U.S. TECH
A TRADITION IN TESTING SERVICES

February 21, 2001

Mr. Mark Tucker
Cirronet Corporation
5375 Oakbrook Parkway
Norcross, GA 30093

Dear Mr. Tucker:

Enclosed please find Cirronet Corporation's file copy of the Part 15 Class II Permissive Change Application for the WIT2410 Transceiver.

Cirronet Corporation should expect to receive a certification grant for this product within the next 7-8 weeks.

If you have any questions, please don't hesitate to call. Thank you for your business.

Sincerely,

Timothy R. Johnson
NARTE Certified EMC Engineer
No. EMC-002205-NE

A TRADITION IN TESTING SERVICES

Cirronet Corporation
FCC Part 15,
Class II Permissive Change Application
WIT2410

February 21, 2001

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **Cirronet Corporation.**

MODEL: **WIT2410**

FCC ID: **HSW-2410M**

DATE: **February 21, 2001**

This report concerns (check one): Original grant_X__
Class II change_____

Equipment type: **_Modular Frequency Hopping Spread Spectrum Transceiver__**

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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SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

1.1 Product Description

The Equipment Under Test (EUT) is a Cirronet Corporation, Model WIT2410 modular 2.4 GHz spread spectrum modular transceiver.

The EUT was originally approved for use with one of seven different antennas. The EUT was previously approved under FCC ID: HSW-2410M by the FCC on 10/6/99. Cirronet Corporation desires to add an additional 5 antennas to their original grant of certification.

1.2 Related Submittal(s)/Grant(s)

The EUT was been previously approved under FCC ID: HSW-2410M by the FCC on 10/6/99.

Additionally, the transceiver presented in this report will be used with other like transceivers.

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. Interconnecting cables were manipulated as necessary to maximize emissions. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2.

The sample used for testing was received by U.S. Technologies on January 17, 2001 in good condition.

The EUT was originally approved for use with one of seven different antennas. The EUT was previously approved under FCC ID: HSW-2410M by the FCC on 10/6/99. Cirronet Corporation desires to add an additional 5 antennas to their original grant of certification. Since the EUT has been previously tested and approved, only the spurious emissions test has been repeated. Additionally, since Cirronet Corporation desires to add two parabolic dish antennas (+18 dBi and +24 dBi), only the highest gain model was selected for test (+24 dBi).

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.

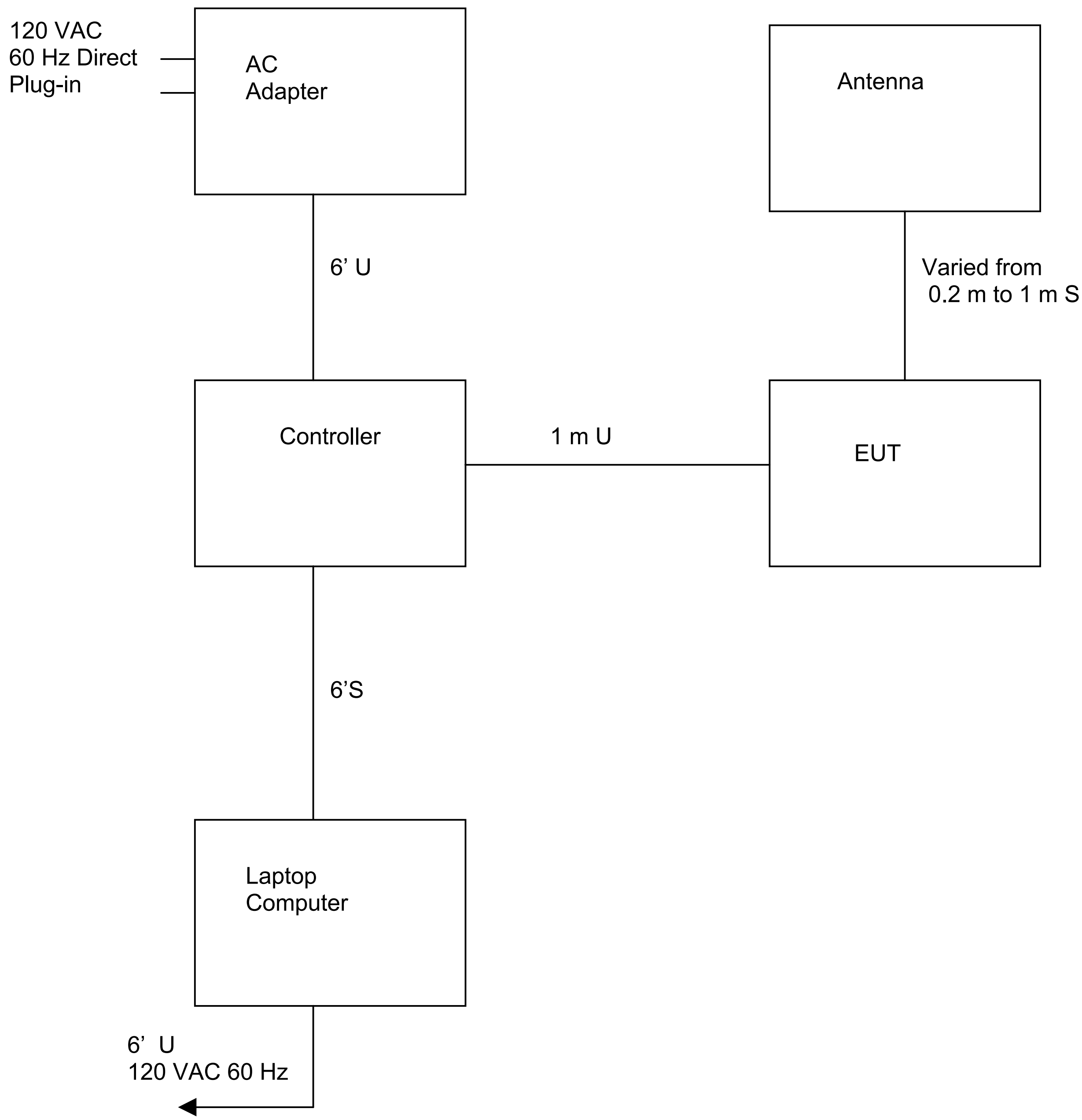
2.3 Test Equipment

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.

FIGURE 1
TEST CONFIGURATION



Test Date: February 4, 2001
UST Project: 01-0057
Customer: Cirronet Corporation
Model: WIT2410

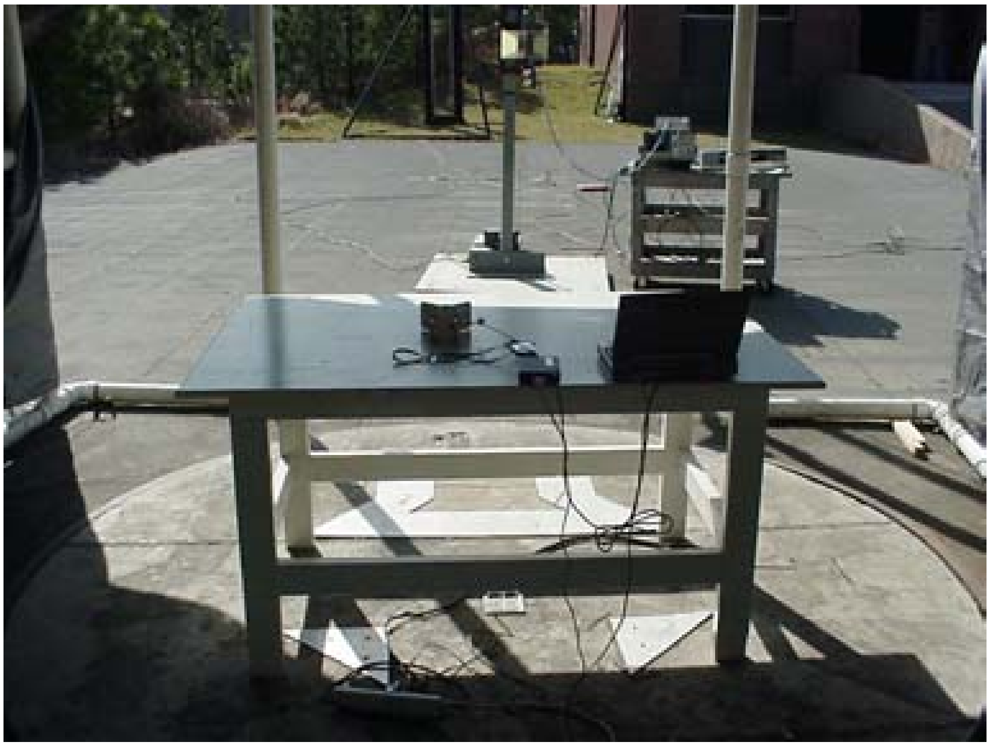
FIGURE 2a

Photograph(s) for Spurious Emissions (2.5 dBi Vehicle Mount)

Test Date: February 4, 2001
UST Project: 01-0057
Customer: Cirronet Corporation
Model: WIT2410

FIGURE 2b

Photograph(s) for Spurious Emissions (9 dBi Corner Reflector)



Test Date: February 4, 2001
UST Project: 01-0057
Customer: Cirronet Corporation
Model: WIT2410

FIGURE 2c

Photograph(s) for Spurious Emissions (5 dBi Whip)

Test Date: February 4, 2001
UST Project: 01-0057
Customer: Cirronet Corporation
Model: WIT2410

FIGURE 2d

Photograph(s) for Spurious Emissions (24 dBi Parabolic Dish)

TABLE 1

Test Date: February 4, 2001
UST Project: 01-0057
Customer: Cirronet Corporation
Model: WIT 2410M

EUT and Peripherals

PERIPHERAL MANU.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
(EUT) Cirronet Corporation	WIT 2410M	008517	HSW-2410M	1 m U
Antenna Various, see antenna descriptions			None	Varied from 0.2 to 1 m S
AC Adapter Volgen	SPU10R-1	None	None	6' U 120 VAC 60 Hz Direct Plug-in
Controller Cirronet Corporation	None	None	None	6' S
Laptop Computer Toshiba	Satelite Pro T2155CDS	09543879	CJ6UK323	6' U 120 VAC Hz Power Cord

TABLE 2
TEST INSTRUMENTS

TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
HORN ANTENNA	EMCO	3115	3723
HORN ANTENNA	EMCO	3116	9505-2255
BICONICAL ANTENNA	EMCO	3110	9307-1431
LOG PERIODIC ANTENNA	EMCO	3146	9110-3600
BILOG	CHASE	CBL6112A	2238
LISN	SOLAR ELE.	8012	865577
LISN	SOLAR ELE.	8028	910494
LISN	SOLAR ELE.	8028	910495
THERMOMETER	FLUKE	52	5215250
MULTIMETER	FLUKE	85	53710469
FUNCTION GENERATOR	TEKTRONIX	CFG250	CFG250TW15059
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394

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.

Previously Approved Antennas as Listed in Original Submital

Cirronet Corporation will sell the WIT2410 with one of the following antennas.

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB	Type of Connector
ACE	Dipole	ACE-2400NF	2 dBi	Reverse SMA to MMCX via adapter cable
Cushcraft	Yagi	PC2415-RTNF	15 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Omni-Directional	OD6-2400-RTNC	6 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Omni-Directional	OD12-2400PTA-RTNC	12 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Corner Reflector	SCR14-2400PTA-RTNC	14 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Patch	P7-2400RTNC	7 dBi	Reverse SMA to MMCX via adapter cable
Cirronet Corporation.	Patch	PA2410	Appx. 3 dBi	Non-standard MMCX

To ensure compliance with 15.203, Cirronet Corporation attachs reverse-sex TNC connectors to the 15dBi Yagi, the 14dBi corner reflector, and the 9dBi and 12dBi omni-directional. The 2dBi dipole is fitted with a reverse sex SMA as the TNC is too large to fit onto the antenna body.

Cirronet Corporation. has arranged for the manufacturers of the 14 dBi corner reflector, the 15 dBi Yagi, the 6 dBi and 12 dBi omni-directional antennas to provide reverse-sex TNC connectors for these antennas. They have also arranged with the manufacturer of the 2dBi dipole to place a reverse sex SMA connector on that antenna. 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 connector (or SMA in the case of the dipole) 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 SMA for the case of the dipole). 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.

The sixth antenna included in their application, the DWC patch, already has a nonstandard

MMCX mating connector attached to it. It cannot be connected to anything else but a MMCX connector. No adapter cable is needed when using this antenna – the antenna snaps directly to the module. Cirronet Corporation has no official data sheet for this antenna. Lab measurements show an approximate antenna gain of 3 dBi for the device.

New Additional Antennas

Cirronet Corporation will sell the WIT2410 with one of the following antennas.

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB	Type of Connector
Mobile Mark	Vehicle Mount	RM3-2400-RTNC	2.5 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Corner Reflector	SCR9-2400-RN	9 dBi	Reverse N to MMCX via adapter cable
MaxRad	Whip	MUF24005-RTNC	5 dBi	Reverse TNC to MMCX via adapter cable
Andrews	Parabolic Dish	26T-2400 A	24 dBi	Reverse N to MMCX via adapter cable
Andrews	Parabolic Dish	18T-2400 A	18 dBi	Reverse N to MMCX via adapter cable

*For more specific antenna specifications, please see the following pages.

To ensure compliance with 15.203, Cirronet Corporation proposes to attach reverse-sex TNC connectors to the 2.5 dBi vehicle mount and the 5 dBi whip antennas. The 2 parabolic dish antennas and the corner reflector will be fitted with a reverse N connector. Cirronet Corporation has arranged for the manufacturers of these antennas to provide non-standard 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 non-standard connector to the end of the antenna before shipping.

The customer then purchases an adapter cable from Cirronet Corporation that will connect the MMCX port on our module to the non-standard connector on the antenna. Given the nonstandard nature of the interconnect between module and antenna and the difficulty involved in circumventing that connection, Cirronet Corporation believes that this procedure meets the requirements called out in 15.203.

Product Specifications

MOBILE MARK®
COMMUNICATIONS ANTENNAS

RM Body Mount Antenna

Now Available in white or black!

Body Mount 2.4 GHz Antenna WLAN, ISM & Video Systems

- Mounts easily to roof, trunk or bulkhead
- 2.5 dBi dipole omnidirectional configuration
- Rugged ABS radome , mounts to 5/8" hole
- "O"ring seal provides watertight use

This new antenna compliments Mobile Mark's 2.4 GHz antenna product line with a new mounting option. The body mount style antenna can be mounted to any vehicle, container or bulkhead. The rugged style is excellent for industrial applications, yet attractive for consumer use.

The design uses a 5/8" feed thru for securing to the vehicle. Access to the underside of the body surface is required to complete the installation. The antennas are outfitted with 1 foot of LMR-200 cable & TNC female connector. Jumper cables for completing the installation are supplied separately, and use LMR-195 low loss cable.

Antenna performance is 2.5 dBi, with no ground plane required for proper operation. The antenna can even be mounted on fiberglass or plastic housing and meet all specifications.

The antenna radome consists of Black ABS UV resistant plastic, with a chrome plated mounting plate and threaded feed thru. The bottom mounting plate is outfitted with an "O" ring for complete sealing. A mounting lock nut and washer are also supplied for securing the antenna.

The antenna can also be used as mini-base station or access point. An optional mounting bracket kit is available for this purpose. It allows mounting the antenna to any vertical surface.

Model Number

Model	Description
RM3-2400	Antenna with TNC coax pigtail and mounting hardware

Installation Jumper Cable Model Numbers

LMXXX-YYY-MTN

Cable length, inches (3 digits)

Connector Type
MTN=Male TNC
FTN=Female TNC
MSA=Male SMA
FSA=Female SMA
MBC=Male BNC
FBC=Female BNC
MMU=Male Mini-UHF
FMU=Female Mini-UHF
MCN=Male N
FCN=Female N

Example
LM096-MTN-MTN is a jumper with 096 inches of LMR-195, a male TNC to connect to the receiver, and the male TNC to connect to the antenna.

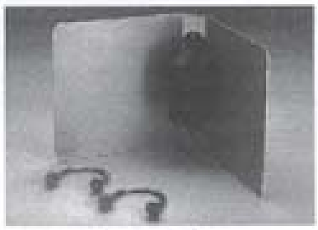
Specifications

Frequency:	2400-2485 MHz	**Mounting:**	5/8" diameter feed thru, 1/2" long thread for up to 1/4" thick metal
Gain:	2.3 dBi max	**Hardware:**	Nut, lockwasher and gasket included
VSWR:	2:1 max over range	**Pigtail Cable :**	LMR-200, 1 foot, exits at bottom
Operating Temp:	-40° to +85° C	**Pigtail Connector:**	TNC female, use jumpers for longer installation
Nominal Impedance:	50 ohms	**Jumper Cable:**	Male TNC with LMR-195 cable and choice of connector for receiver interface, see above
Maximum Power:	10 watts		
Radome/Mount Case Material:	2" diameter x 3" high ABS plastic, UV Resistant		

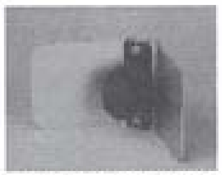
US Office & Headquarters: 3900-B River Road, Schiller Park, IL 60176 Tel: 800-648-2800 or 847-671-6690 Fax: 847-671-6715
UK Office: 106 Anglesey Business Park, Hednesford, Staffs. WS12 5NR UK Tel: (+44) 1543-878343 Fax: (+44) 1543-871714

Product Specifications

MOBILE MARK®
COMMUNICATIONS ANTENNAS



14 dBi Corner Reflector



9 dBi Mini Corner Reflector

Corner Reflector Antenna (Pat.Pend.)

For PCS, ISM & High Frequency Applications

- 14 dBi models for 1.7 - 2.6 GHz
- 9 dBi Mini model for 2.4 GHz applications
- Small aperture; minimizes windloading
- Split balun feed provides superior bandwidth & gain performance

Mobile Mark's high frequency Corner Reflector antennas are useful for many applications including surveillance work, PCS, LAN/WAN and other high frequency applications. Its unique design features allow the antenna to overcome many of the problems normally associated with higher frequency systems.

These corner reflectors utilize a half-wavelength element configuration. A unique balun fed design provides high efficiency radiation without skewing of the radiation pattern. The resultant performance provides excellent bandwidth, gain and match over the frequency range.

Model Numbers

Frequency Range	Gain	Model
1700 -1900 MHz	14 dBi	SCR14-1800
1800 - 2000 MHz	14 dBi	SCR14-1900
2300 - 2600 MHz	14 dBi	SCR14-2400
2300 - 2600 MHz	9 dBi	SCR9-2400

Please confirm desired operating frequency at time of order. Other special configurations are available upon request. Operation subject to bandwidth restrictions.

These antennas are very small in design and appearance. The connector mechanism exits at the rear of the antenna, allowing easy installation. The mounting bracket (supplied) allows both horizontal and vertical mounting of the antenna. Surface mount can also be accommodated. Each reflector panel on the 14 dBi models measure 7" x 7", providing very low aperture and windloading. The 9 dBi Mini-Corner Reflector has 3" x 3" panels, with total aperture of only 3" x 5.5".

The reflectors are made of aluminum, and irridited for weather protection. The radiating elements are weather protected within an ABS radome. This maintains integrity of the antenna without sacrificing looks or windloading.

Specifications

Frequency:	See above	**SCR14 Panel Size:**	7" x 7" each
Gain:	See above	**Max Wind Velocity:**	100+ mph
Bandwidth @2:1 SWR:	200 MHz or better	**Material:**	Irridited aluminum, ABS plastic radome material
Impedance:	50 Ohm nominal		
Maximum Power:	100 Watts	**Weight:**	
SCR9 Beamwidth:	65° vertical, 75° horizontal	SCR9	<1 lbs
SCR14 Beamwidth:	44° vertical, 35° horizontal	SCR14	<2 lbs
Front-to-Back ratio:	22 dB or better	**Mounting:**	Pole, surface, & corner mount, hardware included.
Lightning Protection:	DC grounded, external protection recommended	**Mounting Dimension:**	Mounts up to 2" outside diameter mast
SCR9 Aperture:	3" x 5.5" front face		
SCR9 Panel Size:	3" x 3" each	**Connector:**	N female, attached at rear of antenna
SCR14 Aperture:	7" x 10.5" front face		

3900-B River Road, Schiller Park, IL 60176 Tel: 800-648-2800 or 847-671-6690 Fax: 847-671-6715

Visit our web page at www.mobilemark.com. Specifications subject to change without notice (11/98).

Data/Spec Sheet

ORDER (800) 323-9122 FAX (630) 372-8077

2.4 GHz ISM Mobile Antennas

The 2.4 GHz ISM mobile antennas cover frequencies from 2.400 to 2.4835 GHz. The (B)MAXC models feature MAXRAD's popular BMAX molded polymer base, a plated spring-loaded contact pin, and a .100" diameter stainless steel whip for long lasting, trouble free service. The MUF model is a chrome nut antenna with a .062" stainless steel whip. Various mount and connector options provide low-loss mounting for a variety of metal surfaces.

General Specifications:
2.4 GHz ISM mobile antennas

Radiator Material:
.100" dia. stainless steel; bright (MAXC) or black finish (BMAXC)
.062" dia. stainless steel; bright finish - MUF model

Antenna Base:
Molded polymer with a plated brass insert ring and a spring-loaded, brass contact pin - (B)MAXC models
Brass mount nut with bright chrome finish - MUF model

Maximum Power:
100 Watts - all models

VSWR:
<1.5:1

Nominal Impedance:
50 Ohms

Antenna Type:
Collinear array - (B)MAXC models
Dual open coil chrome nut - MUF model

Rod Ferrule:
5/16" - 24 thread; bright or black chrome plated brass - (B)MAXC models


BMAXC24505 BMAXC24503 MUF24005

Electrical Specifications
2.4 GHz ISM Mobile Antennas

Model #	Frequency Range	Factory Tuned Frequency	Coil Type	Gain
(B)MAXC24503	2.400 - 2.4835 GHz	2.45 GHz	Closed	3 dBi
(B)MAXC24505	2.400 - 2.4835 GHz	2.45 GHz	Closed	5 dBi
MUF24005	2.400 - 2.4835 GHz	2.45 GHz	Open	5 dBi

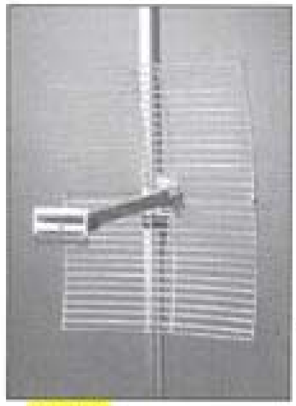
* Prefix "B" indicates black

Mechanical Specifications
2.4 GHz ISM Mobile Antennas

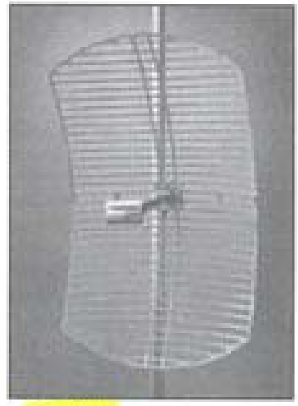
Model #	Antenna Height	Weight
(B)MAXC24503	5-1/4"	0.12 lbs.
(B)MAXC24505	7-1/2"	0.16 lbs.
MUF24005	8-3/4"	0.10 lbs.

* Prefix "B" indicates black

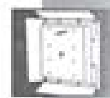
23T-5800



18T-2400



26T-2400



ISM, MMDS, and UNII Band Passive Products

PD Series Parabolic Dish Antennas

- *Durable antenna offers excellent performance at low cost.*
- *Spun aluminum reflector.*
- *Lightweight, stacked packaging minimizes freight and handling costs.*
- *RG8 pigtail, 13 in (330 mm) long.*
- *Up to 60° tilt adjustment.*

MAG GRID Antennas

- *Patented grid reflector design provides excellent reliability plus easy handling and installation.*
- *Lightweight and durable. Materials include magnesium alloy, aluminum, and stainless steel.*
- *RG8 pigtail, 24 in (610 mm) long.*
- *Up to 60° tilt adjustment.*
- *Antenna ships disassembled for minimum freight costs. Factory assembly is available as an option.*

Ordering Information

Frequency Band MHz	Type Number*	Gain dBi	3 dB Beamwidth Degrees	VSWR, MAX (R.L., dB)
PD Series Antennas				
1700-2100	**19T-1940**	19	16	1.5
2100-2700	**19T-2127**	19	16	1.5
2400-2500	**19T-2440**	19	16	1.5
5725-5850	**23T-5800**	23	6	1.5
MAG GRID Antennas				
1700-2100	**18T-1900**	18	14	1.5
1700-2100	**26T-1900**	24	8	1.5
2100-2700	**18T-2127**	18	14	1.5
2100-2700	**26T-2127**	24	8	1.5
2400-2500	**18T-2400**	18	14	1.5
2400-2500	**26T-2400**	24	8	1.5

* N male connector is standard. To order optional N female connector, add F to end of Type Number.

2.6 Peak Radiated Spurious Emission in the Frequency Range 30-25000 MHz (FCC Section 15.247(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 3a –3d and Figure 5a – Figure 5x.

Table 3a. PEAK RADIATED SPURIOUS EMISSIONS (Low)
Mobile Mark 2.5 dBi Vehicle Mount Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.803	-56.95	33.9	34.5	3.4	508.1	5000.0
7.205	-46.79	33.7	37.4	4.7	2689.1	5000.0

Table 3a. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
Mobile Mark 2.5 dBi Vehicle Mount Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.871	-60.12	33.9	34.7	3.4	361.7	5000.0
7.307	-50.89	33.7	37.4	4.7	1685.2	5000.0

Table 3a. PEAK RADIATED SPURIOUS EMISSIONS (High)
Mobile Mark 2.5 dBi Vehicle Mount Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.939	-55.86	33.9	34.9	3.5	605.7	5000.0
7.410	-45.66	33.7	37.5	4.7	3091.7	5000.0

* - Data corrected by 1 dB for loss of high pass filter

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-56.95 – 33.9 + 34.9 + 3.5 + 107)/20) = 508.1
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ **Name: Sam Wismer**

Table 3b. PEAK RADIATED SPURIOUS EMISSIONS (Low)
Mobile Mark 9 dBi Corner Reflector Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.803	-56.71	33.9	34.5	3.4	522.4	5000.0
7.205	-50.35	33.7	37.4	4.7	1784.8	5000.0

Table 3b. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
Mobile Mark 9 dBi Corner Reflector Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.871	-59.69	33.9	34.7	3.4	380.1	5000.0
7.307	-51.52	33.7	37.4	4.7	1567.3	5000.0

Table 3b. PEAK RADIATED SPURIOUS EMISSIONS (High)
Mobile Mark 9 dBi Corner Reflector Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.939	-53.55	33.9	34.9	3.5	790.2	5000.0
7.410	-46.97	33.7	37.5	4.7	2658.9	5000.0

* - Data corrected by 1 dB for loss of high pass filter

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-56.71- 33.9 + 34.5 + 3.4 + 107)/20) = 522.4
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ **Name:** __Sam Wismer________

Table 3c. PEAK RADIATED SPURIOUS EMISSIONS (Low)
MaxRad 5 dBi Whip Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.803	-56.66	33.9	34.5	3.4	525.4	5000.0
7.205	-48.72	33.7	37.4	4.7	2153.3	5000.0

Table 3c. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
MaxRad 5 dBi Whip Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.871	-59.31	33.9	34.7	3.4	397.1	5000.0
7.307	-53.16	33.7	37.4	4.7	1297.6	5000.0

Table 3c. PEAK RADIATED SPURIOUS EMISSIONS (High)
MaxRad 5 dBi Whip Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.939	-55.33	33.9	34.9	3.5	629.1	5000.0
7.410	-47.53	33.7	37.5	4.7	2492.9	5000.0

* - Data corrected by 1 dB for loss of high pass filter

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-56.66 - 33.9 + 34.5 + 3.4 + 107)/20) = 525.4
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ **Name:** **Sam Wismer**

Table 3d. PEAK RADIATED SPURIOUS EMISSIONS (Low)
Andrews 24 dBi Parabolic Dish Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.803	-60.44	33.9	34.5	3.4	340.0	5000.0
7.205	-50.98	33.7	37.4	4.7	1660.0	5000.0

Table 3d. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
Andrews 24 dBi Parabolic Dish Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.871	-63.16	33.9	34.7	3.4	254.9	5000.0
7.307	-51.75	33.7	37.4	4.7	1526.3	5000.0

Table 3d. PEAK RADIATED SPURIOUS EMISSIONS (High)
Andrews 24 dBi Parabolic Dish Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.939	-49.74	33.9	34.9	3.5	1225.3	5000.0
7.410	-45.23	33.7	37.5	4.7	3248.6	5000.0

* - Data corrected by 1 dB for loss of high pass filter

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-60.44 - 33.9 + 34.5 + 3.4 + 107)/20) = 340.0
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ **Name: Sam Wismer**

Figure 3a
Peak Radiated Spurious Emission 15.247(c) Low – Mobile Mark 2.5 dBi Vehicle Mount

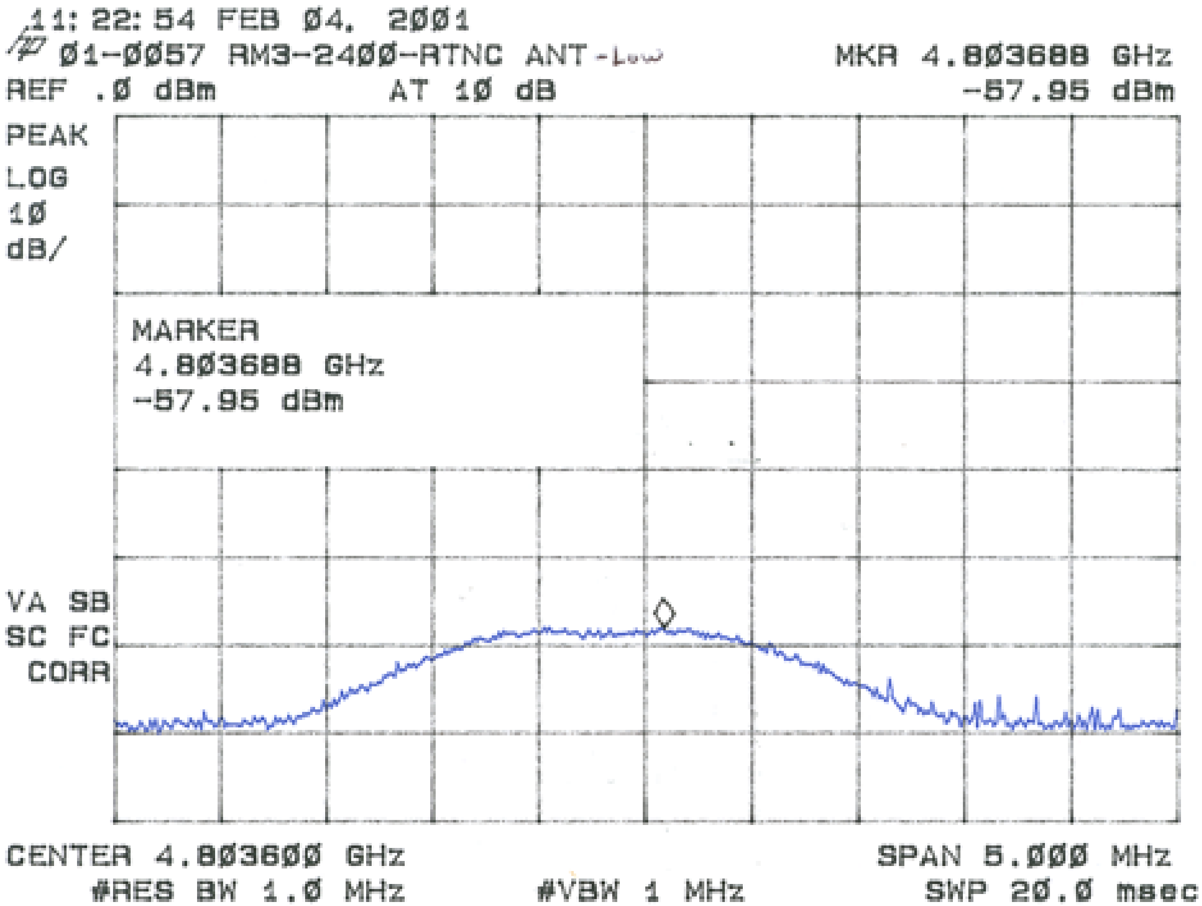


Figure 3b
Peak Radiated Spurious Emission 15.247(c) Low – Mobile Mark 2.5 dBi Vehicle Mount

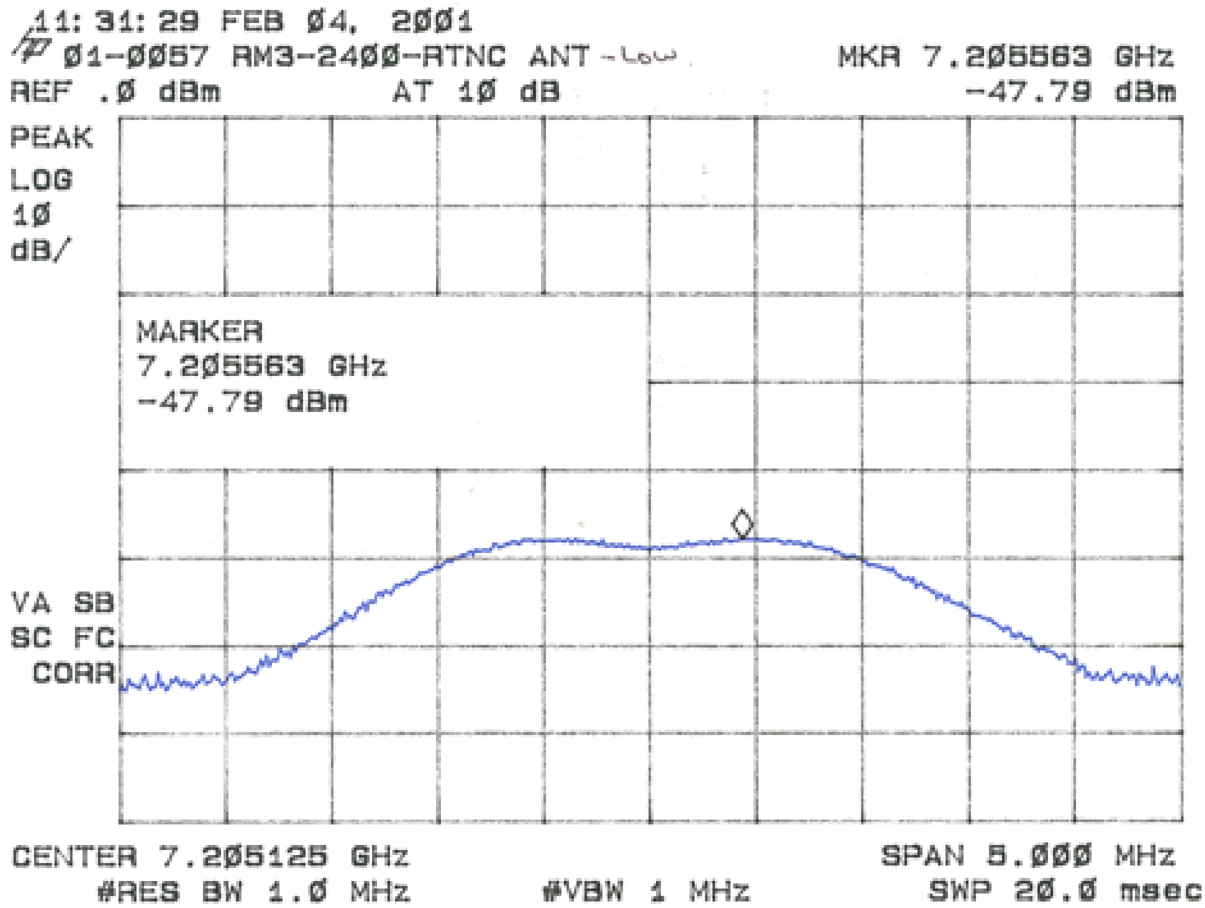


Figure 3c
Peak Radiated Spurious Emission 15.247(c) Mid – Mobile Mark 2.5 dBi Vehicle Mount

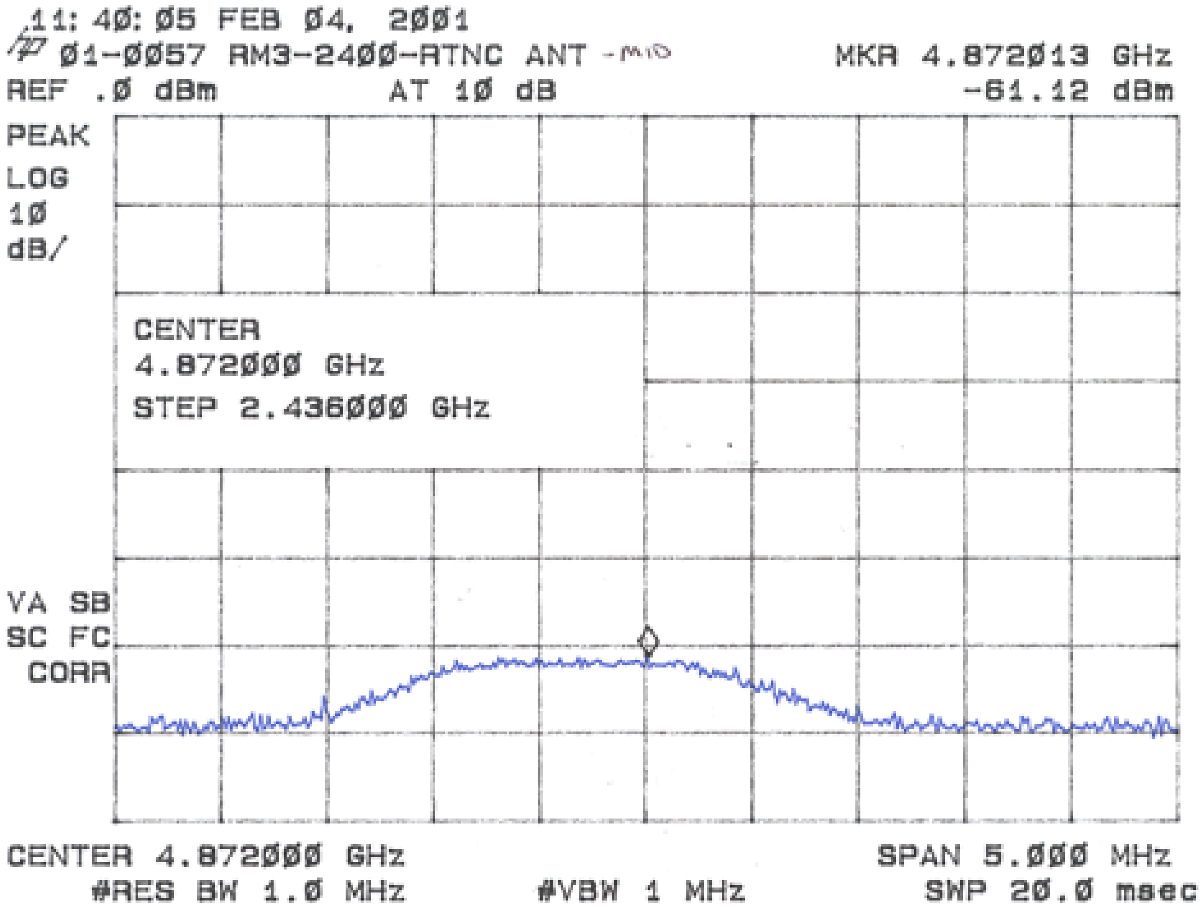


Figure 3d
Peak Radiated Spurious Emission 15.247(c) Mid – Mobile Mark 2.5 dBi Vehicle Mount

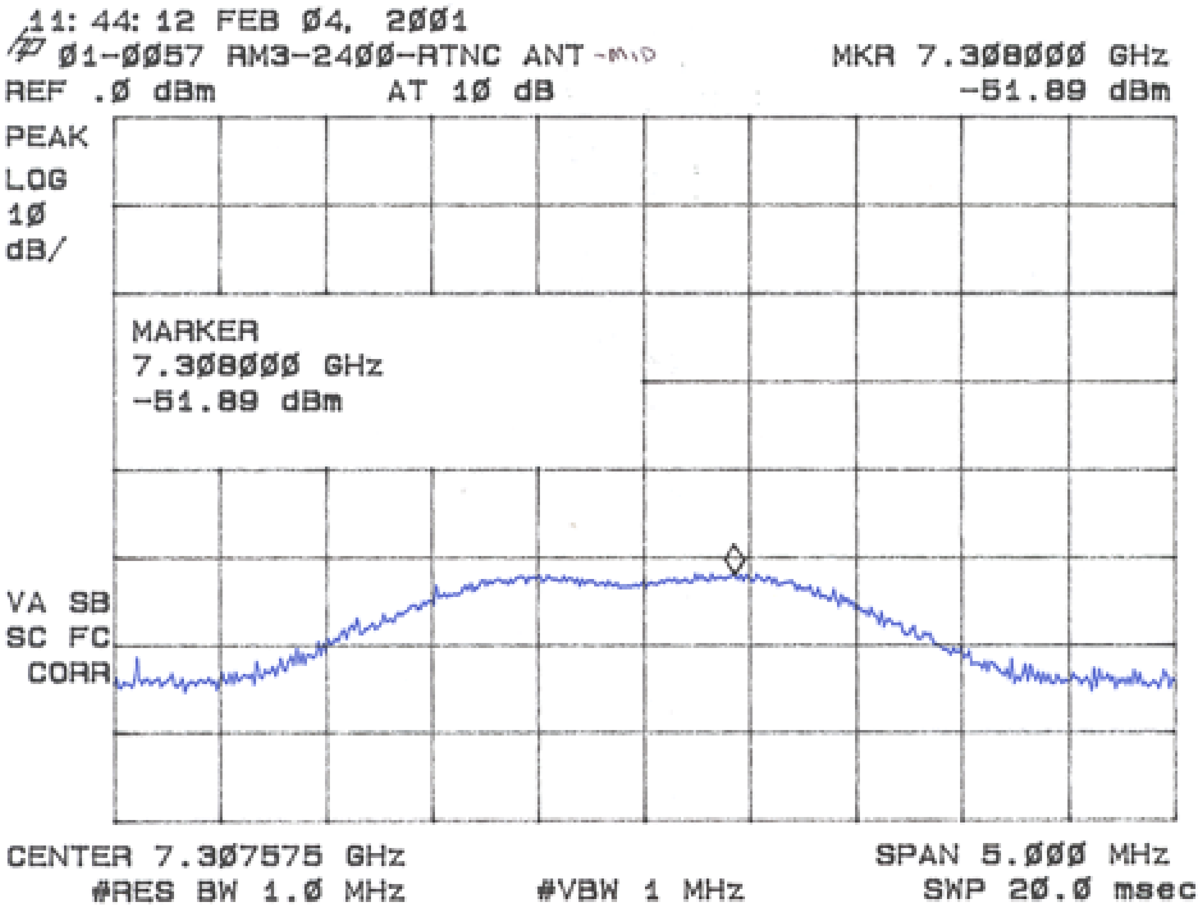


Figure 3e
Peak Radiated Spurious Emission 15.247(c) High– Mobile Mark 2.5 dBi Vehicle Mount

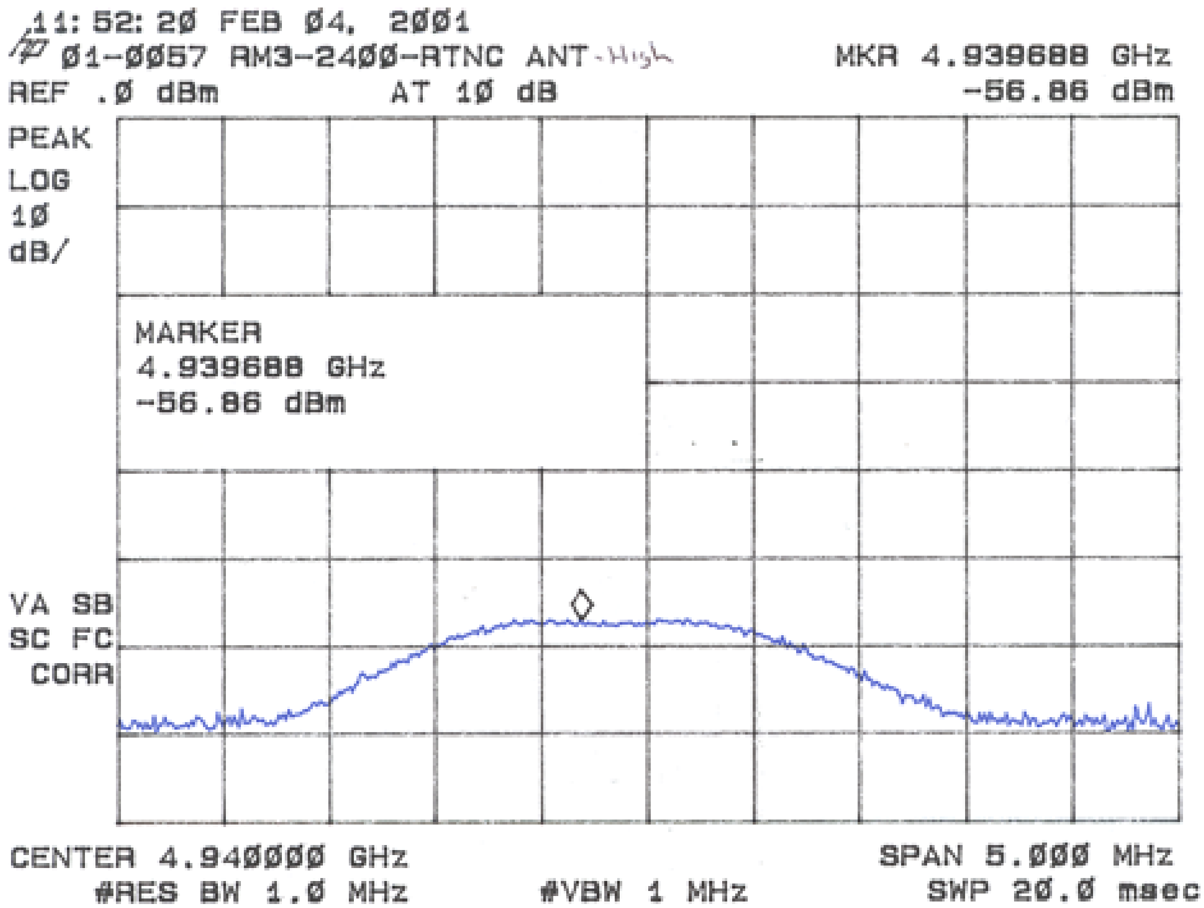


Figure 3f
Peak Radiated Spurious Emission 15.247(c) High– Mobile Mark 2.5 dBi Vehicle Mount

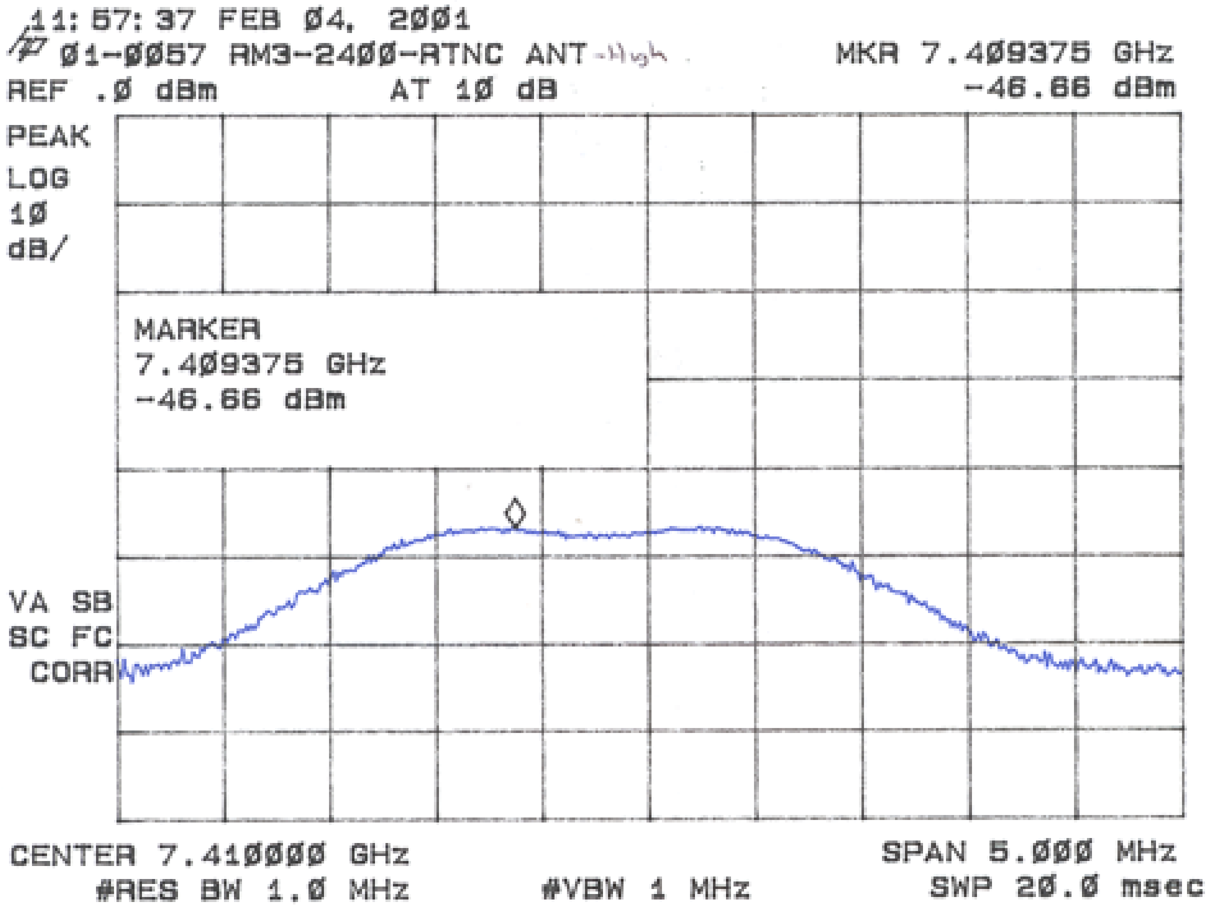


Figure 3g
Peak Radiated Spurious Emission 15.247(c) Low – Mobile Mark 9 dBi Corner Reflector

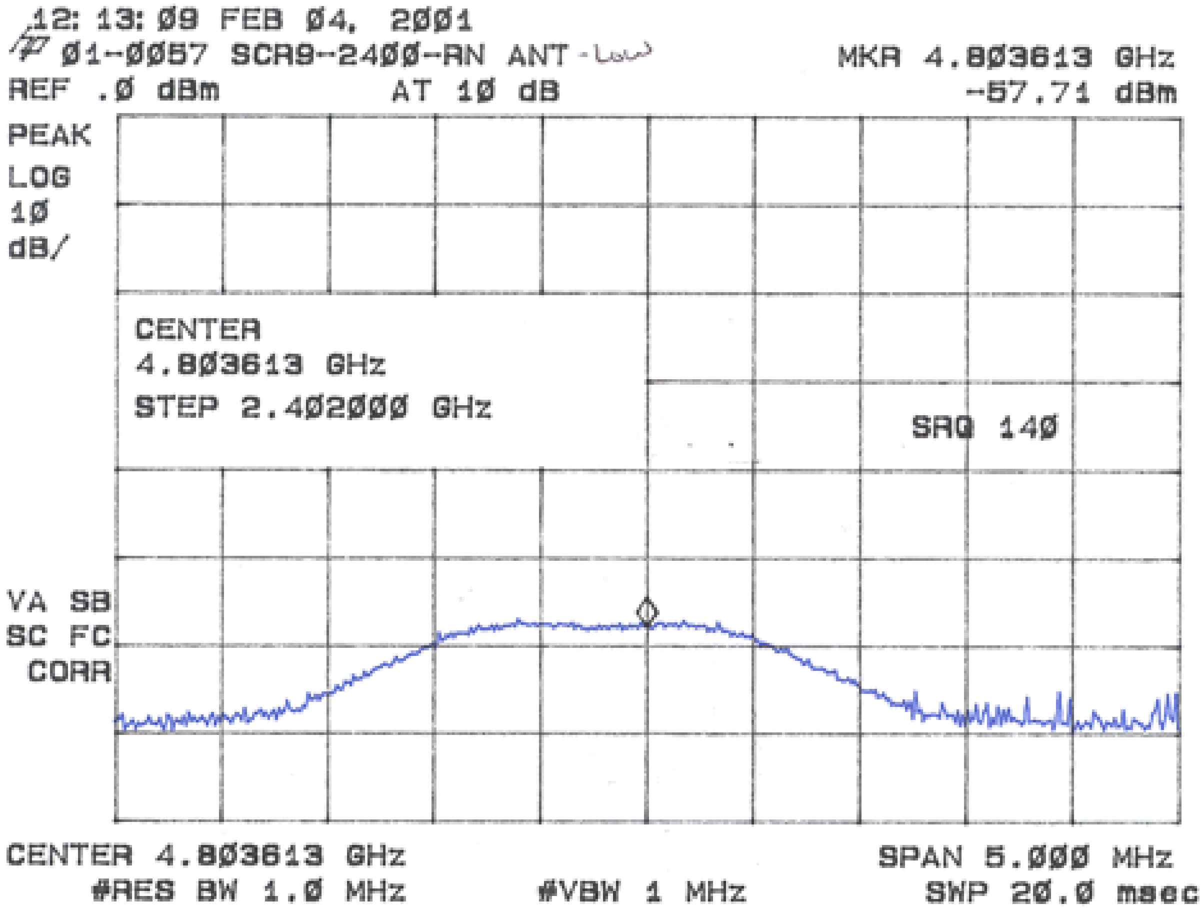


Figure 3h
Peak Radiated Spurious Emission 15.247(c) Low – Mobile Mark 9 dBi Corner Reflector

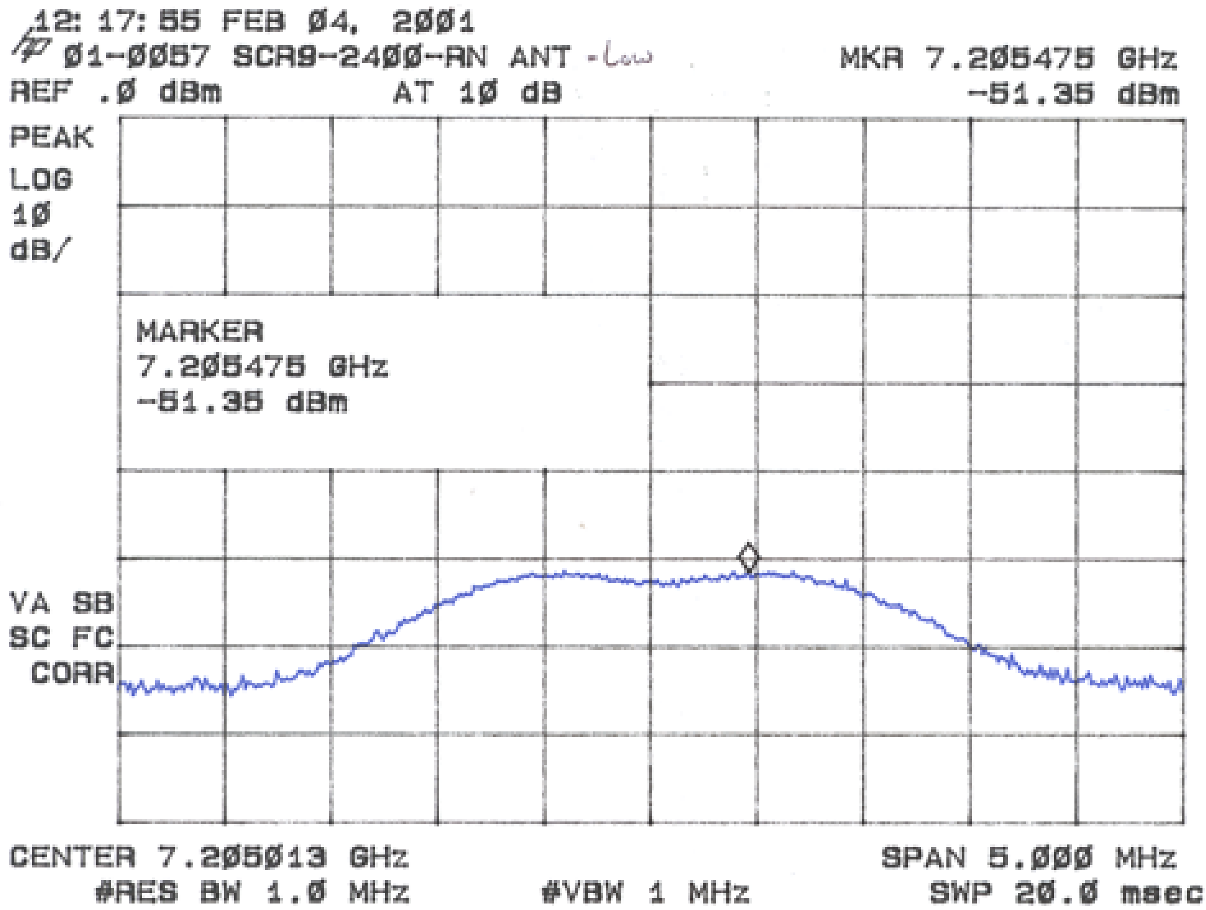


Figure 3i
Peak Radiated Spurious Emission 15.247(c) Mid – Mobile Mark 9 dBi Corner Reflector

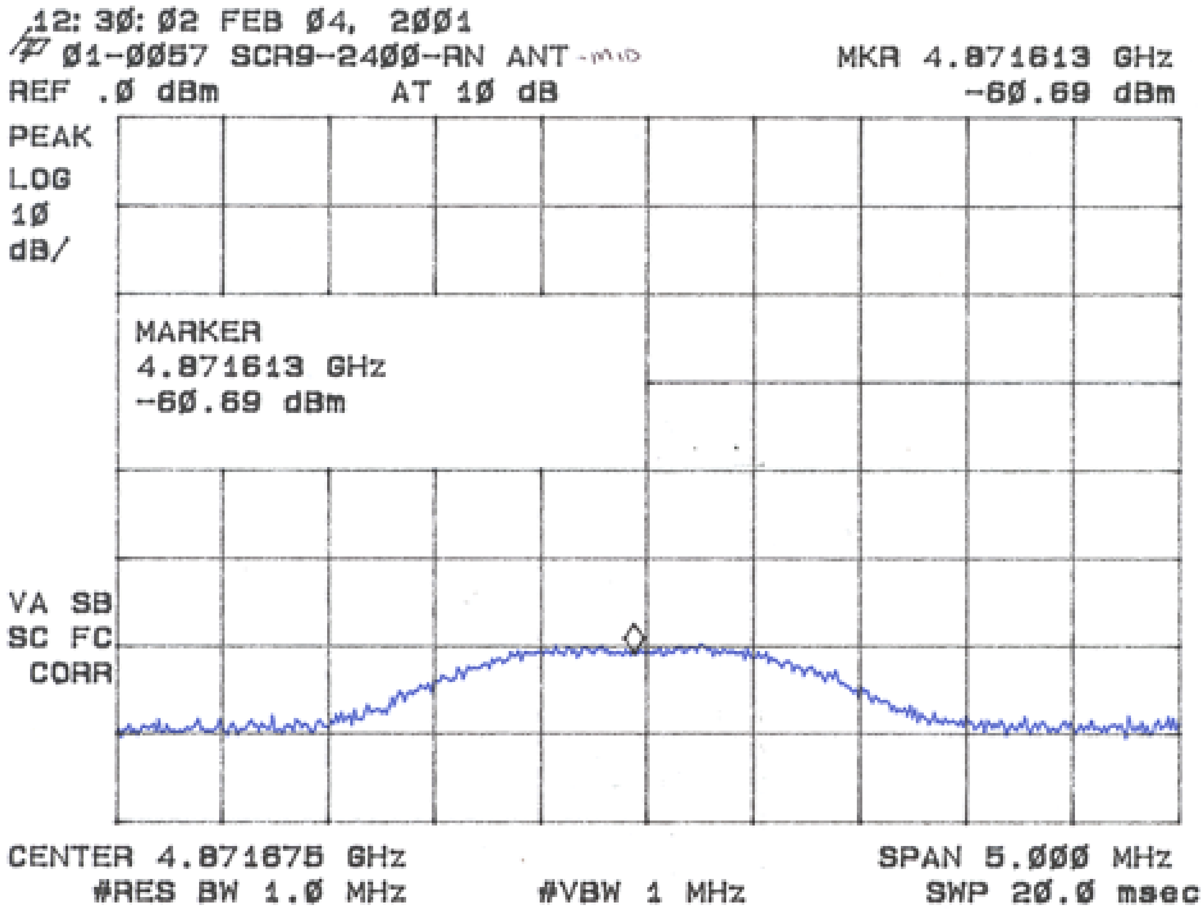


Figure 3j
Peak Radiated Spurious Emission 15.247(c) Mid – Mobile Mark 9 dBi Corner Reflector

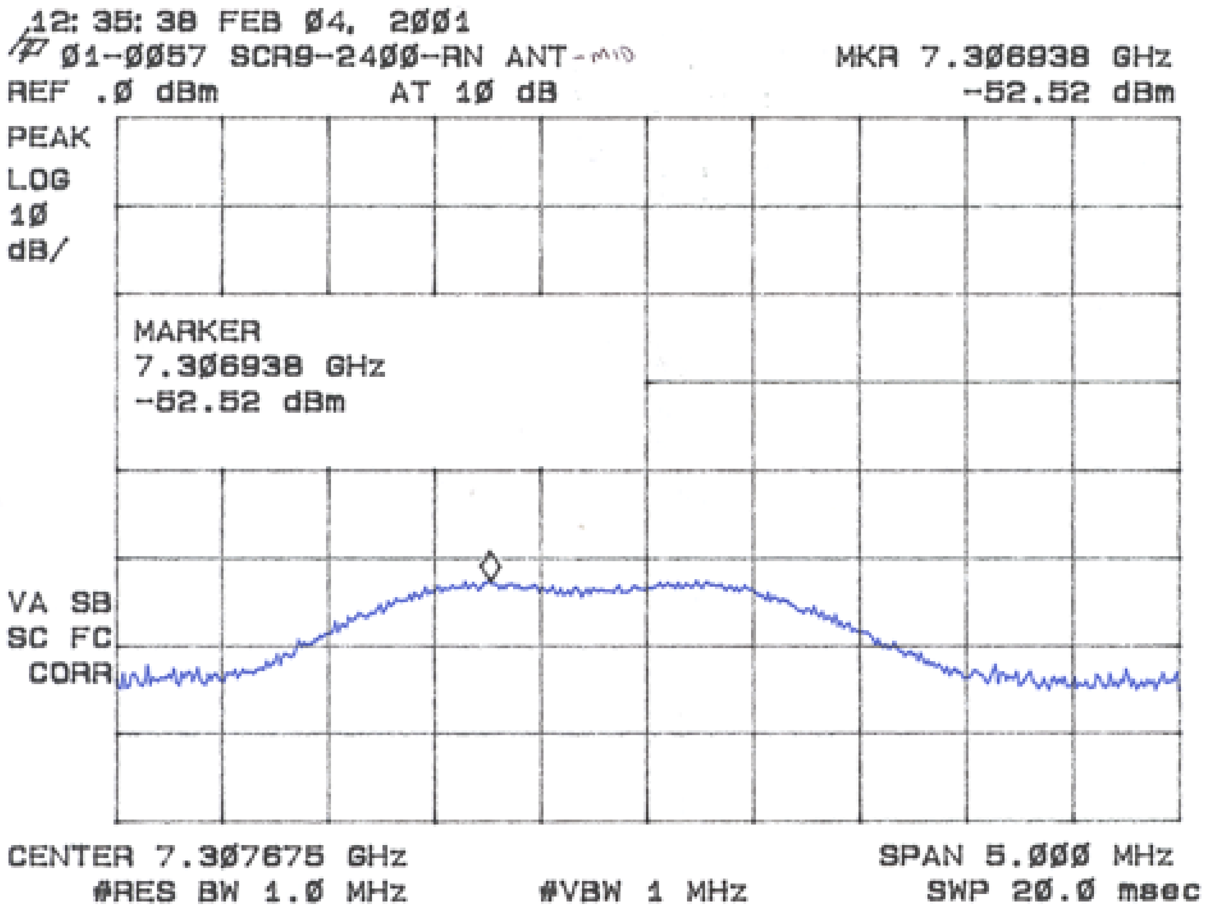


Figure 3k
Peak Radiated Spurious Emission 15.247(c) High– Mobile Mark 9 dBi Corner Reflector

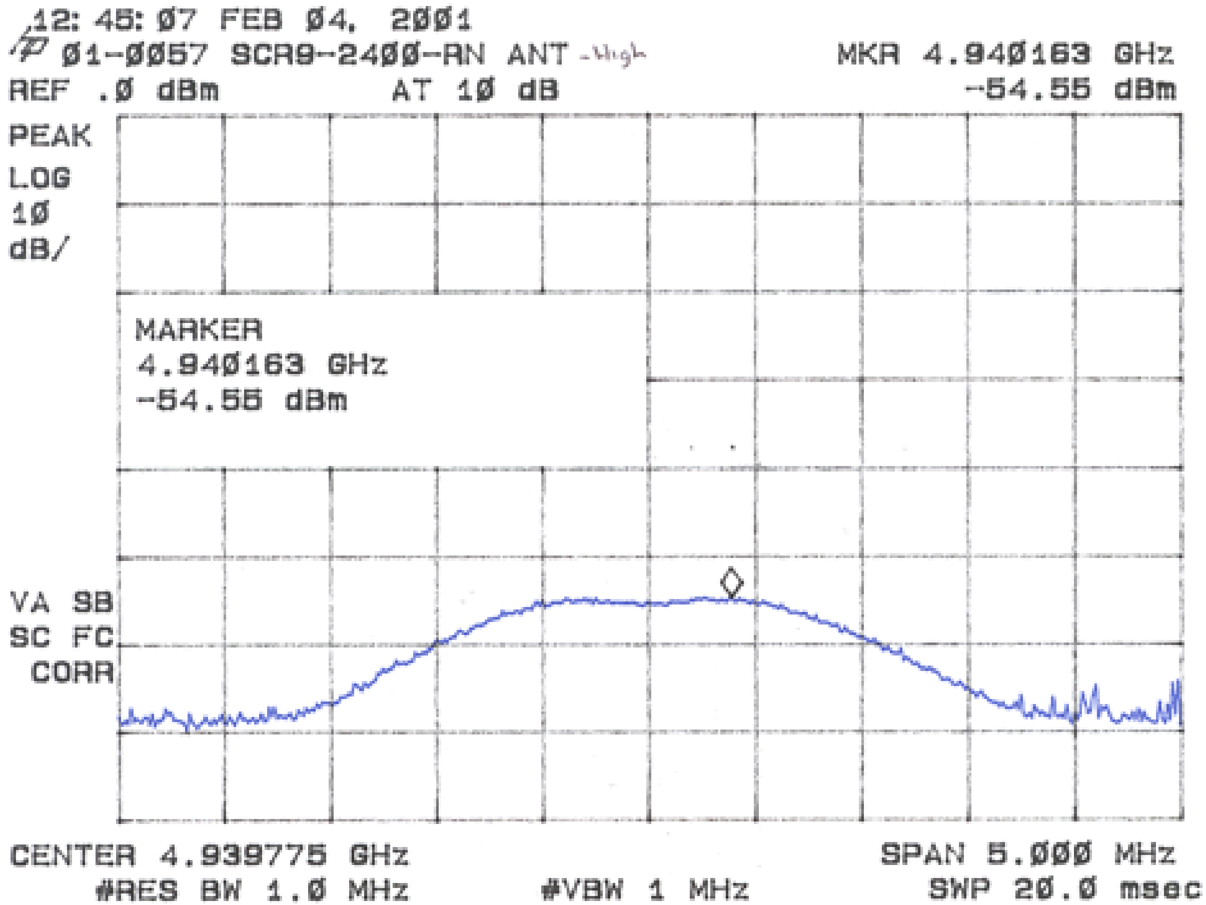


Figure 3I
Peak Radiated Spurious Emission 15.247(c) High– Mobile Mark 9 dBi Corner Reflector

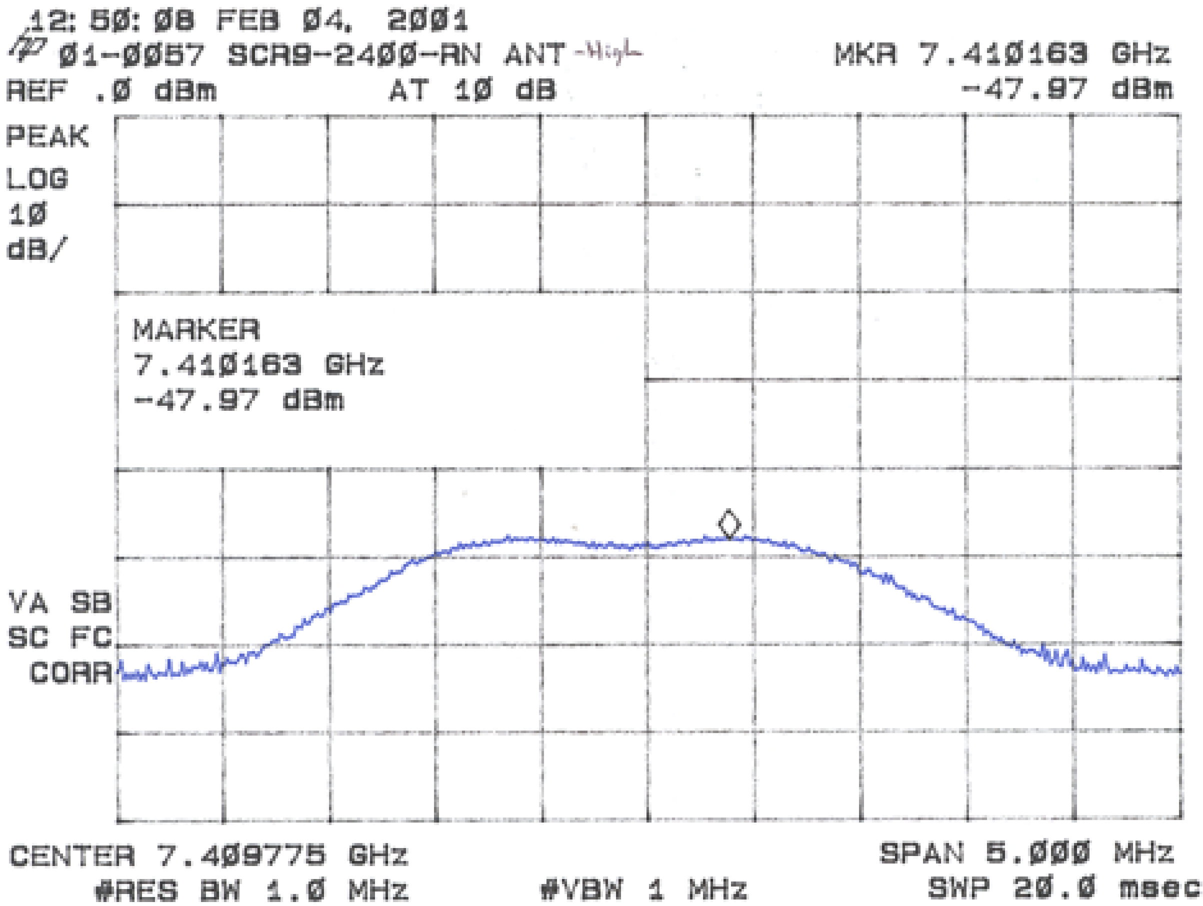


Figure 3m
Peak Radiated Spurious Emission 15.247(c) Low – MaxRad 5 dBi Whip

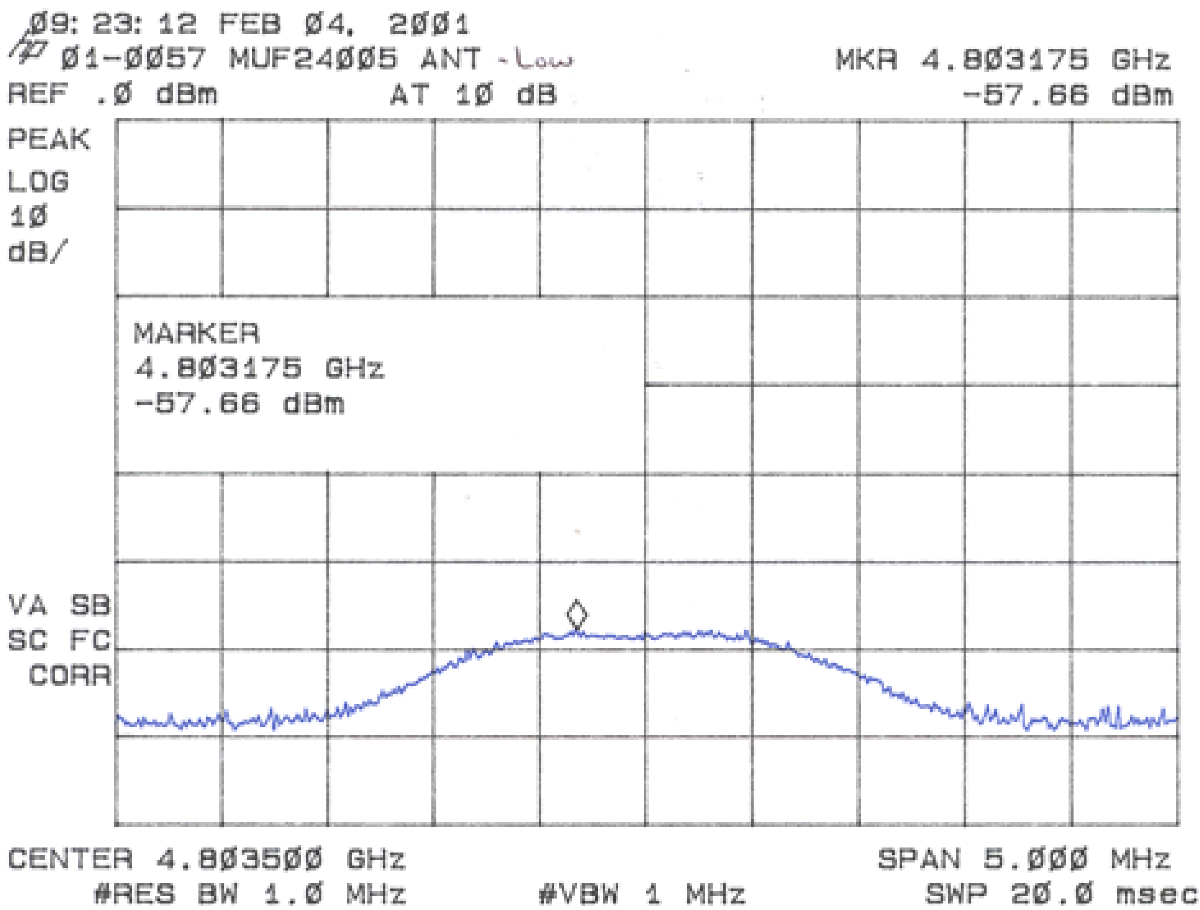


Figure 3n
**Peak Radiated Spurious Emission 15.247(c) Low – MaxRad 5 dBi Whip **

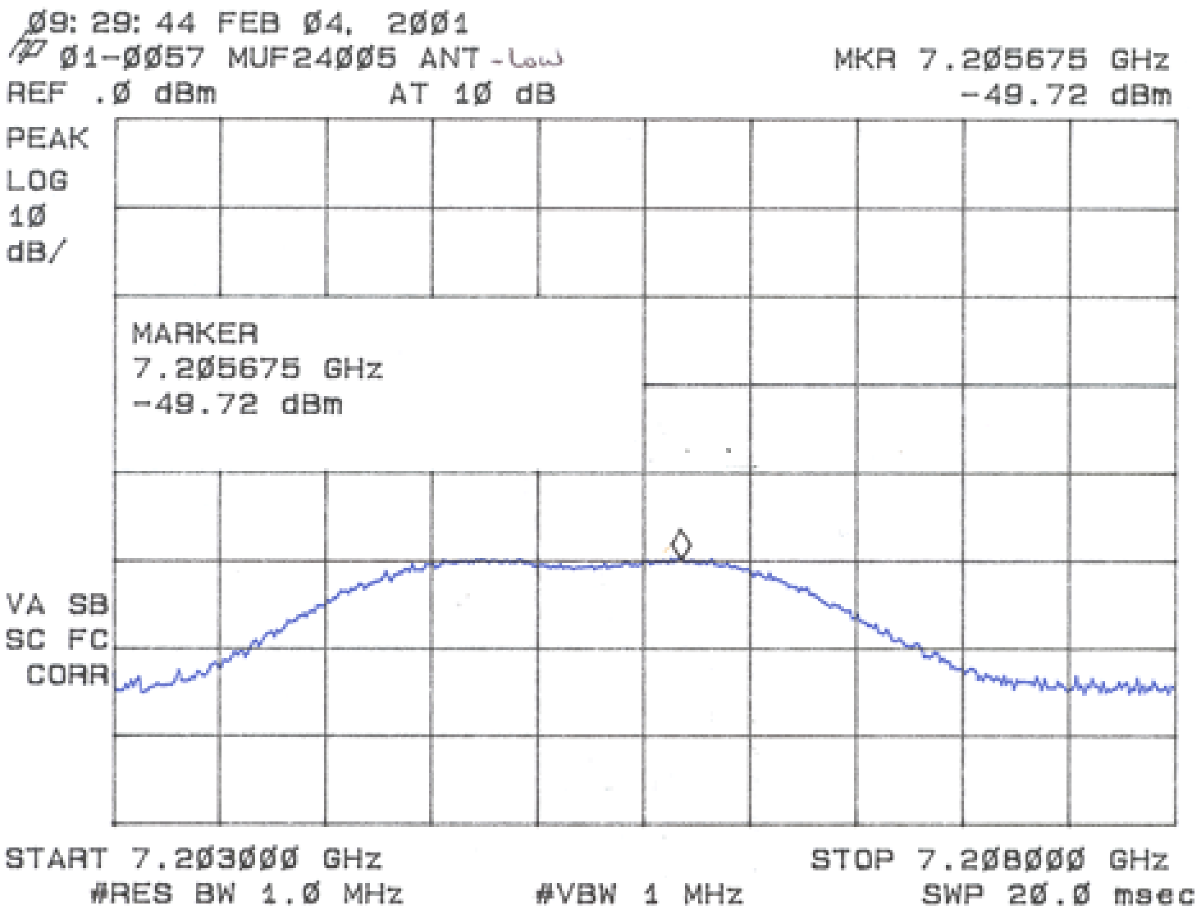


Figure 3o
Peak Radiated Spurious Emission 15.247(c) Mid – MaxRad 5 dBi Whip

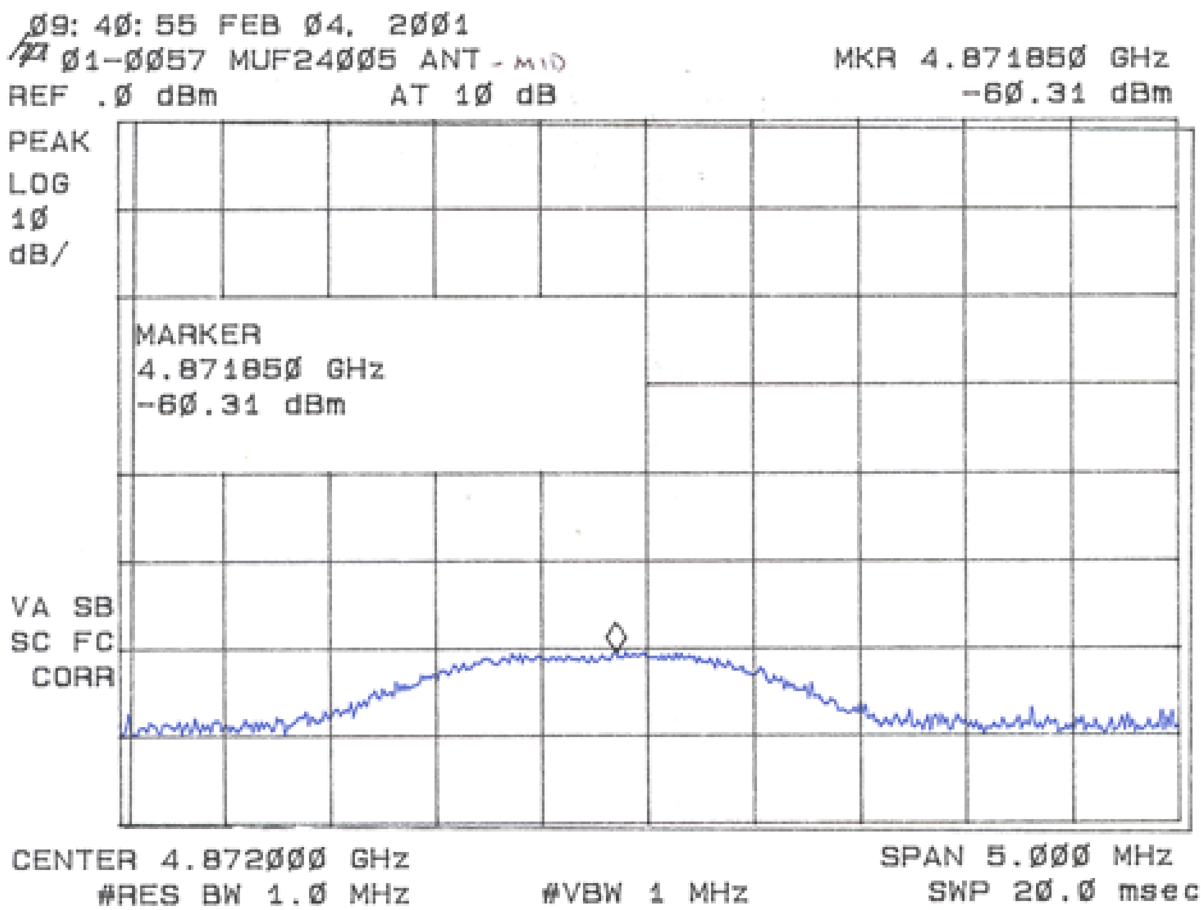


Figure 3p
Peak Radiated Spurious Emission 15.247(c) Mid – MaxRad 5 dBi Whip

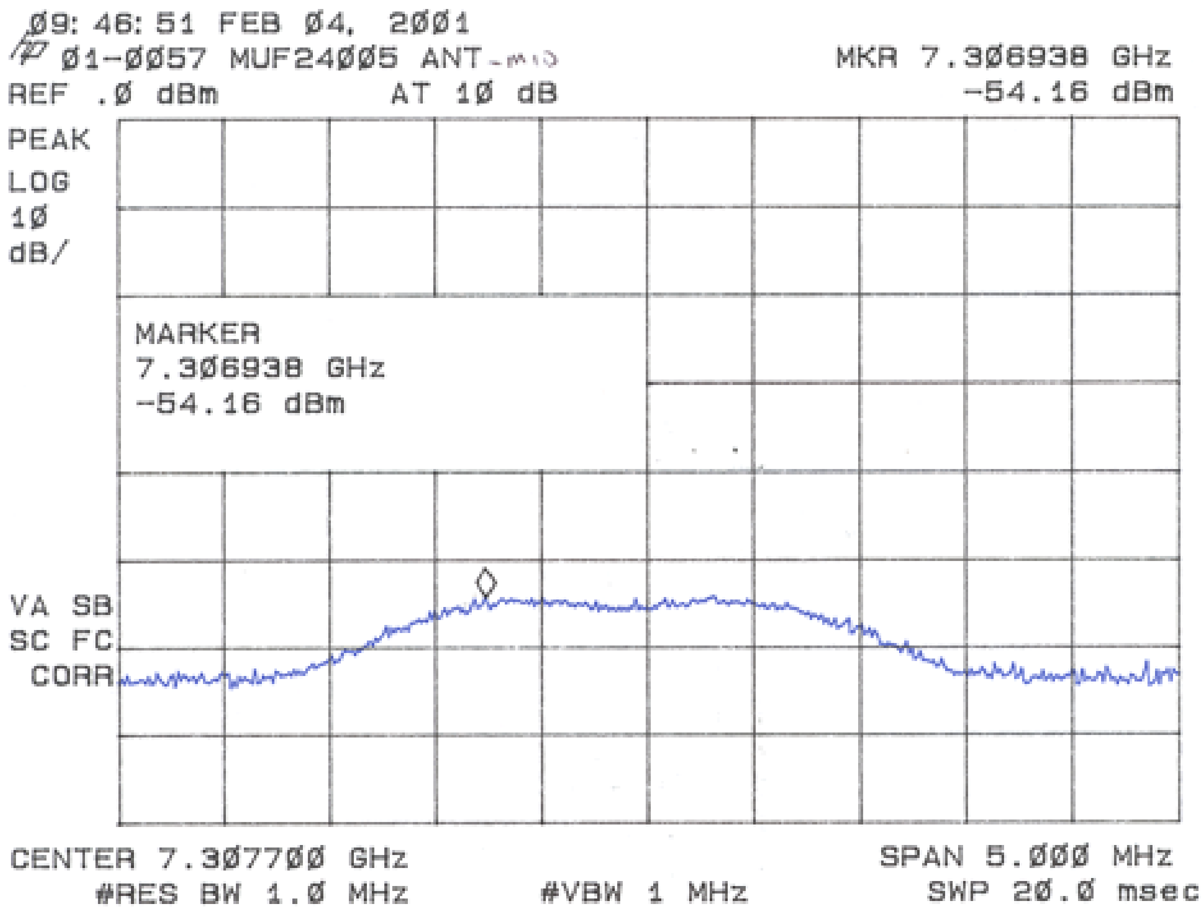


Figure 3q
Peak Radiated Spurious Emission 15.247(c) High – MaxRad 5 dBi Whip

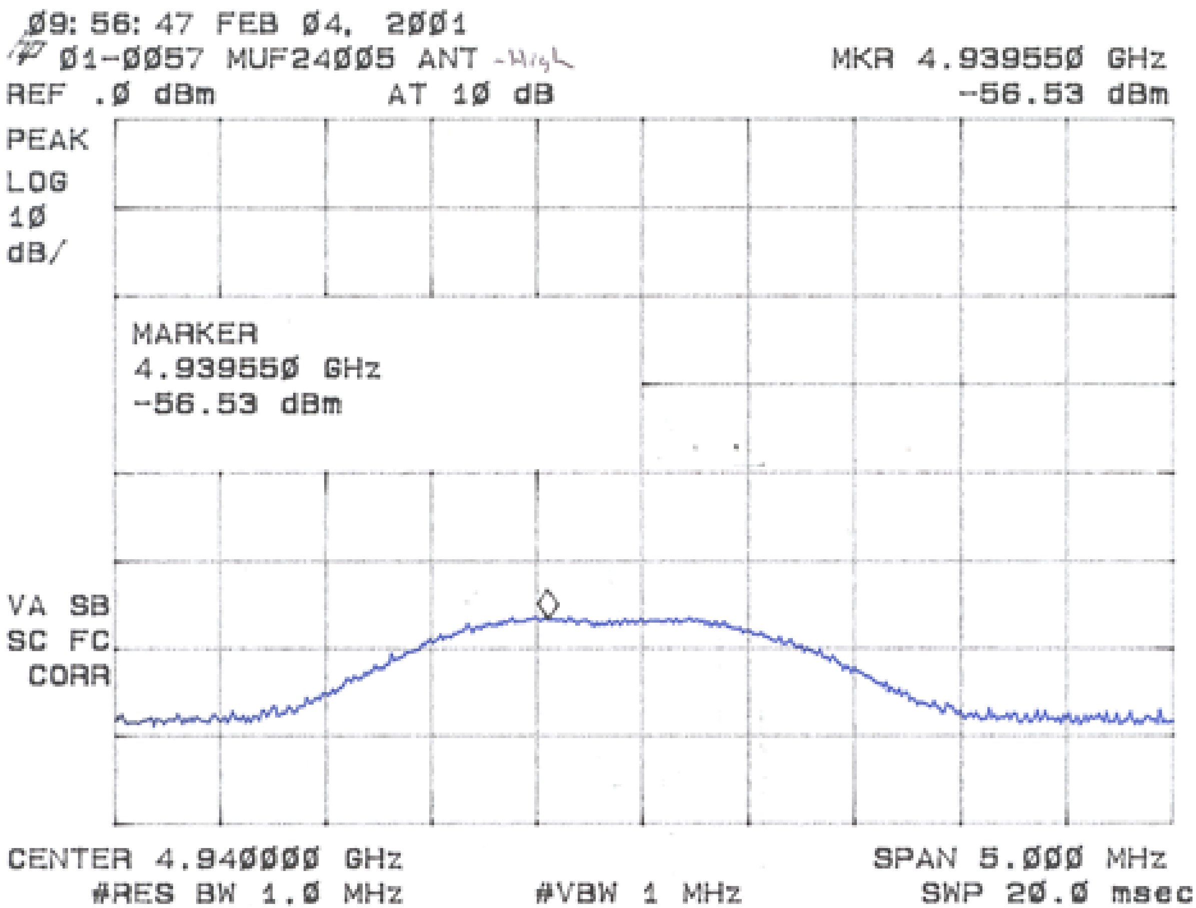


Figure 3r
Peak Radiated Spurious Emission 15.247(c) High – MaxRad 5 dBi Whip

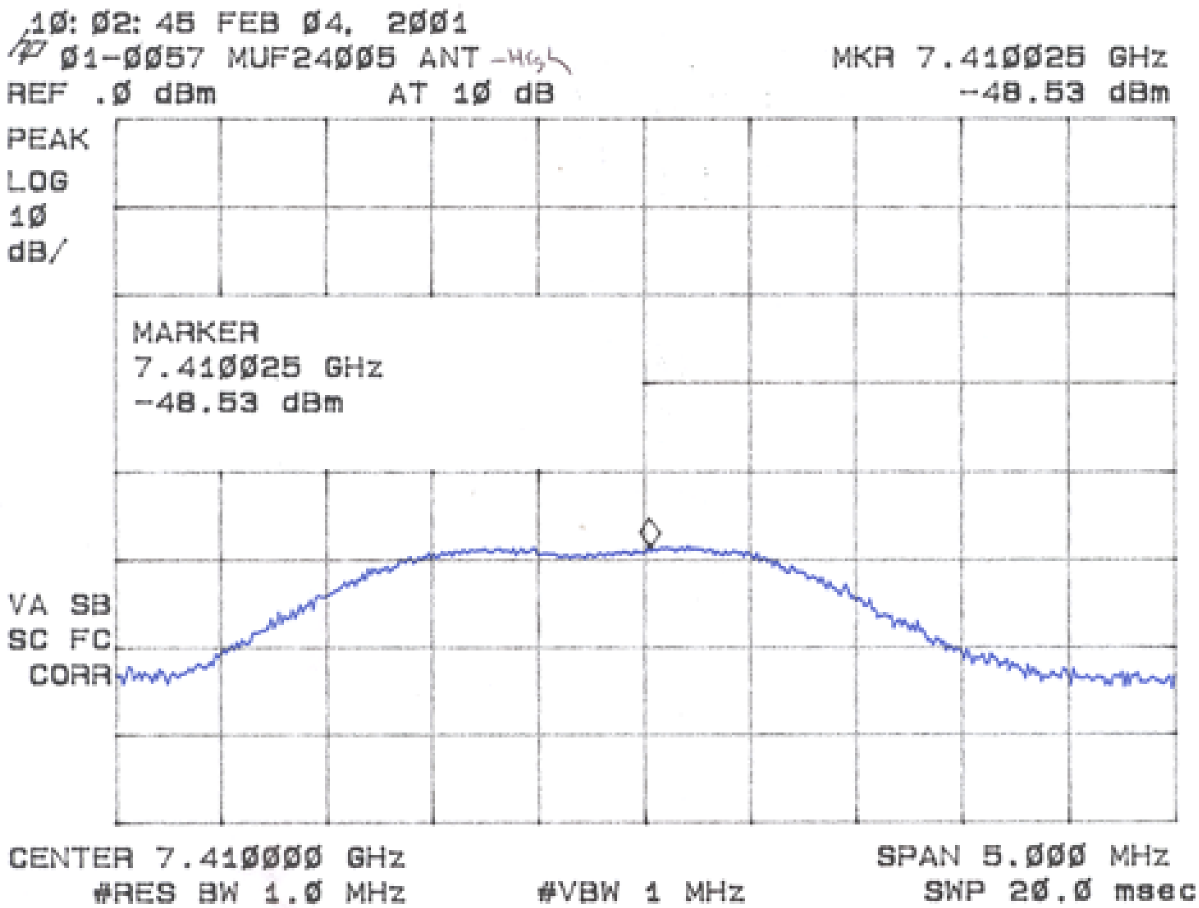


Figure 3s
Peak Radiated Spurious Emission 15.247(c) Low – Andrews 24 dBi Parabolic Dish

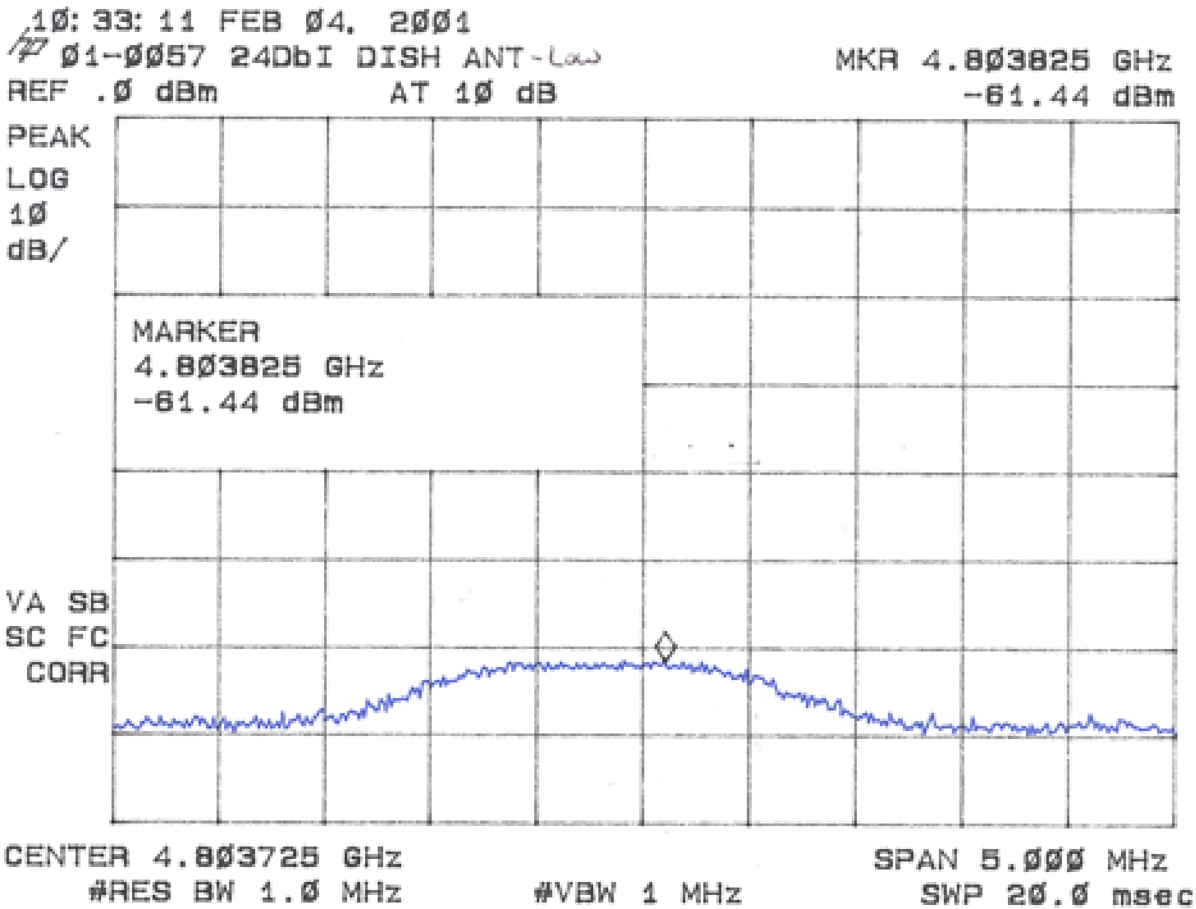


Figure 3t
Peak Radiated Spurious Emission 15.247(c) Low – Andrews 24 dBi Parabolic Dish

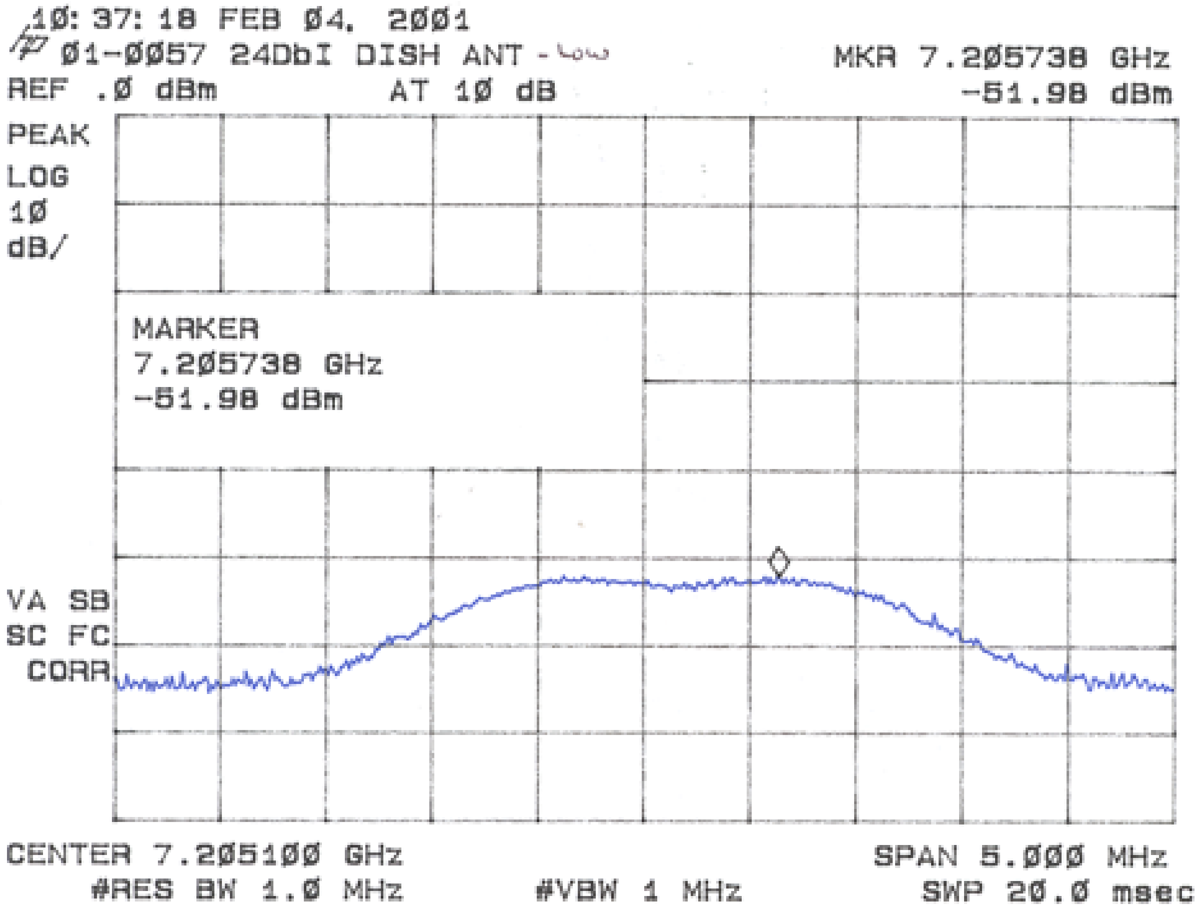


Figure 3u
Peak Radiated Spurious Emission 15.247(c) Mid – Andrews 24 dBi Parabolic Dish

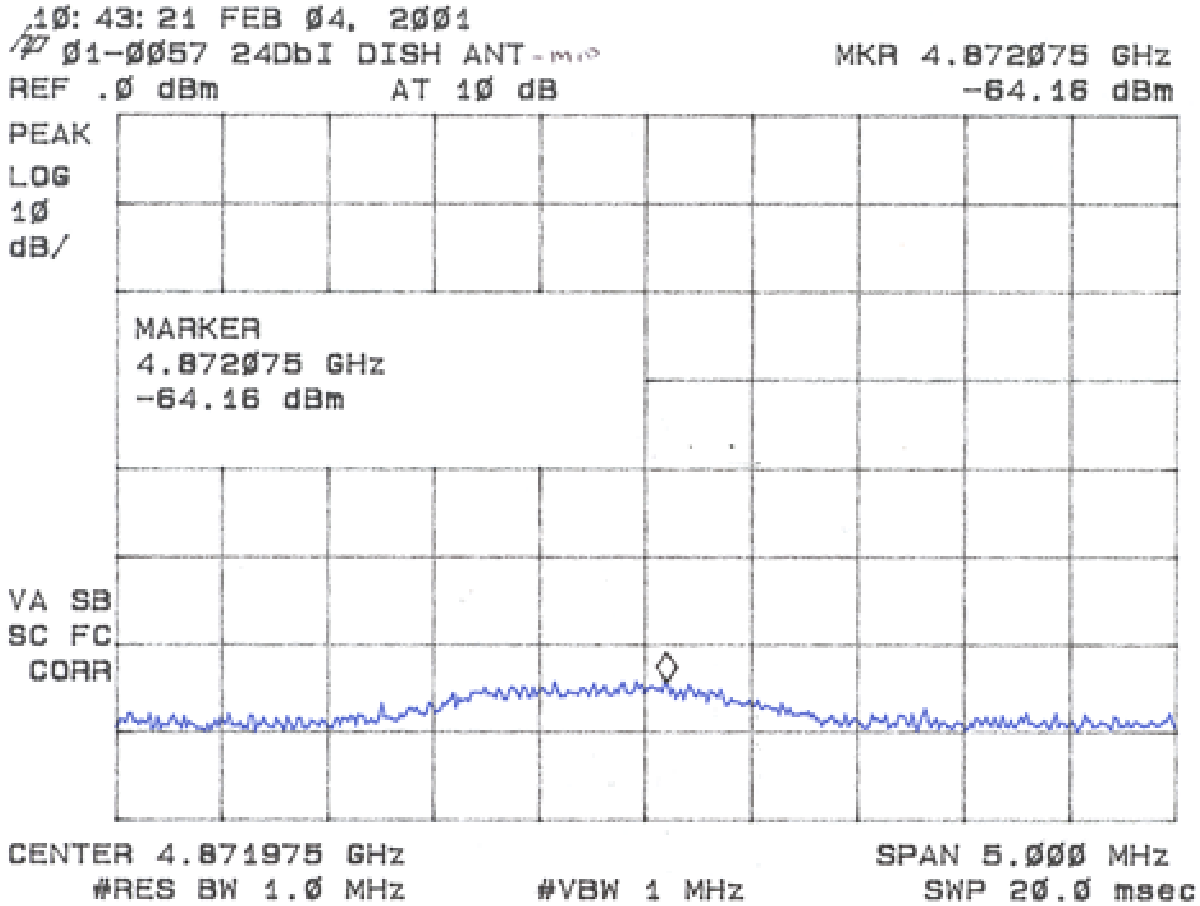


Figure 3v
Peak Radiated Spurious Emission 15.247(c) Mid – Andrews 24 dBi Parabolic Dish

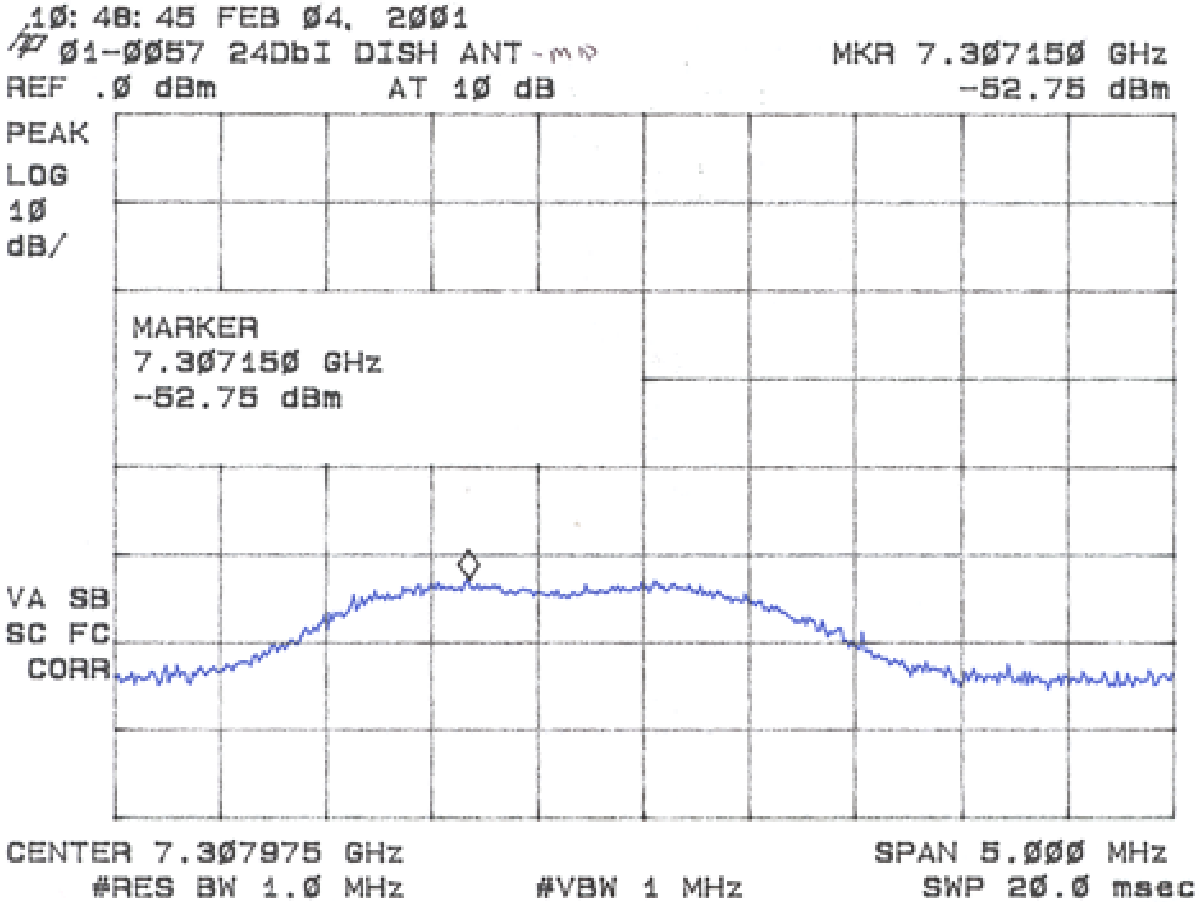


Figure 3w
Peak Radiated Spurious Emission 15.247(c) High - Andrews 24 dBi Parabolic Dish

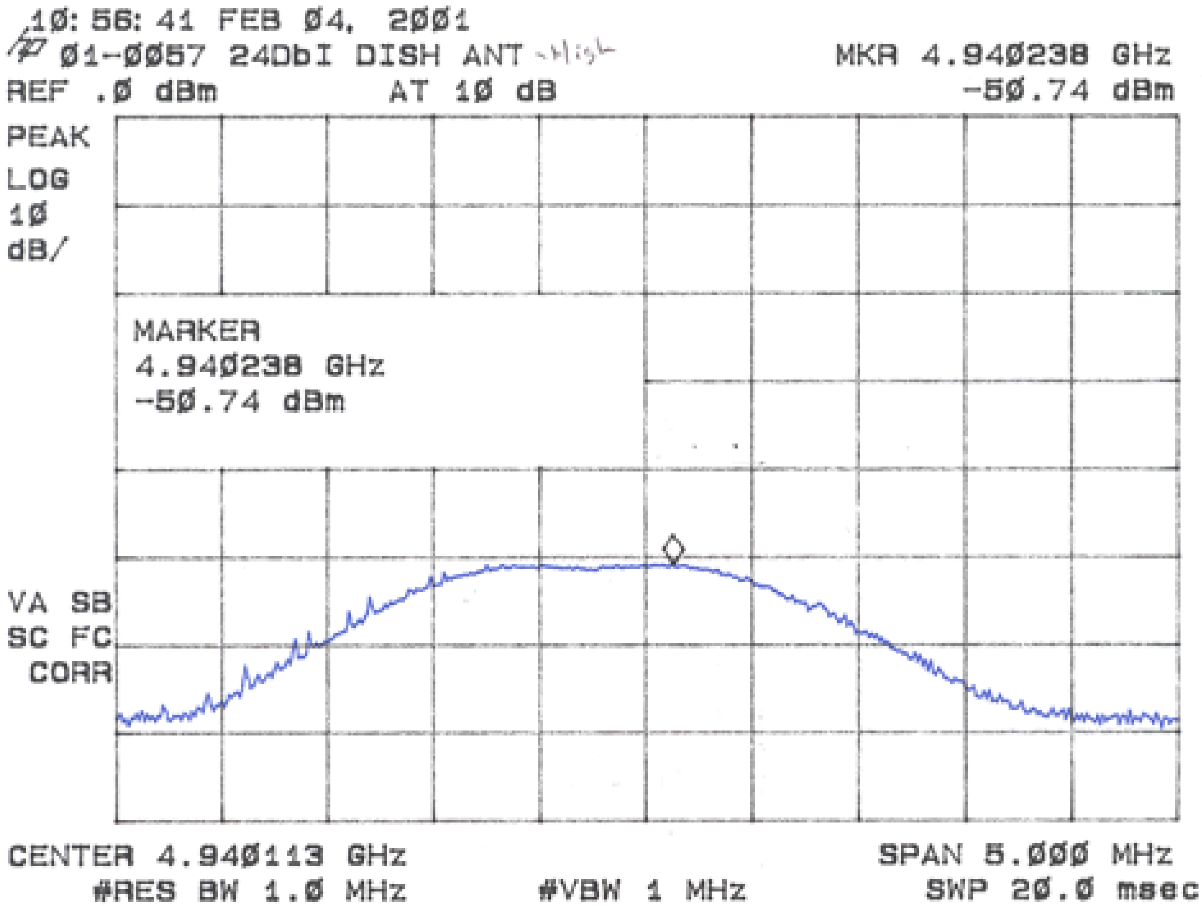
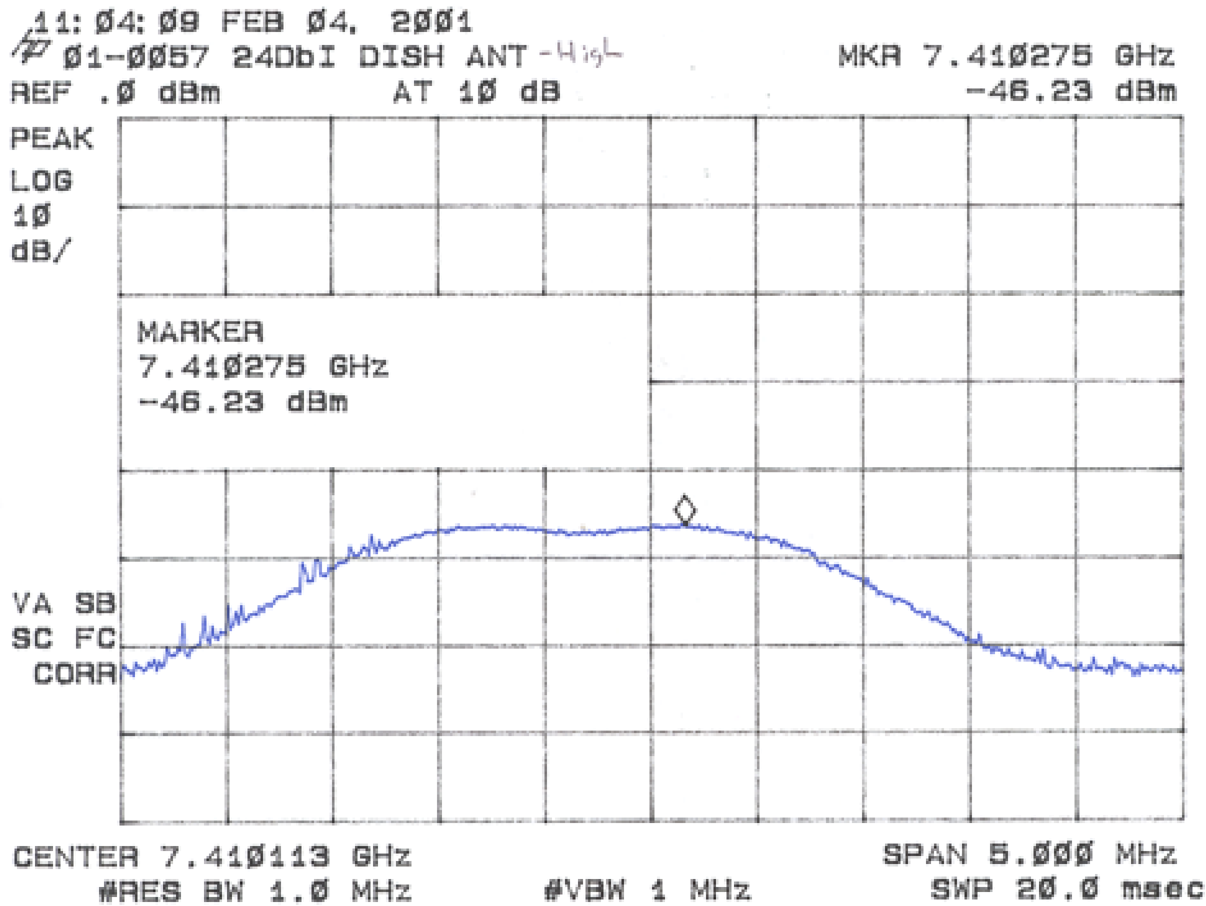


Figure 3x
Peak Radiated Spurious Emission 15.247(c) High - Andrews 24 dBi Parabolic Dish



2.7 Average Spurious Emission in the Frequency Range 30 - 25000 MHz (FCC Section 15.247(c))

The results of average radiated spurious emissions falling within restricted bands are given in Table 4a – 4d. Due to the functionality of the transmitter and the complexity of the test setup in order to measure worse case duty cycle, Cirronet Corporation provided an explanation of the worse case duty cycle of the transmitter (provided on the following pages).

Worst Case Transmit Duty Cycle for WIT2410

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 - worst case being defined as the scenario when the WIT2410 would be transmitting the longest period during a dwell.

This worst case operating scenario is as follows:

1) point-to-point operation
(only two units communicating with one another)

2) data flow is almost completely unidirectional
(that is, one radio is relaying a large amount of data to the other radio with only synchronization data being passed back the other direction)

3) The amount of data being fed to the sending radio is exactly portioned out to fit the maximum packet size allowable (280 bytes). The radio cannot send more than 280 bytes on a single channel – additional data must be sent on the next hop.

For this example, a remote unit is transferring a large data file to a base unit.

Maximum transmit time by Remote on a single channel:

= 280 bytes * 8 bits/byte * (1/460.8Kbps) = 4.86ms

The minimum hop duration for this scenario would be 6.94ms. Given that we have 75 channels in our hop set, it takes 521ms to go through the entire hop table and repeat a transmission on the same channel. Therefore, only 4.86milliseconds worth of data can be transmitted on a single channel in any 100ms time period.

The transmission duty cycle correction factor is then calculated as:

$$20 * \log_{10}(4.86\text{ms}/100\text{ms}) = \mathbf{-26.3\ dB}$$

Table 4a. AVERAGE RADIATED SPURIOUS EMISSIONS (Low)
Mobile Mark 2.5 dBi Vehicle Mount Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.803	-83.25	33.9	34.5	3.4	24.6	500.0
7.205	-73.09	33.7	37.4	4.7	130.2	500.0

Table 4a. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
Mobile Mark 2.5 dBi Vehicle Mount Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.871	-86.42	33.9	34.7	3.4	17.5	500.0
7.307	-77.19	33.7	37.4	4.7	81.6	500.0

Table 4a. AVERAGE RADIATED SPURIOUS EMISSIONS (High)
Mobile Mark 2.5 dBi Vehicle Mount Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.939	-82.16	33.9	34.9	3.5	29.3	500.0
7.410	-71.96	33.7	37.5	4.7	149.7	500.0

*** - Data corrected by 1 dB for loss of high pass filter and 20 Log_{10} (4.86ms/100ms) = -26.3 dB**

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-83.25 –33.9 + 34.5 + 3.4 + 107)/20) = 24.6
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: _________________________ **Name: Sam Wismer**

Table 4b. AVERAGE RADIATED SPURIOUS EMISSIONS (Low)
Mobile Mark 9 dBi Corner Reflector Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.803	-83.01	33.9	34.5	3.4	25.3	500.0
7.205	-76.65	33.7	37.4	4.7	86.4	500.0

Table 4b. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
Mobile Mark 9 dBi Corner Reflector Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.871	-85.99	33.9	34.7	3.4	18.4	500.0
7.307	-77.82	33.7	37.4	4.7	75.9	500.0

Table 4b. AVERAGE RADIATED SPURIOUS EMISSIONS (High)
Mobile Mark 9 dBi Corner Reflector Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.939	-79.78	33.9	34.9	3.5	38.3	500.0
7.410	-73.27	33.7	37.5	4.7	128.7	500.0

*** - Data corrected by 1 dB for loss of high pass filter and 20 Log$_{10}$ (4.86ms/100ms) = -26.3 dB**

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-83.01 – 33.9 + 34.5 + 3.4 + 107)/20) = 25.3
CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature: ____________________ **Name:** __Sam Wismer__

Table 4c. AVERAGE SPURIOUS EMISSIONS (Low)
MaxRad 5 dBi Whip Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.803	-82.96	33.9	34.5	3.4	25.4	500.0
7.205	-75.02	33.7	37.4	4.7	104.3	500.0

Table 4c. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
MaxRad 5 dBi Whip Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.871	-85.61	33.9	34.7	3.4	19.2	500.0
7.307	-79.46	33.7	37.4	4.7	62.8	500.0

Table 4c. AVERAGE RADIATED SPURIOUS EMISSIONS (High)
MaxRad 5 dBi Whip Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.939	-81.83	33.9	34.9	3.5	30.5	500.0
7.410	-73.83	33.7	37.5	4.7	120.7	500.0

*** - Data corrected by 1 dB for loss of high pass filter and 20 Log_{10} (4.86ms/100ms) = -26.3 dB**

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-82.96 - 33.9 + 34.5 + 3.5 + 107)/20) = 25.4
CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature: ____________________ **Name:** __Sam Wismer__

Table 4d. AVERAGE RADIATED SPURIOUS EMISSIONS (Low)
Andrews 24 dBi Parabolic Dish Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.803	-86.74	33.9	34.5	3.4	16.5	500.0
7.205	-77.28	33.7	37.4	4.7	80.4	500.0

Table 4d. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
Andrews 24 dBi Parabolic Dish Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.871	-89.46	33.9	34.7	3.4	12.3	500.0
7.307	-78.05	33.7	37.4	4.7	73.9	500.0

Table 4d. AVERAGE RADIATED SPURIOUS EMISSIONS (High)
Andrews 24 dBi Parabolic Dish Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.939	-76.04	33.9	34.9	3.5	59.3	500.0
7.410	-71.53	33.7	37.5	4.7	157.3	500.0

*** - Data corrected by 1 dB for loss of high pass filter and 20 Log_{10} (4.86ms/100ms) = -26.3 dB**

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-86.74 – 33.9 + 34.5 + 3.4 + 107)/20) = 16.5
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________ **Name: Sam Wismer**

SECTION 3

PHOTOGRAPHS

PHOTOS OF THE TESTED EUT

The following photos are attached:

Photo 1.	Antenna, Mobile Mark 2.5 dBi Vehicle Mount (M/N RM3-2400-RTNC)
Photo 2.	Antenna, Mobile Mark 9 dBi Corner Reflector (M/N SCR9-2400-RN)
Photo 3.	Antenna, MaxRad 5 dBi Whip (M/N MUF24005-RTNC)
Photo 4.	Antenna, Andrews 18 dBi Parabolic Dish (M/N 18T-2400 A)
Photo 5.	Antenna, Andrews 24 dBi Parabolic Dish (M/N 26T-2400 A)

Photo 1. Antenna, Mobile Mark 2.5 dBi Vehicle Mount (M/N RM3-2400-RTNC)

Photo 2. Antenna, Mobile Mark 9 dBi Corner Reflector (M/N SCR9-2400-RN)

Photo 3.	Antenna, MaxRad 5 dBi Whip (M/N MUF24005-RTNC)

Photo 4. Antenna, Andrews 18 dBi Parabolic Dish (M/N 18T-2400 A)

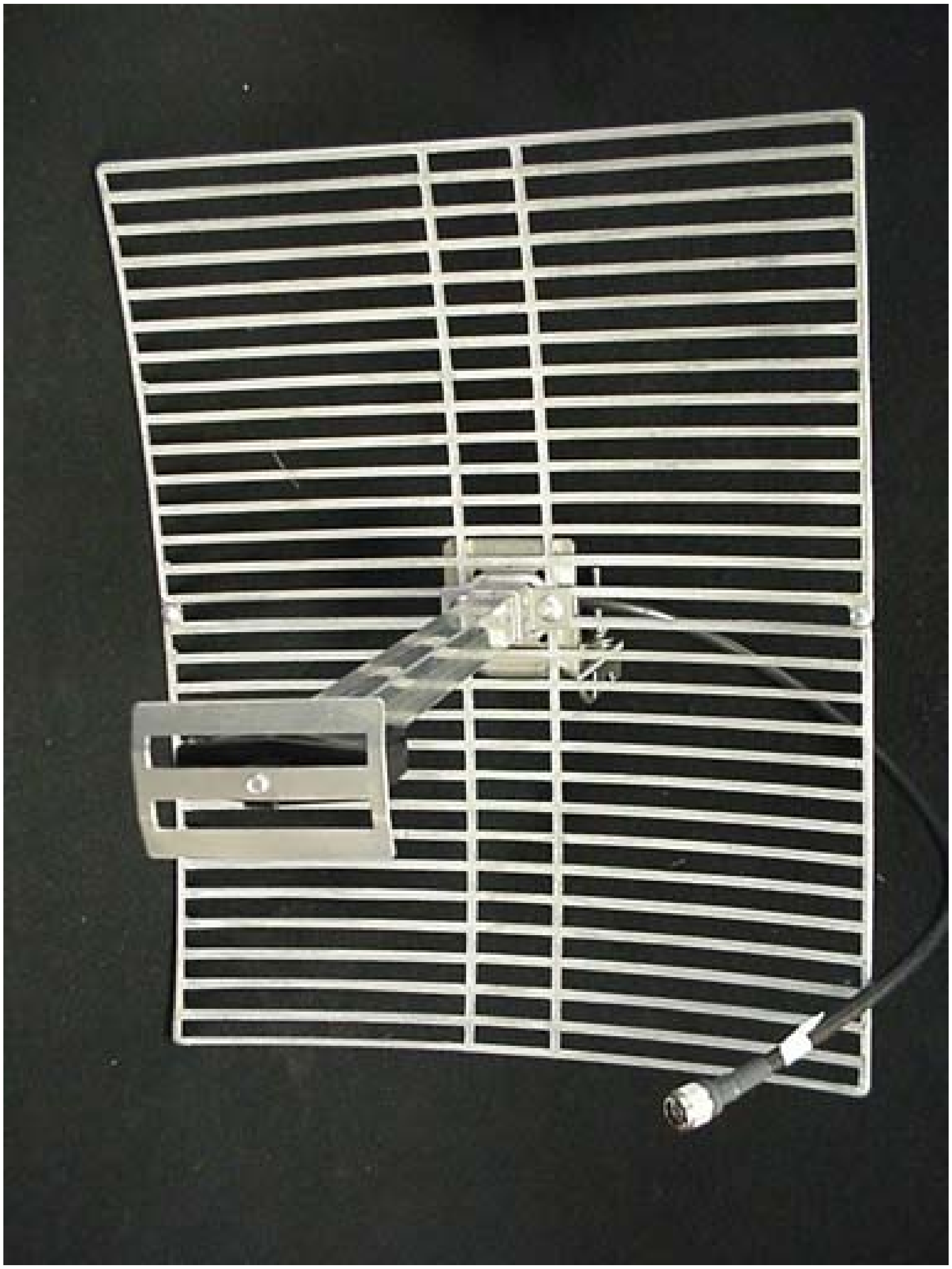


Photo 5. Antenna, Andrews 24 dBi Parabolic Dish (M/N 26T-2400 A)