U.S. TECH
A TRADITION IN TESTING SERVICES

Digital Wireless Corporation
FCC Part 15, Certification Application
WIT2410

July 12, 1999

3505 Francis Circle • Alpharetta, GA 30004
Tel: (770) 740-0717 • Fax: (770) 740-1508 • www.ustech-lab.com

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **Digital Wireless Corporation**

MODEL: **WIT2410**

FCC ID: **HSW-2410M**

DATE: **July 12, 1999**

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

Equipment type: ________________________

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 Digital Wireless Corporation, Model WIT2410 modular 2.4 GHz spread spectrum transceiver. The EUT will be used with one of seven different antennas.

1.2 Related Submittal(s)/Grant(s)

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

The EUT is subject to the following authorizations:

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

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

SECTION 2

TESTS AND MEASUREMENTS

TEST AND MEASUREMENTS

2.1 Configuration of Tested System

The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (1992). Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. 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 April 23 in good condition.

2.2 Test Facility

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

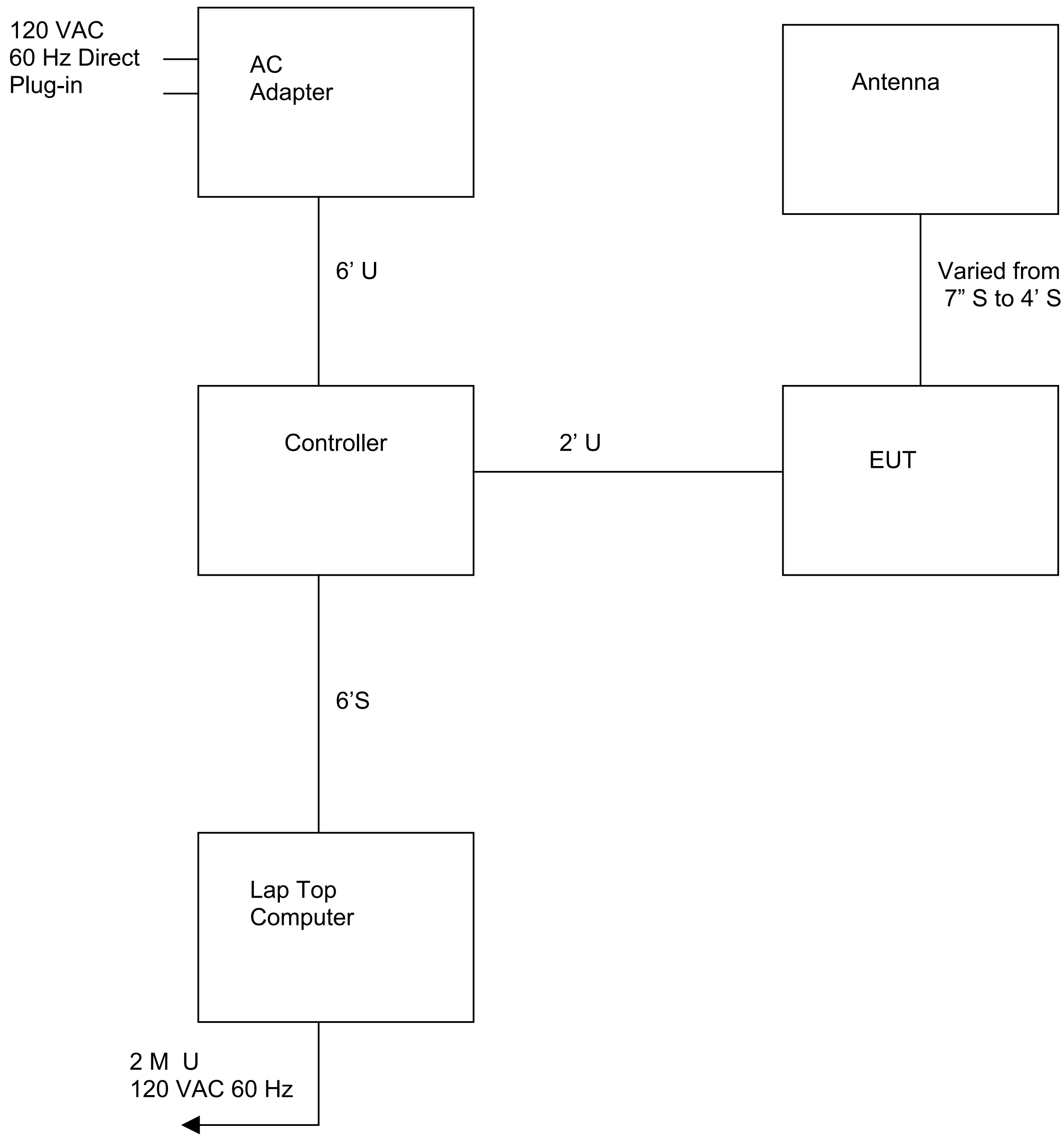
2.3 Test Equipment

Table 2 describes test equipment used to evaluate this product.

2.4 Modifications

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

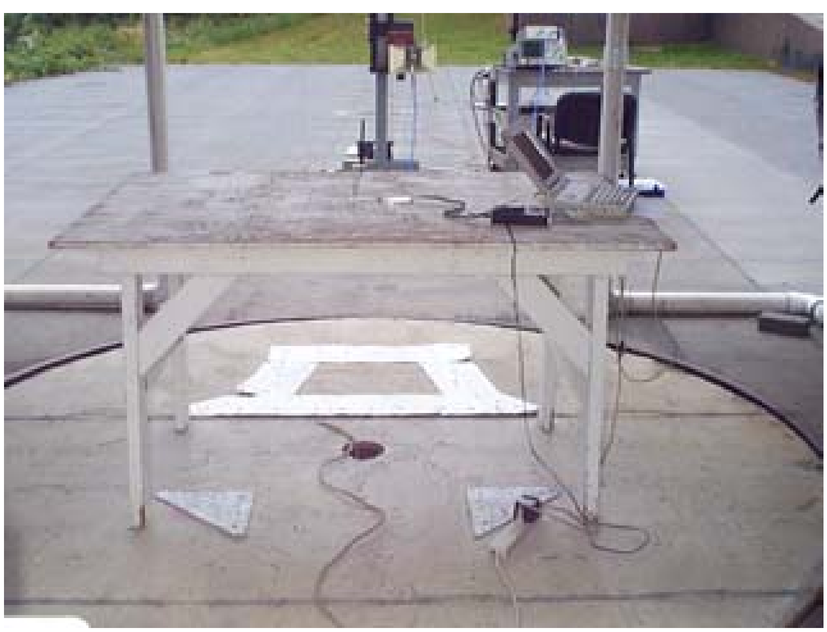
FIGURE 1
TEST CONFIGURATION



Test Date: April 23, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

FIGURE 2a

Photograph(s) for Spurious and Fundamental Emissions (Ace Dipole)



Test Date: April 23, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

FIGURE 2b

Photograph(s) for Spurious and Fundamental Emissions (6 dBi Omni)

Test Date: April 23, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

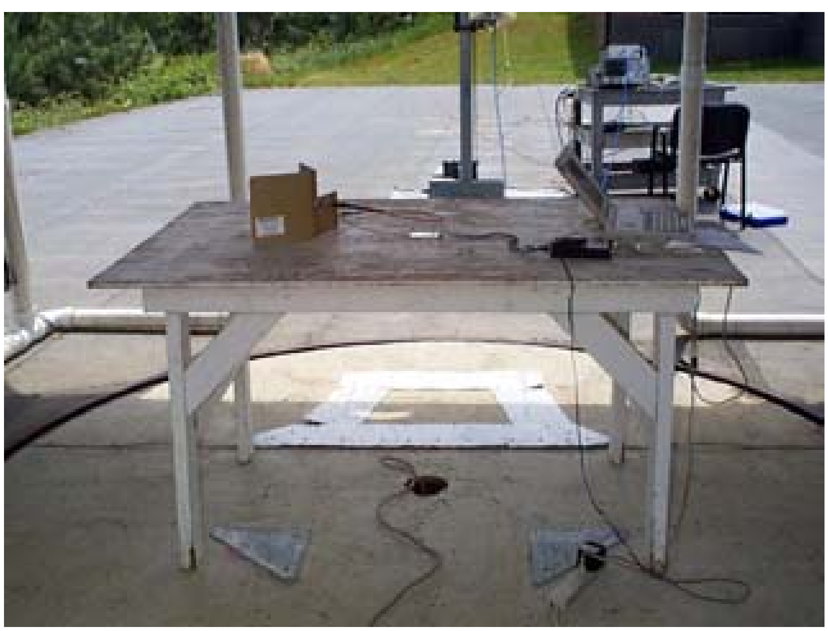
FIGURE 2c

Photograph(s) for Spurious and Fundamental Emissions (12 dBi Omni)

Test Date: April 23, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

FIGURE 2d

Photograph(s) for Spurious and Fundamental Emissions
(14 dBi Corner Reflector)



Test Date: April 23, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

FIGURE 2e

Photograph(s) for Spurious and Fundamental Emissions (DWC Patch)

Test Date: April 29, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

FIGURE 2f

Photograph(s) for Spurious and Fundamental Emissions (Mobile Mark Patch)

Test Date: April 23, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

FIGURE 2g

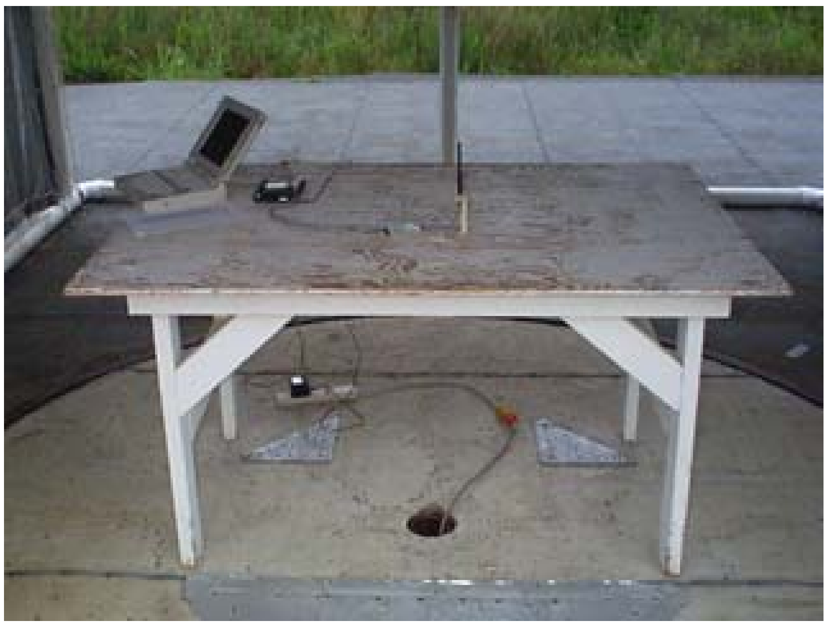
Photograph(s) for Spurious and Fundamental Emissions (Cushcraft14 dBi Yagi)

Photographs Not Available

Test Date: April 26, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

FIGURE 2h

Photograph(s) for Digital Device Emissions (Using Ace Dipole)



Test Date: April 26, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

FIGURE 2i

Photograph(s) for Conducted Emissions (Various Antennas)

TABLE 1

Test Date: April 23, 1999-April 29, 1999
UST Project: 99-317
Customer: Digital Wireless
Model: WIT 2410M

EUT and Peripherals

PERIPHERAL MANU.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
(EUT) Digital Wireless Corporation	WIT 2410M	00239	HSW-2410M	2'U
Antenna	Various, see antenna descriptions		None	Varied from 7" S to 4' S
AC Adapter CUI Stack	DV-1280	0695	None	120 VAC 60 Hz Direct Plug-in
Controller Digital Wireless Corporation	DWC	None	None	6' U
Lap Top Computer LTE Elite	4/75CX	6520HFJ6F406	CNT75MB1CB	2m 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

2.6 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.

Digital Wireless 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
Digital Wireless Corporation	Patch	PA2410	Appx. 3 dBi	Non-standard MMCX

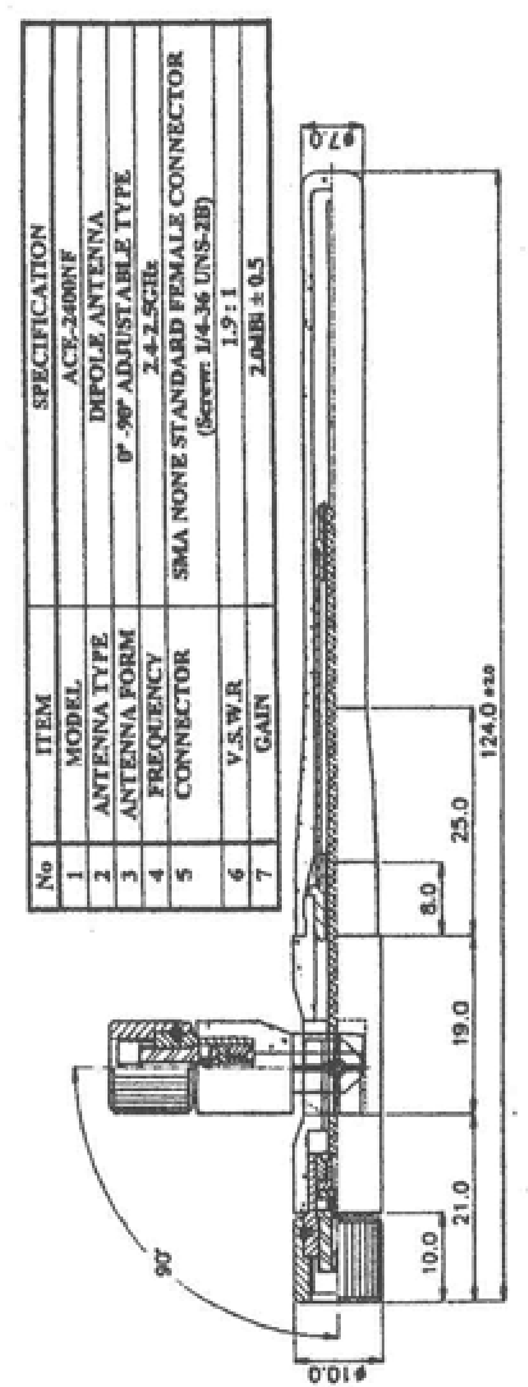
*For more specific antenna specifications, please see the following pages.

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

Digital Wireless 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. We 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 Digital Wireless 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 Digital Wireless that will connect the MMCX port on our 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, Digital Wireless Corporation believes that this procedure meets the requirements called out in 15.203.

The sixth antenna included in our 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. Digital Wireless has no official data sheet for this antenna. Lab measurements show an approximate antenna gain of 3dBi for the device.



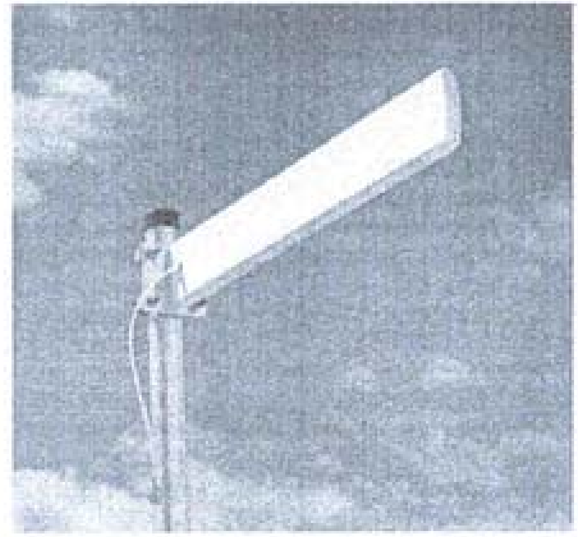
No	ITEM	SPECIFICATION
1	MODEL	ACE-2400NF
2	ANTENNA TYPE	DIPOLE ANTENNA
3	ANTENNA FORM	0°-90° ADJUSTABLE TYPE
4	FREQUENCY	2.4-2.5GHz
5	CONNECTOR	SMA NONE STANDARD FEMALE CONNECTOR (Screw: 1/4-36 UNS-2B)
6	V.S.W.R	1.9:1
7	GAIN	2.0dBi ± 0.5

Radome Enclosed Yagis

PC2415N

Specifications

Minimum Gain (dBi/dBd)	15.0 / 13.0
Bandwidth (MHz)	2400-2500
Impedance (Ohms)	50
VSWR	1.5:1
Polarization	Linear
E Plane Beamwidth (@ -3 dB point)	30
H Plane Beamwidth (@ -3 dB point)	34
Front/Back Ratio (dB)	18
Maximum Power (watts)	50
Wind Rating (MPH)	125
L x W x D (inches)	26.0 x 4.0 x 1.5
Weight (pounds)	1.25
Mounting	1.5-2.2 OD

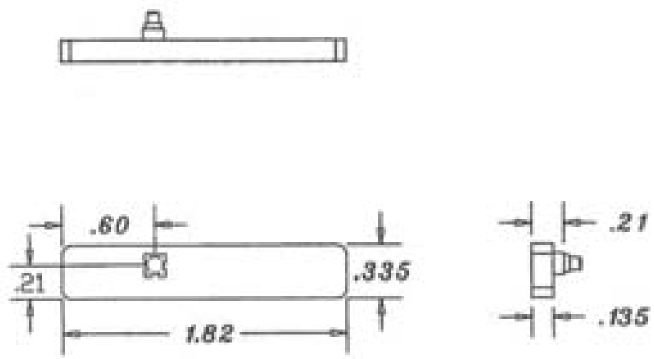


- *Directional*
- *Sealed, UV Stable Radome*
- *Easy Installation*
- *Also at 1.7 and 1.8GHz*

Cushcraft Corporation

REVISIONS

REV	CC NO.	DESCRIPTION	DRN	ENGR. CHK.	DATE



1. CONNECTOR IS HUBER-SUHNER TYPE 81 MMCX-50-0-1 (PLUG) OR EQUIVALENT.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE: INCHES--------XXXXXXX
MM--------[XXXXXX]

TOLERANCES
.XX = ±.02 INCHES
[.X] = ±.5 MM
ANGULAR = ±.5° .XXX = ±.006 INCHES
[.XX] = ±.15 MM

THIRD ANGLE PROJECTION

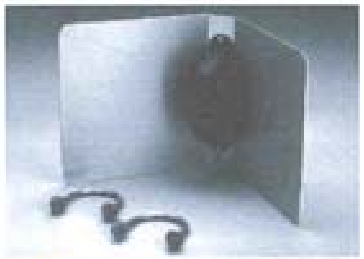
DIGITAL WIRELESS CORP.
ONE MECA WAY, NORCROSS, GA 30093 USA
TEL (770) 564-5540 FAX (770) 564-5541

TITLE DRAWING, ASSEMBLY
2.4 GHz PATCH ANTENNA
WIT2410M

DRAWN: PM	DATE 14MAY99	DESCRIPTION THIS PAGE	
ENGR. PM	DATE 14MAY99	SIZE A / SCALE 1:1 / DOC NUMBER 800262	REV. —
ENGR. MGR. MT	DATE 14MAY99	PART NUMBER	SHEET 1 OF 1

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

Product Specifications

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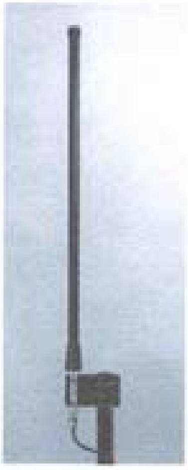


OD12 Series Antenna

OD9 Series with Reflector Option Kit

OD Series Omni Antenna

For WLAN, Video, PCS, and Data Systems

- 6 dBi, 9 dBi & 12 dBi antennas provide uniform omni coverage
- Unique design allows economical build out
- Mounting kit includes all hardware needed
- Reflector option provides directional beamshaping & increased performance

The OD Series Antennas are optimized for use in a wide variety of wireless systems. They are usable in point to point, multipoint and broadcast configurations. Typical uses include WLAN access points or bridge, PCS Micro-cell, and video surveillance transmitters.

These antennas consist of a collinear array with elements stacked vertically. Unique phasing cancels out-of-phase current distribution, improving system performance. This design maintains an omni pattern in the horizontal plane. The OD Series are free space antennas and can be mounted anywhere; no ground plane is required.

An option for the OD series is a reflector kit that beam shapes the omni pattern into a directional cardioid shape. This can result in improved performance for gain, and isolation for reduced interference.

The low profile black radome (1" diameter) makes the OD Series durable and rugged. They can withstand the harshest environments of snow, wind, rain and ice. The feed assembly is made of precision machined aluminum components and is irridited for weather protection. The OD Series comes with all the hardware needed to install it to a mast. Customized hardware is also available for unique mounting needs. For ISM, special connectors and models with cable are available including reverse polarized; please consult factory.

Model Numbers

Model	Freq.(MHz)	Gain	Applications
OD6-1800	1700-1900	6 dBi	PCN, Surveillance
OD9-1800	1700-1900	9 dBi	PCN, Surveillance
OD6-1900	1850-1990	6 dBi	PCS, CDMA/TDMA
OD9-1900	1850-1990	9 dBi	PCS, CDMA/TDMA
OD12-1900	1850-1990	12 dBi	PCS, CDMA/TDMA
OD6-2400	2400-2485	6 dBi	WLAN, ISM, Video
OD9-2400	2400-2485	9 dBi	WLAN, ISM, Video
OD12-2400	2400-2485	12 dBi	WLAN, ISM, Video

Frequencies subject to bandwidth constraints; confirm desired frequencies at time of order. Special frequencies are also available, please consult factory for information.

Reflector Options	Model
Add-on kit for 6 dBi models	ODR6-Kit
Add-on kit for 9 dBi models	ODR9-Kit
Add-on kit for 12 dBi models	ODR12-Kit

Specifications

Frequency & Gain:	See above
Bandwidth @2:1 SWR:	140 MHz, 85 MHz for OD12
Nominal Impedance:	50 ohms
Max. Power (continuous):	100 watts
Vertical Beamwidth (-3 dB point):	
6 dBi Models	25 degrees
9 dBi Models	14 degrees
12 dBi Models	9 degrees
Wind Loading (flat plate equiv.):	30-40 sq. inches
Rated Wind Velocity:	100+ mph
Lightning Protection:	External suggested
Material:	ABS radome/aluminum feed
Length/Weight:	
6 dBi Models	19 inches, 1.5 lbs
9 dBi Models	27 inches, 2.0 lbs
12 dBi Models	43 inches, 2.5 lbs
Antenna Diameter:	1", main mast
Connector:	N female standard
Mounting Kit:	Mast mount kit included
Mounting Dimensions:	Use mast up to 2" OD
Accessory:	Reflector Option Kit

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

Product Specifications

MOBILE MARK®
COMMUNICATIONS ANTENNAS

P7-2400 shown wall mounted

Preliminary Info

Patch Antenna (Pat.Pend.)

WLAN & 2.4 GHz ISM Applications

- 4 1/2" weatherproof radome; perfect for in-building & outdoor coverage
- 7 dBi Gain model for 2.40 - 2.49 GHz
- Semi-hemisphere radiation pattern for easy installation
- Unique design provides high performance at an economical price

Mobile Mark's 2.4 GHz Patch Antenna is perfect for new Wireless LAN systems, as well as other applications in the ISM band. It has design features that make it invaluable, solving many of the problems normally associated with 2.4 GHz patch designs.

These antennas use a unique plate-air dielectric technology that provides significant improvements in efficiency while being very economical. VSWR performance is maintained across the operating bandwidth. The antenna design also provides near hemispherical energy radiation, resulting in broad area coverage, yet maintaining directivity and isolation. The antenna provides 7 dBi gain with vertical polarization.

This Patch antenna is small and provides an attractive design. It has a diameter of 4 1/2". The radome consists of a ergo-white polycarbonate, allowing aesthetic installation in all environments. It is durable and weatherproof. The antenna is mounted to a swivel that allows it to be angled left or right with a 30 degree angle. Flush surface mounting and pole mounting can also be accommodated.

The cable feed exits near the bottom of the antenna in a "scalloped" port. This allows the cable to be directed up, down or straight back. The antenna terminates with 6" of low loss RG-188 with a choice of a female TNC or a female SMA connector.

Model Number

Model	Description
P7-2400T	Patch Antenna with TNC
P7-2400S	Patch Antenna with SMA

Connectors provided are female. For other connectors or cable configurations, please consult factory.

Specifications

Frequency:	2400 - 2485 MHz	**Antenna Radome:**	White Polycarbonate
Gain:	7 dBi nominal	**Weight:**	0.5 lbs
Bandwidth @2.0:1 SWR:	85 MHz	**Mounting:**	Surface & pole mount, with articulating swivel bracket
Impedance:	50 Ohm nominal		
Maximum Power:	50 Watts	**Swivel Standoff:**	3" from wall to outer radome surface, centered
E Plane beamwidth:	45°		
H Plane beamwidth:	60°	**Mounting Dimension:**	Mounts up to 2" outside diameter mast
Front-to-Back ratio:	10 dB minimum		
Lightning Protection:	external recommended	**Connector:**	TNC or SMA female, others available upon request
Radome Size:	4 1/2" diameter x 3/4" high,		
Rated Wind Velocity:	100 mph+	**Cable:**	6 inches of RG-188

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

2.7 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 $\geq$ RBW 6 dB bandwidth. The results of the measurements are given in Table 3 and Figure 3a through Figure 3c.

The EUT did not incorporate any antennas of directional gain greater than 6 dBi, therefore the output power has not been reduced as required by 15.247(b)(3).

TABLE 3
PEAK POWER OUTPUT

Test Date: April 30, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

Frequency of Fundamental (MHz)	Measurement (dBm)*	Measurement (Watt)*	FCC Limit* (Watt)
2401.9	16.2	41.7	1.0
2440.0	16.8	47.8	1.0
2483.5	16.8	47.8	1.0

*** Measurement includes 0.3 dB for cable loss**

Tester
Signature: ____________________ **Name:** __Tim R. Johnson________

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

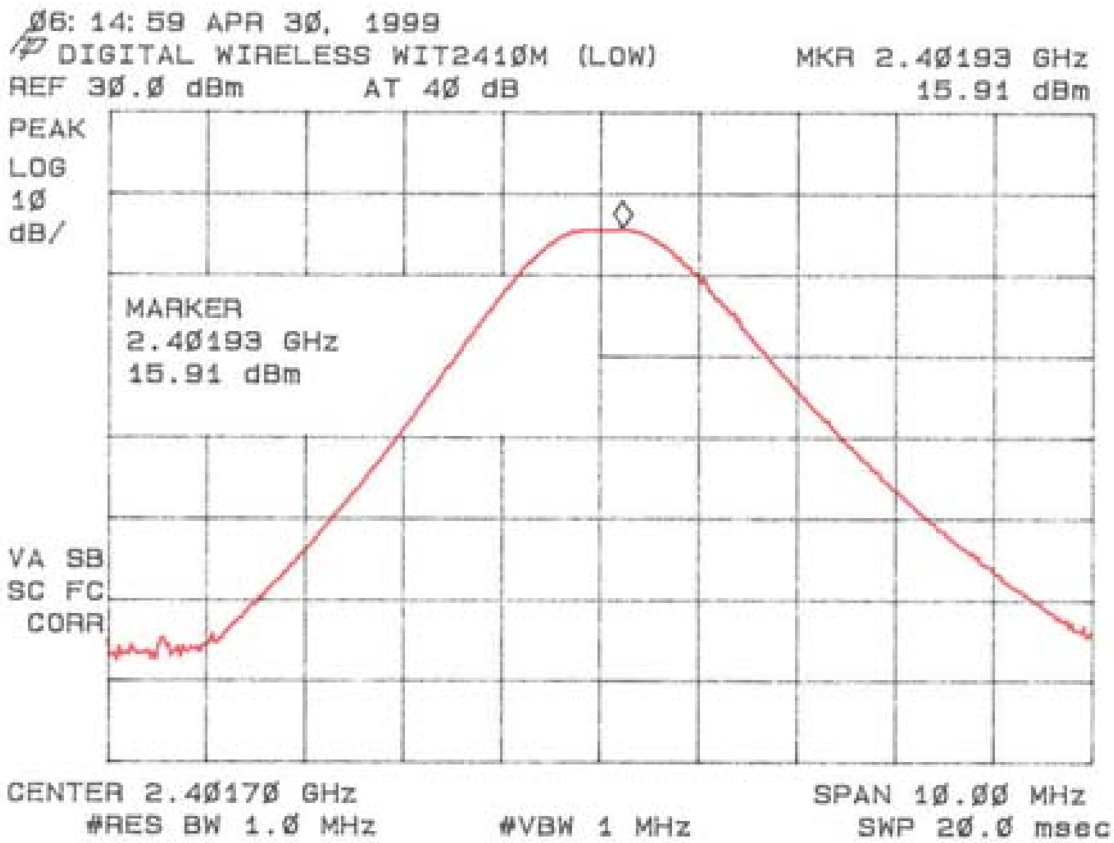


Figure 3b.
Peak Power per FCC Section 15.247(b) (Mid)

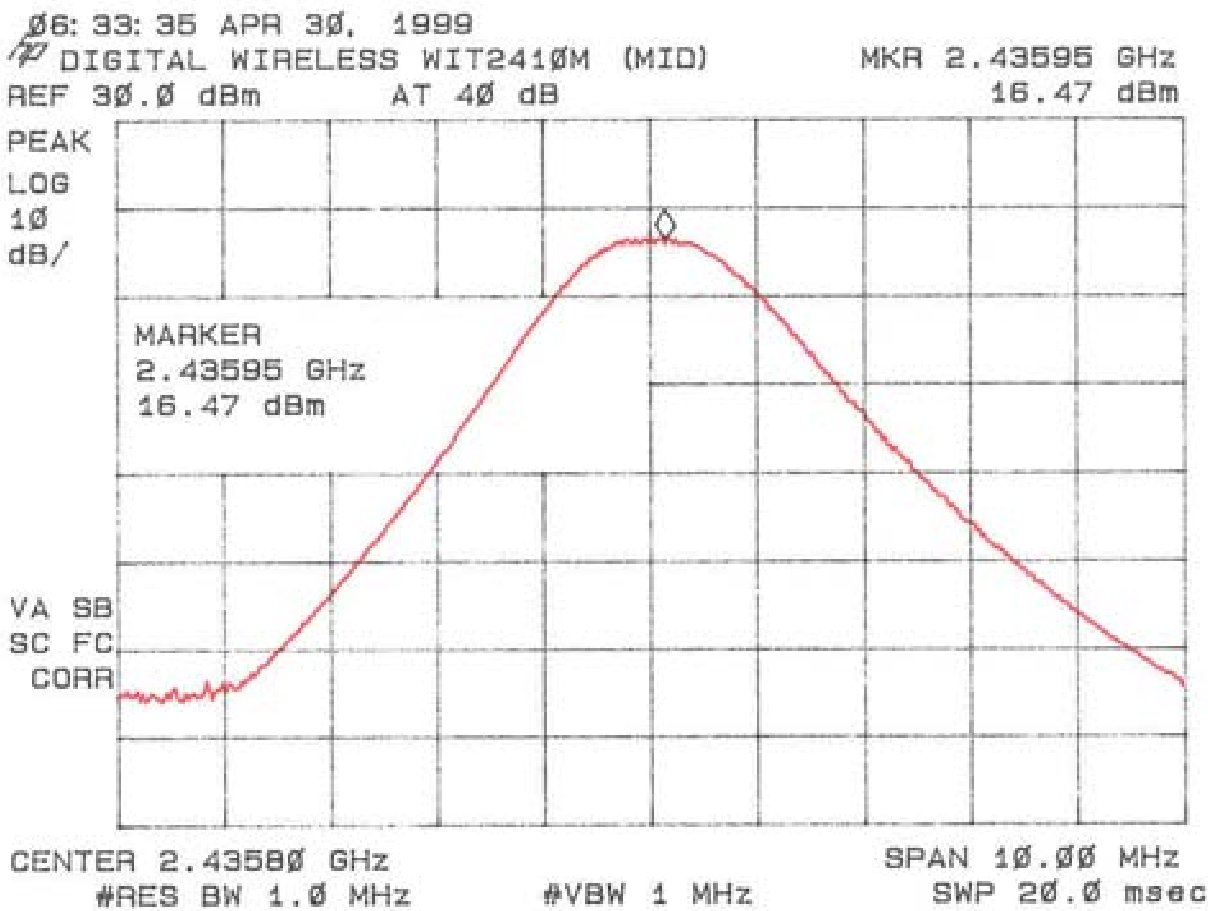
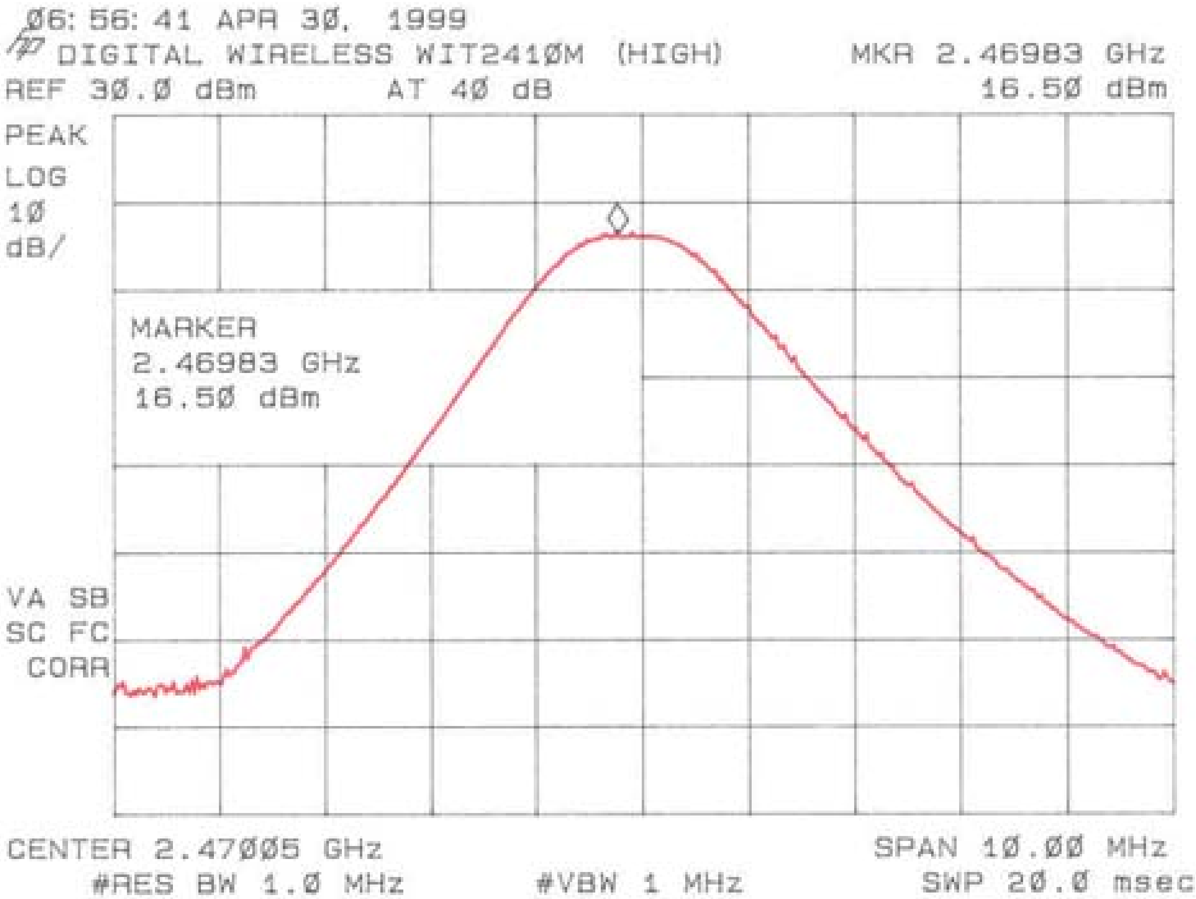


Figure 3c.
Peak Power per FCC Section 15.247(b) (High)



2.8 Antenna Conducted Spurious Emission in the Frequency Range 30 - 25000 MHz (FCC Section 15.247(c))

Spurious emissions in the frequency range 30 - 25000 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 of conducted spurious emissions are given in Figure 4a through Figure 4l.

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

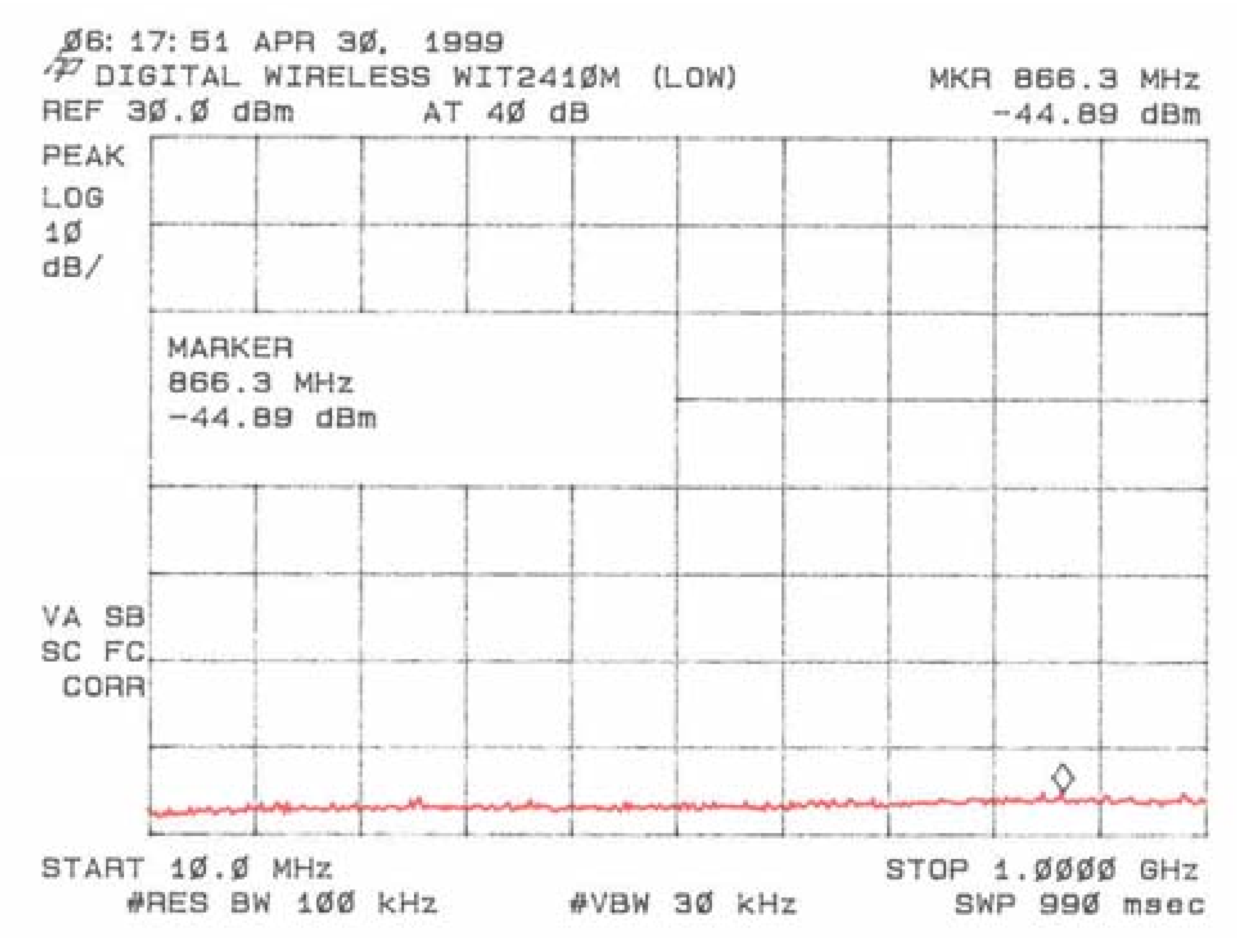


Figure 4b
Antenna Conducted Spurious Emissions 5.247(c) Low

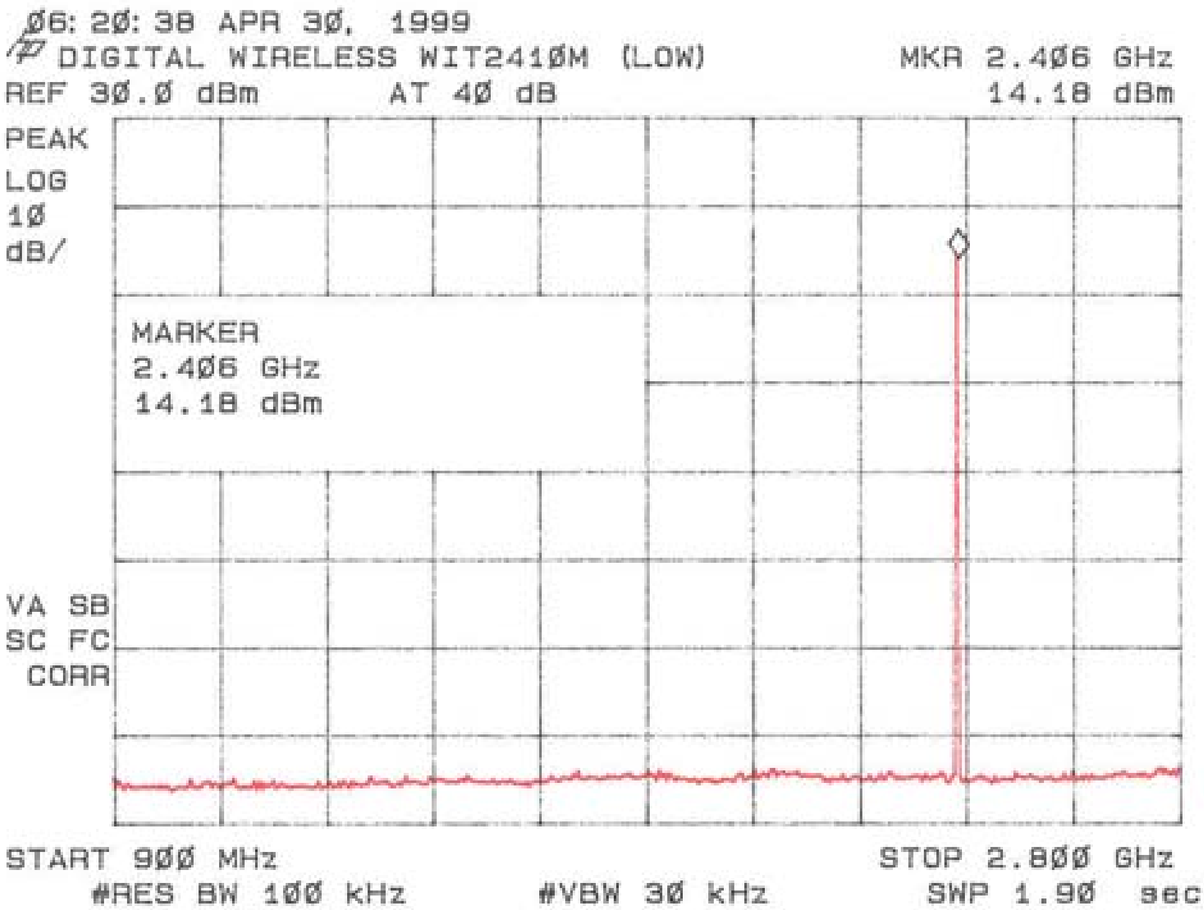


Figure 4c
Antenna Conducted Spurious Emissions 15.247(c) Low

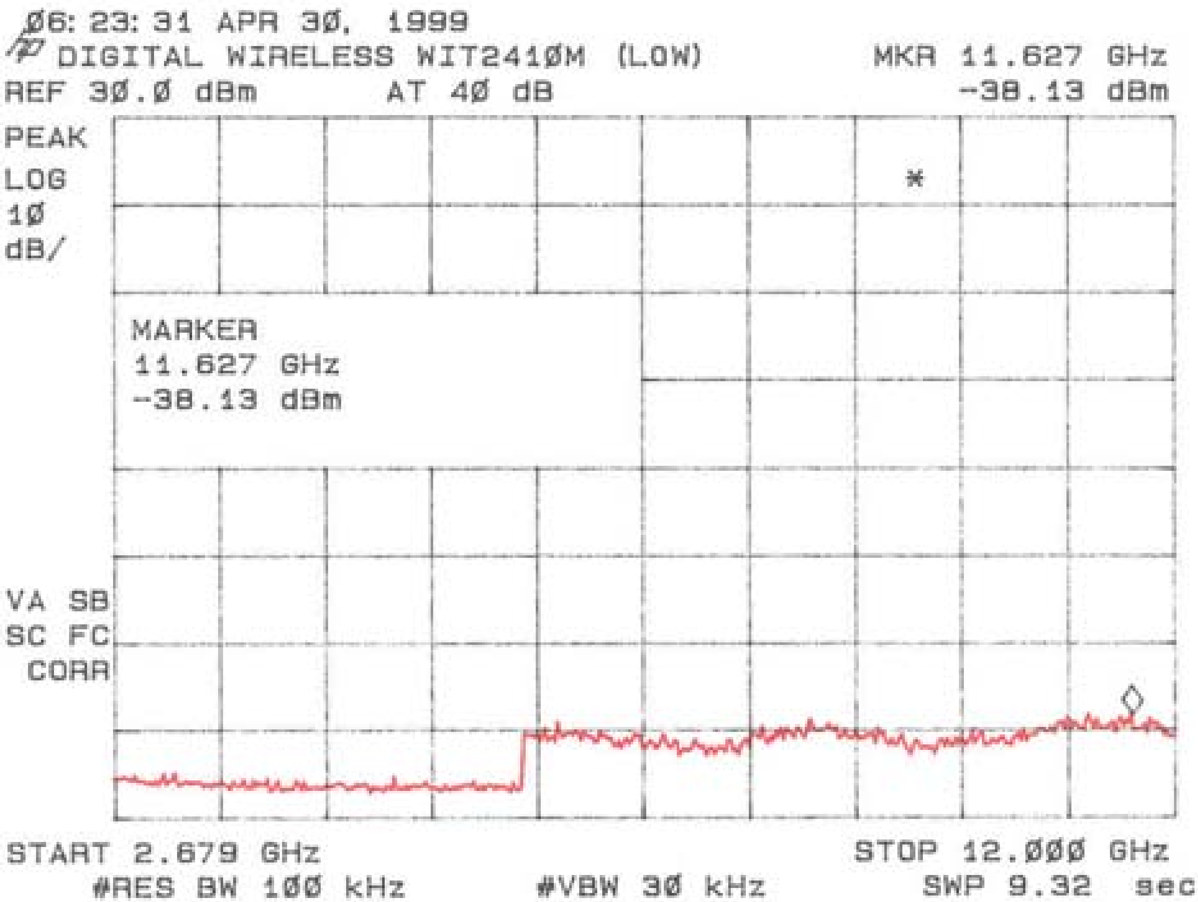


Figure 4d
Antenna Conducted Spurious Emissions 15.247(c) Low

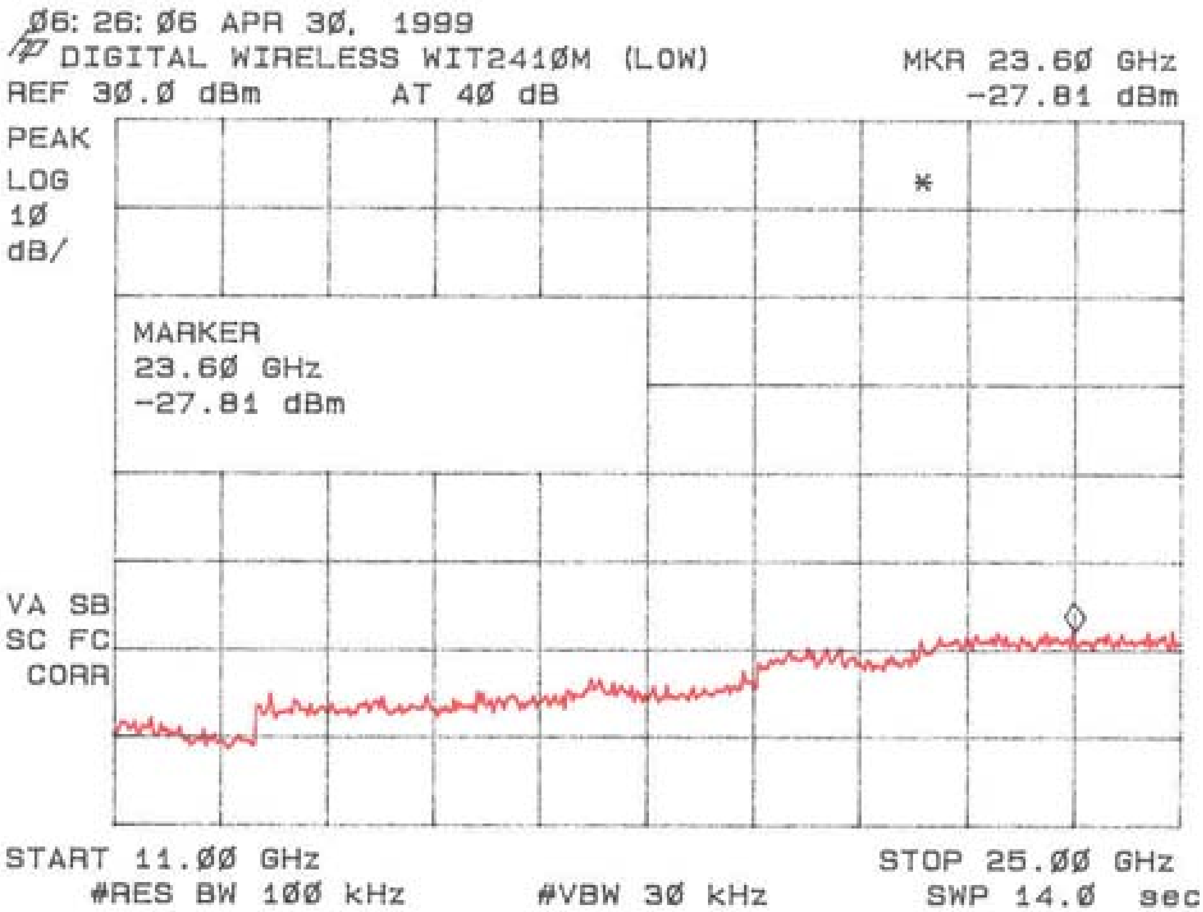


Figure 4e
Antenna Conducted Spurious Emissions 15.247(c) Mid

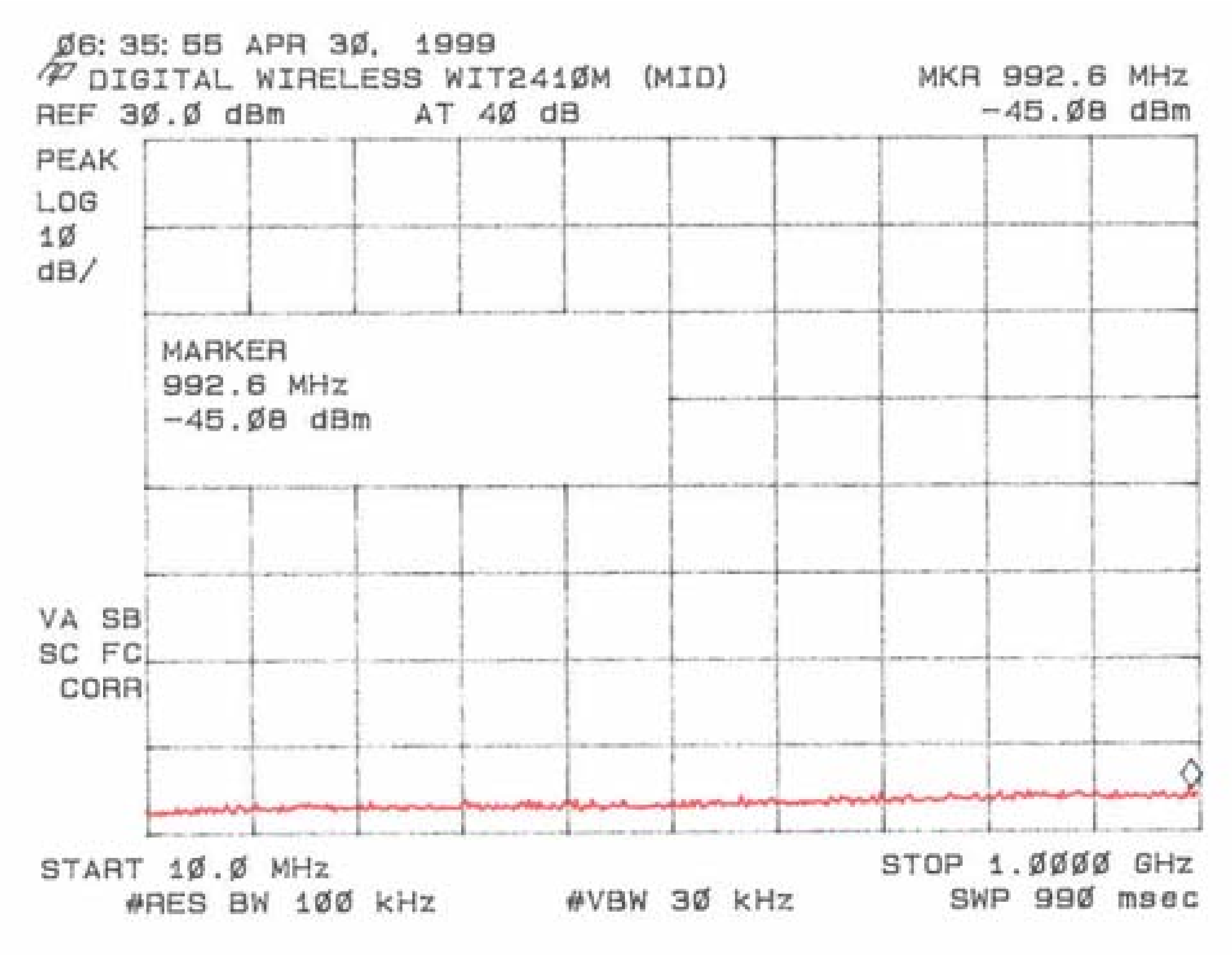


Figure 4f
Antenna Conducted Spurious Emissions 15.247(c) Mid

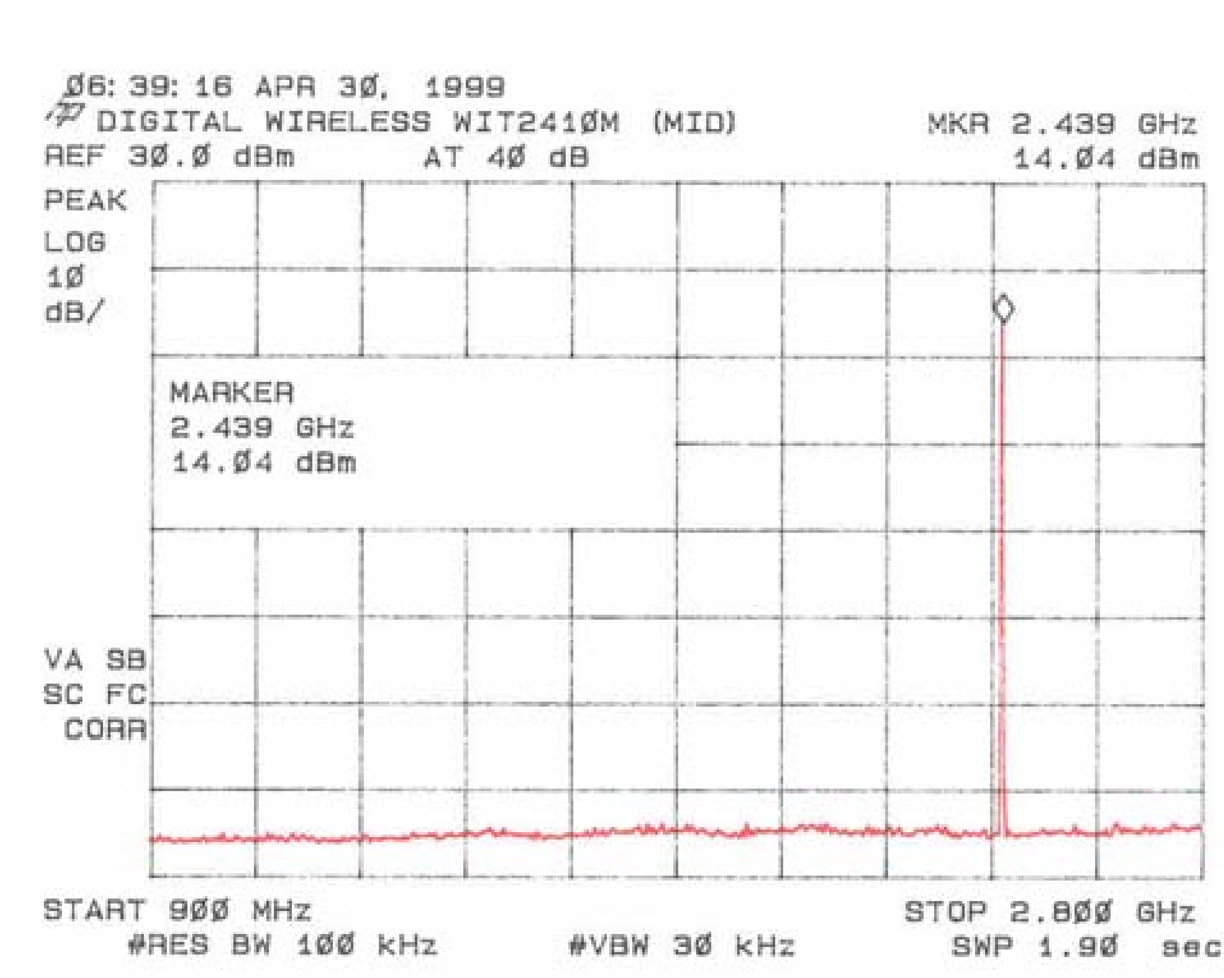


Figure 4g
Antenna Conducted Spurious Emissions 15.247(c) Mid

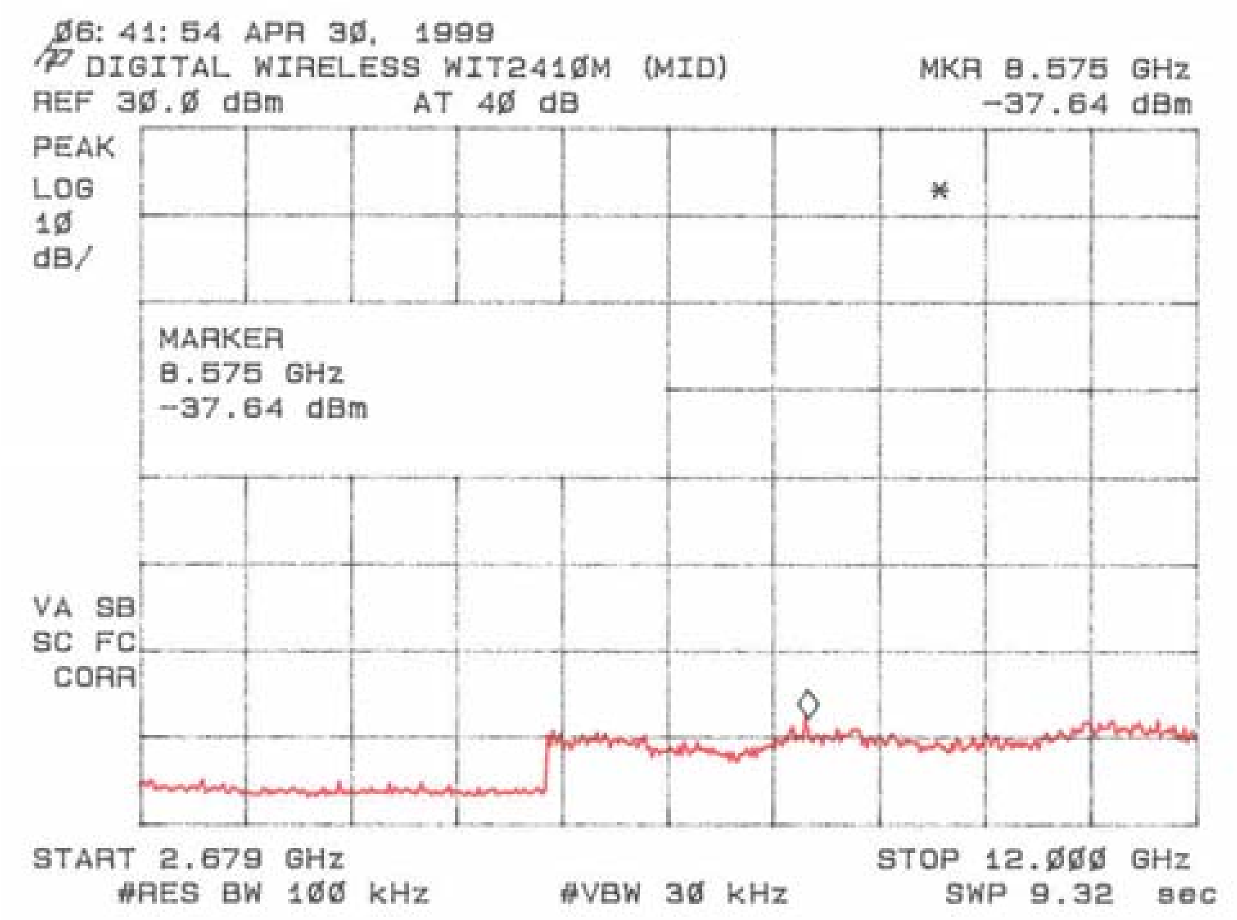


Figure 4h
Antenna Conducted Spurious Emissions 15.247(c) Mid

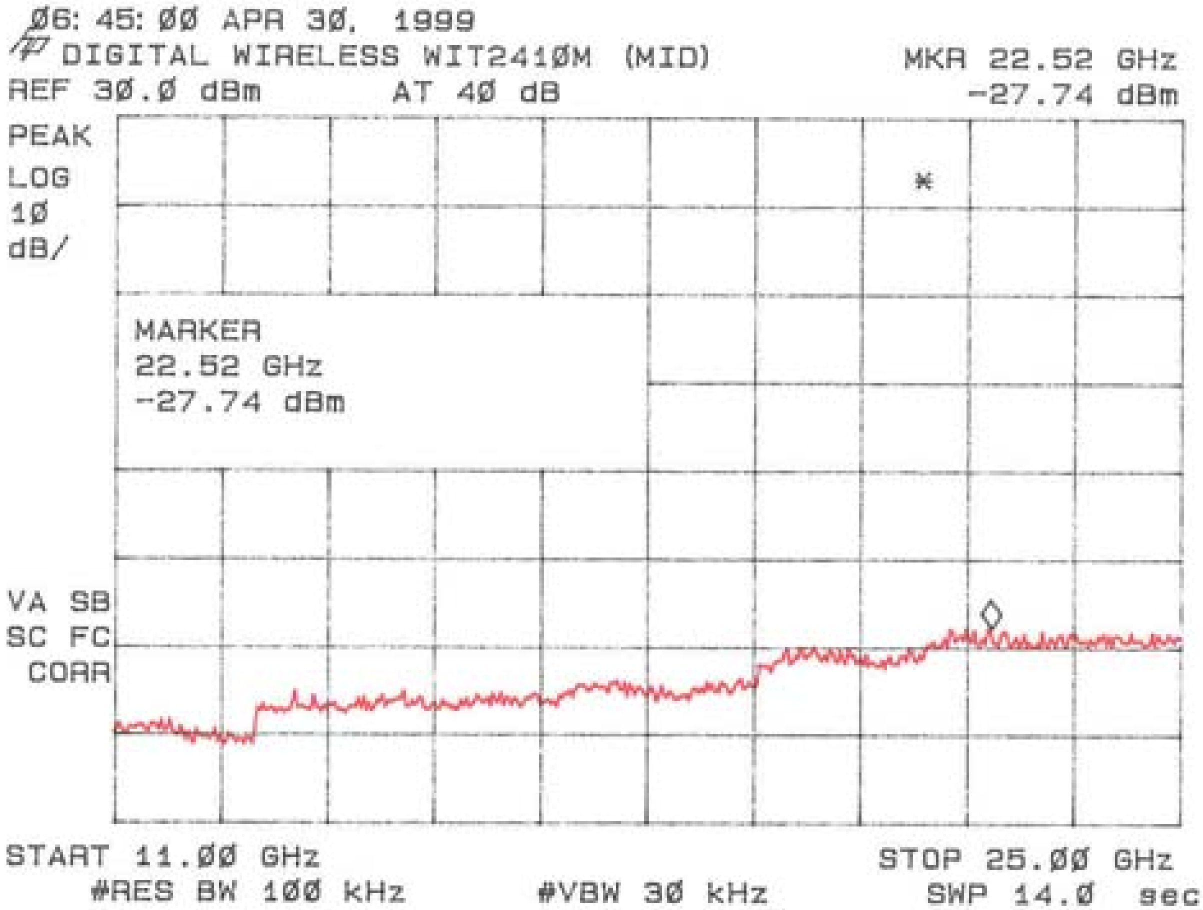


Figure 4i
Antenna Conducted Spurious Emissions 15.247(c) High

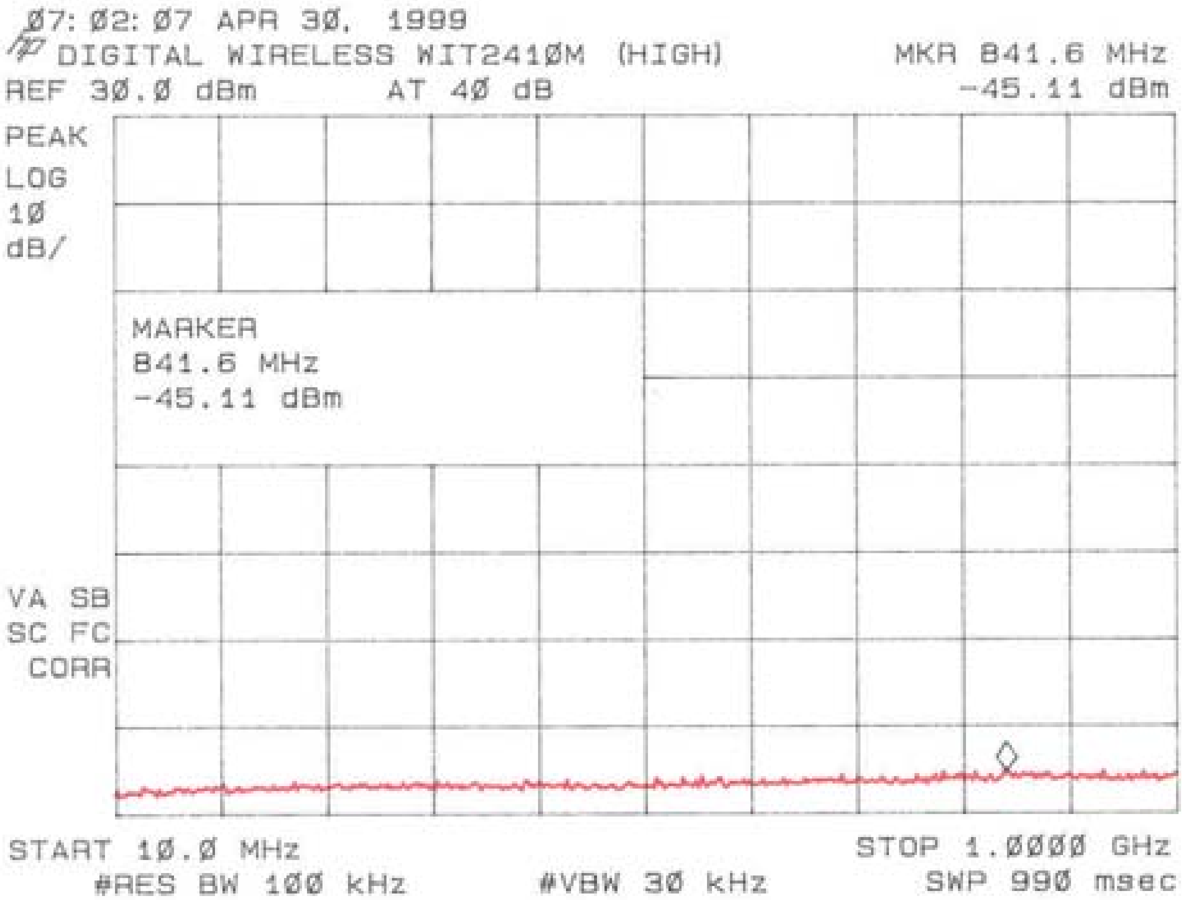


Figure 4j
Antenna Conducted Spurious Emissions 15.247(c) High

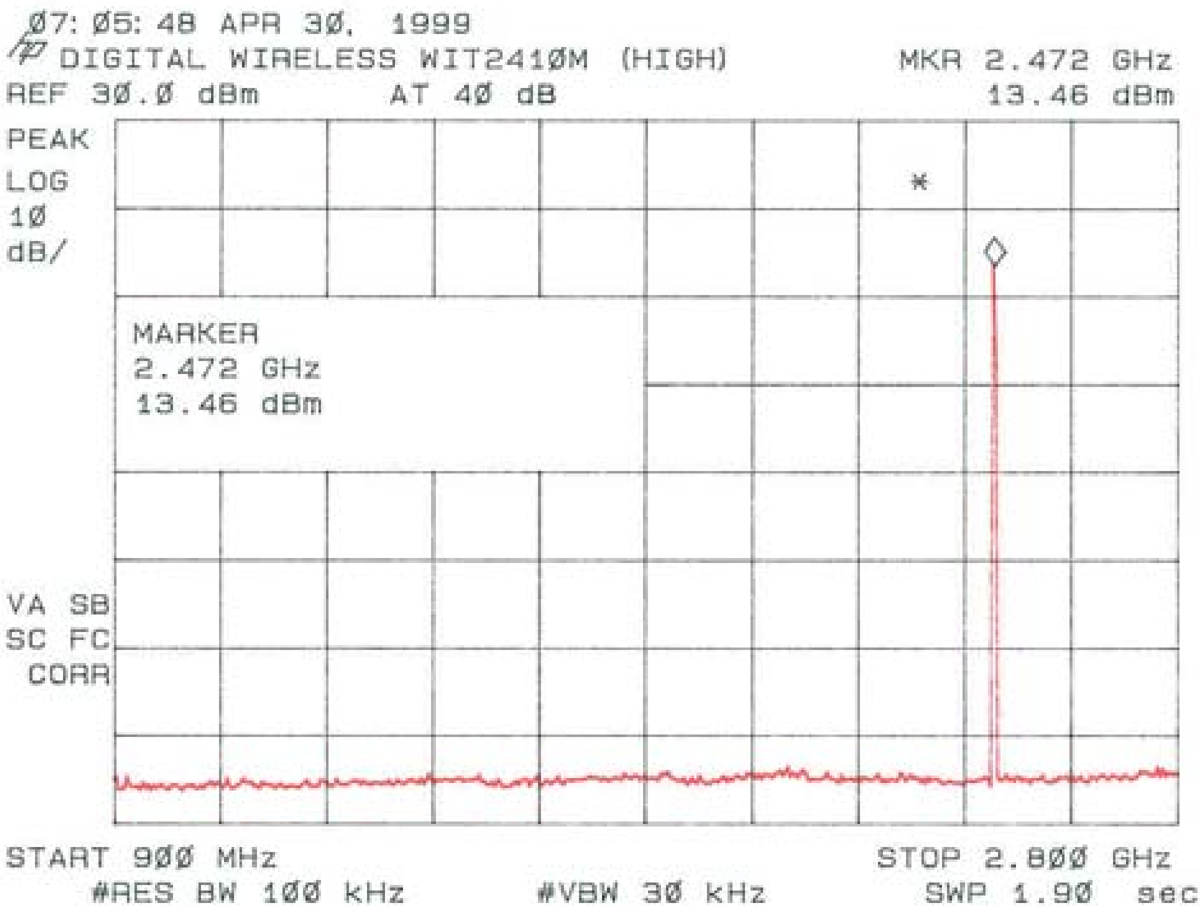


Figure 4k
Antenna Conducted Spurious Emissions 15.247(c) High

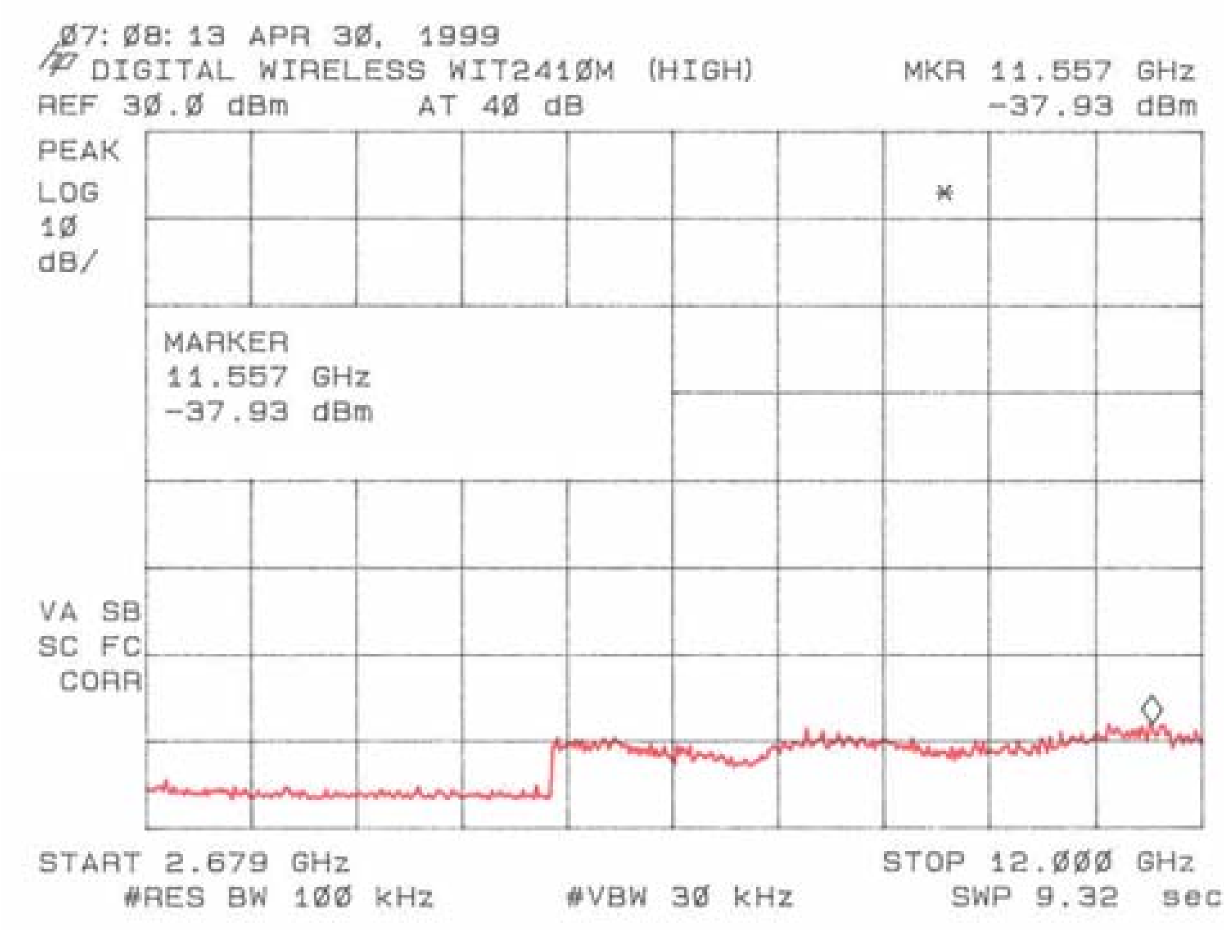
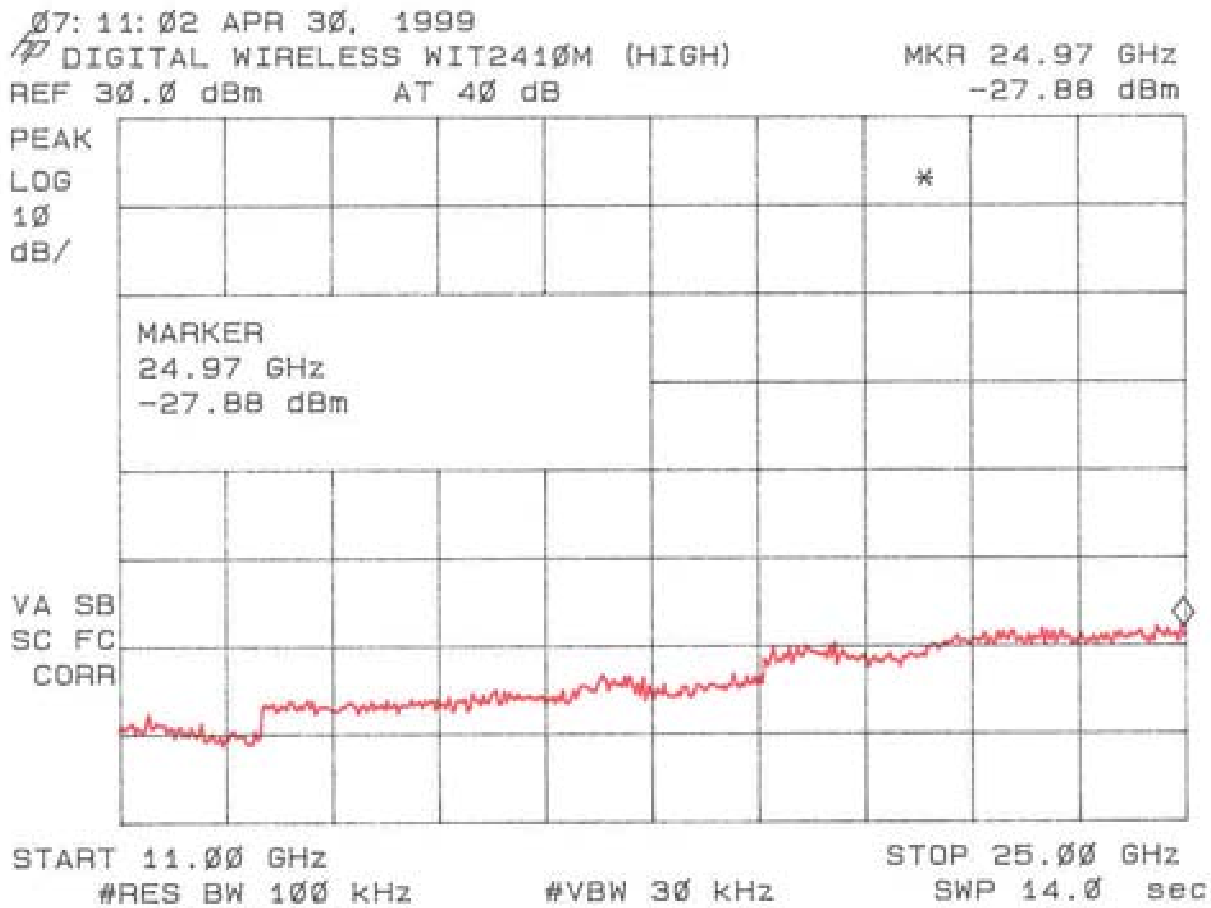


Figure 4I
Antenna Conducted Spurious Emissions 15.247(c) High



2.9 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 4a –4g and Figure 5a – Figure 5ai.

Table 4A. PEAK RADIATED SPURIOUS EMISSIONS (Low End)
Ace Dipole Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20450	-49.86	34.5	36.9	7.8	2341.5	5000

Table 4A. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
Ace Dipole Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87105	-61.45	34.3	34.7	8.1	501.7	5000
7.30700	-51.35	34.6	37.2	7.9	2024.3	5000

Table 4A. PEAK RADIATED SPURIOUS EMISSIONS (High End)
Ace Dipole Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93995	-58.75	34.3	34.8	8.2	707.8	5000
7.41055	-54.13	34.6	37.4	7.9	1508.9	5000

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-49.86 – 34.5 + 36.9 + 7.8 + 107)/20) = 2341.5
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ______________________ Name: Roger Bowen________

Table 4B. PEAK RADIATED SPURIOUS EMISSIONS (Low End)
DWC 3dBi Patch Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20465	-51.95	34.5	37.0	7.8	1840.8	5000

Table 4B. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
DWC 3 dBi Patch Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87105	-66.78	34.3	34.7	8.1	271.6	5000
7.30710	-54.12	34.6	37.2	7.9	1471.6	5000

Table 4B. PEAK RADIATED SPURIOUS EMISSIONS (High End)
DWC 3 dBi Patch Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93980	-61.31	34.3	34.8	8.2	527.1	5000
7.41055	-55.46	34.6	37.4	7.9	1294.7	5000

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-51.95 – 34.5 + 37.0 + 7.8 + 107)/20) = 1840.8
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: Roger Bowen

Table 4C. PEAK RADIATED SPURIOUS EMISSIONS (Low End)
Mobile Mark Patch Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.80356	-59.88	34.3	34.6	7.9	581.8	5000
7.20459	-51.89	34.5	37.0	7.8	1853.6	5000

Table 4C. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
Mobile Mark Patch Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87210	-58.45	34.3	34.7	8.1	709.0	5000
7.30720	-53.05	34.6	37.2	7.9	1664.5	5000

Table 4C. PEAK RADIATED SPURIOUS EMISSIONS (High End)
Mobile Mark Patch Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93960	-59.73	34.3	34.8	8.2	632.1	5000
7.40930	-51.35	34.6	37.4	7.9	2077.4	5000

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-59.88 - 34.3 + 34.6 + 7.9 + 107)/20) = 581.8
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: Roger Bowen

Table 4D. PEAK RADIATED SPURIOUS EMISSIONS (Low End)
6dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20585	-53.14	34.5	37.0	7.8	1605.5	5000

Table 4D. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
6dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87200	-59.31	34.3	34.7	8.1	642.1	5000
7.30735	-55.72	34.6	37.2	7.9	1224.1	5000

Table 4D. PEAK RADIATED SPURIOUS EMISSIONS (High End)
6dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93970	-64.99	34.3	34.8	8.2	345.0	5000
7.40950	-54.54	34.6	37.4	7.9	1438.9	5000

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-53.14 - 34.5 + 37.0 + 7.8 + 107)/20) = 1605.5
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: Roger Bowen

Table 4E. PEAK RADIATED SPURIOUS EMISSIONS (Low End)
12dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20570	-54.79	34.5	37.0	7.8	1327.8	5000

Table 4E. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
12dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87145	-57.10	34.3	34.7	8.1	828.0	5000
7.30840	-55.63	34.6	37.2	7.9	1237.2	5000

Table 4E. PEAK RADIATED SPURIOUS EMISSIONS (High End)
12dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93980	-66.80	34.3	34.8	8.2	280.1	5000
7.41025	-52.48	34.6	37.4	7.9	1824.4	5000

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-54.79 - 34.5 + 37.0 + 7.8 + 107)/20) = 1327.8
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: __Roger Bowen________

Table 4F. PEAK RADIATED SPURIOUS EMISSIONS (Low End)
14dBi Corner Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20465	-50.58	34.5	37.0	7.8	2155.3	5000

Table 4F. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
14dBi Corner Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87250	-59.86	34.3	34.7	8.1	602.9	5000
7.30815	-53.31	34.6	37.2	7.9	1615.8	5000

Table 4F. PEAK RADIATED SPURIOUS EMISSIONS (High End)
14dBi Corner Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93960	-64.43	34.3	34.8	8.2	368.0	5000
7.40940	-54.96	34.6	37.4	7.9	1371.0	5000

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-50.58 - 34.5 + 37.0 + 7.8 + 107)/20) = 2155.3
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: Roger Bowen

Table 4G. PEAK RADIATED SPURIOUS EMISSIONS (Low End)

14dB YAGI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20565	-55.29	34.5	37.0	7.8	1253.5	5000

Table 4G. PEAK RADIATED SPURIOUS EMISSIONS (Middle)
14dB YAGI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87201	-58.27	34.3	34.7	8.1	723.0	5000
7.30694	-55.95	34.6	37.2	7.9	1192.0	5000

Table 4G. PEAK RADIATED SPURIOUS EMISSIONS (High End)
14dB YAGI Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93960	-63.72	34.3	34.8	8.2	399.3	5000
7.41010	-55.01	34.6	37.4	7.9	1363.4	5000

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-55.29 - 34.5 + 37.0 + 7.8 + 107)/20) = 1253.5
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: Roger Bowen

Figure 5a
Peak Radiated Spurious Emission 15.247(c) Low – Ace Dipole

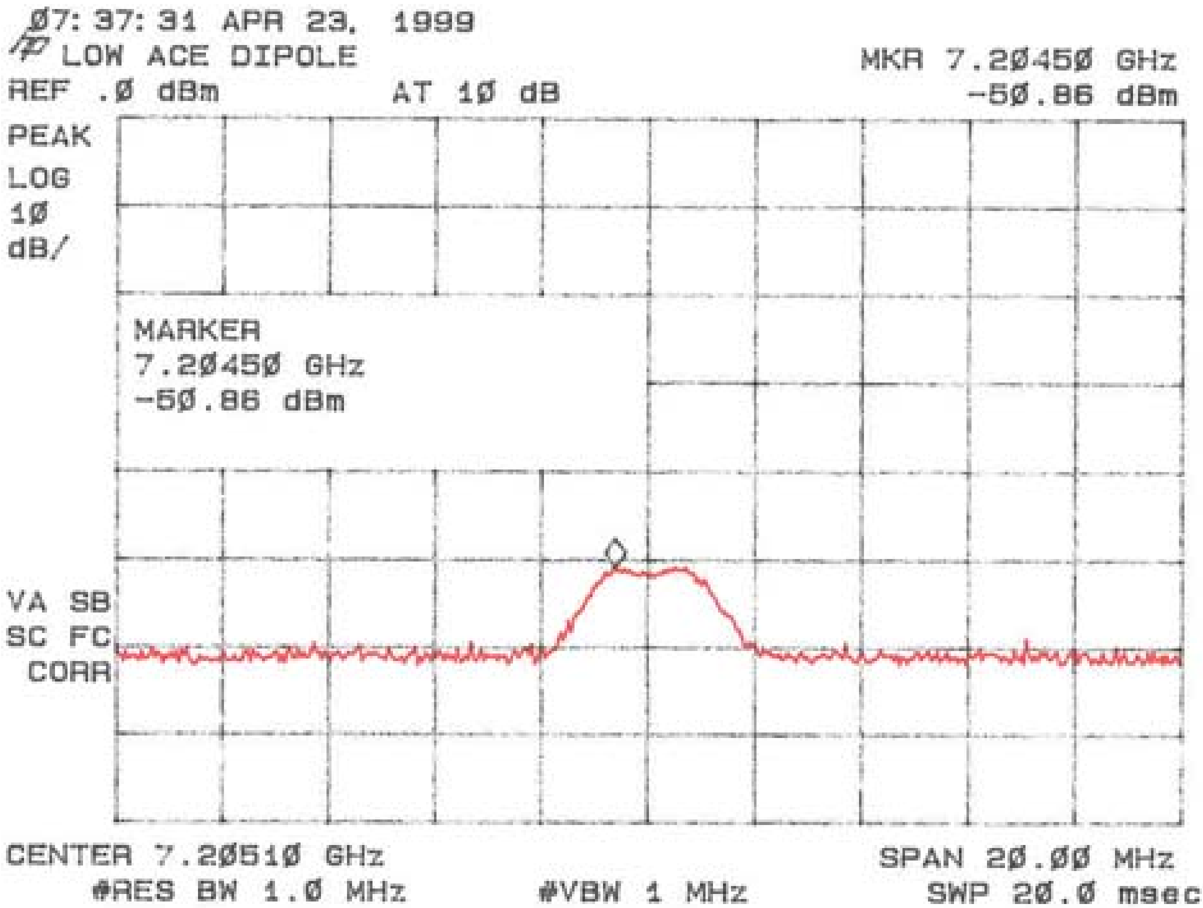


Figure 5b
Peak Radiated Spurious Emission 15.247(c) Mid – Ace Dipole

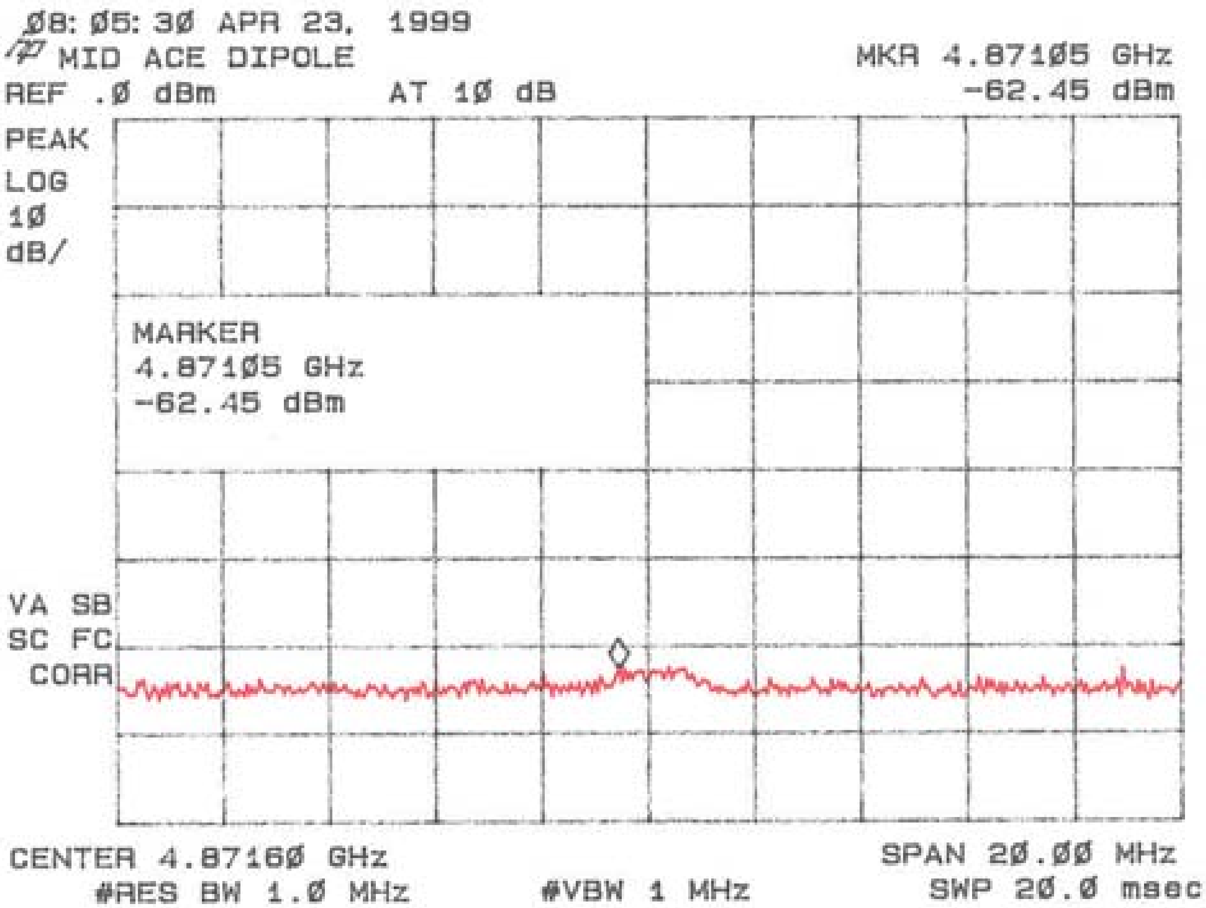


Figure 5c
Peak Radiated Spurious Emission 15.247(c) Mid – Ace Dipole

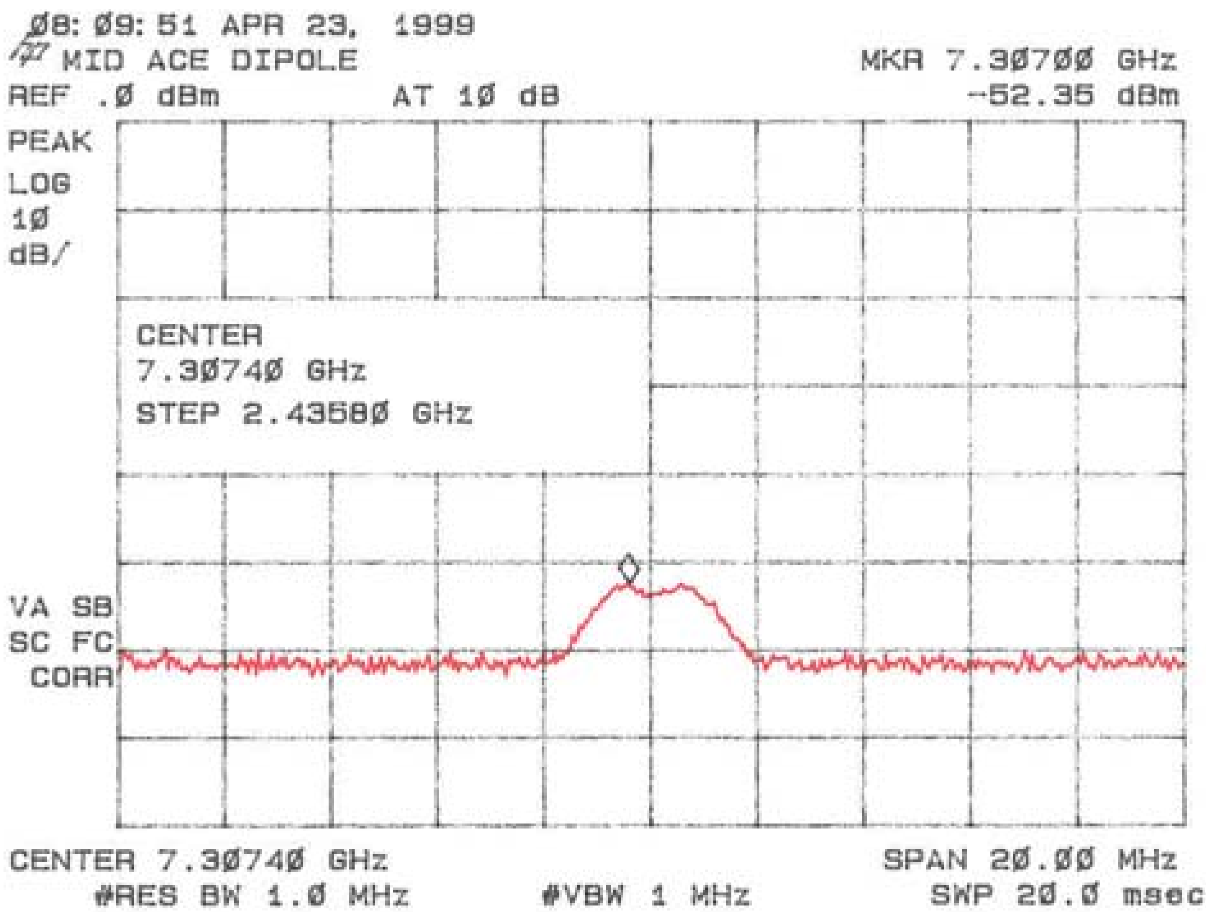


Figure 5d
Peak Radiated Spurious Emission 15.247(c) High – Ace Dipole

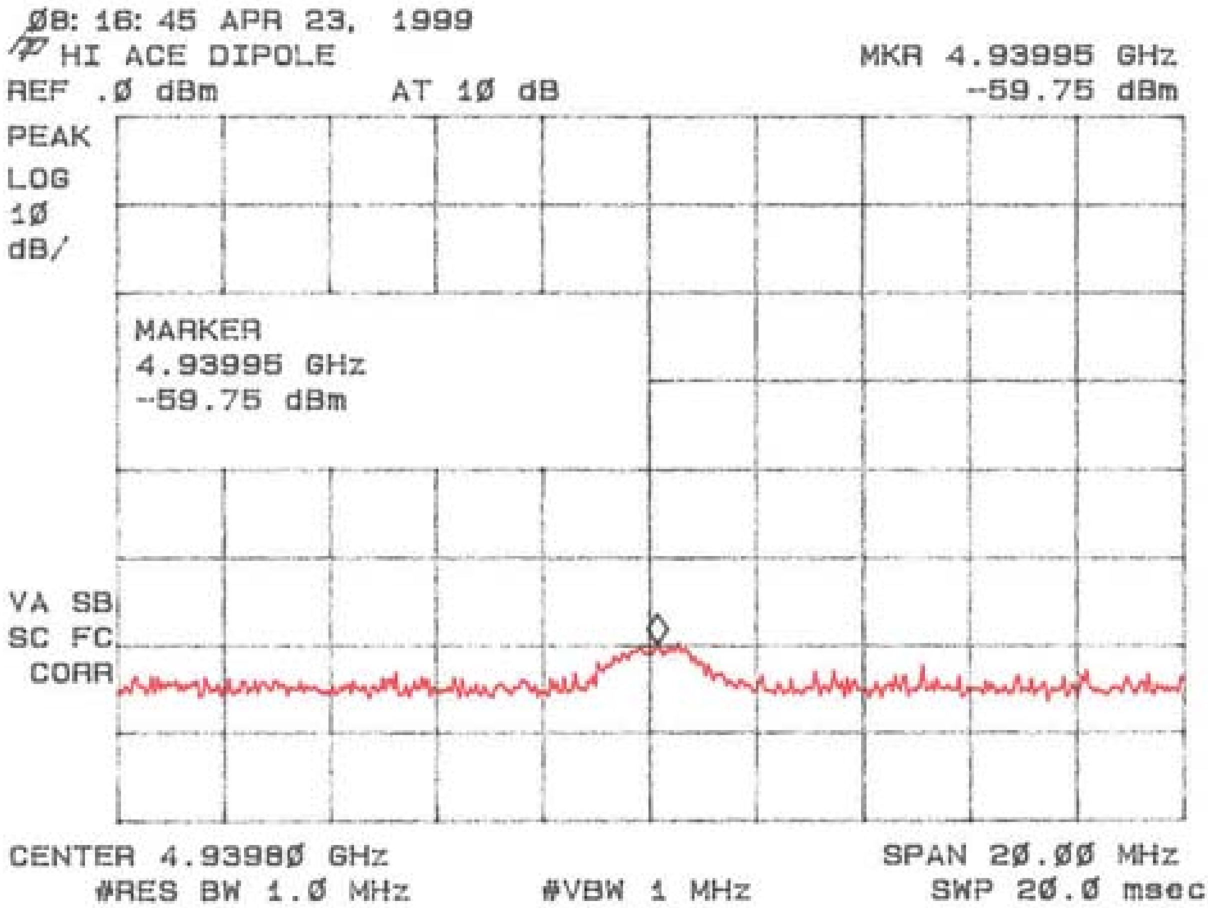


Figure 5e
Peak Radiated Spurious Emission 15.247(c) High – Ace Dipole

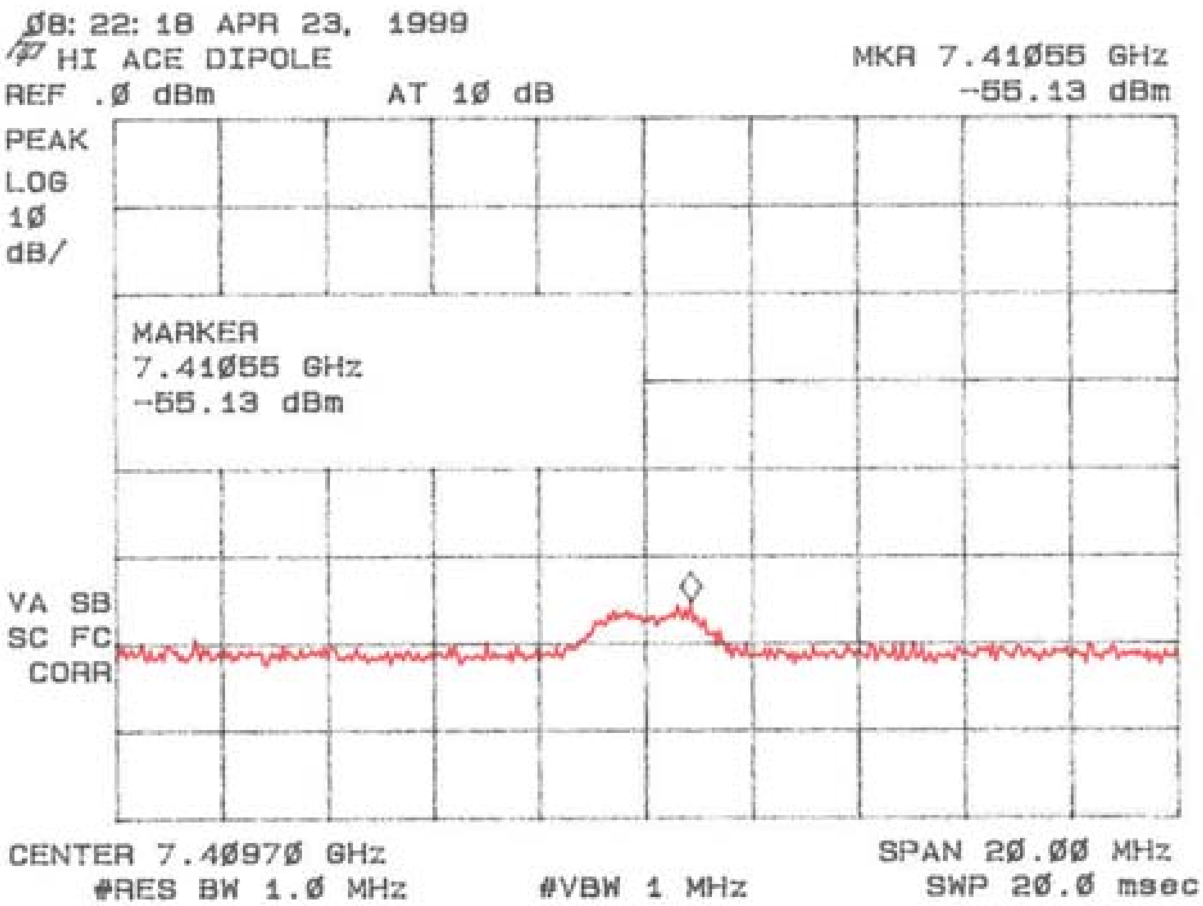


Figure 5f
Peak Radiated Spurious Emission 15.247(c) Low – DWC Patch

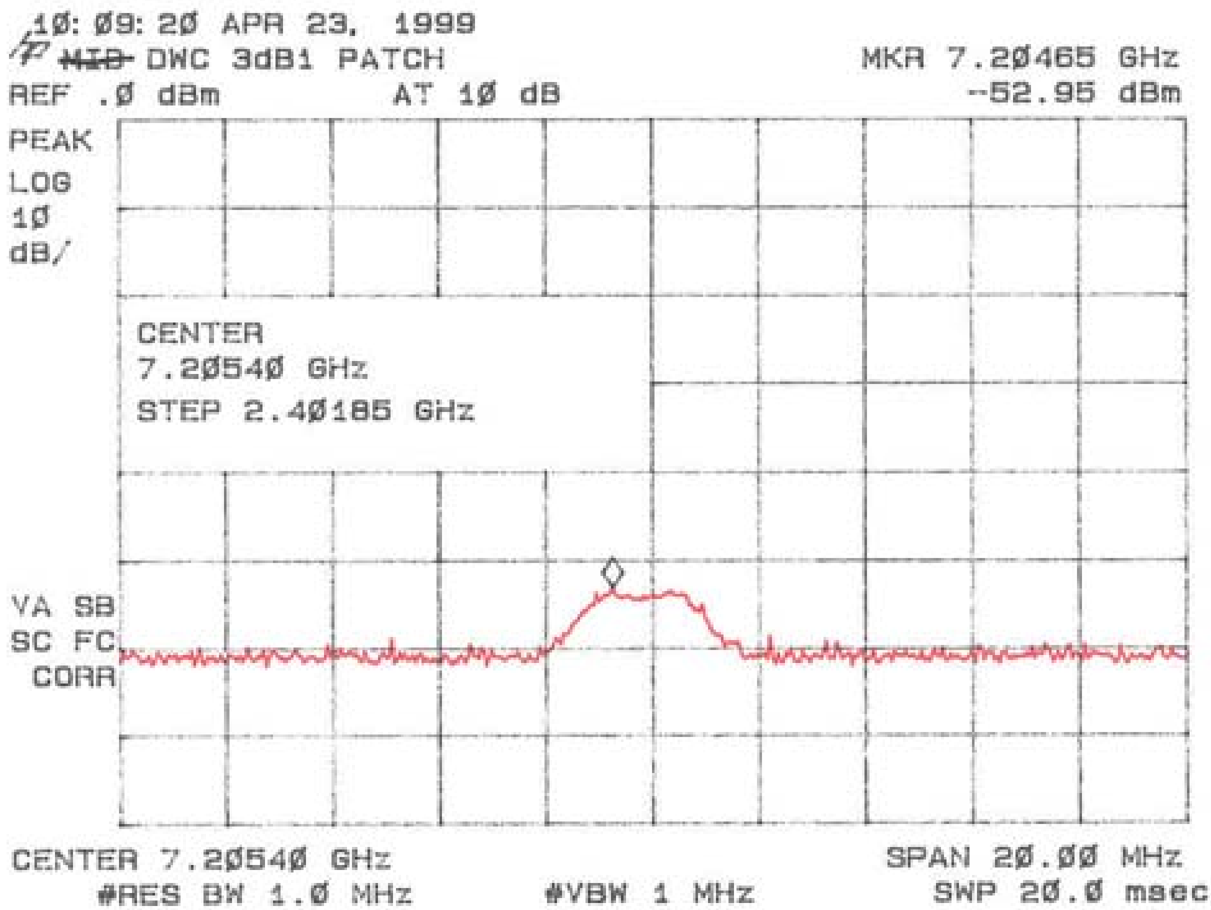


Figure 5g
Peak Radiated Spurious Emission 15.247(c) Mid – DWC Patch

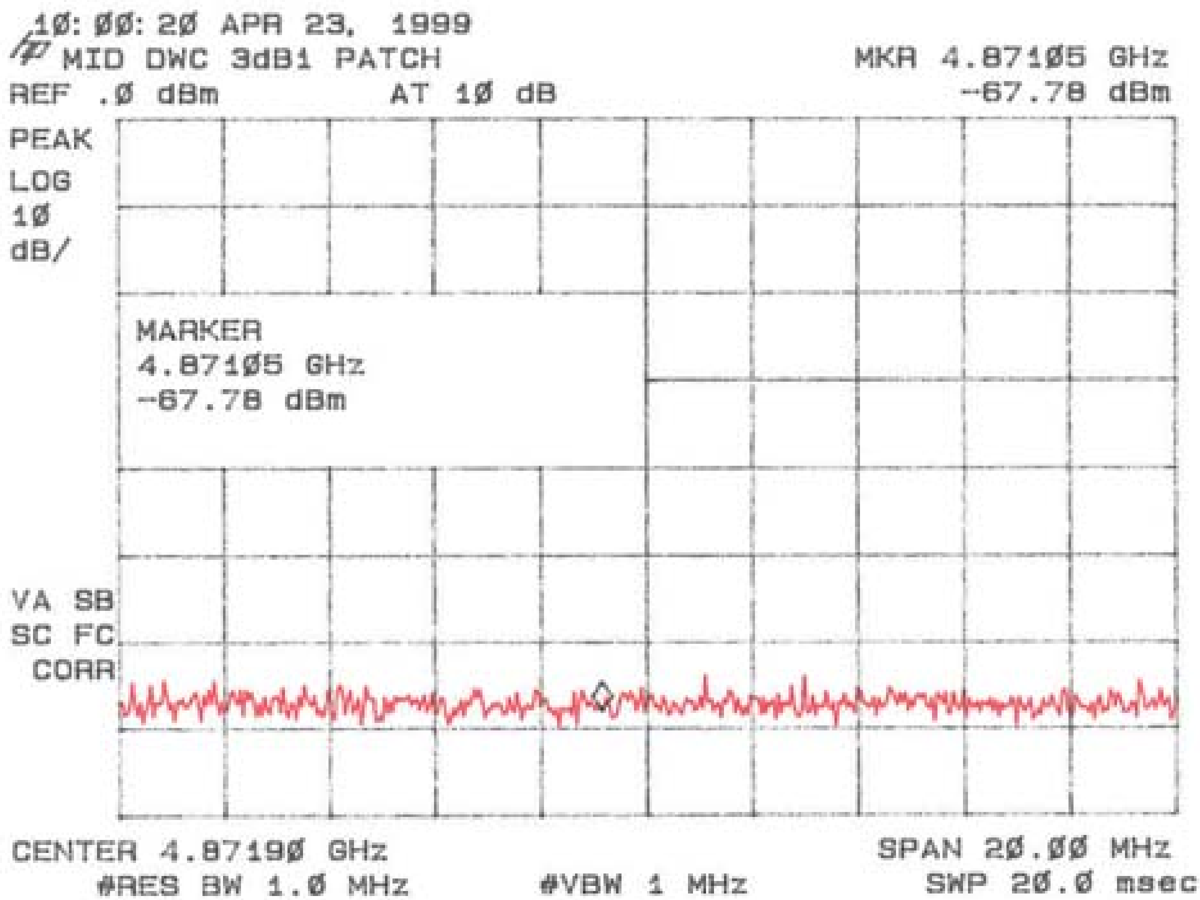


Figure 5h
Peak Radiated Spurious Emission 15.247(c) Mid – DWC Patch

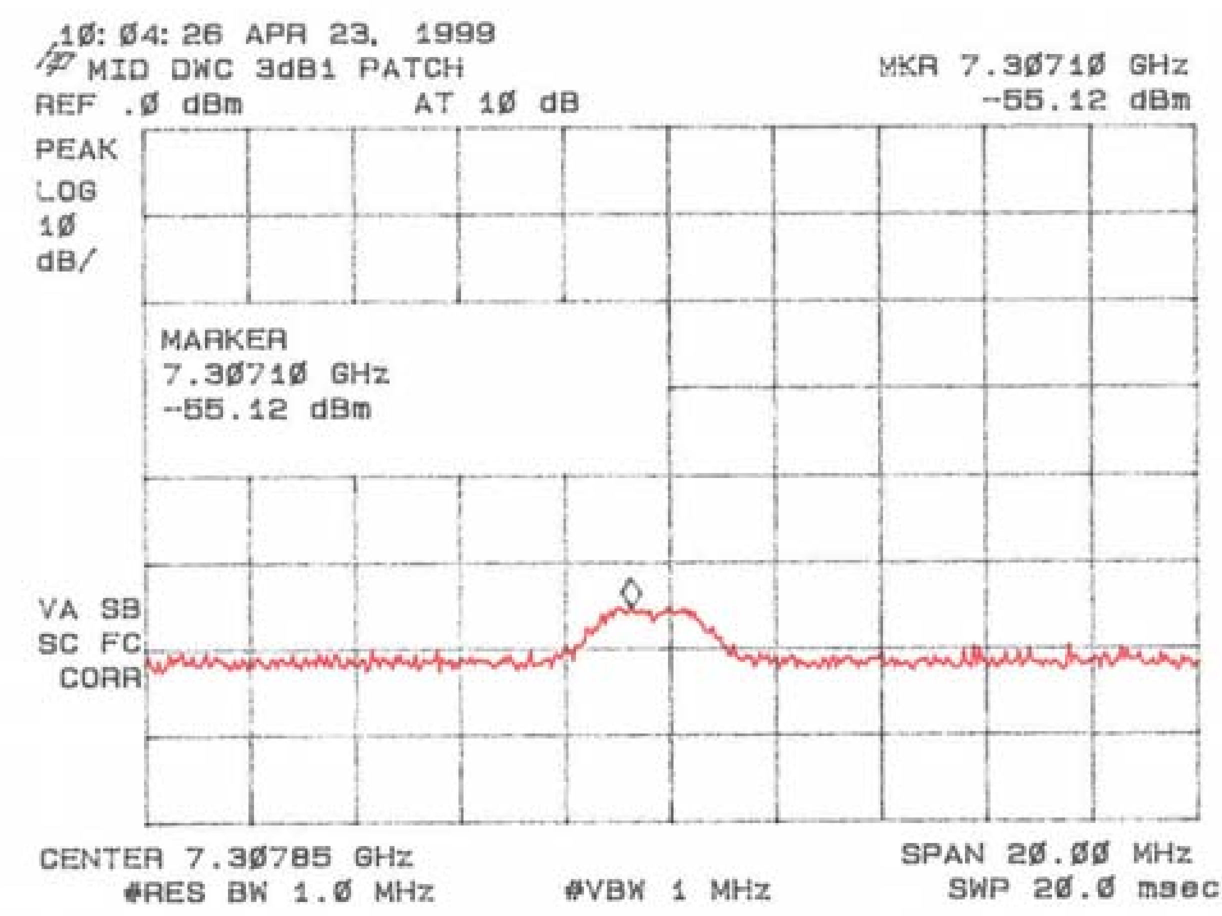


Figure 5i
Peak Radiated Spurious Emission 15.247(c) High – DWC Patch

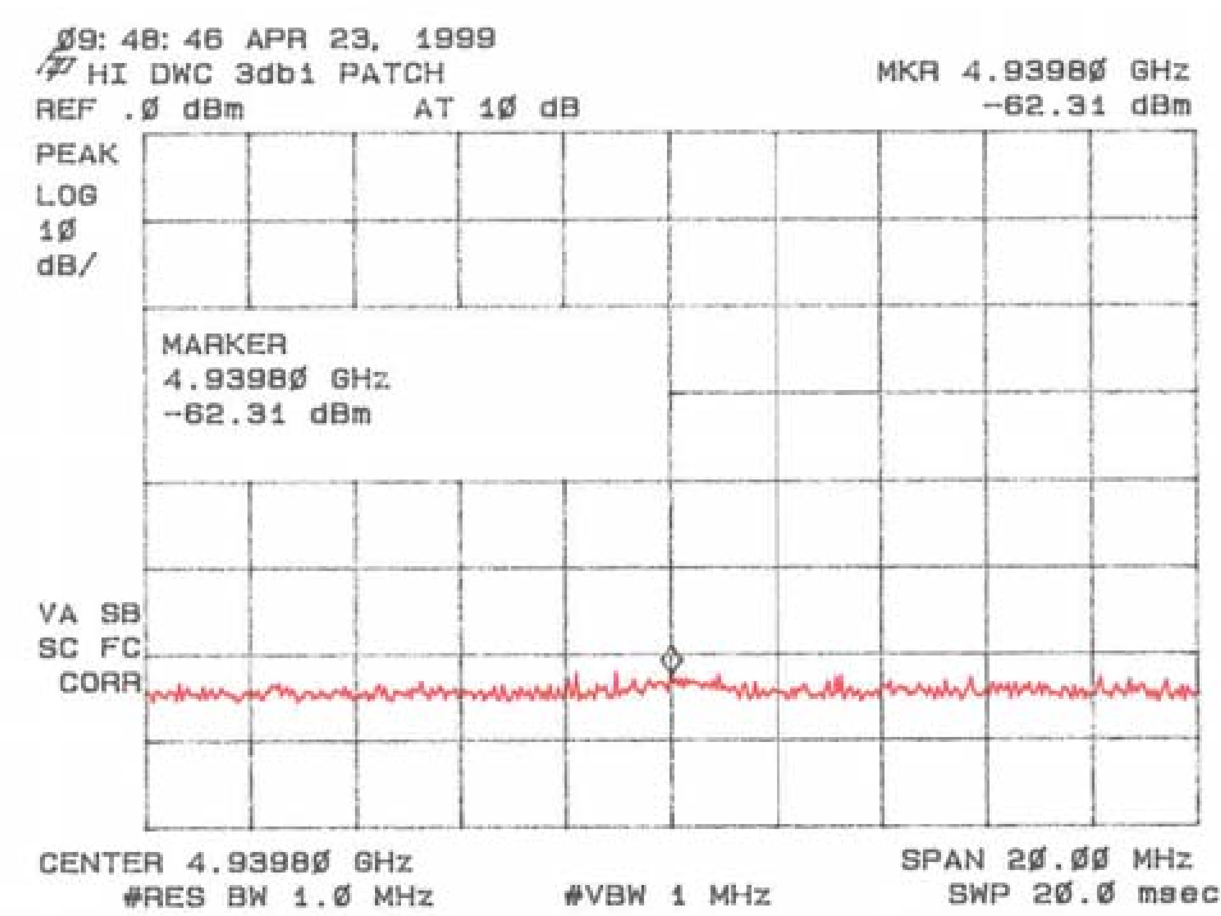


Figure 5j
Peak Radiated Spurious Emission 15.247(c) High – DWC Patch

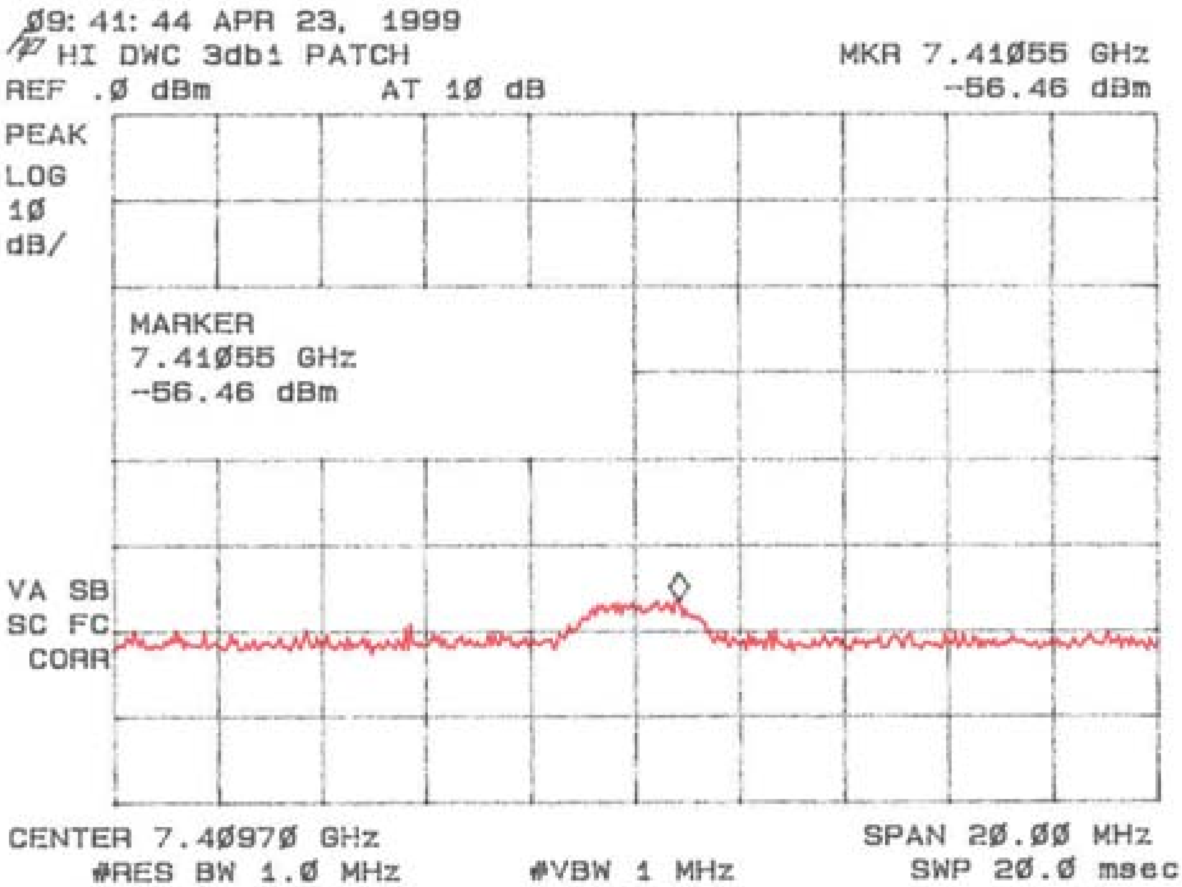


Figure 5k
Peak Radiated Spurious Emission 15.247(c) Low – Mobile Mark Patch

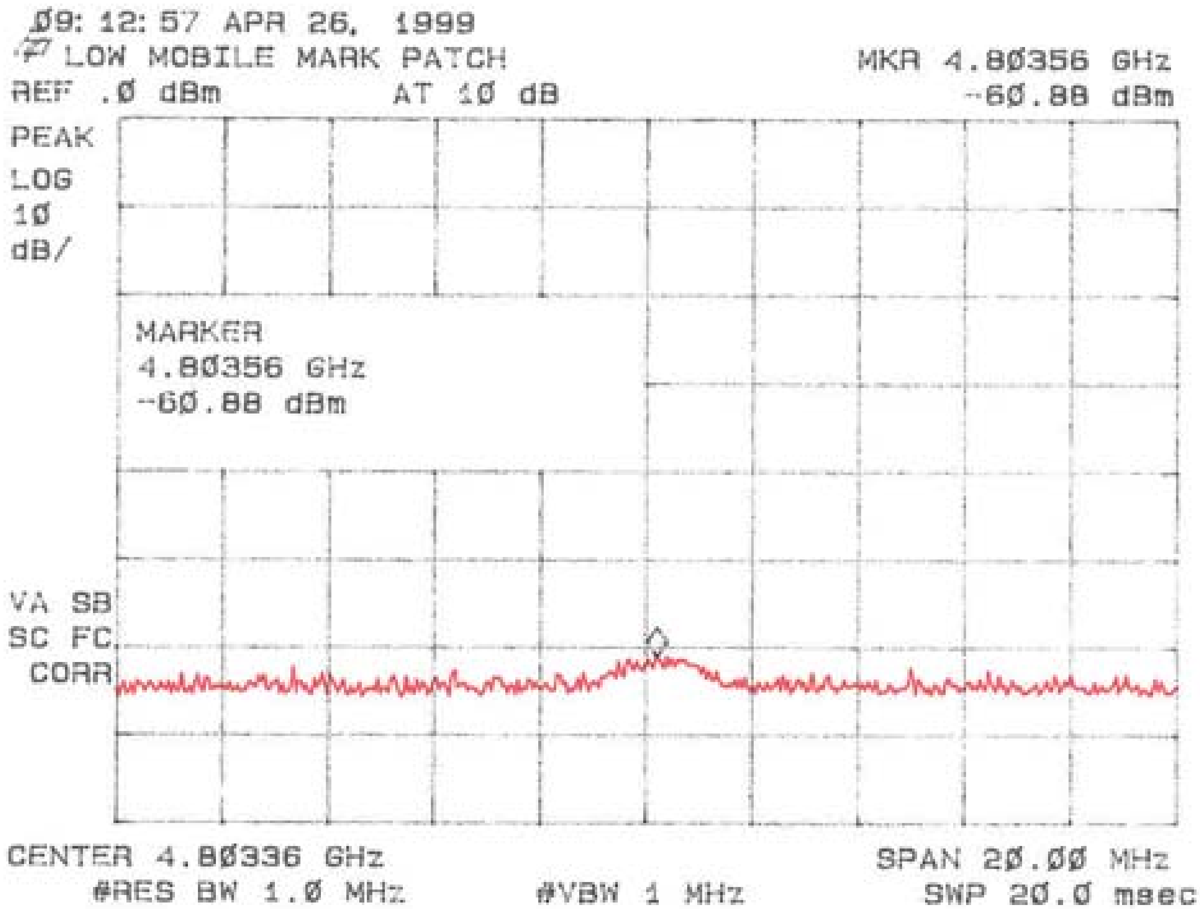


Figure 5l
Peak Radiated Spurious Emission 15.247(c) Low – Mobile Mark Patch

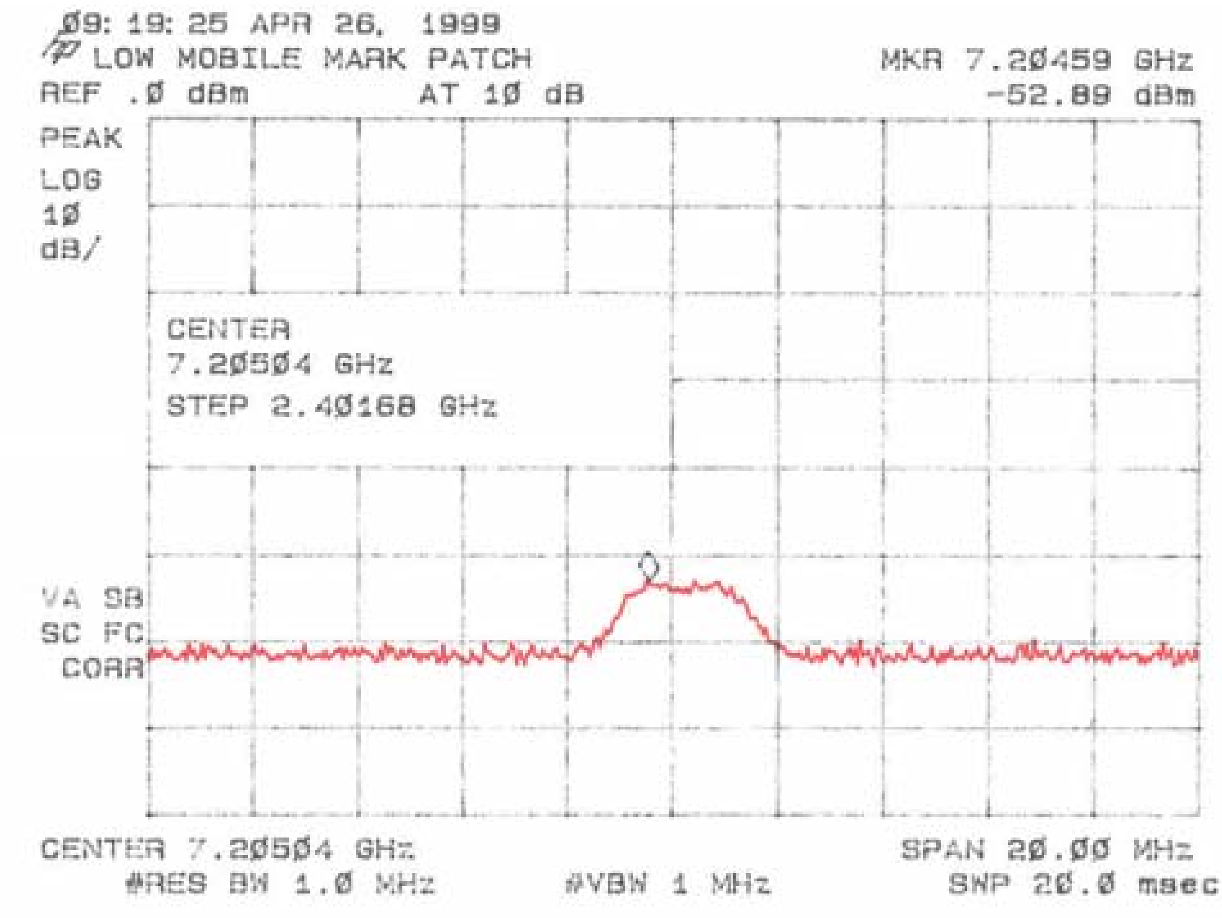


Figure 5m
Peak Radiated Spurious Emission 15.247(c) Mid – Mobile Mark Patch

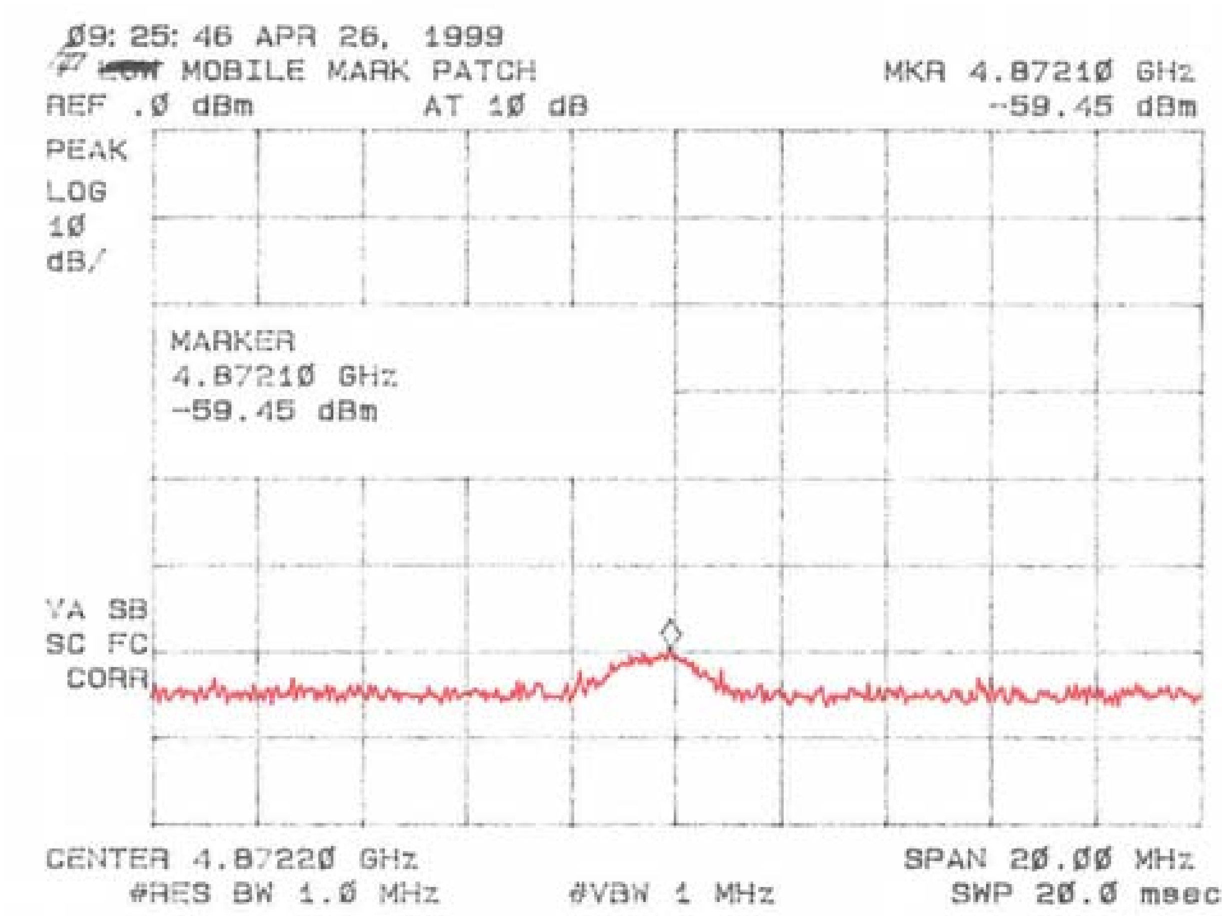


Figure 5n
Peak Radiated Spurious Emission 15.247(c) Mid – Mobile Mark Patch

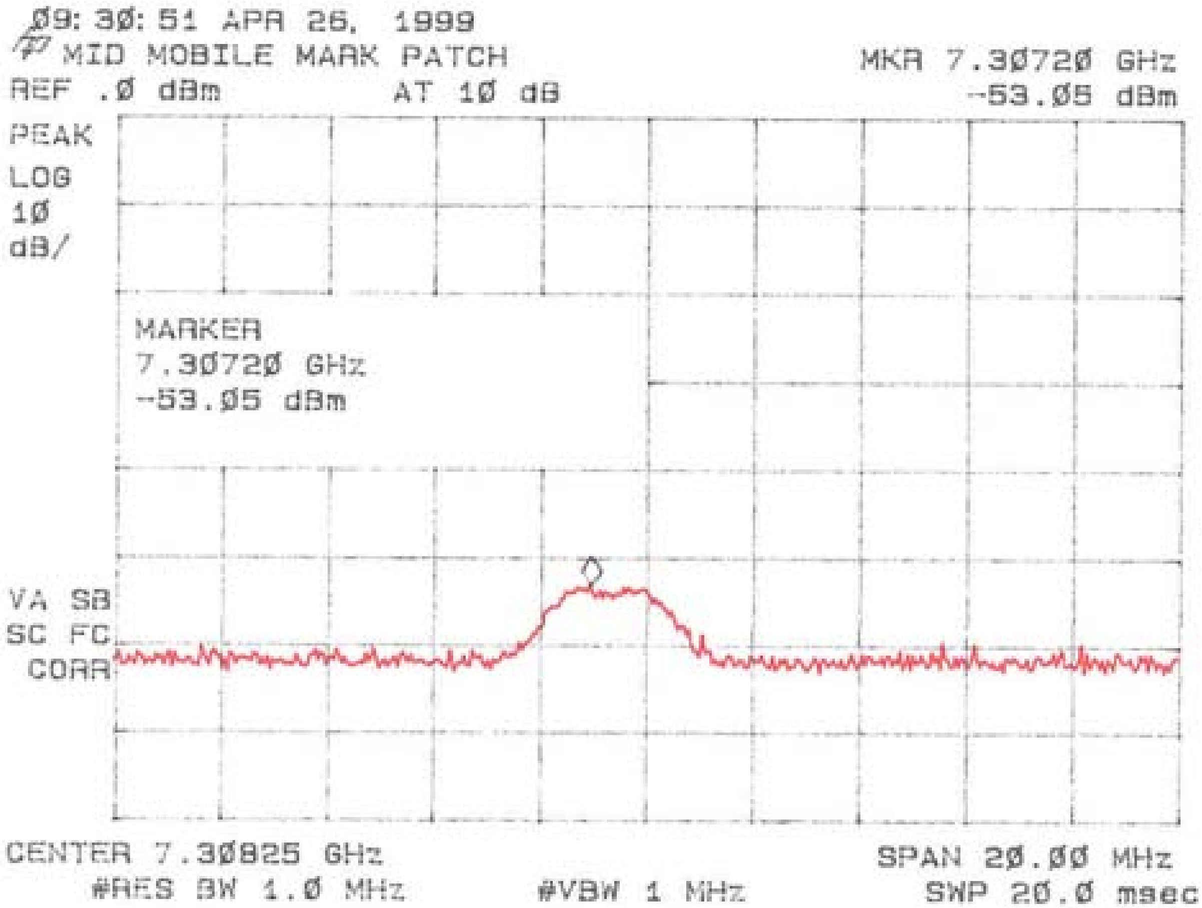


Figure 5o
Peak Radiated Spurious Emission 15.247(c) High – Mobile Mark Patch

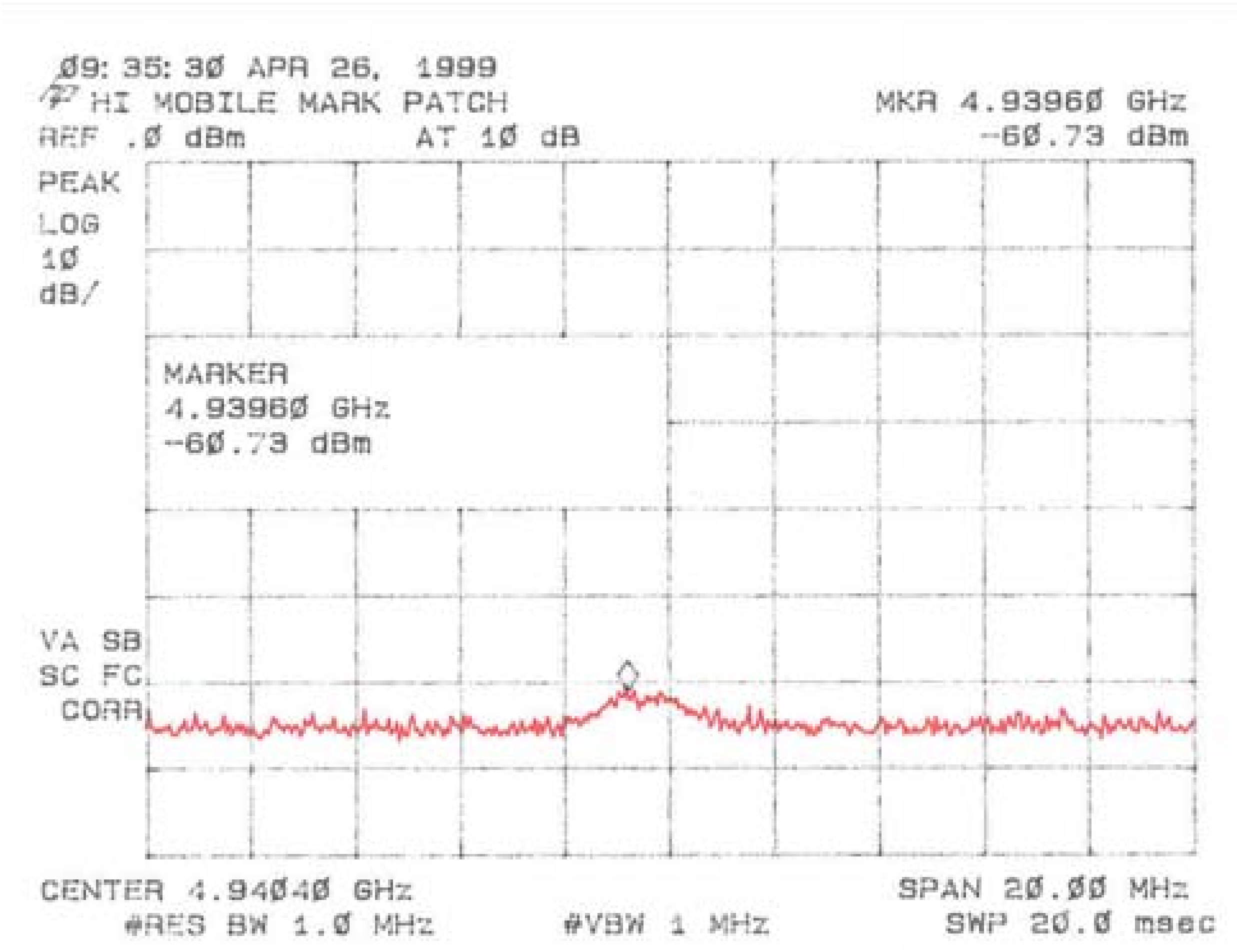


Figure 5p
Peak Radiated Spurious Emission 15.247(c) High – Mobile Mark Patch

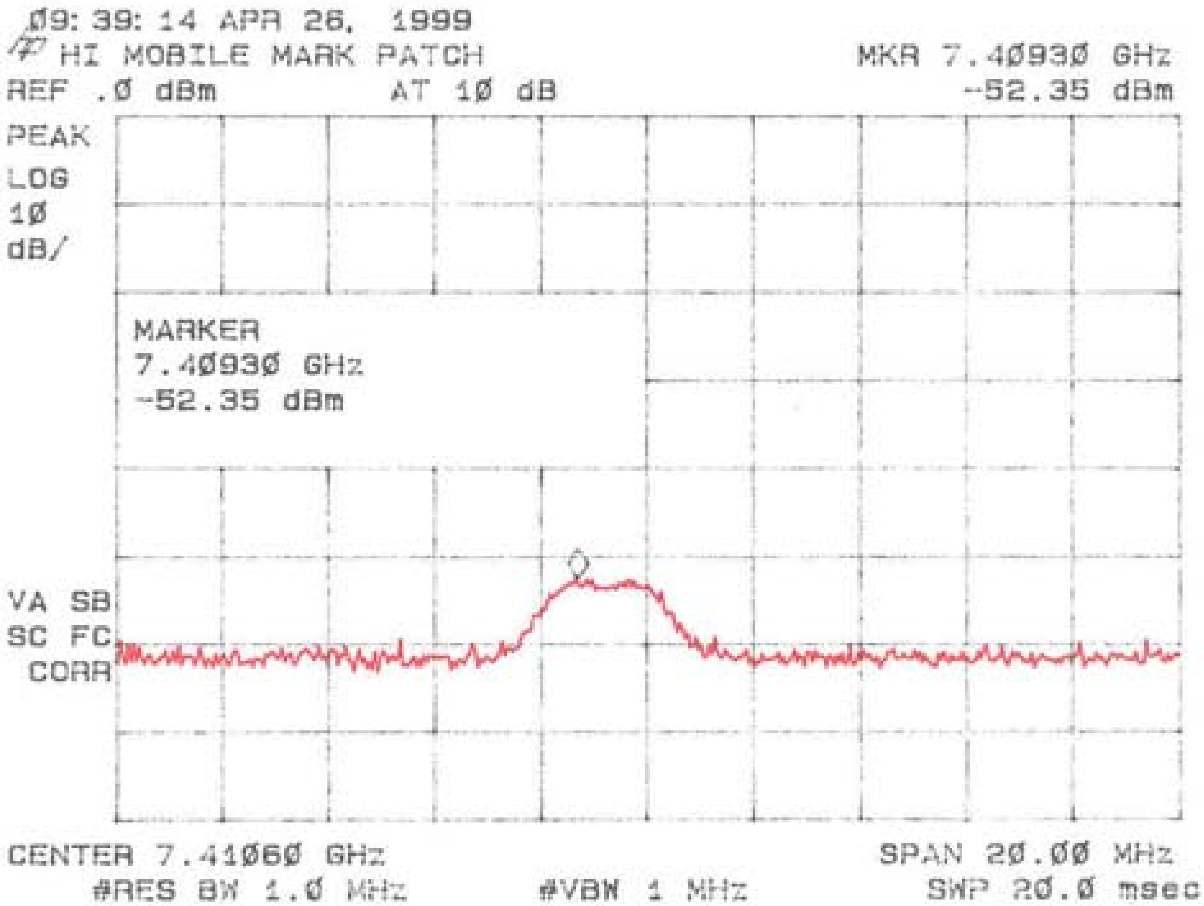


Figure 5q
Peak Radiated Spurious Emission 15.247(c) Low – 6 dB Omni

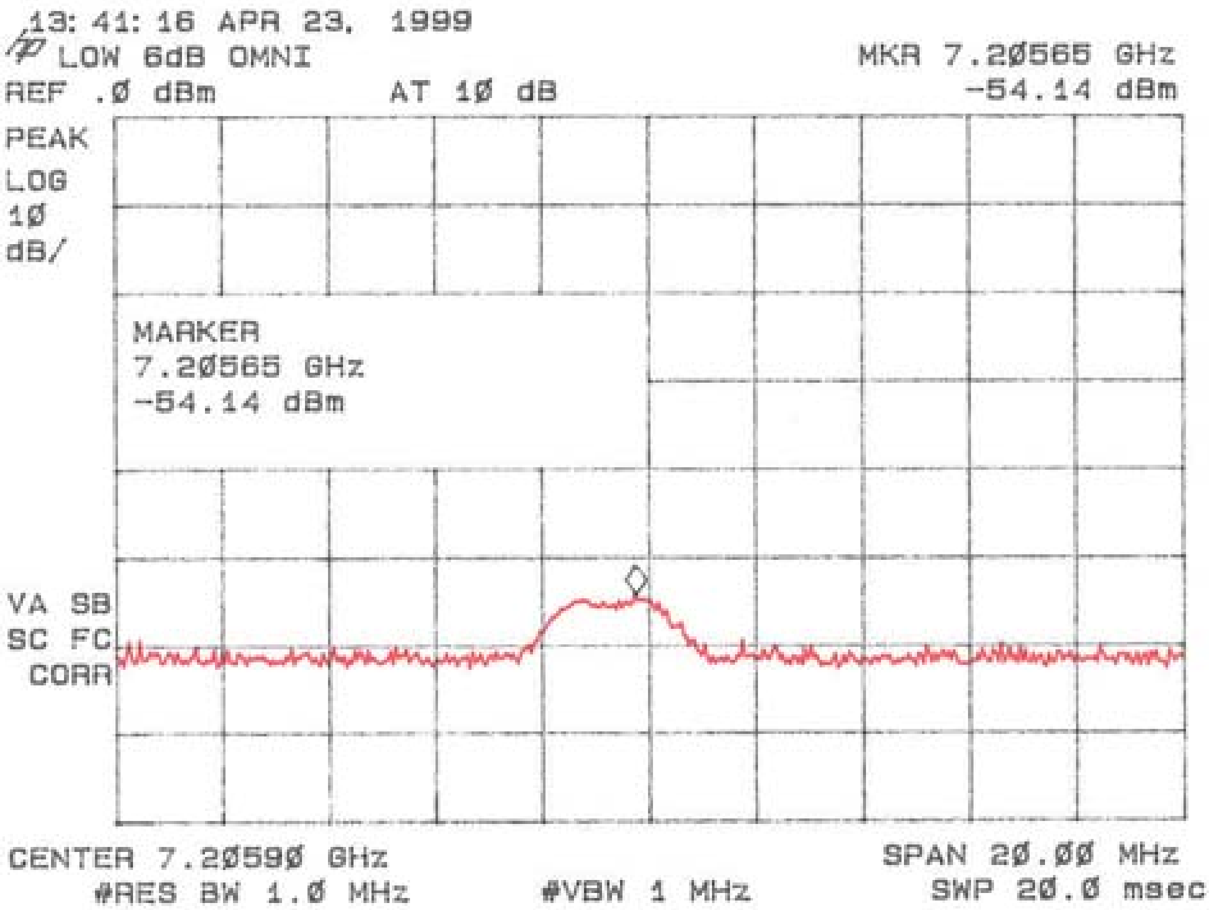


Figure 5r
Peak Radiated Spurious Emission 15.247(c) Mid – 6 dB Omni

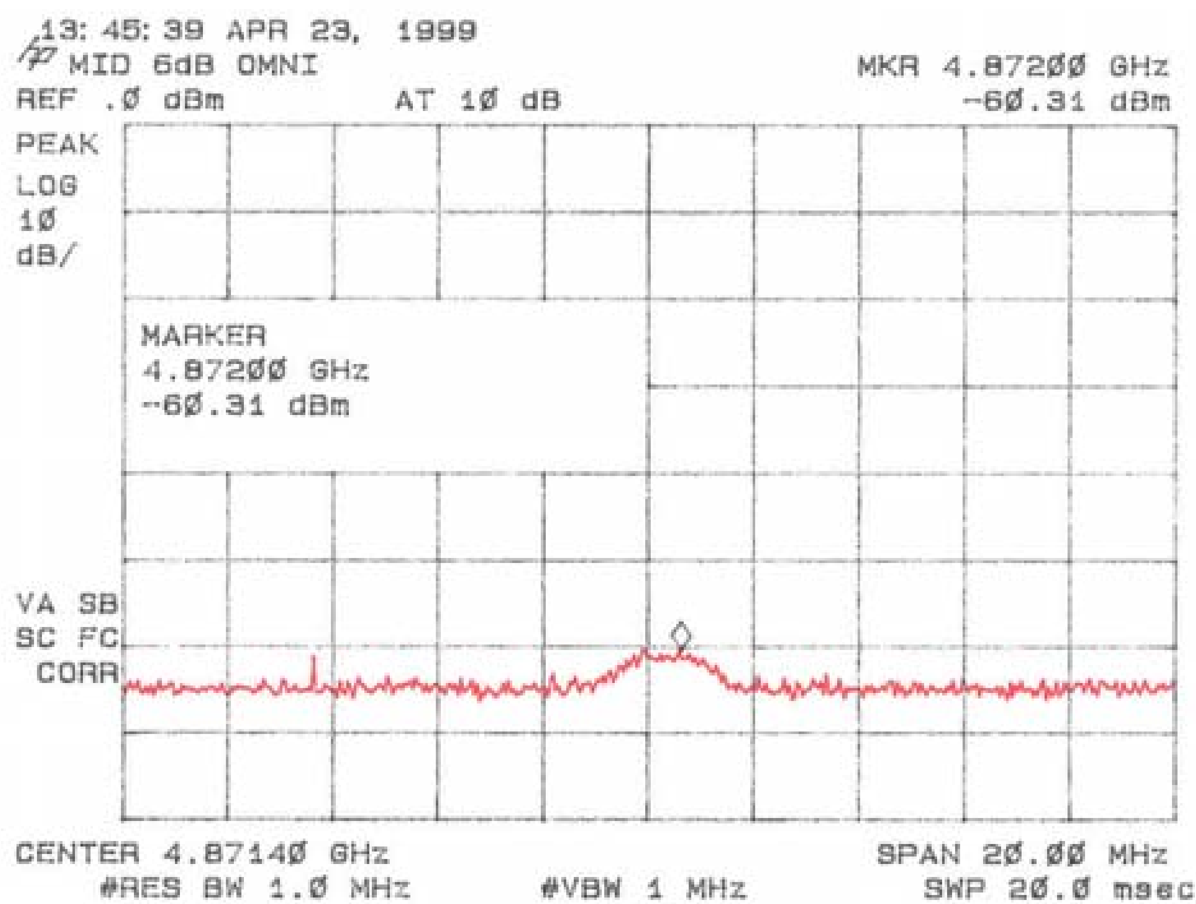


Figure 5s
Peak Radiated Spurious Emission 15.247(c) Mid – 6 dB Omni

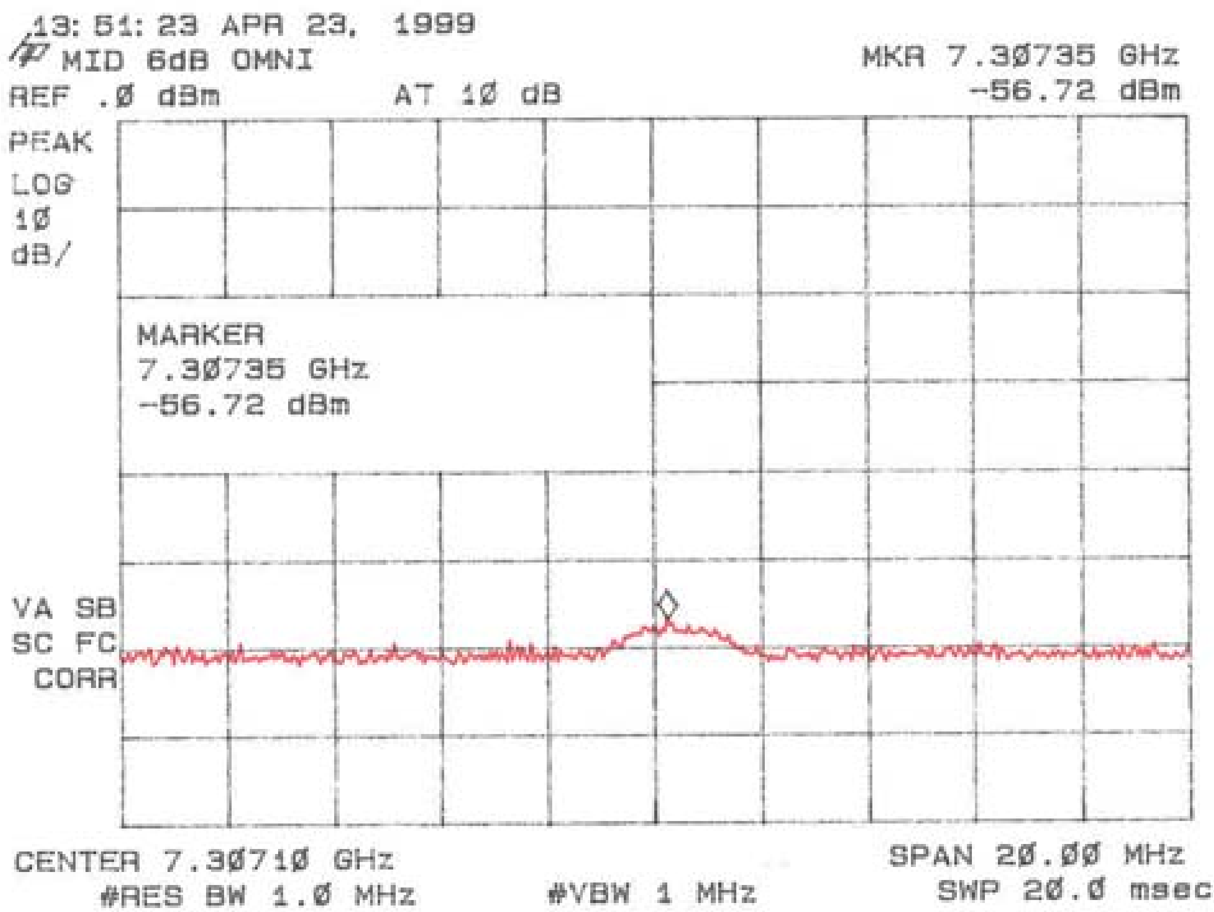


Figure 5t
Peak Radiated Spurious Emission 15.247(c) High – 6 dB Omni

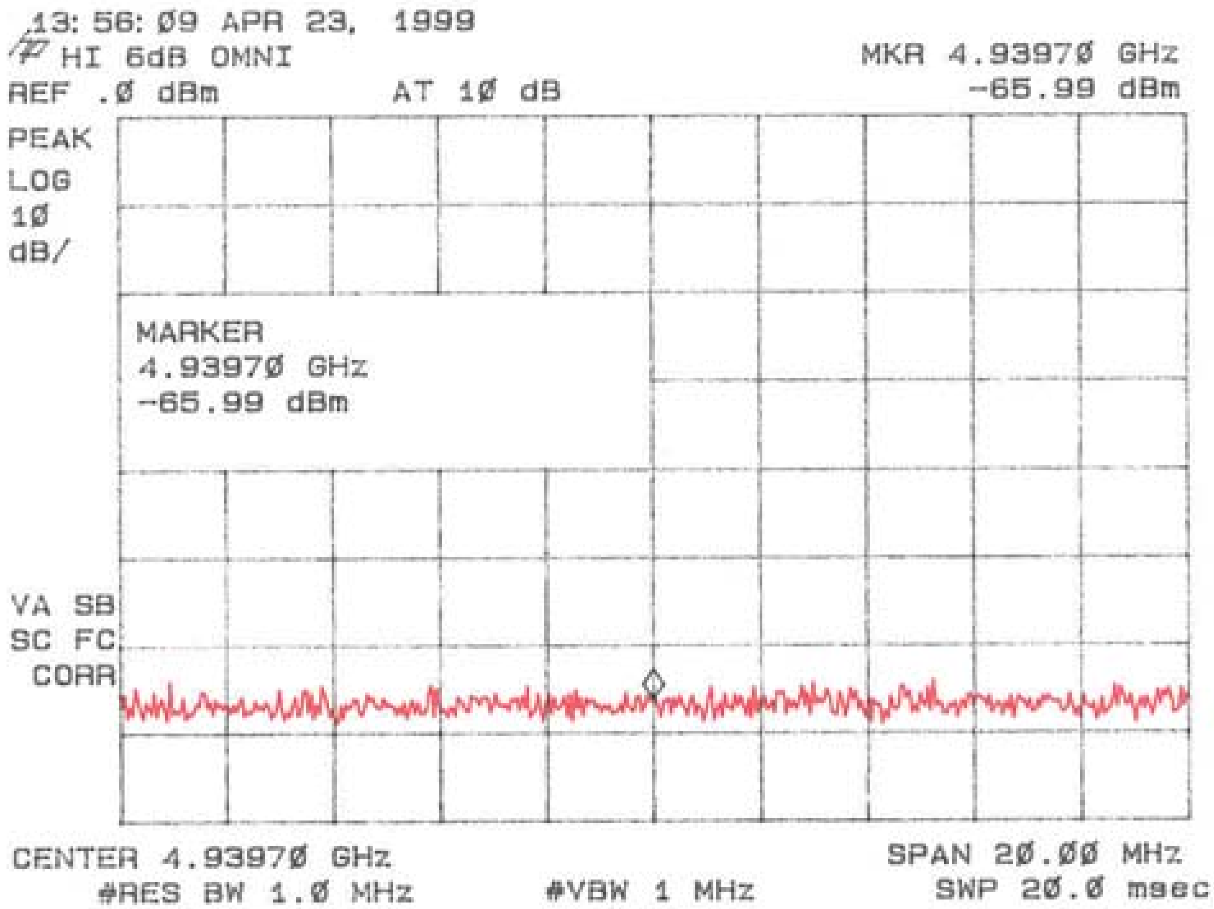


Figure 5u
Peak Radiated Spurious Emission 15.247(c) High – 6 dB Omni

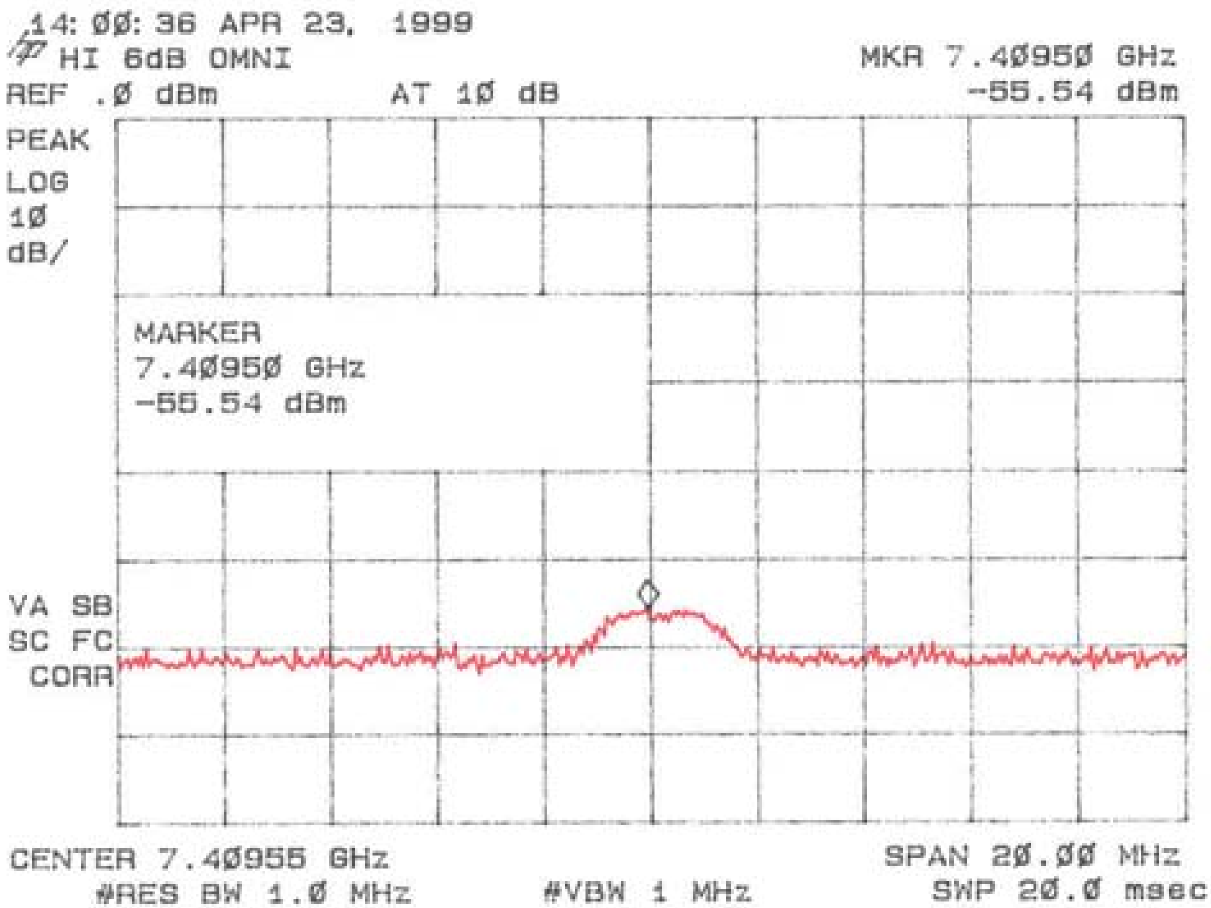


Figure 5v
Peak Radiated Spurious Emission 15.247(c) Low – 12 dB Omni

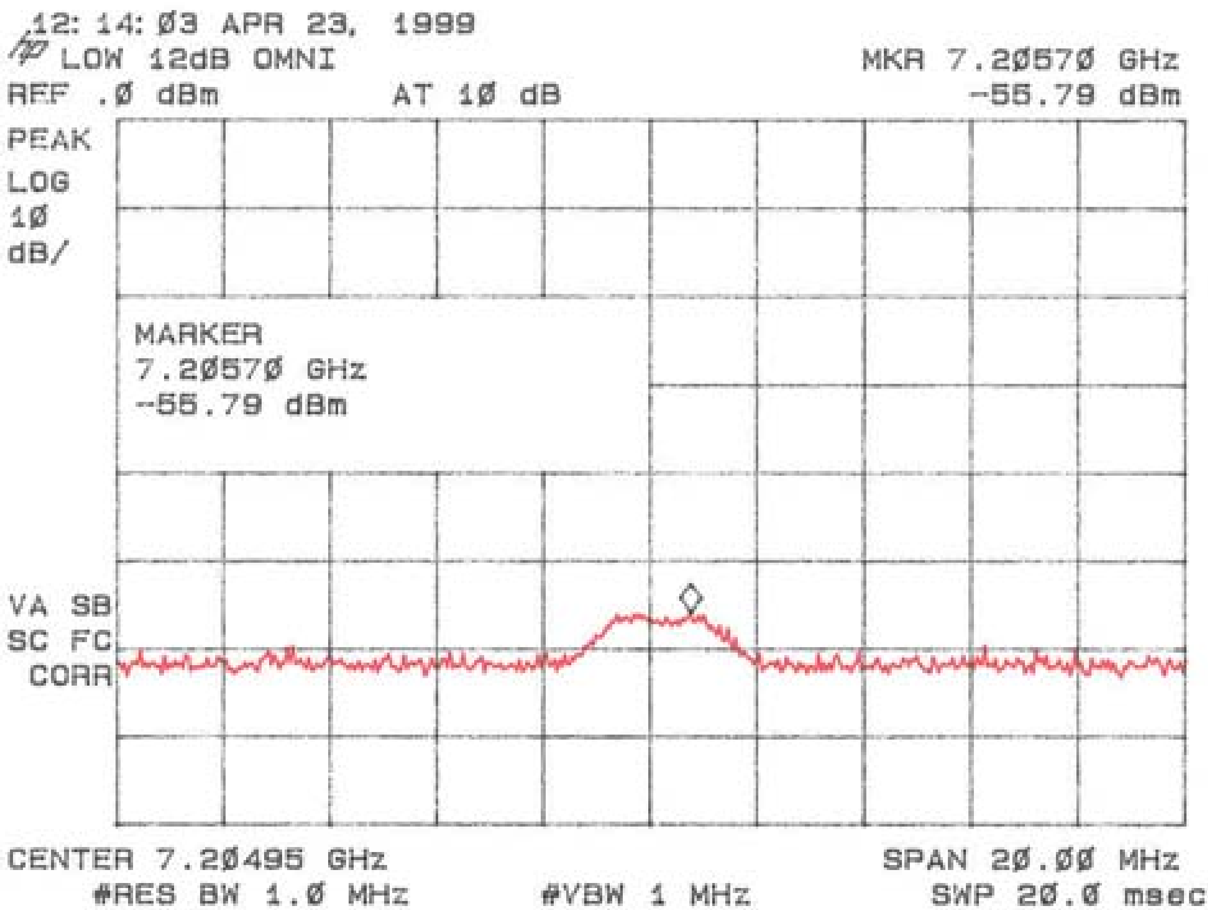


Figure 5w
Peak Radiated Spurious Emission 15.247(c) Mid – 12 dB Omni

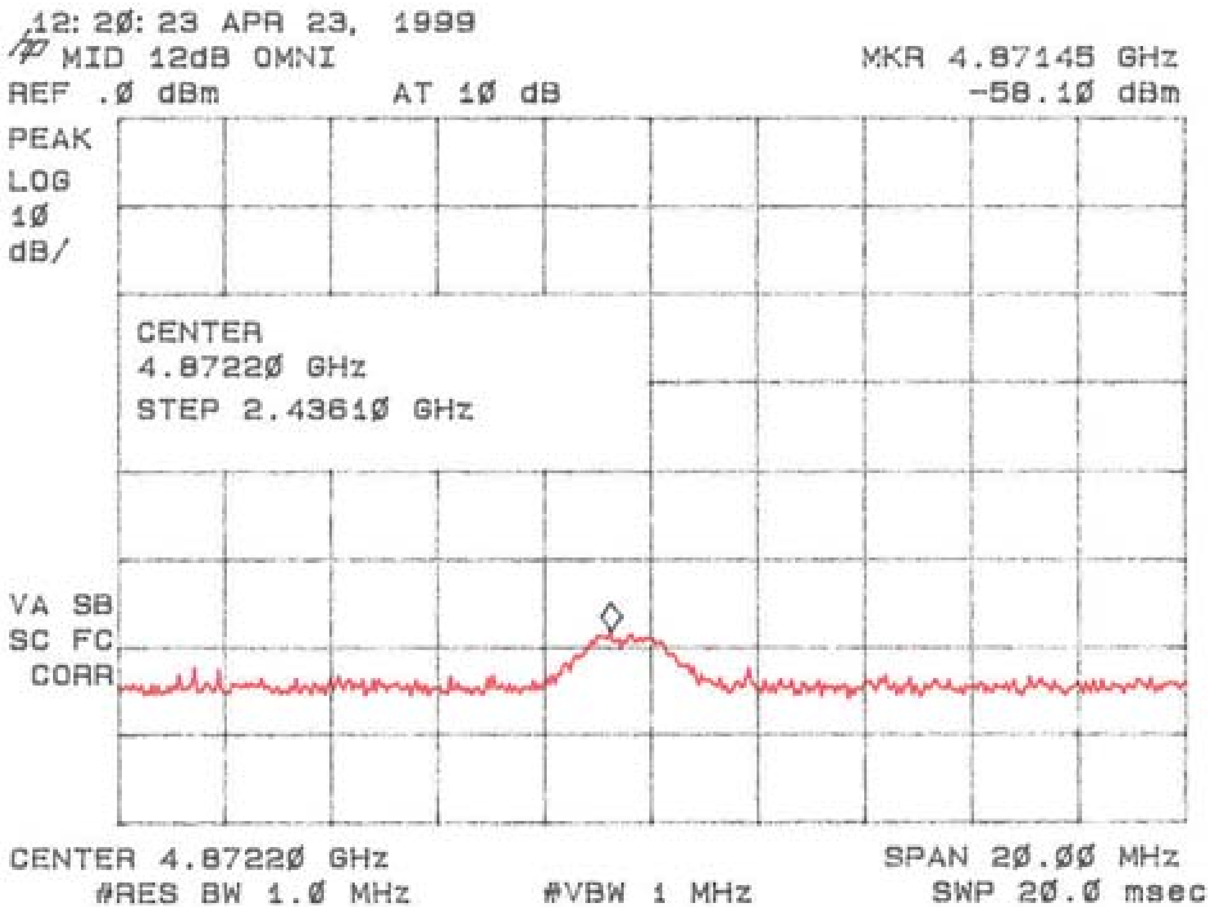


Figure 5x
Peak Radiated Spurious Emission 15.247(c) Mid – 12 dB Omni

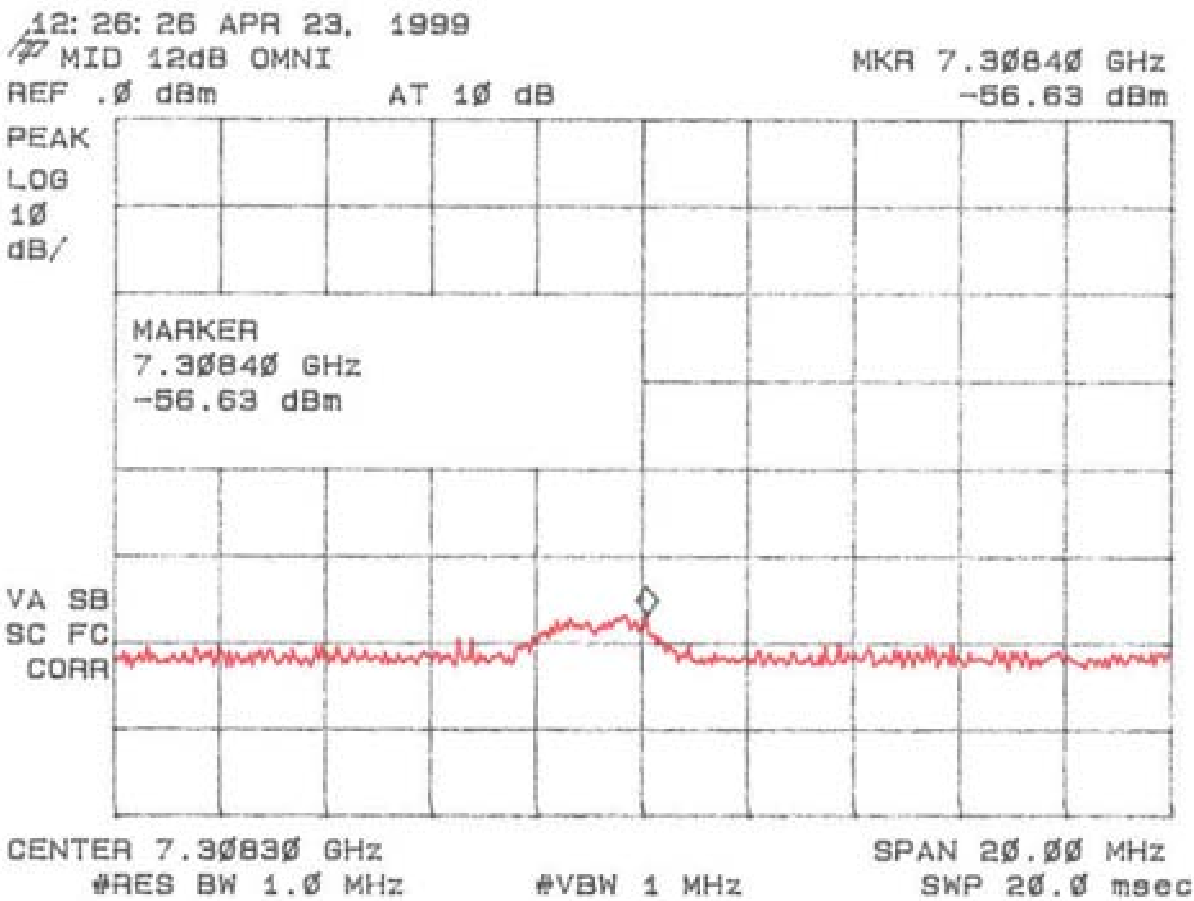


Figure 5y
Peak Radiated Spurious Emission 15.247(c) High – 12 dB Omni

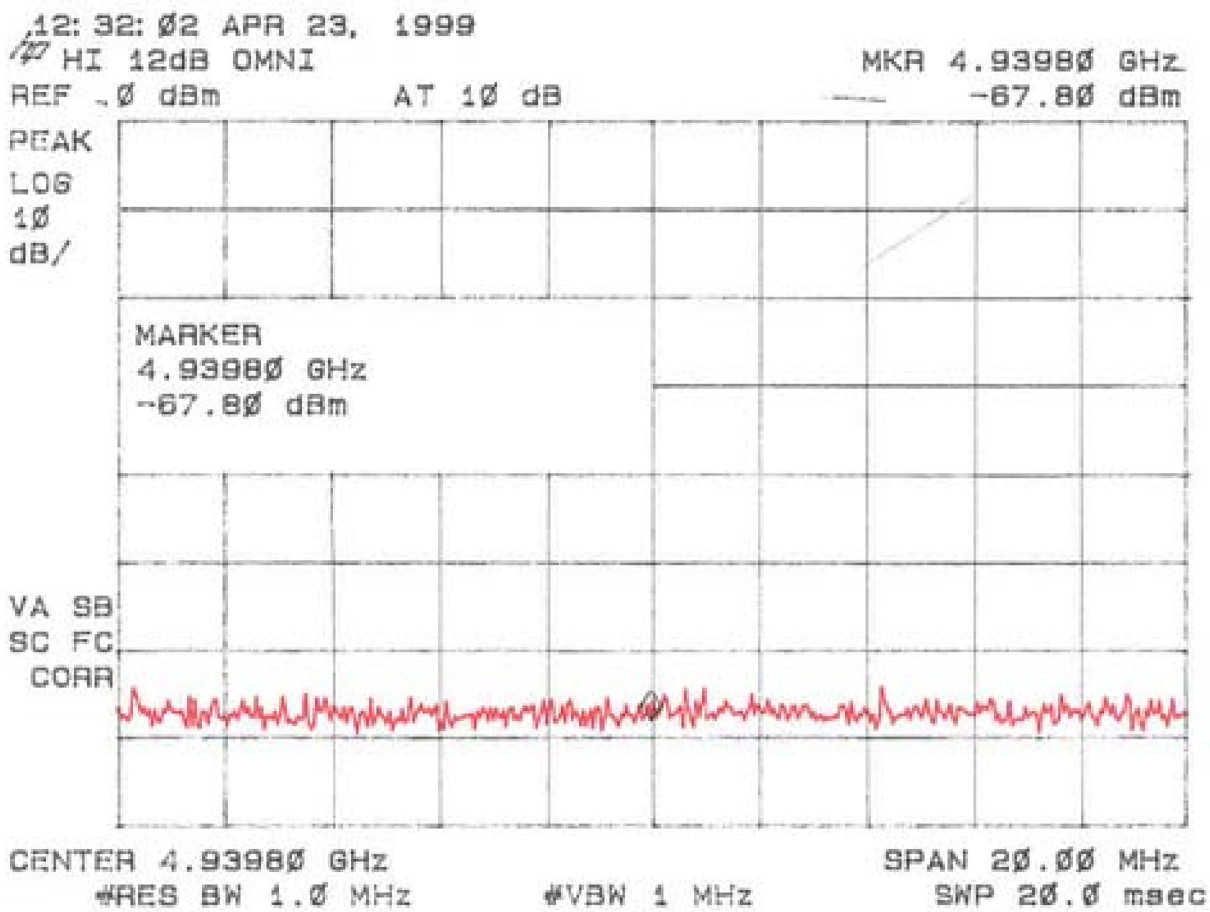


Figure 5z
Peak Radiated Spurious Emission 15.247(c) High – 12 dB Omni

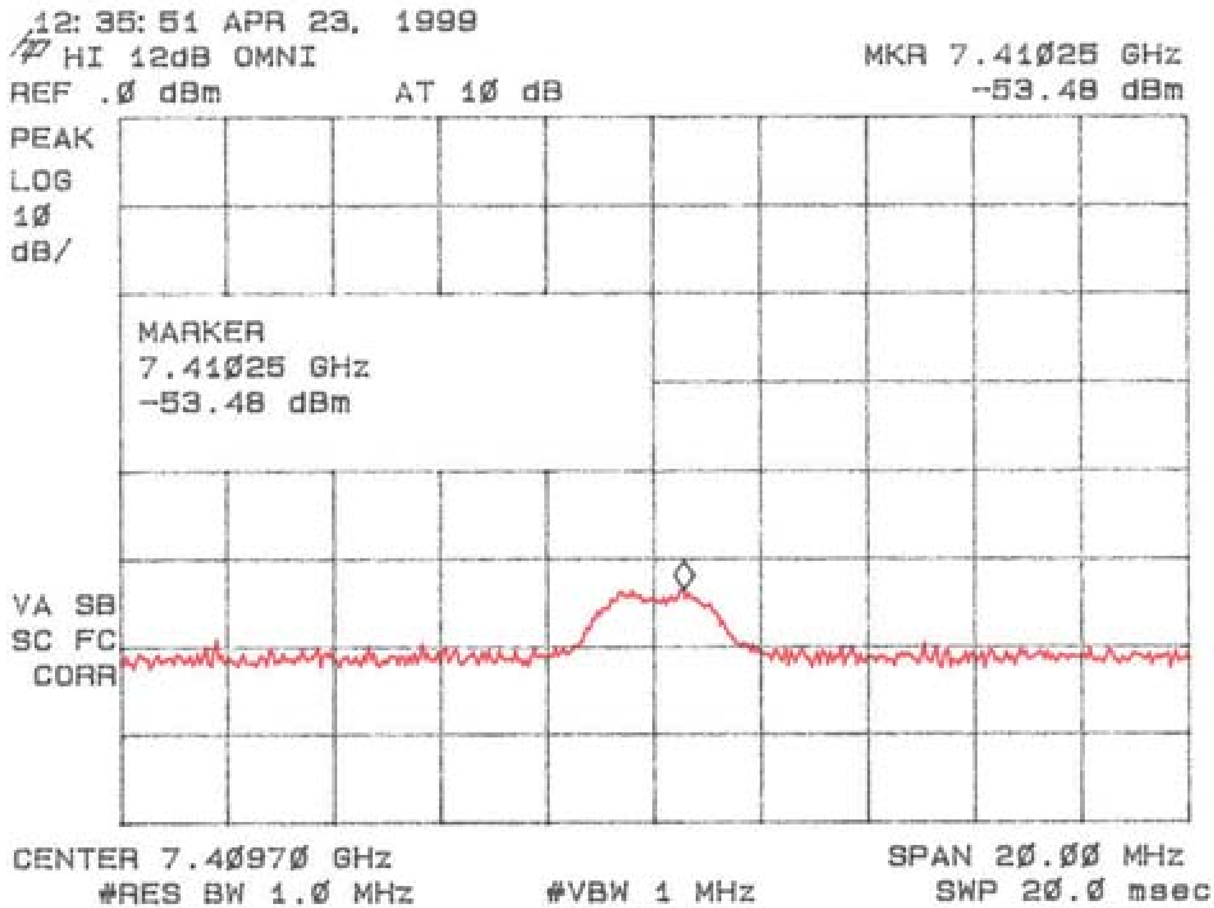


Figure 5aa
Peak Radiated Spurious Emission 15.247(c) Low – 14 dB Corner Ant.

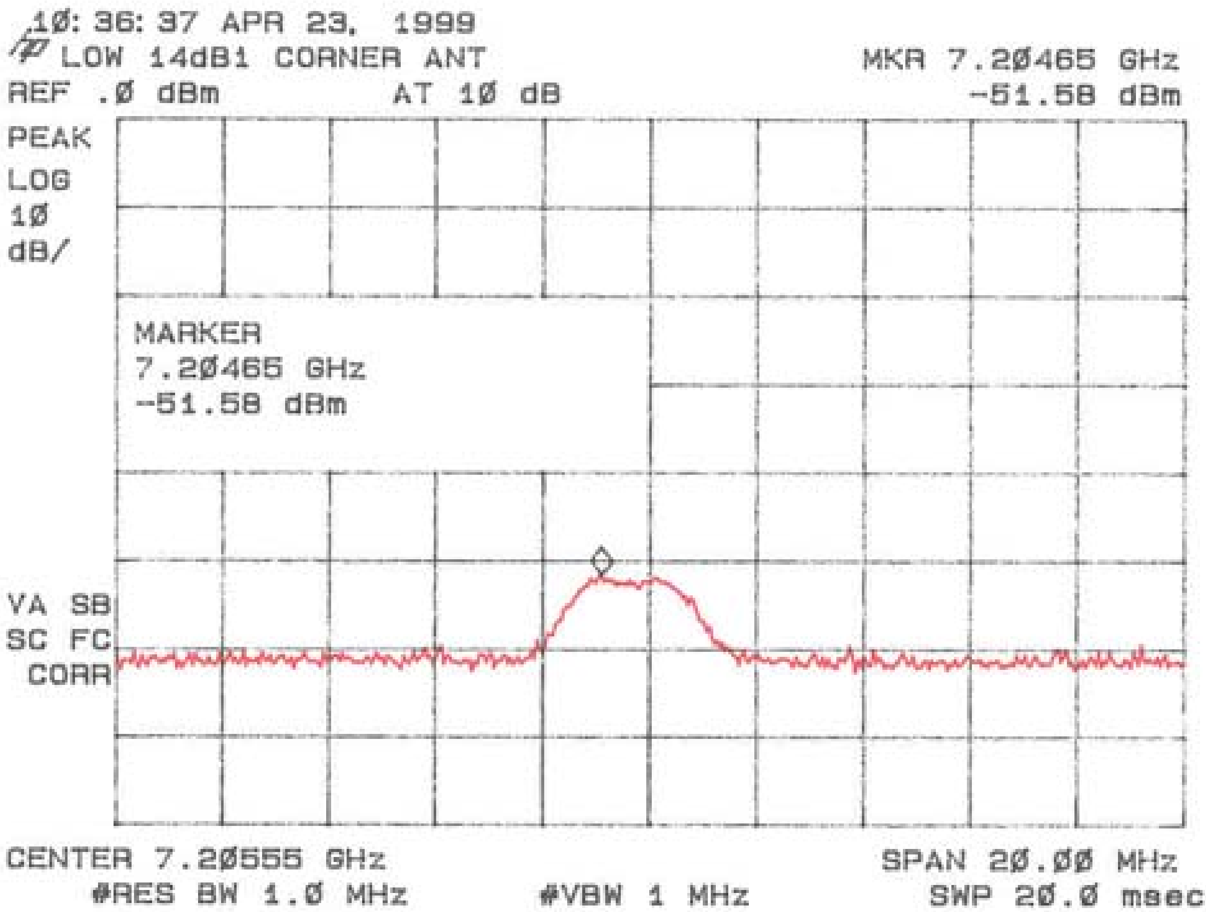


Figure 5ab
Peak Radiated Spurious Emission 15.247(c) Mid – 14 dB Corner Ant.

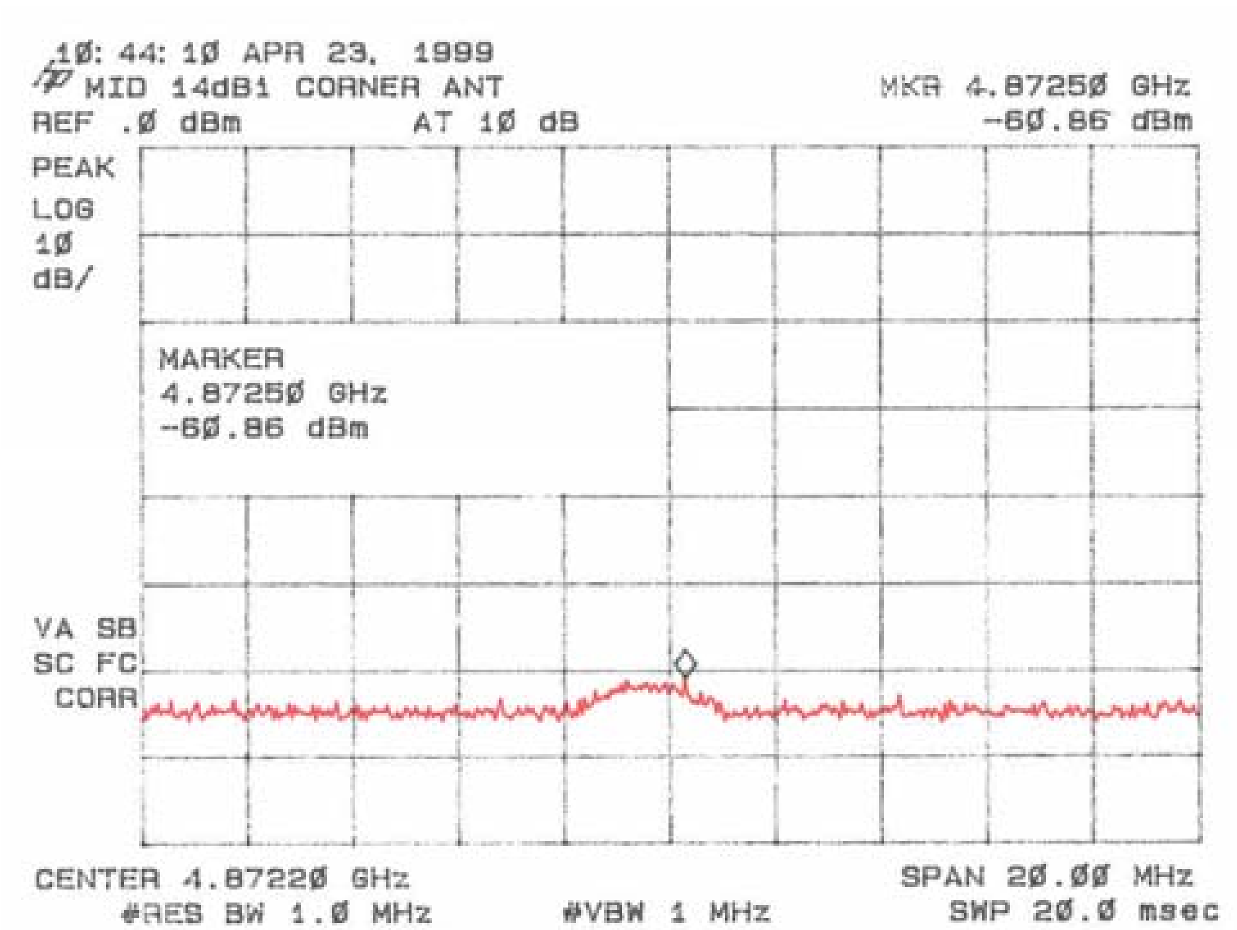


Figure 5ac
Peak Radiated Spurious Emission 15.247(c) Mid – 14 dB Corner Ant.

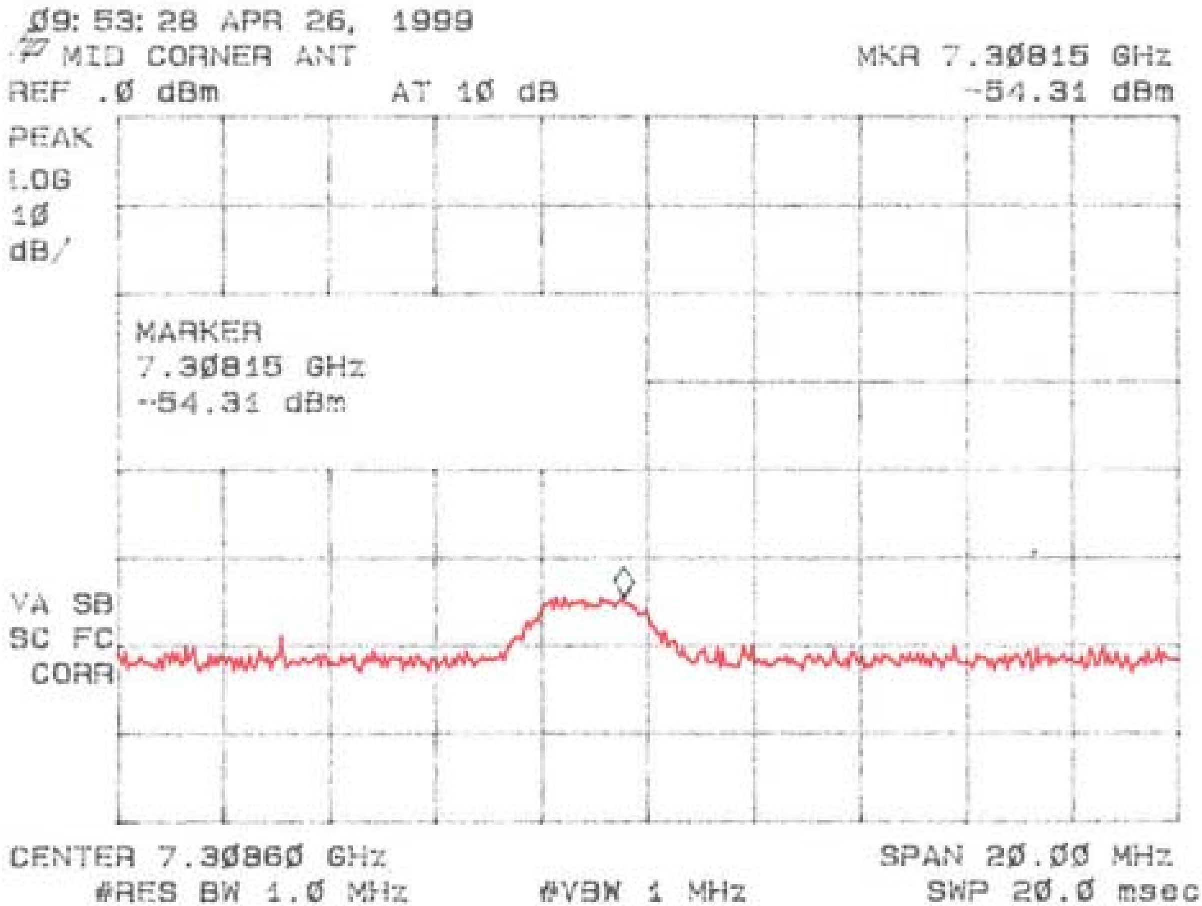


Figure 5ad
Peak Radiated Spurious Emission 15.247(c) High – 14 dB Corner Ant.

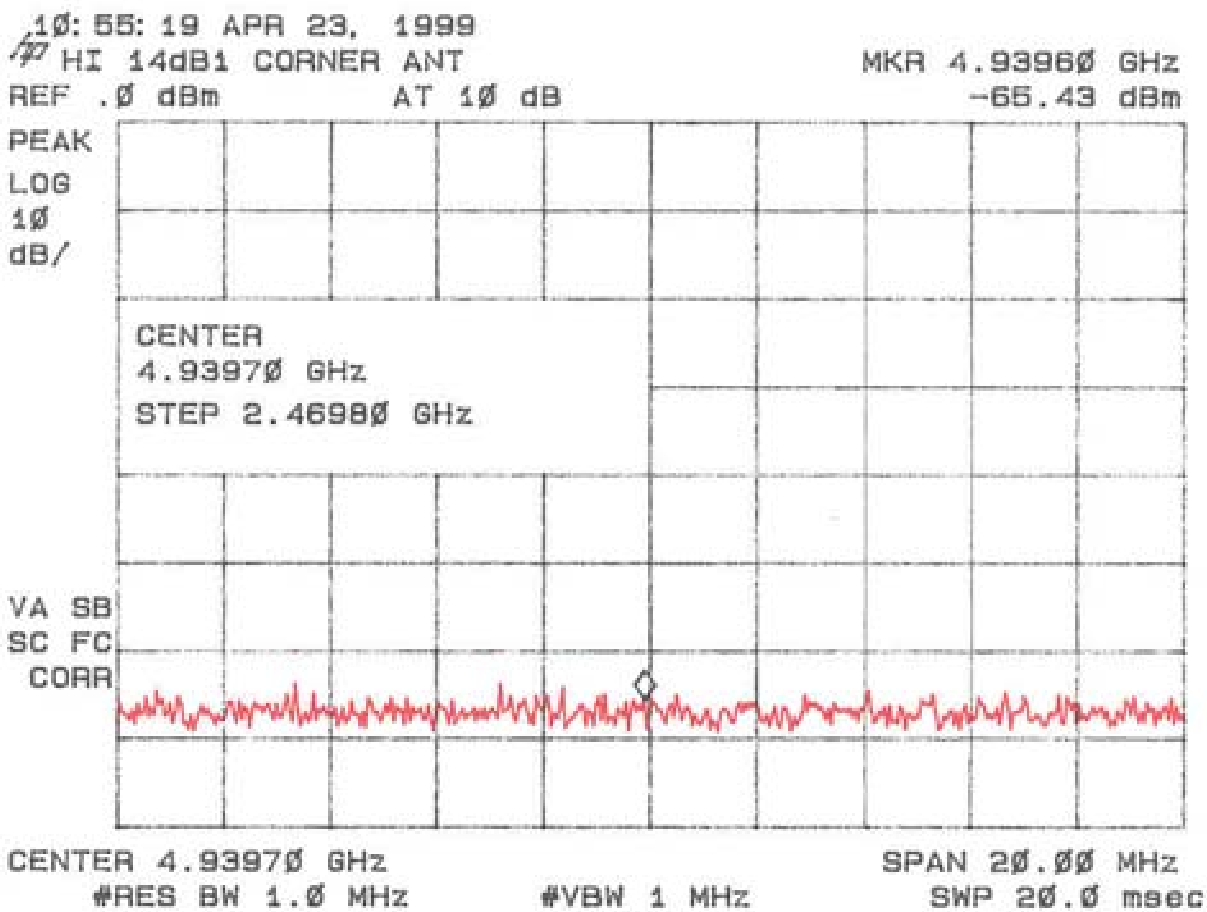


Figure 5ae
Peak Radiated Spurious Emission 15.247(c) High – 14 dB Corner Ant.

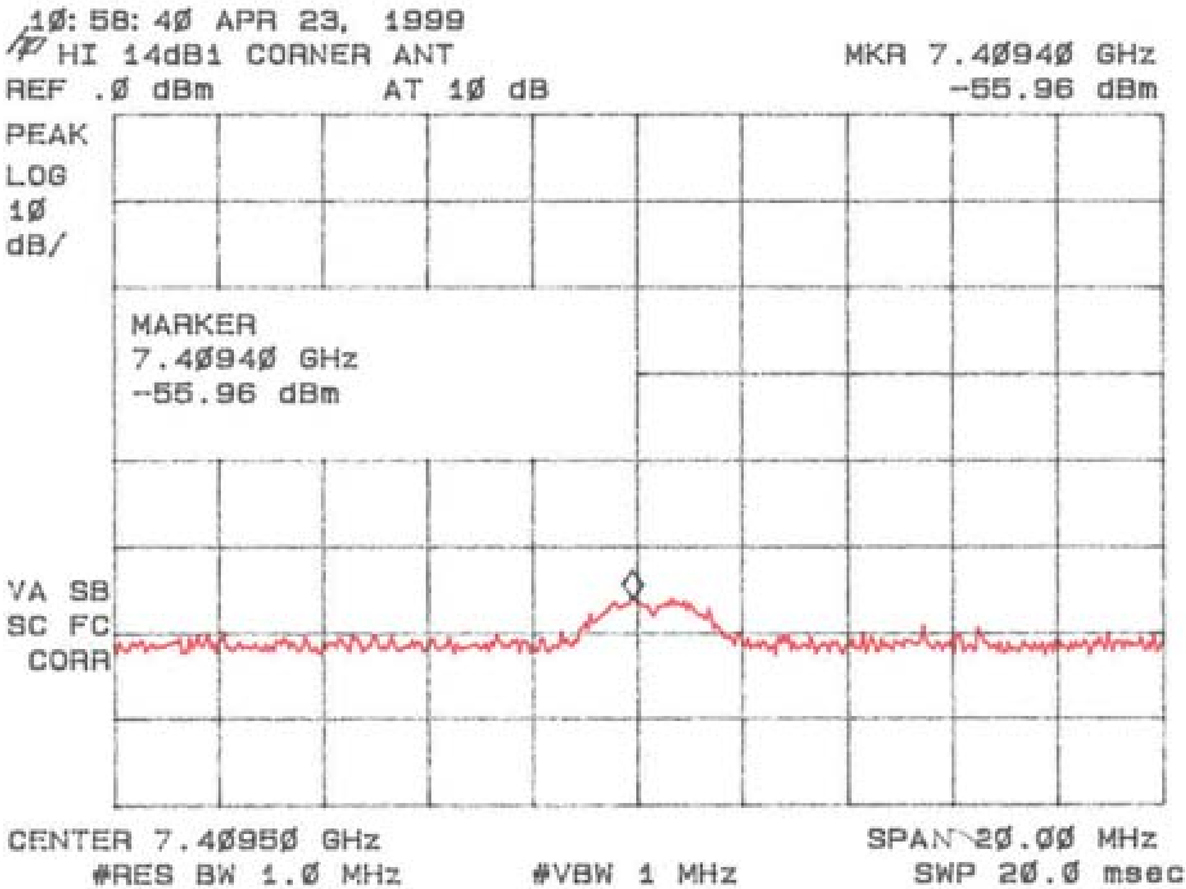


Figure 5af
Peak Radiated Spurious Emission 15.247(c) Low – 14 dB Yagi

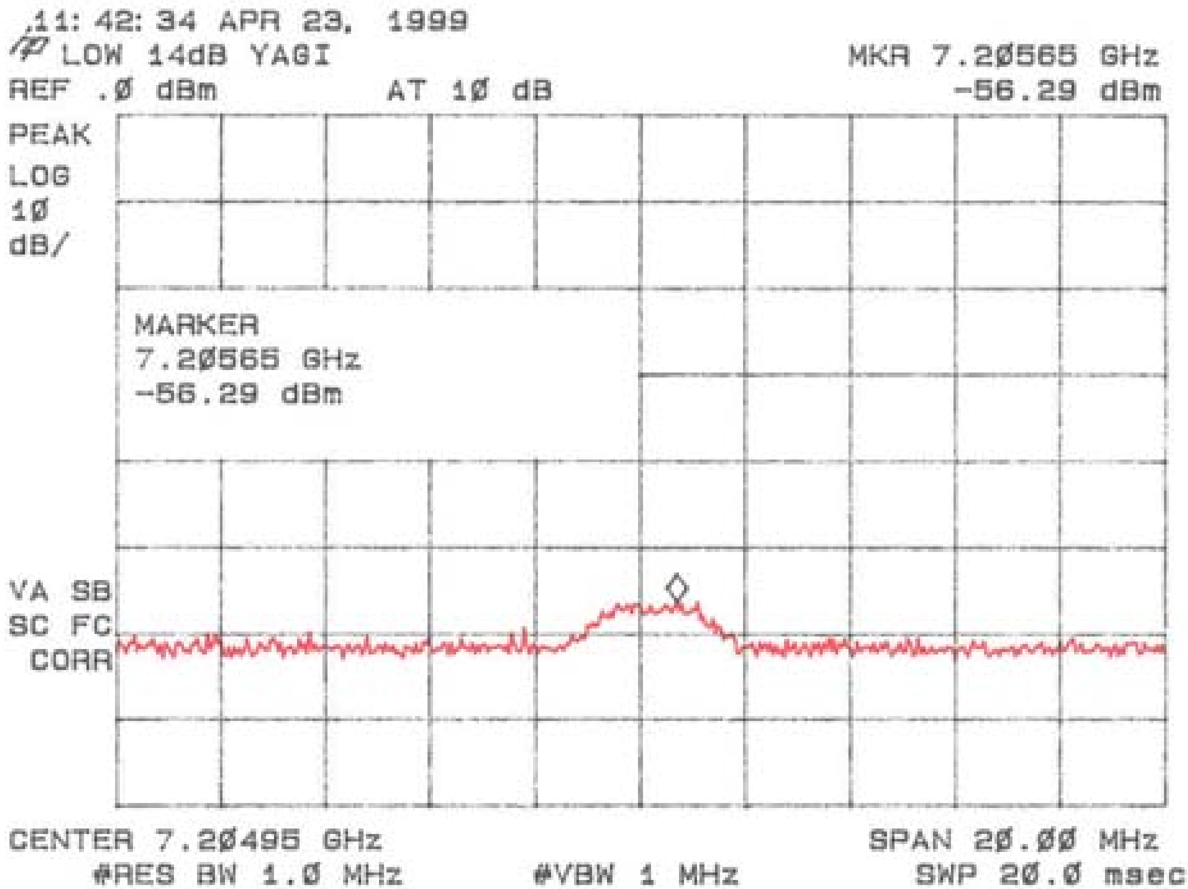


Figure 5ag
Peak Radiated Spurious Emission 15.247(c) Mid – 14 dB Yagi

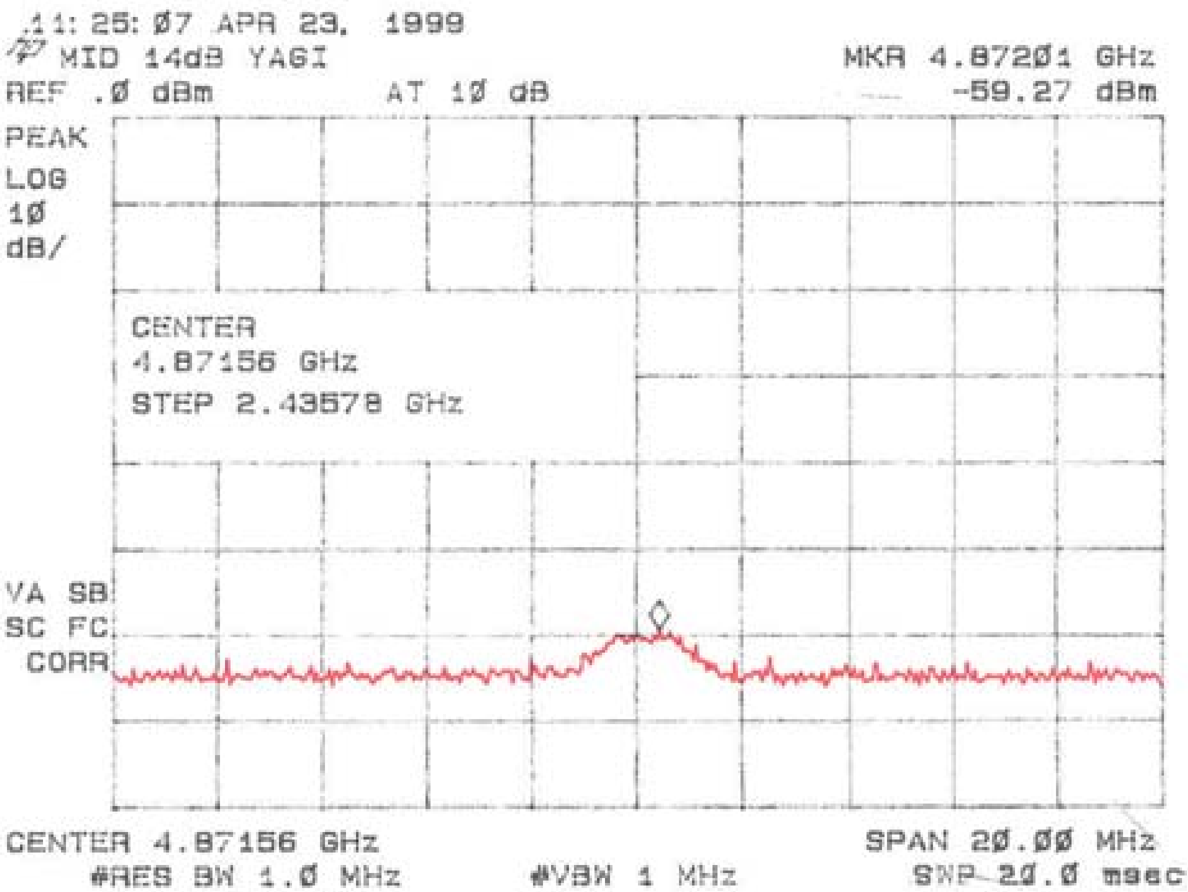


Figure 5ah
Peak Radiated Spurious Emission 15.247(c) Mid – 14 dB Yagi

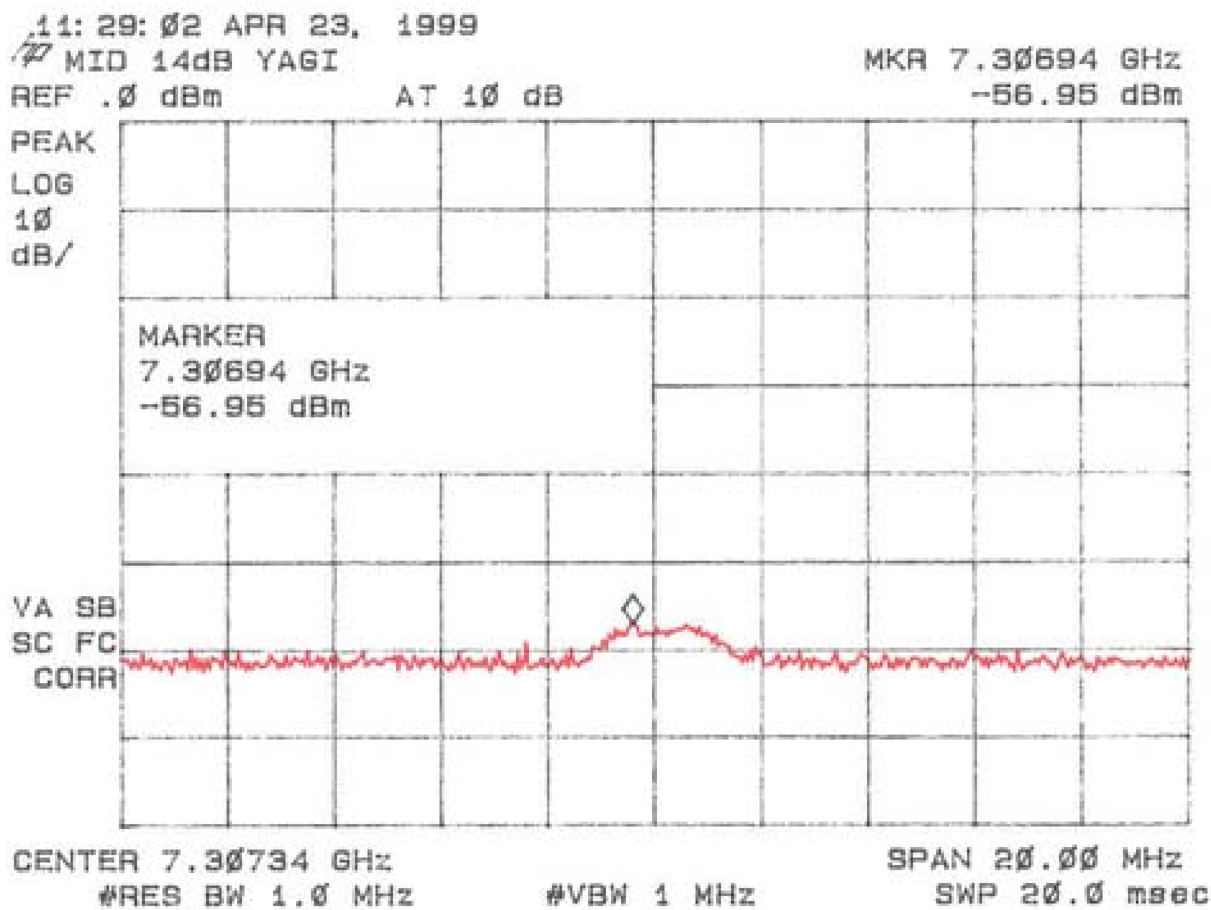


Figure 5ai
Peak Radiated Spurious Emission 15.247(c) High – 14 dB Yagi

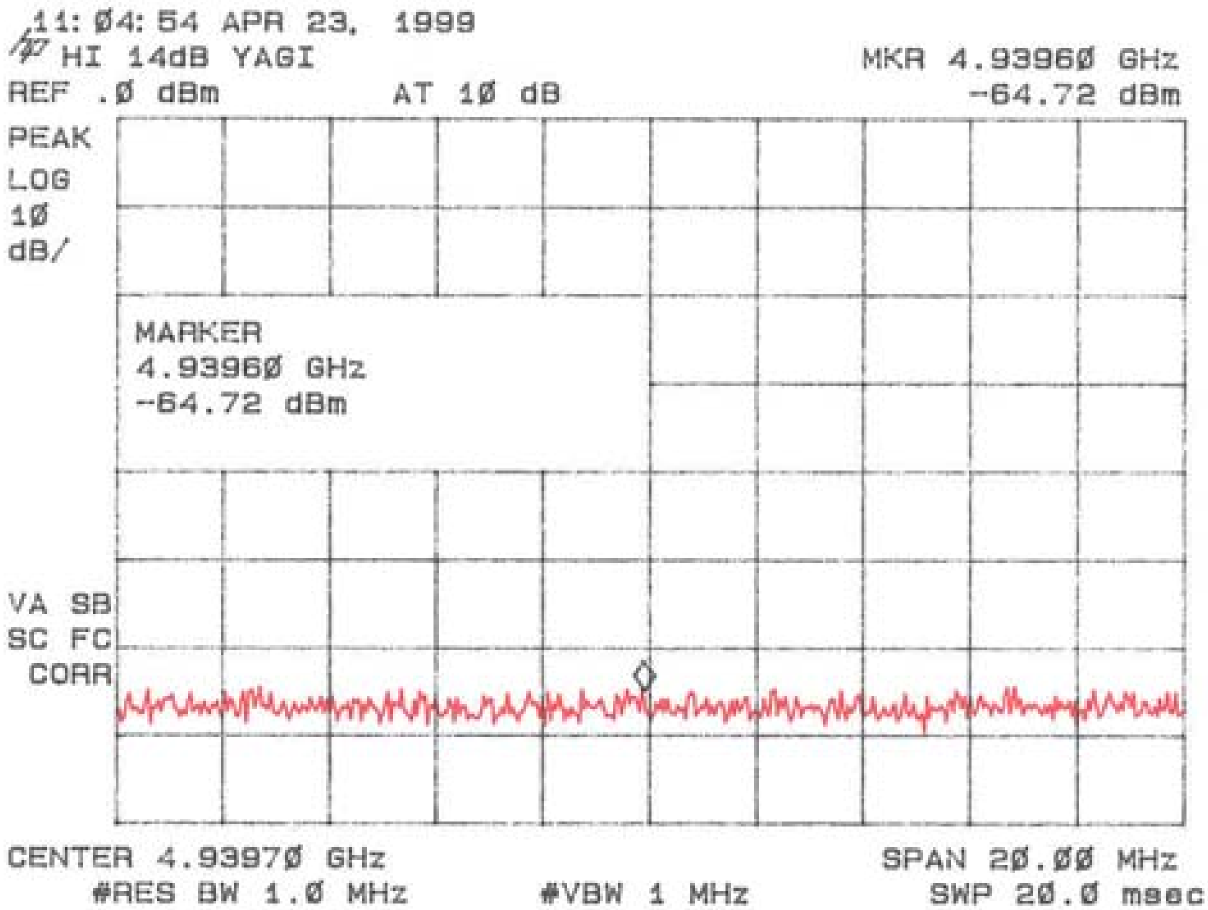
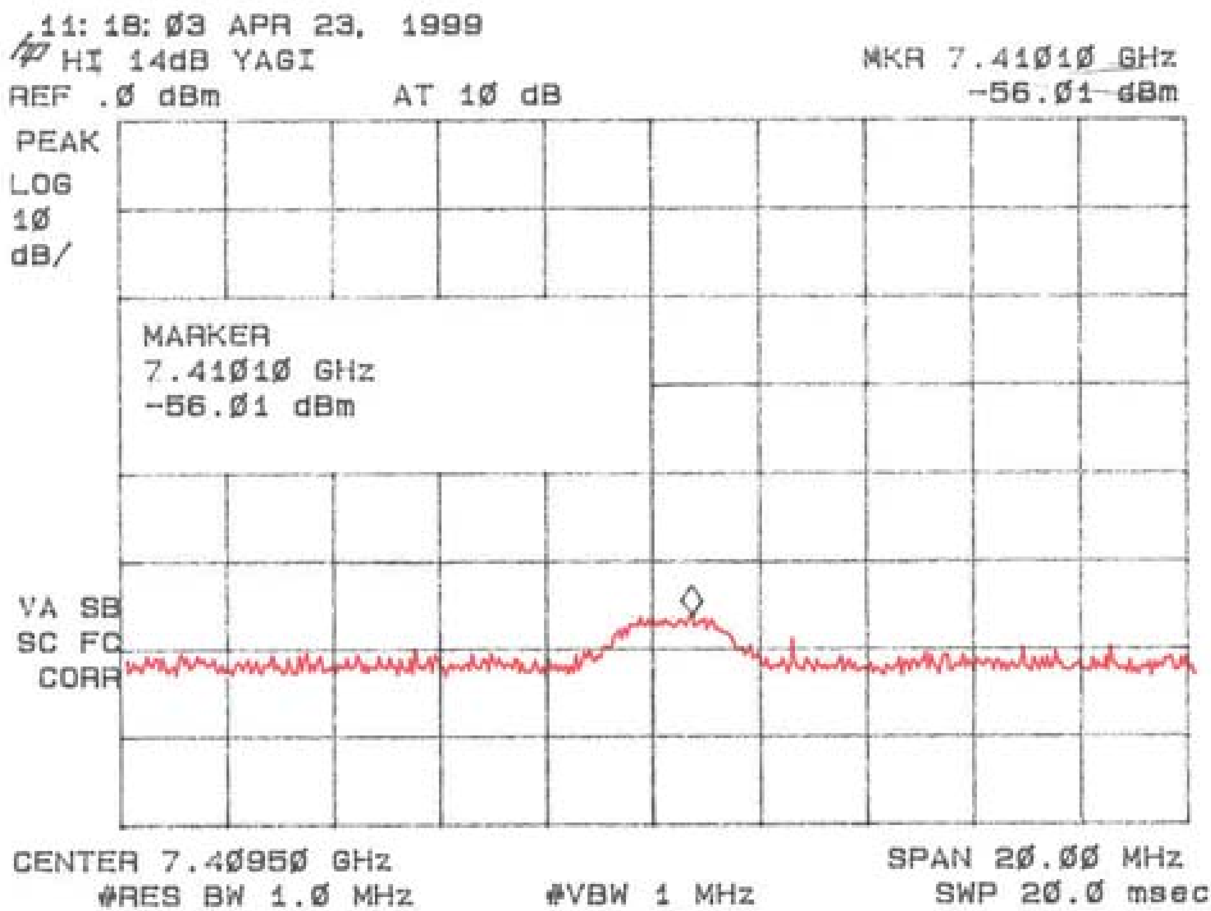


Figure 5aj
Peak Radiated Spurious Emission 15.247(c) High – 14 dB Yagi



2.10 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 5a – 5g. Due to the functionality of the transmitter and the complexity of the test setup in order to measure worse case duty cycle, Digital Wireless 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:

$$20 * \mathrm{Log}_{10}(4.86\mathrm{ms}/100\mathrm{ms}) = \mathbf{-26.3\ dB}$$

Table 5A. AVERAGE RADIATED SPURIOUS EMISSIONS (Low End)
Ace Dipole Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20450	-76.16	34.5	36.9	7.8	113.4	500

Table 5A. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
Ace Dipole Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87105	-87.75	34.3	34.7	8.1	24.3	500
7.30700	-77.65	34.6	37.2	7.9	98..0	500

Table 5A. AVERAGE RADIATED SPURIOUS EMISSIONS (High End)
Ace Dipole Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93995	-85.05	34.3	34.8	8.2	34.3	500
7.41055	-80.43	34.6	37.4	7.9	73.1	500

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-76.16 – 34.5 + 36.9 + 7.8 + 107)/20) = 113.4
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ **Name: Roger Bowen**

Table 5B. AVERAGE RADIATED SPURIOUS EMISSIONS (Low End)
DWC 3dBi Patch Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20465	-78.25	34.5	37.0	7.8	89.1	500

Table 5B. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
DWC 3 dBi Patch Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87105	-93.08	34.3	34.7	8.1	13.1	500
7.30710	-80.42	34.6	37.2	7.9	71.2	500

Table 5B. AVERAGE RADIATED SPURIOUS EMISSIONS (High End)
DWC 3 dBi Patch Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93980	-87.61	34.3	34.8	8.2	25.5	500
7.41055	-81.61	34.6	37.4	7.9	62.7	500

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-78.25 – 34.5 + 37.0 + 7.8 + 107)/20) = 89.1
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: __Roger Bowen__

Table 5C. AVERAGE SPURIOUS EMISSIONS (Low End)
Mobile Mark Patch Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.80356	-86.18	34.3	34.6	7.9	28.2	500
7.20459	-78.19	34.5	37.0	7.8	89.7	500

Table 5C. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
Mobile Mark Patch Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87210	-84.75	34.3	34.7	8.1	34.3	500
7.30720	-79.35	34.5	37.0	7.8	78.6	500

Table 5C. AVERAGE RADIATED SPURIOUS EMISSIONS (High End)
Mobile Mark Patch Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93960	-86.03	34.3	34.8	8.2	30.6	500
7.40930	-77.65	34.6	37.4	7.9	100.6	500

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-86.18 - 34.3 + 34.6 + 7.9 + 107)/20) = 28.2
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ **Name:** __Roger Bowen__

Table 5D. AVERAGE RADIATED SPURIOUS EMISSIONS (Low End)
6dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20585	-79.44	34.5	37.0	7.8	77.7	500

Table 5D. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
6dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87200	-85.61	34.3	34.7	8.1	31.1	500
7.30735	-82.02	34.6	37.2	7.9	59.3	500

Table 5D. AVERAGE RADIATED SPURIOUS EMISSIONS (High End)
6dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93970	-91.29	34.3	34.8	8.2	16.7	500
7.40950	-80.84	34.6	37.4	7.9	69.7	500

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-79.44 - 34.5 + 37.0 + 7.8 + 107)/20) = 77.7
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: __Roger Bowen__

Table 5E. AVERAGE RADIATED SPURIOUS EMISSIONS (Low End)
12dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20570	-81.09	34.5	37.0	7.8	64.3	500

Table 5E. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
12dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87145	-83.40	34.3	34.7	8.1	40.1	500
7.30840	-91.93	34.6	37.2	7.9	59.9	500

Table 5E. AVERAGE RADIATED SPURIOUS EMISSIONS (High End)
12dB OMNI Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93980	-93.10	34.3	34.8	8.2	13.6	500
7.41025	-78.78	34.6	37.4	7.9	88.3	500

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-81.09 - 34.5 + 37.0 + 7.8 + 107)/20) = 64.3
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: Roger Bowen

Table 5F. AVERAGE RADIATED SPURIOUS EMISSIONS (Low End)
14dBi Corner Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20465	-76.88	34.5	37.0	7.8	104.4	500

Table 5F. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
14dBi Corner Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87250	-86.16	34.3	34.7	8.1	29.2	500
7.30815	-79.61	34.6	37.2	7.9	78.2	500

Table 5F. AVERAGE RADIATED SPURIOUS EMISSIONS (High End)
14dBi Corner Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93960	-90.73	34.3	34.8	8.2	17.8	500
7.40940	-81.26	34.6	37.4	7.9	66.4	500

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-76.88 - 34.5 + 37.0 + 7.8 + 107)/20) = 104.4
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ____________________ Name: __Roger Bowen__

Table 5G. AVERAGE RADIATED SPURIOUS EMISSIONS (Low End)
14dB YAGI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
7.20565	-81.59	34.5	37.0	7.8	60.7	500

Table 5G. AVERAGE RADIATED SPURIOUS EMISSIONS (Middle)
14dB YAGI Antenna

Freq. (GHz)	Test Data* (dBm) @ 3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.87201	-84.57	34.3	34.7	8.1	35.0	500
7.30694	-82.25	34.6	37.2	7.9	57.7	500

Table 5G. AVERAGE RADIATED SPURIOUS EMISSIONS (High End)
14dB YAGI Antenna

Freq. (GHz)	Test Data* (dBm) @3m	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) 3m	FCC Limits (uV/m)
4.93960	-90.02	34.3	34.8	8.2	19.3	500
7.41010	-81.31	34.6	37.4	7.9	66.0	500

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-81.59 - 34.5 + 37.0 + 7.8 + 107)/20) = 60.7
CONVERSION FROM dBm TO dBuV = 107 dB

Tester
Signature: ______________________ **Name:** __Roger Bowen________

2.11 20 dB Bandwidth per FCC Section 15.247(a)(1)(ii)

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 6a through 6c.

TABLE 6
20 dB Bandwidth

Test Date: April 30, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

Frequency (GHz)	20 dB Bandwidth (MHz)	MAXIMUM FCC LIMIT (MHz)
2.407	0.850	1.0
2.441	0.750	1.0
2.475	0.750	1.0

Tester Signature: ____________________ **Name:** Tim R. Johnson

Figure 6a.
20 dB Bandwidth per FCC Section 15.247(a)(1)(ii) (low)

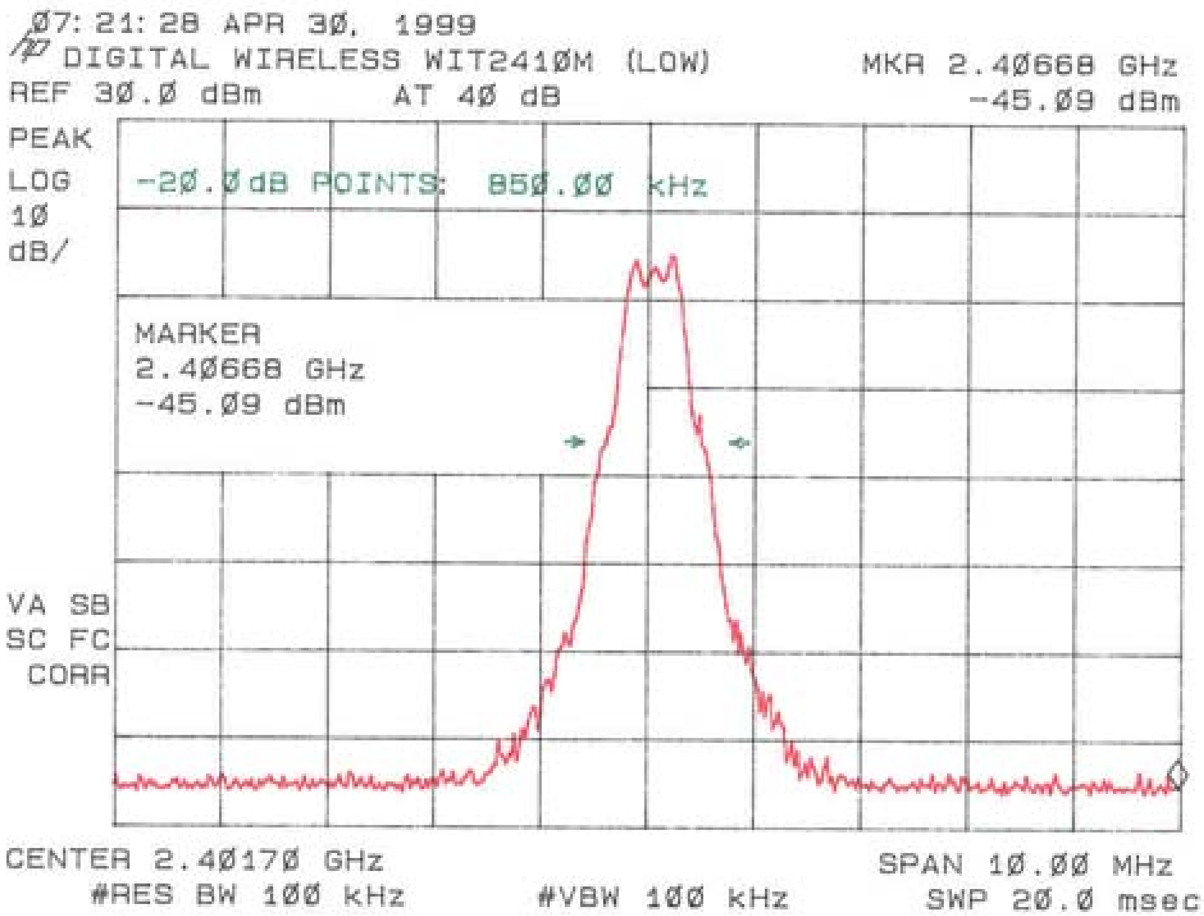


Figure 6b.
20 dB Bandwidth per FCC Section 15.247(a)(1)(ii) (Mid)

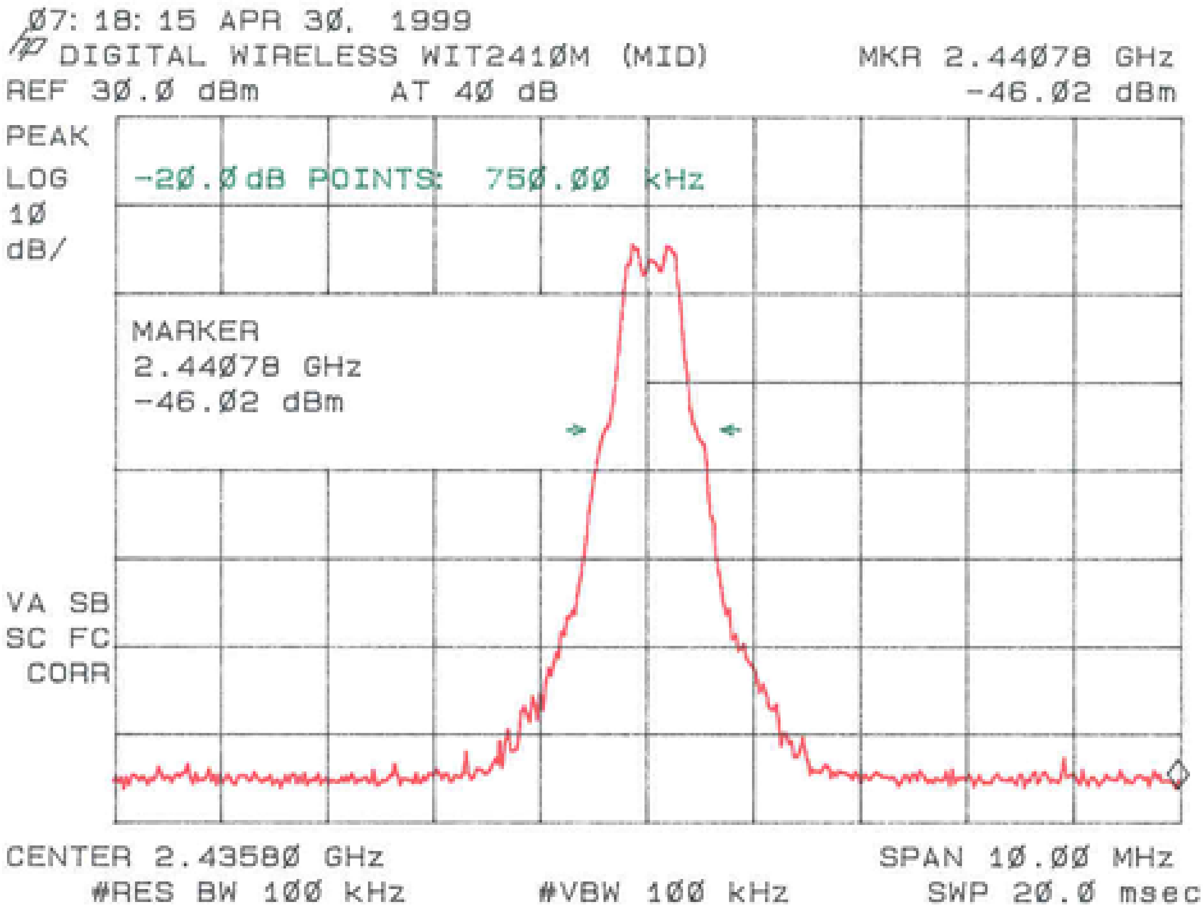
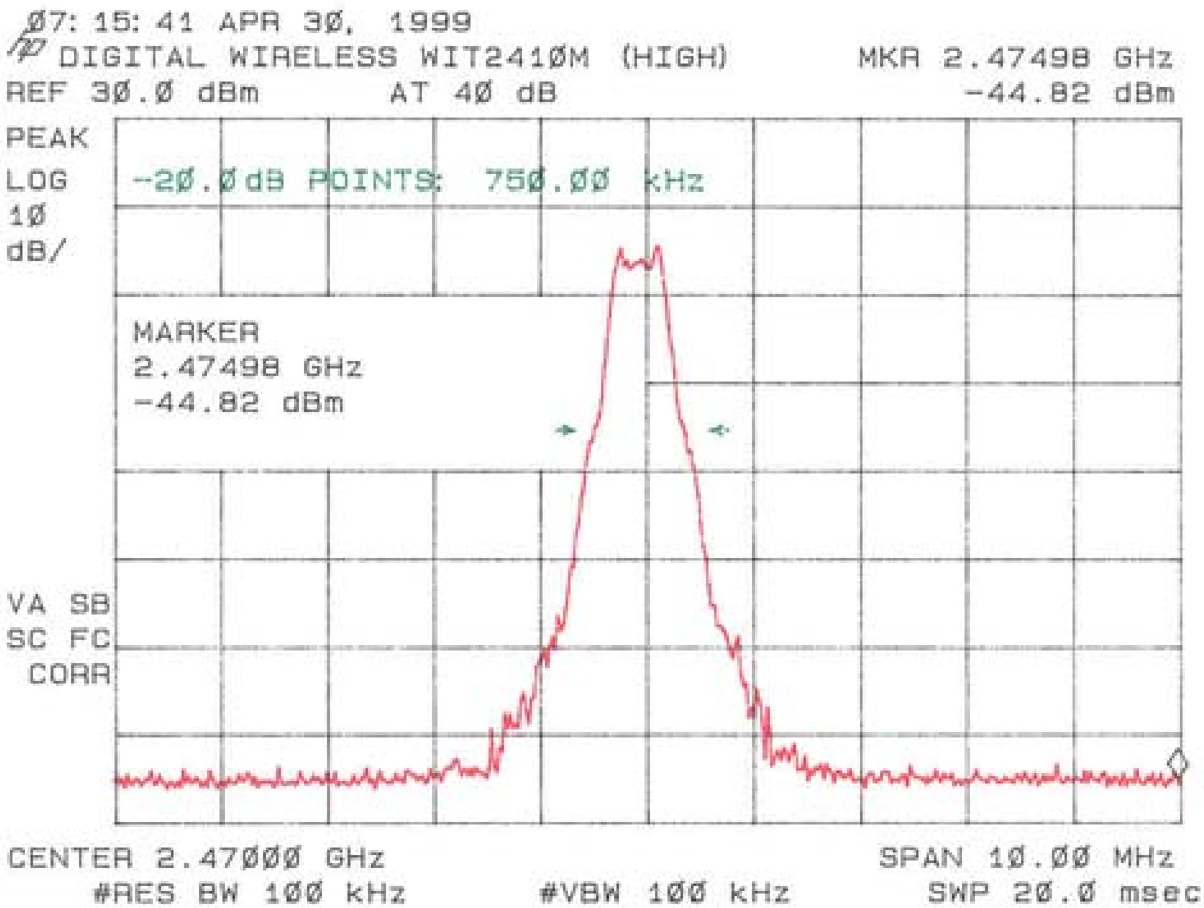


Figure 6c.
20 dB Bandwidth per FCC Section 15.247(a)(1)(ii) (High)



2.12 Number of Hopping Channels FCC Section 15.247(a)(1)(ii)

The transmitter was placed into a typical frequency hopping mode of operation. The 2400 – 2483.5 MHz band was centered on the screen and the RBW and VBW chosen such that the individual channels could be discerned. The trace capture time was a minimum of 5 minutes.

The results of this test are given in Table 7 and Figure 7.

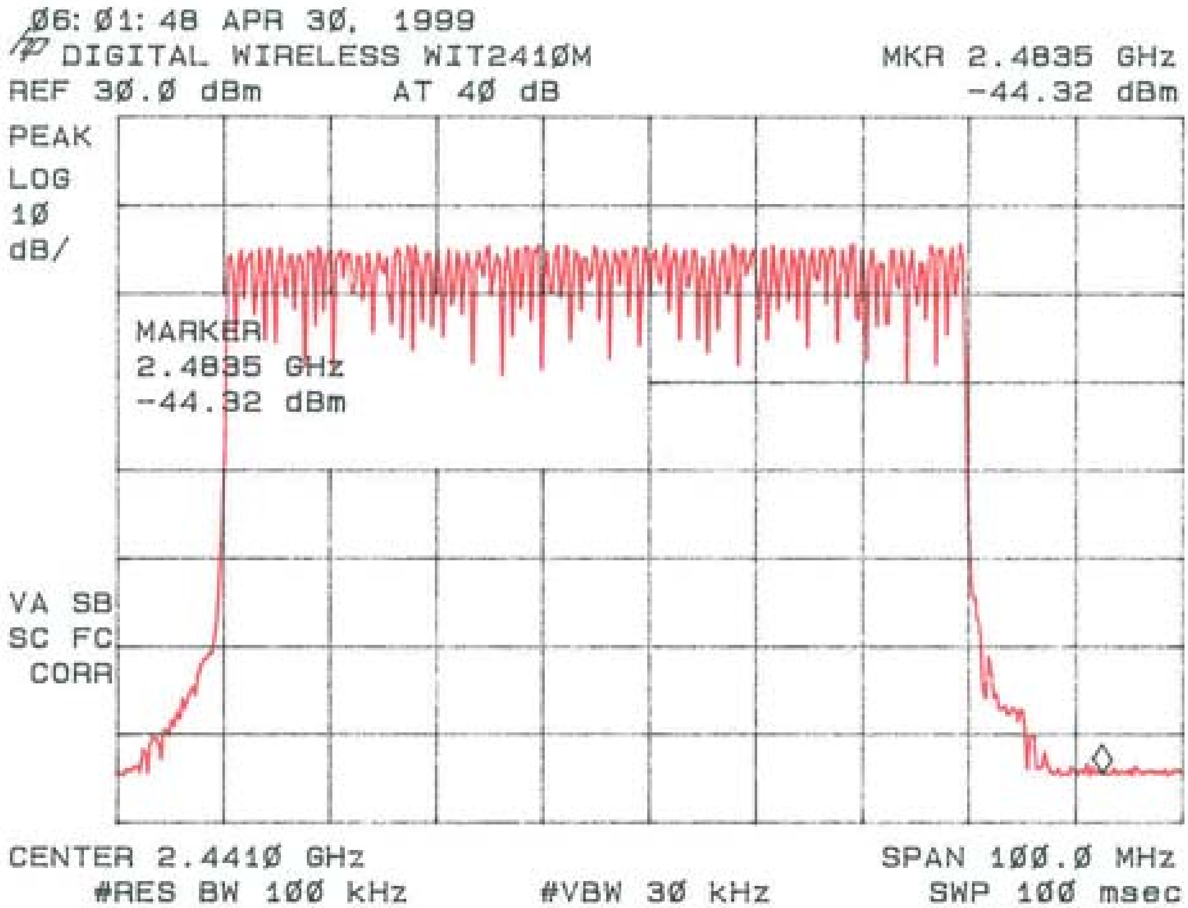
TABLE 7
NUMBER OF HOPPING CHANNELS

Test Date: April 30, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Model: WIT2410

Number of Hopping Frequencies Measured	FCC Limit (Minimum Number of Channels)
75	75

Tester Signature: ____________________ **Name:** Tim R. Johnson

Figure 7
Number of Hopping Channels FCC Section 15.247(a)(1)(ii)



2.13 Average Time of Occupancy per Channel FCC Section 15.247(a)(1)(ii)

Please refer to the theory of operation portion of the report for this.

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 8.

TABLE 8. CONDUCTED EMISSIONS DATA

CLASS B

Test Date: April 26, 1999
UST Project: 99-317
Customer: Digital Wireless
Model: WIT 2410M

Worse Case Mode of Operaton (TX – Low channel)

FREQUENCY (MHz)	TEST DATA (dBm)		RESULTS (uV)		FCC LIMITS (uV)
	PHASE	NEUTRAL	PHASE	NEUTRAL	
0.455	-63.0*	-62.0*	158.5	177.8	250
1.42	-74.0*	-78.0*	44.7	28.2	250
7.45	-84.0*	-83.0*	14.1	15.8	250
11.4	-78.0*	-81.0*	28.2	20.0	250
15.9	-79.0*	-72.0*	25.1	56.2	250
17.6	-81.0*	-81.0*	20.0	20.0	250
22.7	-81.0*	-80.0*	20.0	22.4	250
26.5	-68.0*	-68.0*	89.1	89.1	250

* = QUASI PEAK

SAMPLE CALCULATION:

RESULTS uV = Antilog ((-63.0 + 107)/20) = 158.5
CONVERSION FROM dBm TO dBuV = 107 dB

Test Results
Reviewed By
Signature: ______________________ **Name:** __Tim Johnson__

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

Radiated emissions were evaluated from 30 to 5000 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 9.

TABLE 9. RADIATED EMISSIONS DATA
(Digital Device & Receiver)

CLASS B

Test Date: April 26, 1999
UST Project: 99-317
Customer: Digital Wireless Corporation
Product: WIT2410

Frequency (MHz)	Receiver Reading (dBm) @3m	Correction Factor (dB)	Corrected Reading (uV/m)	FCC Limit (uV/m) @3m
No Emissions seen within 10 dB of the FCC limit				

*= Quasi Peak

SAMPLE CALCULATIONS:

Test Results Reviewed By Signature: ____________________ **Name:** Tim R. Johnson

2.16 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 8.

SECTION 5

PHOTOGRAPHS

PHOTOS OF THE TESTED EUT

The following photos are attached:

Photo 1. EUT, 3 Dimensional Front View
Photo 2. EUT, 3 Dimensional Rear View
Photo 3. EUT, Top View with Cover Opened
Photo 4. EUT, Top View of Board
Photo 5. EUT, Bottom View of Board
Photo 6. Antenna, ACE Dipole (M/N ACE-2400NF)
Photo 7. Antenna, Cushcraft 14 dBi Yagi (M/N PC2415-RTNF)
Photo 8. Antenna, Mobile Mark 6 dBi Omnidirectional (M/N OD6-2400-RTNC)
Photo 9. Antenna, Mobile Mark 12 dBi Omnidirectional (M/N OD6-2400-RTNC)
Photo 10. Antenna, Mobile Mark 14 dBi Corner Reflector, Front View (M/N SCR14-2400PTA-RTNC)
Photo 11. Antenna, Mobile Mark 14 dBi Corner Reflector, Rear View (M/N SCR14-2400PTA-RTNC)
Photo 12. Antenna, Mobile Mark Patch (M/N P7-2400RTNC)
Photo 13. Antenna, Digital Wireless Corporation Patch, Front View (M/N PA2410)
Photo 14. Antenna, Digital Wireless Corporation Patch, Rear View (M/N PA2410)

Photo 1. EUT, 3 Dimensional Front View

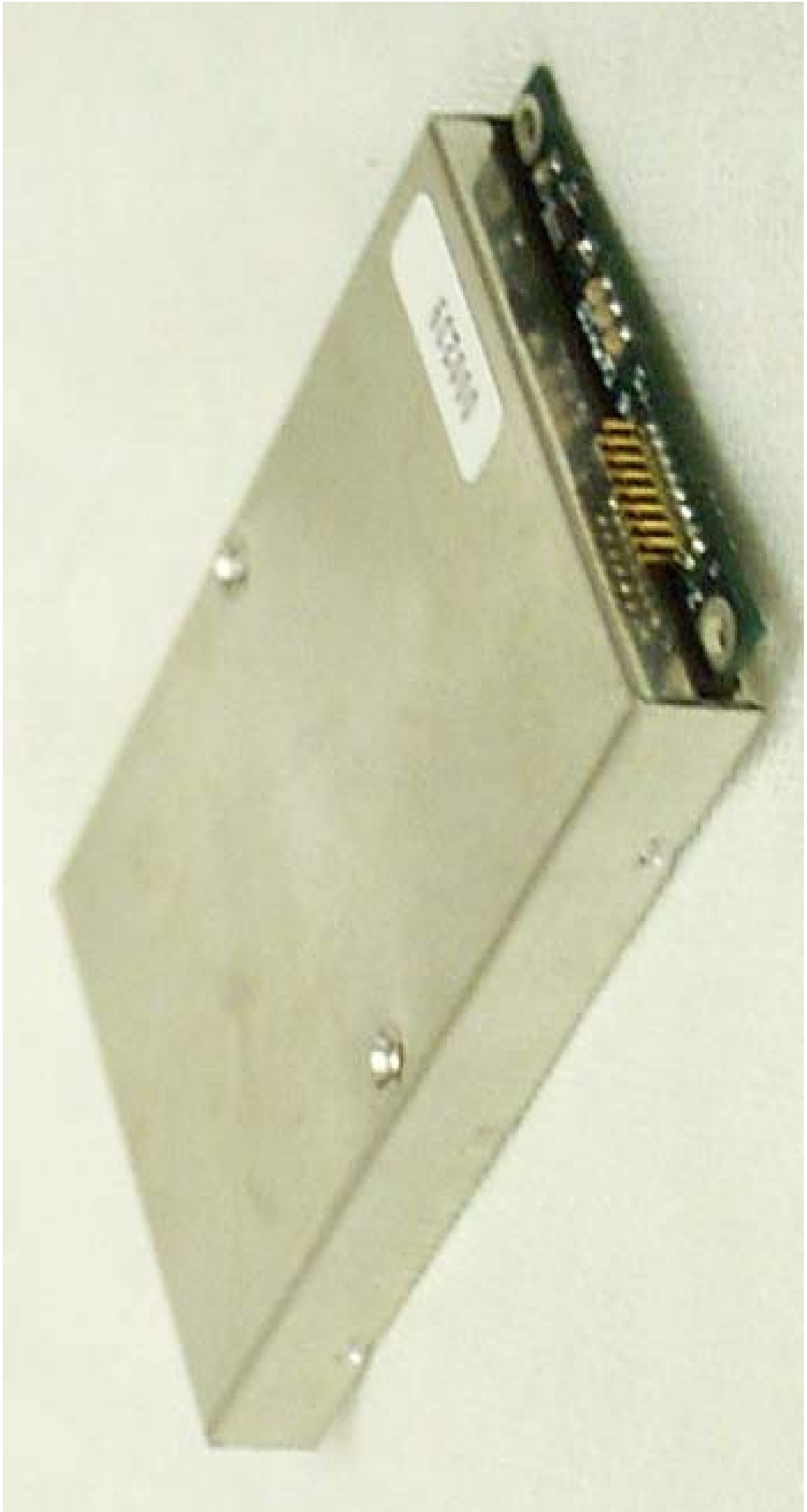


Photo 2. EUT, 3 Dimensional Rear View

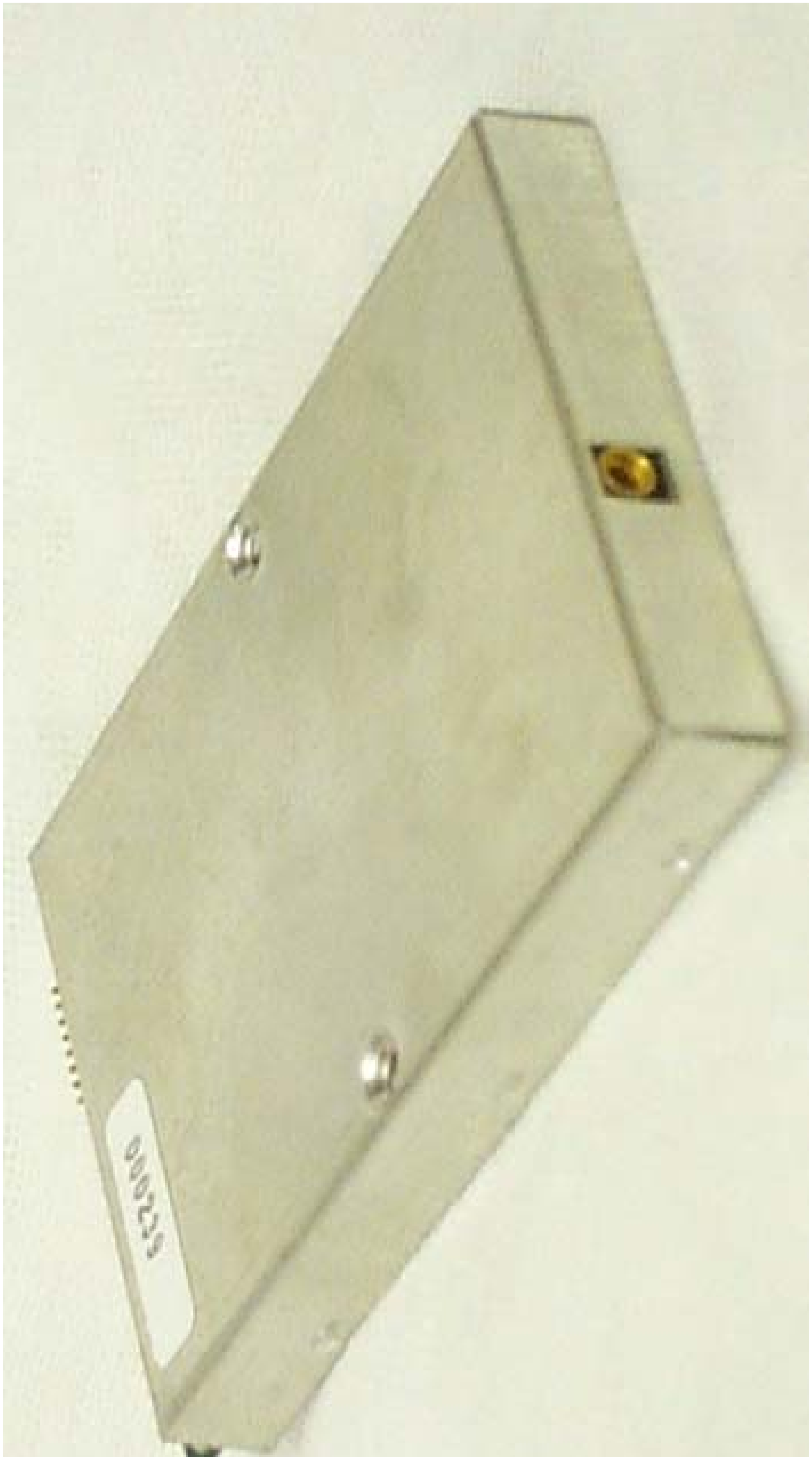


Photo 3. EUT, Top View with Cover Opened

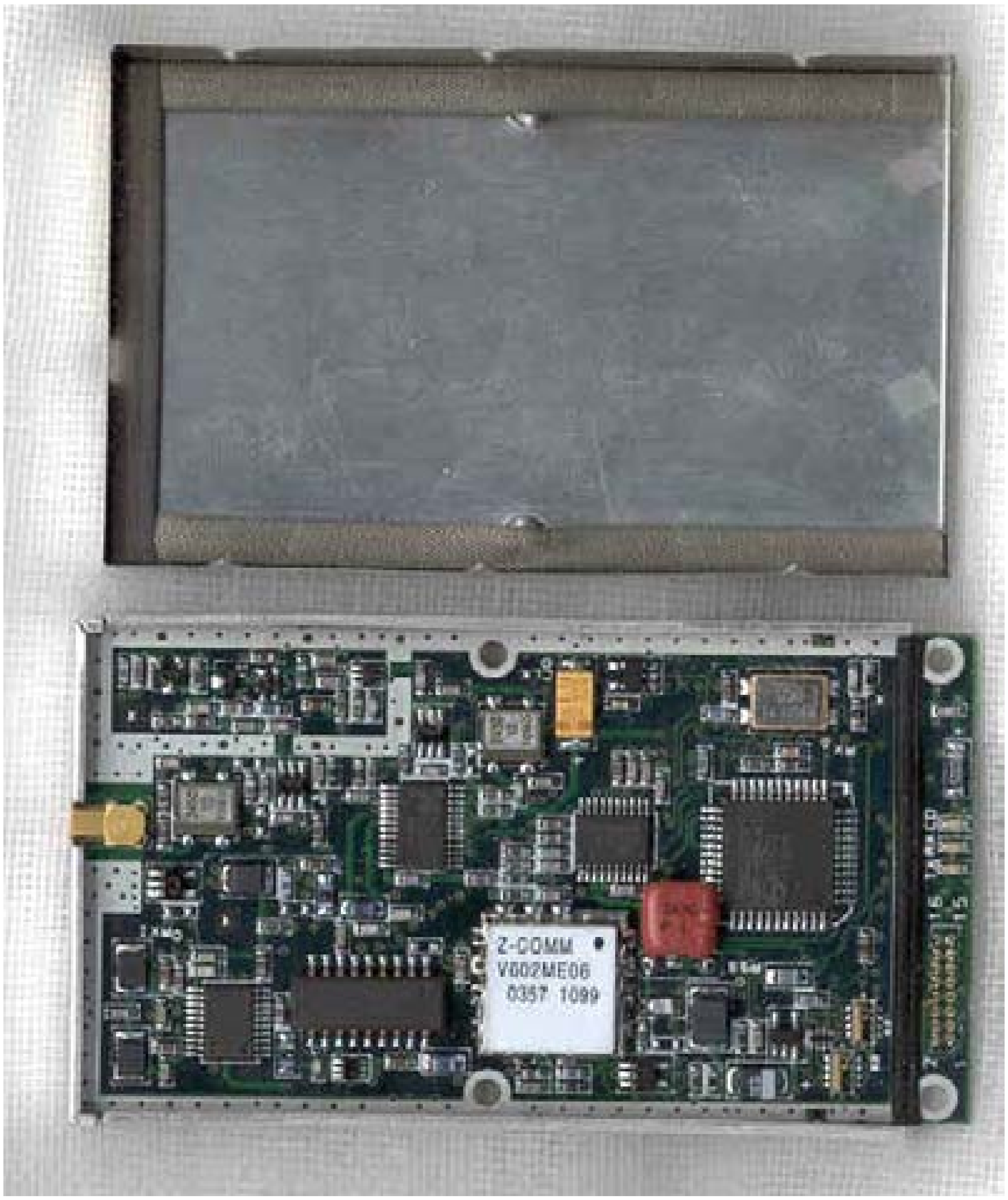


Photo 4. EUT, Top View of Board

Photo 5. EUT, Bottom View of Board

Photo 6. Antenna, ACE Dipole (M/N ACE-2400NF)

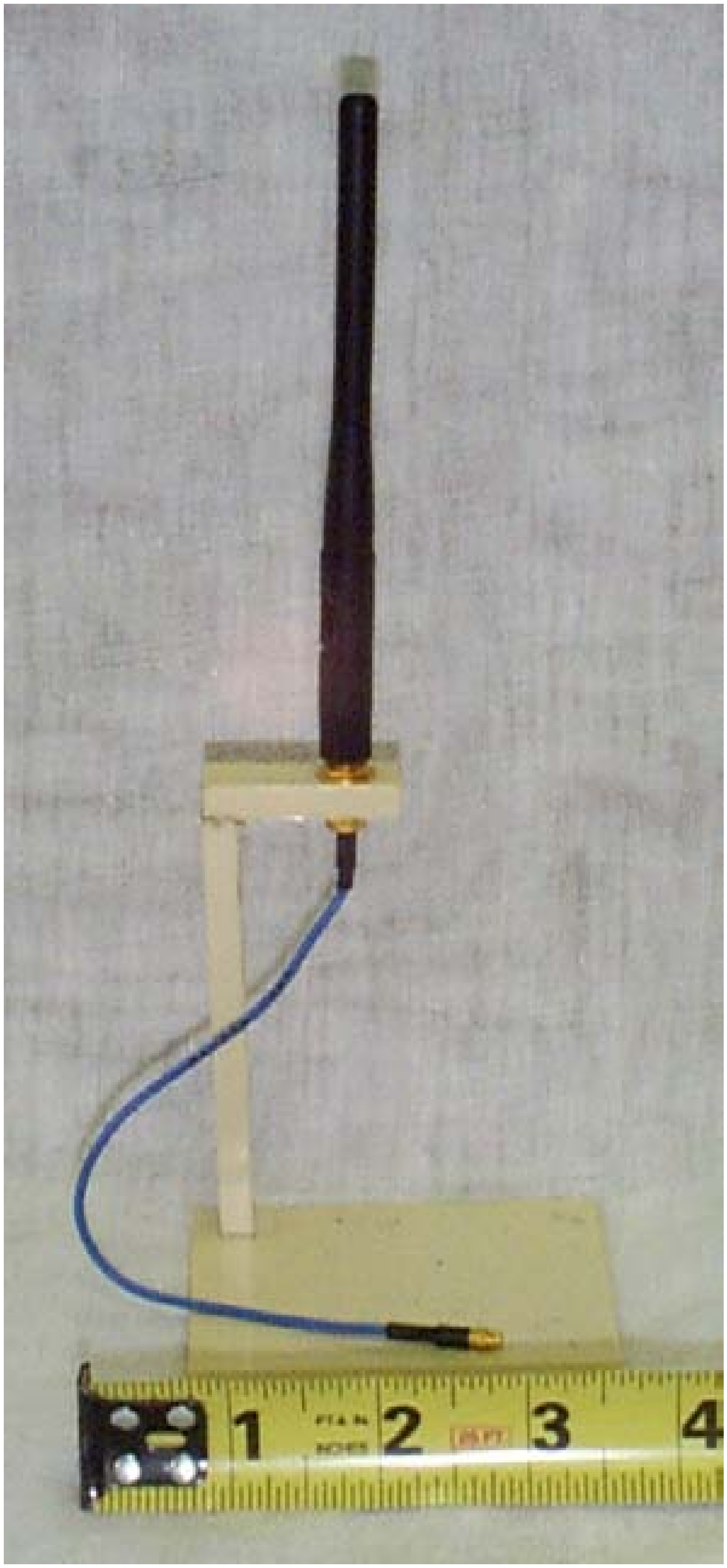


Photo 7. Antenna, Cushcraft 14 dBi Yagi (M/N PC2415-RTNF)

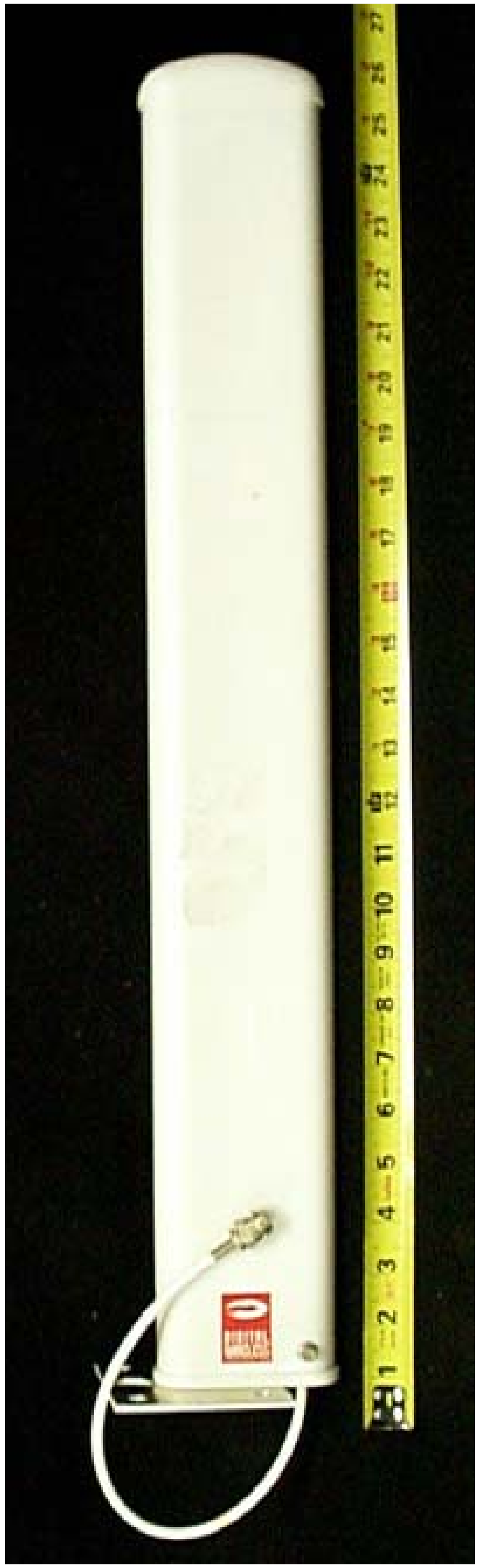


Photo 8. Antenna, Mobile Mark 6 dBi Omnidirectional (M/N OD6-2400-RTNC)

Photo 9. Antenna, Mobile Mark 12 dBi Omnidirectional (M/N OD6-2400-RTNC)

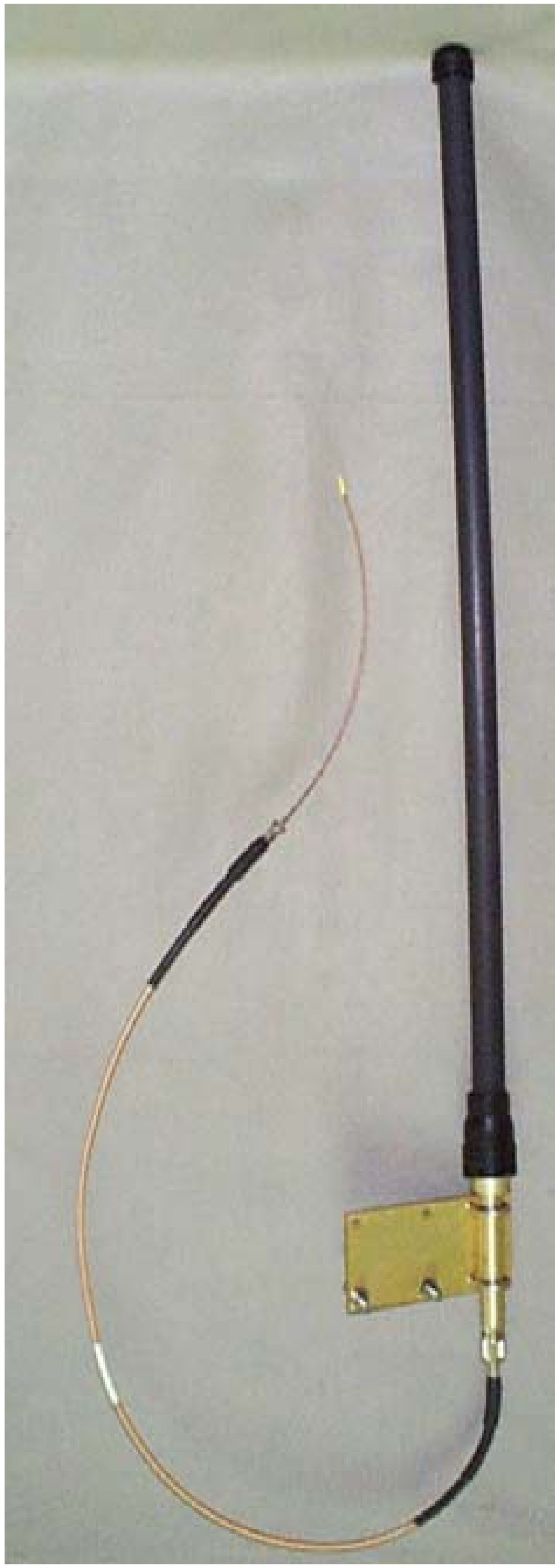


Photo 10. Antenna, Mobile Mark 14 dBi Corner Reflector, Front View
(M/N SCR14-2400PTA-RTNC)

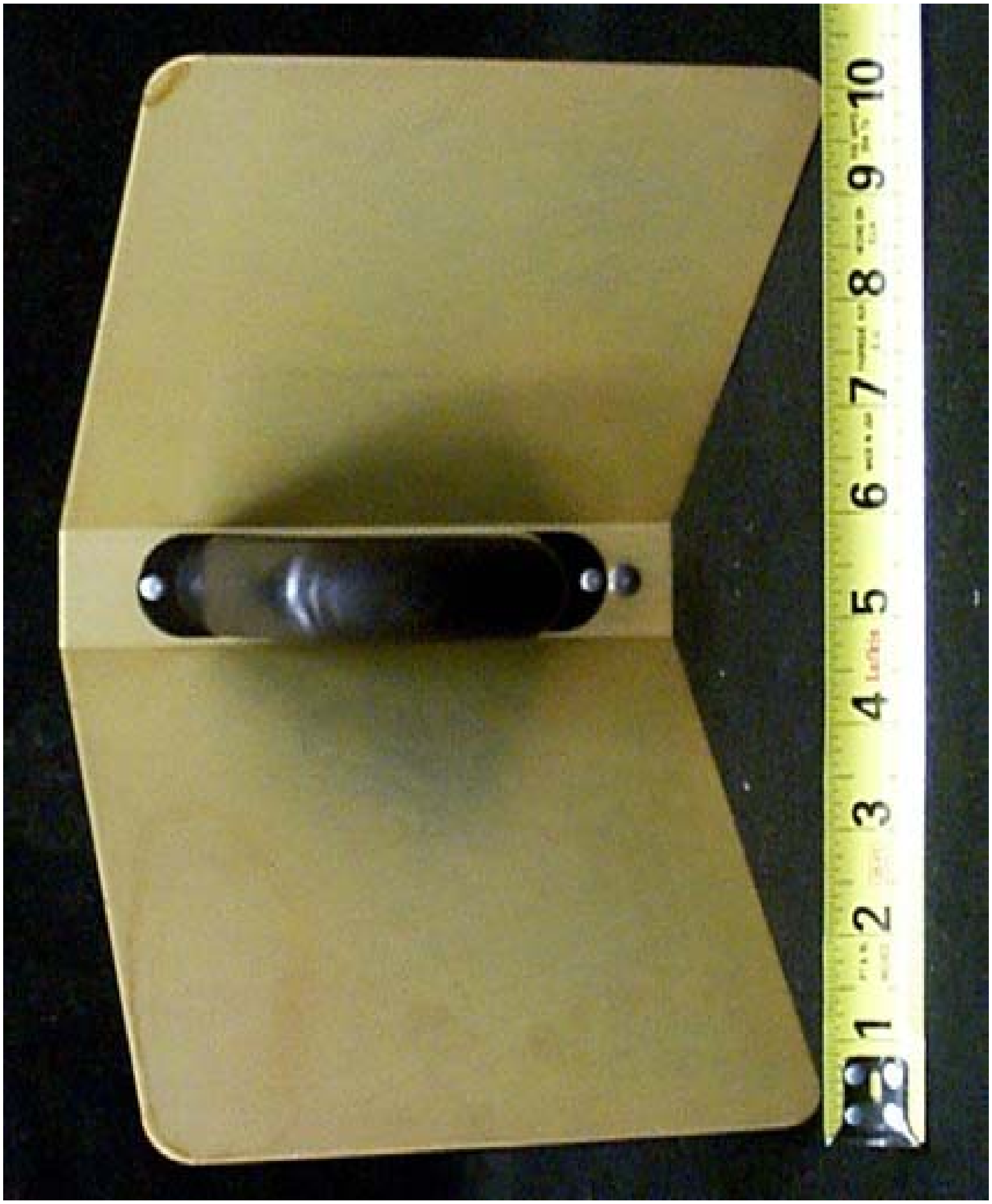


Photo 11. Antenna, Mobile Mark 14 dBi Corner Reflector, Rear View (M/N SCR14-2400PTA-RTNC)

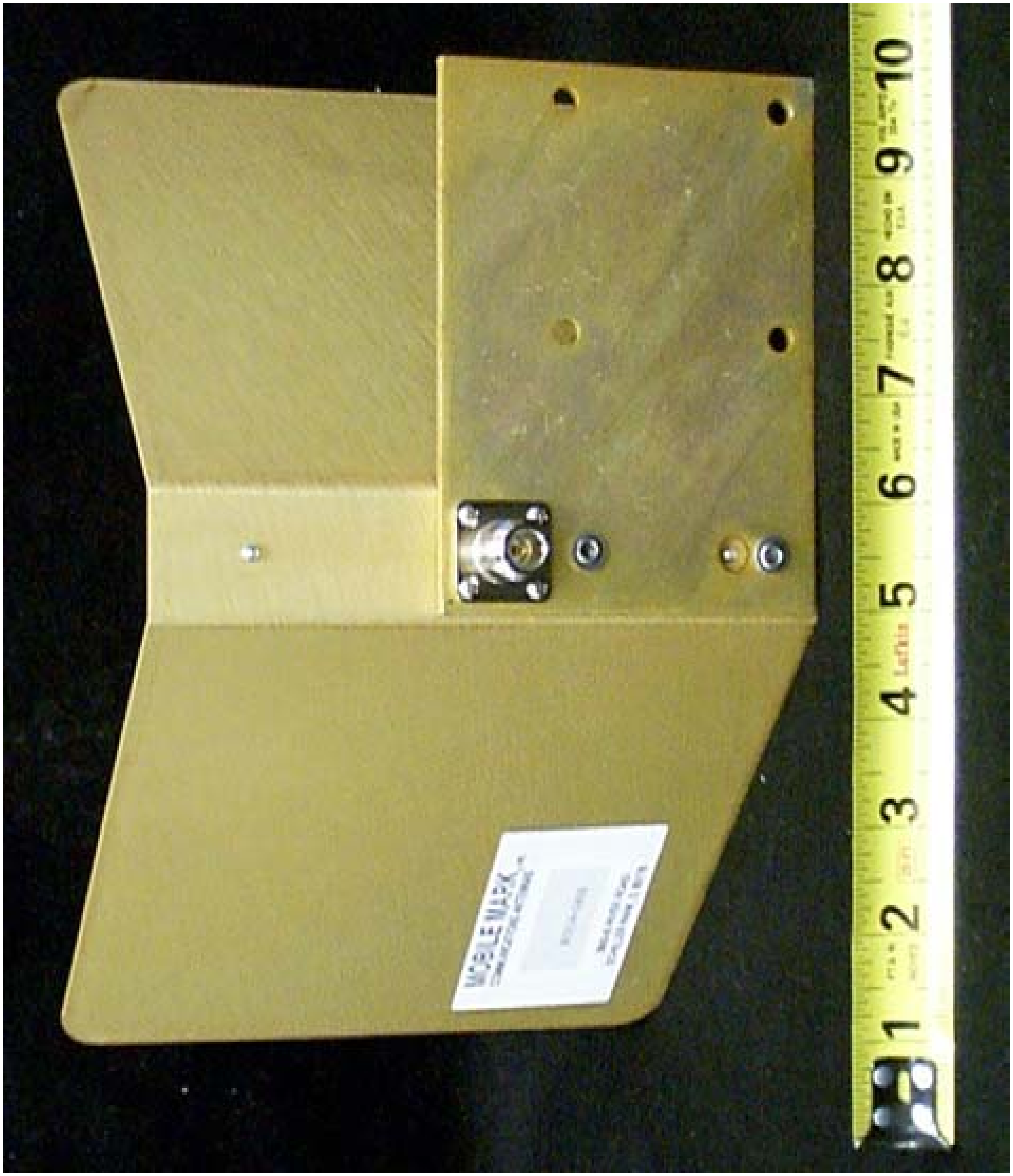
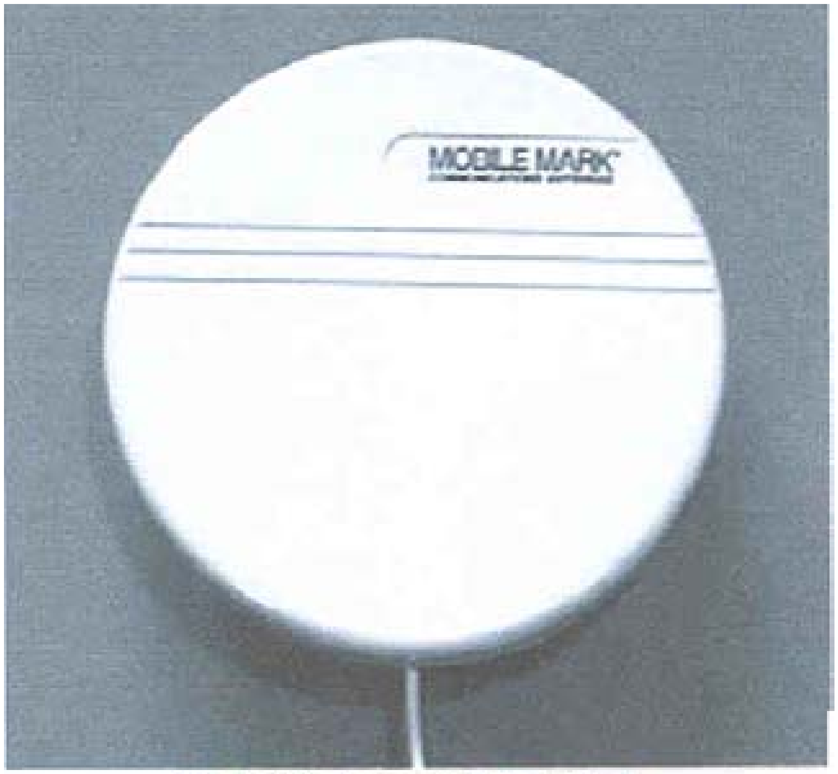


Photo 12. Antenna, Mobile Mark Patch (M/N P7-2400RTNC)



P7-2400 shown wall mounted

Photo 13. Antenna, Digital Wireless Corporation Patch, Front View (M/N PA2410)

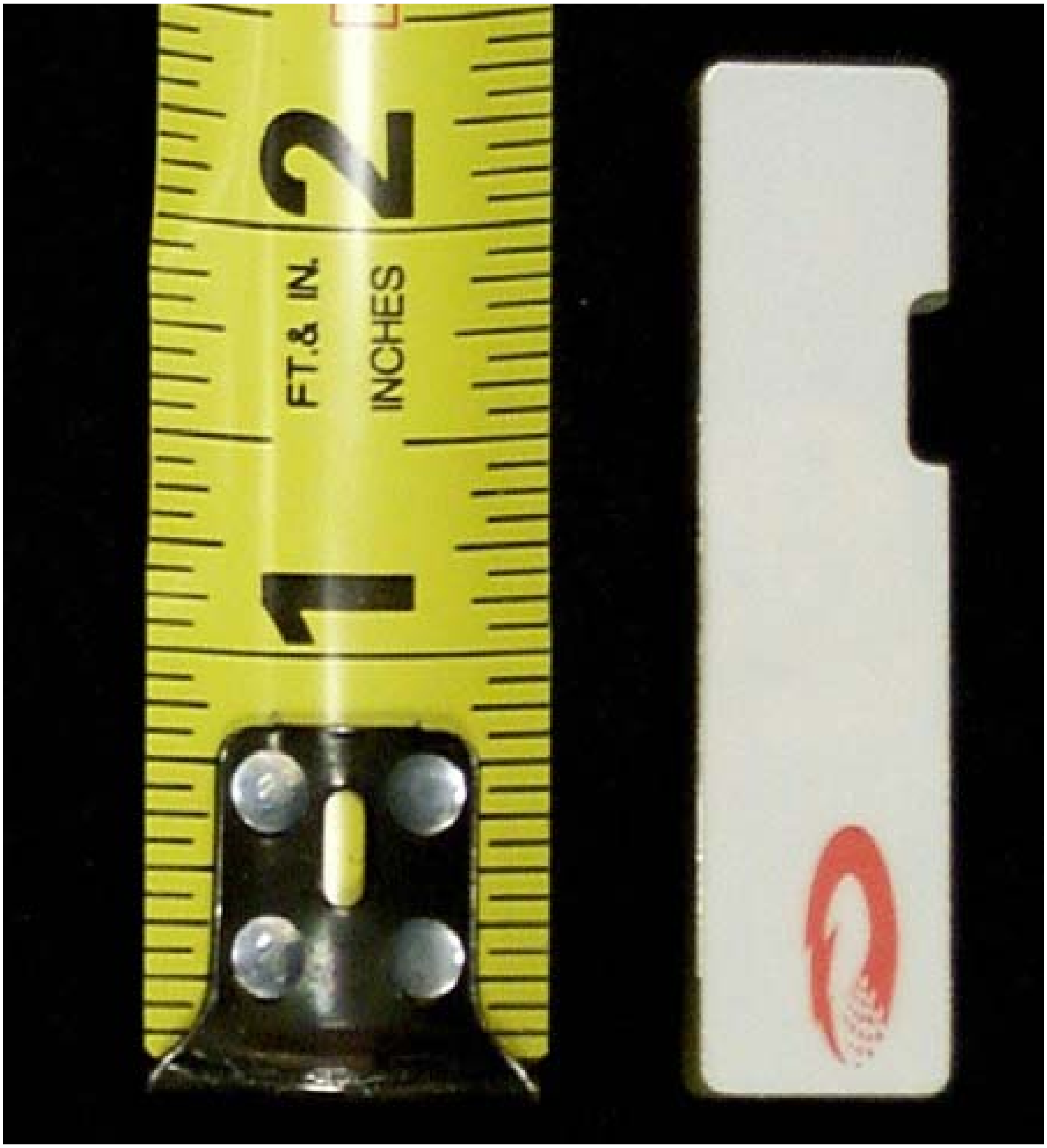


Photo 14. Antenna, Digital Wireless Corporation Patch, Rear View (M/N PA2410)