Application for

Nivis, LLC
FCC Part 15 Certification
For the
2.4 GHz Ainode

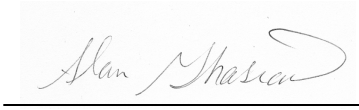
FCC ID: SQB-NIVISAN0010
UST Project: 07-0245
Issue Date: December 27, 2007

Total number of pages contained in this report: 86

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

I certify that I am authorized to sign for the manufacturer and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (AGENT RESPONSIBLE FOR TEST):

By: 

Name: Alan Ghasiani

Title: Operations & Engineering

Date: December 27, 2007

Nivis, LLC
1000 Circle 75 Parkway
Atlanta, GA 30339

By: _____

Name: _____

Title: _____

Date: _____

3505 Francis Circle Alpharetta, GA 30004
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MEASUREMENT/TECHNICAL REPORT

Manufacturers Name **Nivis, LLC**

Model Number: **2.4 GHz Ainode**

FCC ID: **SQB-NIVISAN0010**

Date: **December 27, 2007**

This report concerns (check one): Original grant X
Class II permissive change_____

Equipment type: **2.4 GHz 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:

US TECH
3505 Francis Circle
Alpharetta, GA 30004

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

1. General Information

1.1 Product Description

The Equipment Under Test (EUT) is a Nivis, LLC, Model 2.4 GHz Ainode. The EUT is a modular 2.4 GHz spread spectrum transceiver. The EUT will be used with an integrated antenna.

1.2 Related Submittal(s)/Grant(s)

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

The EUT is subject to the following authorizations:

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

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

2. 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 (2004). 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. Block diagrams of the tested systems are shown in Figure 1. Test configuration photographs for spurious and fundamental emissions measurement are shown in Figure 2 and 3..

The sample used for testing was received by US Tech on September 24, 2007 in good condition.

2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and 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 to EUT

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

Figure 1. Test Configuration

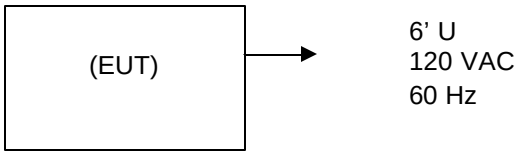

Table 1. EUT and Peripherals

PERIPHERAL MANU.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
(EUT) Nivis, LLC	2.4 GHz Ainode	None	Pending: SQB- NIVISAN0010	6' U 120 VAC/ 60 Hz

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Customer: **Nivis, LLC**
Model: **2.4 GHz Ainode**

Table 2. Test Instruments

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A10055	3/28/07
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	7/16/07
RF PREAMP	8447D	HEWLETT-PACKARD	2944A06291	6/14/07
BICONICAL ANTENNA	BIA-25	Electro-Metrics	2451	8/24/07
LOG PERIODIC	3146	EMCO	3600	8/24/07
LISN (x 2) 8028-50-TS24-BNC	8028	SOLAR ELE.	910494 & 910495	5/10/07
HORN ANTENNA	3115	EMCO	9107-3723	10/6/07 2 Yr.
PREAMP	8449B	HEWLETT PACKARD	3008A00480	8/21/07
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

Figure 2

Photograph(s) for Spurious Emissions Measurement (Front)

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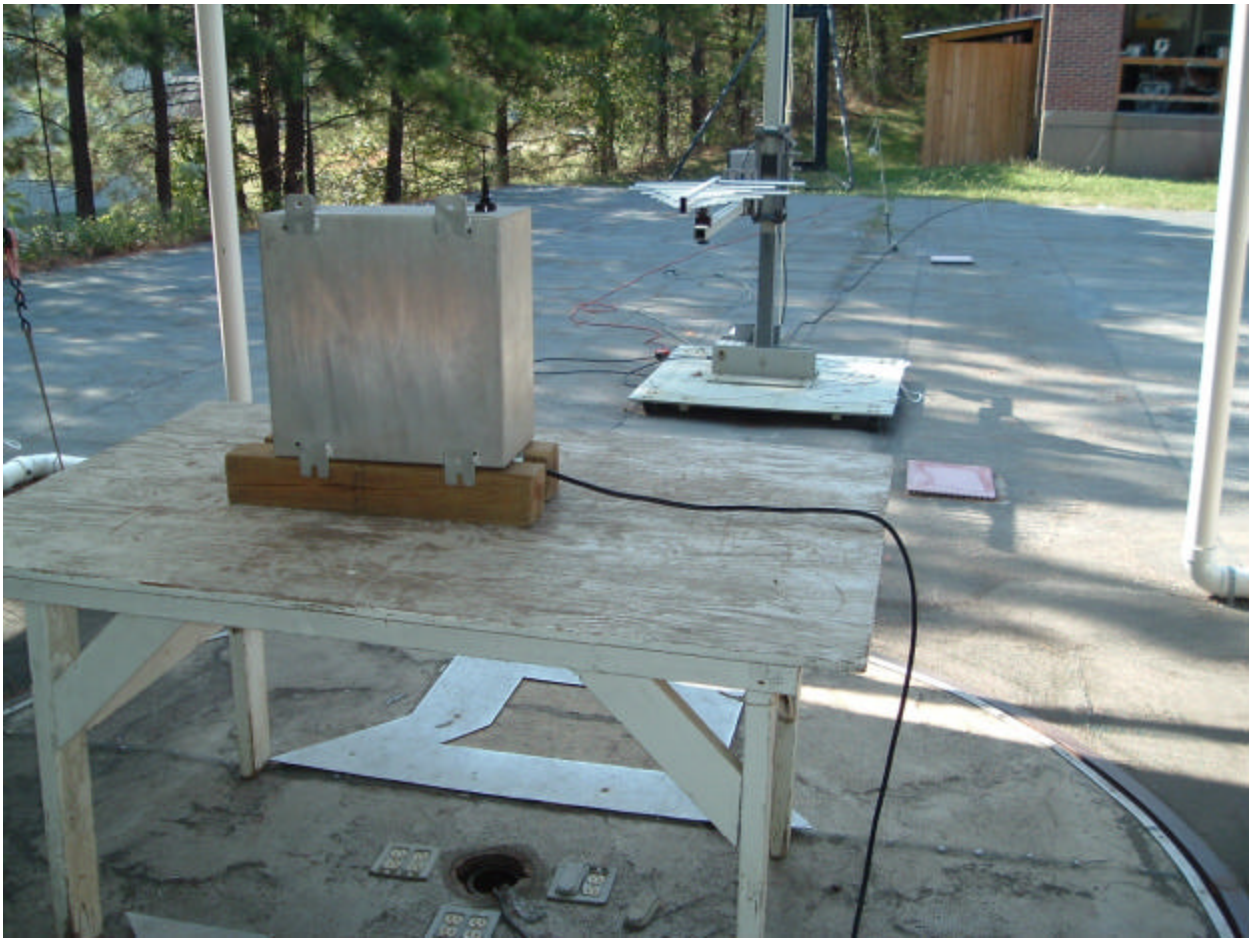
Model: **2.4 GHz Ainode**

Figure 3

Photograph(s) of Spurious Emissions Measurement (Rear)



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Model: 2.4 GHz Ainode

Figure 4

Photograph(S) of Conducted Emissions Measurement

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Model: **2.4 GHz Ainode**

2.5 Antenna Description (47 CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The Nivis Ainode use a reverse threaded SMA connector.

Nivis, LLC will sell the 2.4 GHz Ainode with the following antenna.

Table 3. Antenna Supplied With Ainode

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dBi	TYPE Of CONNECTOR
Nearson	DIPOLE	S151AH-2450	5	SMA RP

2.6 Peak Power Within the Band 2400 MHz to 2483.5 MHz per 47 CFR 15.247(b)

Peak power within the band 2400-2483.5 MHz has been measured with a spectrum analyzer by connecting the spectrum analyzer directly to the antenna output terminals via a short cable 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 4 and Figure 5 through Figure 7.

Table 4 Peak Power Output

Frequency of Fundamental (MHz)	Measurement (dBm)*	Measurement (mW)*	FCC Limit (Watt)
2405.00	22.70	186.20	1.0
2440.01	22.25	167.88	1.0
2480.05	22.33	171.00	1.0

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

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Tester Signature:  **Name:** **Daniel Aparaschivei**

Figure 5
Peak Power per FCC Section 15.247(b) Low Channel

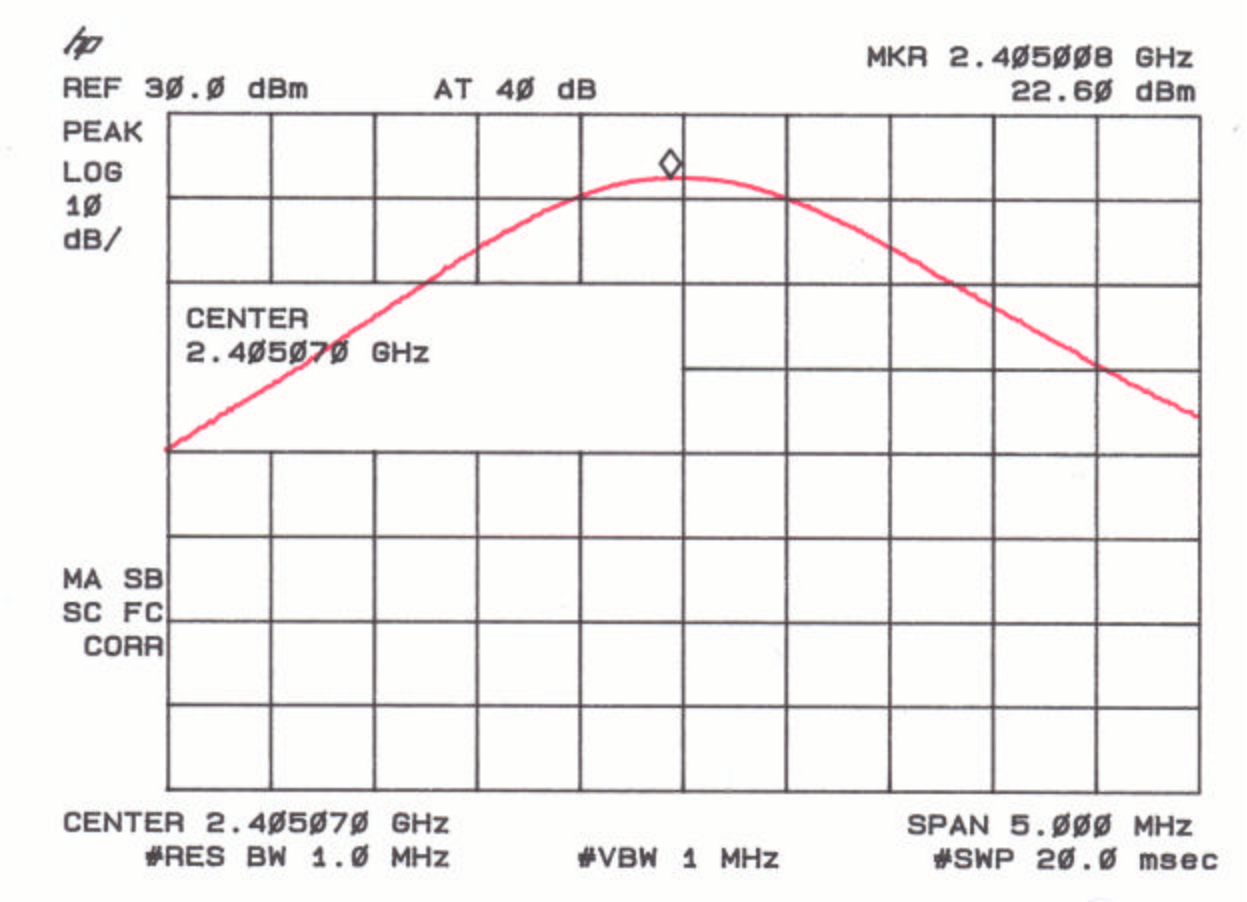

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Figure 6.
Peak Power per FCC Section 15.247(b) Mid Channel

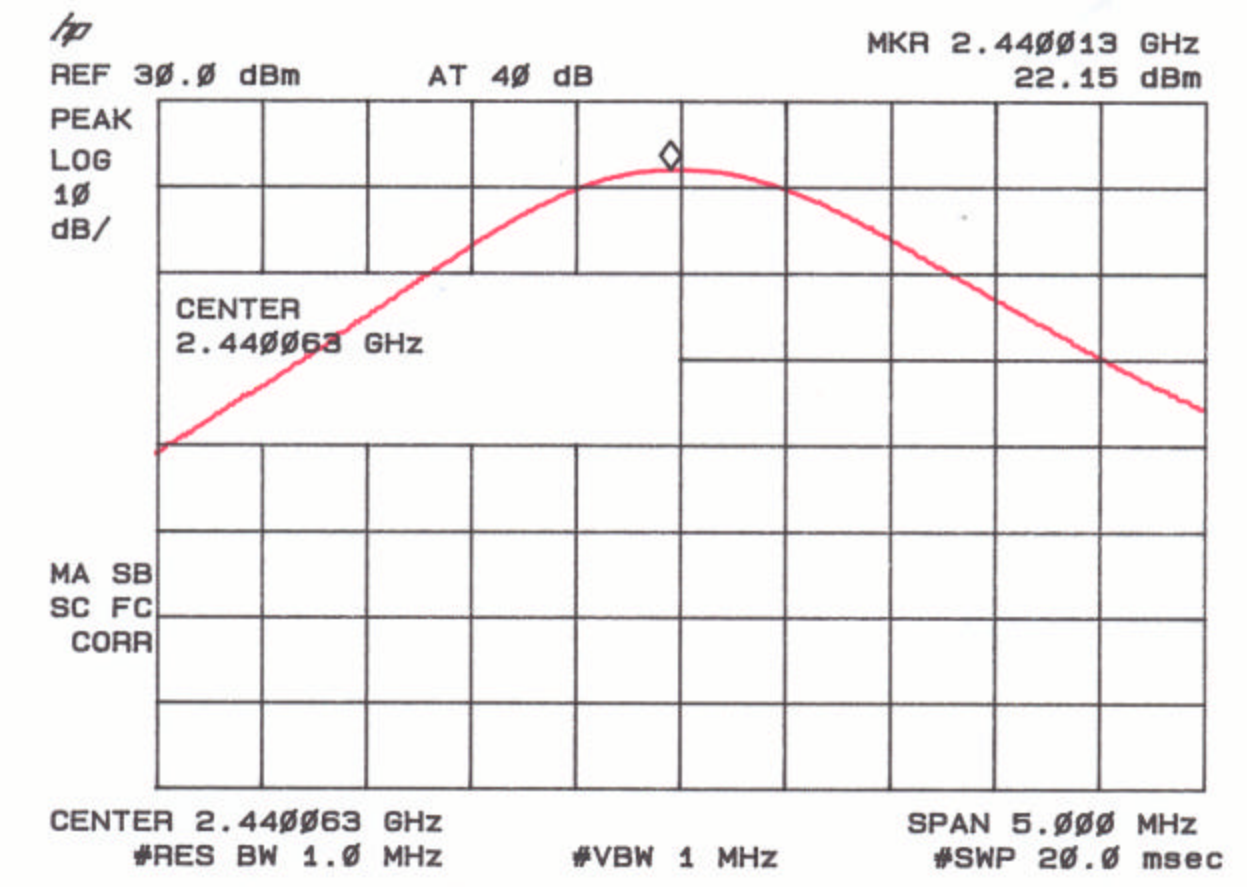

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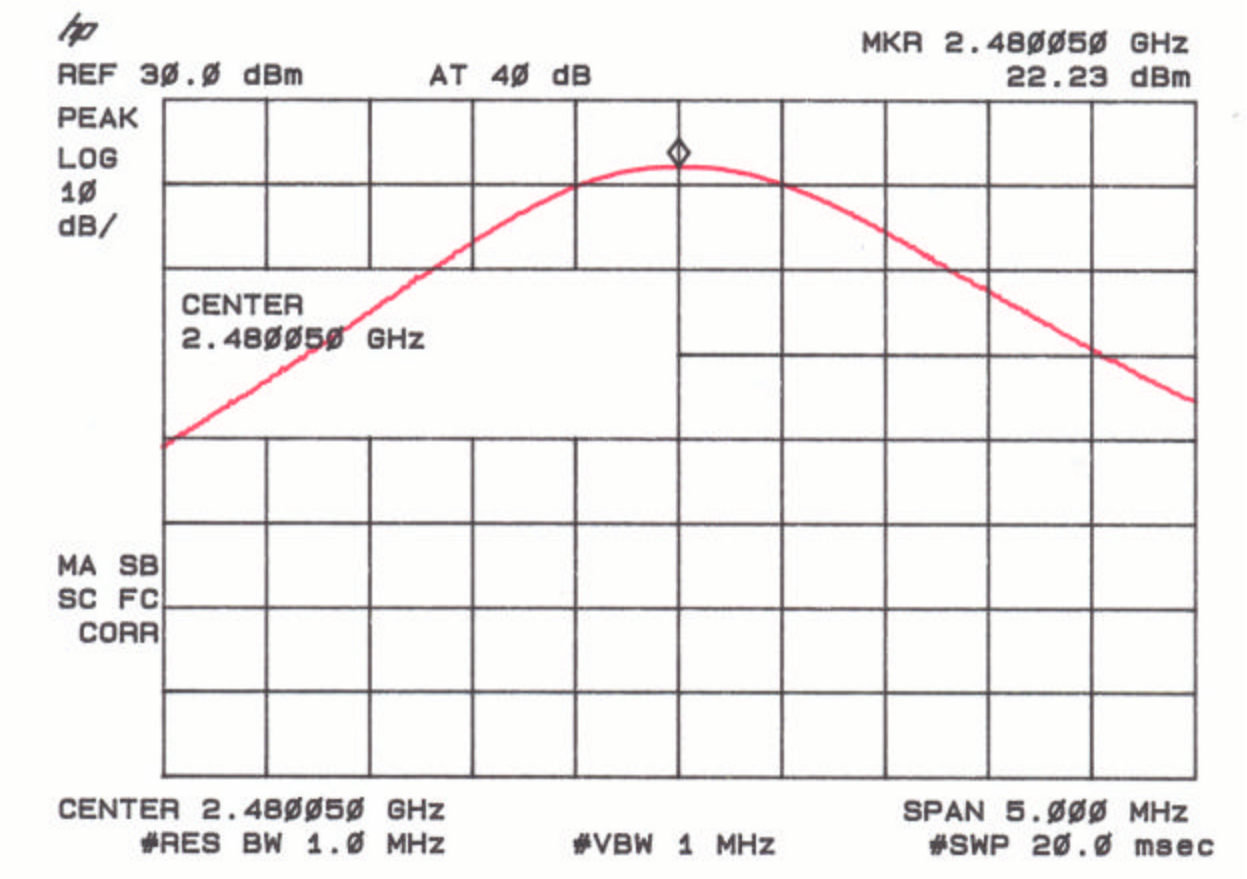
Figure 7.
Peak Power per FCC Section 15.247(b) High Channel



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

Spurious emissions in the frequency range 30 MHz to 25000 MHz have been measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. The spectrum analyzer was set for a 50 Ω impedance with the RBW = 100 kHz & VBW> RBW. All spurious emissions were measured to be greater than 20 dB down from the fundamental. The results or conducted spurious emissions are given in Figure 9 through 20.

Figure 8
Antenna Conducted Spurious Emissions 15.247(c) Low

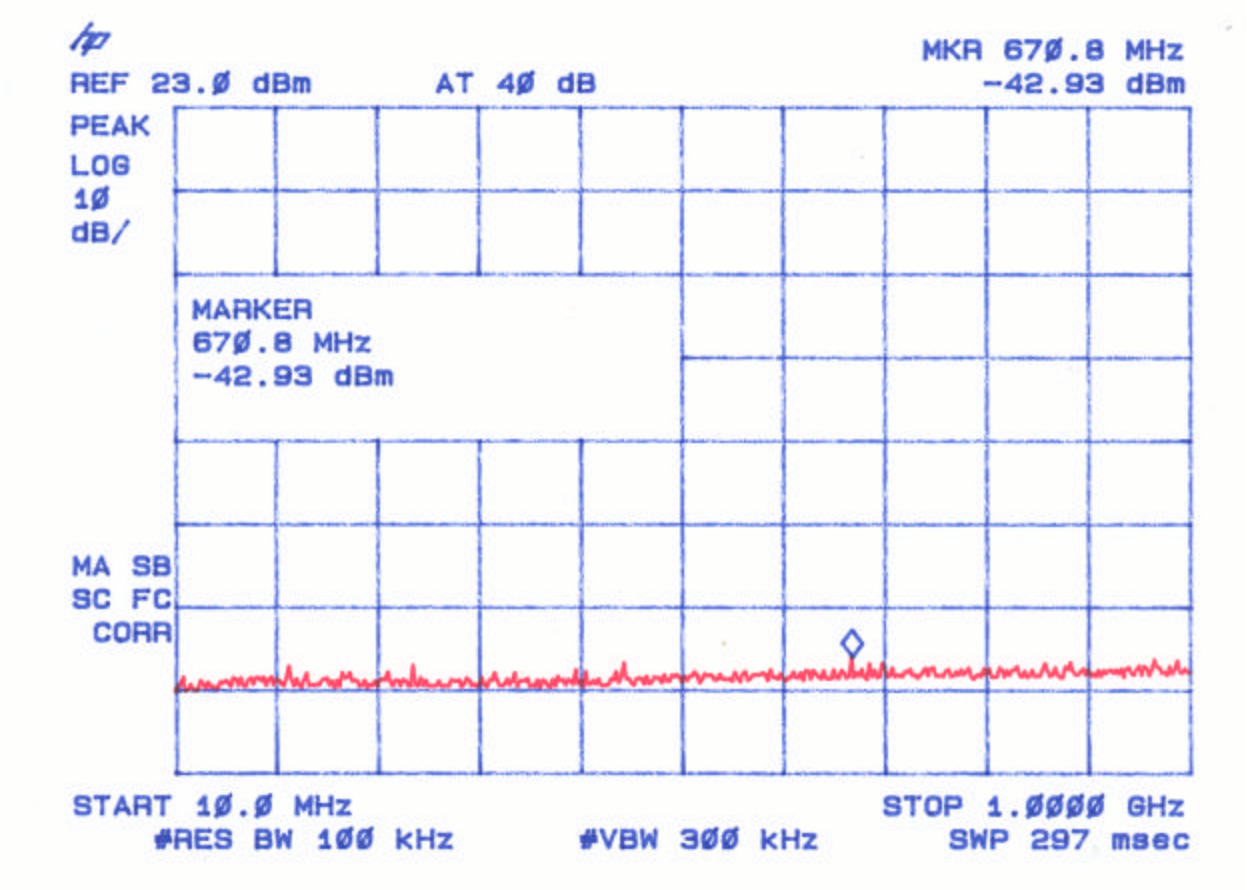


Figure 9
Antenna Conducted Spurious Emissions 5.247(c) Low (Cont'd)

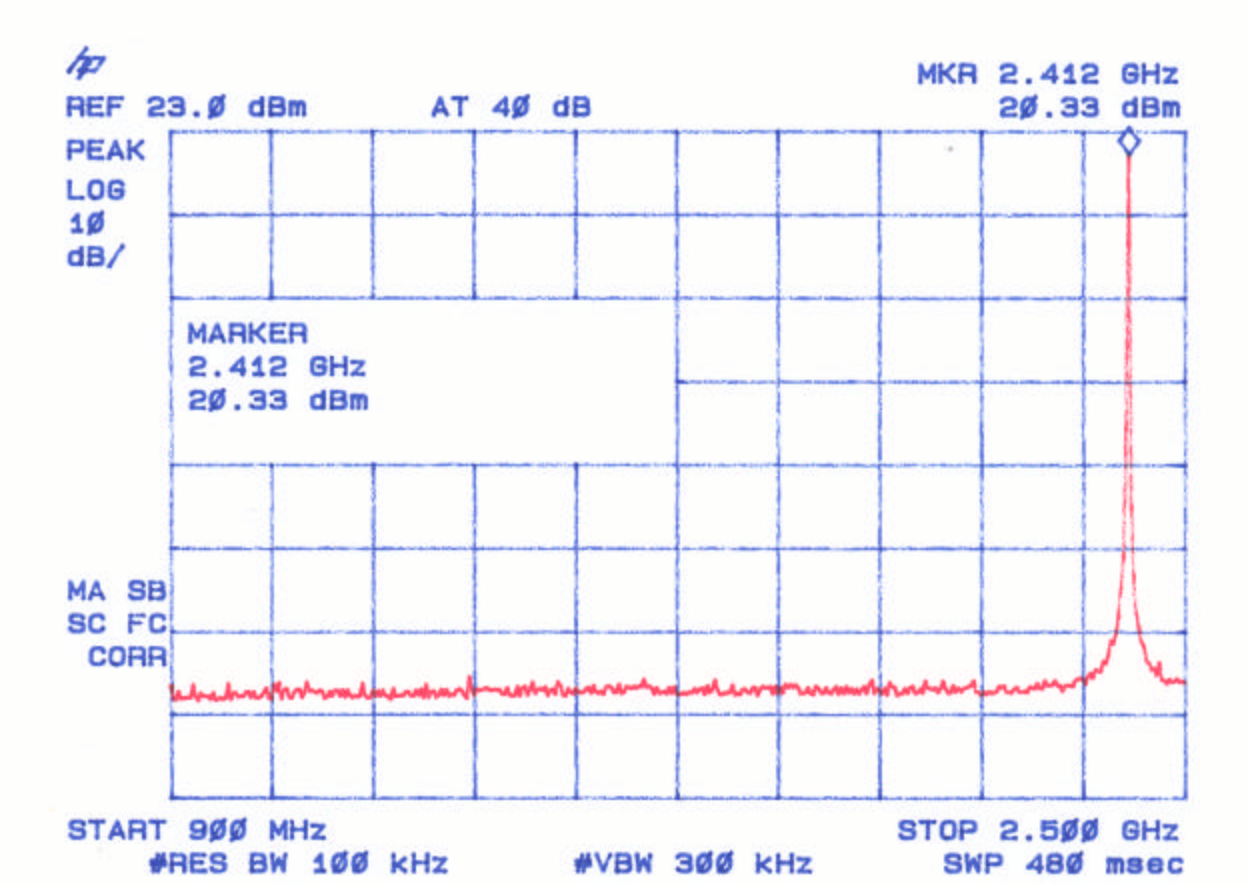


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Figure 10
Antenna Conducted Spurious Emissions 15.247(c) Low (Cont'd)

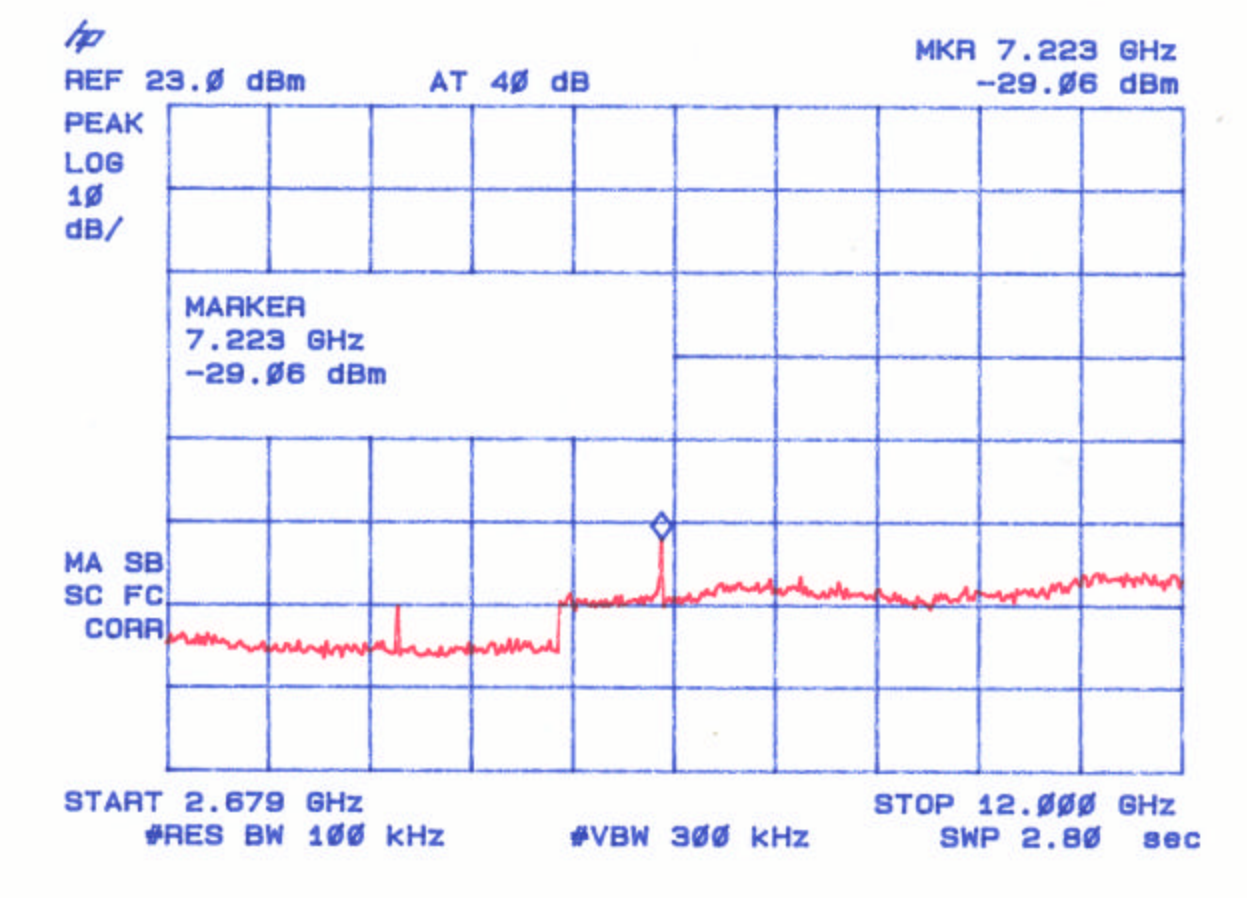


Figure 11
Antenna Conducted Spurious Emissions 15.247(c) Low (Cont'd)

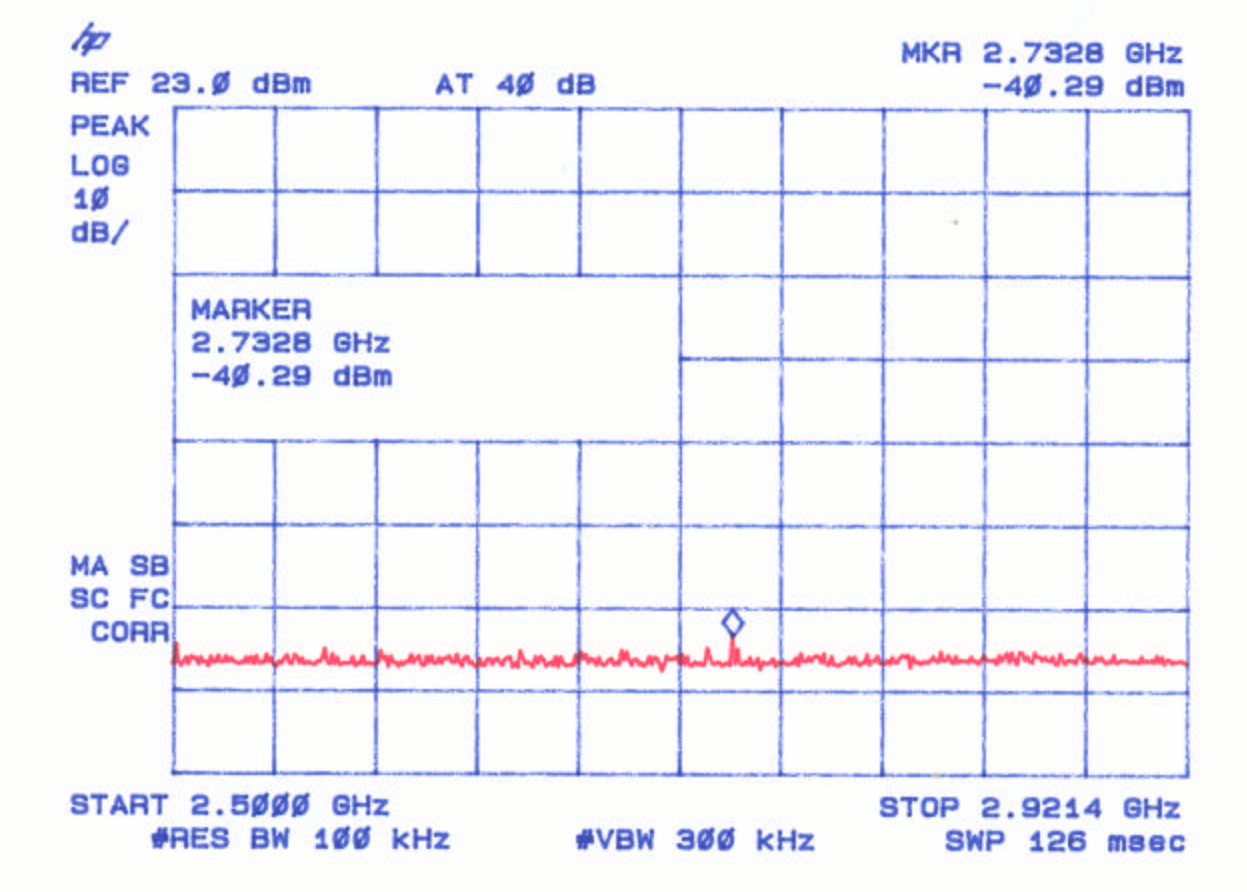


Figure 12
Antenna Conducted Spurious Emissions 15.247(c) Low (Cont'd)

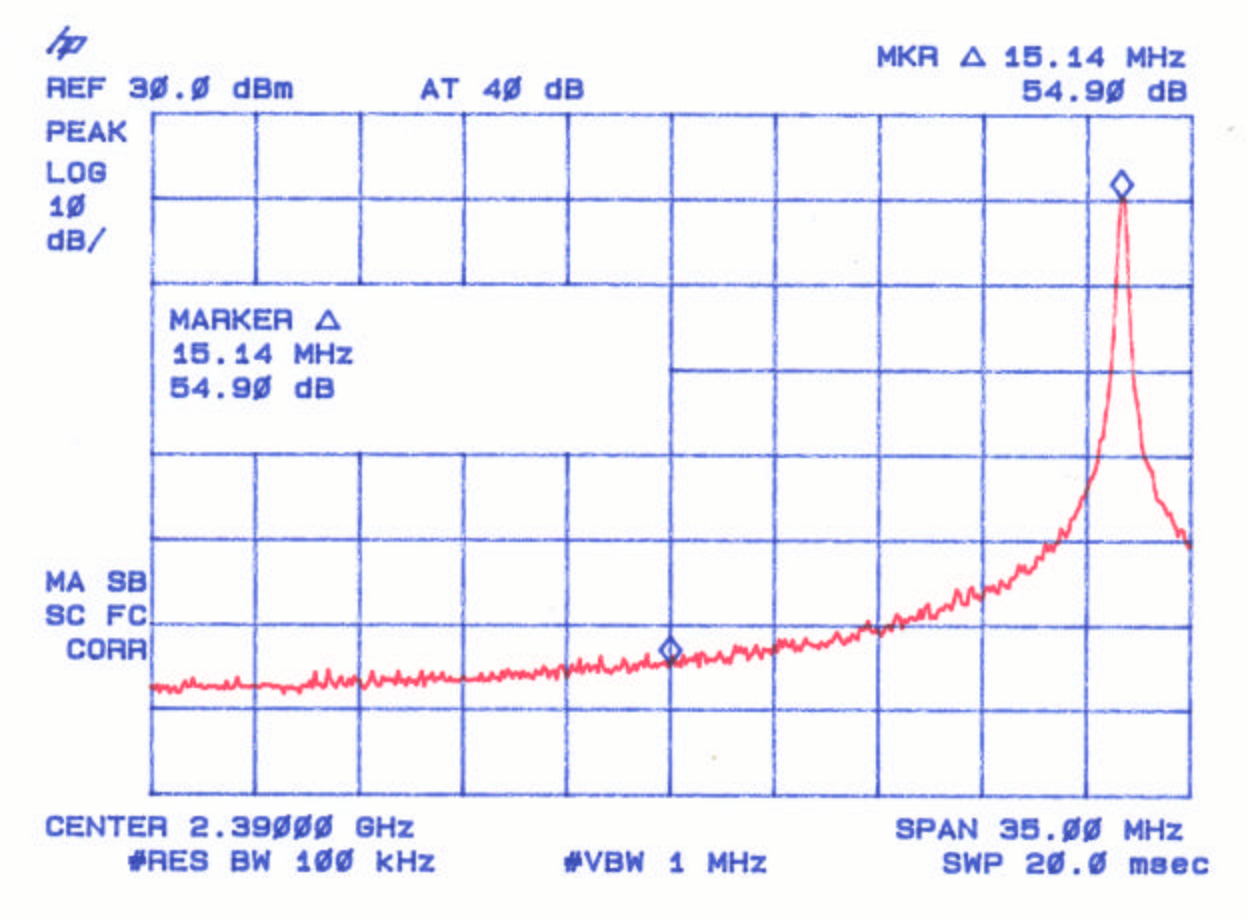


Figure 13
Antenna Conducted Spurious Emissions 15.247(c) Mid

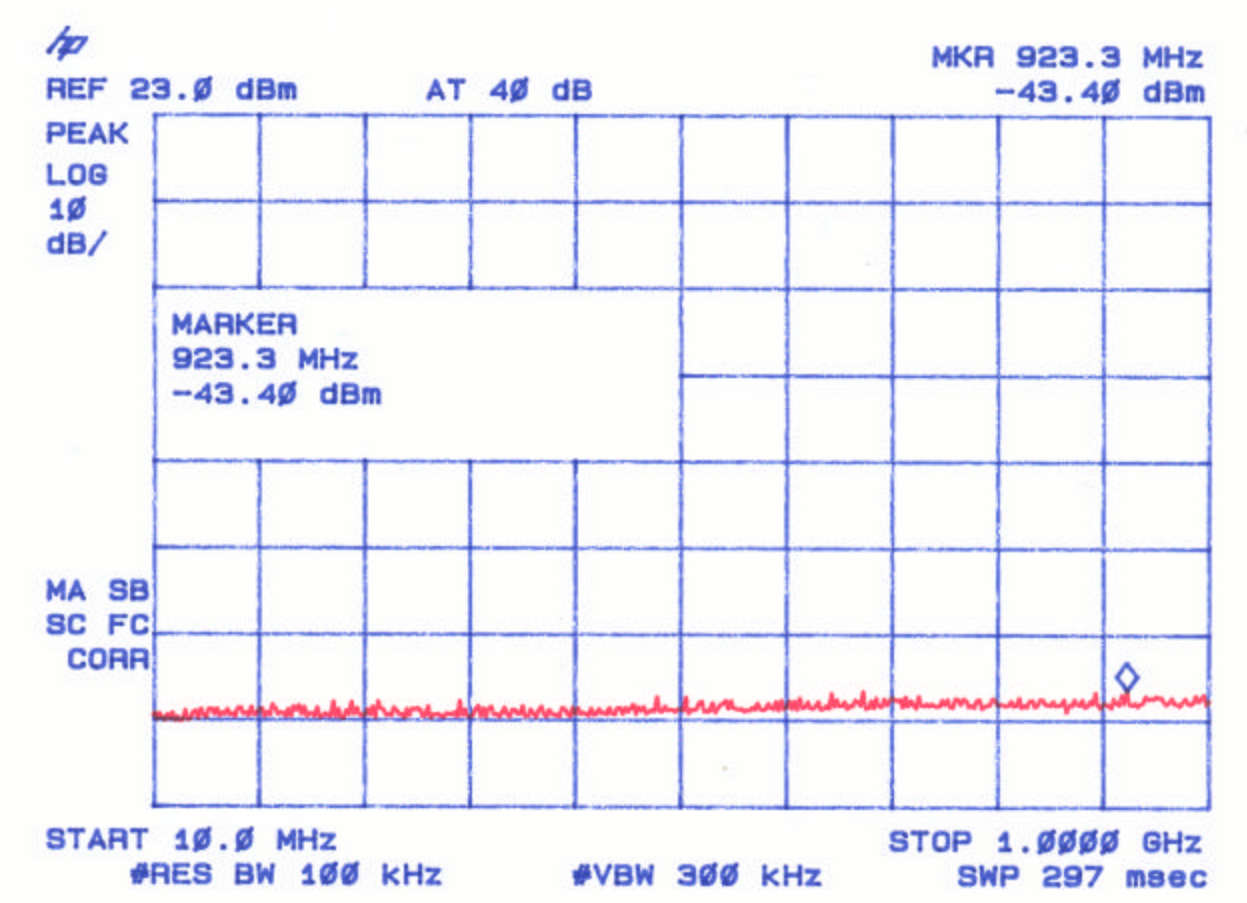


Figure 14
Antenna Conducted Spurious Emissions 15.247(c) Mid Channel (Cont'd)

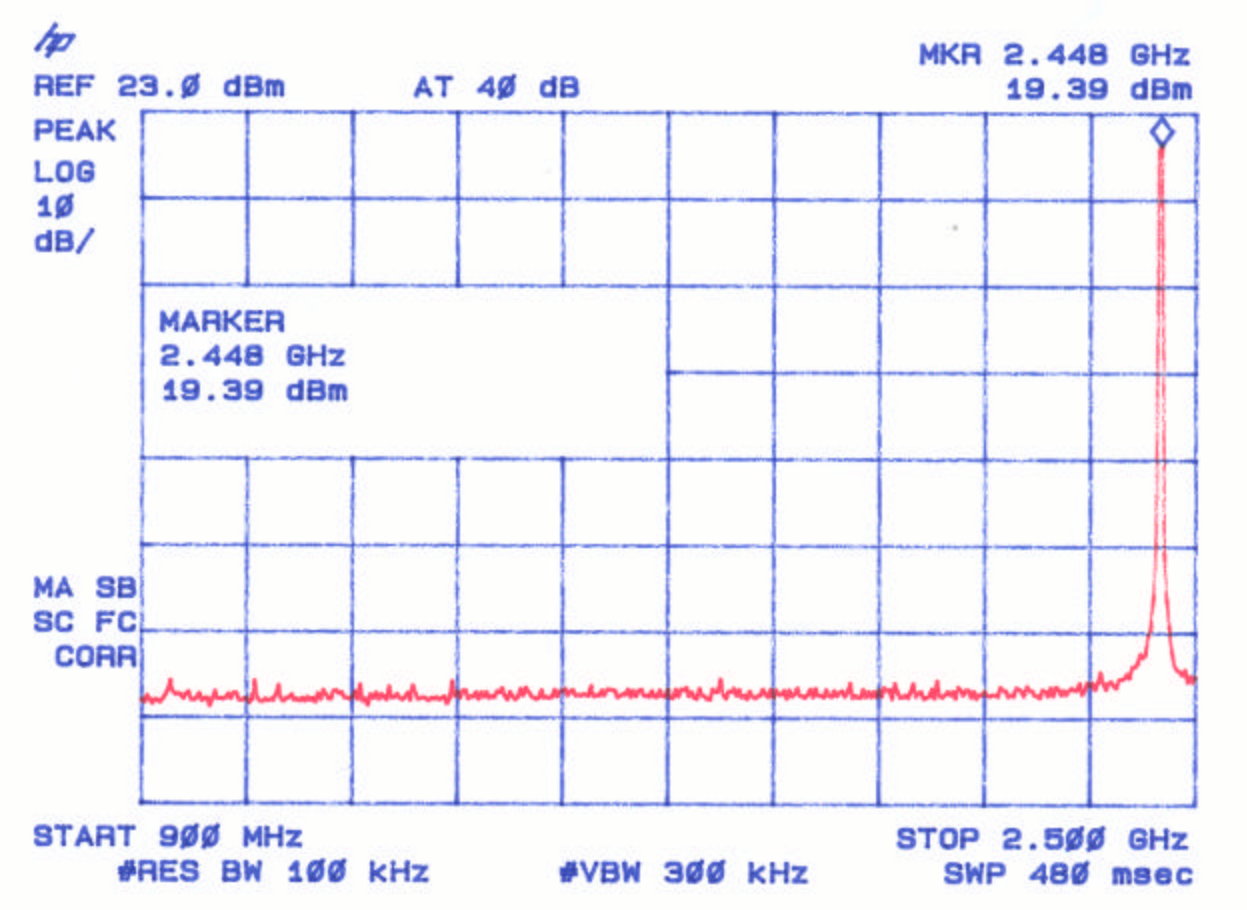


Figure 15
Antenna Conducted Spurious Emissions 15.247(c) Mid Channel (Cont'd)

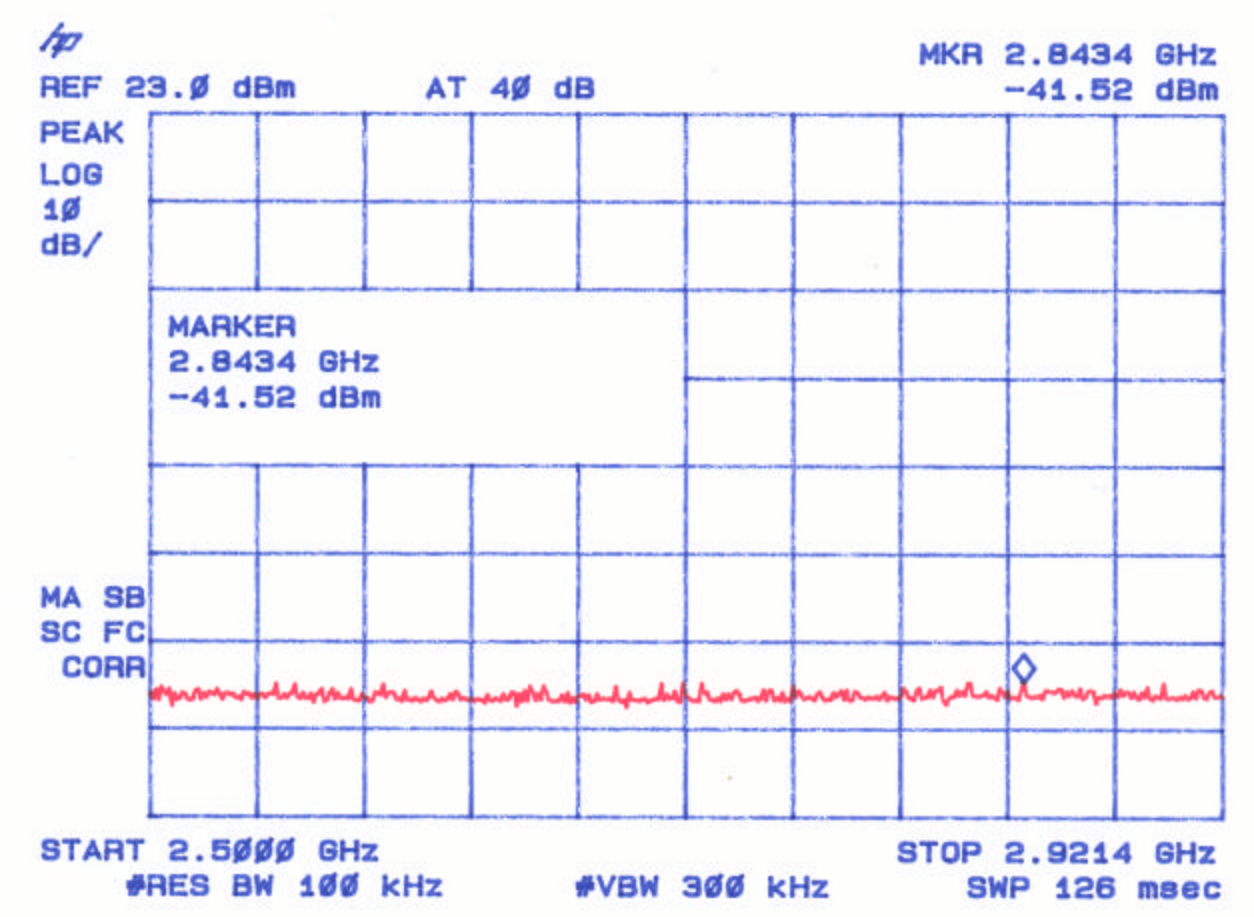


Figure 16
Antenna Conducted Spurious Emissions 15.247(c) Mid Channel (Cont'd)

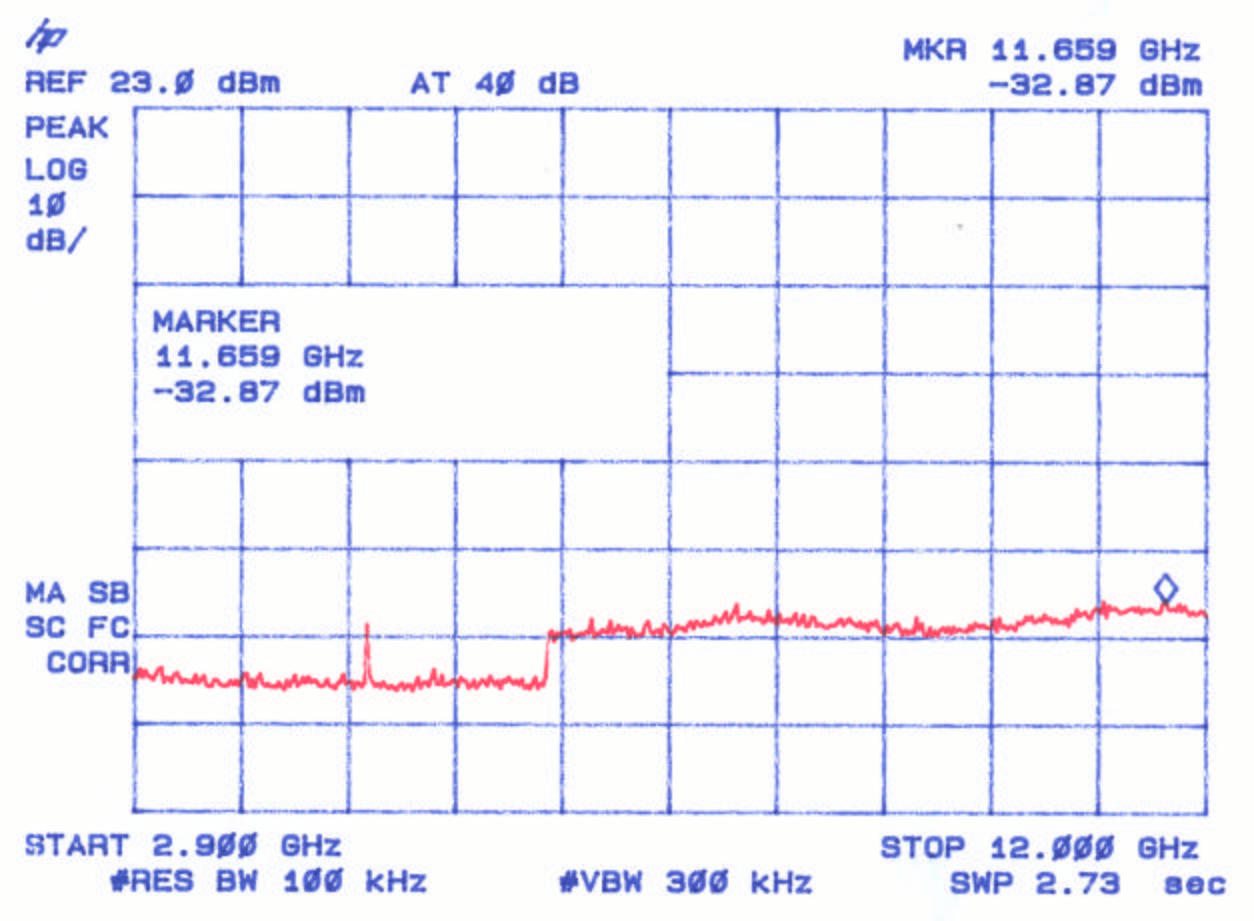


Figure 17
Antenna Conducted Spurious Emissions 15.247(c) High Channel

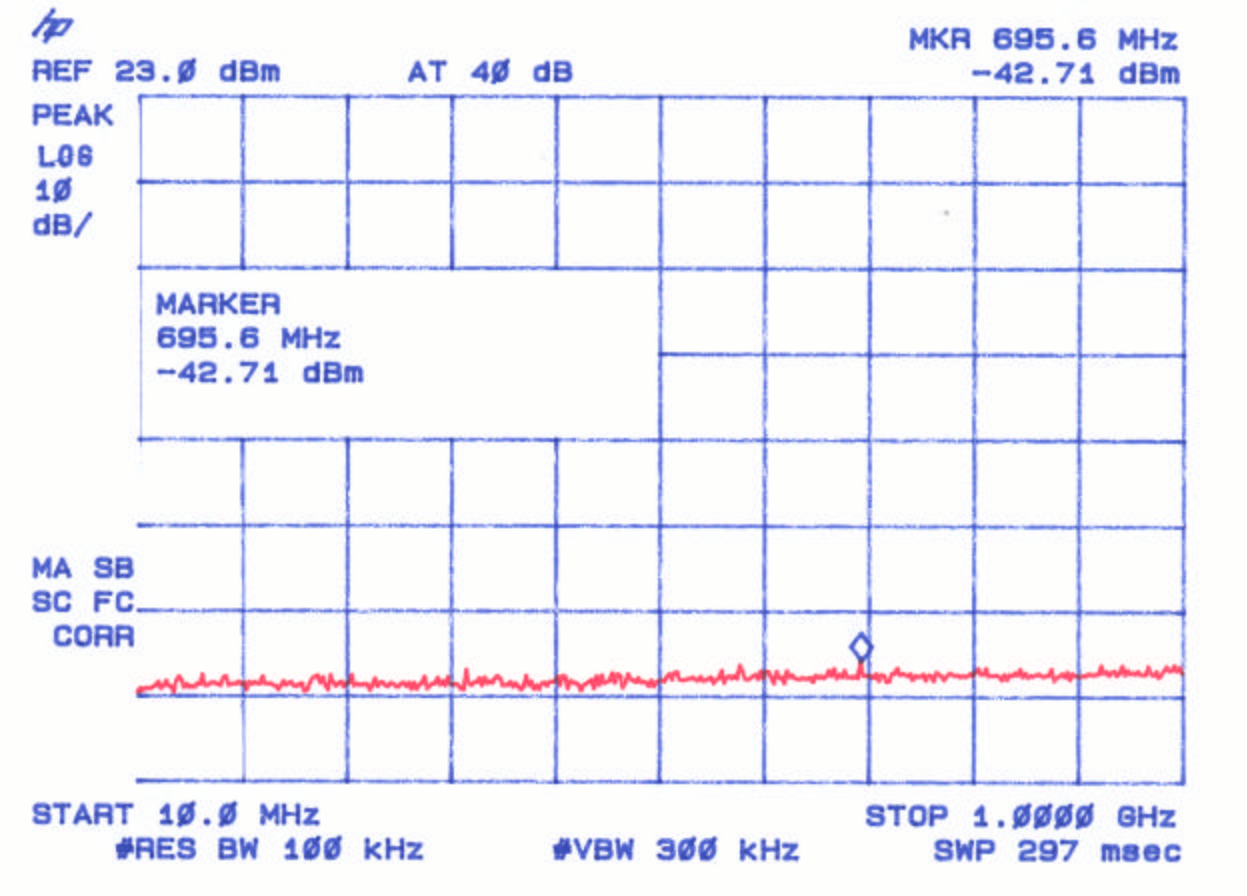


Figure 18
Antenna Conducted Spurious Emissions 15.247(c) High Channel (Cont'd)

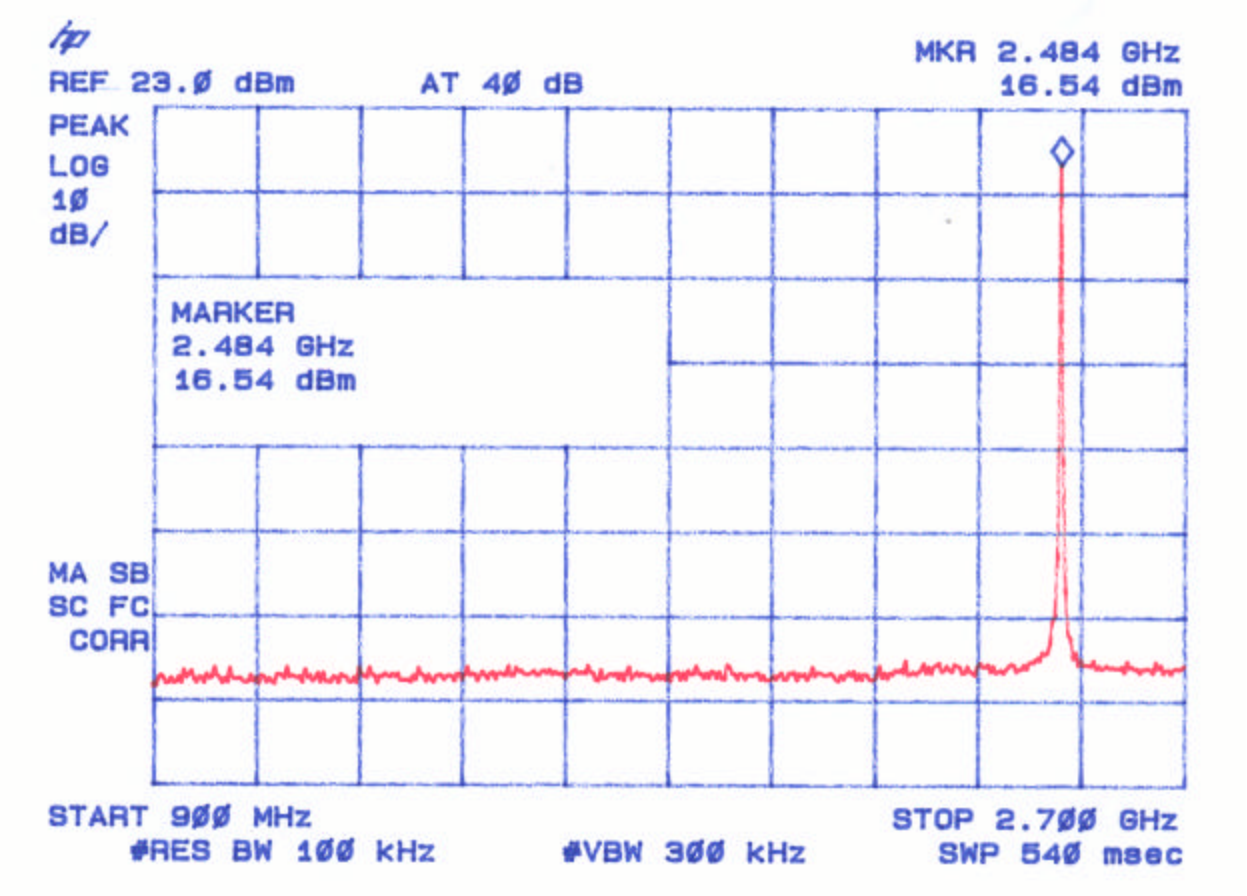


Figure 19
Antenna Conducted Spurious Emissions 15.247(c) High Channel (Cont'd)

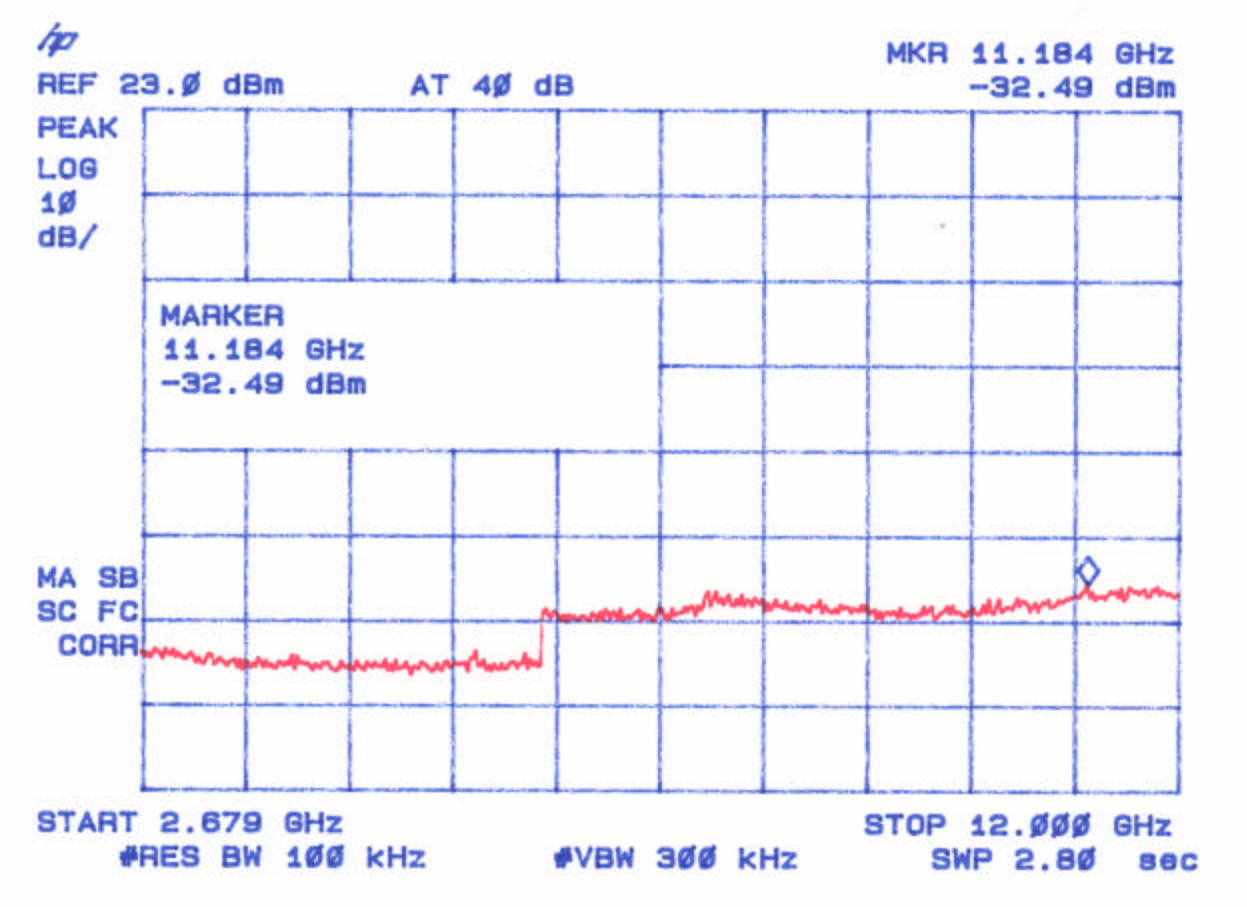
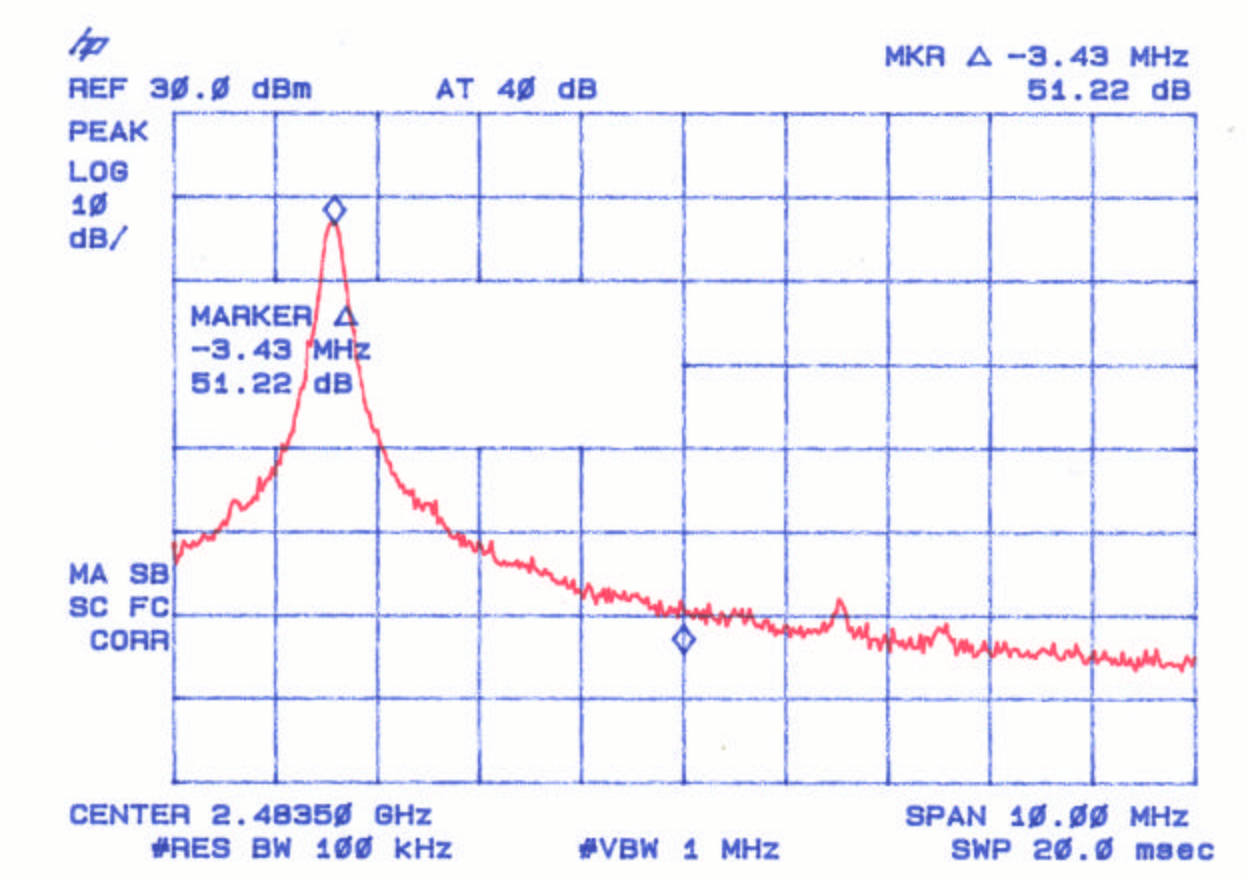


Figure 20
Antenna Conducte d Spurious Emissions 15.247(c) High Channel (Cont'd)



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

The EUT was 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 OATS site. Radiated measurements below 1 GHz were tested with a RBW of 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 5 and Figures 21 through 24.

Signals found in the restricted bands of 15.205 include only 2nd and 3rd harmonics of the transmitter. They are all within the limits of 15.209.

2.8.1 Worst Case Transmit Duty Cycle for 2.4 GHz Ainode

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

The worst case operating scenario is as follows:

Maximum transmit time-on equals 10 mS over a 125 mS period.

The transmission duty cycle is then calculated as:

$$(10/125)100\% = 8\%$$

In terms of voltage dB; 20 log(10/125) = -21.9 dB

Table 5. PEAK RADIATED SPURIOUS EMISSIONS

Radiated Emissions Spurious Emissions

Test By:	Test:		Client:
D.A.	FCC Part 15		Nivis, LLC
	Project: 07-0245	Class: B	Model: 2.4 GHz Ainode

Frequency (MHz)	Test Data (dBm)	AF Table	Test Data (dBuV)	AF+CA-AMP (dB)	Results (uV/m)	Limits (uV/m)	Distance / Polarity	Margin (dB)	PK = n / QP
Low									
2404.99	-42.8	1HN3mv	64.3	31.9	64260.7		3m./VERT		PK
4810.125	-53.3	1HN3mv	53.7	5.2	882.3	5000.0	3m./VERT	15.1	PK
7214.975	-45.5	1HN3mv	61.5	9.6	3580.1	5000.0	3m./VERT	5.1	PK
9620.15	-58.3	1HN3mv	48.7	13.1	1230.5	5000.0	3m./VERT	14.4	PK
Mid									
2439.963	-46.8	1HN3mv	60.2	32.0	40637.7		3m./VERT		PK
4880.075	-51.2	1HN3mv	55.8	5.5	1161.2	5000.0	3m./VERT	12.7	PK
7319.95	-60.0	1HN3mv	47.0	9.9	698.7	5000.0	3m./VERT	17.1	PK
9760.1	-57.2	1HN3mv	49.8	13.3	1432.4	5000.0	3m./VERT	9.1	PK
High									
2480.05	-55.1	1HN3mv	51.9	32.0	15734.3		3m./VERT		PK
4969.013	-44.1	1HN3mv	62.9	5.8	2712.8	5000.0	3m./VERT	5.3	PK
7440.1	-52.5	1HN3mv	54.5	10.2	1716.5	5000.0	3m./VERT	9.3	PK
9920.262	-60.2	1HN3mv	46.8	13.5	1032.8	5000.0	3m./VERT	3.7	PK

Data corrected by 1 dB for loss of high pass filter, except to fundamental

** Conversion from 1 meter to 3 meters = -9.54 dB

SAMPLE CALCULATION:
RESULTS : At 4810.125 MHz, corrected value = Antilog ((-53.7 + 5.2 + 107)/20) = 882.3 uV/m
CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature: Daniel Aparaschivei **Name: Daniel Aparaschivei**

Table 6. AVERAGE RADIATED SPURIOUS EMISSIONS

Radiated Emissions Spurious Emissions

Test By:	Test:		Client:						
D.A.	FCC Part 15		Nivis, LLC						
	Project:	Class:	Model:						
	07-0245	B	2.4 GHz Ainode						

Frequency	Test Data	AF	Test Data	AF+CA-AMP	Results	Limits	Distance /	Margin	PK = n
(MHz)	(dBm)	Table	(dBuV)	(dB)	(uV/m)	(uV/m)	Polarity	(dB)	/ QP
Low									
2404.99	-64.7	1HN3mv	42.3	31.9	5139.8		3m./VERT		AVG
4810.125	-75.3	1HN3mv	31.7	5.2	70.6	500.0	3m./VERT	17.0	AVG
7214.975	-67.5	1HN3mv	39.6	9.6	286.4	500.0	3m./VERT	5.1	AVG
9620.15	-80.2	1HN3mv	26.8	13.1	98.4	500.0	3m./VERT	14.4	AVG
Mid									
2439.963	-68.7	1HN3mv	38.3	32.0	3250.3		3m./VERT		AVG
4880.075	-73.1	1HN3mv	33.9	5.5	92.9	500.0	3m./VERT	14.6	AVG
7319.95	-81.9	1HN3mv	25.1	9.9	55.9	500.0	3m./VERT	19.0	AVG
9760.1	-79.1	1HN3mv	27.9	13.3	114.6	500.0	3m./VERT	9.1	AVG
High									
2480.05	-77.0	1HN3mv	30.0	32.0	1258.5		3m./VERT		AVG
4969.013	-66.1	1HN3mv	41.0	5.8	217.0	500.0	3m./VERT	7.3	AVG
7440.1	-74.4	1HN3mv	32.6	10.2	137.3	500.0	3m./VERT	11.2	AVG
9920.262	-82.2	1HN3mv	24.8	13.5	82.6	500.0	3m./VERT	3.7	AVG

Data corrected by 1 dB for loss of high pass filter, except to fundamental

** Conversion from 1 meter to 3 meters = -9.54 dB

SAMPLE CALCULATION:
RESULTS At 4810.125 MHz, Corrected Value = Antilog ((-75.3 + 5.2 + 107)/20) = 286.4 uV/m
CONVERSION FROM dBm TO dBuV = 107 dB

Tester Signature: Daniel Aparschivei **Name:** **Daniel Aparaschivei**

Figure 21
Peak Radiated Spurious Emission 15.209(c) Fundamental Low

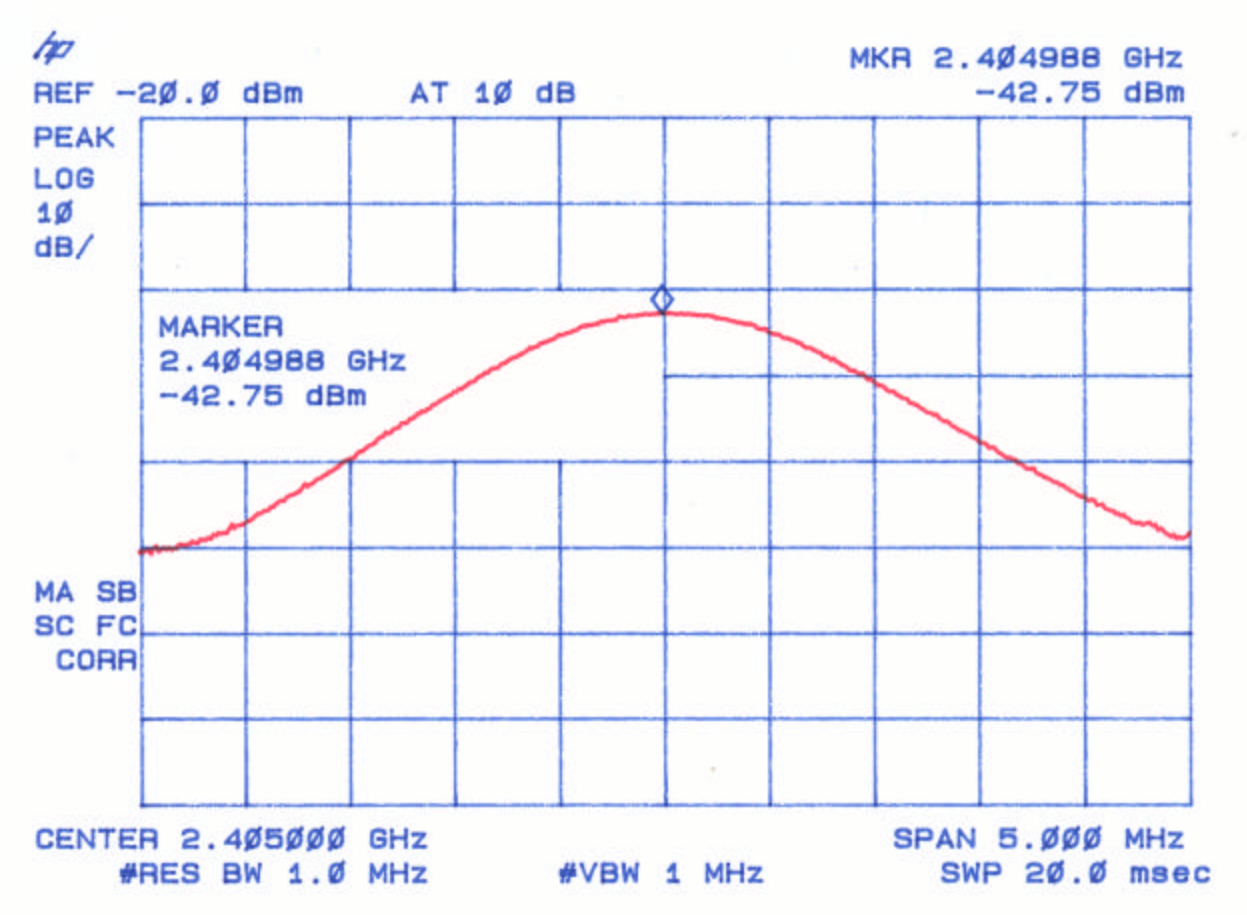


Figure 22
Peak Radiated Spurious Emission 15.209(c) Fundamental Mid

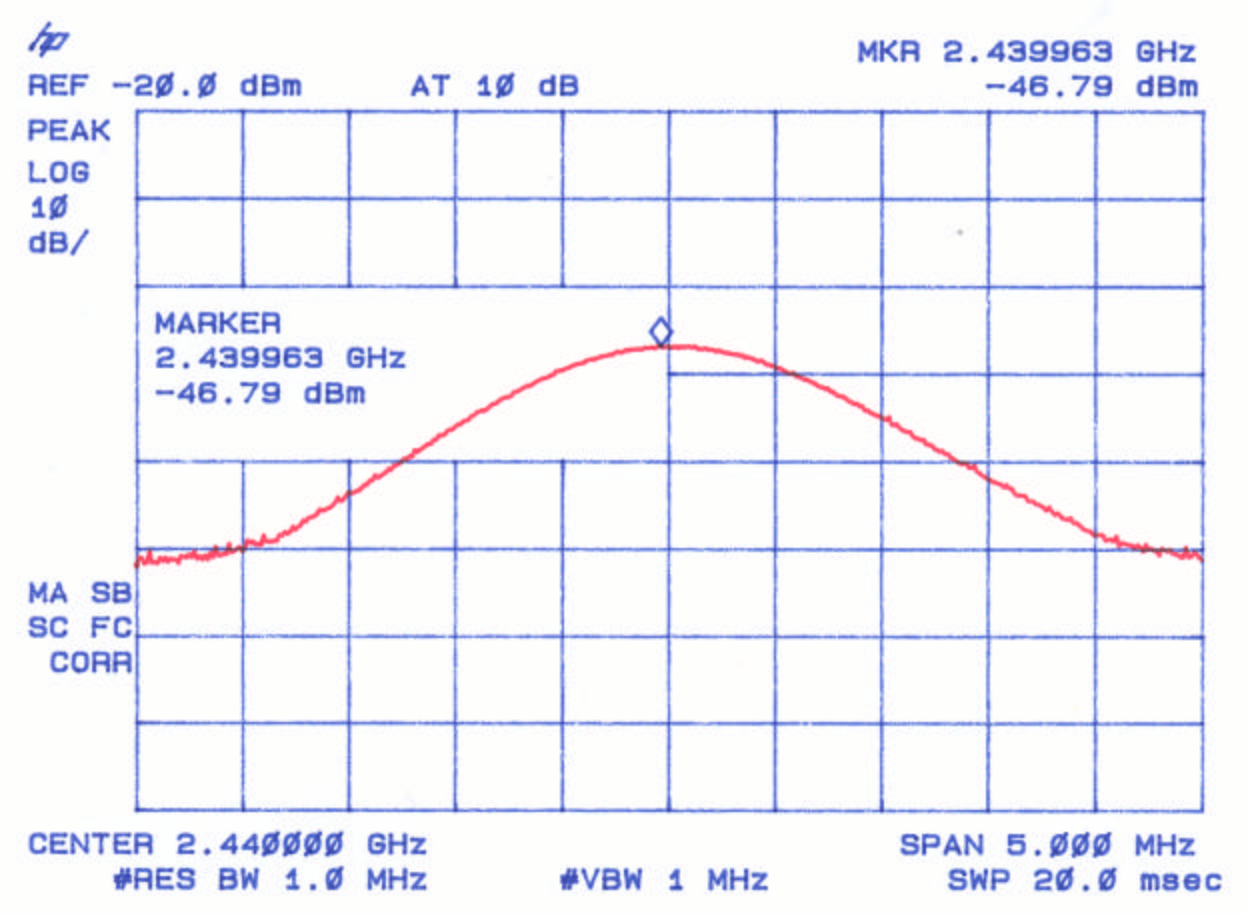


Figure 23
Peak Radiated Spurious Emission 15.209(c) Fundamental High

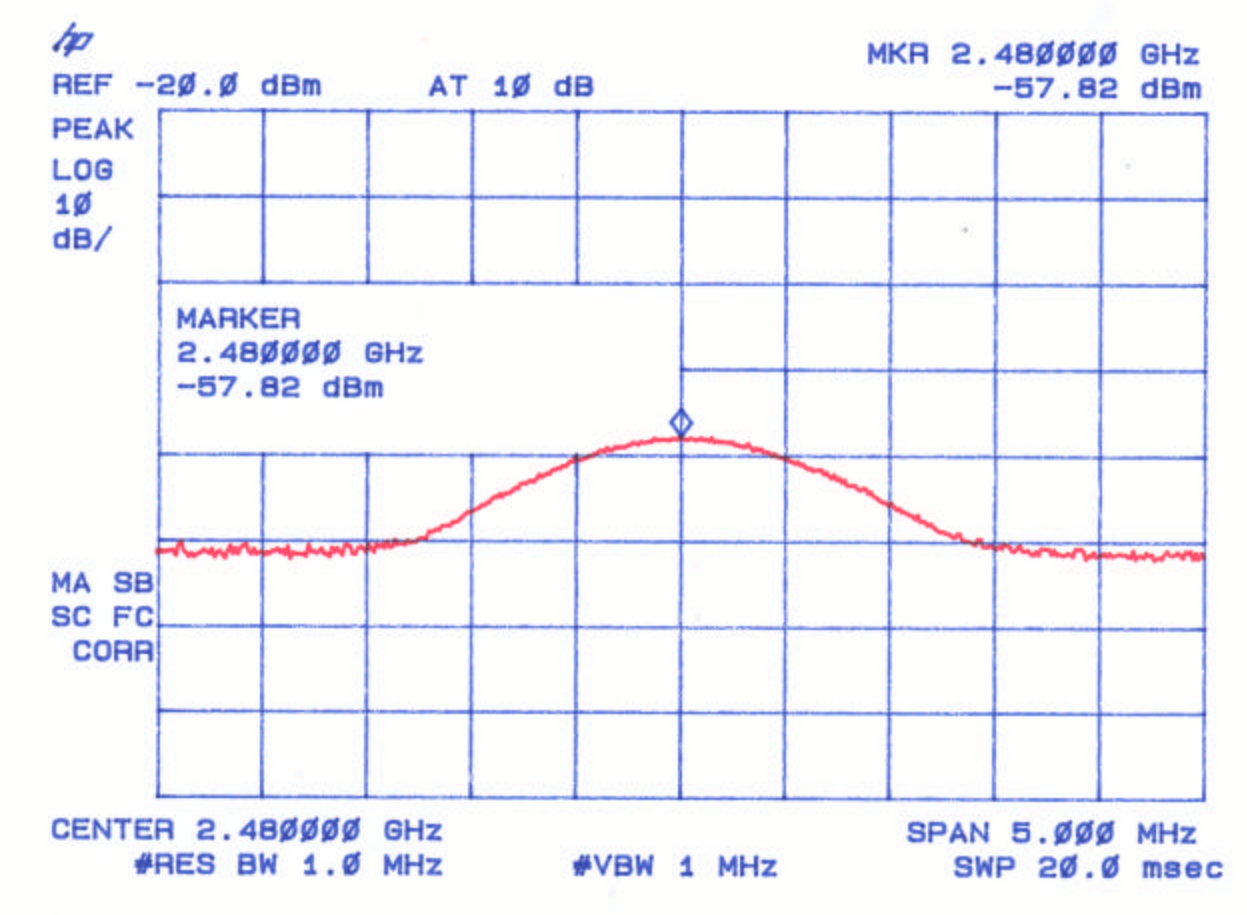
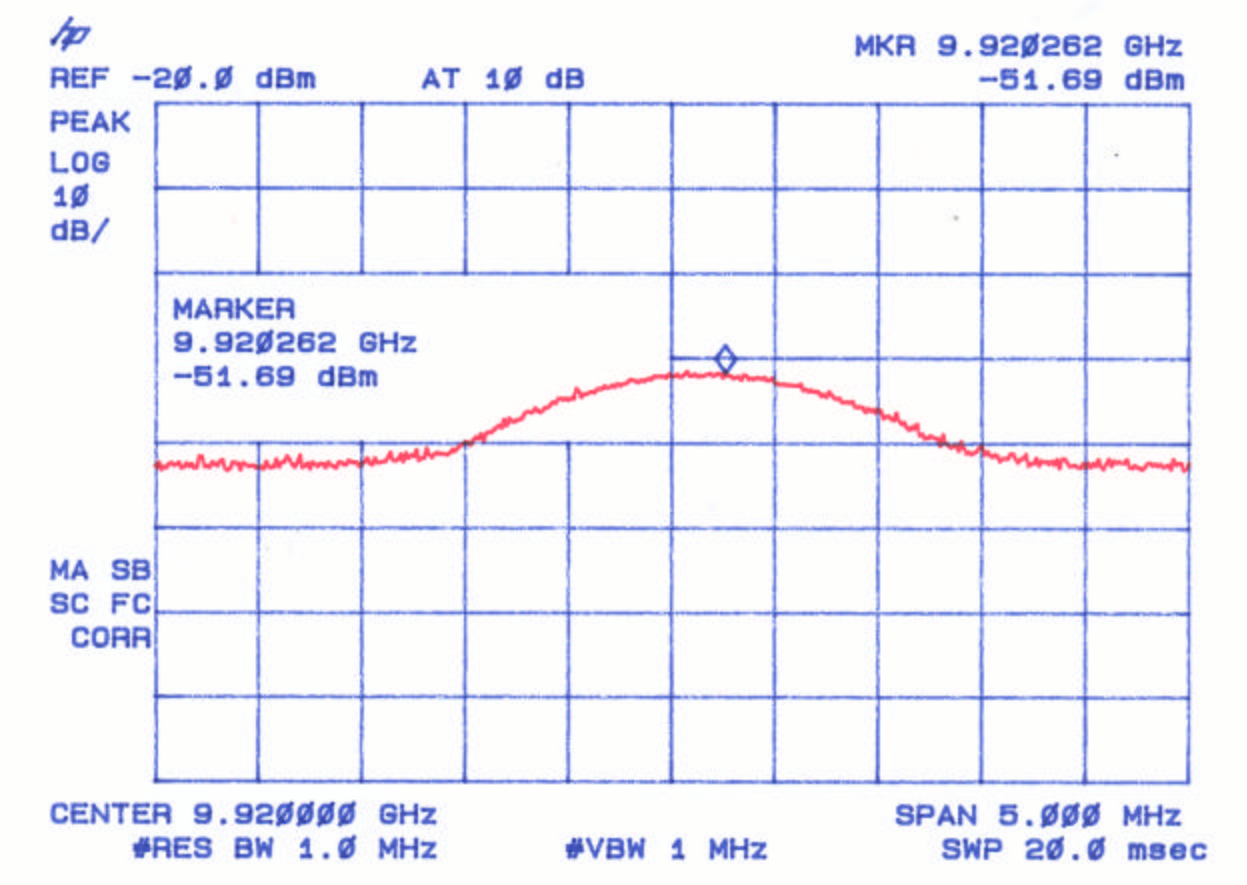


Figure 24
Peak Radiated Spurious Emission 15.209(c) Representative Harmonic Plot



2.9 Band Edge Measurements

Band edge measurements are required by 15.209(b) and 15.247 (d). Because the transmitter operates well above highest frequency specified by 15.209(b) (1000 MHz), this requirement is moot for this application. However, the requirement of 15.247 (d) is important and is discussed below.

2.9.1 Lower Band Edge

With the transmitter set to 2.405 GHz, Figure 25, the signal level at 2.4000 GHz, the lower band edge, is more than 40 dB but less than 50 dB down from the peak. The limit is that it be at least 20 dB down.

2.9.2 Higher Band Edge

With the transmitter set to 2.4800 GHz, Figure 26, the signal level at 2.4835 GHz is more than 40 dB but less than 50 dB down from the peak. The limit is that it must be down by at least 20 dB.

Figure 25
Band Edge per FCC Section 15.247(a)(1)(iii) Low

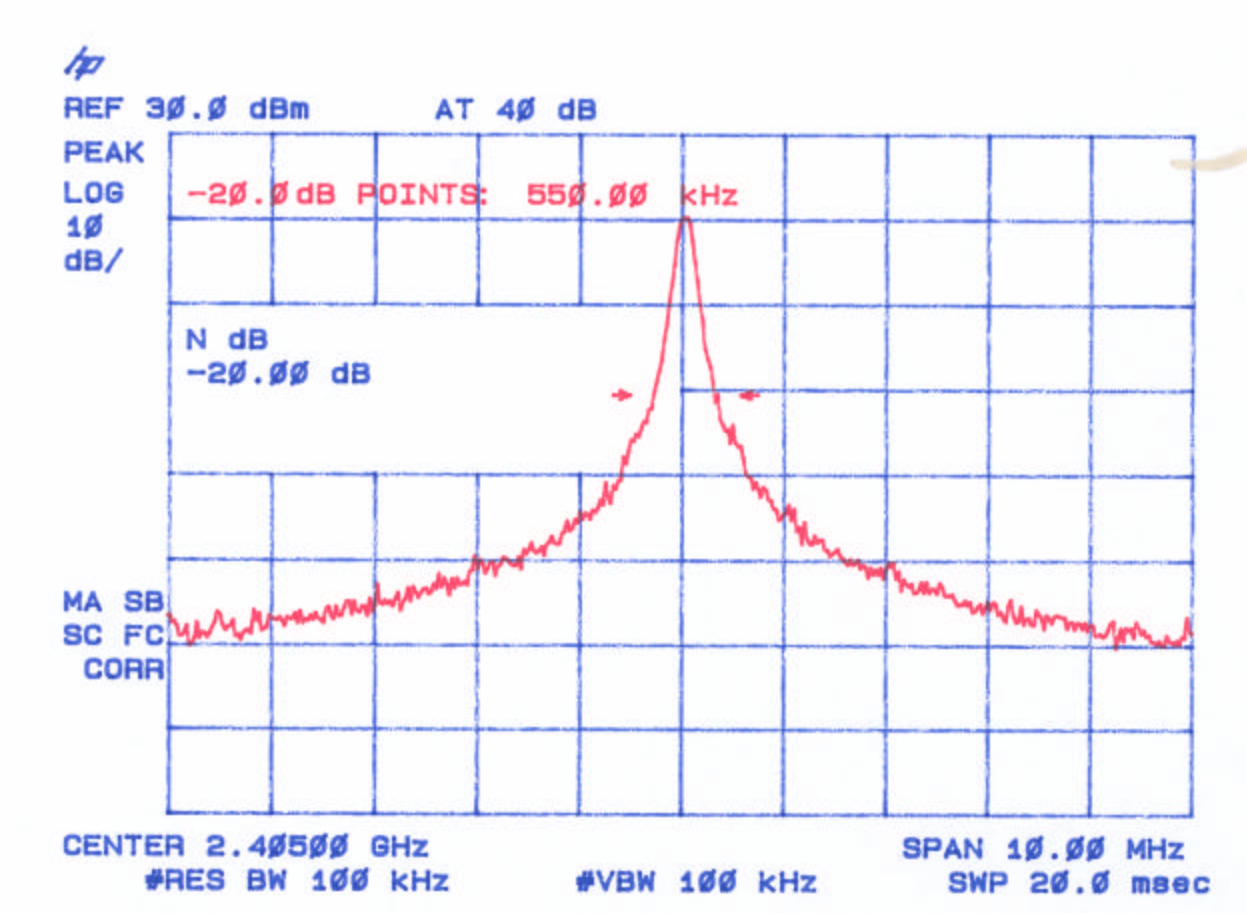
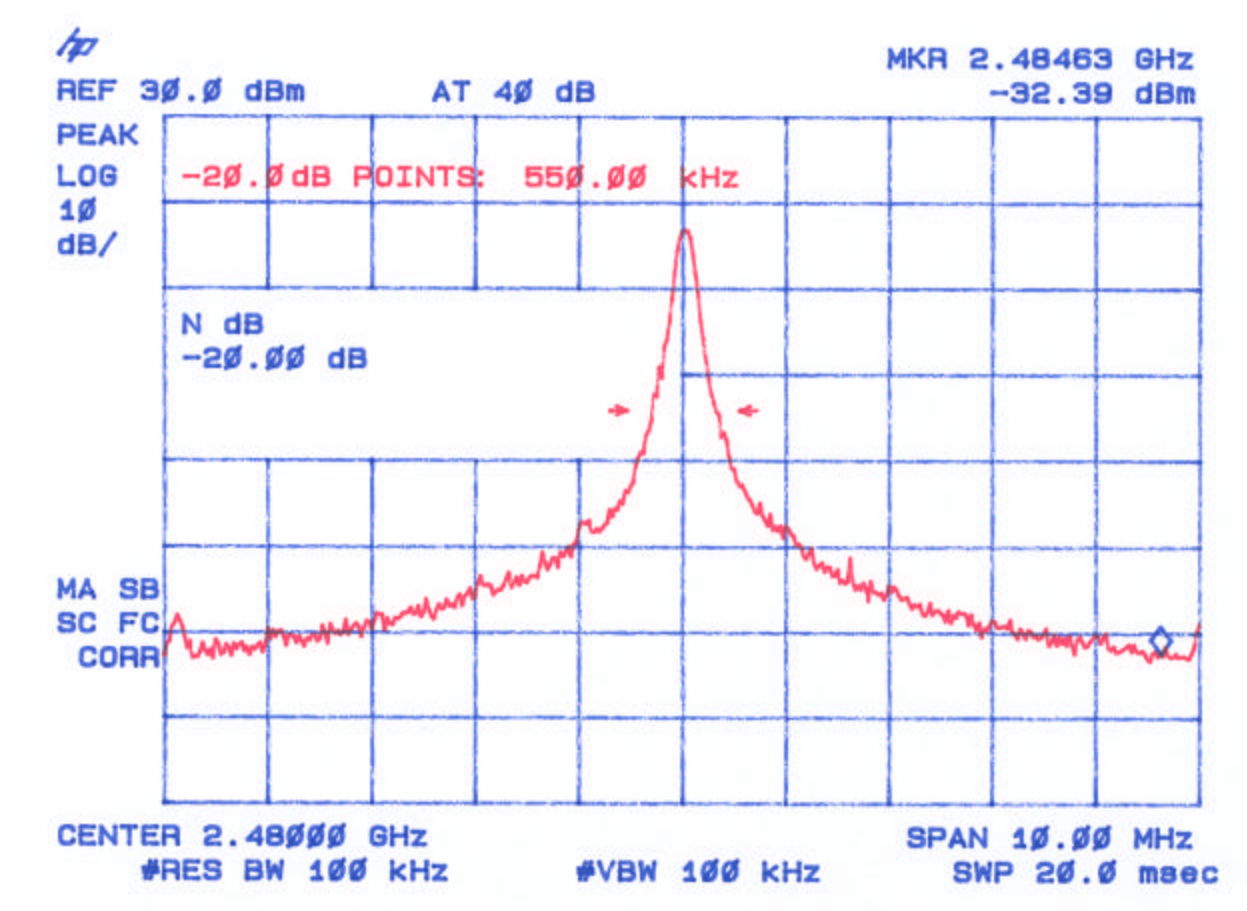


Figure 26
Band Edge per FCC Section 15.247(a)(1)(iii) High



2.10 Six dB Bandwidth per FCC Section 15.247(a)(2)

The antenna port was connected to a spectrum analyzer that was set for a 50 Ω impedance with the RBW = approximately 1/100 of the manufacturers claimed RBW & VBW > RBW. The results of this test are given in Table 6 and Figure 27 through 29.

Table 7. Six dB Bandwidth

Frequency (GHz)	6 dB Bandwidth (MHz)	Minimum FCC Limit (for 6 dB BW) (MHz)
2.40500	1.63	0.5
2.44000	1.60	0.5
2.48000	1.60	0.5

Test Date: **September 24, 2007**
UST Project: **07-0245**
Customer: **Nivis, LLC**
Model: **2.4 GHz Ainode**

Tester Signature:  **Name:** **Daniel Aparaschivei**

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Figure 27.
Six dB Bandwidth per FCC Section 15.247(a)(1)(iii) Low

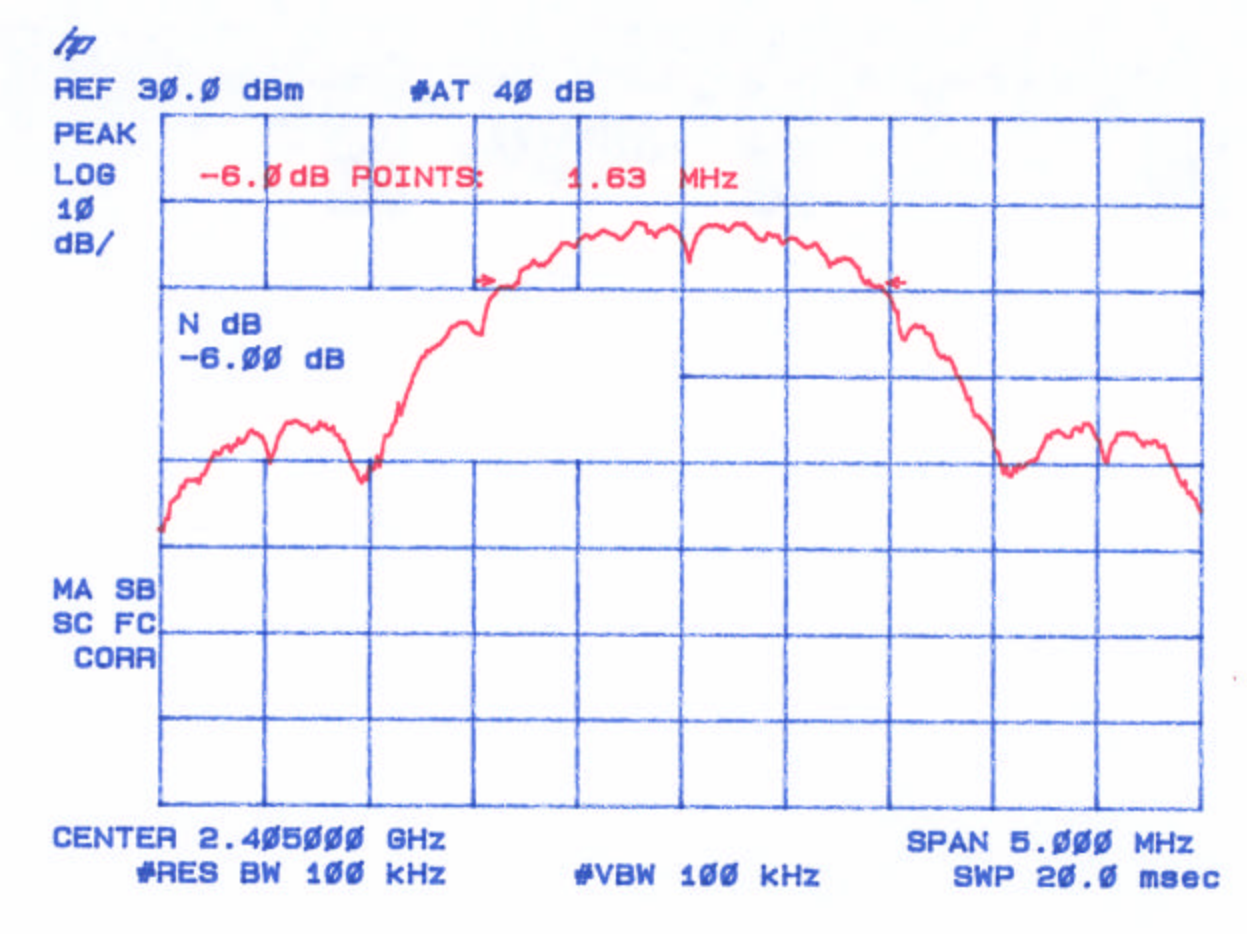


Figure 28.
Six dB Bandwidth per FCC Section 15.247(a)(1)(ii) Mid

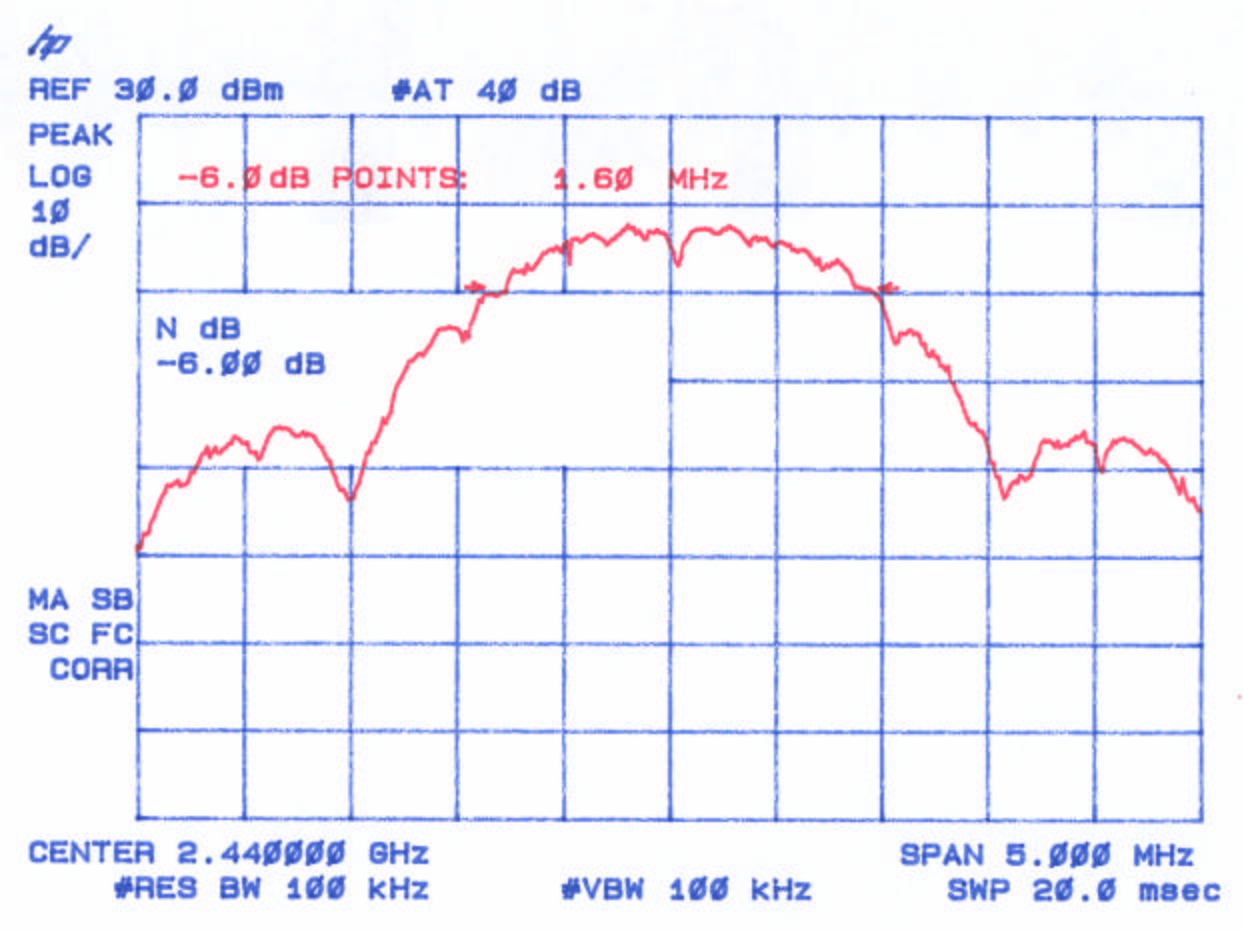
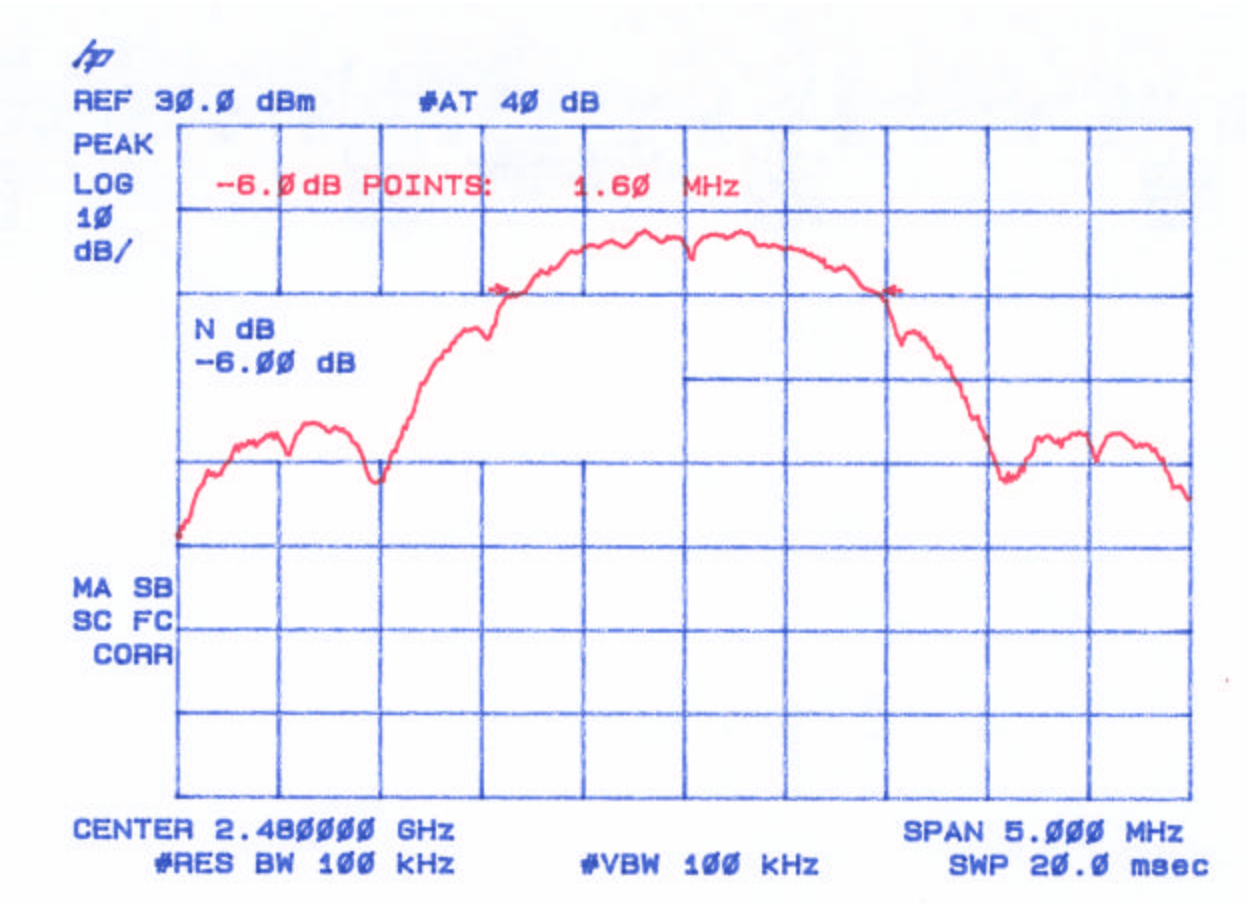


Figure 29.
Six dB Bandwidth per FCC Section 15.247(a)(1)(ii) High



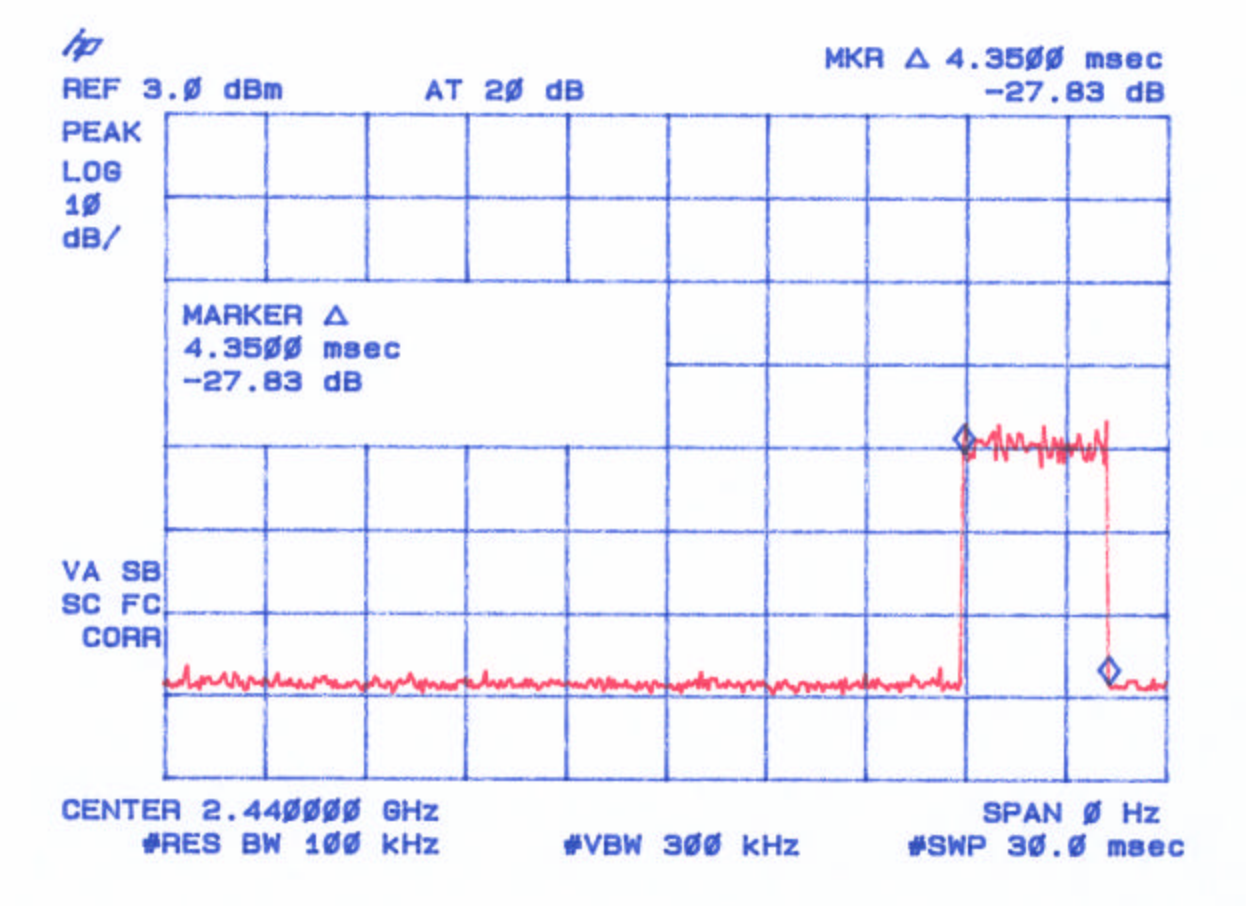
2.11 Average Time of Occupancy per Channel FCC Section 15.247(a)(1)(iii)

Per the theory of operation, the EUT channel spacing is 5 MHz. This yields 16 channels over the operating range. The requirement is that it uses at least 15 channels. Further, the average time of occupancy is measured to be 4.35 mSec per Figure 30. The allowed time of occupancy is 0.4 seconds per 6.4 seconds (0.4 seconds within a period of 0.4 sec multiplied by the number of hopping channels employed).

Allowed time of Occupancy is; 0.4/6.4 = 62.5 mSec

Average time of occupancy is: 4.35 mSec

Figure 30.
Pulse Duration for Average Time of Occupancy



2.12 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.

2.13 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, Transmitter, Receiver and Digital Device (Class B)

(Quasi-Peak vs Average Limits)

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Conducted Emissions									
Test By:	**Test:** Quasi- Peak vs Average Conducted Emissions					**Client:** **Nivis, LLC**			
DA	**Project:** 07-0245		**Class:** **B**			**Model:** 2.4 GHz Ainode			
Frequency	**Test Data**	**AF**	**Test Data**	**AF+CA-AMP**	**Results**	**Limits**	**Distance /**	**Margin**	**PK**
(MHz)	**(dBm)**	**Table**	**(dBuV)**	**(dB)**	**(dBuV)**	**(dBuV)**	**Polarity**	**(dB)**	**/ QP**
0.16	-62.8	LISNP	44.2	-0.1	44.0	65.7	Phase	**21.7**	**QP**
0.9522	-72.2	LISNP	34.8	0.1	34.9	56.0	Phase	**21.1**	**QP**
3.49	-78.3	LISNP	28.7	0.3	29.0	56.0	Phase	**27.0**	**QP**
5.55	-75.3	LISNP	31.7	0.3	32.0	60.0	Phase	**28.0**	**QP**
17.127	-60.8	LISNP	46.2	0.6	46.7	60.0	Phase	**13.3**	**QP**
20.537	-75.2	LISNP	31.8	0.6	32.4	60.0	Phase	**27.6**	**QP**
0.16	-65.9	LISNN	41.1	-0.2	40.9	65.7	Neutral	**24.9**	**QP**
0.9522	-70.8	LISNN	36.2	0.1	36.3	56.0	Neutral	**19.7**	**QP**
3.49	-75.8	LISNN	31.2	0.3	31.5	56.0	Neutral	**24.5**	**QP**
4.996	-81.4	LISNN	25.6	0.2	25.9	56.0	Neutral	**30.1**	**QP**
17.127	-61.8	LISNN	45.2	0.6	45.8	60.0	Neutral	**14.2**	**QP**
20.537	-76.8	LISNN	30.3	0.6	30.9	60.0	Neutral	**29.1**	**QP**

SAMPLE CALCULATIONS: At 160 kHz, 44.2 dBuV + -0.2dB = 44.0 dBuV

Test Date: **October 22, 2007**
UST Project: **07-0245**
Customer: **Nivis, LLC**
Model: **2.4 GHz Ainode**

Tester Signature: Daniel Aparaschivei **Name:** **Daniel Aparaschivei**

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

Radiated emissions were evaluated from 30 MHz to 14500 MHz while the EUT was placed into a Receive mode of operation. Measurements were made with the analyzer's bandwidth set to 120 kHz for measurements made at less than 1 GHz and 1 MHz for measurements made at greater than or equal to 1 GHz. The results for a bandwidth of less than 1 GHz are shown in Table 9.

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

CLASS B

Measurements 30 MHz – 1 GHz

Radiated Emissions

Test By: DA	**Test:** FCC Part 15	**Client:** Nivis, LLC
Project: 07-0245	**Class: B**	**Model:** 2.4 GHz Ainode

Frequency (MHz)	Test Data (dBm)	AF Table	Test Data (dBuV)	AF+CA-AMP (dB)	Results (uV/m)	Limits (uV/m)	Distance/ Polarity	Margin (dB)	PK / QP
228.56	-83.9	1lp3mh	23.1	14.3	74.1	200.0	3m./HORZ	**8.6**	**PK**
258.045	-79.9	1lp3mh	27.1	15.8	133.3	200.0	3m./HORZ	**3.5**	**PK**
235.925	-83.8	1lp3mv	23.2	14.4	76.4	200.0	3m./VERT	**8.4**	**PK**
258.065	-84.2	1lp3mv	22.8	15.8	85.1	200.0	3m./VERT	**7.4**	**PK**

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

** Conversion from 1 meter to 3 meters = - 9.54 dB

SAMPLE CALCULATION at 228.56 MHz:

RESULTS (uV/m @ 3m) = Antilog ((-83.9 + 14.3 + 107)/20) = 74.1 uV/m

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: **September 26, 2007**
UST Project: **07-0245**
Customer: **Nivis, LLC**
Product: **2.4 GHz Ainode**

Tester Signature: Daniel Aparaschivei **Name:** **Daniel Aparaschivei**

2.15 Peak Power Spectral Density (15.247(e))

The transmitter was placed into continuous operation for low,mid and high channel. Each channel was centered on the screen and the RBW was set at 3 kHz and the span was reduced to 300 kHz. The Video Bandwidth was set to ≥ RBW (VBW) = 100 kHz). The span was set to 300 kHz. The trace capture time was a minimum of Span/RBW or 100 sec. The measured power spectral density conducted from the transmitter to the antenna was less than 8 dBm in any 3 kHz band during any time interval.

Results are shown in Figures 31-33.

Figure 31.
Peak Power Spectral Density (15.247(e)) Low Channel

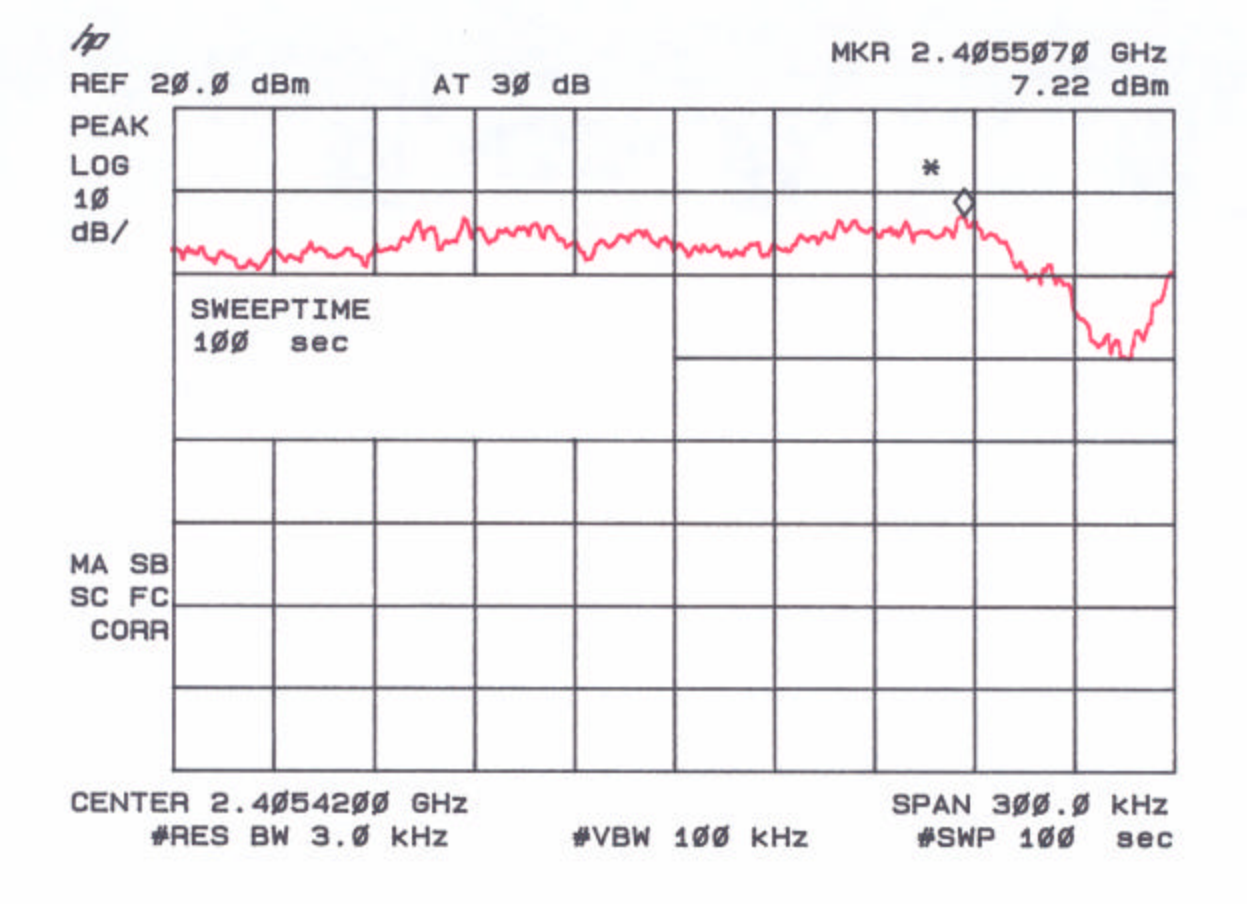

Figure 32.
Peak Power Spectral Density (15.247(e)) Mid Channel

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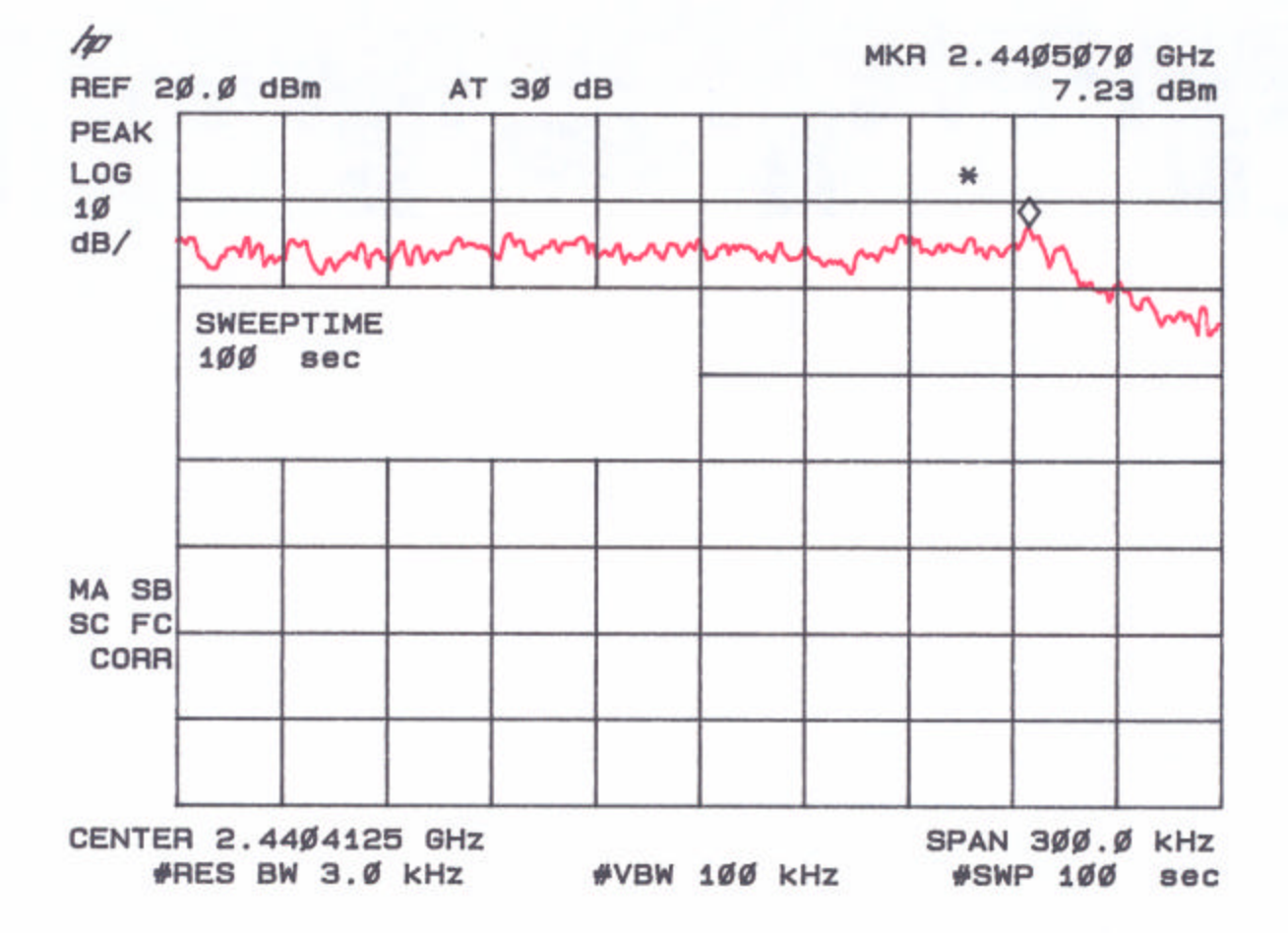
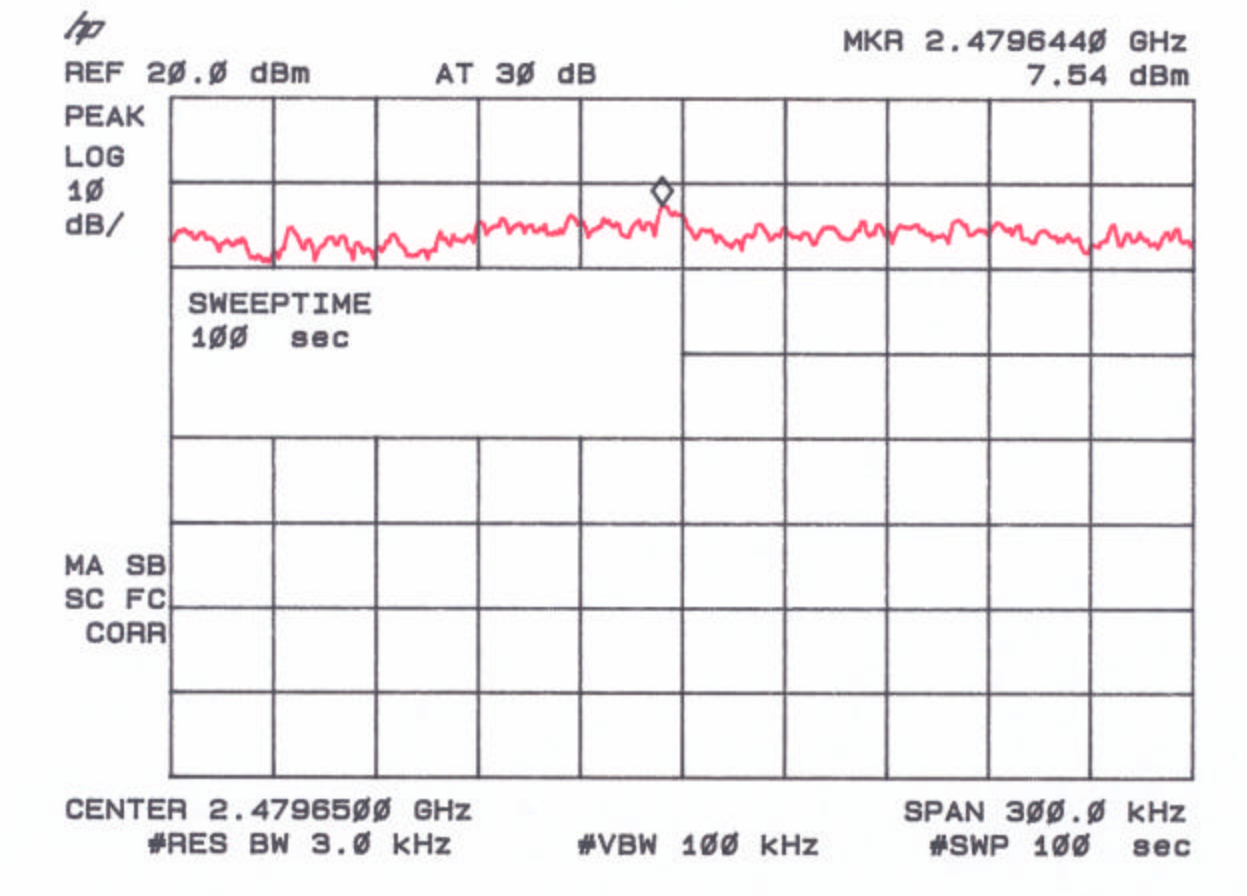


Figure 33.
Peak Power Spectral Density (15.247(e)) High Channel



2.16 Maximum Public Exposure to RF (MPE)

The maximum exposure level to the public from the RF power of the RUT shall not exceed a power density, S, of 1 mW/cm^2 at a distance, d, of 20 cm from the EUT.

Therefore, for :

Peak Power (Watts) = 0.186 (from paragraph 2.6, herein)
Gain of Transmit Antenna = $5dB_i$ = 3.16 numeric (Paragraph 2.5, herein)
Distance = 20 cm

$$S = (PG/ 4\pi d^2) = EIRP/4A$$

Where: A = The area of the circle of radius d = 20cm.

$$= 0.186x3.16 / 4x3.14 x (20)^2 = 0.59/5026 = 0.117 mW/cm^2$$

which is well below the limit.

2.17 Co-located Transmitters

The EUT contains two transmitters. The Navis module and a Sony/Ericsson module, FCC ID PY76220501-BV. The Sony/Ericsson module is a communications module operating at 850 MHz with 30.47 dBm Peak and 1900 MHz with 31.45 dBm, Peak power. The transmitter modules are located within 5 cm of each other. Their antennae are located around 29 cm apart external to the equipment case. Figures 34 and 35 show the transmitter modules contained within the equipment case. Figure 38 shows the antenna locations. The two transmitters can operate simultaneously.

An Intermodulation test was performed using the two transmitters and there were no intermod products within 20 dB of the Part15.209 limits. Also there were no intermod products falling in the forbidden bands of 15.205.

3. Labeling Information

Label information is found on the following page.

4. Block Diagram / Schematic

A functional Block diagram and schematic diagram are found on the following pages.

5. Photographs

5.1 Photos Of the Tested EUT

The following photos are attached:

Figure 34. Card Module for Ainode.
Figure 35. Card Module for Sony/Ericsson Module.
Figure 36. Module w/Display Unit
Figure 37. Bottom of Case.
Figure 38. Top of Case.
Figure 39. Front of equipment Case.
Figure 40. Left Side of Equipment Case.
Figure 41. Photo Bottom and Top of EUT, Cover Removed

6. Theory Of Operation

A functional block diagram for the Nivis RF module is shown on page 62. This module is a direct sequence spread spectrum transceiver operating in the 2400MHz to 2483.5 MHz ISM band. The system is based on the IEEE 802.15.4 standard, with channels spaced at 5 MHz intervals in the ISM band. The system operates at a chip rate of 2 Mcps, a symbol rate of 62.5 kbps, and a bit rate of 250 kbps. O-QPSK modulation is used with 16-ary orthogonal symbols.

An input supply of 3.3 VDC is supplied to the RF module using a two-stage power supply. Specifically, this supply consists of a switching regulator followed by linear regulator. The input range of this supply is 105-305 VAC.

The module transmits with a maximum power of +22 dBm into an external ¼ wave whip antenna. This module does not transmit for more than 10 ms over any 125 ms time period.

The receiver is a low-IF receiver. The received RF signal is amplified by a low noise amplifier and down-converted to a 1st IF of 65 MHz and then down-converted in quadrature (I and Q) to the intermediate frequency (IF) of 1 MHz. The digital back end performs Differential Chip Detection; the correlator de-spreads the Direct Sequence Spread Spectrum O-QPSK signal, determines the symbols and packets, and detects the data.

7. User's Manual