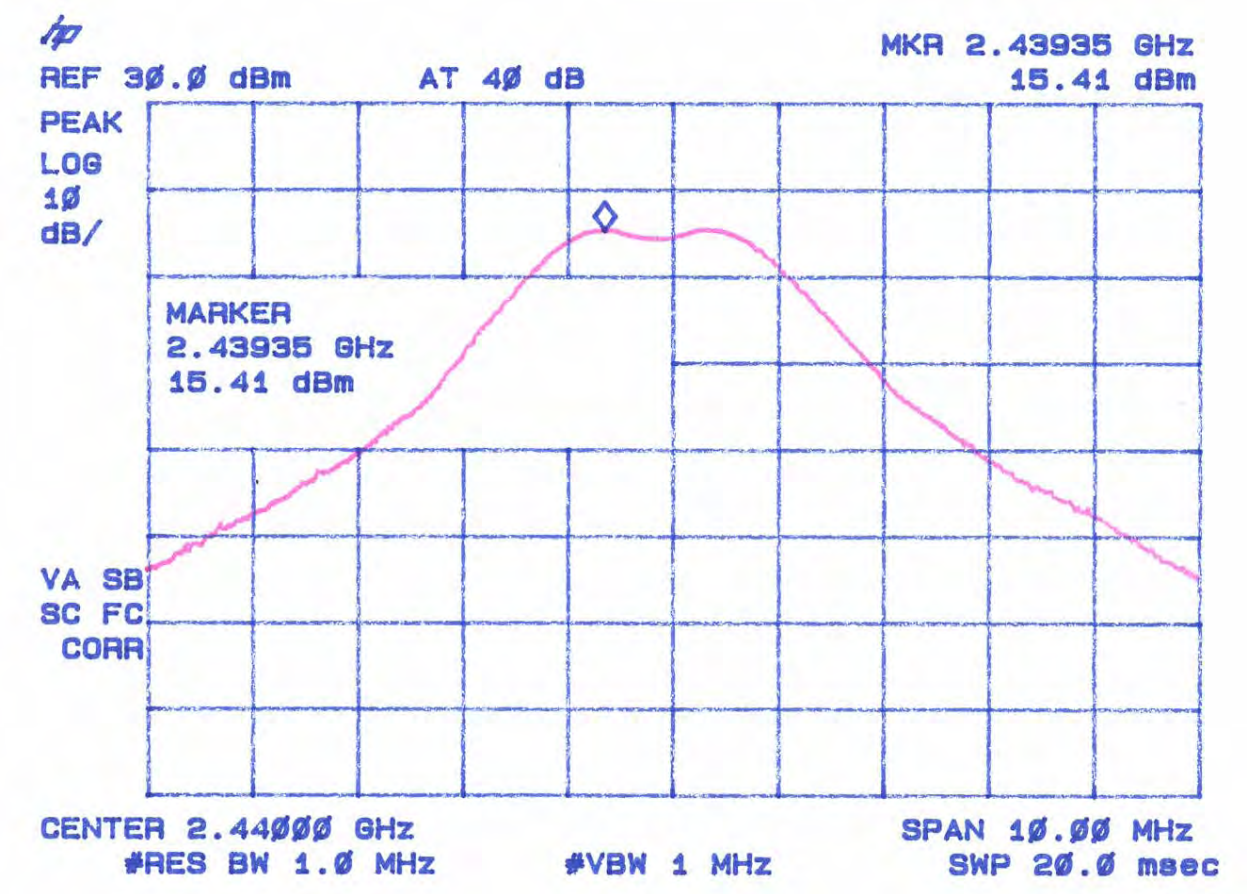
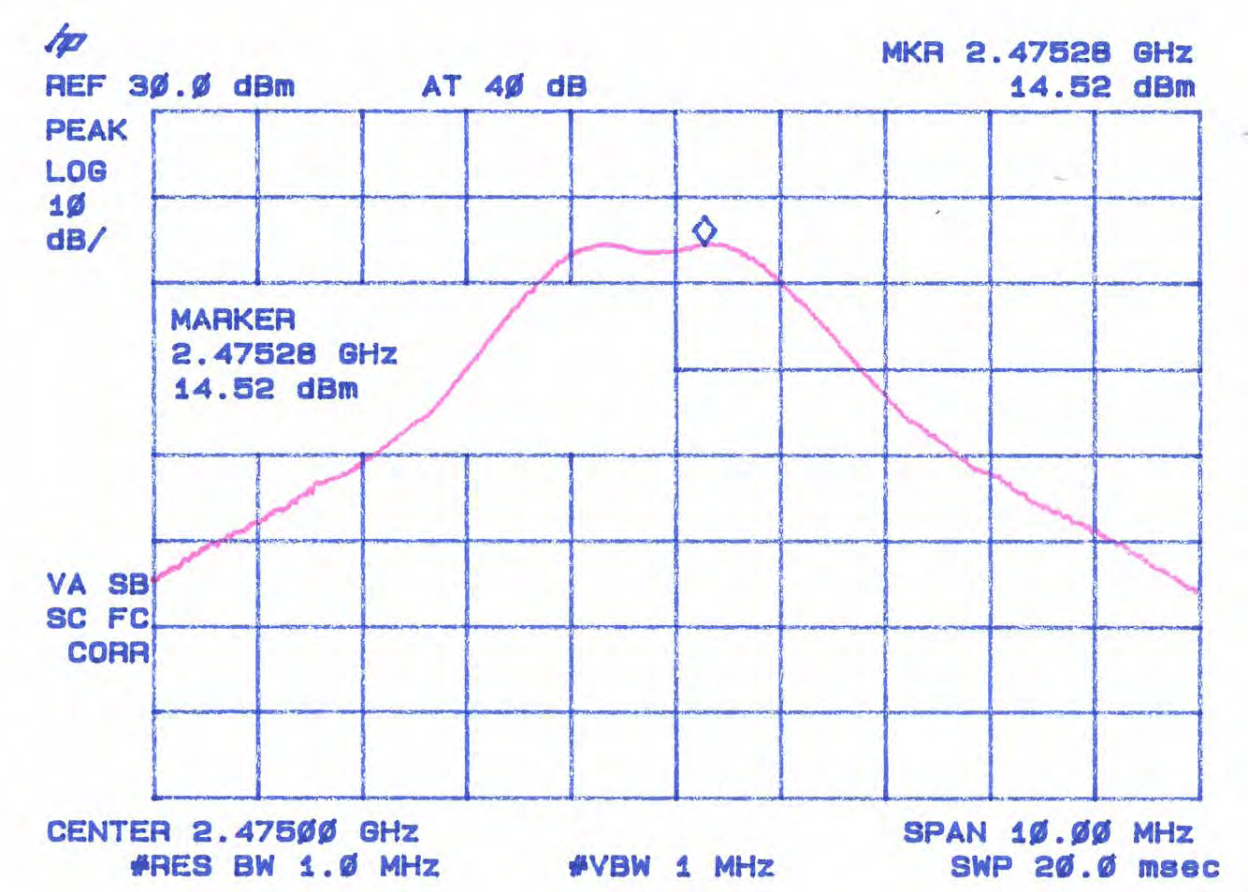


Figure 3a3.
Peak Power per FCC Section 15.247(b) High Channel Module #1



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

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 Ω 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 or conducted spurious emissions are given in Figure 4a through 4f.

Figure 4a
Antenna Conducted Spurious Emissions 15.247(d) Low Module #1

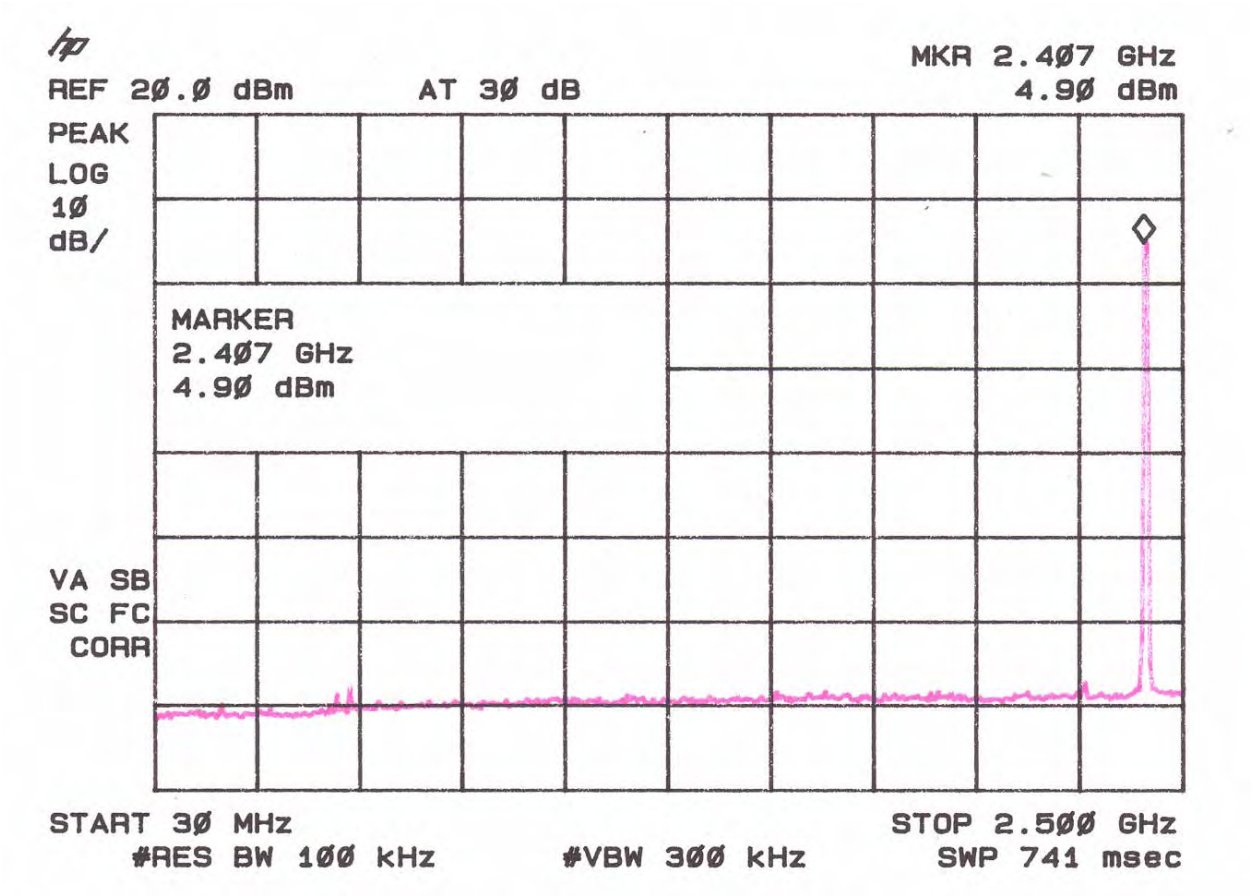


Figure 4b
Antenna Conducted Spurious Emissions 15.247(d) Low Module #1

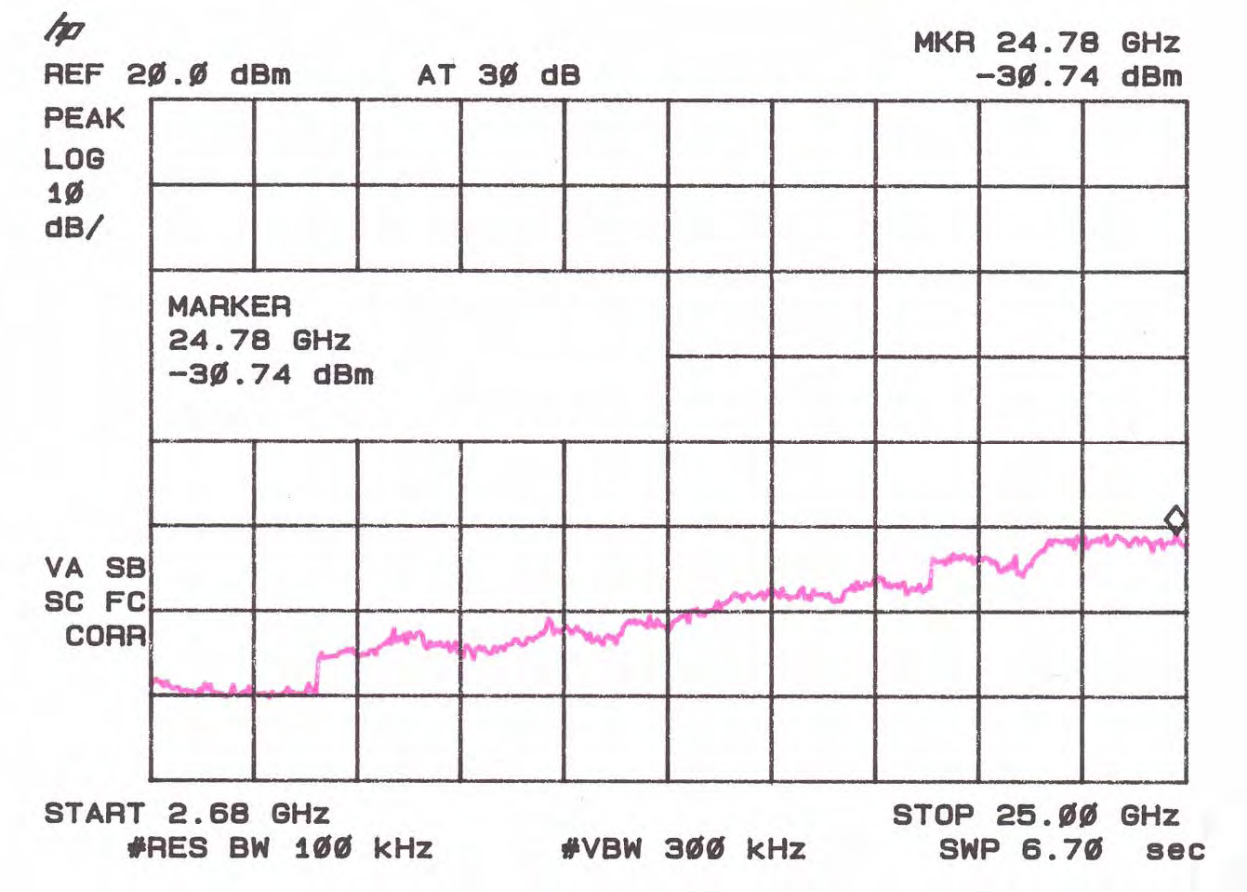


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Figure 4c
Antenna Conducted Spurious Emissions 15.247(d) Mid Module #1

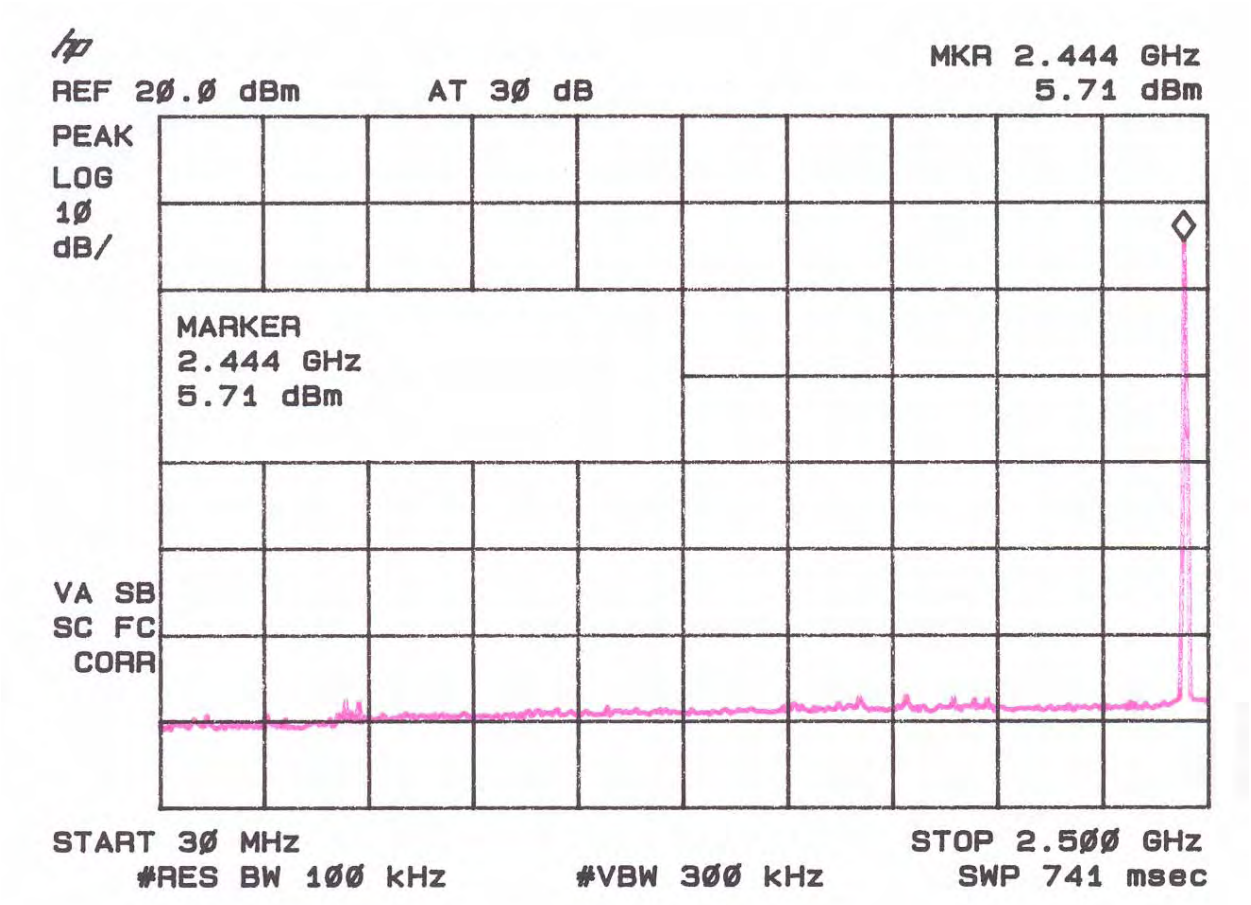
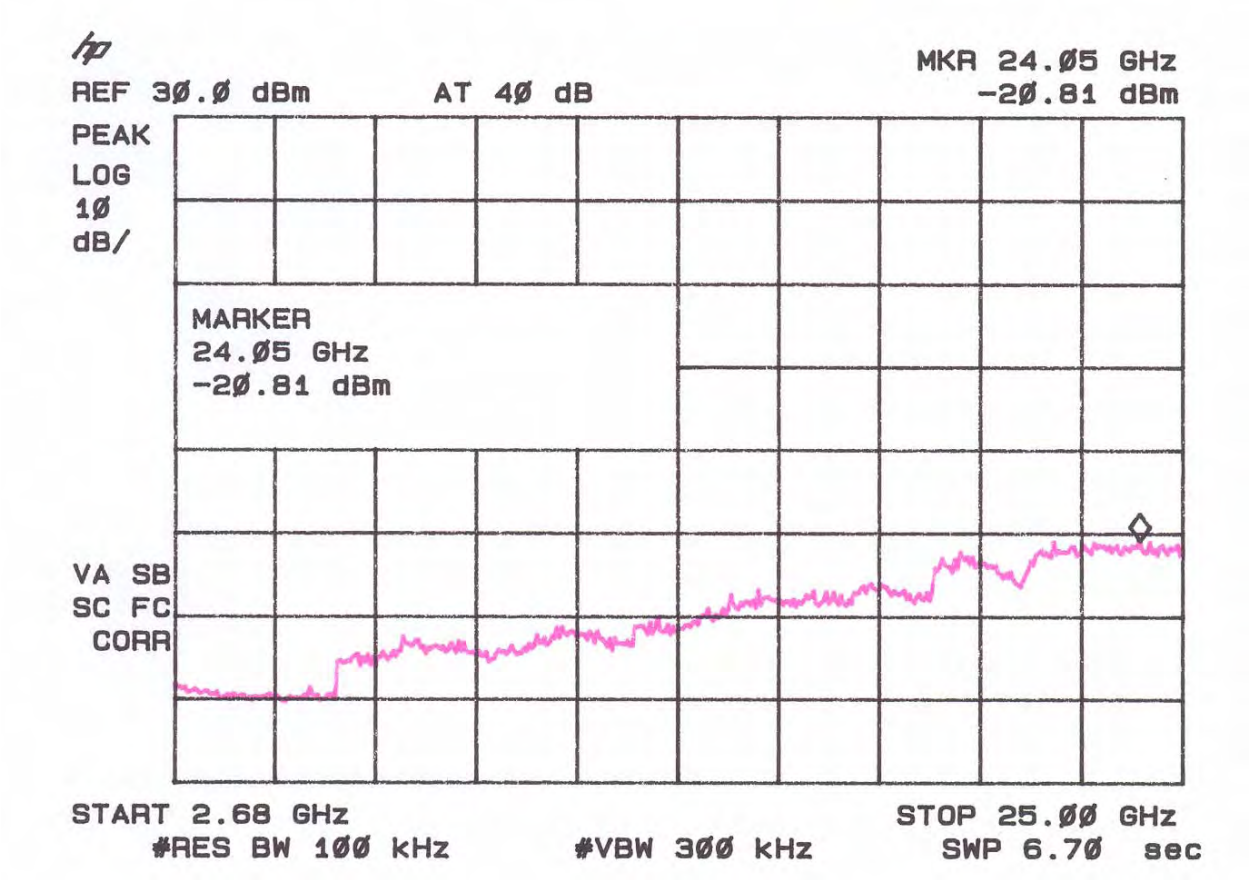


Figure 4d
Antenna Conducted Spurious Emissions 15.247(d) Mid Module #1



Note: Signal shown represents Fundamental Frequency.

Figure 4e
Antenna Conducted Spurious Emissions 15.247(d) High Module #1

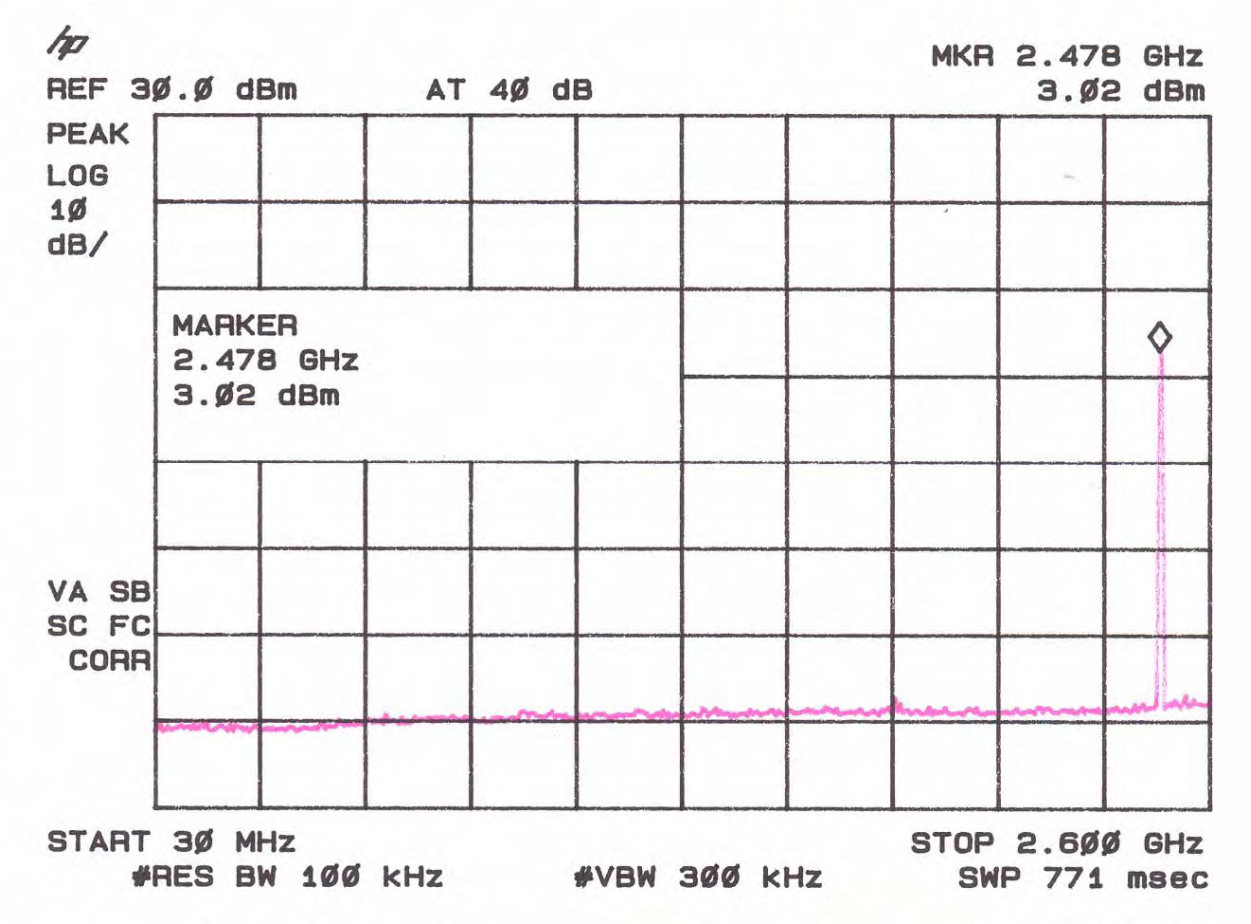
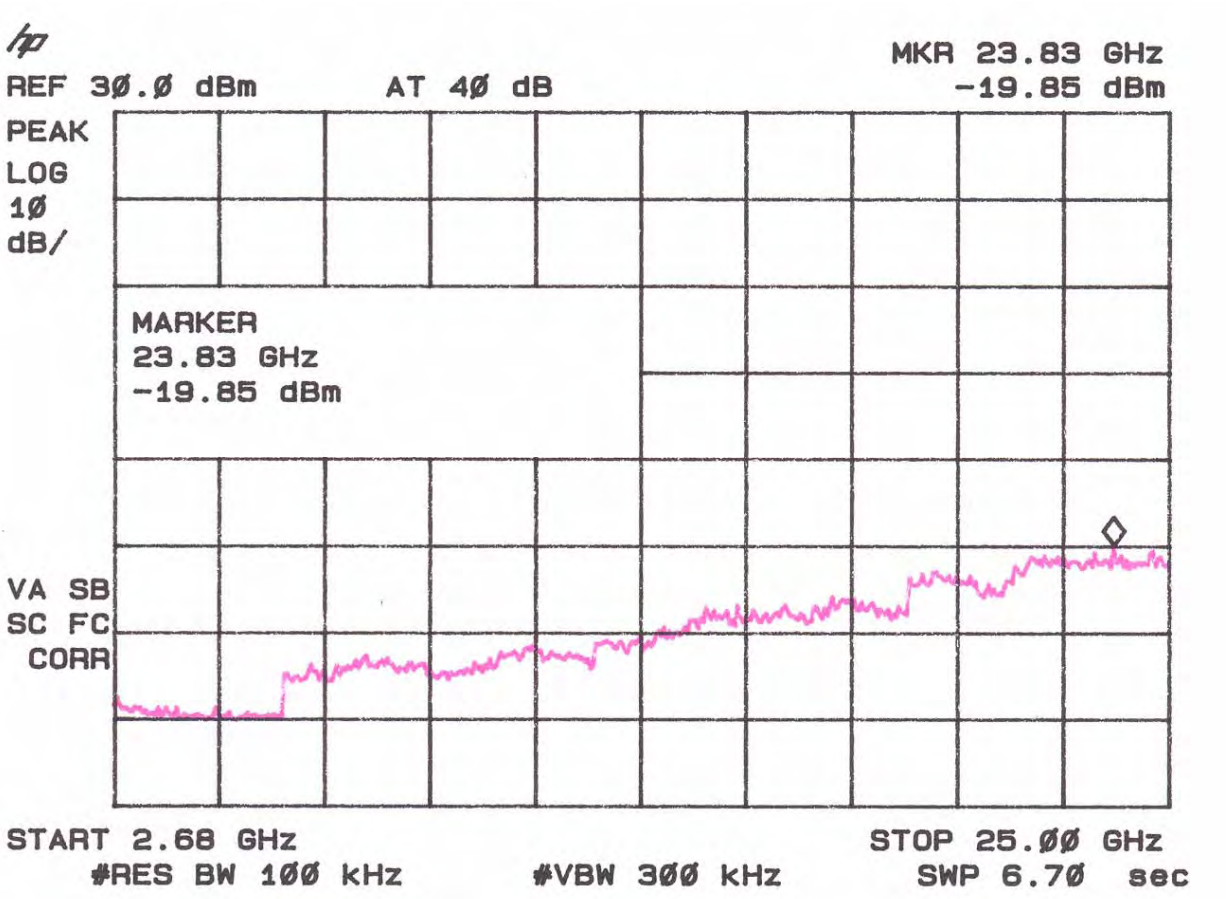


Figure 4f
Antenna Conducted Spurious Emissions 15.247(d) High Module #1



2.8 Peak Radiated Spurious Emission in the Frequency Range 30 -25000 MHz (FCC Section 15.209(c))

The EUT was hop-stopped and when possible, 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 –4f and Figure 5a – Figure 5f.

Worst Case Transmit Duty Cycle for ZMN2400HP

The duty cycle de-rating factor used in the calculation of average radiated limits (per 15.209) is described below. This factor was calculated by first determining the worst case scenario for system operation.

The worst case operating scenario is as follows:

Maximum transmit time/on equals 0.5ms over a 100 ms period.

The transmission duty cycle correction factor is then calculated as:

$$20 \log_{10} (0.5\text{ms}/100\text{ms}) = \mathbf{-46.02dB}$$

Table 4a1. PEAK RADIATED SPURIOUS EMISSIONS Corner Antenna Module #1

Radiated Emissions Spurious Emissions									
Test By: GR	**Test:** FCC Part 15 Corner Antenna Module #1					**Client:** Cirronet Corporation			
	Project: 07-0207			**Class:** B		**Model:** ZMN2400HP			
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**
Low									
2405.30	-20.8	1hn3mv	86.2	31.9	806254.4		3m./VERT		PK
4808.65	-60.5	1hn3mh	46.6	5.4	398.0	5000.0	3m./HORZ	**22.0**	PK
7213.01	-62.6**	1hn3mv	44.4	9.6	497.9	80625.4	3m./VERT	**44.2**	PK
9621.42	-60.6**	1hn3mv	46.4	13.1	940.1	80625.4	3m./VERT	**38.7**	PK
Mid									
2440.25	-22.7	1hn3mv	84.3	32.0	653060.3		3m./VERT		PK
4880.78	-64.0	1hn3mh	43.0	5.7	273.0	5000.0	3m./HORZ	**25.3**	PK
7320.81	-69.4**	1hn3mv	37.6	9.9	236.5	5000.0	3m./VERT	**26.5**	PK
9761.59	-62.3**	1hn3mh	44.7	13.5	814.3	65306.0	3m./HORZ	**38.1**	PK
High									
2474.33	-25.0	1hn3mv	82.0	32.0	503338.6		3m./VERT		PK
4950.83	-66.2	1hn3mh	40.8	5.9	217.6	5000.0	3m./HORZ	**27.2**	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 ((-60.5 + 5.4 + 107)/20) = 398.0
CONVERSION FROM dBm TO dBuV = 107 dB

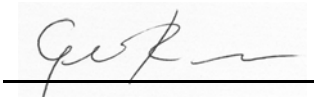
Tester Signature:  **Name: Gersop Riera**

Figure 5a - 1
Peak Radiated Spurious Emission 15.209(c) Fundamental Low Corner Antenna Module #1

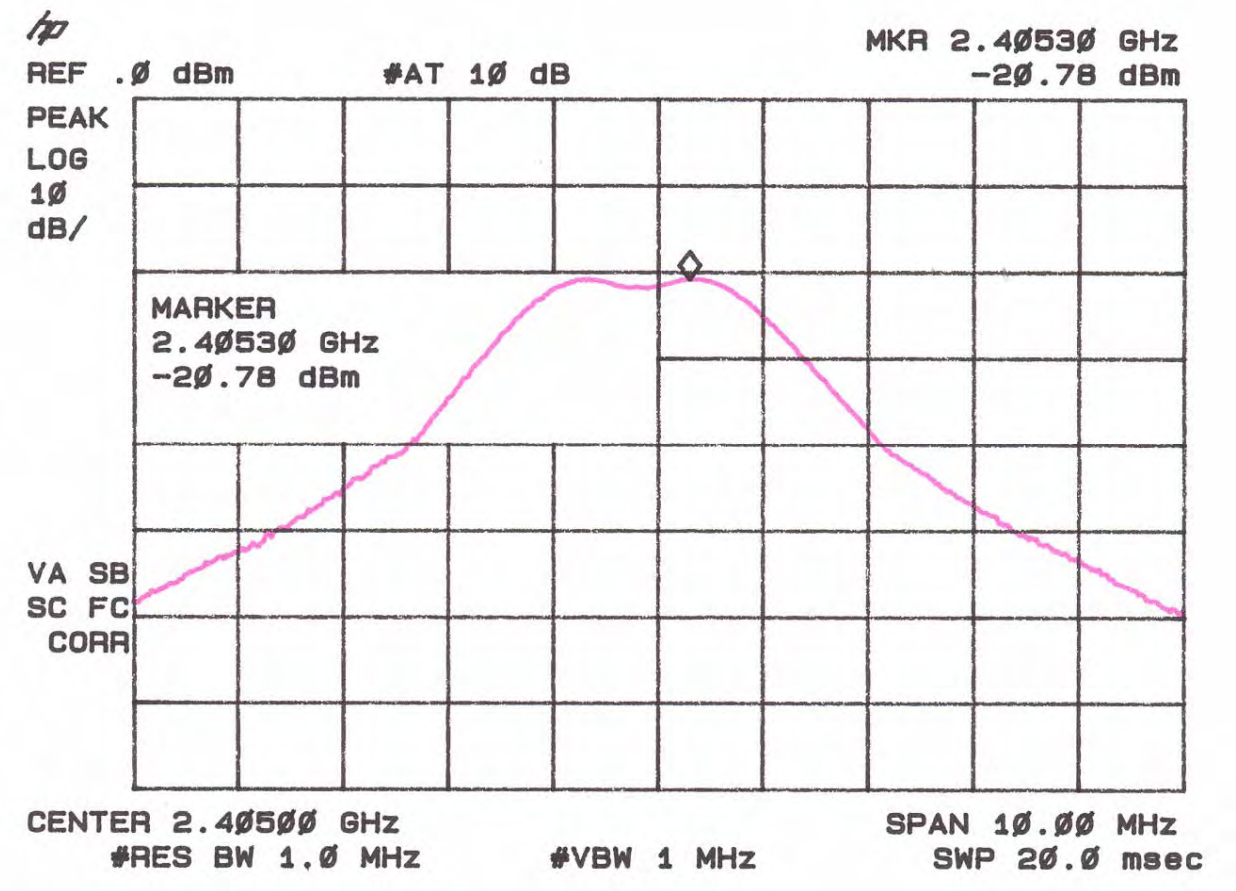


Figure 5a – 2
Peak Radiated Spurious Emission 15.209(c) Fundamental Mid Corner Antenna Module #1

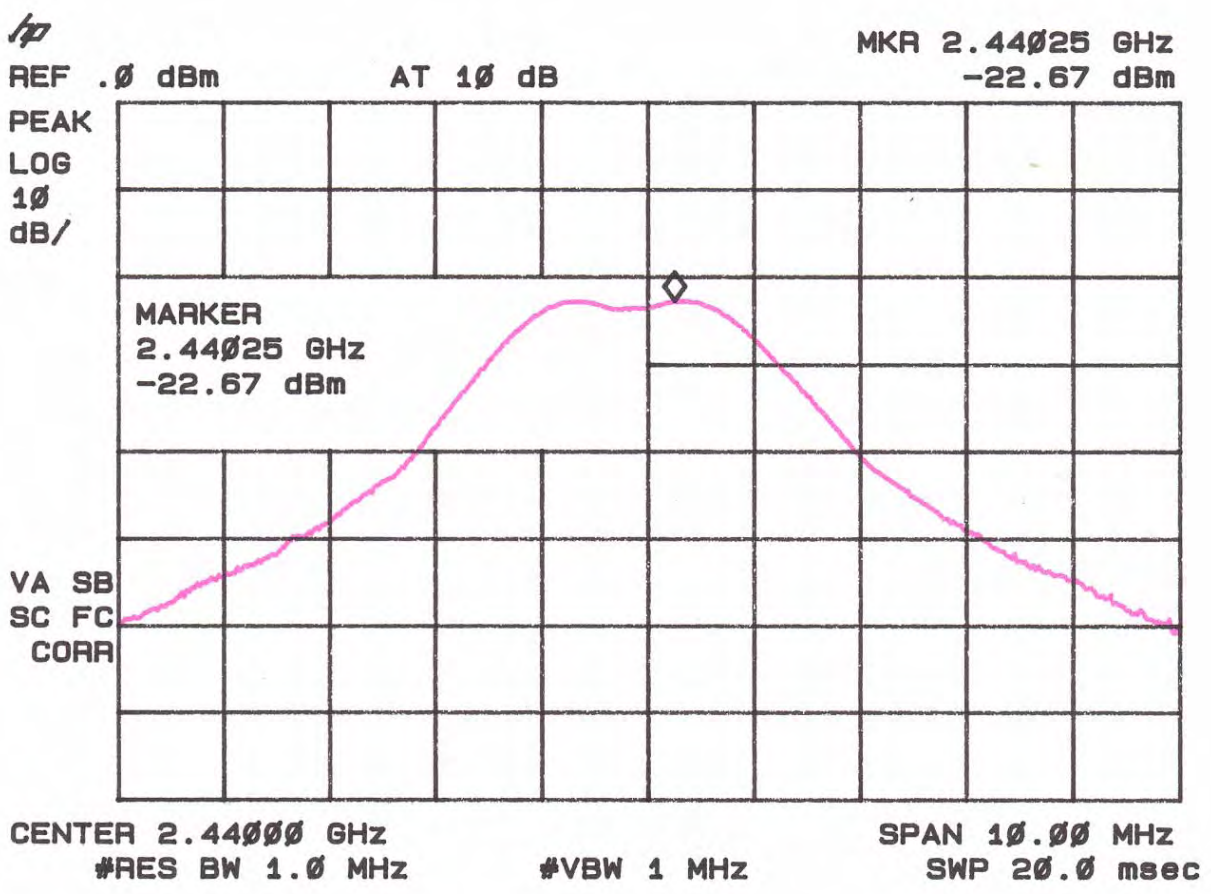


Figure 5a – 3
Peak Radiated Spurious Emission 15.209(c) Fundamental High Corner Antenna Module #1

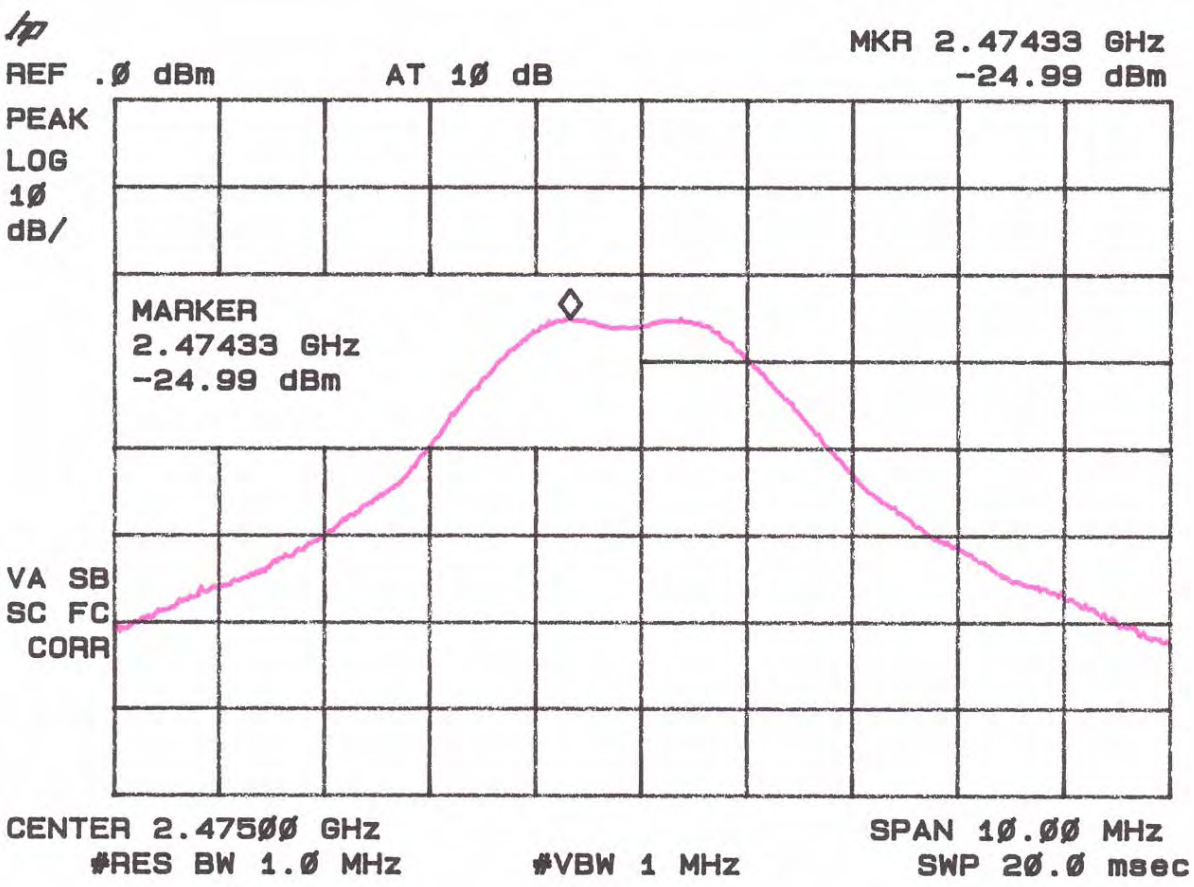


Figure 5a - 4
Peak Radiated Spurious Emission 15.209(c) Corner Antenna Module #1

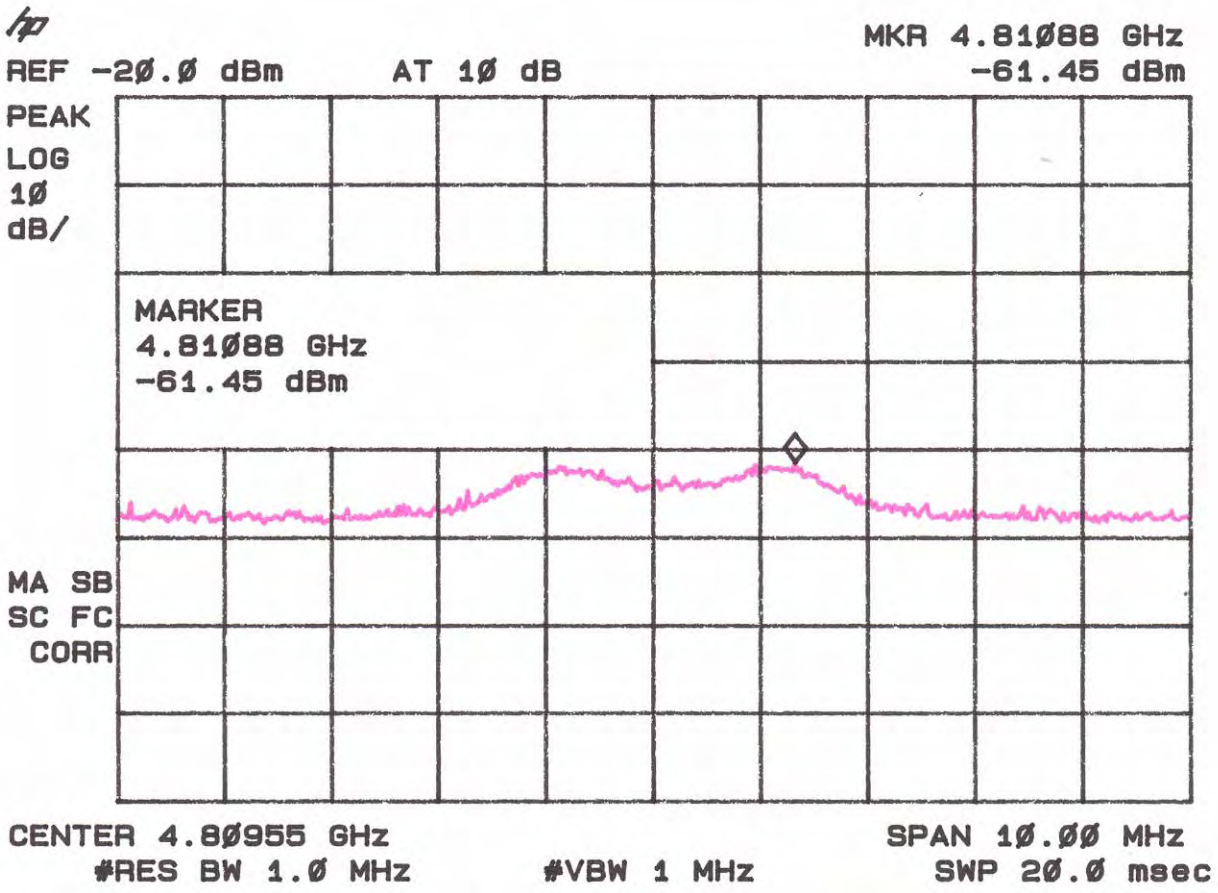


Table 5a. AVERAGE RADIATED SPURIOUS EMISSIONS Corner Antenna Module #1

Radiated Emissions Spurious Emissions									
Test By: GR	**Test:** FCC Part 15 Corner Antenna Module #1					**Client:** Cirronet Corporation			
	Project: 07-0207			**Class:** B		**Model:** ZMN2400HP			
Frequency	**Test Data**	**AF**	**Test Data**	**AF+CA-AMP**	**Results**	**Limits**	**Distance /**	**Margin**	**Average**
(MHz)	**(dBm)**	**Table**	**(dBuV)**	**(dB)**	**(uV/m)**	**(uV/m)**	**Polarity**	**(dB)**	
LOW									
2405.30	-66.8	1hn3mv	40.2	31.9	4031.6		3m./VERT		
4808.65	-106.5	1hn3mh	0.5	5.4	2.0	500.0	3m./HORZ	**48.0**	**AVG**
7213.01	-108.7**	1hn3mv	-1.7	9.6	2.5	403.2	3m./VERT	**44.2**	**AVG**
9621.42	-106.6**	1hn3mv	0.4	13.1	4.7	403.2	3m./VERT	**38.7**	**AVG**
MID									
2440.25	-68.7	1hn3mv	38.3	32.0	3265.5		3m./VERT		
4880.78	-110.0	1hn3mh	-3.0	5.7	1.4	500.0	3m./HORZ	**51.3**	**AVG**
7320.81	-115.4**	1hn3mv	-8.4	9.9	1.2	500.0	3m./VERT	**52.5**	**AVG**
9761.59	-108.3**	1hn3mh	-1.3	13.5	4.1	326.6	3m./HORZ	**38.1**	**AVG**
HIGH									
2474.33	-71.0	1hn3mv	36.0	32.0	2516.9		3m./VERT		
4950.83	-112.2	1hn3mh	-5.2	5.9	1.1	500.0	3m./HORZ	**53.2**	**AVG**

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 ((-106.5 + 5.4 + 107)/20) = 2.0
CONVERSION FROM dBm TO dBuV = 107 dB

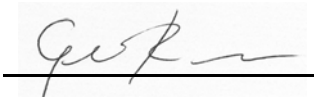
Tester Signature:  **Name: Gersop Riera**

Table 4b1. PEAK RADIATED SPURIOUS EMISSIONS Omni Antenna Module #1

Radiated Emissions Spurious Emissions

Test By:	Test:		Client:
GR	FCC Part 15 Omni Antenna Module #1		Cirronet Corporation
	Project: 07-0207	Class: B	Model: ZMN2400HP

Frequency (MHz)	Test Data (dBm)	AF Table	Test Data (dBuV)	AF+CA-AMP (dB)	Results (uV/m)	Limits (uV/m)	Distance / Polarity	Margin (dB)	PK = n / QP
Low									
2405.35	-25.2	1HN3mv	81.8	31.9	486941.0		3m./VERT		2405.35
4808.79	-61.3	1HN3mv	45.7	5.2	352.7	5000.0	3m./VERT	**23.0**	4808.79
7213.1	-67.6**	1HN3mv	39.4	9.6	281.0	48694.1	3m./VERT	**44.8**	7213.1
Mid									
2440.35	-25.1	1HN3mv	82.0	32.0	496548.6		3m./VERT		2440.35
4880.16	-74.1	1HN3mv	32.9	5.5	82.6	5000.0	3m./VERT	**35.6**	4880.16
High									
2474.38	-27.2	1HN3mv	79.8	32.0	392070.8		3m./VERT		2474.38
4950.26	-74.5	1HN3mv	32.5	5.7	81.2	5000.0	3m./VERT	**35.8**	4950.26

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 ((-61.3 + 5.2 + 107)/20) = 352.7
CONVERSION FROM dBm TO dBuV = 107 dB

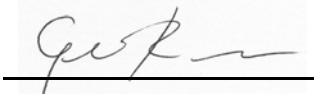
Tester Signature:  **Name: Gersop Riera**

Figure 5b - 1
Peak Radiated Spurious Emission 15.209(c) Fundamental Low Omni Antenna
Module #1

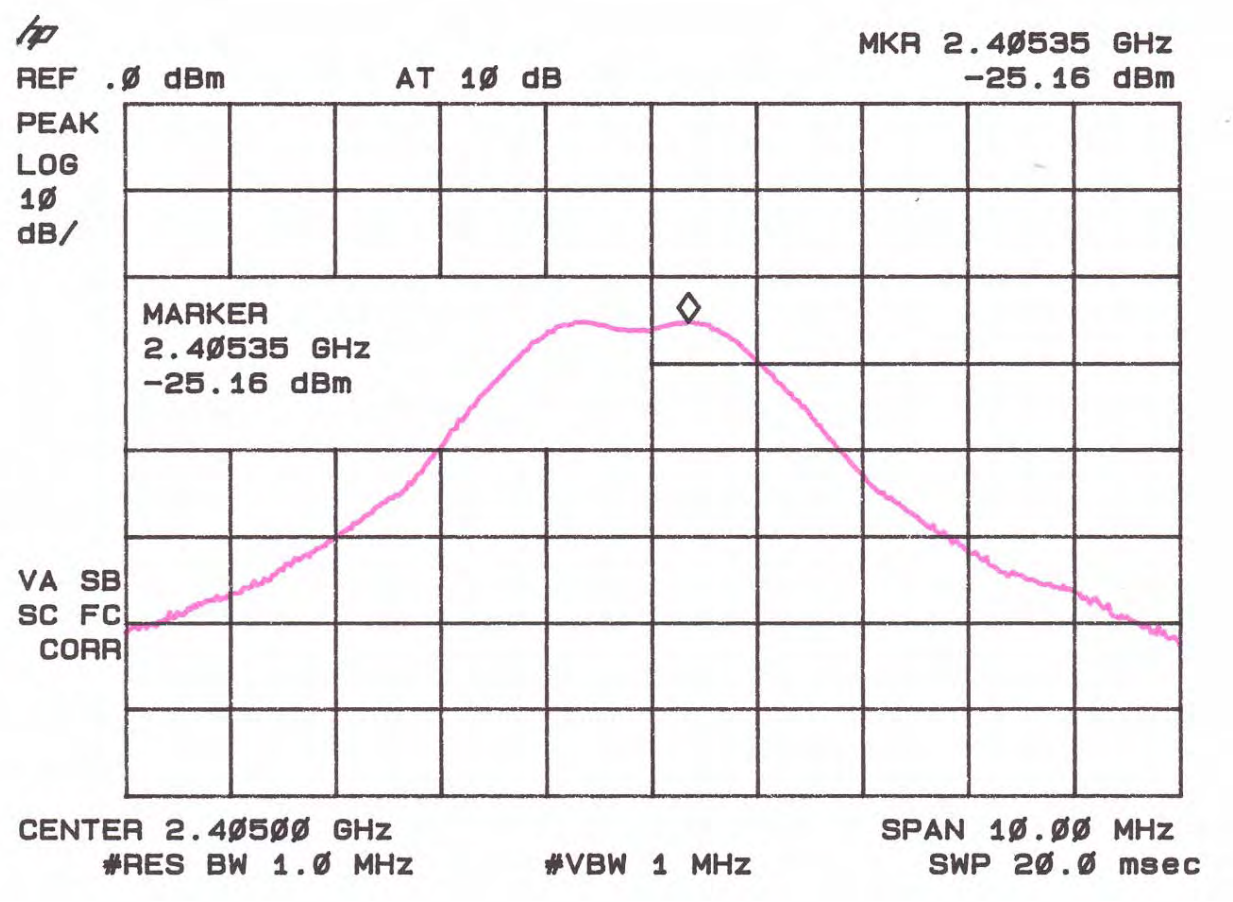


Figure 5b – 2
Peak Radiated Spurious Emission 15.209(c) Fundamental Mid Omni
Antenna Module #1

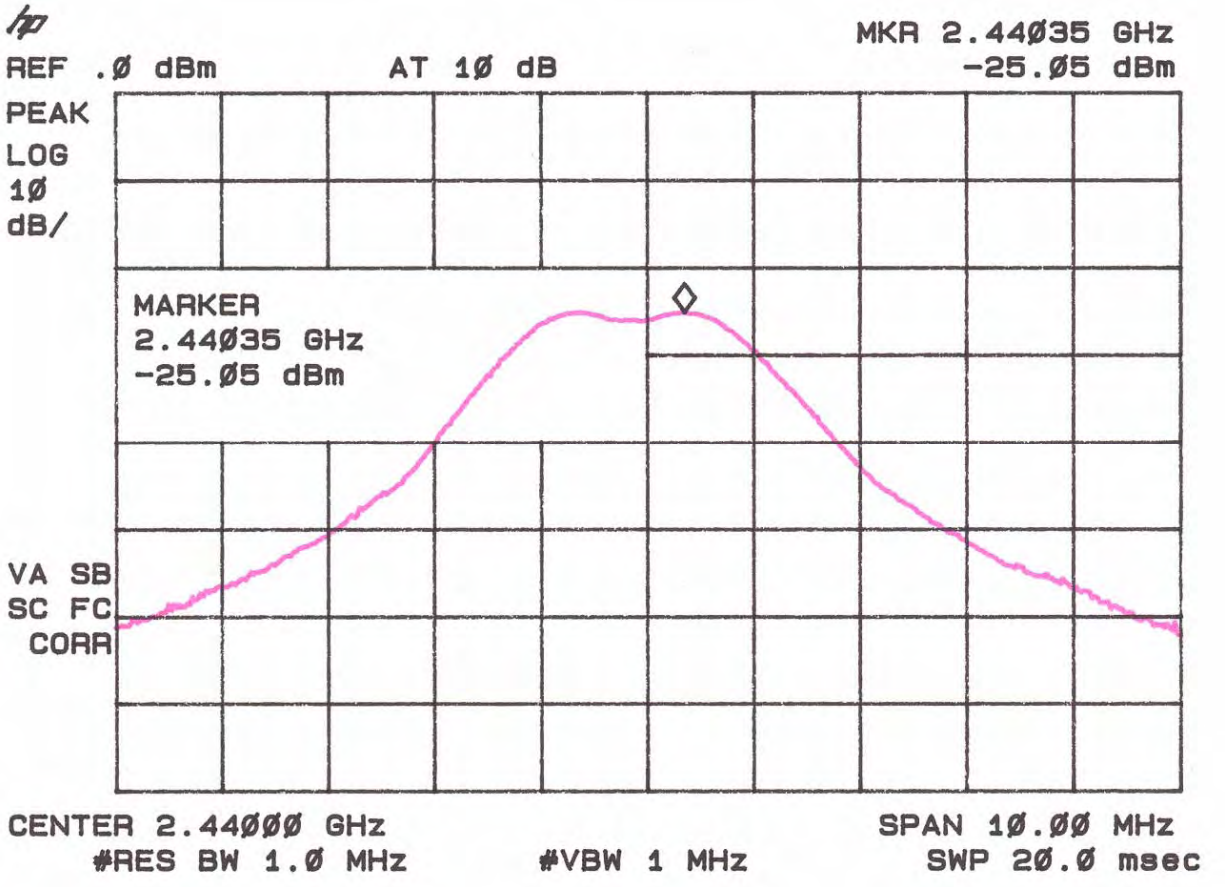


Figure 5b – 3
Peak Radiated Spurious Emission 15.209(c) Fundamental High Omni Antenna Module #1

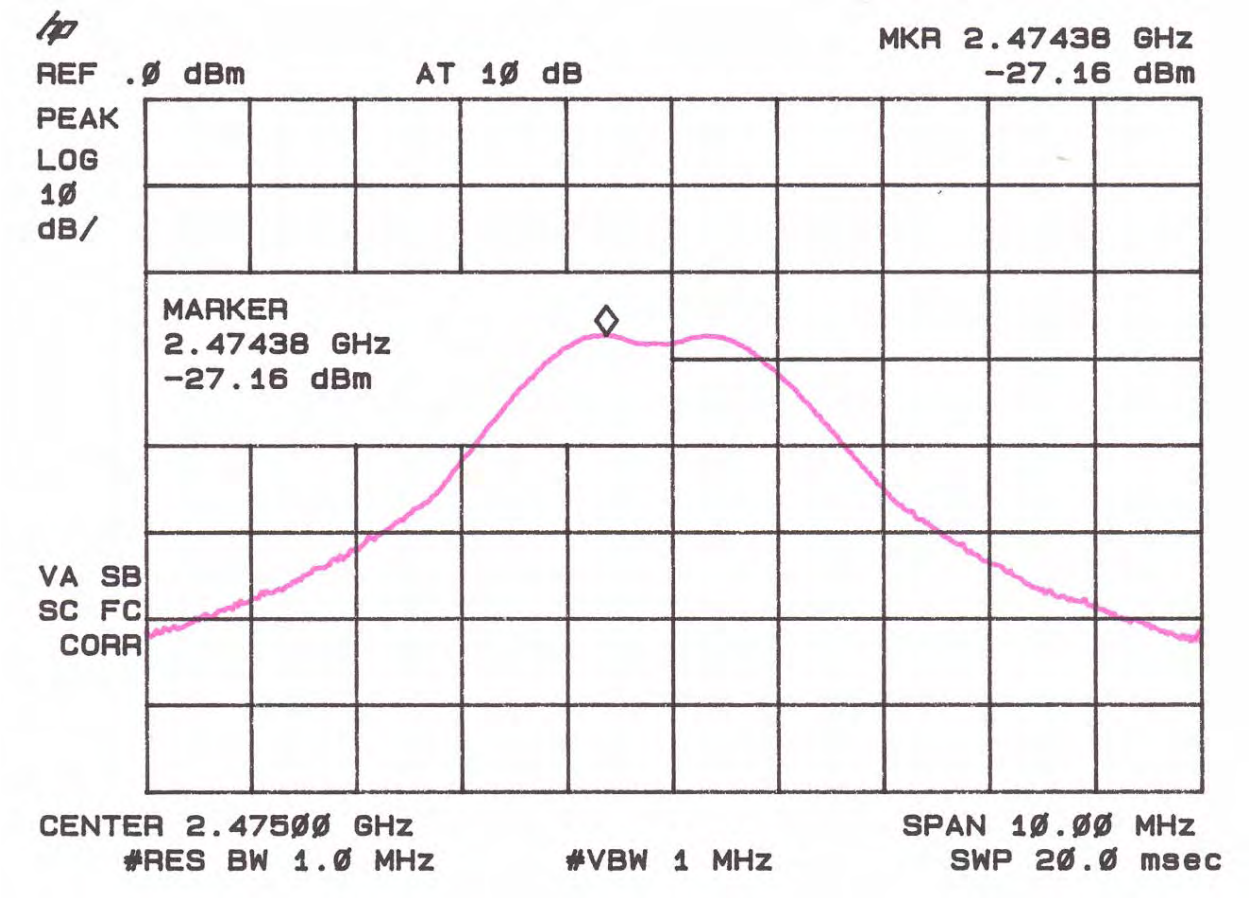


Figure 5b - 4
Peak Radiated Spurious Emission 15.209(c) Omni Antenna Module #1

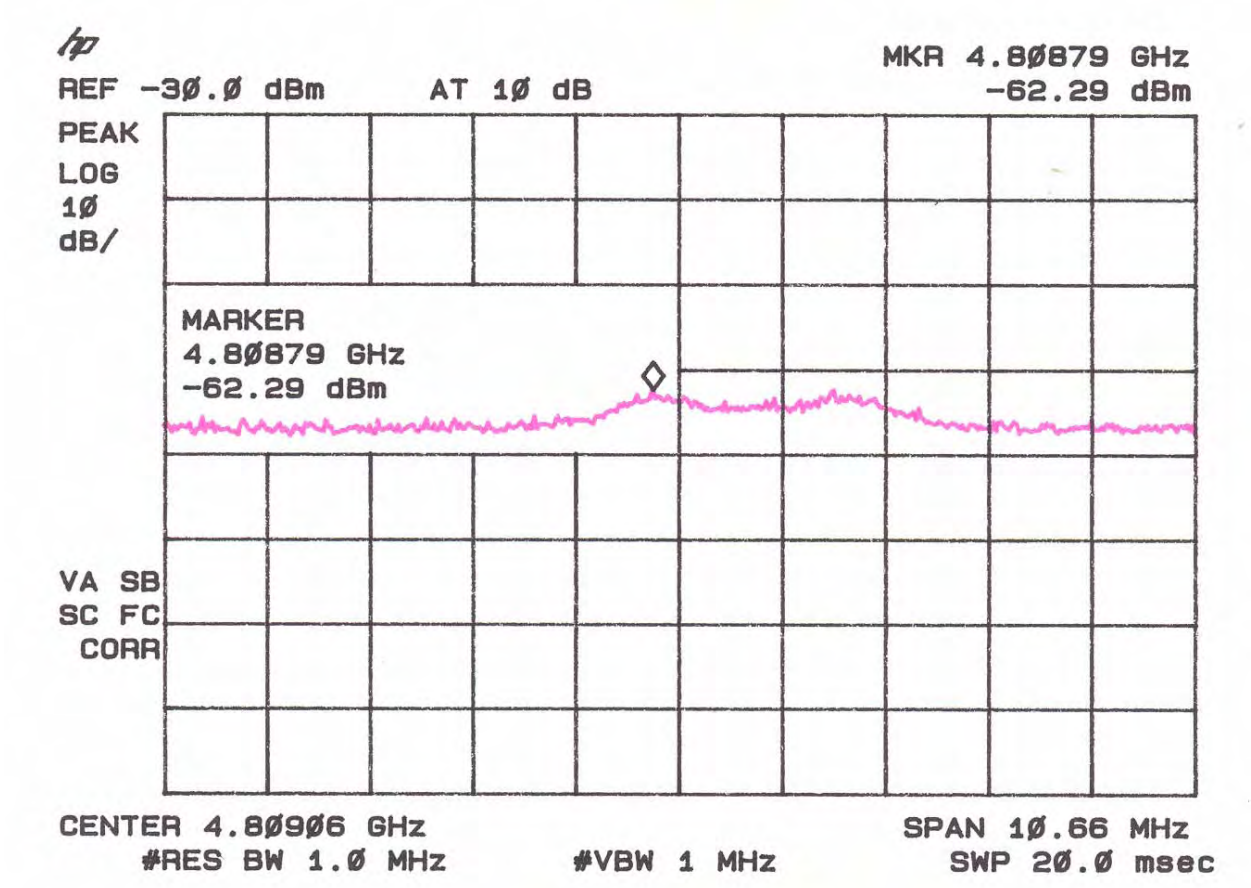


Table 5b. AVERAGE RADIATED SPURIOUS EMISSIONS Omni Antenna Module #1

Radiated Emissions Spurious Emissions									
Test By: GR	**Test:** FCC Part 15 Omni Antenna Module #1					**Client:** Cirronet Corporation			
	Project: 07-0207			**Class:** B		**Model:** ZMN2400HP			
Frequency	**Test Data**	**AF**	**Test Data**	**AF+CA-AMP**	**Results**	**Limits**	**Distance /**	**Margin**	**Average**
(MHz)	**(dBm)**	**Table**	**(dBuV)**	**(dB)**	**(uV/m)**	**(uV/m)**	**Polarity**	**(dB)**	
LOW									
2405.35	-71.2	1HN3mv	35.8	31.9	2434.9		3m./VERT		**AVG**
4808.79	-107.3	1HN3mv	-0.3	5.2	1.8	500.0	3m./VERT	**49.1**	**AVG**
7213.1	-113.6**	1HN3mv	-6.6	9.6	1.4	243.5	3m./VERT	**44.8**	**AVG**
MID									
2440.35	-71.1	1HN3mv	35.9	32.0	2482.9		3m./VERT		**AVG**
4880.16	-120.2	1HN3mv	-13.2	5.5	0.4	500.0	3m./VERT	**61.7**	**AVG**
HIGH									
2474.38	-73.2	1HN3mv	33.8	32.0	1960.5		3m./VERT		**AVG**
4950.26	-120.5	1HN3mv	-13.5	5.7	0.4	500.0	3m./VERT	**61.8**	**AVG**

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 ((-107.3 + 5.2 + 107)/20) = 1.8
CONVERSION FROM dBm TO dBuV = 107 dB

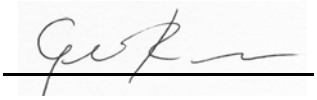
Tester Signature:  **Name: Gersop Riera**

Table 4c1. PEAK RADIATED SPURIOUS EMISSIONS Patch Antenna Module #1

Radiated Emissions Spurious Emissions

Test By:	Test:		Client:
GR	FCC Part 15 Patch Antenna Module #1		Cirronet Corporation
	Project: 07-0207	Class: B	Model: ZMN2400HP

Frequency (MHz)	Test Data (dBm)	AF Table	Test Data (dBuV)	AF+CA-AMP (dB)	Results (uV/m)	Limits (uV/m)	Distance / Polarity	Margin (dB)	PK = n / QP
Low									
2404.40	-25.2	1hn3mv	81.8	31.9	482942.3		3m./VERT		2404.40
4808.85	-57.2	1hn3mv	49.8	5.2	564.1	5000.0	3m./VERT	**19.0**	4808.85
7213.1	-62.8**	1hn1mv	44.2	10.5	547.7	48294.2	1m./VERT	**38.9**	7213.1
9617.35	-61.7**	1hn1mv	45.3	13.6	874.0	48294.2	1m./VERT	**34.8**	9617.35
Mid									
2440.4	-25.5	1hn3mv	81.5	32.0	471483.0		3m./VERT		2440.4
4880.7	-68.7	1hn1mh	38.3	6.5	172.5	5000.0	1m./HORZ	**29.2**	4880.7
7321.05	-67.5**	1hn1mv	39.5	10.8	327.5	5000.0	1m./VERT	**23.7**	7321.05
9761.9	-68.9**	1hn1mv	38.1	13.8	391.2	47148.3	1m./VERT	**41.6**	9761.9
High									
2475.45	-25.9	1hn3mv	81.1	32.0	452851.6		3m./VERT		2475.45
4950.55	-70.6	1hn1mv	36.4	6.6	141.9	5000.0	1m./VERT	**30.9**	4950.55
7423.35	-68.8**	1hn1mv	38.2	11.1	291.4	5000.0	1m./VERT	**24.7**	7423.35

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 ((-57.2 + 5.2 + 107)/20) = 564.1
CONVERSION FROM dBm TO dBuV = 107 dB

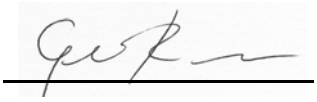
Tester Signature:  **Name: Gersop Riera**

Figure 5c - 1
Peak Radiated Spurious Emission 15.209(c) Fundamental Low Patch Antenna Module #1

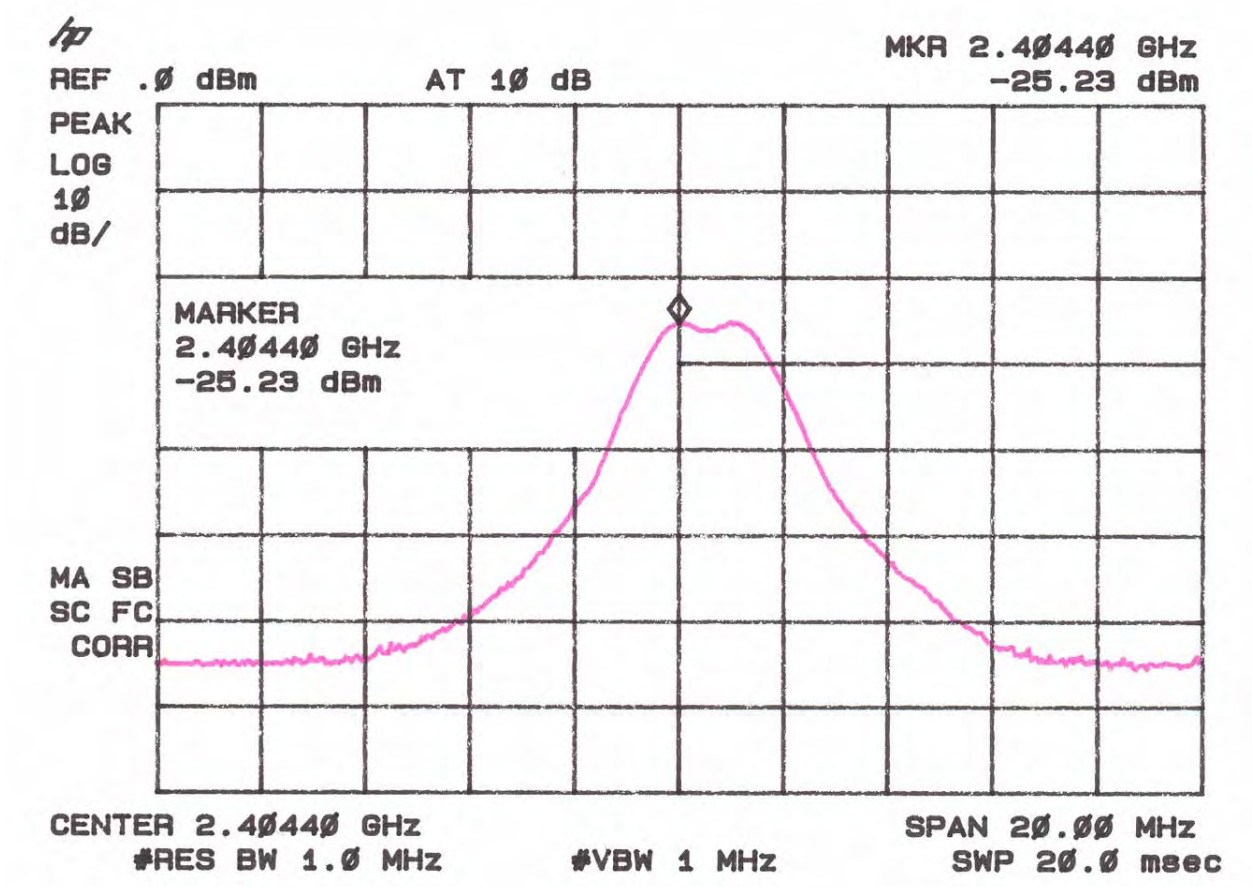


Figure 5c – 2
Peak Radiated Spurious Emission 15.209(c) Fundamental Mid Patch
Antenna Module #1

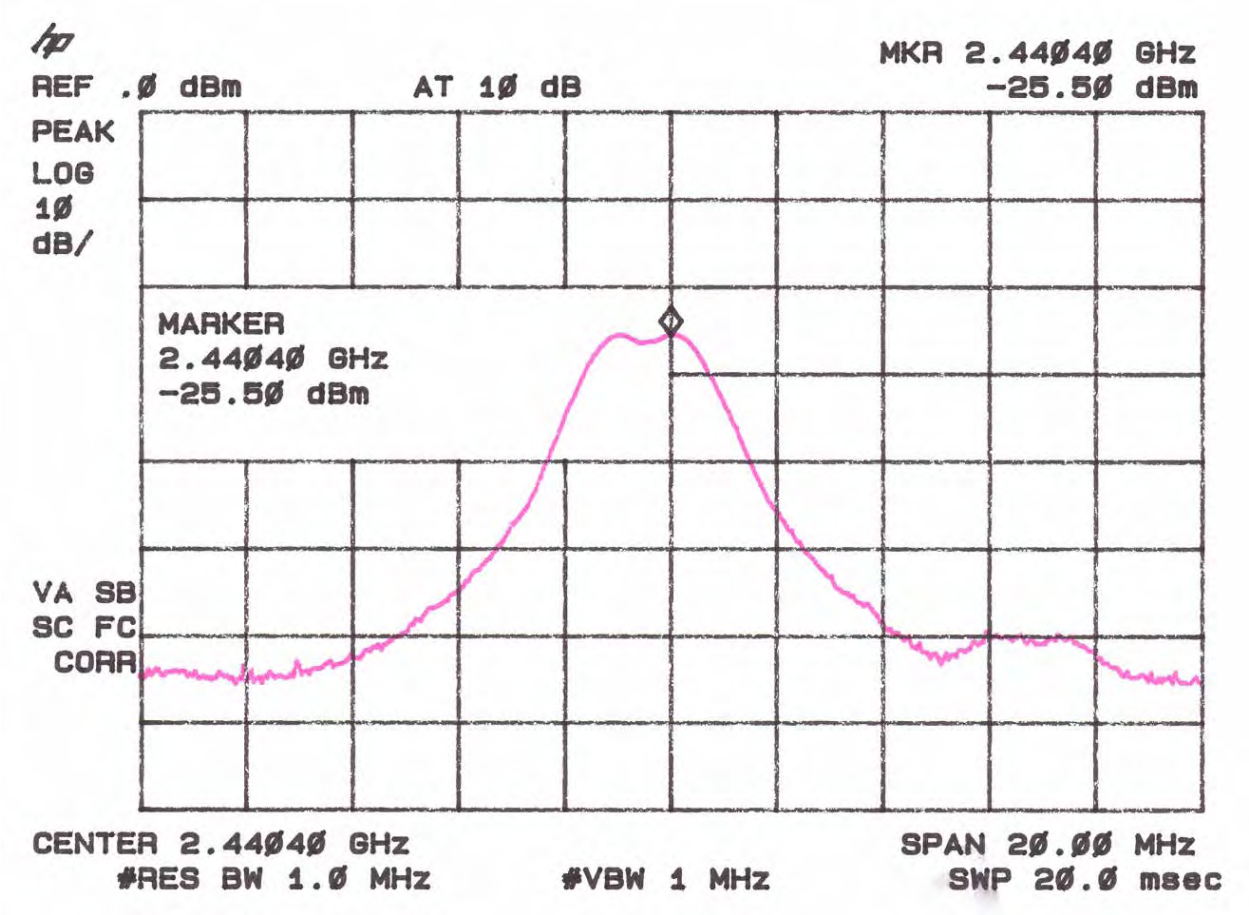


Figure 5c – 3
Peak Radiated Spurious Emission 15.209(c) Fundamental High Patch Antenna Module #1

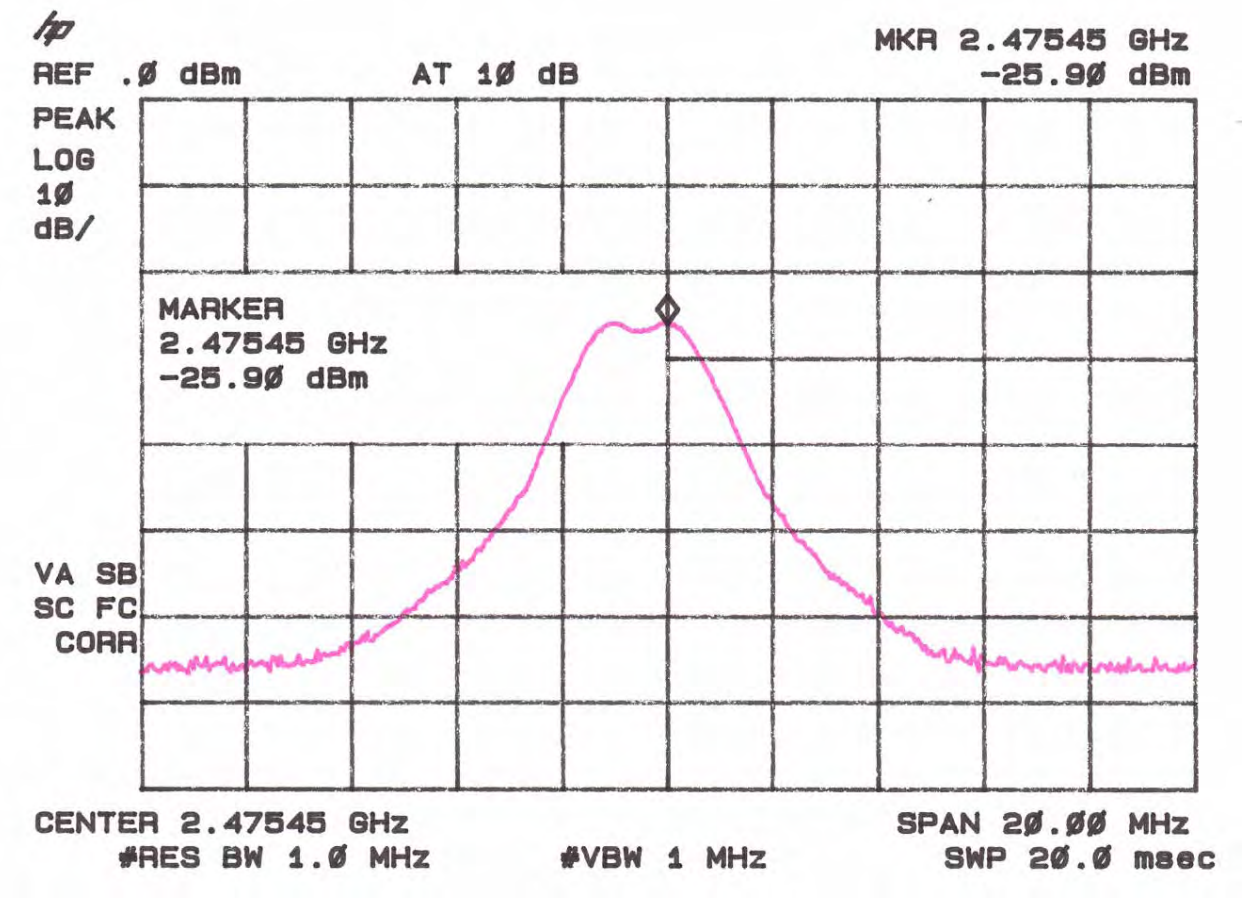


Figure 5c - 4
Peak Radiated Spurious Emission 15.209(c) Patch Antenna Module #1

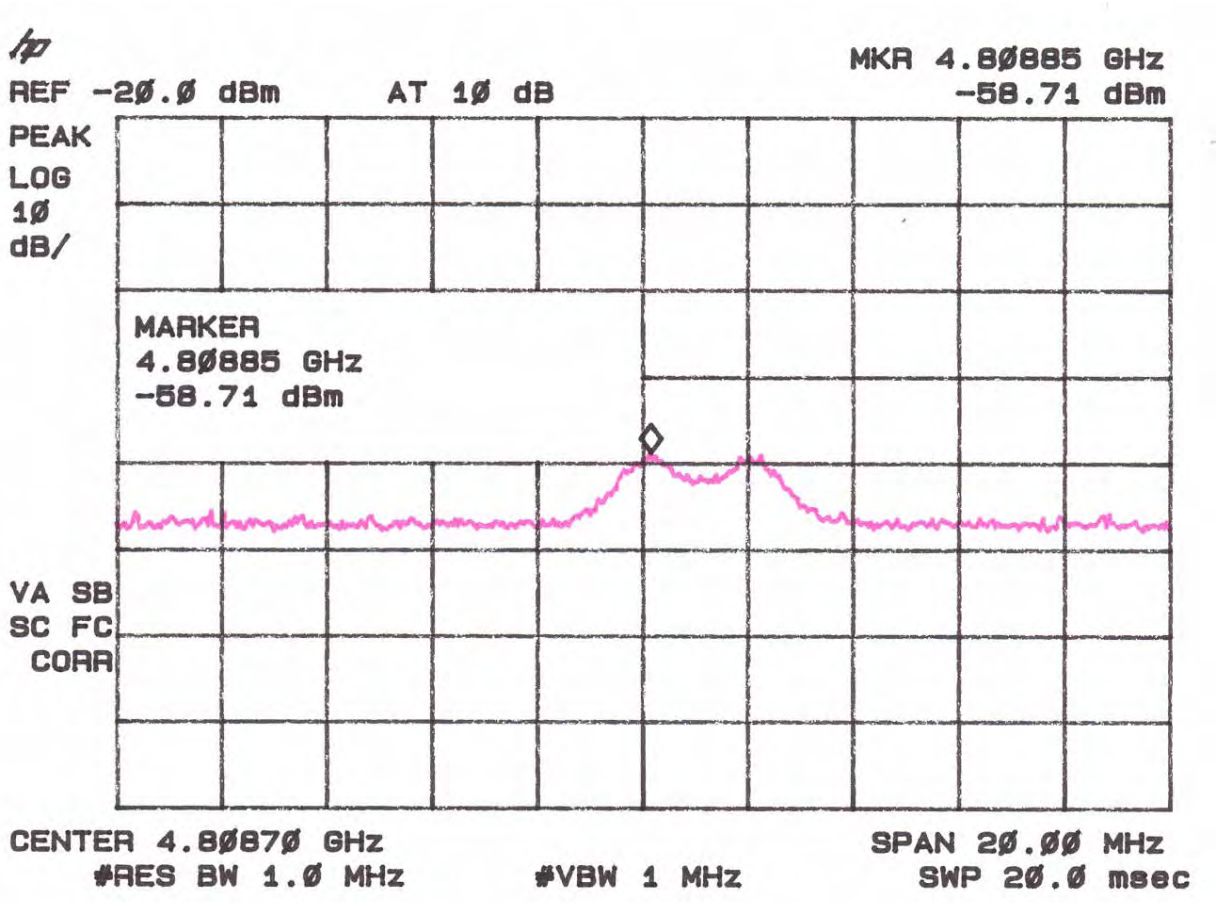


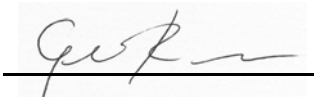
Table 5c. AVERAGE RADIATED SPURIOUS EMISSIONS Patch Antenna Module #1

Radiated Emissions Spurious Emissions									
Test By: GR	**Test:** FCC Part 15 Patch Antenna Module #1					**Client:** Cirronet Corporation			
	Project: 07-0207			**Class:** B		**Model:** ZMN2400HP			
Frequency	**Test Data**	**AF**	**Test Data**	**AF+CA-AMP**	**Results**	**Limits**	**Distance /**	**Margin**	**Average**
(MHz)	**(dBm)**	**Table**	**(dBuV)**	**(dB)**	**(uV/m)**	**(uV/m)**	**Polarity**	**(dB)**	
LOW									
2404.40	-71.3	1hn3mv	35.8	31.9	2414.9		3m./VERT		**AVG**
4808.85	-103.2	1hn3mv	3.8	5.2	2.8	500.0	3m./VERT	**45.0**	**AVG**
7213.1	-108.8**	1hn1mv	-1.8	10.5	2.7	241.5	1m./VERT	**38.9**	**AVG**
9617.35	-107.8**	1hn1mv	-0.8	13.6	4.4	241.5	1m./VERT	**34.8**	**AVG**
MID									
2440.4	-71.5	1hn3mv	35.5	32.0	2357.6		3m./VERT		**AVG**
4880.7	-114.7	1hn1mh	-7.7	6.5	0.9	500.0	1m./HORZ	**55.3**	**AVG**
7321.05	-113.5**	1hn1mv	-6.5	10.8	1.6	500.0	1m./VERT	**49.7**	**AVG**
9761.9	-114.9**	1hn1mv	-7.9	13.8	2.0	235.8	1m./VERT	**41.6**	**AVG**
HIGH									
2475.45	-71.9	1hn3mv	35.1	32.0	2264.4		3m./VERT		**AVG**
4950.55	-116.6	1hn1mv	-9.6	6.6	0.7	500.0	1m./VERT	**57.0**	**AVG**
7423.35	-114.8**	1hn1mv	-7.8	11.1	1.5	500.0	1m./VERT	**50.7**	**AVG**

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 ((-103.2 + 5.2 + 107)/20) = 2.8
CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature:  **Name: Gersop Riera**

2.10 Band Edge Measurements

Band Edge measurements were made at a Low Channel and High Channel peak at highest EUT related emission outside the occupied bandwidth. A peak measurement was made of the fundamental, and the emission was measured using a peak setting. A Resolution Bandwidth of > 1% of the emission bandwidth was used. This procedure was repeated for the high channel.

The plots shown were verified using Horn Antenna. No preamp was used.

The limits were derived as follows:

High Bandedge:

5000 uV/m = -32.02 dBm

Limit = -33.02 dBm – 32.0 dB (antenna factor and cable loss) = -62.02 dBm

Maximum level of Fundamental measured at High Channel from Table 4a1: -25 dBm

Delta from conducted measurement of band edge from fundamental peak to highest spur 10 MHz outside band edge: 54.27

-25 dBm – 54.27 dBm= -79.2 dBm < limit = -62.02 dBm

Low Bandedge:

Limit = -33.02 dBm – 31.9 dB (antenna factor and cable loss) = -64.92 dBm

Maximum level of Fundamental measured at Low Channel from Table 4a1: -20.8 dBm

Delta from conducted measurement of band edge from fundamental peak to highest spur 10 MHz outside band edge: 55.69

-20.8 dBm – 55.69 dBm = -76.49 dBm < limit = -64.92 dBm

* -9.54 dB correction from 3m to 1m distance.

Figure 6a. Band Edge Compliance
Antenna Conducted, High Channel

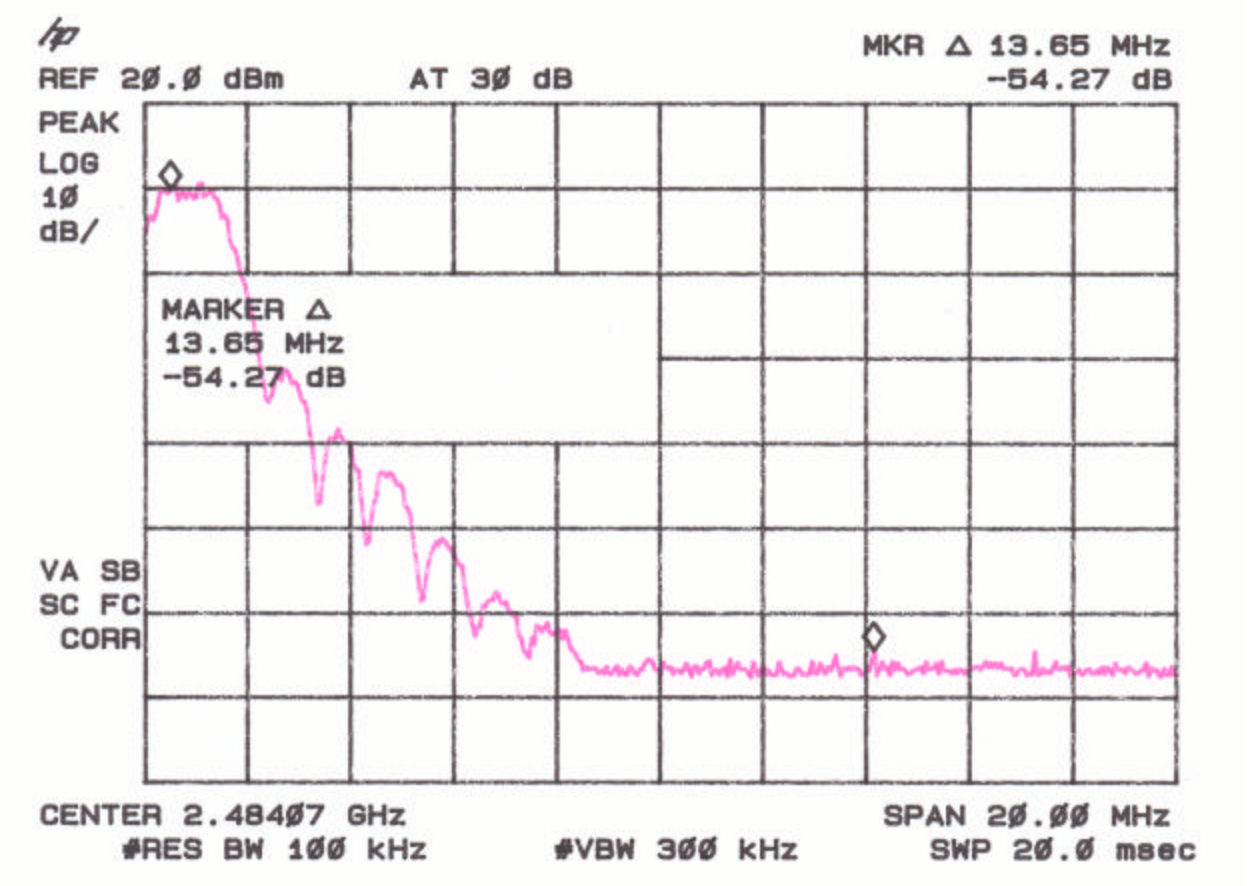
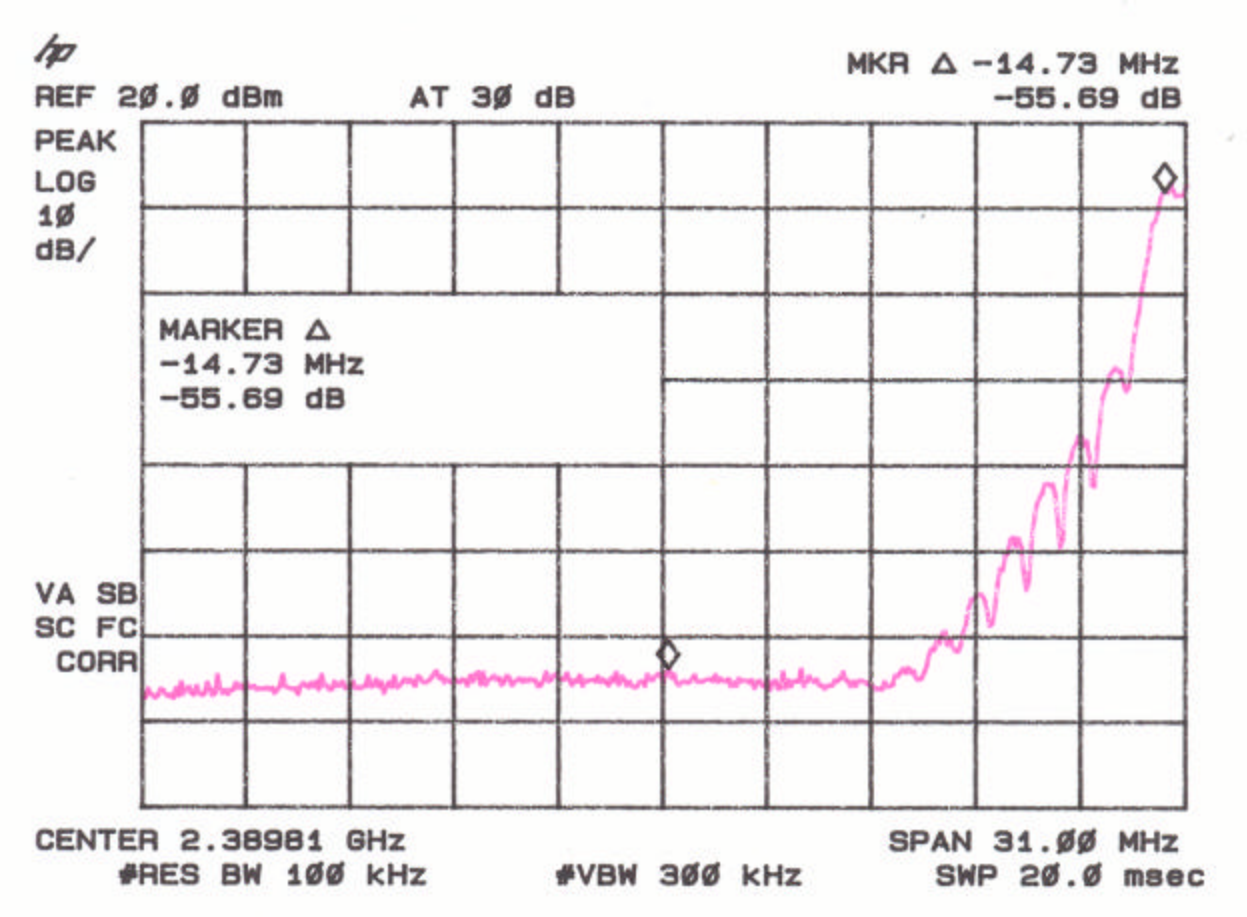


Figure 6b. Band Edge Compliance
Antenna Conducted, Low Channel



2.11 6 dB Bandwidth per FCC Section 15.247(a (2))

The antenna port was connected to a spectrum analyzer that was set for a 50 Ω impedance with the RBW = approximately 1/100 of the manufacturers claimed RBW & VBW > RBW. The results of this test are given in Table 6 and Figure 7.

TABLE 6
6 dB Bandwidth

Test Date: **July 20, 2007**
UST Project: **07-0207**
Customer: **Cirronet Corporation**
Model: **ZMN2400HP**

Frequency (GHz)	6 dB Bandwidth (MHz)	MINIMUM FCC LIMIT (MHz)
2.405138	1.59	0.5
2.440138	1.58	0.5
2.475133	1.60	0.5

.

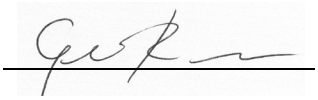
Tester Signature:  **Name:** **Gersop Riera**

Figure 7a.
6 dB Bandwidth per FCC Section 15.247(a)(2) Low

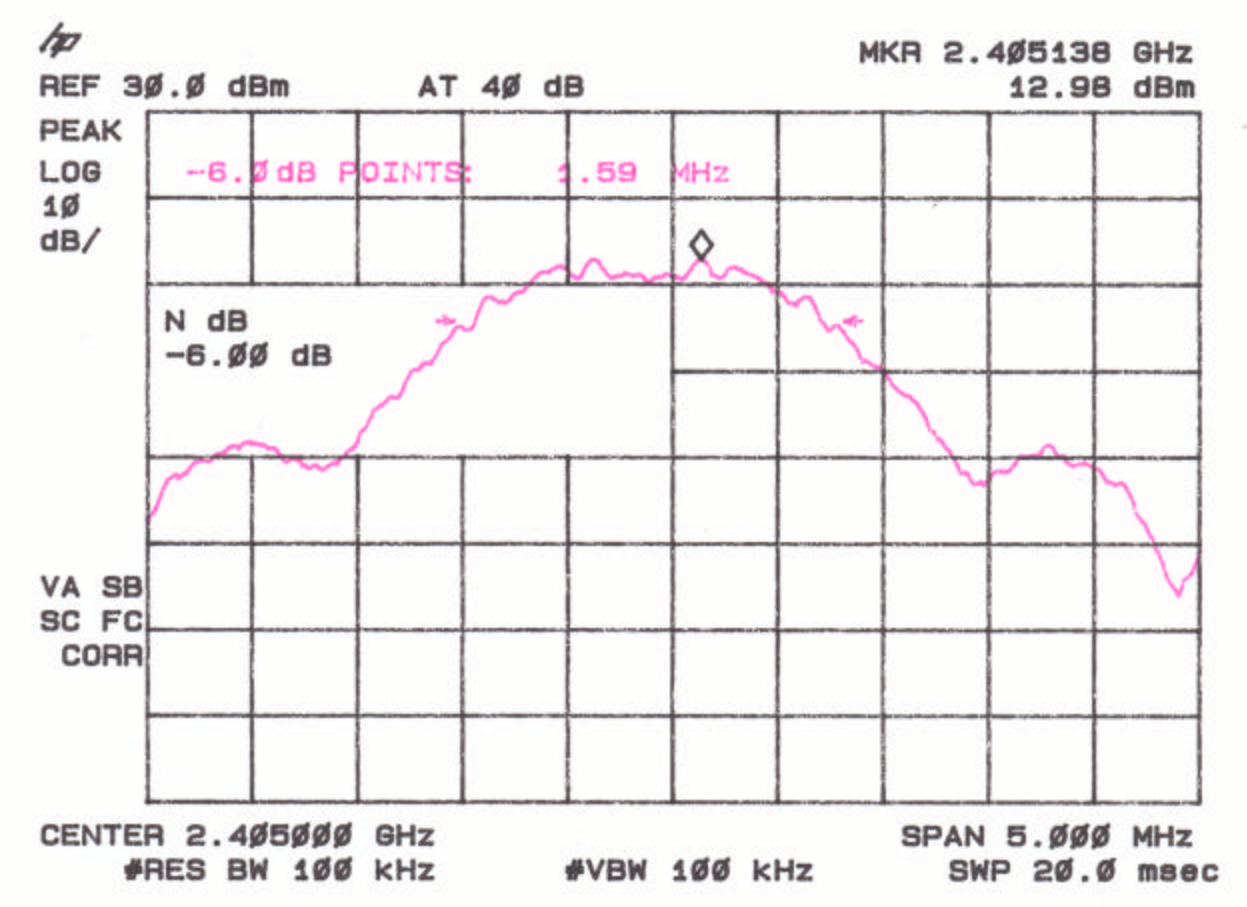


Figure 7b.
6 dB Bandwidth per FCC Section 15.247(a)(2) Mid

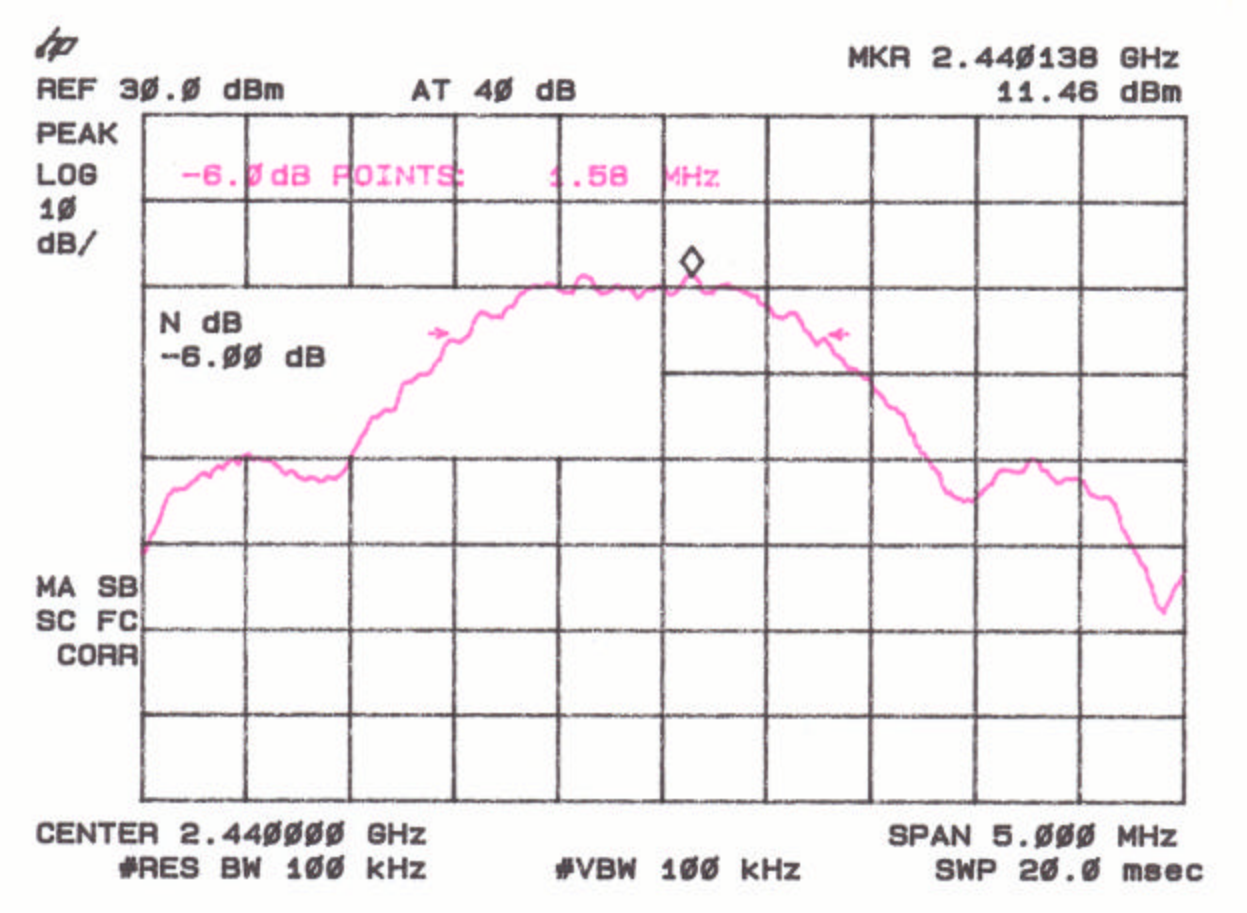
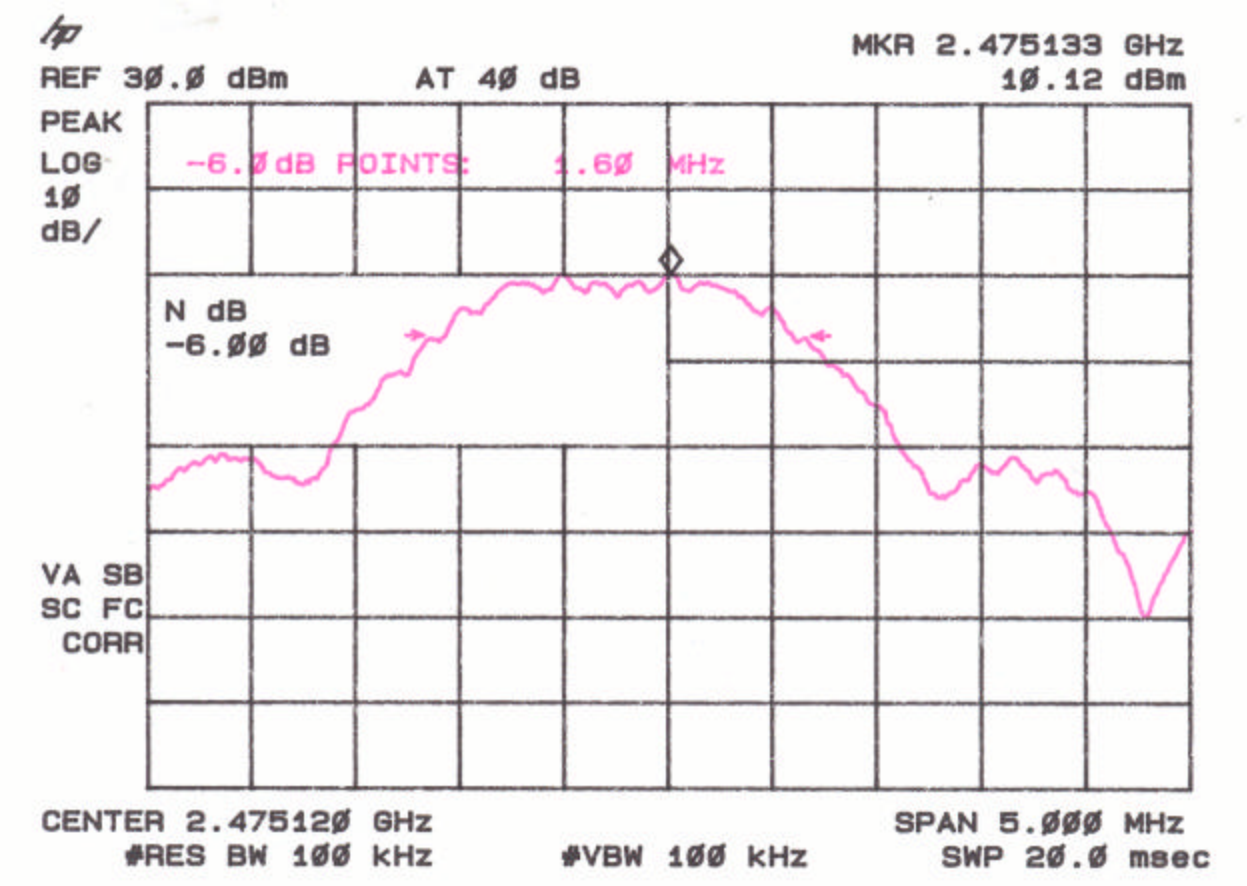


Figure 7c.
6 dB Bandwidth per FCC Section 15.247(a)(2) High



2.12 Average Time of Occupancy per Channel FCC Section 15.247(a)(1)(iii)

Please refer to the Average Spurious Emissions portion of the report for details.

. Worst Case Transmit Duty Cycle for ZMN2400HP

The duty cycle de-rating factor used in the calculation of average radiated limits (per 15.209) is described below. This factor was calculated by first determining the worst case scenario for system operation.

The worst case operating scenario is as follows:

Maximum transmit time/on equals 0.5ms over a 100 ms period.

The transmission duty cycle correction factor is then calculated as:

$$20 \log_{10} (0.5\text{ms}/100\text{ms}) = \textbf{-46.02dB}$$

2.13 Power Line Conducted Emissions for Digital Device and Receiver FCC Section 15.107

The conducted voltage measurements have been carried out in accordance with FCC Section 15.107, with a spectrum analyzer connected to a LISN and the EUT placed into an idle condition or a continuous mode of receive. Similar results were seen as compared to the EUT in a transmit mode of operation.
Therefore, please refer to the results as shown in Table 7a.

2.14 Power Line Conducted Emissions for Transmitter FCC Section 15.207

The conducted voltage measurements have been carried out in accordance with FCC Section 15.207, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmit. The results are given in Table 7a.

TABLE 7a. CONDUCTED EMISSIONS DATA

CLASS B

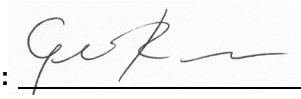
Test Date: July 20, 2007
UST Project: 07-0207
Customer: Cirronet Corporation
Model: ZMN2400HP

(Quasi-Peak vs Average Limits)

.

Conducted Emissions									
Test By:	**Test:** Quasi- Peak vs Average Conducted Emissions					**Client:** Cirronet Corporation			
GR	**Project:** 07-0207			**Class:** B		**Model:** ZMN2400HP			
Frequency	**Test Data**	**AF**	**Test Data**	**AF+CA-AMP**	**Results**	**Limits**	**Distance /**	**Margin**	**PK**
(MHz)	**(dBm)**	**Table**	**(dBuV)**	**(dB)**	**(dBuV)**	**(dBuV)**	**Polarity**	**(dB)**	**/ QP**
0.15	-54.5	lisnp	52.5	-0.2	52.2	56.0	PHASE	**3.8**	**QP**
0.351	-75.6	lisnp	31.4	-0.1	31.3	48.9	PHASE	**17.6**	**QP**
0.5	-80.4	lisnp	26.6	-0.1	26.5	46.0	PHASE	**19.5**	**QP**
0.5284	-85.4	lisnp	21.6	0.0	21.6	46.0	PHASE	**24.4**	**QP**
18.4	-84.0	lisnp	23.0	0.7	23.6	50.0	PHASE	**26.4**	**QP**
21.22	-85.4	lisnp	21.6	0.7	22.3	50.0	PHASE	**27.7**	**QP**
0.15	-54.7	lisnn	52.3	-0.2	52.0	56.0	NEUTRAL	**4.0**	**QP**
0.36	-75.0	lisnn	32.0	-0.1	31.9	48.7	NEUTRAL	**16.8**	**QP**
0.5	-83.1	lisnn	23.9	-0.1	23.8	46.0	NEUTRAL	**22.2**	**QP**
2.5	-99.4	lisnn	7.6	0.2	7.9	46.0	NEUTRAL	**38.1**	**QP**
18.584	-83.4	lisnn	23.7	0.6	24.3	50.0	NEUTRAL	**25.7**	**QP**
20.68	-86.2	lisnn	20.8	0.6	21.4	50.0	NEUTRAL	**28.6**	**QP**

SAMPLE CALCULATIONS: 52.5 + -0.2 = 52.2 dBuV

Tester Signature:  **Name: Gersop Riera**

2.15 Radiated Emissions for Digital Device & Receiver (47 CFR 15.109a)

Radiated emissions were evaluated from 30 to 14500 MHz while the EUT was placed into a Receive mode of operation. Measurements were made with the analyzer's bandwidth set to 120 kHz measurements made less than 1 GHz and 1 MHz for measurements made greater than or equal to 1 GHz. The results for less than 1 GHz are shown in Table 8.

TABLE 8. RADIATED EMISSIONS DATA
(Digital Device & Receiver)

CLASS B

Test Date: **July 27, 2007**
UST Project: **07-0207**
Customer: **Cirronet Corporation**
Product: **ZMN2400HP**

Measurements 30 MHz – 1 GHz

Radiated Emissions									
Test By: GR		**Test:** FCC Part 15 Low Channel		**Client:** **Cirronet Corporation**					
Project: 07-0207			**Class: B**	**Model:** **ZMN2400HP**					
Frequency	**Test Data**	**AF**	**Test Data**	**AF+CA-AMP**	**Results**	**Limits**	**Distance/ Polarity**	**Margin**	**PK**
(MHz)	**(dBm)**	**Table**	**(dBuV)**	**(dB)**	**(uV/m)**	**(uV/m)**		**(dB)**	**/ QP**
289.00	-94.0	2lp3mh	13.0	17.2	32.4	200.0	3m./HORZ	**15.8**	**PK**

No other emissions were detected between 30 MHz and 1 GHz in either Vertical or Horizontal Polarity.

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-94.0 + 13.0 = 107)/20) = 32.4
CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature: _____ **Name:** **Gersop Riera**

2.16 Peak Power Spectral Density (15.247(e))

The transmitter was placed into a hop stop mode of continuous operation for low, mid and high channel. Each channel was centered on the screen and the RBW was set at 3 kHz and the span was reduced to 300 kHz while constantly centering the peak signal. The trace capture time was a minimum of Span/RBW or 100 sec.
The measured power spectral density conducted from the transmitter to the antenna was less than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
Results are shown in Figure 8a-c.

Figure 8a. Peak Power Spectral Density (15.247(e)

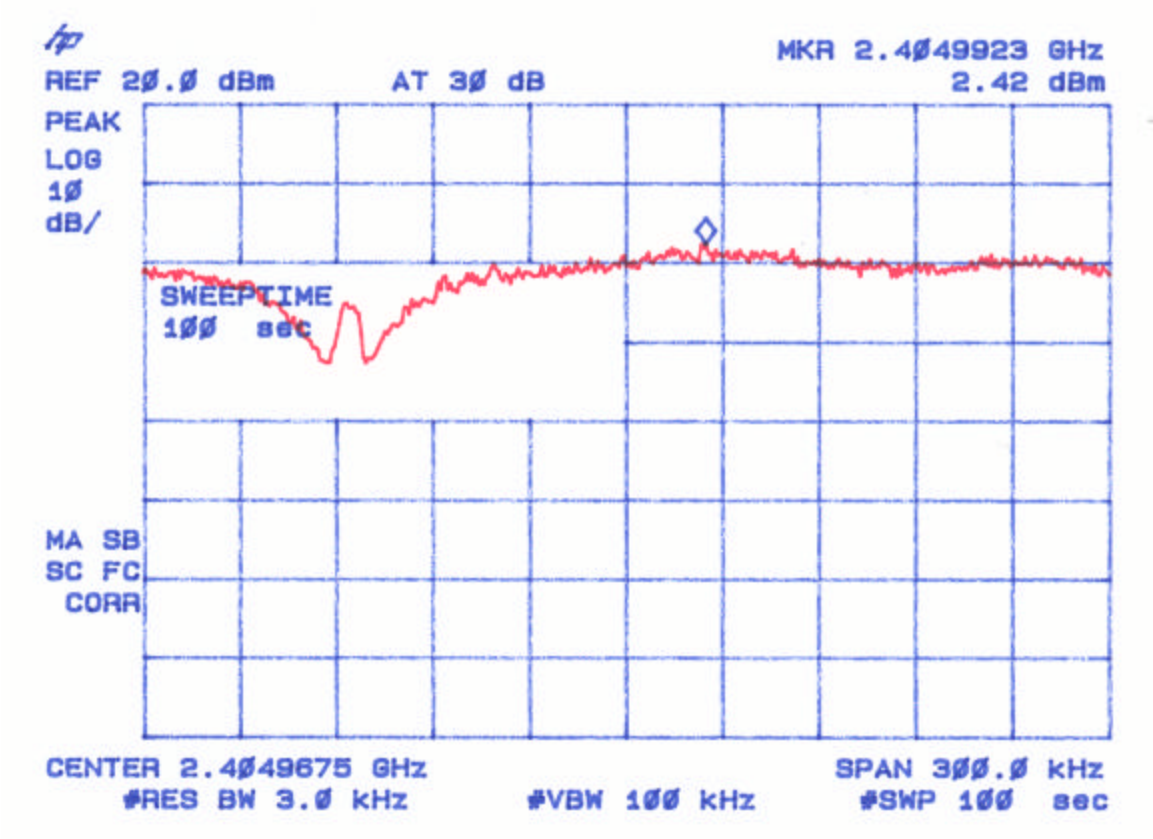


Figure 8b. Peak Power Spectral Density (15.247(e))

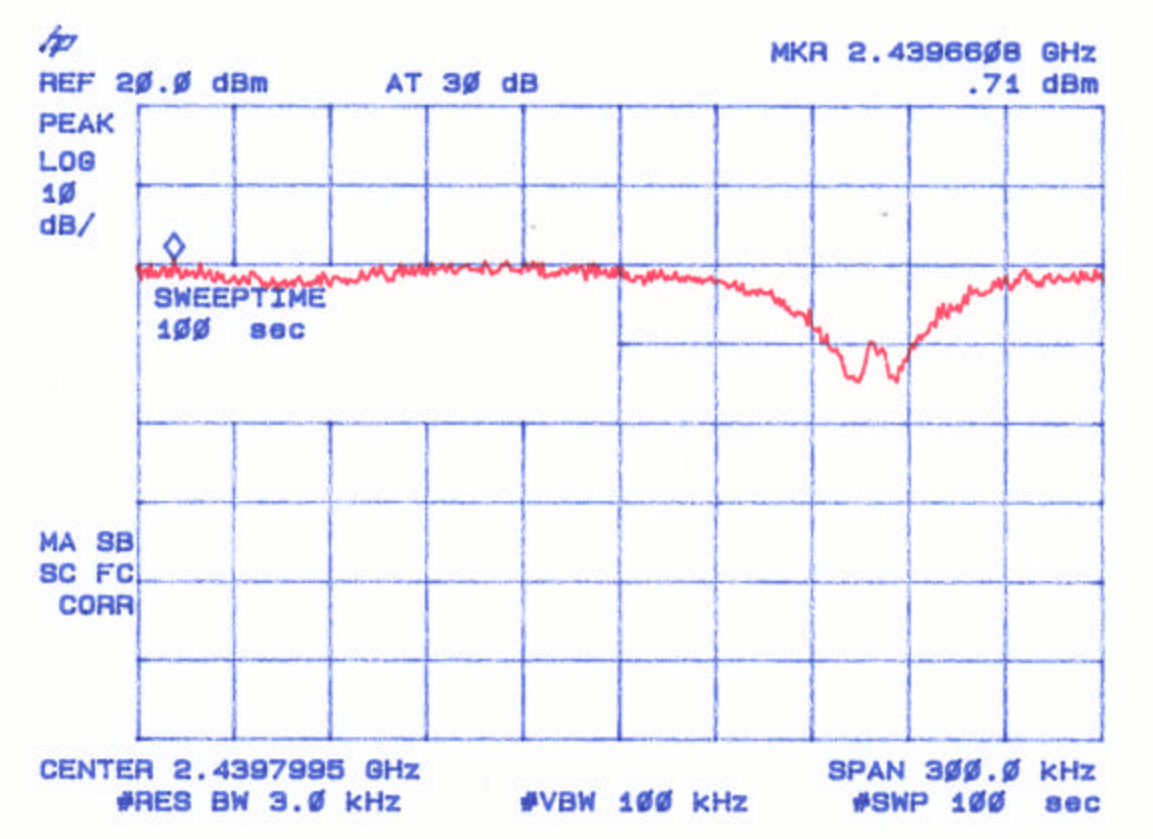


Figure 8c. Peak Power Spectral Density (15.247(e))