Home Wireless Networks, Inc.
Addendum to 95-0016-XXX
FCC Part 15, Certification Application

January 21, 2000

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SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

1.1 Product Description

The Equipment Under Test (EUT) is a Home Wireless Networks, Inc., Model 95-0016-XXX. The Model 95-0016-XXX is an IEEE 802.11 Wireless Ethernet Transceiver Module (2.4 GHz) which may be used as either a self contained unit or attached to Home Wireless Networks, Inc. NCU controller (model 95-0005-XXX) for added functionality and communication with other Home Wireless Networks, Inc. products.

When utilized as a self contained unit, the EUT obtains power through use of an external AC adapter. Units used with a NCU controller are connected directly to the bottom side of the NCU and obtain their power from the NCU through the interface connecting the two units.

The following is a list of the channels designed into the EUT:

RF Frequencies HWN IEEE 802.11 Wireless Ethernet Module		
RF CHANNEL	TRANSMIT/RECEIVE FREQUENCY (MHZ)	RF LOCAL OSCILLATOR FREQUENCY (Internal radio version only)
1	2412	2038
2	2417	2043
3	2422	2048
4	2427	2053
5	2432	2058
6	2437	2063
7	2442	2068
8	2447	2073
9	2452	2078
10	2457	2083
11	2462	2088

The EUT is identical to a previously approved model with the exception of higher output power and other changes which only affect the digital device circuitry.

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.

Since the EUT was identical to a previously tested model, only tests affected by the changes made were performed.

The sample used for testing was received by U.S. Technologies on January 14, 2000 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.

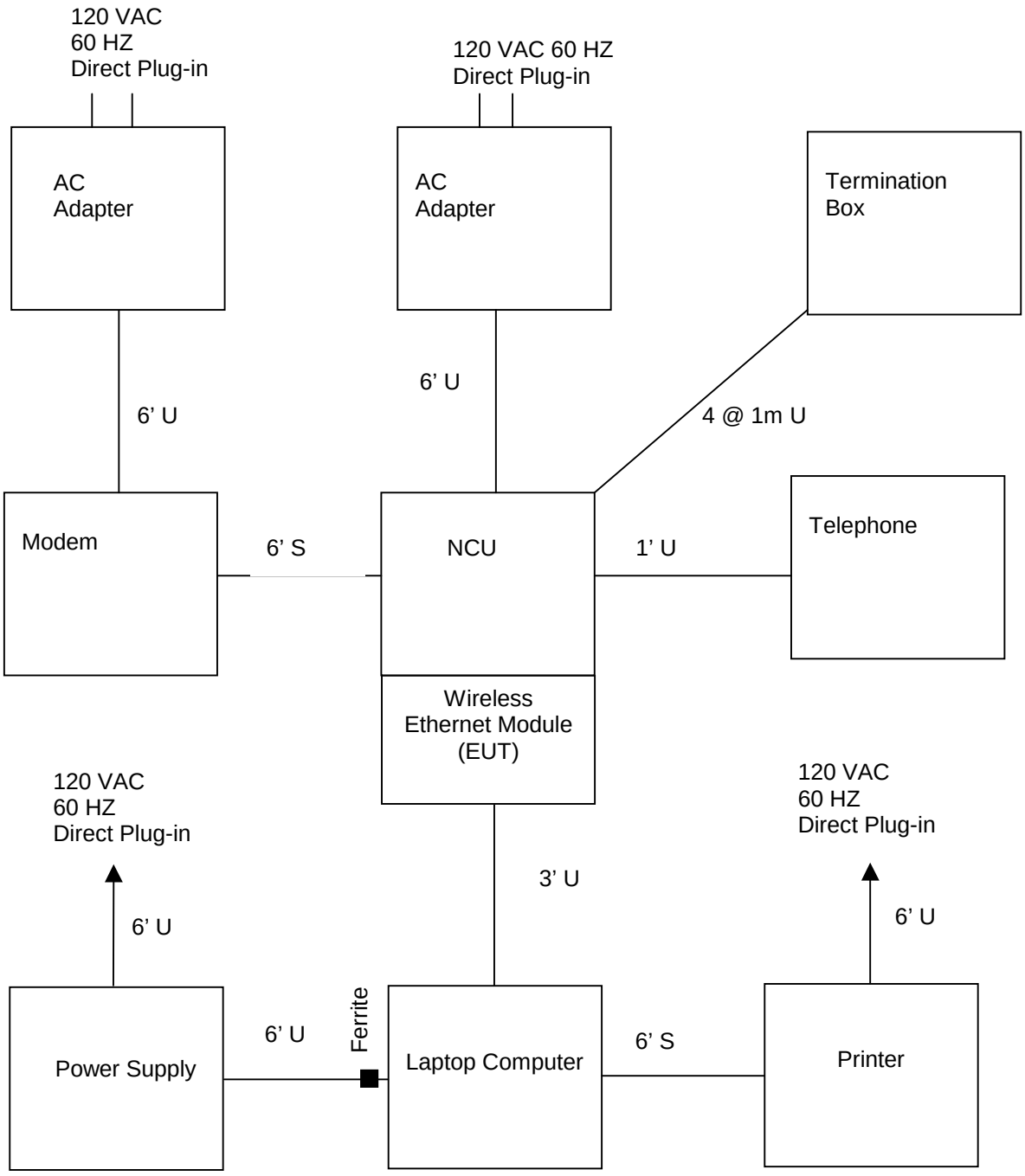
2.4 Modifications

No modifications were made by US Tech, to bring the EUT into compliance with FCC Part 15 limits for the transmitter portion of the EUT.

FIGURE 1

TEST CONFIGURATION

Configuration for Radiated and Conducted Tests, EUT with NCU



Test Date: January 14, 2000
UST Project: 99-901
Customer: Home Wireless Networks, Inc.
Model: 95-0016-XXX

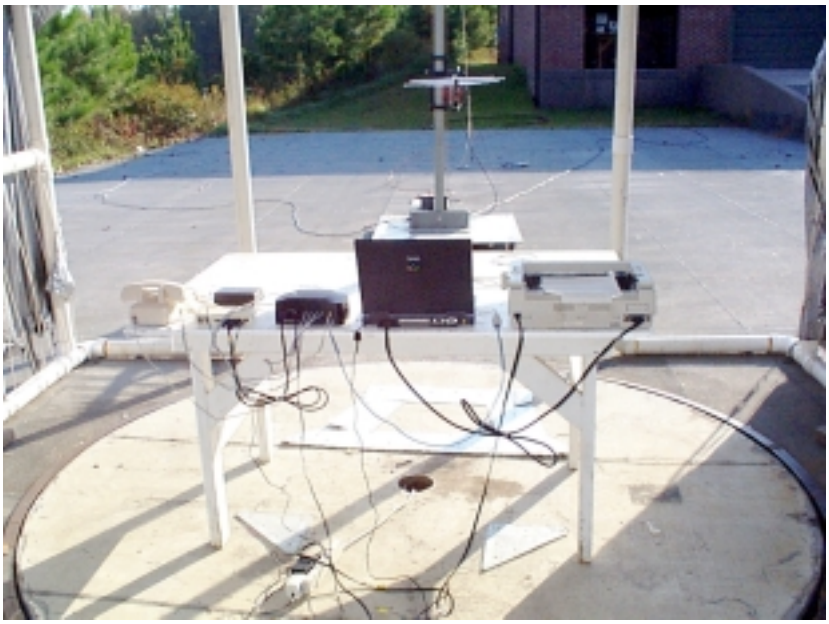
FIGURE 2a

Photograph(s) for Spurious Emissions (Front)

Test Date: January 14, 2000
UST Project: 99-901
Customer: Home Wireless Networks, Inc.
Model: 95-0016-XXX

FIGURE 2b

Photograph(s) for Spurious Emissions (Back)



Test Date: January 20, 2000
UST Project: 99-901
Customer: Home Wireless Networks, Inc.
Model: 95-0016-XXX

FIGURE 2c

Photograph(s) for Conducted Emissions During Transmit

TABLE 1

EUT and Peripherals for Configuration with NCU

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Wireless Ethernet Transceiver Module (EUT) Home Wireless Networks, Inc.	95-0016-XXX	Unknown	NSK0016A	3' U
NCU Transceiver Module Home Wireless Networks, Inc.	95-0005-XXX	Unknown	NSK0005A	
AC Adapter Home Wireless Networks, Inc.	AD-072A	Unknown	None	6' U
Telephone Lucent Technologies	Unknown	B143GD	None	1' U
Modem U.S. Robotics	Sportster 2400	0033-0307442	CJE-0104	6' S
AC Adapter Radio Shack	273-1631	F-4 99 May	None	6' U
Laptop Gateway	Solo 5100	BC598301511	DoC Approved	
Power Supply Gateway	ADP-50FB	AC298413385	None	6' U 6' U Power Cord
Printer Panasonic	KX-P1180	1CKARQ99923	ACJ5Z6KX-P1180	6' S 6' U Power Cord
Termination Box Home Wireless Networks, Inc.	None	None	None	4@ 1 m U

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
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 Peak power within the band 2.4 – 2.4835 GHz per FCC Section 15.247(b)

Peak power within the band 2.4–2.4835 GHz has been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. The spectrum analyzer was set for a 50 Ω impedance with the VBW ≥ RBW 6 dB bandwidth. The results of the measurements are given in Table 3 and Figure 3a through Figure 3c.

The spectrum analyzer did not have a RBW greater than the 6 dB bandwidth for the largest fundamental bandwidth, therefore this data was taken using the channel power function of the spectrum analyzer.

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: **January 14, 2000**
UST Project: **99-901**
Customer: **Home Wireless Networks, Inc.**
Model: **95-0016-XXX**

Frequency of Fundamental (GHz)	Measurement (dBm)*	Measurement (Watt)*	FCC Limit (Watt)
2.412	18.2	0.0661	1.0
2.437	18.1	0.0656	1.0
2.462	16.7	0.0468	1.0

*** Measurement includes 0.4 dB cable loss**

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

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

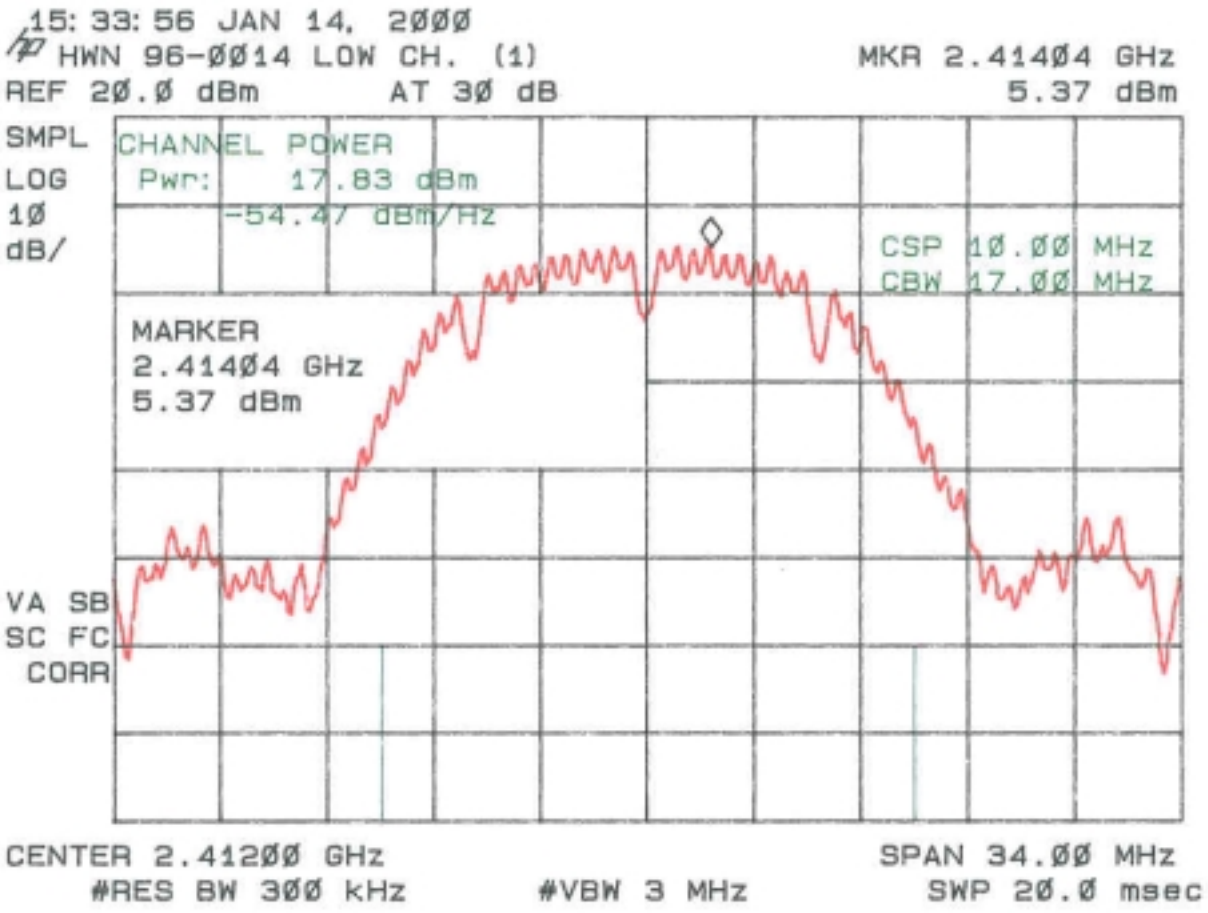


Figure 3b.
Peak Power per FCC Section 15.247(b) (Mid)

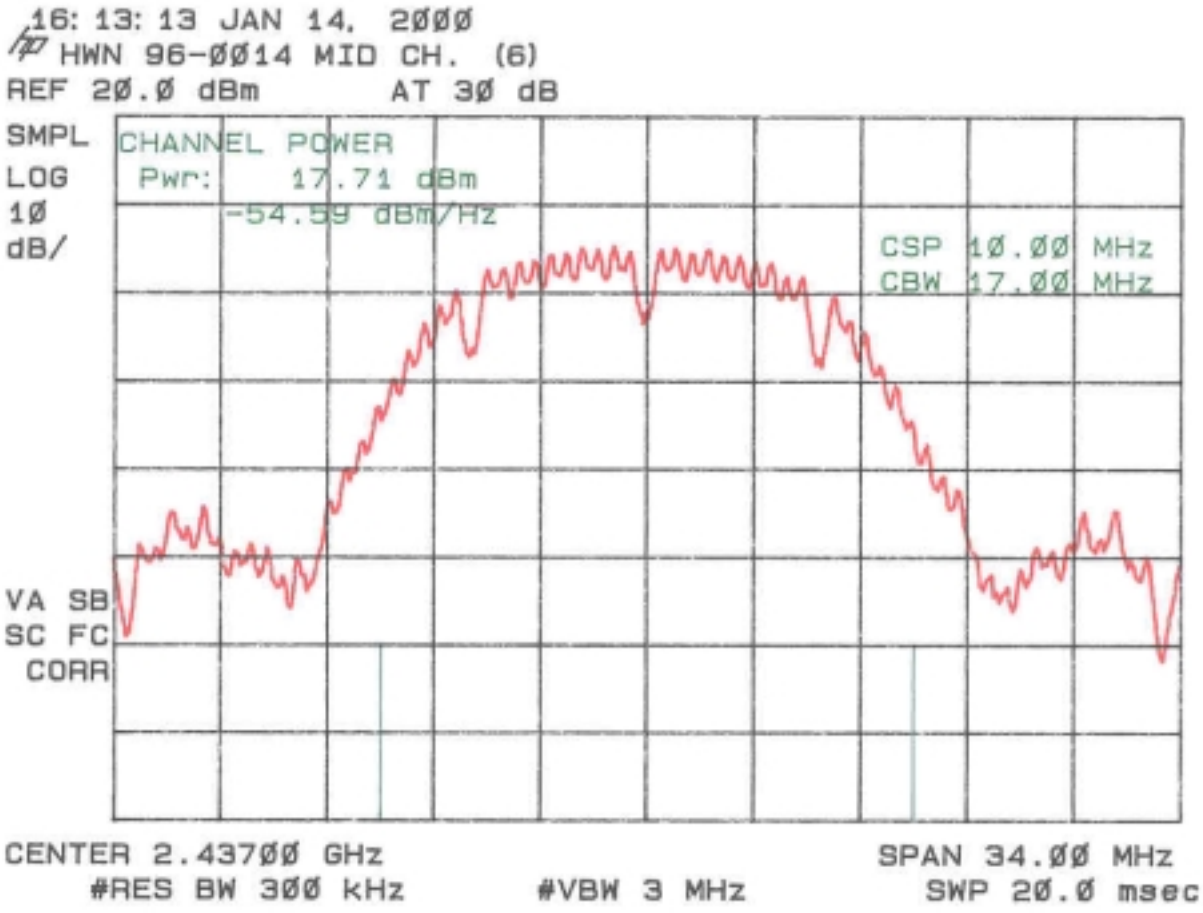
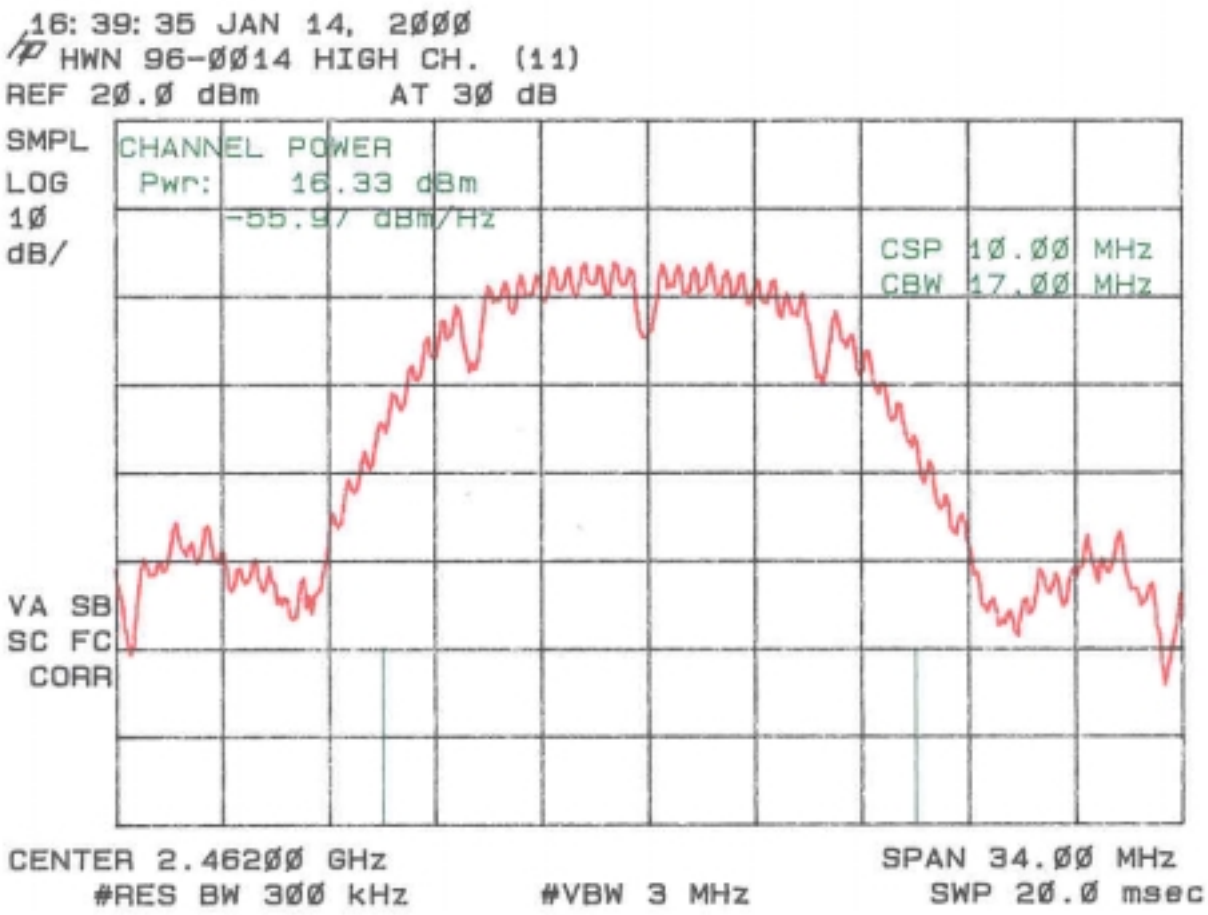


Figure 3c.
Peak Power per FCC Section 15.247(b) (High)



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

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

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

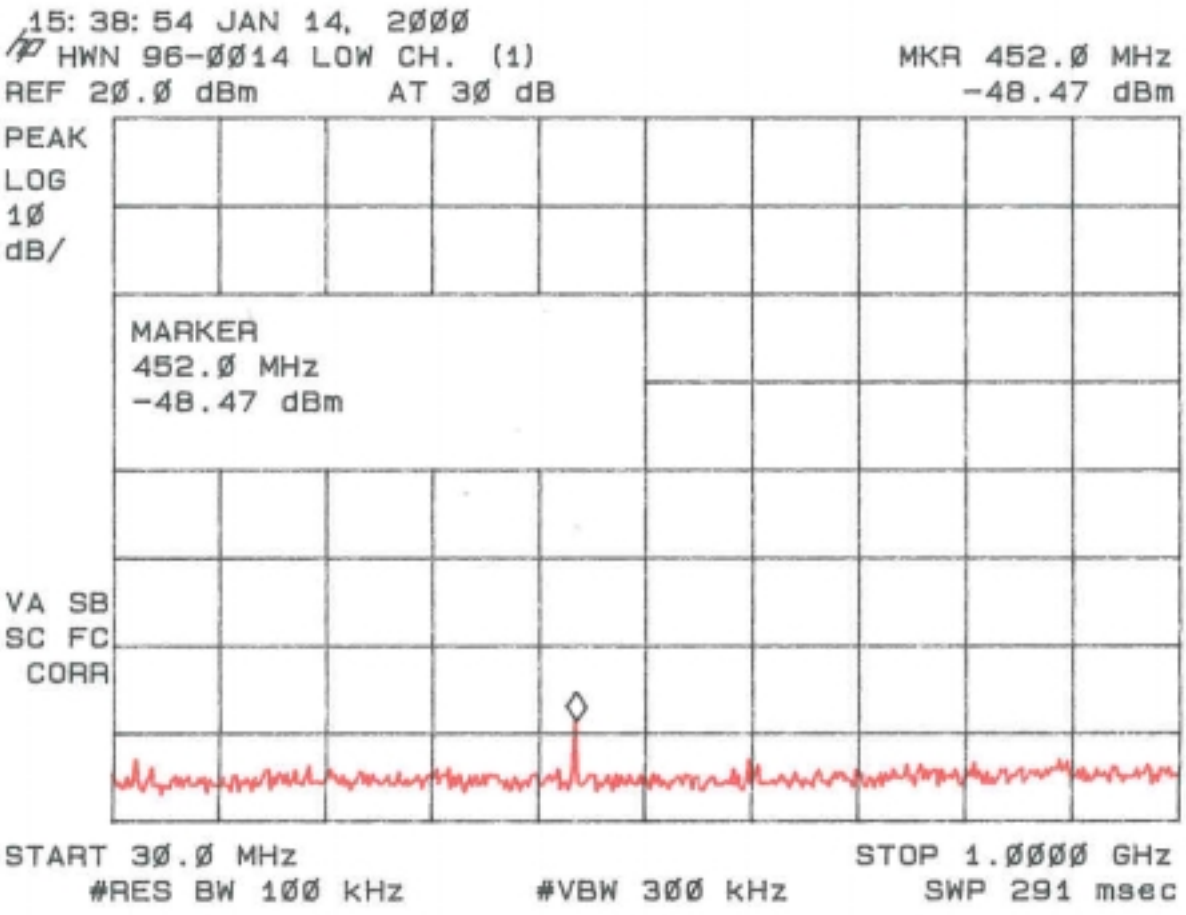


Figure 4b
Antenna Conducted Spurious Emissions 5.247(c) Low

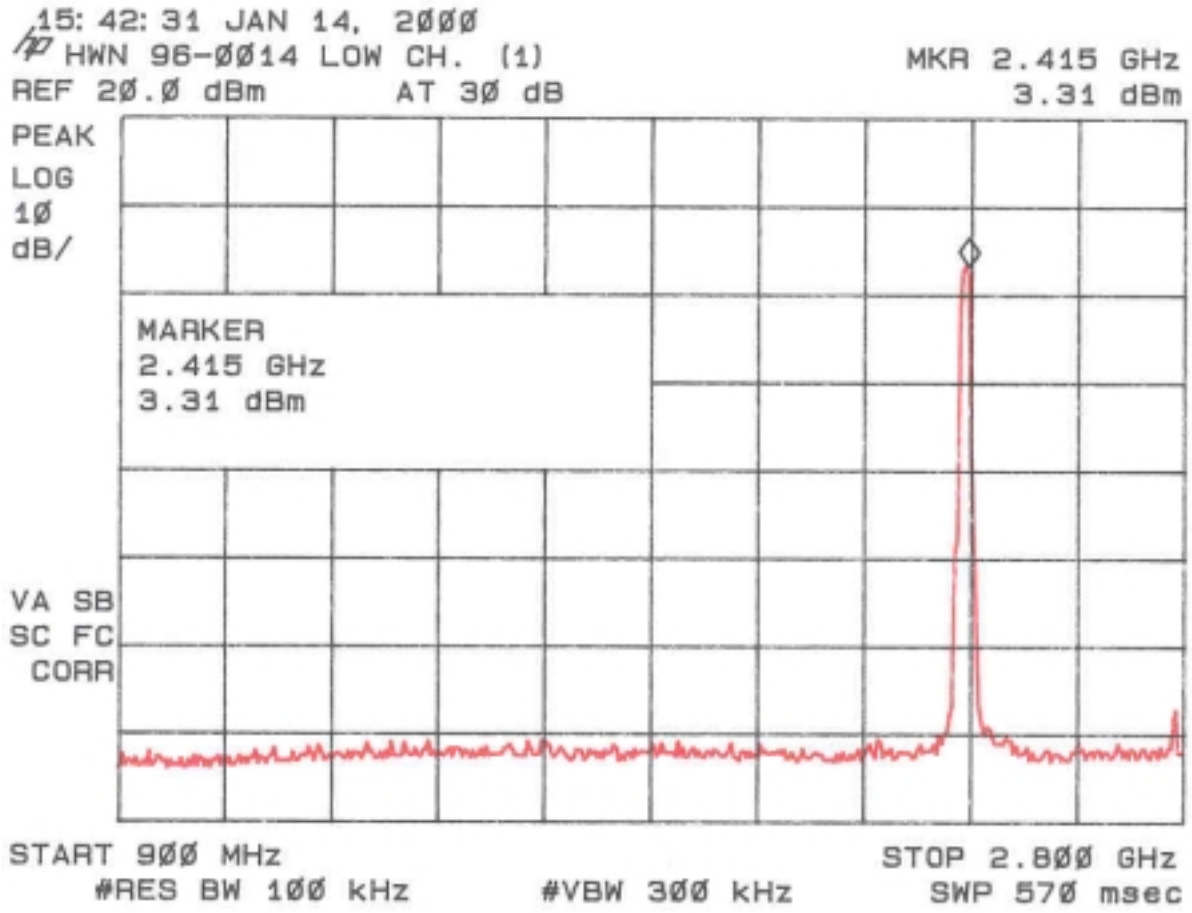


Figure 4c
Antenna Conducted Spurious Emissions 15.247(c) Low

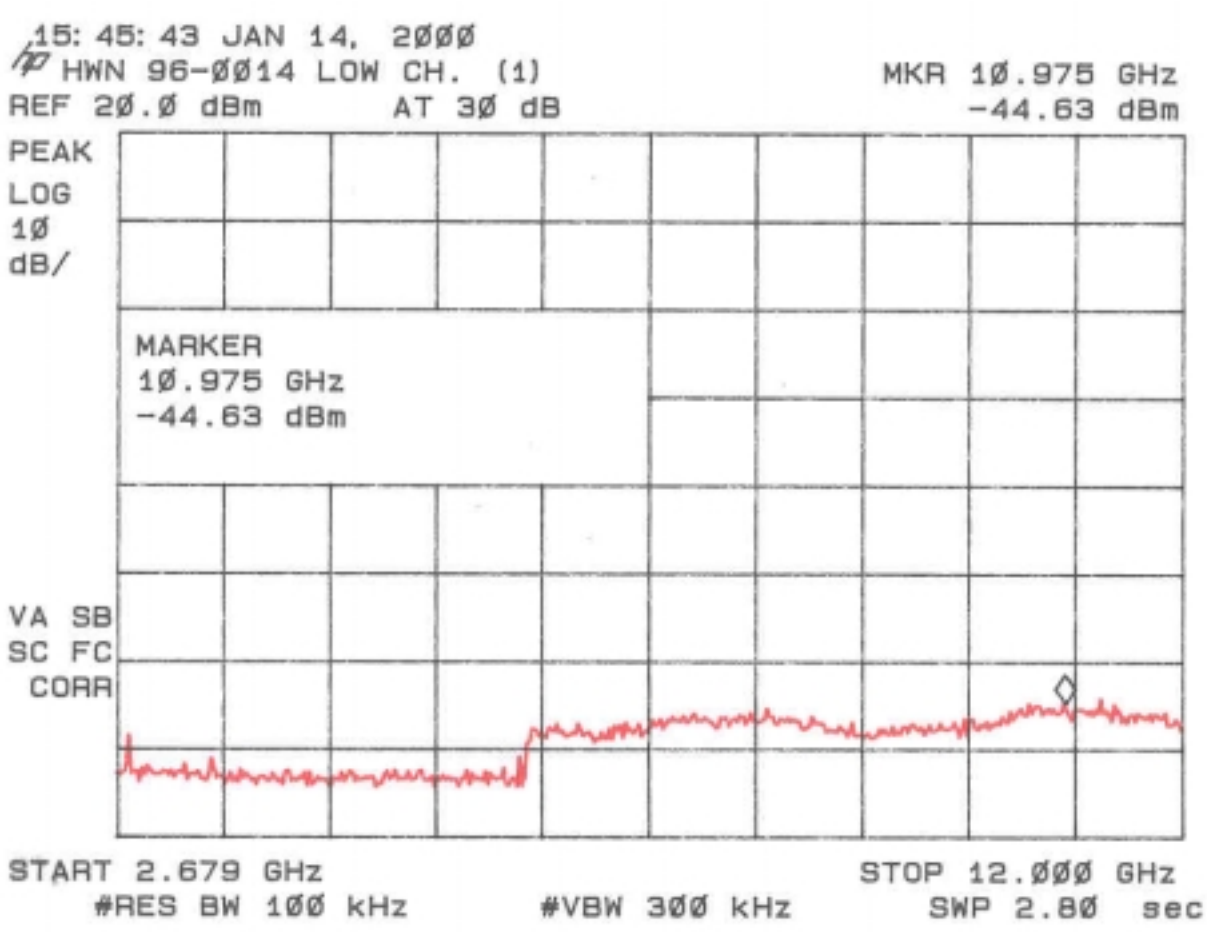


Figure 4d
Antenna Conducted Spurious Emissions 15.247(c) Low

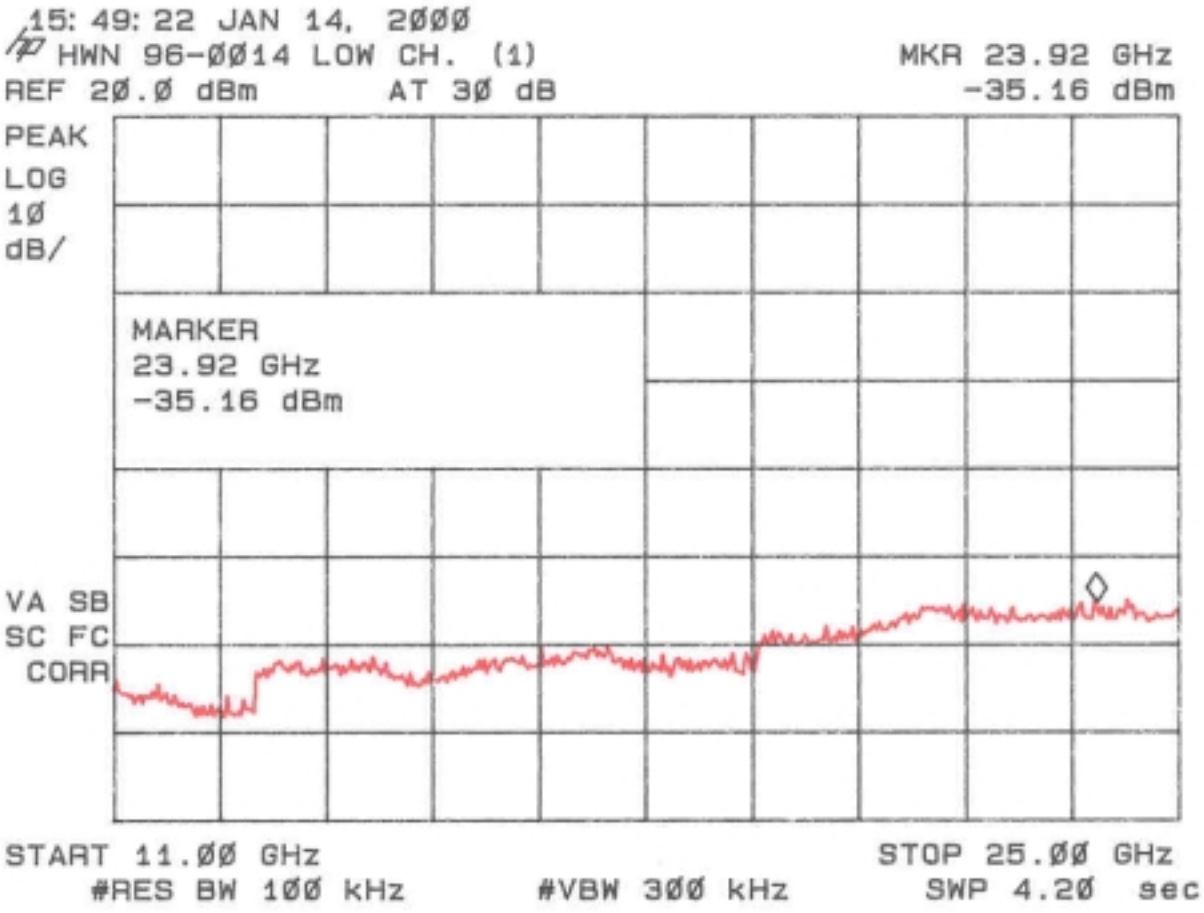


Figure 4e
Antenna Conducted Spurious Emissions 15.247(c) Mid

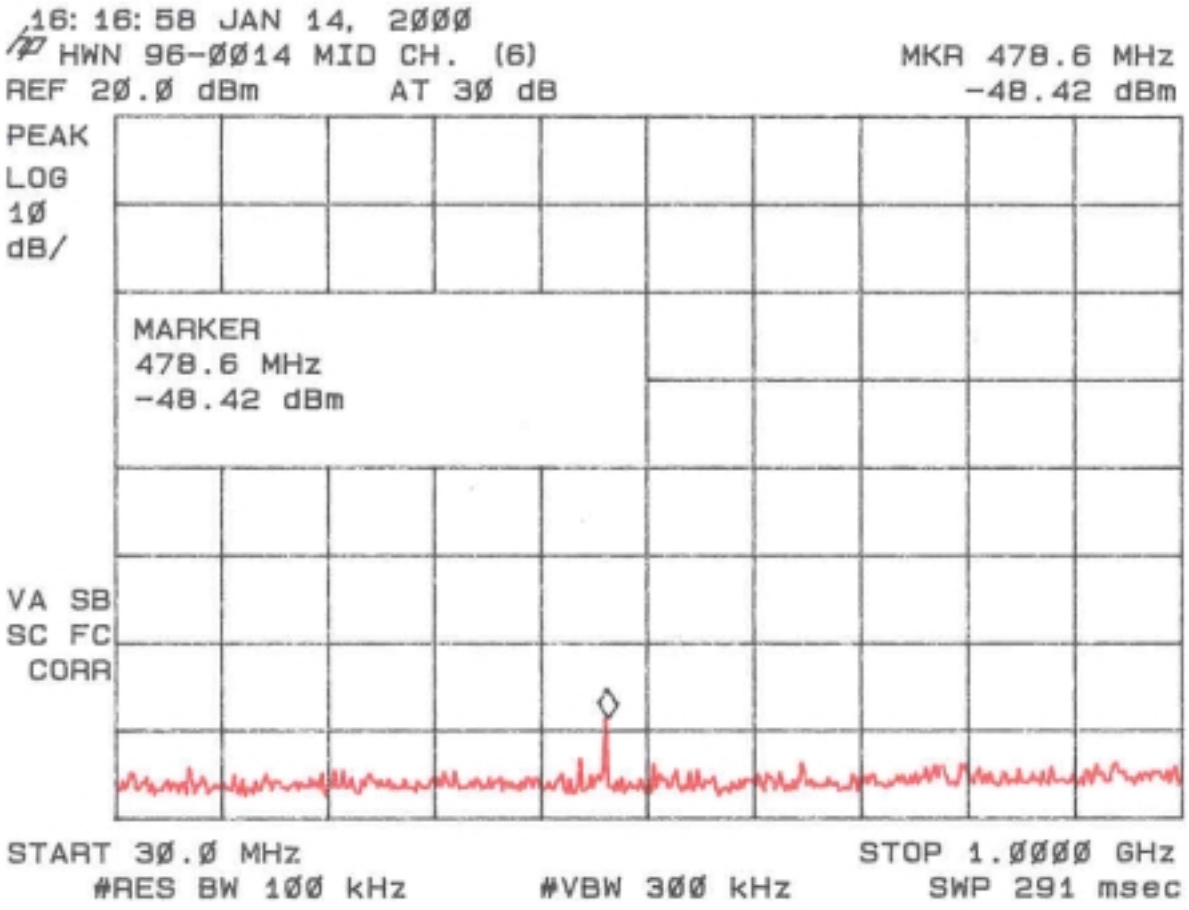


Figure 4f
Antenna Conducted Spurious Emissions 15.247(c) Mid

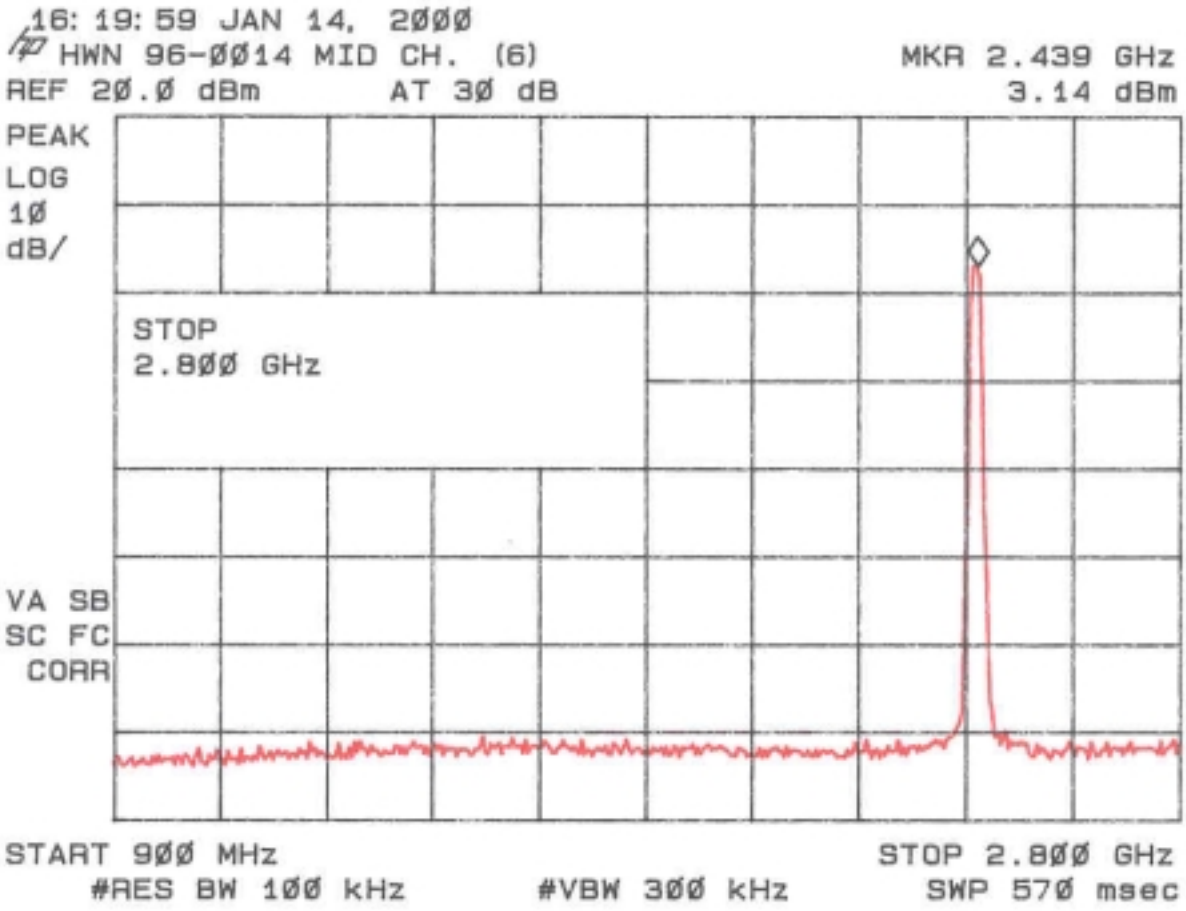


Figure 4g
Antenna Conducted Spurious Emissions 15.247(c) Mid

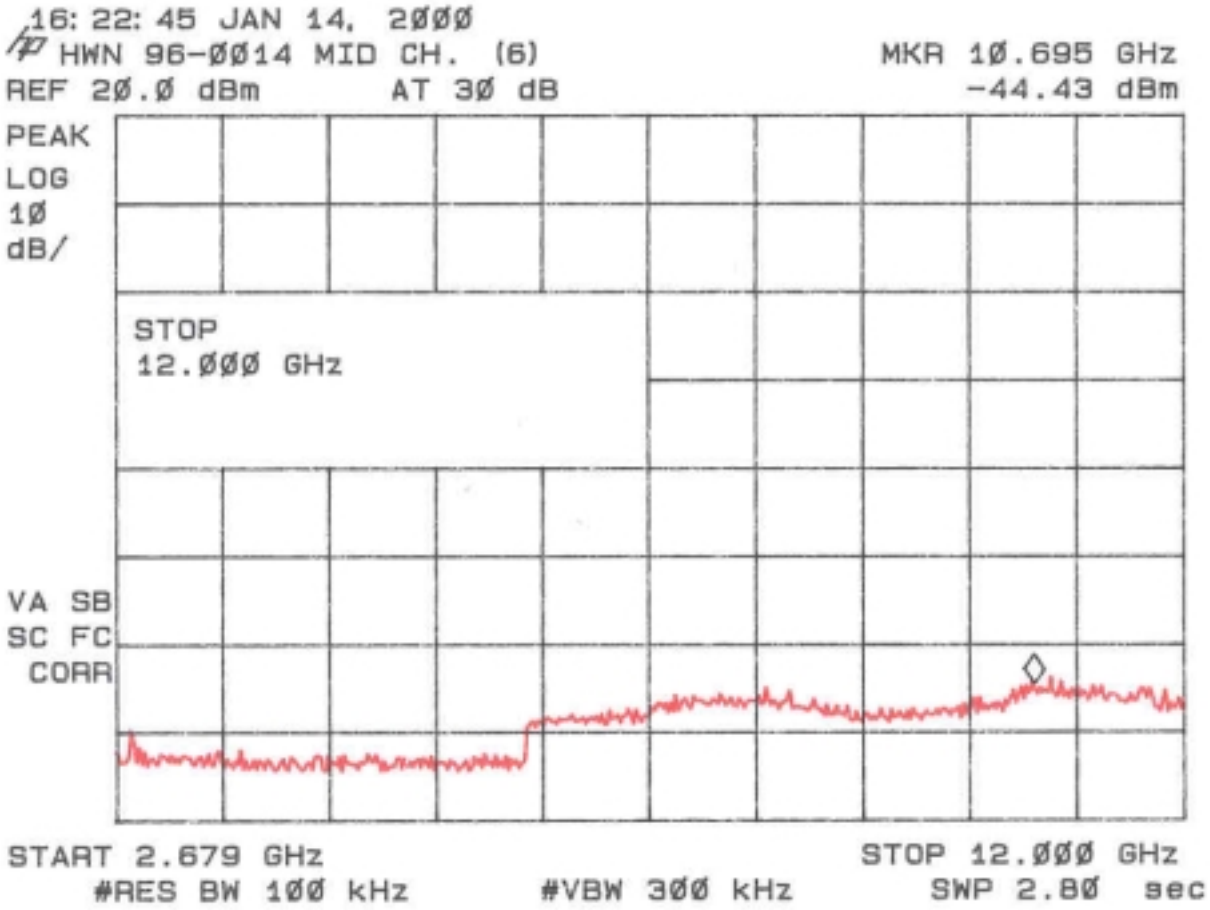


Figure 4h
Antenna Conducted Spurious Emissions 15.247(c) Mid

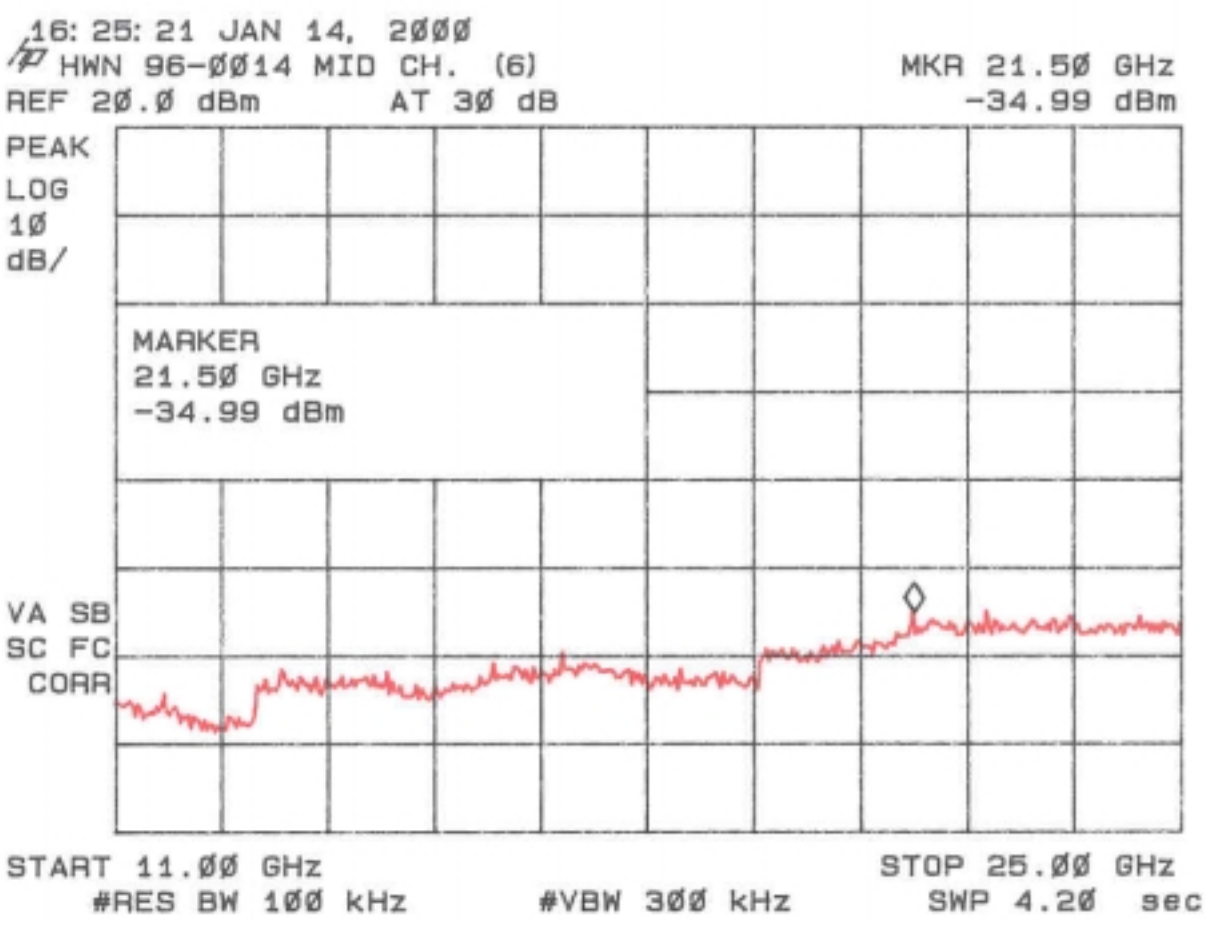


Figure 4i
Antenna Conducted Spurious Emissions 15.247(c) High

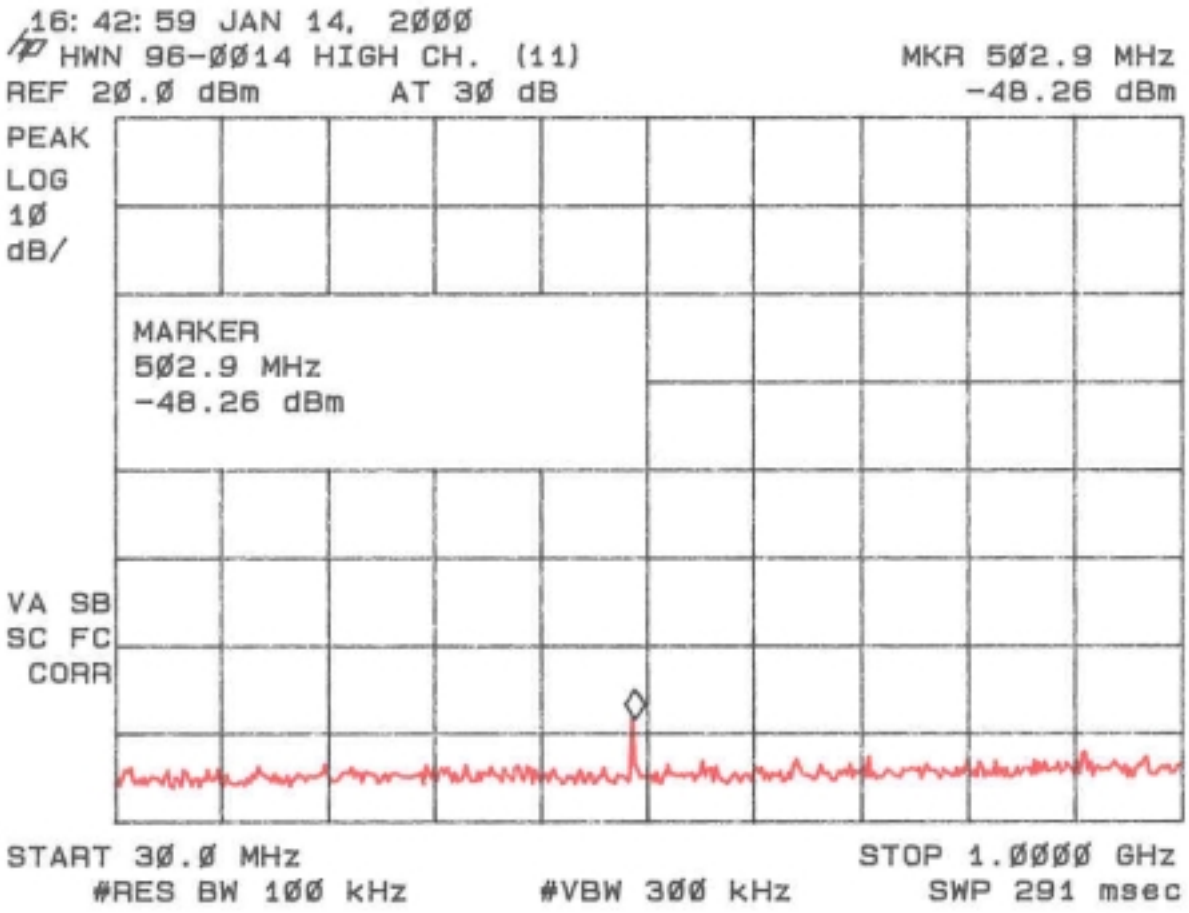


Figure 4j
Antenna Conducted Spurious Emissions 15.247(c) High

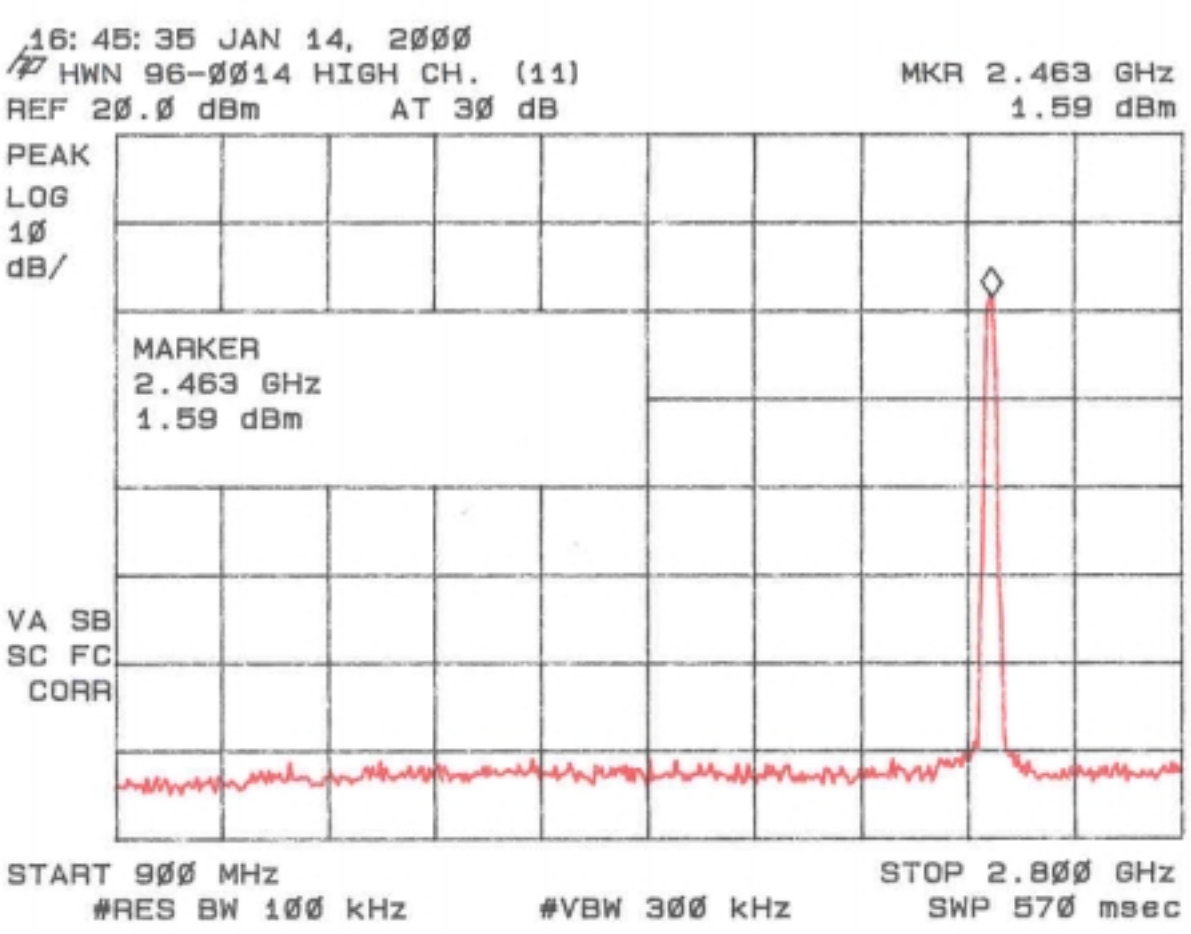


Figure 4k
Antenna Conducted Spurious Emissions 15.247(c) High

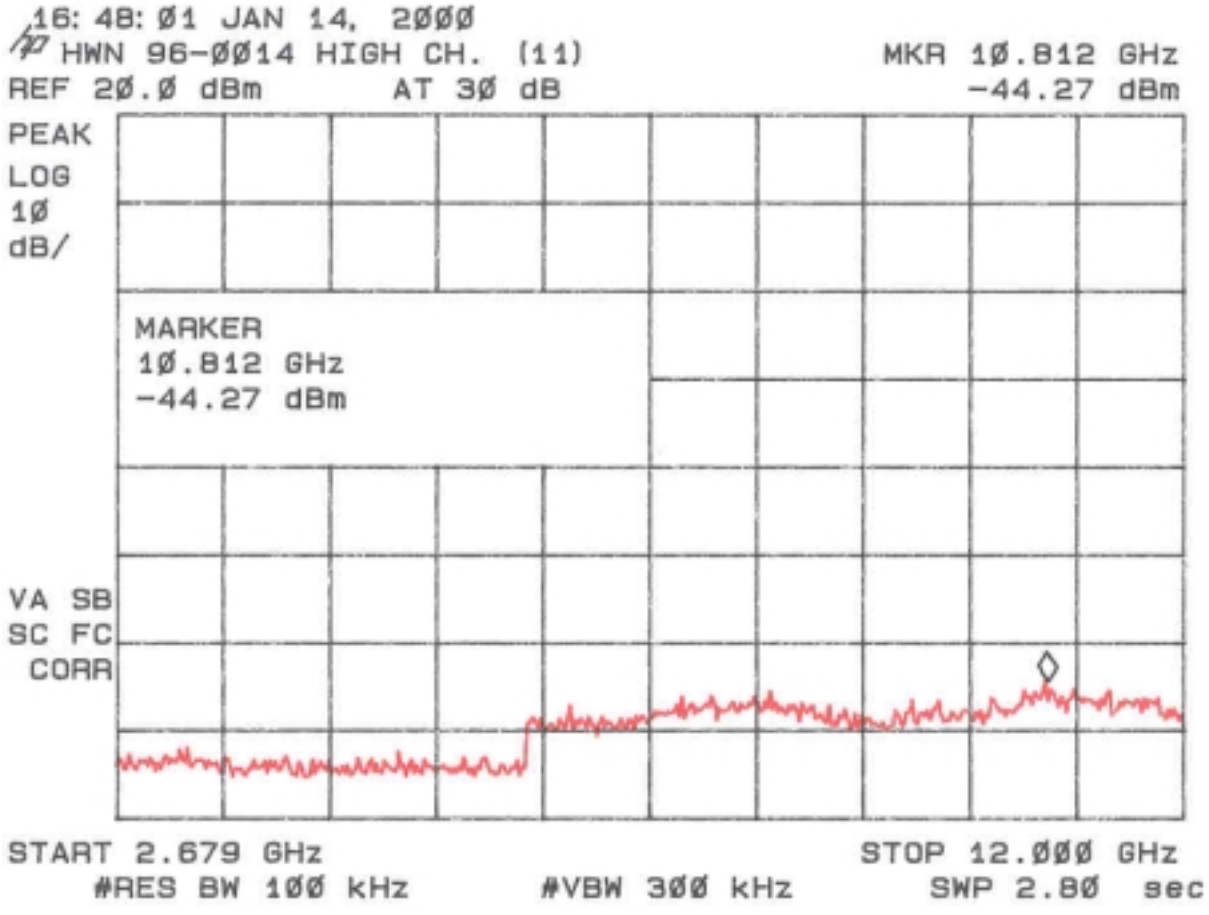
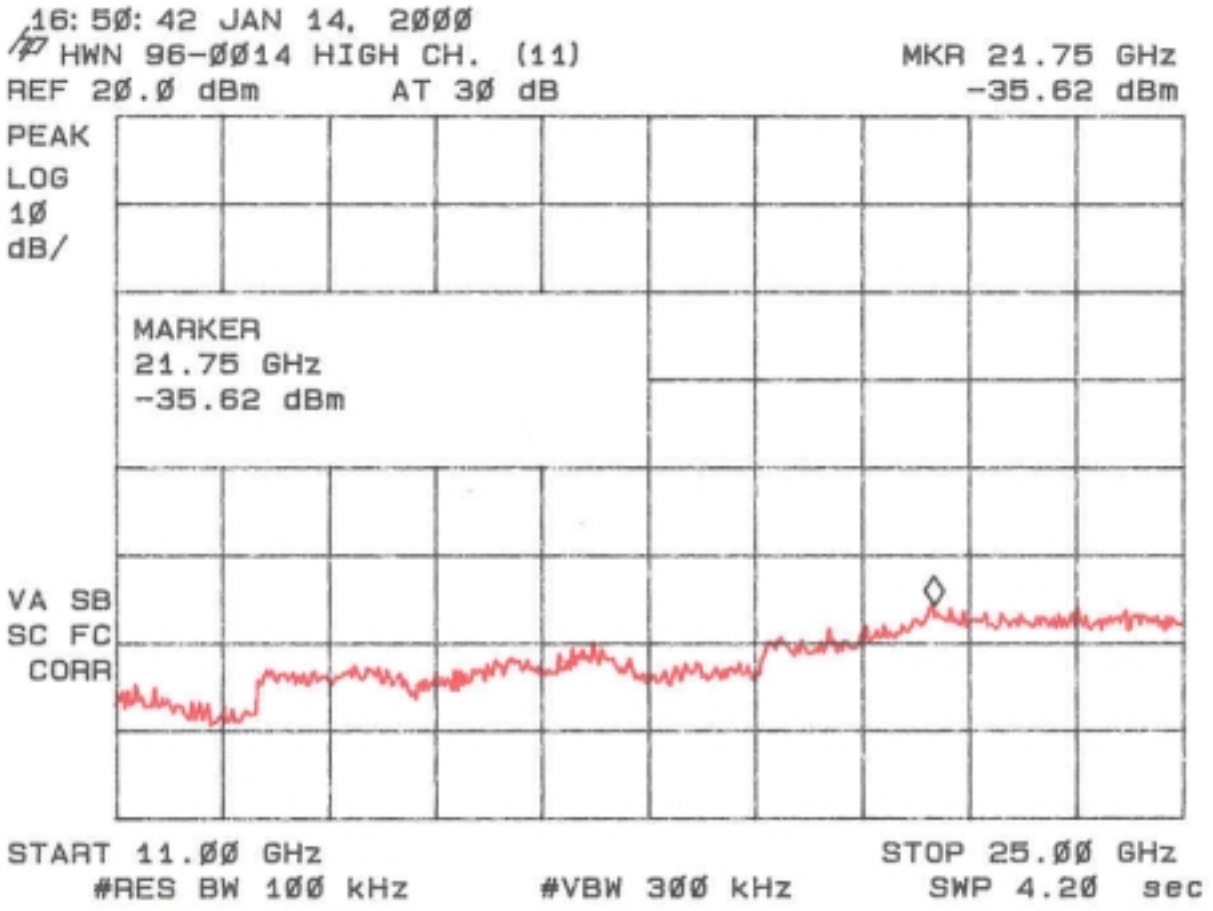


Figure 4l
Antenna Conducted Spurious Emissions 15.247(c) High



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

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 (low), Table 4b, (mid), Table 4c (high) and Figure 5a-5b (low), Figure 5c-5e (mid) and Table 5f (high).

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

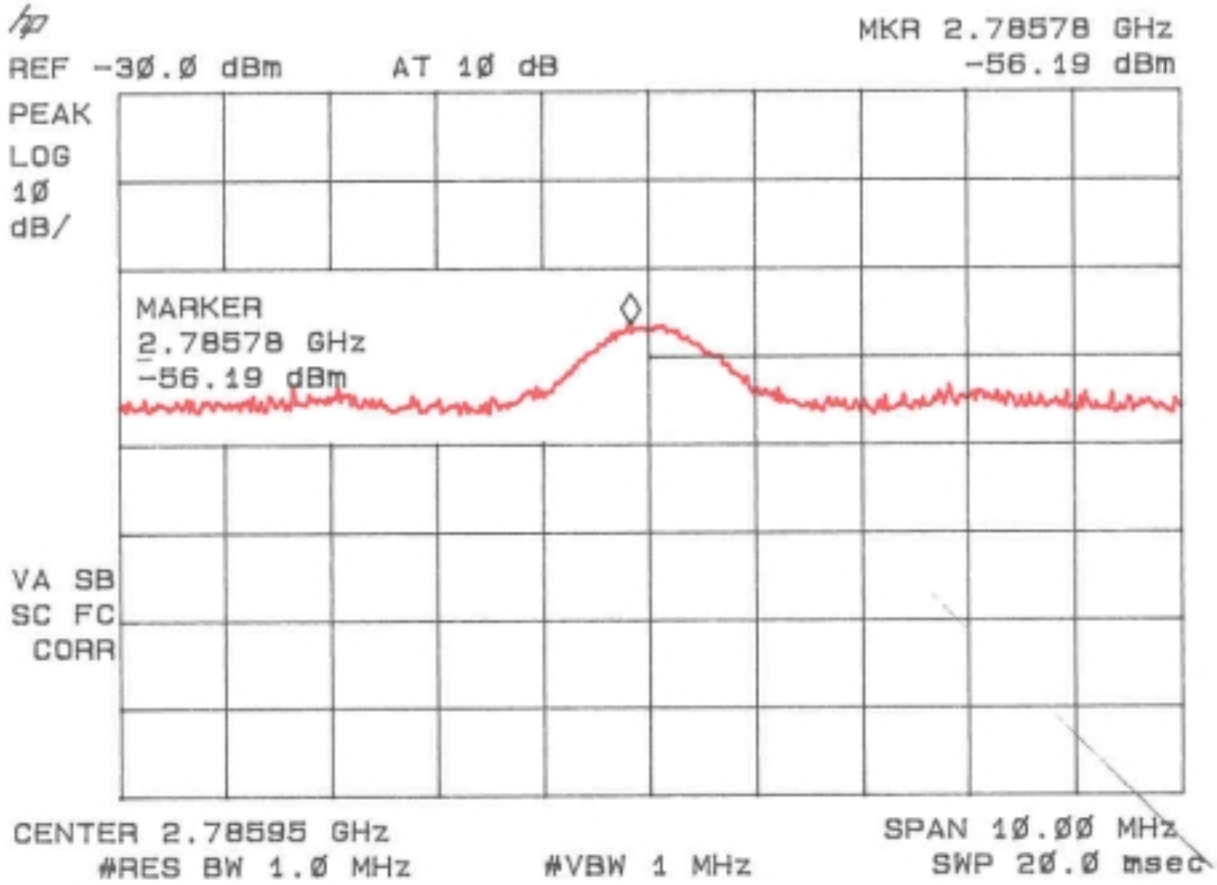


Figure 5b
Peak Radiated Spurious Emission 15.247(c) Low

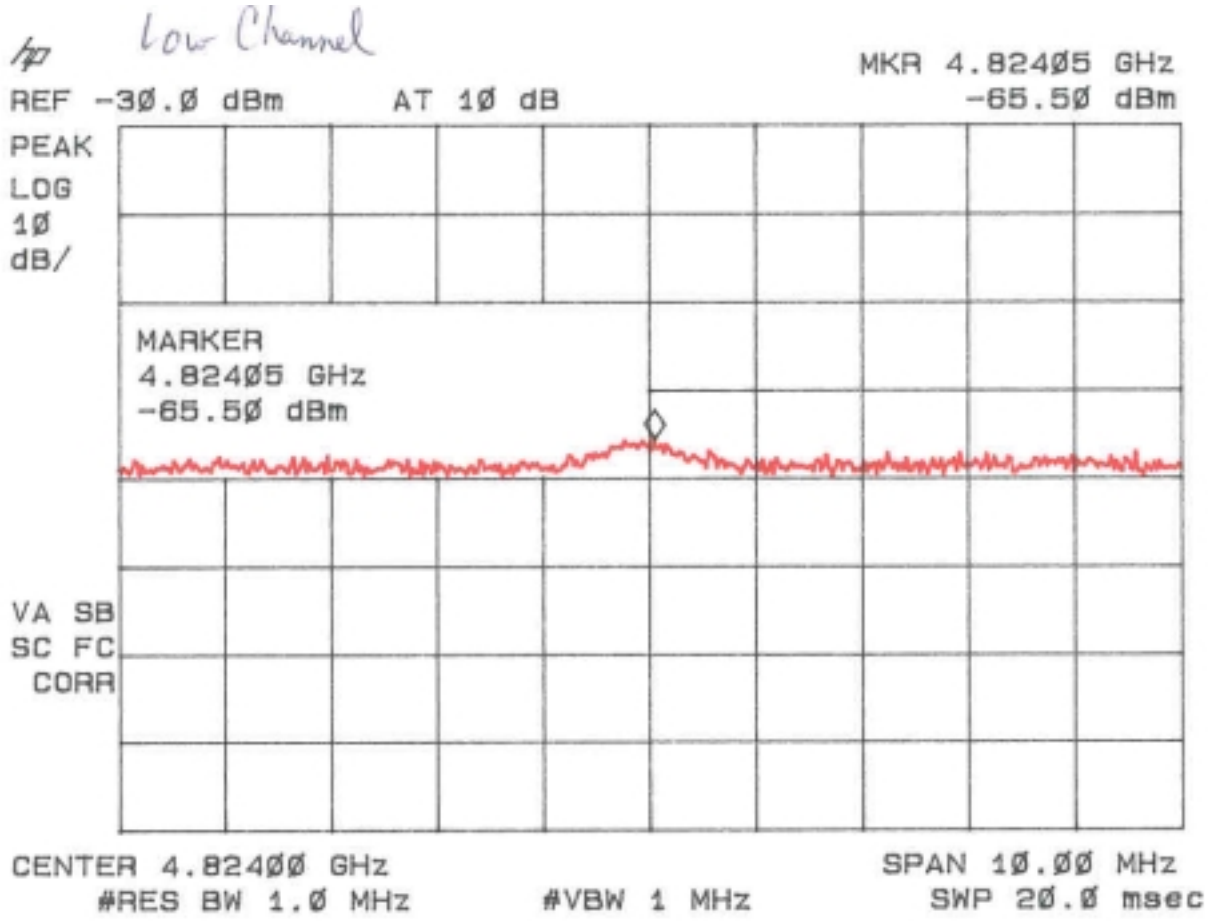


Figure 5c
Peak Radiated Spurious Emission 15.247(c) Mid

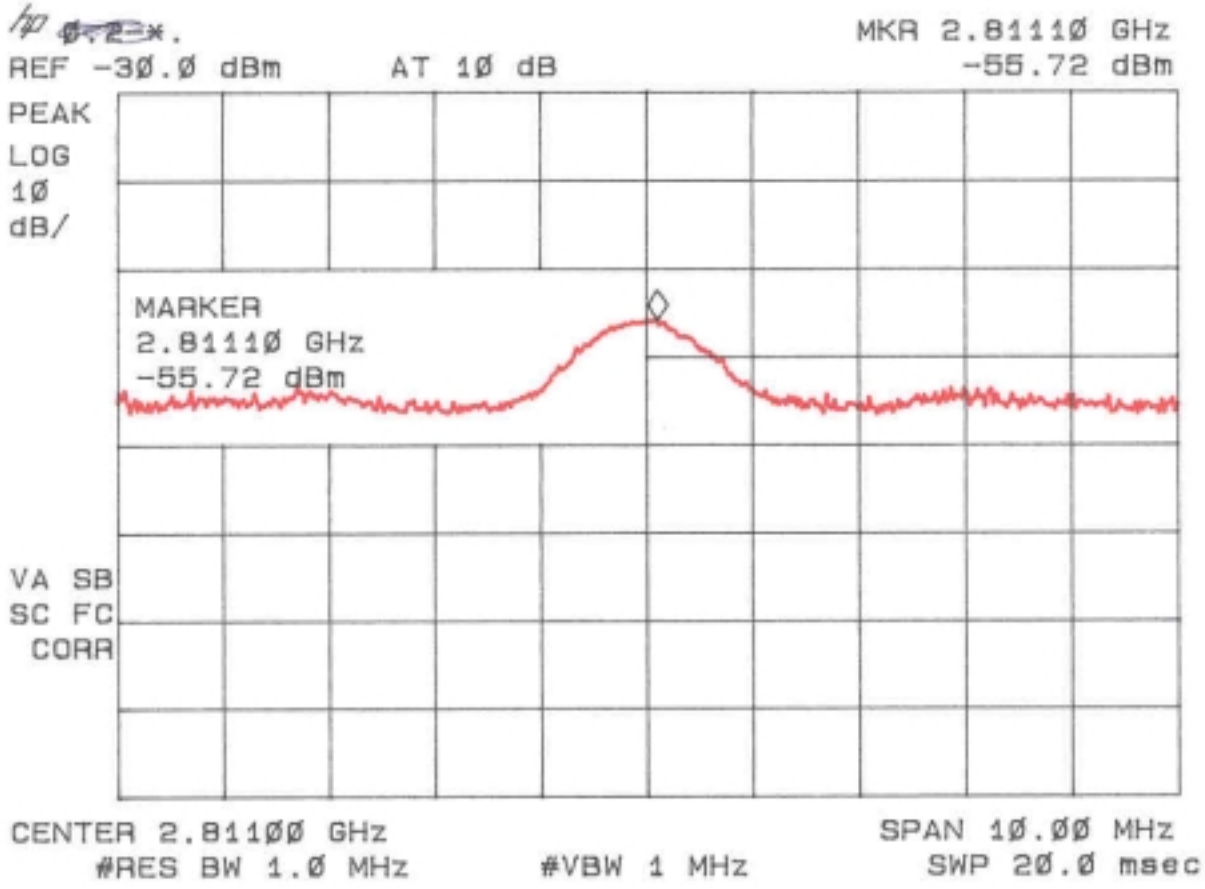


Figure 5d
Peak Radiated Spurious Emission 15.247(c) Mid

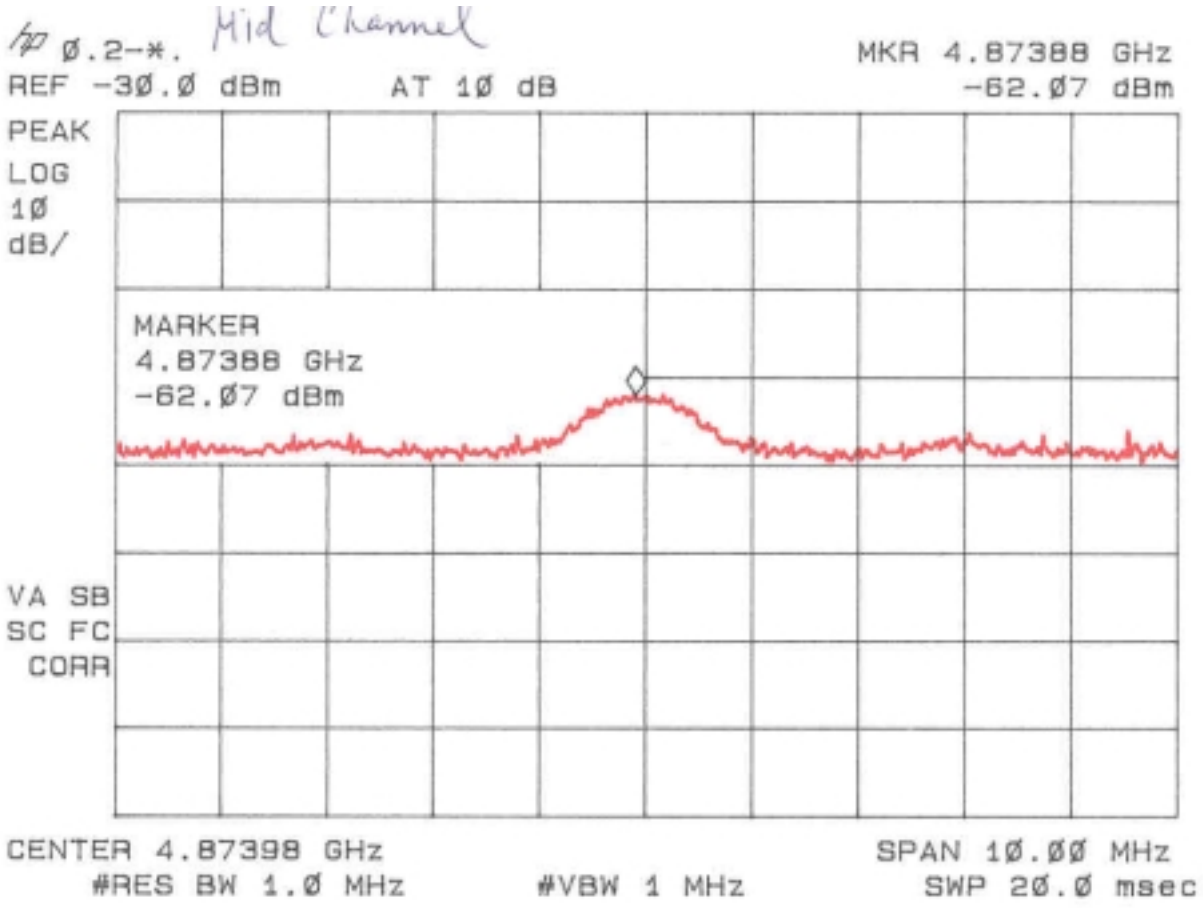


Figure 5e
Peak Radiated Spurious Emission 15.247(c) Mid

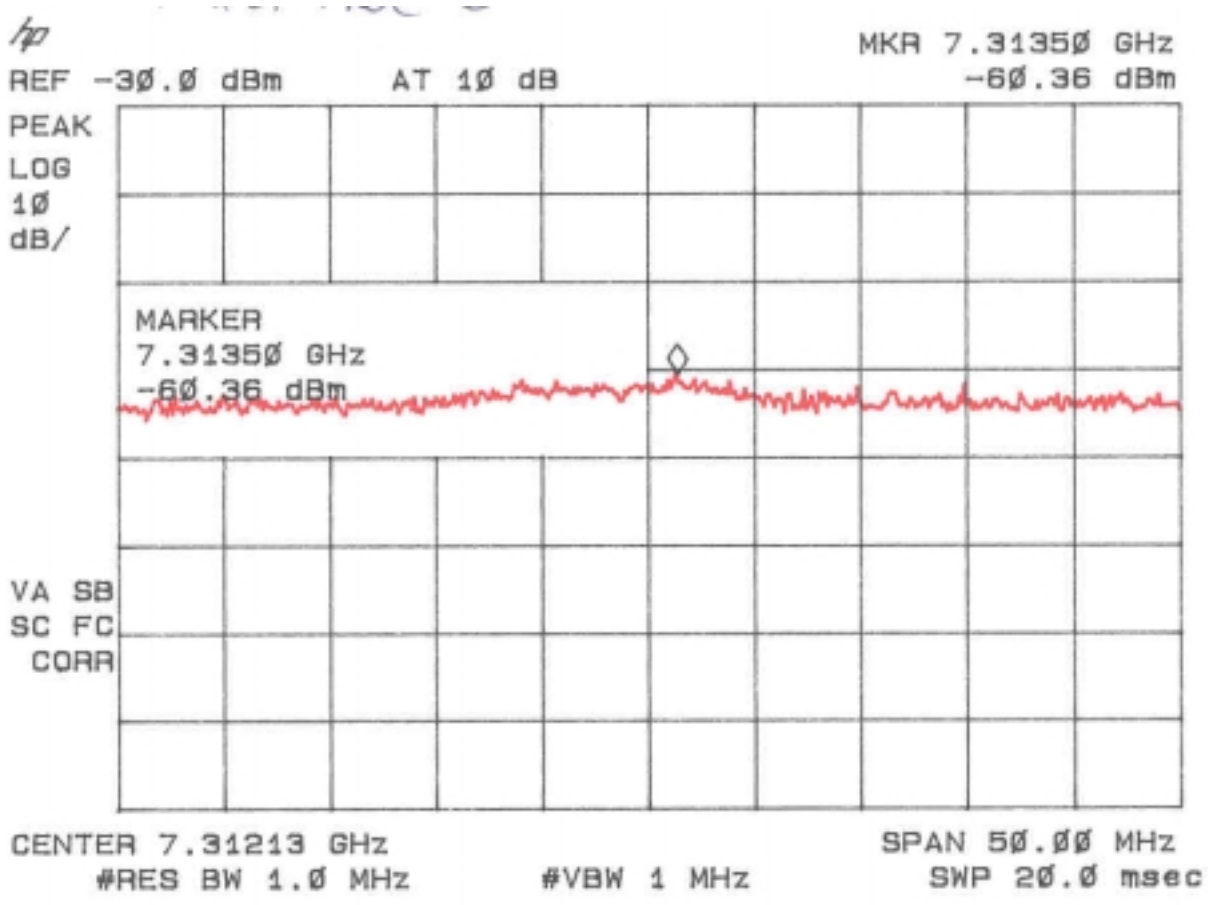


Figure 5f
Peak Radiated Spurious Emission 15.247(c) High

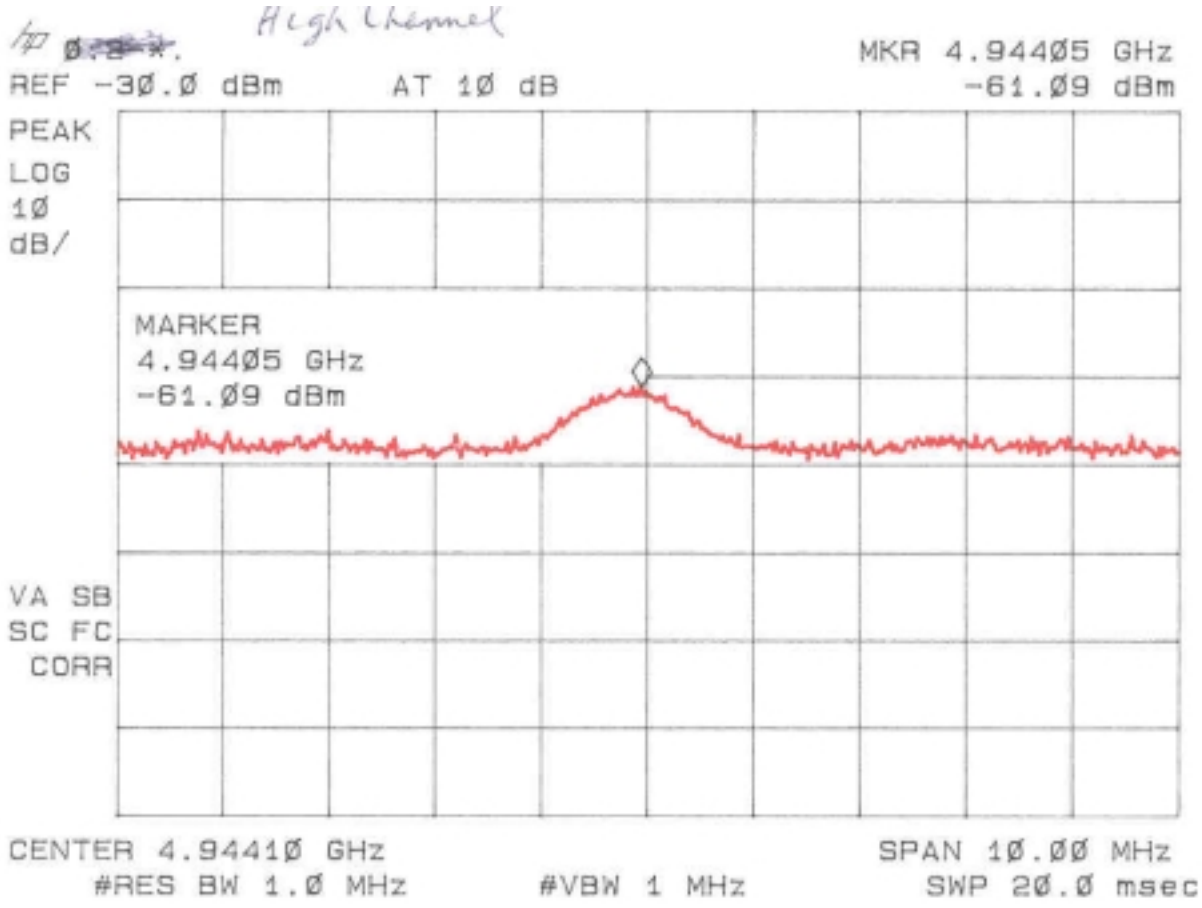


TABLE 4a
PEAK RADIATED SPURIOUS EMISSIONS (Low)

Test Date: January 14, 2000
UST Project: 99-901
Customer: Home Wireless Networks, Inc.
Model: 95-0016-XXX

Freq. (GHz)	Test Data (dBm) @3m	High Pass Filter Loss (dB)	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
2.786	-56.1	1.6	34.9	31.4	4.2	457.1	5000
4.824	-65.5	1.0	34.3	34.7	7.9	346.7	5000

**** = Instrumentation ground floor**

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-56.1 + 1.6 - 34.9 + 31.4 + 4.2 + 107)/20) = 457.1
CONVERSION FROM dBm TO dBuV = 107 dB

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

TABLE 4b
PEAK RADIATED SPURIOUS EMISSIONS (Mid)

Test Date: January 14, 2000
UST Project: 99-901
Customer: Home Wireless Networks, Inc.
Model: 95-0016-XXX

Freq. (GHz)	Test Data (dBm) @3m	High Pass Filter Loss (dB)	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
2.811	-55.7	1.6	34.9	31.4	4.2	478.6	5000
4.874	-62.1	1.0	34.1	34.8	8.1	543.3	5000
7.314	-69.9*	1.0	33.8	37.2	7.9	295.1	5000

*** = EUT measured at 1 meter to achieve better dynamic range. Measurement has been adjusted by 20 log (1/3) = -9.54 dB**
**** = Instrumentation ground floor**

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-55.7 + 1.6 - 34.9 + 31.4 + 4.2 + 107)/20) = 478.6
CONVERSION FROM dBm TO dBuV = 107 dB

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

TABLE 4c
PEAK RADIATED SPURIOUS EMISSIONS (High)

Test Date: January 14, 2000
UST Project: 99-901
Customer: Home Wireless Networks, Inc.
Model: 95-0016-XXX

Freq. (GHz)	Test Data (dBm) @3m	High Pass Filter Loss (dB)	Amp. Gain (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @3m	FCC Limits (uV/m) @3m
4.944	-61.1	1.0	34.1	35.0	8.2	631.0	5000

**** = Instrumentation ground floor**

SAMPLE CALCULATION:
RESULTS (uV/m @ 3m) = Antilog ((-61.1 + 1.0 - 34.1 + 35.0 + 8.2 + 107)/20) = 631.0
CONVERSION FROM dBm TO dBuV = 107 dB

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