TEST REPORT

Class II Permissive Change

for the

Lucent PC24-H-FC RF Modem for Wireless LAN

used in the

Apple Airport Base Station

Model # M8440

Apple Computer, Inc.

November 9, 2001

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EMC Test Engineer: _____ Date: 11/9/2001
Mike Kriege

Test Report Summary

Specification	Test Description	Result	Comment
CFR 15.203(a) pg. 70	Antenna Requirement	Pass	Section 1.6
CFR 15.207(a) pg. 72	Conducted Emission/Mains 450 kHz to 30 MHz, 250 microvolts	Pass	Section 2
CFR 15.209(a) pg. 73	Radiated Emissions 30 MHz to 25 GHz	Pass	Section 3
CFR 15.247(a)(2) pg. 89	Bandwidth for Direct Sequence Systems Shall be at least 500 kHz	Pass	Section 4
CFR 15.247(b)(1) pg. 89	Maximum Peak Output Power Shall be less than 1 Watt	Pass	Section 5
CFR 15.247(b)(4) pg. 90	RF Exposure Calculation	Pass	Section 6
CFR 15.247(c)	-20 dBc Spurious Emissions	Pass	Section 7
CFR 15.247(e)	Processing Gain Shall be at least 10 dB	Pass	Reference RevB of Processing Gain found under FCC Grant IMRWLPC24H. Grant Date: 07/06/1999

TABLE OF CONTENTS

1 General Information

1.1 Introduction and Purpose of testing for Class II Permissive Change

Apple Computer will use the 2.4 GHz wireless LAN card listed below in a new Apple Airport Base Station with an Apple antenna. This card is manufactured by Lucent Technologies and has already been approved by the FCC per CFR 47 Part 15 , Subpart C for Direct Sequence Spread Spectrum systems.

1.2 Product General and Technical Descriptions

The Apple Airport Base Station uses the Lucent LUC PC24-H-FC Wireless LAN card. Information on the Lucent Wireless LAN card is provided in the table below.

Existing Wireless Lan Card information	
Model Number	LUC PC24-H-FC
FCC ID	IMRWLPC24H
Date of Original FCC Grant	July 6, 1999
Class	Spread Spectrum Transceiver
Method	Direct Sequence Spread Spectrum
Max RF Power Output	14.7 dBm
Frequency Range	2412 MHz - 2462 MHz
Number of Channels	11
Data Rates	11 Mbps, 5 Mbps, 2 Mbps, 1 Mbps

The Airport Base Station provides a wireless access point to a Local Area Network or RJ-11 modem. The wireless access conforms to IEEE standard 802.11b using the 2.4 GHz IS band. The Airport Base Station comes with the following I/O ports: Additional information on the Apple Airport Base Station is provided in the table below.

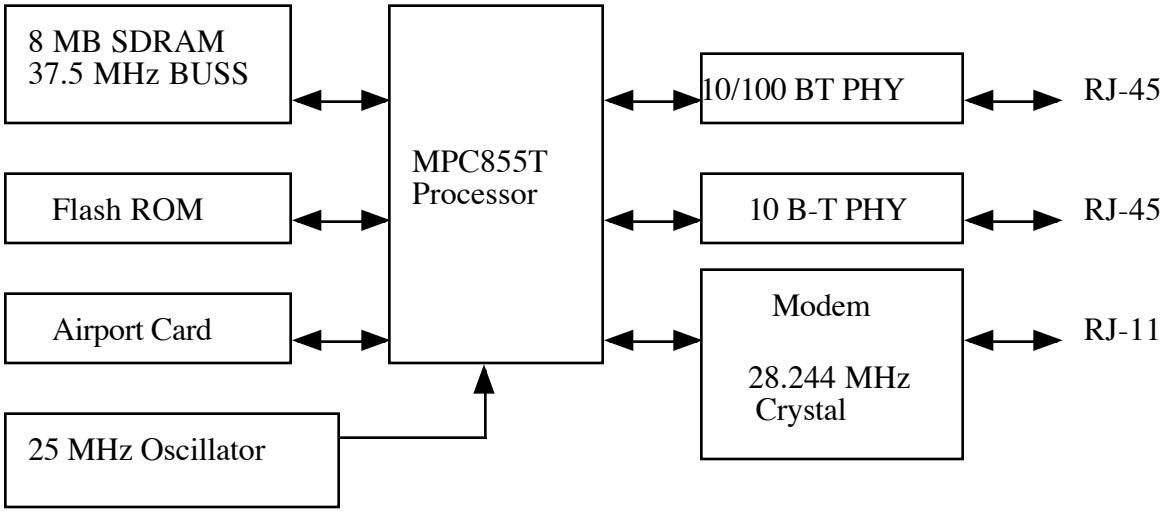
- RJ-45 10/100 Base T Ethernet port
- RJ-45 10 Base T Ethernet Port
- RJ-11 modem
- 12 Volt DC Input Port

Apple Airport Base Station - Class II Change	
Model Number	M8440
Antenna Type	Apple Designed “Inverted F”
Antenna Gain	3 dBi

1.3 Product Photograph

NOTE: Additional photographs of the product can be found at the end of this report.

1.4 Product Block Diagram



1.5 Product Label

Below is the Product ID label for the Apple Airport Base Station. The FCC ID reflects the FCC ID granted for the Lucent LUC PC24-H-FC Wireless LAN card.

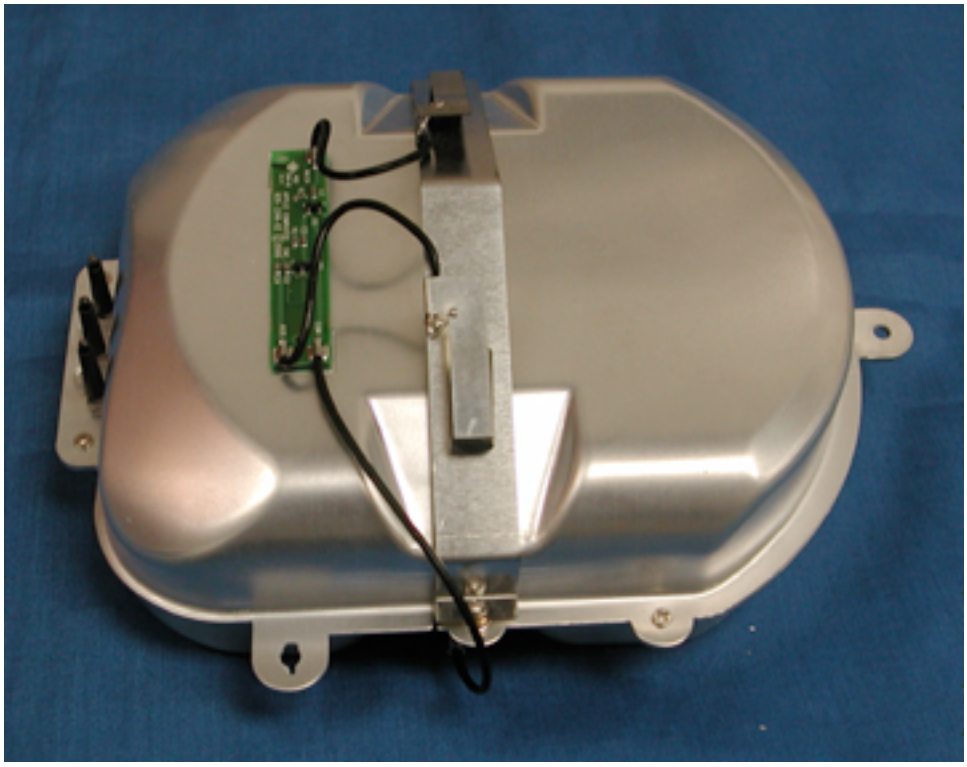
1.6 Antenna Information

1.6.1 CFR 47 Section 15.203(a) Antenna Requirement

Per CFR 47 Section 15.203(a), an intentional radiator shall be designed to insure that no antenna other than that furnished by the responsible party shall be used with the device. The Apple Airport Base Station Antenna is permanently attached to an RF coax cable which connects to the LUC PC24-H-FC wireless module using a unique connector. This connector is not available for sale to the public.

1.6.2 Antenna Photograph

Two sheetmetal antennas are used with the Apple Airport BaseStation. One is used for transmitting and both can be used for receiving. Below is a photograph of the Apple Airport BaseStation Antennas.

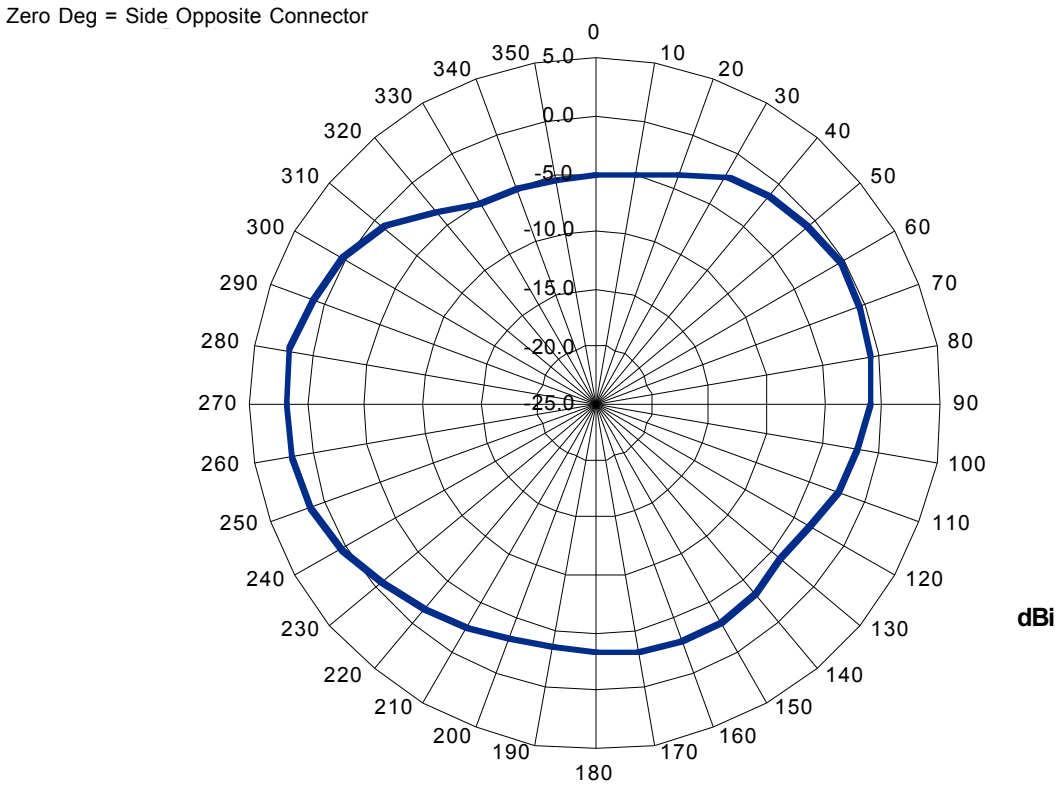


1.6.3 Antenna Electrical Information

The Apple Airport Base Station can be mounted either horizontally or vertically (for example, on a wall). Therefore, the antenna radiation pattern measurements were performed in azimuth and with two orthogonal elevations. The radiation patterns and tabular data is provided in the following sections.

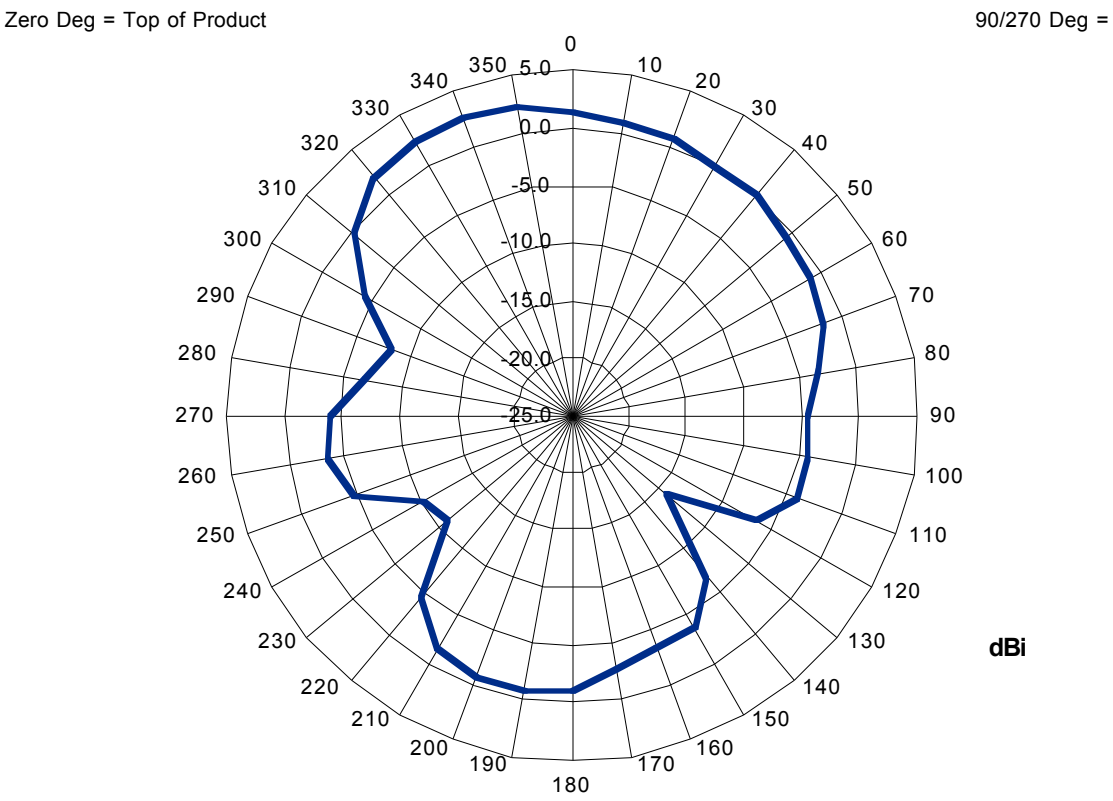
1.6.4 Antenna Azimuth Radiation Pattern

P19 Transmit Pattern; Azimuth Pattern; Diversity Switch Loss Included; 8/15/01
V and H Polarizations Summed



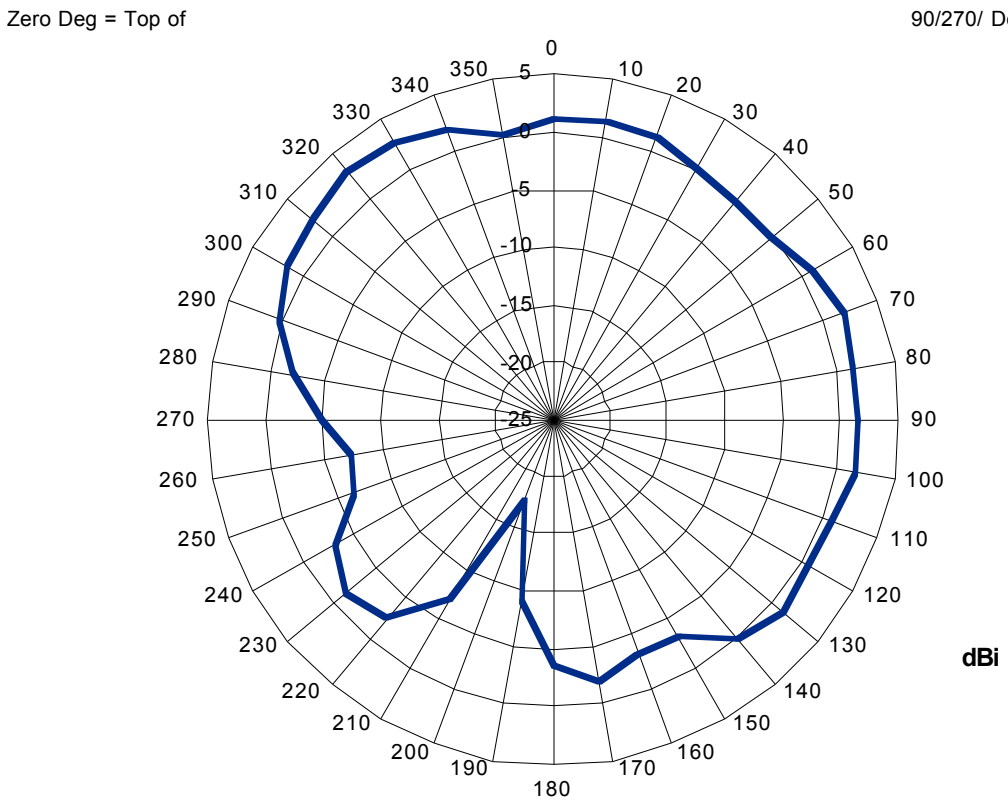
1.6.5 Antenna Elevation #1 Radiation Pattern

P19 Transmit Pattern; Elevation Pattern; Diversity Switch Loss Included; 8/15/01
V and H Polarizations Summed



1.6.6 Antenna Elevation #2 Radiation Pattern

P19 Transmit Pattern; Elevation Pattern; Diversity Switch Loss Included; 8/15/01
V and H Polarizations Summed

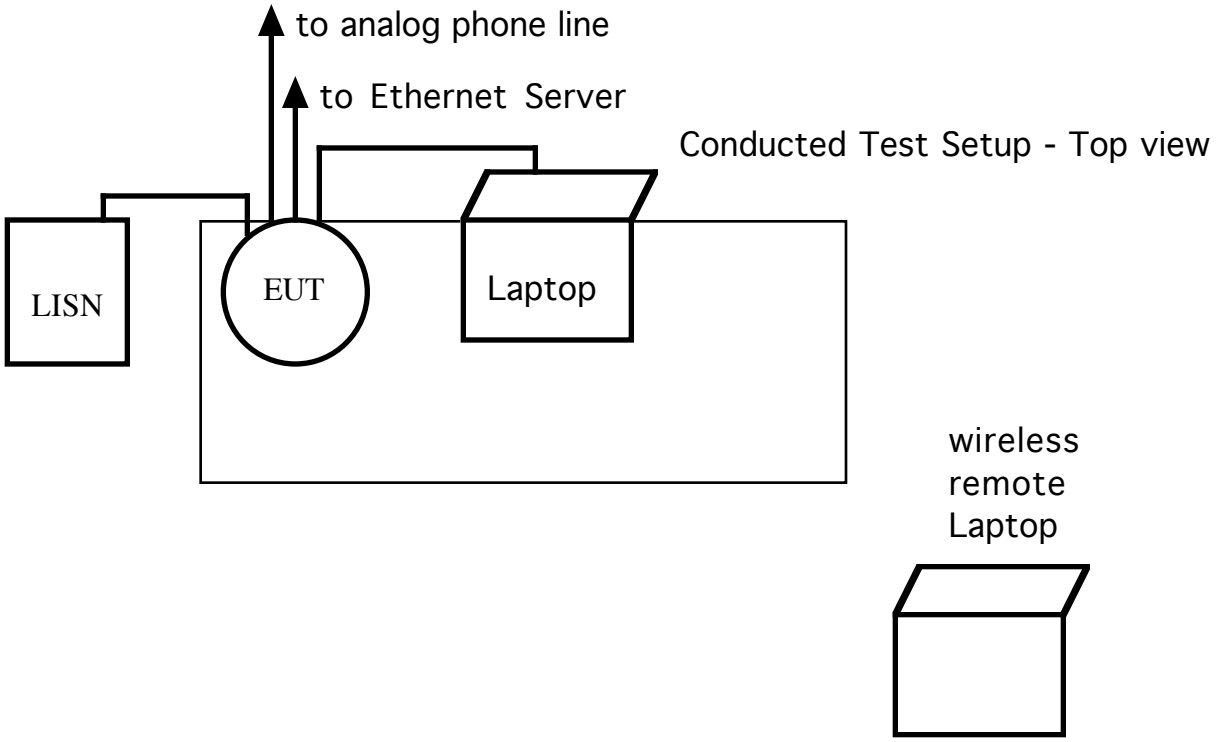


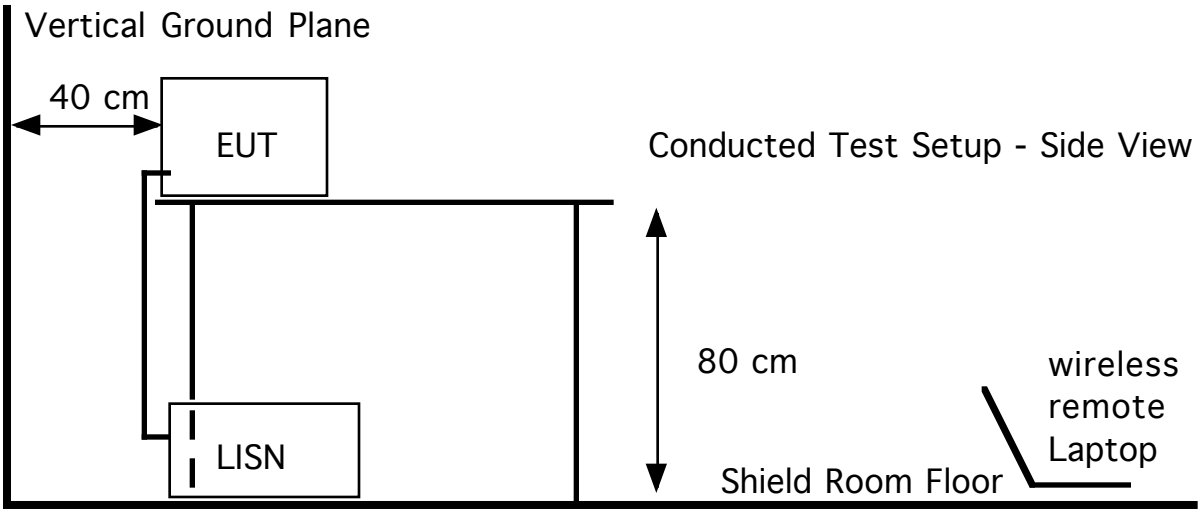
1.6.7 Antenna Azimuth and Elevation Radiation Pattern Tabular Data

8/15/01; P19 DVT Unit; All cables and switch loss included			
Angle	Azimuth Pattern	Elevation Pattern 1	Elevation Pattern 2
0	-5.0	1.4	1.1
10	-4.6	0.9	1.4
20	-3.8	0.4	1.2
30	-2.2	-0.2	0.1
40	-1.3	0.0	-0.5
50	-1.2	-0.7	-0.3
60	-0.5	-1.3	0.9
70	-0.8	-1.7	1.8
80	-0.7	-3.2	1.4
90	-1.0	-4.6	1.5
100	-2.0	-4.3	1.6
110	-2.6	-4.2	0.8
120	-3.5	-6.7	0.4
130	-4.1	-14.3	0.9
140	-3.3	-6.6	-0.2
150	-3.1	-3.9	-3.2
160	-3.0	-3.7	-3.4
170	-3.0	-2.6	-2.0
180	-3.5	-1.3	-3.6
190	-3.7	-0.7	-9.1
200	-3.3	-0.9	-17.6
210	-2.6	-1.7	-7.0
220	-1.9	-4.4	-2.5
230	-0.8	-11.0	-1.6
240	0.3	-9.9	-3.0
250	1.3	-4.7	-6.5
260	1.7	-3.5	-7.3
270	**2.0**	-4.0	-4.8
280	1.8	-6.5	-1.9
290	1.2	-8.4	0.2
300	0.2	-4.4	1.7
310	-1.1	-0.1	2.2
320	-3.2	1.7	**3.0**
330	-4.8	**2.4**	2.7
340	-5.0	2.4	1.8
350	-5.3	2.1	0.1
Maximum Gain	**2.0**	**2.4**	**3.0**

2 CFR 15.207(a) AC Power Line Conducted Emissions

2.1 CFR 15.207(a) AC Power Line Conducted Emissions Test Setup





2.2 CFR 15.207(a) AC Power Line Conducted Emissions Test Procedure

Conducted Emissions were performed at the Apple Computer EMC compliance lab located at 20650 Valley Green Drive, Cupertino, California. The EUT was placed on a nonmetallic table, 80 cm above the metallic ground-plane. The EUT and peripherals were powered from a filtered main supply. The frequency spectrum from 150 kHz to 30 MHz was scanned. This procedure was performed for both ac lines of the EUT.

2.3 CFR 15.207(a) Conducted Emissions Test Equipment

Description	Manufacturer	Model No.	Identification No.	Last Cal	Next Cal
Spectrum Analyzer	HP	8568B	E2564/E2565	April 5, 2001	April 5, 2002
Receiver	R&S	ESH 10	E5388	January 19, 2001	January 19, 2002
LISN/AMN	R&S	ESH3-Z5	LISN 01	June 21, 2001	June 21, 2002
LISN/AMN Periph.	Solar	8012-50-R-24	E5520	N/A	N/A
Coaxial Test Cable	Beldon	8268	CE#2	December 20, 2001	December 20, 2002

Notes: H.P. is an abbreviation for Hewlett Packard.
R&S is an abbreviation for Rhode & Schwarz.
Ca. Inst. is an abbreviation for California Instruments.
N/A is an abbreviation for Not Applicable
The above equipment is traceable to NVLAP calibration standards.

2.3.1 CFR 15.207(a) Conducted Emissions Instrument Settings:

Instrument Settings				
Frequency Range	Reference Level	Attenuation	Resolution BW	Video BW
450 kHz - 30 MHz	90 dBuV	10	10 kHz	10 kHz

2.4 CFR 15.207(a) AC Power Line Conducted Emissions EUT Operating Conditions

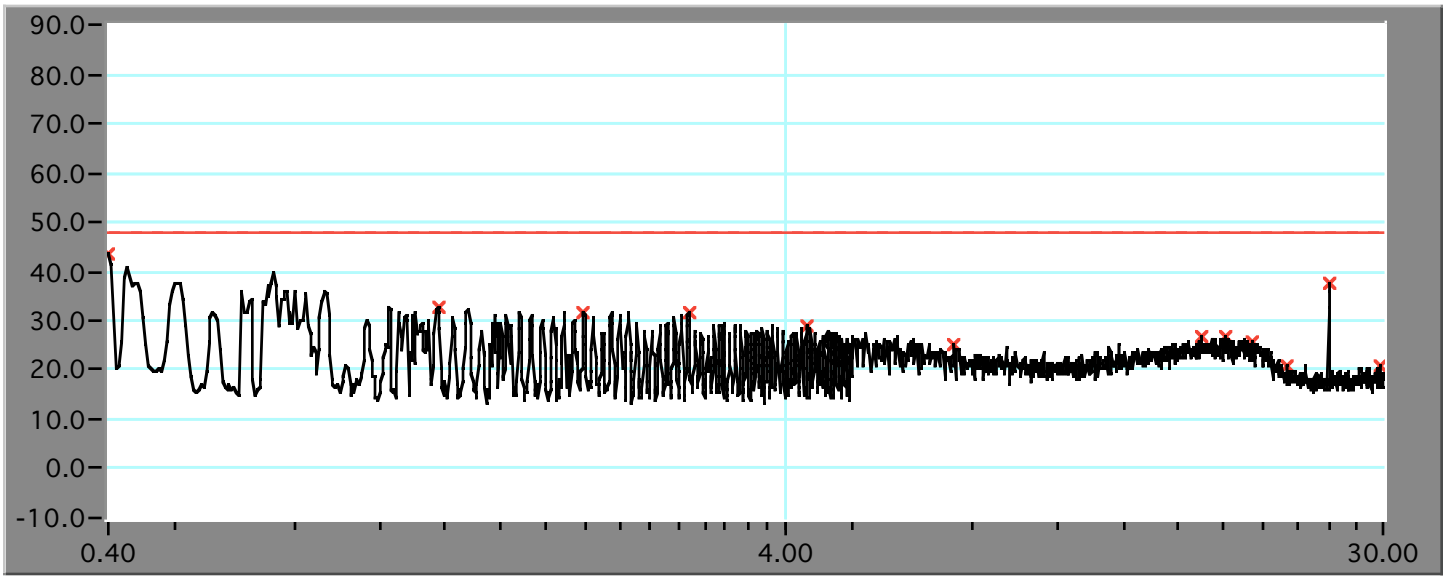
Conducted Emissions scans were performed with the transmitter frequency set to the low, mid and high channels. In each case, the emissions were found to be similar. Thus conducted emissions data in this report is provided for channel 1 only. The Airport Base Station ethernet ports, internal modem and RF portion were activated simultaneously throughout the testing as described in the following two paragraphs.

The ethernet ports on the Airport Base Station were activated by using them as an ethernet hub as follows. A local laptop computer was connected to one of the Airport Base Station ethernet ports and the other Airport Base Station ethernet port was connected to a local server. The local laptop computer was configured to continuously read and write a text file to the local server through the Airport Base Station. The scans were performed and data is provided with the transmitter frequency set to the following channels

The wireless portion of the Airport Base Station was activated as follows: The Airport Base Station was configured with the modem connected to an analog line. The modem was on and configured to maintain a connection to a local ISP which provided a dynamic IP address to the Airport Base Station. The Airport Base Station dynamically assigned an IP address wirelessly to a remote wireless laptop computer. The remote wireless laptop computer, using a web browser, downloaded a large file over the internet throughout the testing.

2.5 CFR 15.207(a) AC Power Line Conducted Emissions Line 1 Test results

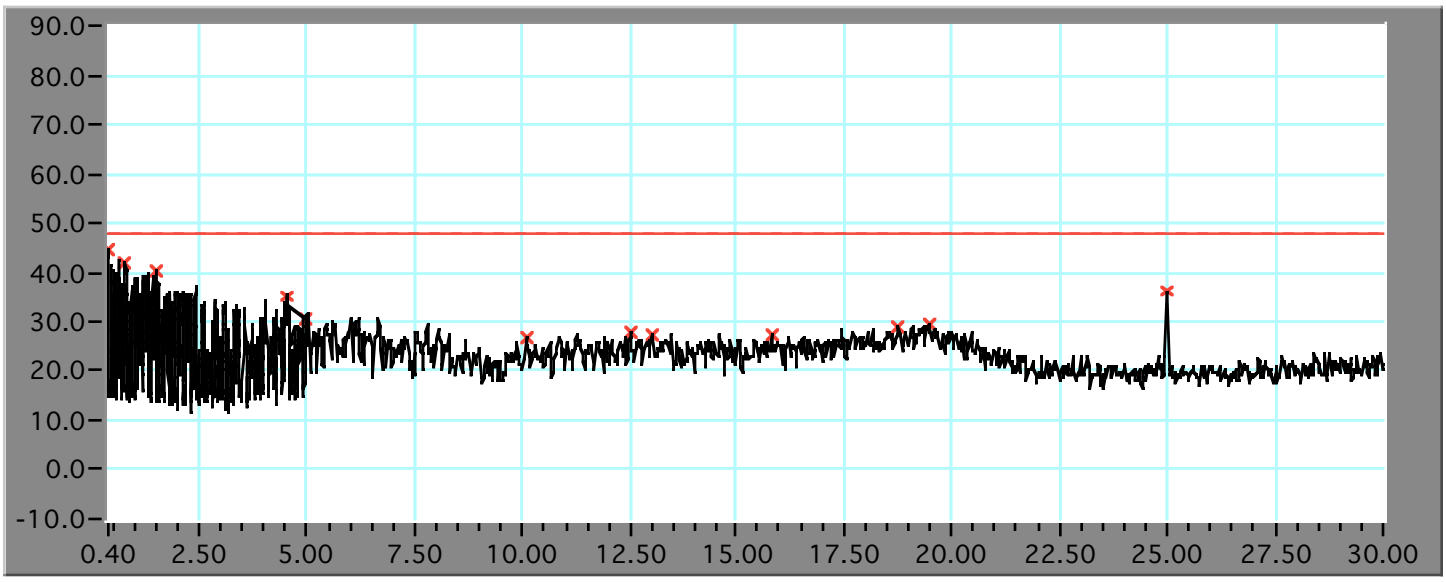
Date of test: September 4, 2001



Frequency	Level	Limit	Delta	Raw Data	LISN	Cable	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB
0.400	44.0	48.0	-4.0	43.10	0.85	0.06	-0.90
1.219	32.7	48.0	-15.3	32.25	0.36	0.09	-0.45
1.996	31.4	48.0	-16.6	30.95	0.33	0.12	-0.45
2.843	31.2	48.0	-16.8	30.72	0.32	0.16	-0.48
4.273	28.5	48.0	-19.5	28.01	0.30	0.19	-0.49
7.050	24.7	48.0	-23.3	24.06	0.37	0.26	-0.64
16.256	26.7	48.0	-21.3	25.85	0.45	0.40	-0.85
17.556	26.3	48.0	-21.7	25.41	0.48	0.41	-0.89
19.316	25.3	48.0	-22.7	24.30	0.53	0.47	-1.00
21.636	20.9	48.0	-27.1	19.72	0.72	0.46	-1.18
24.976	38.0	48.0	-10.0	36.59	0.89	0.52	-1.41
29.796	20.6	48.0	-27.4	19.11	0.94	0.55	-1.49

All levels are with a peak detector.

2.6 CFR 15.207(a) AC Power Line Conducted Emissions Line 2 Test Results



Frequency	Level	Limit	Delta	Raw Data	LISN	Cable	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB
0.400	44.8	48.0	-3.2	43.89	0.85	0.06	-0.91
0.800	42.0	48.0	-6.0	41.47	0.44	0.09	-0.53
1.490	40.8	48.0	-7.2	40.33	0.36	0.12	-0.47
4.551	35.0	48.0	-13.0	34.48	0.31	0.21	-0.52
5.000	30.1	48.0	-17.9	29.56	0.32	0.22	-0.54
10.085	26.5	48.0	-21.5	25.78	0.40	0.31	-0.72
12.507	27.5	48.0	-20.5	26.68	0.46	0.36	-0.82
12.991	27.2	48.0	-20.8	26.37	0.46	0.37	-0.83
15.822	27.0	48.0	-21.0	26.14	0.45	0.41	-0.86
18.780	28.8	48.0	-19.2	27.85	0.52	0.43	-0.95
19.469	29.2	48.0	-18.8	28.19	0.56	0.45	-1.01
24.976	36.5	48.0	-11.5	35.09	0.89	0.52	-1.41

All levels are with a peak detector.

3 CFR 15.209(a) Radiated Emissions

3.1 CFR 15.209(a) Radiated Emissions less than 1 GHz

Pre-scans below 1 GHz were performed with the transmitter frequency set to the low, mid and high channels. In each case, the emissions below 1 GHz were found to be similar. Thus radiated emissions data in this report below 1 GHz is provided for channel 1 only.

3.1.1 CFR 15.209(a) Radiated Emissions less than 1 GHz Test Setup

Radiated Emission measurements at or below 1 GHz were performed at the Apple Computer Test Site ALTS #1, located at 123 East Evelyn Ave., Mountain View, California. The EUT was placed on a nonmetallic table, 80 cm above the metallic ground-plane. The EUT and peripherals were powered from a filtered main supply.

3.1.2 CFR 15.209(a) Radiated Emissions less than 1 GHz Test Procedure

The frequency spectrum from 30 MHz to ≤ 1 GHz was scanned and the emission levels maximized at each frequency recorded. The antenna was varied in height between 1.0 and 4.0 meters and the system was rotated 360 degrees while scanning for maximum emission amplitudes. This procedure was performed for both horizontal and vertical polarization of the receiving antenna. During maximization the position of the cables was varied and the scanning repeated until the worst case emission was found. The data recorded in this report are the maximum emission levels measured.

Radiated Emission measurements at or below 1 GHz were performed at an EUT to antenna distance of 3 meters.

3.1.3 CFR 15.209(a) Radiated Emissions less than 1 GHz Test Equipment

The following test equipment was used when performing radiated emissions tests below 1 GHz.

Description	Manufacturer	Model No.	Identification No.	Last Cal	Next Cal
Spectrum Analyzer	Hewlett Packard	8566	E4663/E	2/01	2/02
EMI Receiver	R&S	ESI 26	100025	6/01	6/02
Wide Band Amplifier	Penstock	PSAJ9138A	104	1/01	1/02
Coaxial Cable	Times Microwave	N/A	ALT TS#1	10/00	10/01
Bilog Antenna	Chase	CBL6112B	2518	4/01	4/02

Notes: HP is an abbreviation for Hewlett Packard.
R&S is an abbreviation for Rhode & Schwarz.
N/A is an abbreviation for Not Applicable
The above equipment is traceable to NVLAP calibration standards.

3.1.3.1 CFR 15.209(a) Radiated Emissions less than 1 GHz Instrument Settings:

Instrument Settings				
Frequency Range	Reference Level	Attenuation	Resolution BW	Video BW
30 MHz - 1 GHz	90 dBuV	10	100 kHz	100 kHz

3.1.4 CFR 15.209(a) Radiated Emissions less than 1 GHz EUT Operation Conditions

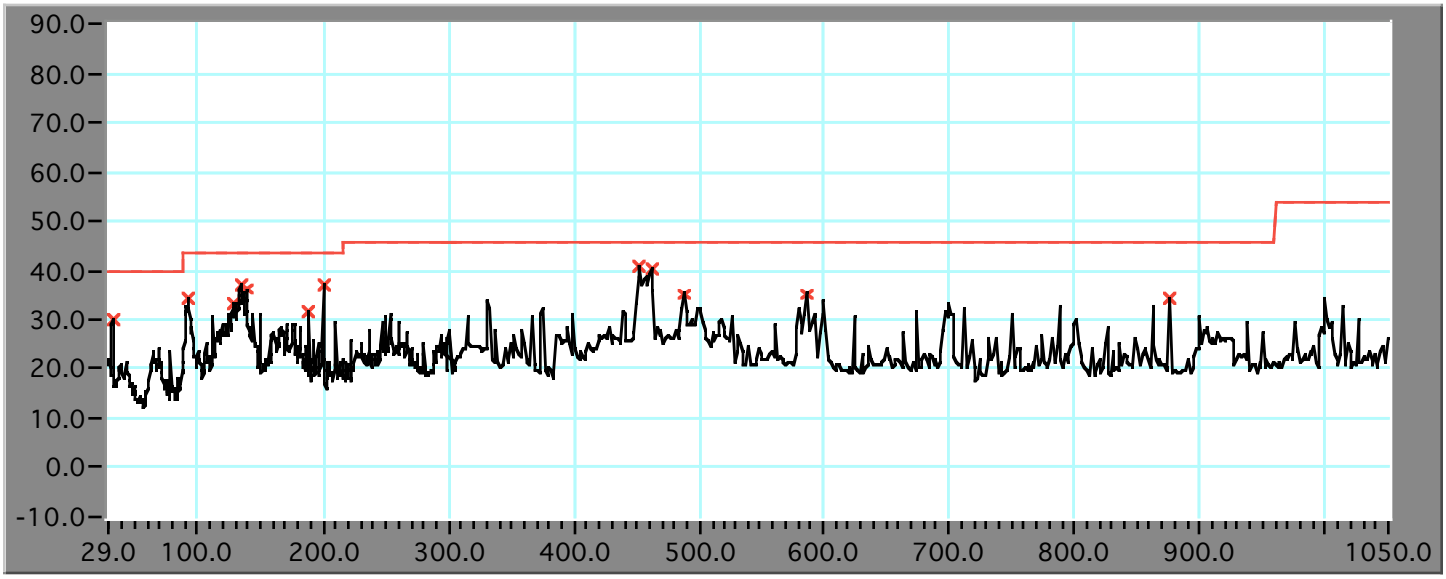
The Airport Base Station ethernet ports, internal modem and RF portion were activated simultaneously throughout the testing as described in the following two paragraphs.

The ethernet ports on the Airport Base Station were activated by using them as an ethernet hub as follows. A local laptop computer was connected to one of the Airport Base Station ethernet ports and the other Airport Base Station ethernet port was connected to a local server. The local laptop computer was configured to continuously read and write a text file to the local server through the Airport Base Station. The scans were performed and data is provided with the transmitter frequency set to the following channels

The wireless portion of the Airport Base Station was activated as follows: The Airport Base Station was configured with the modem connected to an analog line. The modem was on and configured to maintain a connection to a local ISP which provided a dynamic IP address to the Airport Base Station. The Airport Base Station dynamically assigned an IP address wirelessly to a remote wireless laptop computer. The remote wireless laptop computer, using a web browser, downloaded a large file over the internet throughout the testing.

3.1.5 CFR 15.209(a) Radiated Emissions less than 1 GHz - Vertical Data

The data below was collected with a transmitter frequency of 2.412 GHz.

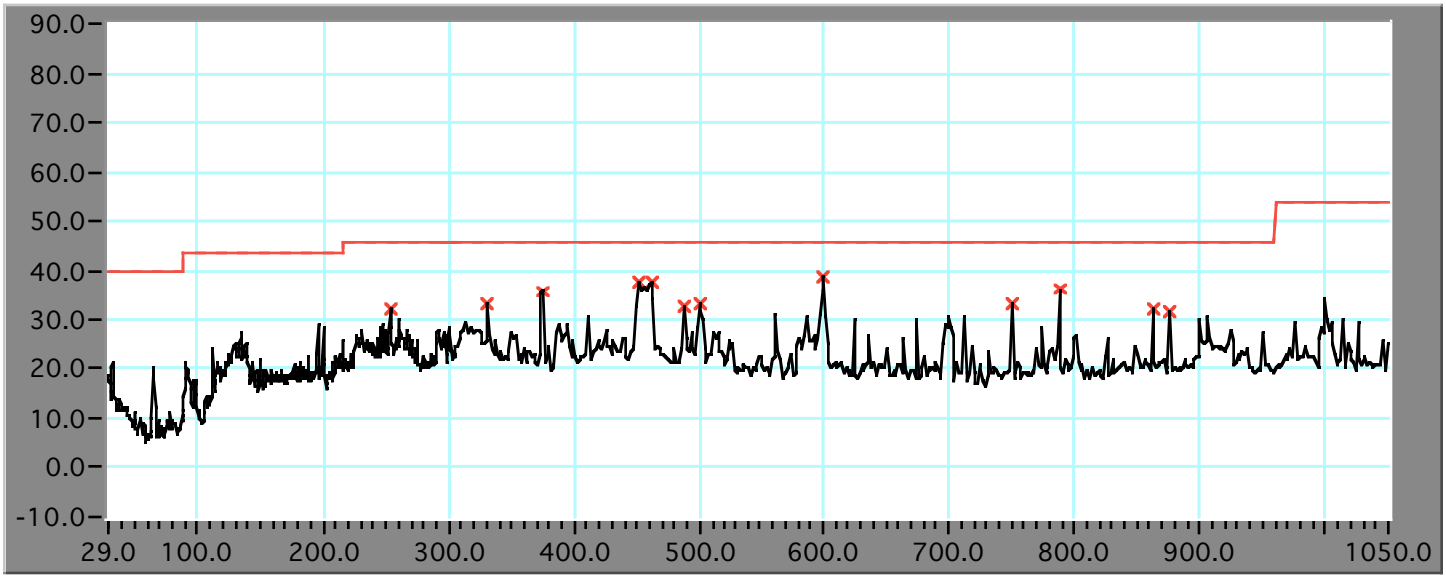


Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
32.32	30.0	40.0	-10.0	54.14	18.02	0.75	42.90	24.13
93.16	34.1	43.5	-9.4	63.80	9.46	1.17	40.31	29.69
128.56	33.2	43.5	-10.3	62.08	11.78	1.34	42.04	28.92
134.09	37.5	43.5	-6.0	66.82	11.54	1.38	42.23	29.30
139.07	36.2	43.5	-7.3	65.79	11.43	1.42	42.39	29.55
187.74	31.7	43.5	-11.8	64.43	9.20	1.62	43.59	32.77
199.91	37.1	43.5	-6.4	70.19	9.30	1.67	44.04	33.07
452.35	41.2	46.0	-4.8	65.65	16.50	2.53	43.52	24.50
461.43	40.8	46.0	-5.2	65.19	16.61	2.55	43.56	24.40
487.15	35.0	46.0	-11.0	58.41	17.45	2.63	43.47	23.39
587.01	35.3	46.0	-10.7	57.07	18.70	2.90	43.40	21.80
876.00	34.2	46.0	-11.8	53.23	20.54	3.57	43.11	19.01

All levels are with a peak detector.

3.1.6 CFR 15.209(a) Radiated Emissions less than 1 GHz - Horizontal Data

The data below was collected with a transmitter frequency of 2.412 GHz.



Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
254.11	31.8	46.0	-14.2	60.25	13.14	1.88	43.47	28.46
331.31	32.8	46.0	-13.2	60.14	13.90	2.13	43.41	27.39
375.19	35.9	46.0	-10.1	62.15	14.92	2.28	43.48	26.29
450.84	37.7	46.0	-8.3	62.17	16.55	2.52	43.52	24.45
461.43	37.7	46.0	-8.3	62.09	16.61	2.55	43.56	24.40
487.15	32.2	46.0	-13.8	55.62	17.45	2.63	43.47	23.39
499.26	33.3	46.0	-12.7	56.45	17.55	2.67	43.41	23.19
600.63	39.2	46.0	-6.8	60.43	19.20	2.93	43.40	21.27
750.42	32.9	46.0	-13.1	53.04	19.51	3.31	42.99	20.17
788.25	36.0	46.0	-10.0	55.91	19.80	3.38	43.07	19.89
862.38	32.0	46.0	-14.0	51.21	20.40	3.54	43.13	19.19
876.00	31.6	46.0	-14.4	50.61	20.54	3.57	43.11	19.01

All levels are with a peak detector.

3.2 CFR 15.209(a) Radiated Emissions greater than 1 GHz

3.2.1 CFR 15.209(a) Radiated Emissions greater than 1 GHz Test Setup

Radiated Emission measurements above 1 GHz were performed at the Apple Computer 3 meter semi-anechoic chamber located at 20650 Valley Green Drive. The EUT was placed on a nonmetallic table, 80 cm above the metallic ground-plane. The EUT and peripherals were powered from a filtered main supply.

Radiated Emission measurements above 1 GHz were performed at an EUT to antenna distance of 30 centimeters.

3.2.2 CFR 15.209(a) Radiated Emissions greater than 1 GHz Test Procedure

The frequency spectrum from 1 GHz to 18 GHz was scanned and the emission levels maximized at each frequency. The antenna was varied in height and the system was rotated 360 degrees while scanning for maximum emission amplitudes. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

During maximization the position of the cables was varied and the scanning repeated until the worst case emission was found. The data recorded in this report are the maximum emission levels measured.

Scans above 1 GHz were performed with the transmitter frequency set to the low, mid and high channels and Radiated Emissions data is provided in this report for each case.

- low channel - 2.412 GHz
- mid channel - 2.437 GHz
- high channel - 2.462 GHz

3.2.3 CFR 15.209(a) Radiated Emissions greater than 1 GHz Test Equipment

The following test equipment was used when performing radiated emissions tests above 1 GHz.

Description	Manufacturer	Model No.	Identification No.	Last Cal	Next Cal
Spectrum Analyzer	HP	HP 8563E	AOU201613	Feb., 2001	Feb., 2002
Amplifier	HP	8449	3008A00713	12/00	12/01
Cable	Pasternack	RG55B/C	26G1/2	08/01	08/02
Cable	Pasternack	RG142B/U	26G2/2	08/01	08/02
Horn Antenna	EMCO	3160-09	011269-0041264	09/01	09/05
Horn Antenna	EMCO	3115	9904-5788	09/01	09/05

3.2.3.1 CFR 15.209(a) Radiated Emissions greater than 1 GHz Instrument Settings

Instrument Settings				
Frequency Range	Reference Level	Attenuation	Resolution BW	Video BW
1 GHz - 2.4 GHz	110 dBuV	20	1 MHz	1 MHz
2.4 GHz - 2.8 GHz	120 dBuV	30	1 MHz	1 MHz
2.8 GHz - 13 GHz	100 dBuV	10	1 MHz	1 MHz
13 GHz - 25 GHz	100 dBuV	0	1 MHz	1 MHz

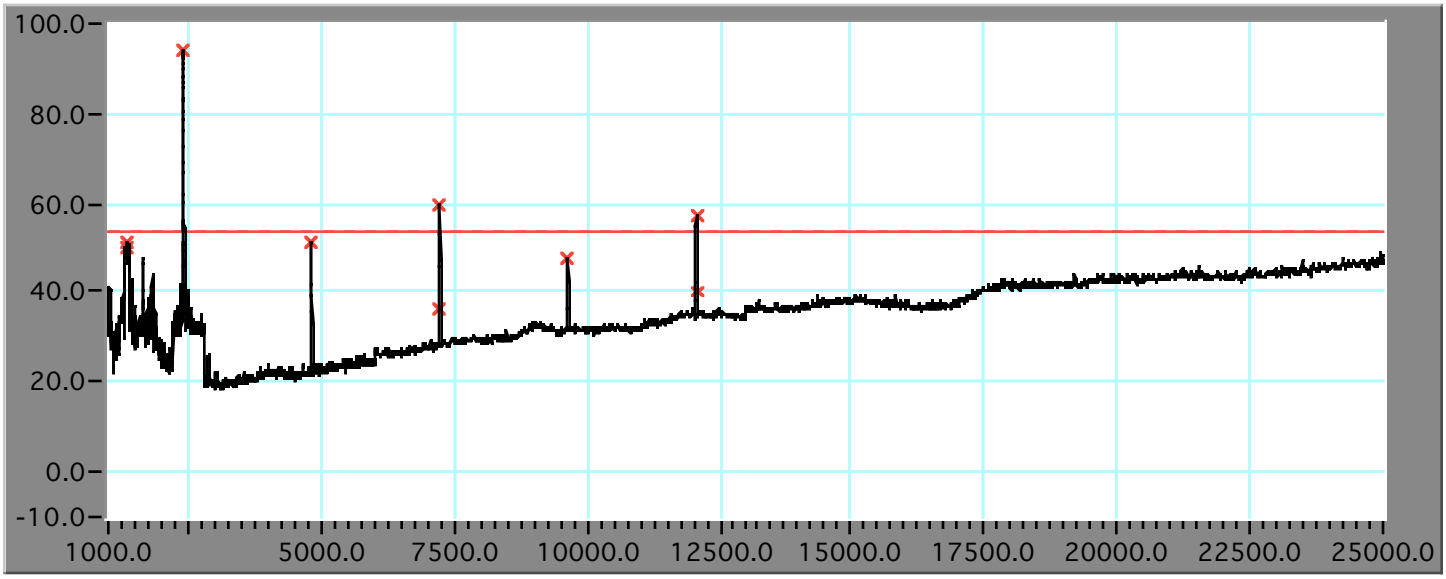
3.2.4 CFR 15.209(a) Radiated Emissions greater than 1 GHz EUT Operating Conditions

The Airport Base Station ethernet ports, internal modem and RF portion were activated simultaneously throughout the testing as described in the following two paragraphs.

The ethernet ports on the Airport Base Station were activated by using them as an ethernet hub as follows. A local laptop computer was connected to one of the Airport Base Station ethernet ports and the other Airport Base Station ethernet port was connected to a local server. The local laptop computer was configured to continuously read and write a text file to the local server through the Airport Base Station.

The wireless portion of the Airport Base Station was activated as follows: The Airport Base Station was configured with the modem connected to an analog line. The modem was on and configured to maintain a connection to a local ISP which provided a dynamic IP address to the Airport Base Station. The Airport Base Station dynamically assigned an IP address wirelessly to a local client labtop computer. The client laptop computer, using a web browser, downloaded a large file over the internet throughout the testing.

3.2.5 CFR 15.209(a) Radiated Emissions - Vertical, channel 1 (2.412 GHz)

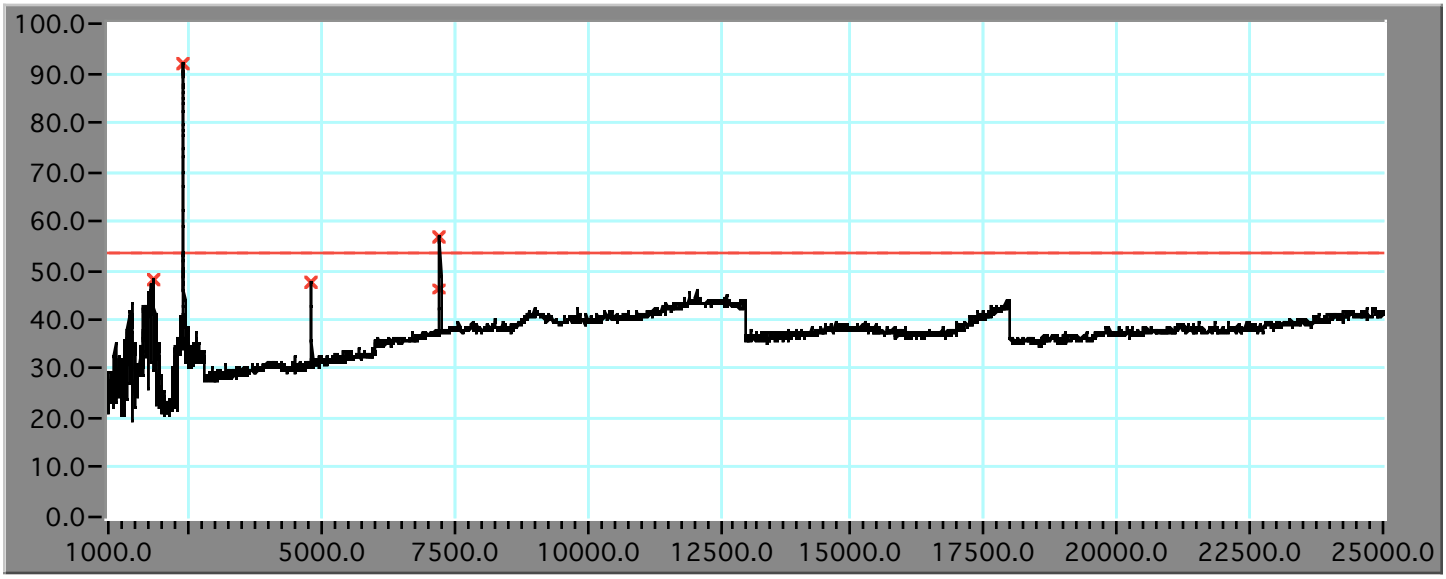


Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1333.67	50.5	54.0	-3.5	77.10	26.13	0.27	53.00	26.60
1368.33	51.5	54.0	-2.5	77.97	26.25	0.27	53.00	26.47
2415.00	94.2	54.0	40.2	116.38	30.35	0.44	53.00	22.21
4821.33	51.7	54.0	-2.3	69.39	34.60	0.68	53.00	17.72
7236.00	36.3 Av	54.0	-17.7	50.57	37.24	1.49	53.00	14.27
7236.67	59.7	54.0	5.7	73.94	37.24	1.49	53.00	14.27
9640.00	47.7	54.0	-6.3	59.23	38.61	2.83	53.00	11.56
12055.00	57.5	54.0	3.5	65.21	41.76	3.53	53.00	7.71
12059.00	40.3 Av	54.0	-13.7	48.04	41.76	3.53	53.00	7.71

All levels are with a peak detector unless otherwise indicated.

Date of Test: October 30, 2001

3.2.6 CFR 15.209(a) Radiated Emissions - Horizontal, channel 1 (2.412 GHz)

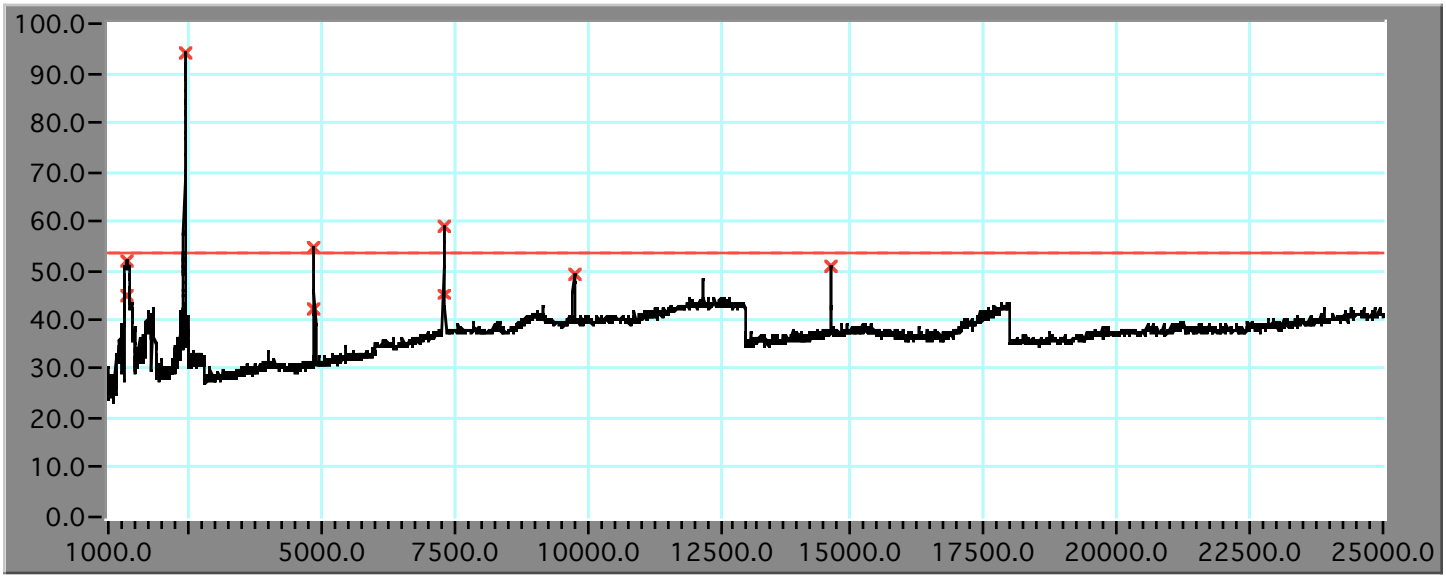


Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1840.67	48.2	54.0	-5.8	72.47	28.34	0.37	53.00	24.30
2410.83	92.0	54.0	38.0	114.23	30.33	0.44	53.00	22.23
4821.33	47.7	54.0	-6.3	65.39	34.60	0.68	53.00	17.72
7236.00	46.5 Av	54.0	-7.5	60.77	37.24	1.49	53.00	14.27
7236.67	57.2	54.0	3.2	71.44	37.24	1.49	53.00	14.27

All levels are with a peak detector unless otherwise indicated.

Date of Test: October 30, 2001

3.2.7 CFR 15.209(a) Radiated Emissions - Vertical Channel 6 (2.437 GHz)

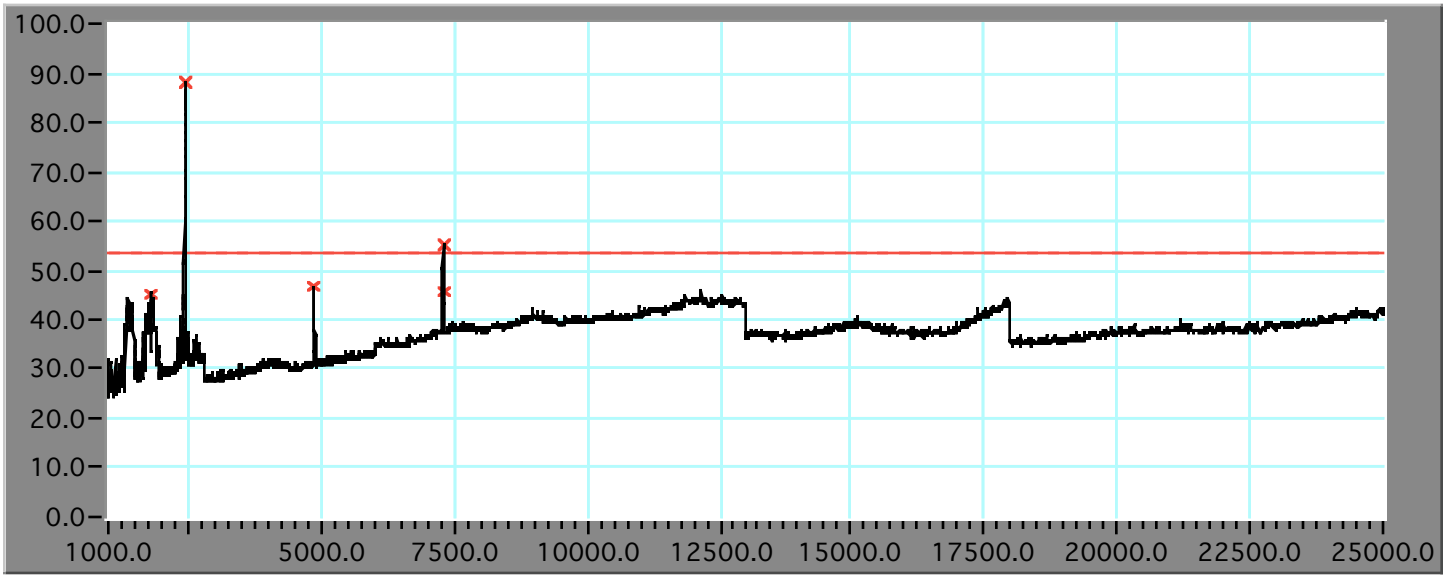


Frequency	Level	Limit	Delta		Height	Angle	Raw Data	Antenna	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB		m	Deg	dBuV	dB	dB	dB	dB
1348.83	52.2	54.0	-1.8		0.00		78.71	26.19	0.27	53.00	26.54
1349.00	44.6 Av	54.0	-9.4				71.14	26.19	0.27	53.00	26.54
2439.17	94.2	54.0	40.2	*	0.00		116.31	30.42	0.44	53.00	22.14
4874.00	41.7 Av	54.0	-12.3				59.26	34.75	0.69	53.00	17.56
4874.67	55.0	54.0	1.0	*	0.00		72.56	34.75	0.69	53.00	17.56
7306.67	59.0	54.0	5.0	*	0.00		73.17	37.31	1.52	53.00	14.17
7310.40	45.3 Av	54.0	-8.7				59.47	37.31	1.52	53.00	14.17
9745.00	49.3	54.0	-4.7		0.00		60.80	38.70	2.85	53.00	11.46
14625.00	51.0	54.0	-3.0		0.00		57.73	41.65	4.62	53.00	6.73

All levels are with a peak detector unless otherwise indicated.

Date of Test: October 30, 2001

3.2.8 CFR 15.209(a) Radiated Emissions - Horizontal Channel 6 (2.437 GHz)

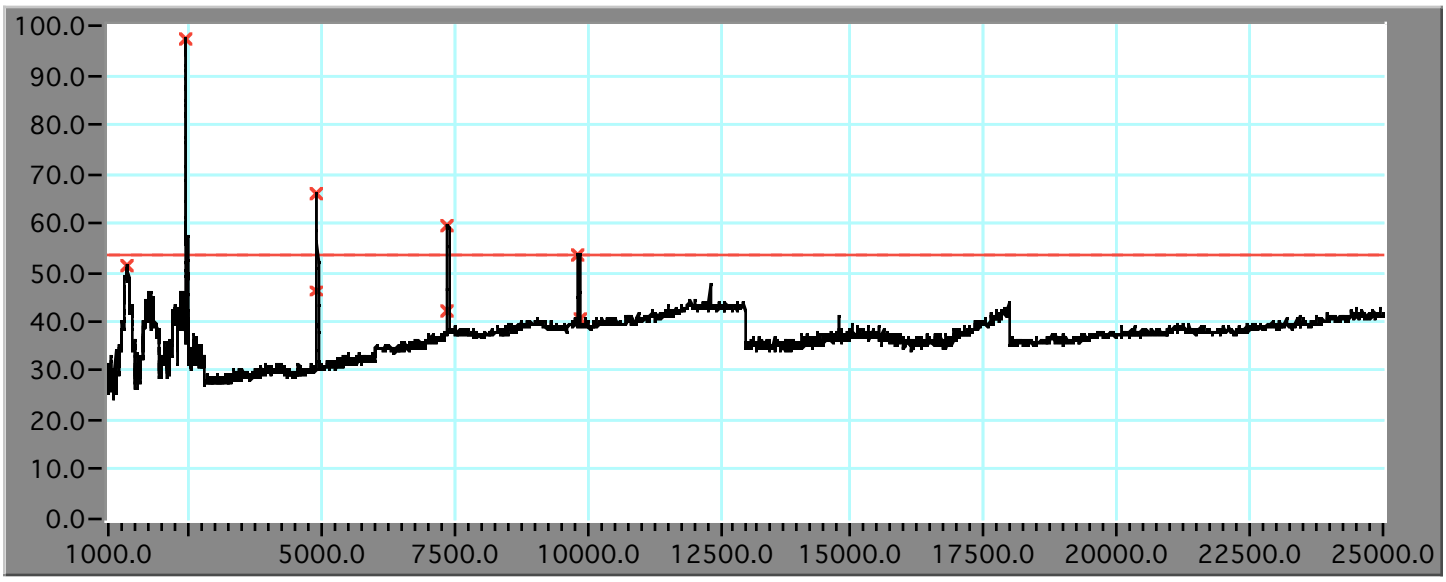


Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
1812.50	45.2	54.0	-8.8	69.41	28.40	0.36	53.00	24.24
2438.33	88.0	54.0	34.0	110.29	30.26	0.44	53.00	22.29
4874.67	46.7	54.0	-7.3	64.18	34.80	0.69	53.00	17.51
7295.00	55.3	54.0	1.3	69.36	37.47	1.52	53.00	14.02
7311.00	45.8 Av	54.0	-8.2	59.78	37.50	1.52	53.00	13.98

All levels are with a peak detector unless otherwise indicated.

Date of Test: October 30, 2001

3.2.9 CFR 15.209(a) Radiated Emissions - Vertical Channel 11 (2.462 GHz)

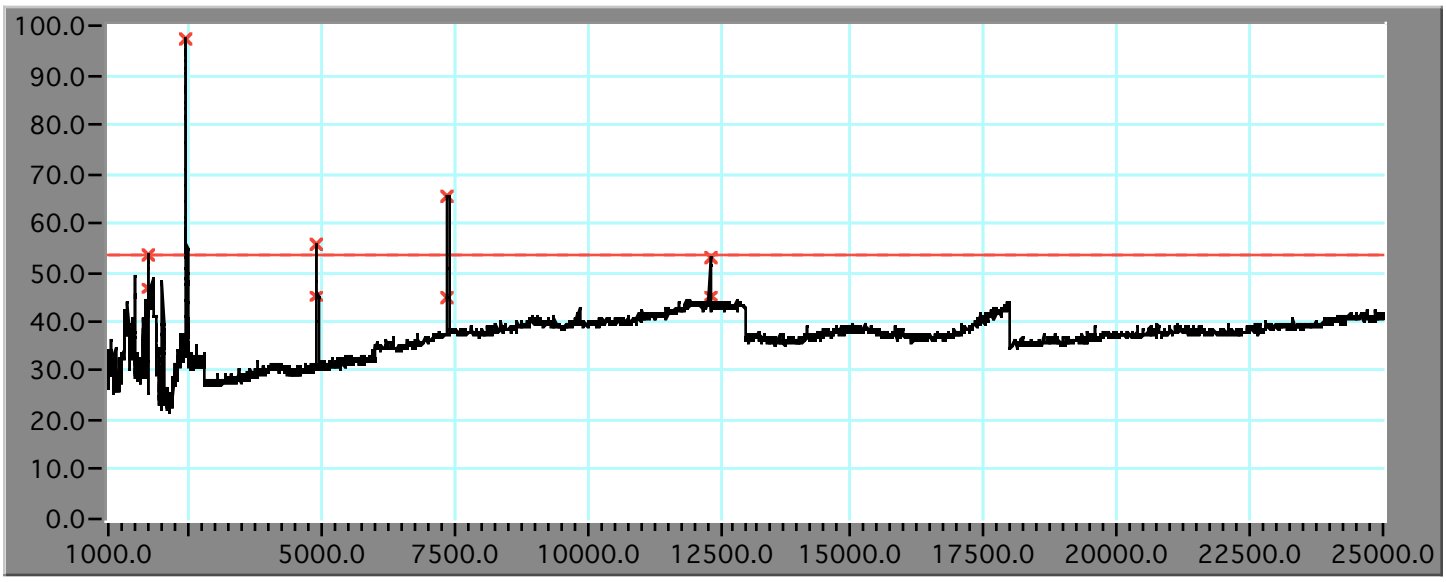


Frequency	Level	Limit	Delta		Height	Angle	Raw Data	Antenna	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB		m	Deg	dBuV	dB	dB	dB	dB
1346.67	51.5	54.0	-2.5		0.00		78.05	26.18	0.27	53.00	26.55
2462.50	97.2	54.0	43.2	*	0.00		119.24	30.49	0.45	53.00	22.07
4922.67	66.2	54.0	12.2	*	0.00		83.59	34.88	0.69	53.00	17.42
4924.00	46.2 Av	54.0	-7.8				63.62	34.88	0.69	53.00	17.42
7376.67	59.8	54.0	5.8	*	0.00		73.61	37.68	1.55	53.00	13.77
7386.00	41.7 Av	54.0	-12.3				55.44	37.71	1.56	53.00	13.73
9838.33	53.7	54.0	-0.3		0.00		64.96	38.84	2.87	53.00	11.29
9848.00	40.2 Av	54.0	-13.8				51.47	38.86	2.87	53.00	11.27

All levels are with a peak detector unless otherwise indicated.

Date of Test: October 30, 2001

3.2.10 CFR 15.209(a) Radiated Emissions - Horizontal Channel 11 (2.462 GHz)



Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1736.67	53.8	54.0	-0.2	78.46	28.04	0.35	53.00	24.62
1737.00	46.7 Av	54.0	-7.3	71.32	28.04	0.35	53.00	24.62
2463.33	97.2	54.0	43.2	119.40	30.32	0.45	53.00	22.23
4922.67	55.7	54.0	1.7	73.06	34.91	0.69	53.00	17.39
4924.00	45.2 Av	54.0	-8.8	62.59	34.91	0.69	53.00	17.39
7376.67	65.8	54.0	11.8	79.61	37.68	1.55	53.00	13.77
7388.00	44.8 Av	54.0	-9.2	58.53	37.71	1.56	53.00	13.73
12300.00	53.2	54.0	-0.8	60.73	41.76	3.68	53.00	7.56
12311.00	45.0 Av	54.0	-9.0	52.57	41.74	3.69	53.00	7.57

All levels are with a peak detector unless otherwise indicated.

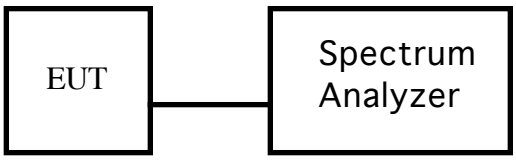
Date of Test: October 30, 2001

4 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems

4.1 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Test Setup

The 6 dB Bandwidth for Direct Sequence Systems must be at least 500 kHz. The Setup for measuring the bandwidth is straight forward and is depicted in the figure below.

Bandwidth Test Setup



4.2 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Test Procedures

The transmitter output is connected to the spectrum analyzer RF input. The bandwidth of the spectrum analyzer was set to 100 kHz. The 6 dB bandwidth of the transmitter is defined as the portion of the signal which is higher than the peak signal minus 6 dB.

4.3 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Test Equipment

Description	**Manufacturer**	**Model No.**	**Identification No.**	**Last Cal**	**Next Cal**
Spectrum Analyzer	HP	HP 8563E	AOU201613	Feb., 2001	Feb., 2002

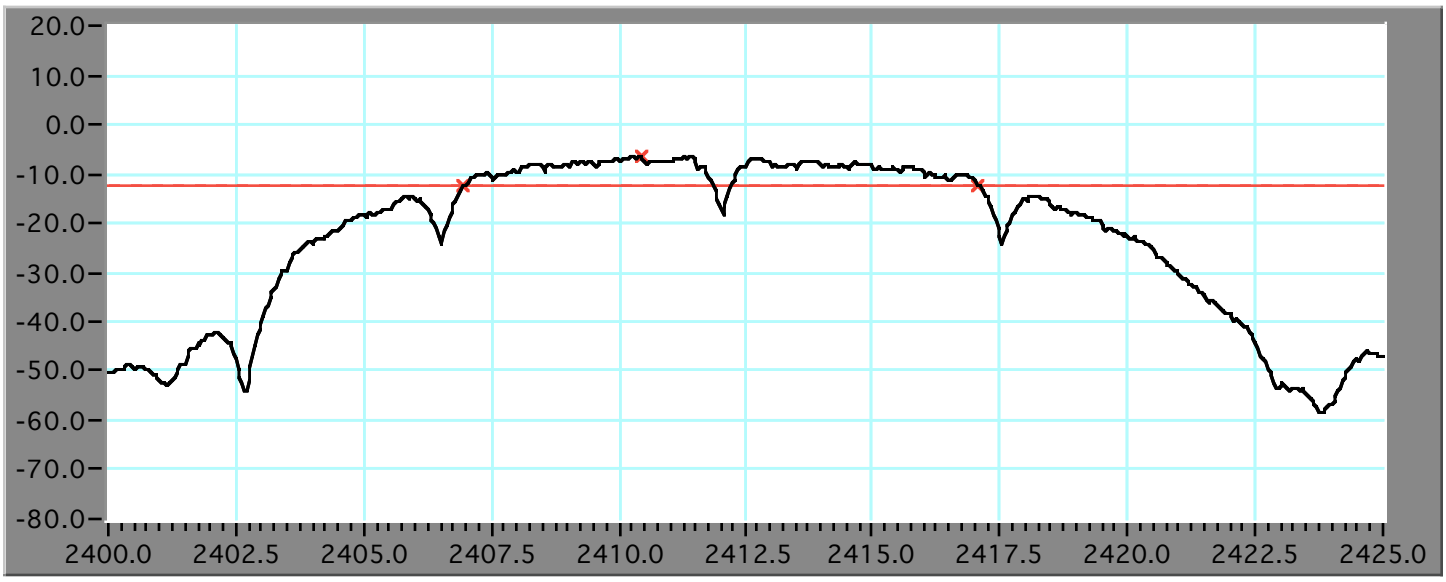
4.3.1 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Instrument Settings

Instrument Settings					
Reference Level	Attenuation	Resolution BW	Video BW	Sweep Rate	Span
20 dBm	30 dB	100 kHz	1 kHz	630 mS	25 MHz

4.4 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems EUT Operating Conditions

The transmitter was set to transmit continuously at 1 Mbps and the channels which were measured were the low, mid and high channels. At each channel, the bandwidth was recorded. The process was repeated using an 11 Mbps data rate.

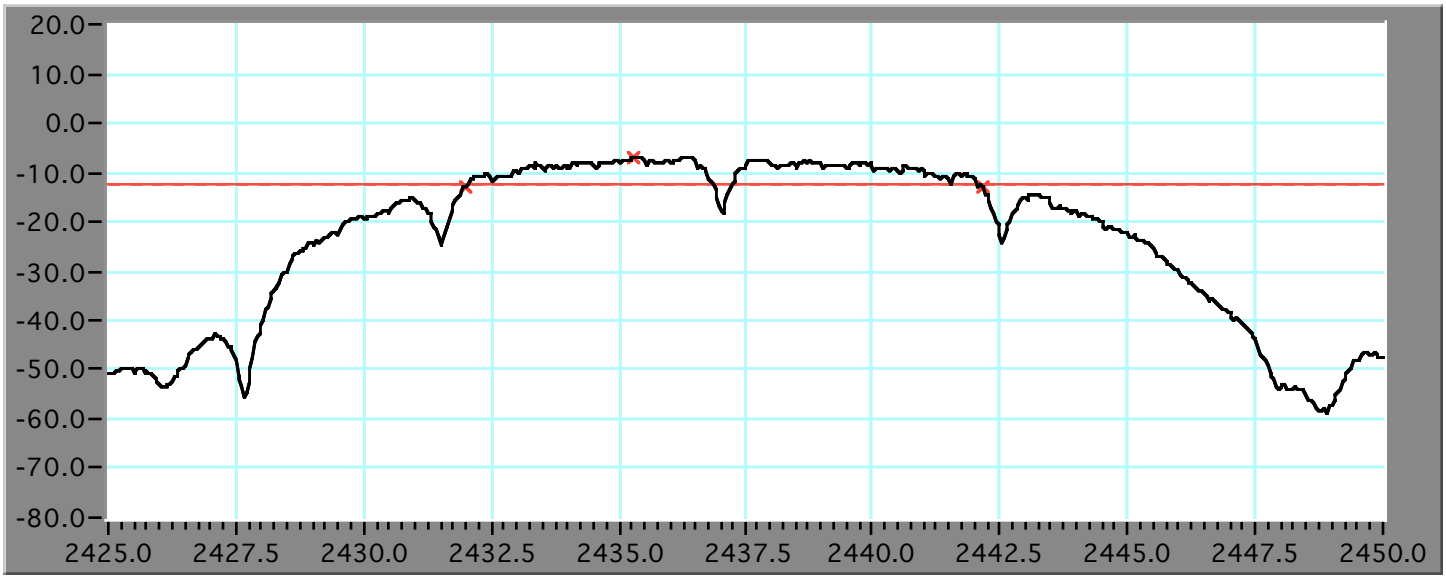
4.5 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Channel 1 (2.412 GHz), 1 Mbps



Channel	lower -6 dB frequency	upper -6 dB frequency	Data Rate	**6 dB Bandwidth**
1 - 2412 MHz	2407 MHz	2417.1 MHz	1 Mbps	9.1 MHz

Date of Test: November 7, 2001

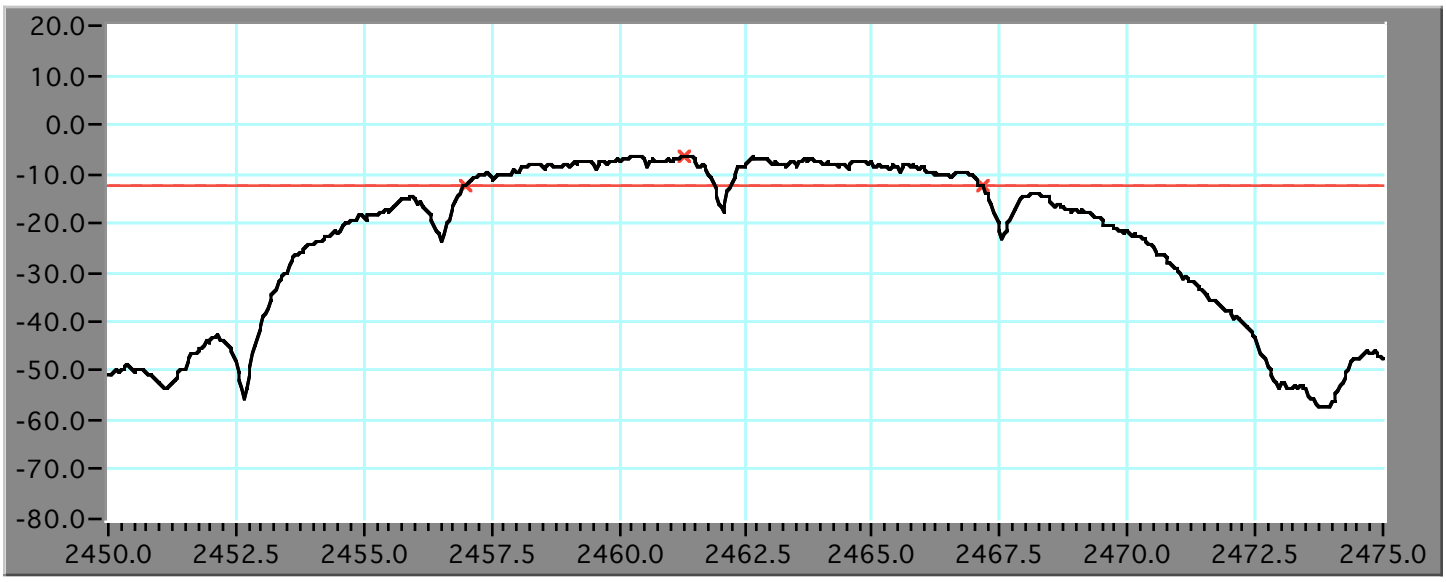
4.6 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Channel 6 (2.437 GHz), 1 Mbps



Channel	lower -6 dB frequency	upper -6 dB frequency	Data Rate	**6 dB Bandwidth**
6 - 2437 MHz	2432 MHz	2442 MHz	1 Mbps	10 MHz

Date of Test: November 7, 2001

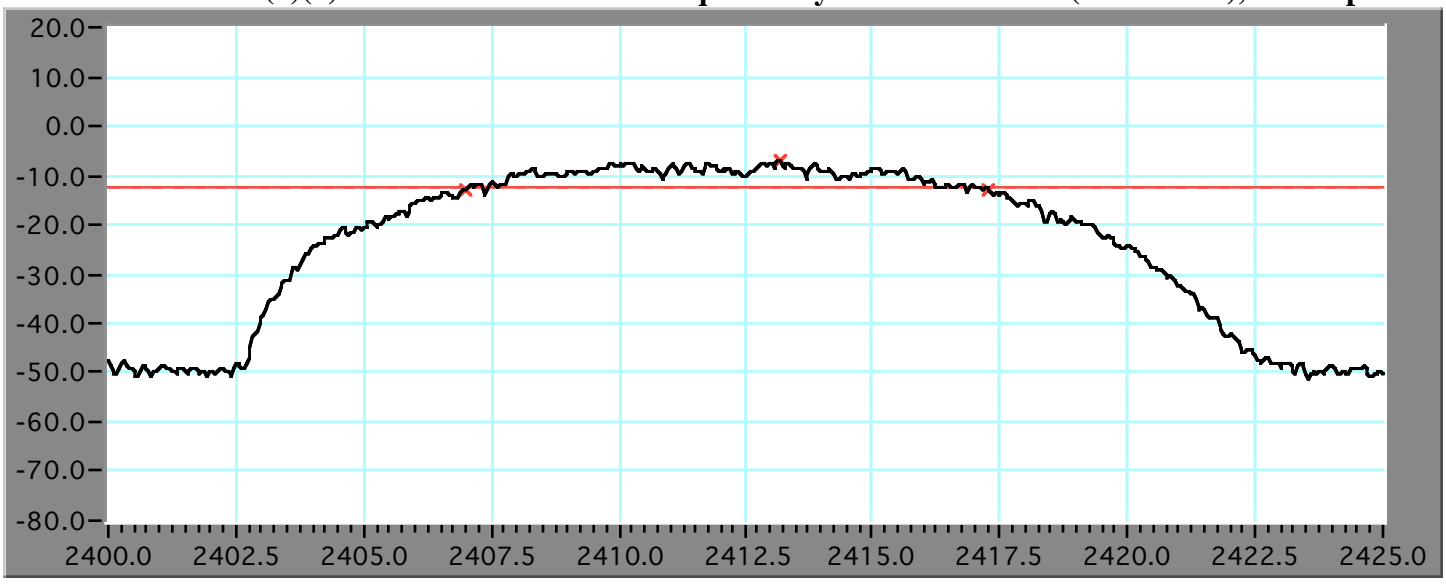
4.7 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Channel 11 (2.462 GHz), 1 Mbps



Channel	lower -6 dB frequency	upper -6 dB frequency	Data Rate	**6 dB Bandwidth**
11 - 2462 MHz	2457 MHz	2467.2 MHz	1 Mbps	10.2 MHz

Date of Test: November 7, 2001

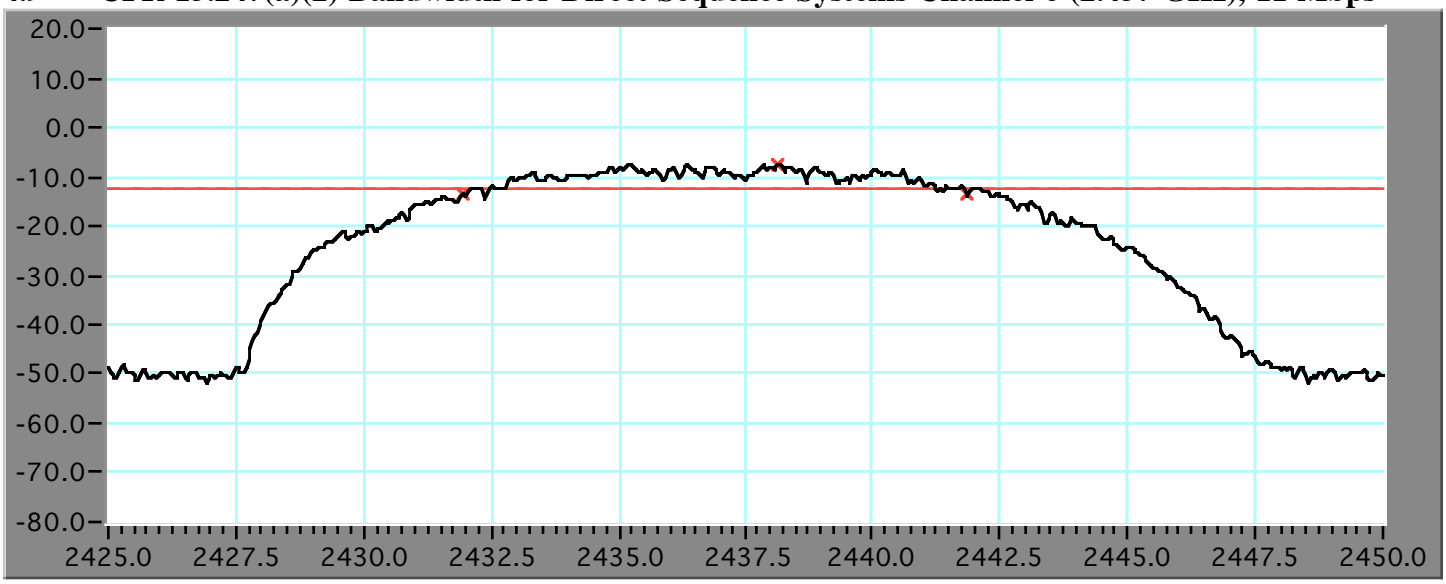
4.8 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Channel 1 (2.412 GHz), 11 Mbps



Channel	lower -6 dB frequency	upper -6 dB frequency	Data Rate	**6 dB Bandwidth**
1 - 2412 MHz	2407 MHz	2417.3 MHz	11 Mbps	10.3 MHz

Date of Test: November 7, 2001

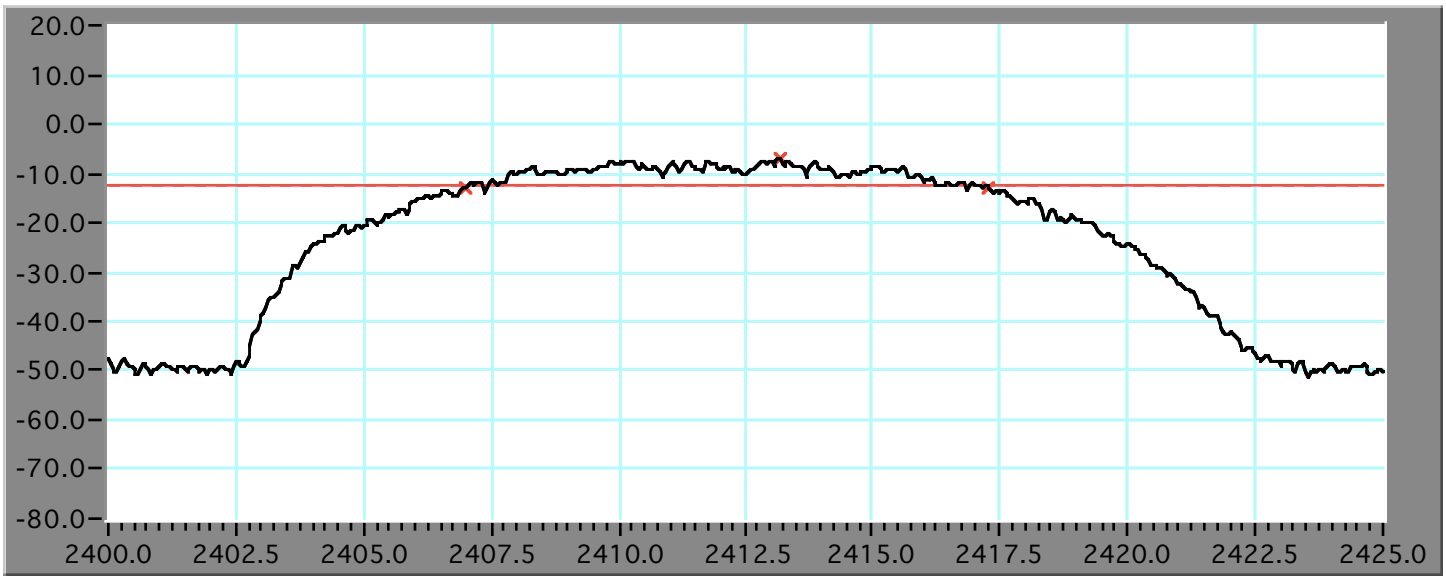
4.9 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Channel 6 (2.437 GHz), 11 Mbps



Date of Test: November 7, 2001

Channel	lower -6 dB frequency	upper -6 dB frequency	Data Rate	**6 dB Bandwidth**
6 - 2437 MHz	2431.9 MHz	2441.8 MHz	11 Mbps	9.9 MHz

4.10 CFR 15.247(a)(2) Bandwidth for Direct Sequence Systems Channel 11 (2.462 GHz), 11 Mbps



Channel	lower -6 dB frequency	upper -6 dB frequency	Data Rate	**6 dB Bandwidth**
11 - 2462 MHz	2457 MHz	2466.8 MHz	11 Mbps	9.8 MHz

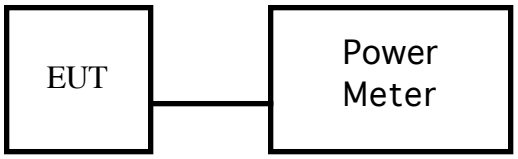
Date of Test: November 7, 2001

5 CFR 15.247(b)(1)Maximum Power Output

5.1 CFR 15.247(b)(1)Maximum Power Output Test Setup

The Setup for measuring the bandwidth is straight forward and is depicted in the figure below.

Conducted Output Power Test Setup



5.2 CFR 15.247(b)(1)Maximum Power Output Test Procedures

The transmitter output is connected to the spectrum analyzer RF input. The bandwidth of the spectrum analyzer was set to 100 kHz. The 6 dB bandwidth of the transmitter is defined as the portion of the signal which is higher than the peak signal minus 6 dB.

5.3 CFR 15.247(b)(1)Maximum Power Output Test Equipment

Description	Manufacturer	Model No.	Identification No.	Last Cal	Next Cal
Power Meter	Rohde & Schwarz	URV5	E3954	Nov., 2001	Nov., 2002
100nW - 500 mW 10 MHz - 18 GHz Power Sensor Head	Rohde & Schwarz	NRV-Z-2	A0410	Nov., 2001	Nov., 2002

5.3.1 CFR 15.247(b)(1)Maximum Power Output Instrument Settings

Rohde & Schwarz Power Meter Instrument Settings	
Measurement Mode	Absolute Units
Measurement Units	dBm
Range	Auto
Channel	B

5.4 CFR 15.247(b)(1)Maximum Power Output EUT Operating Conditions

The transmitter was set to transmit continuously at 1 Mbps and the channels which were measured were the low, mid and high channels. At each channel, the bandwidth was recorded. The process was repeated using 2, 5.5 and 11 Mbps data rates.

5.5 CFR 15.247(b)(1)Maximum Power Output - Channels 1, 6 and 11

Channel	Frequency	Maximum Output Power (1 Mbps)	Maximum Output Power (2 Mbps)	Maximum Output Power (5.5 Mbps)	Maximum Output Power (11 Mbps)
1	2412 MHz	14.4 dBm	14.4 dBm	14.0 dBm	14.2 dBm
6	2437 MHz	14.6 dBm	14.6 dBm	14.2 dBm	14.4 dBm
11	2462 MHz	14.7 dBm	14.7 dBm	14.3 dBm	14.4 dBm

Date of Test: November 7, 2001

6 CFR 15.247(b)(4) RF Exposure Calculation

The following calculations are based on guidelines published in OET Bulliten 65, Supplement C, Edition 01-01, August 1997:Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

For a simple case discounting reflections, from Friis formula the power density is given as:

$$\text{Power Density} = PG / 4 \bullet \pi \bullet r^2$$

where

P = Maximum Transmitter Output Power
G = Antennna Gain
r = distance from antenna

P = 16.08 dBm (see Section 5.1 of this report)
P = 10^(6.08 / 10) = 40.55 mW

G = 3.0 dB (see Section 1.6.7 of this report)
G = 10^(3 / 10) = 2

Using the general population - uncontrolled Maximum Power Density limit of 1mW / cm^2 at a distance of 20 cm as given in OET Bulliten 65

Power Density = 40.55 • 2 / (4 • π • 20^2)

Power Density = 0.0161 mW / cm^2 - This is well under the limit of 1 mW / cm^2.

If we use a stricter prediction which includes reflections from nearby surfaces to determine worst case

Power Density = PG / π•r^2

Power Density = 40.55 • 2 / (π • 20^2)

Power Density = 0.064 mW / cm^2 - This is still under the limit of 1mW / cm^2

7 CFR 15.247(c) -20 dBc Spurious Conducted Emissions

7.1 CFR 15.247(c) -20 dBc Spurious Conducted Emissions Test Setup

Spurious Emissions measurements were performed at the Apple Computer 3 meter semi-anechoic chamber located at 20650 Valley Green Drive. The EUT was placed on a nonmetallic table, 80 cm above the metallic ground-plane. The EUT and peripherals were powered from a filtered main supply.

7.2 CFR 15.247(c) -20 dBc Spurious Conducted Emissions Test Procedure

The frequency spectrum from 1 GHz to 25 GHz was scanned

Scans were performed with the transmitter frequency set to the low, mid and high channels and -20 dBc Spurious Emissions data is provided in this report for each case.

- low channel - 2.412 GHz
- mid channel - 2.437 GHz
- high channel - 2.462 GHz

7.3 CFR 15.247(c) -20 dBc Spurious Conducted Emissions Test Equipment

The following test equipment was used when performing spurious emissions tests above 1 GHz.

Description	Manufacturer	Model No.	Identification No.	Last Cal	Next Cal
Spectrum Anayzer	HP	HP 8563E	AOU201613	Feb., 2001	Feb., 2002

7.3.1 CFR 15.247(c) -20 dBc Spurious Conducted Emissions Instrument Settings

Instrument Settings					
Frequency Range	Resolution BW	Video BW	Reference Level	Attenuation	Sweep Time
2 GHz - 2.8 GHz	100 kHz	300 kHz	20 dBm	30 dB	100 mS
2.8 GHz - 6 GHz	100 kHz	300 kHz	20 dBm	30 dB	100 mS
6 GHz - 12 GHz	100 kHz	300 kHz	20 dBm	30 dB	800 mS
12 GHz - 18 GHz	100 kHz	300 kHz	20 dBm	30 dB	1.5 S
18 GHz - 25 GHz	100 kHz	300 kHz	20 dBm	30 dB	1.8 S

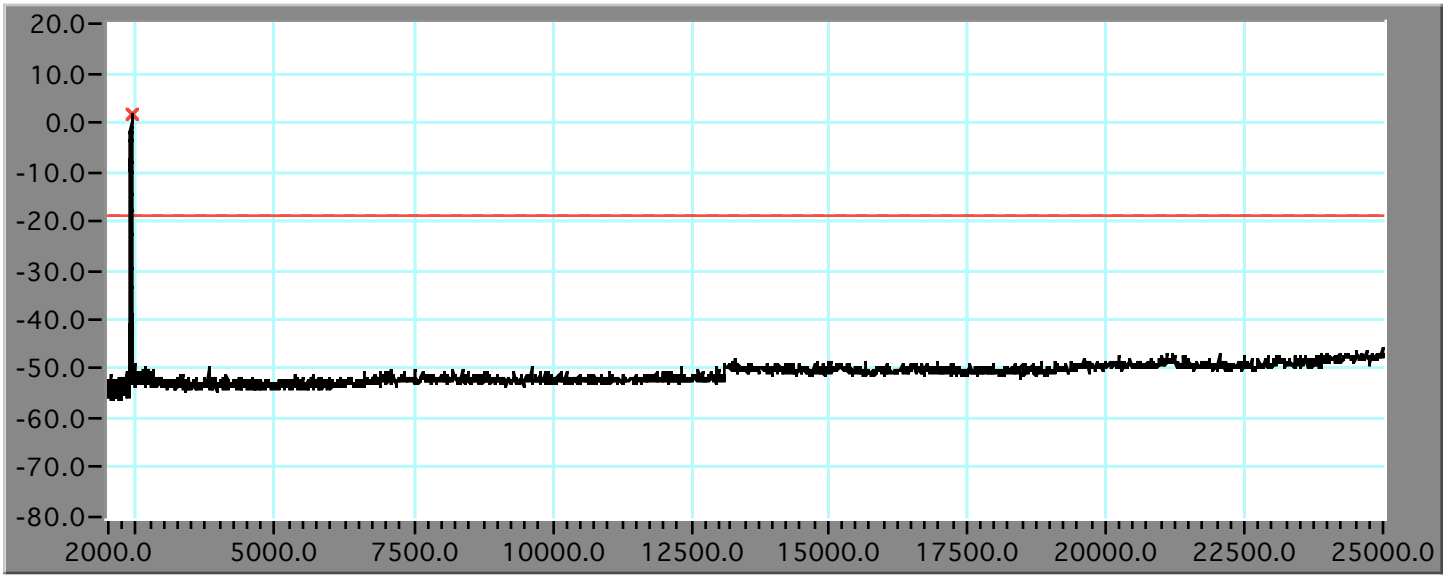
7.4 CFR 15.247(c) -20 dBc Spurious Conducted Emissions EUT Operating Conditions

The Airport Base Station ethernet ports, internal modem and RF portion were activated simultaneously throughout the testing as described in the following two paragraphs.

The ethernet ports on the Airport Base Station were activated by using them as an ethernet hub as follows. A local laptop computer was connected to one of the Airport Base Station ethernet ports and the other Airport Base Station ethernet port was connected to a local server. The local laptop computer was configured to continuously read and write a text file to the local server through the Airport Base Station.

The wireless portion of the Airport Base Station was activated as follows: The Airport Base Station was configured with the modem connected to an analog line. The modem was on and configured to maintain a connection to a local ISP which provided a dynamic IP address to the Airport Base Station. The Airport Base Station dynamically assigned an IP address wirelessly to a local client labtop computer. The client laptop computer, using a web browser, downloaded a large file over the internet throughout the testing.

7.5 CFR 15.247(c) -20 dBc Spurious Conducted Emissions -Channel 1 (2.412 GHz)

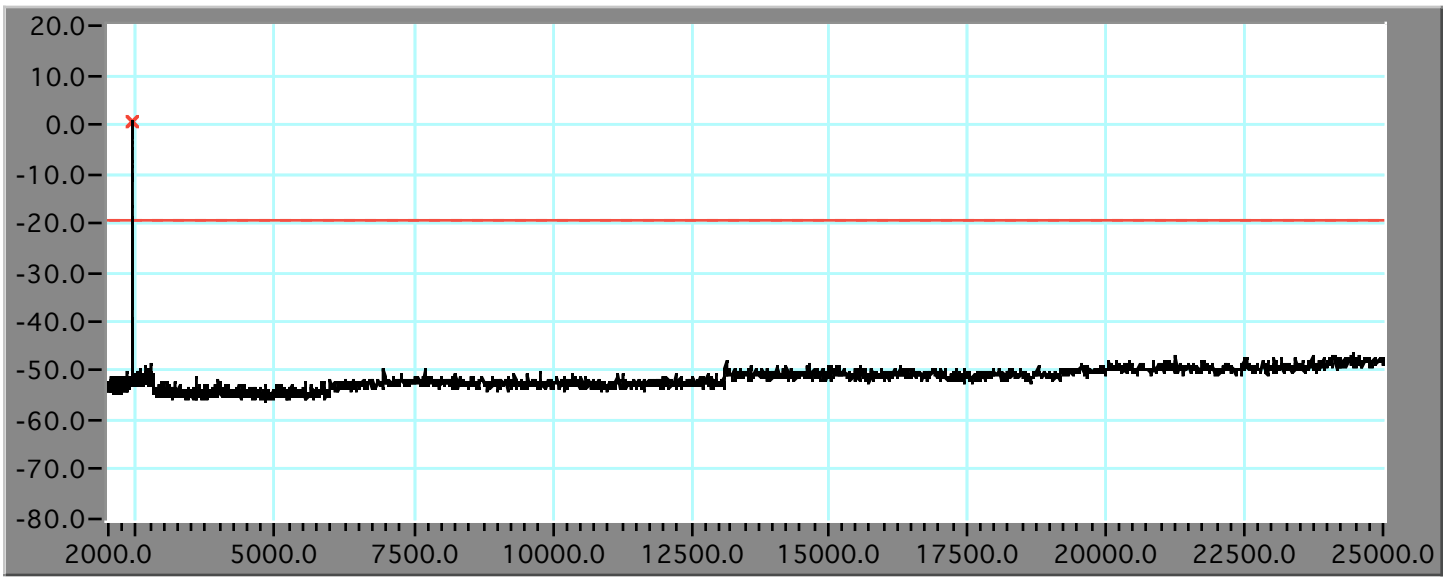


Frequency	Level	Limit	Raw Data	Cable	All Factors
MHz	dBm	dBm	dBm	dB	dB
2409.33	1.5	-18.5	0.82	0.68	-0.68

All levels are with a peak detector unless otherwise indicated.
The values listed in the table have a frequency precision error due to the wide span.

Date of Test: November 9, 2001

7.6 CFR 15.247(c) -20 dBc Spurious Conducted Emissions - Channel 6 (2.437 GHz)

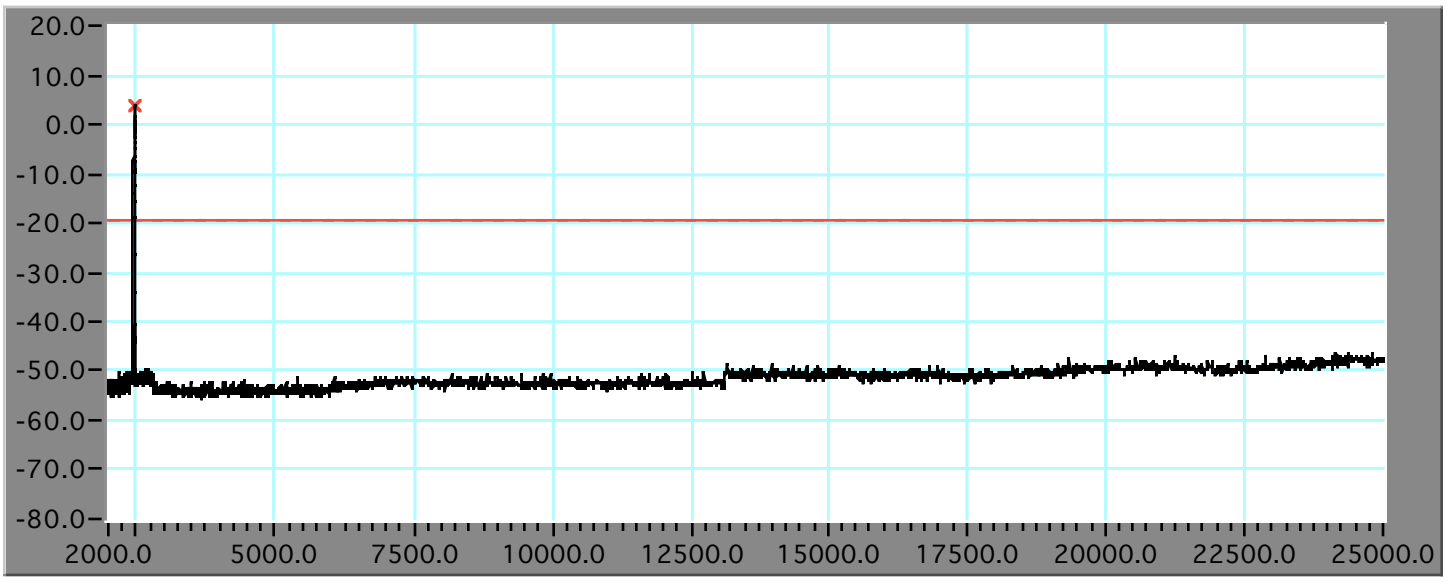


Frequency	Level	Limit	Raw Data	Cable	All Factors
MHz	dBm	dBm	dBm	dB	dB
2438.67	0.5	-19.5	-0.18	0.68	-0.68

All levels are with a peak detector unless otherwise indicated.
The values listed in the table have a frequency precision error due to the wide span.

Date of Test: November 9, 2001

7.7 CFR 15.247(c) -20 dBc Spurious Conducted Emissions Channel 11 (2.462 GHz)



Frequency	Level	Limit	Raw Data	Cable	All Factors
MHz	dBm	dBm	dBm	dB	dB
2462.00	3.8	-19.5	3.16	0.68	-0.68

All levels are with a peak detector unless otherwise indicated.

Date of Test: November 9, 2001