

# TEST REPORT

## Class II Permissive Change

for the

## Apple Bluetooth Module

Bluetooth Model # A1044  
New Antenna Model # A1067

Apple Computer, Inc.

June 17, 2003

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## Test Report Summary

Specification	Test Description	Result	Comment
CFR 15.207(a)	Conducted Emission/Mains 150 kHz to 30 MHz	Pass	Section 2
CFR 15.209(a)	Radiated Emissions 30 MHz to 25 GHz	Pass	Section 3
CFR 15.247(b)(4)	RF Exposure	Pass	Section 4
CFR 15.247(c)	-20 dBc Spurious Emissions	Pass	Section 5

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## 1 General Information

### 1.1 Introduction and Purpose of testing for Class II Permissive Change

Apple Computer uses a Bluetooth module in our computers. The module has already been approved by the FCC per CFR 47 Part 15, Subpart C as a Frequency Hopping Spread Spectrum system. Apple Computer plans to use this module in a new Apple Desktop computer with a new external Apple antenna.

The first 2 antennas listed below have already been approved by the FCC for use with the Apple Bluetooth module. The last antenna, shown in bold, is the new antenna and is the purpose of this application for a Class II permissive change.

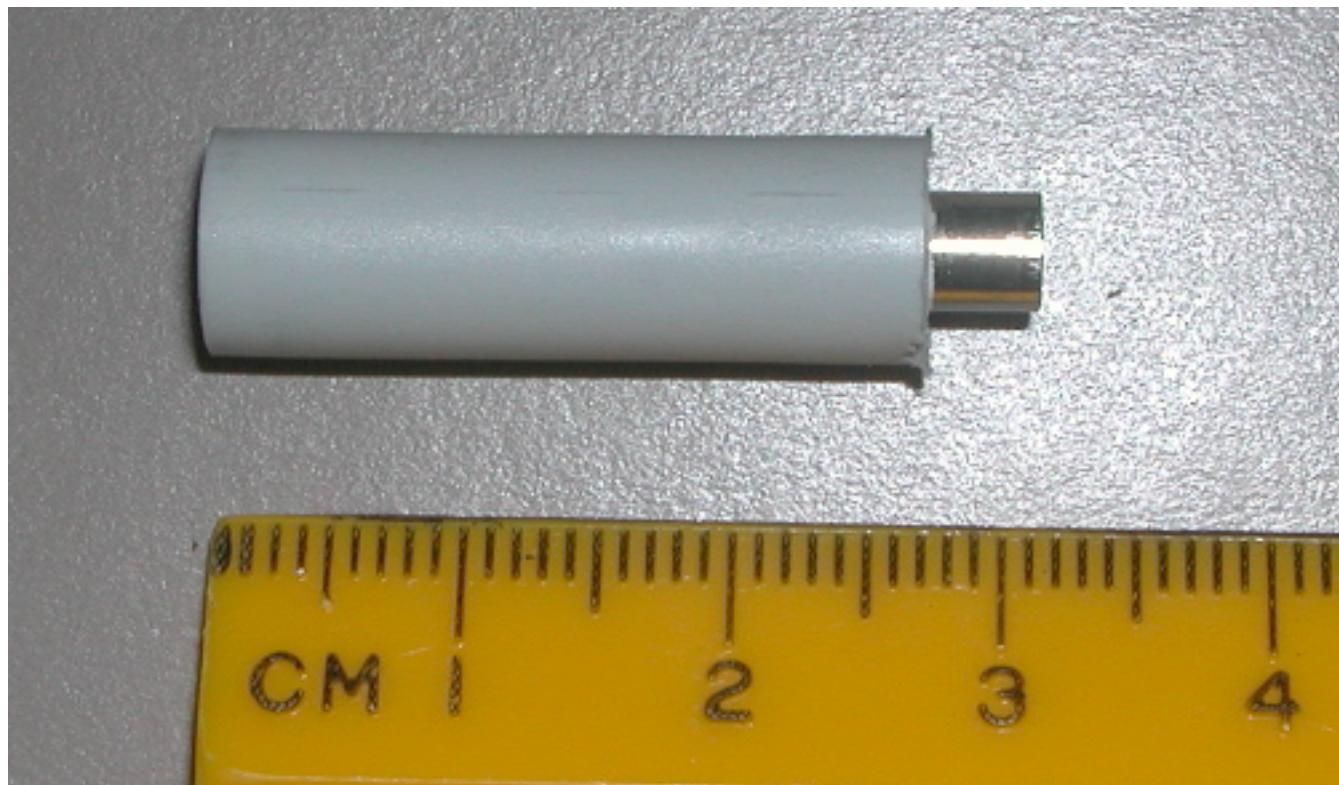
Type	Antenna Gain dBi	Antenna Model Number
Internal Inverted F	-4.4	620-2250
Internal Patch	-1.9	603-2239
<b>External Monopole - new</b>	<b>+2.41</b>	<b>A1067</b>

### 1.2 Product General and Technical Descriptions

Information on the existing Apple Bluetooth Module card is provided in the table below.

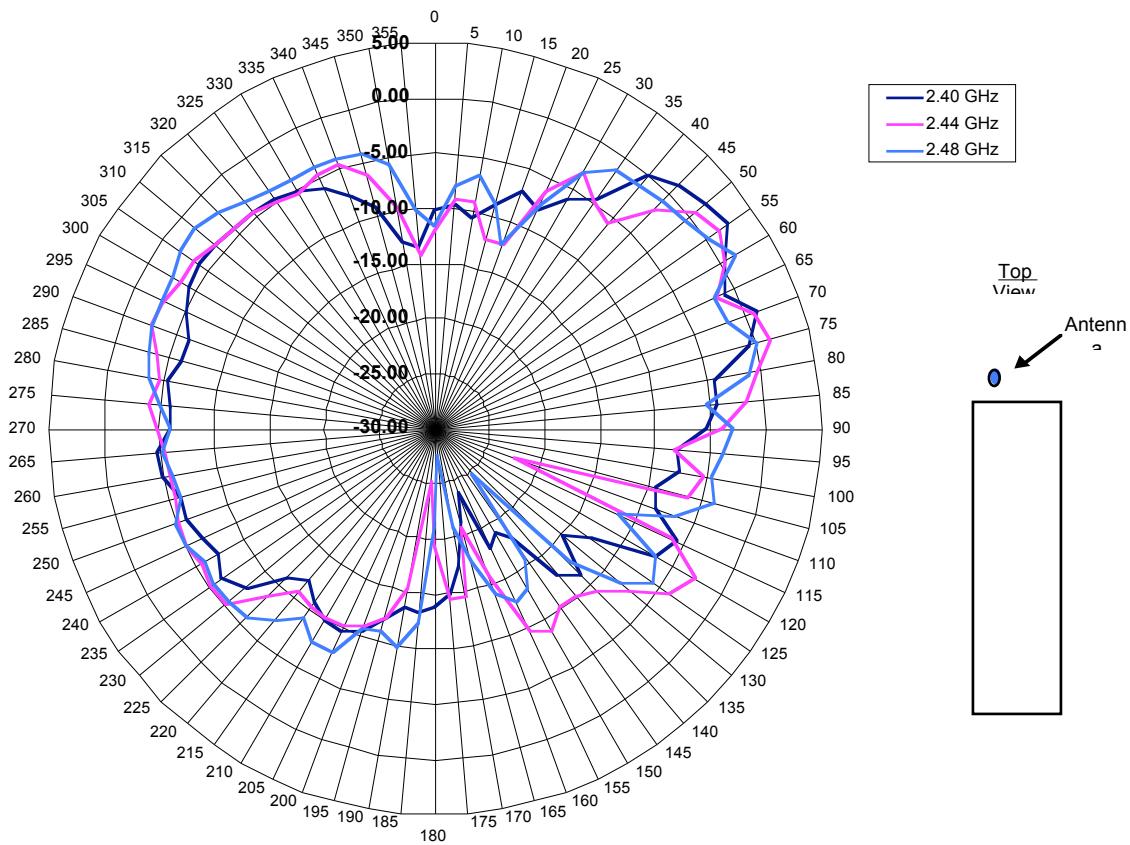
Existing Wireless Lan Card information	
<b>Model Number</b>	A1044
<b>FCC ID</b>	BCGA1026
<b>Date of Original FCC Grant</b>	January 7, 2003
<b>Equipment Class</b>	Part 15 Spread Spectrum
<b>Method</b>	Frequency Hopping Spread Spectrum
<b>Max RF Power Output</b>	0.005 W
<b>Frequency Range</b>	2402 MHz - 2480 MHz
<b>Number of Channels</b>	79

1.3 Antenna Photographs



## 1.4

## Antenna Radiation Data

Model A1067 Bluetooth Antenna; All Cables Included; Azimuth Pattern  
(AirPort Antenna Installed)

## 1.4 Antenna Radiation Data - continued

Model A1067 BlueTooth Antenna				Model A1067 BlueTooth Antenna			
Angle	2.40 GHz	2.44 GHz	2.48 GHz	Angle	2.40 GHz	2.44 GHz	2.48 GHz
0	-10.04	-11.96	-11.50	185	-13.20	-25.34	-12.34
5	-9.58	-9.07	-7.82	190	-13.71	-15.32	-9.88
10	-10.57	-9.15	-6.71	195	-12.33	-12.32	-10.89
15	-8.97	-12.24	-8.86	200	-10.46	-11.01	-10.66
20	-7.01	-12.27	-12.30	205	-9.67	-10.36	-7.78
25	-8.07	-6.11	-7.66	210	-9.99	-10.20	-7.59
30	-5.99	-3.22	-3.10	215	-10.97	-10.25	-9.27
35	-4.44	-4.82	-1.38	220	-12.16	-10.65	-7.44
40	0.07	-5.70	-1.13	225	-10.91	-8.50	-5.79
45	1.31	-1.89	-0.73	230	-7.60	-5.42	-5.45
50	1.89	0.68	-0.39	235	-6.40	-5.00	-5.47
55	2.41	1.49	0.24	240	-7.28	-5.65	-5.90
60	0.35	0.25	1.35	245	-6.73	-5.20	-5.20
65	-0.96	-1.76	-2.00	250	-5.93	-5.08	-5.05
70	1.03	0.62	-1.88	255	-6.06	-5.59	-6.22
75	-0.69	1.32	0.12	260	-4.97	-5.59	-5.78
80	-4.21	-0.52	-1.26	265	-4.51	-5.46	-5.14
85	-4.43	-1.83	-5.42	270	-5.91	-4.67	-5.88
90	-5.34	-3.92	-3.16	275	-5.84	-3.99	-5.01
95	-7.97	-8.24	-3.91	280	-5.31	-4.72	-3.69
100	-7.47	-5.46	-4.63	285	-6.14	-3.85	-3.17
105	-9.21	-6.21	-3.93	290	-6.21	-2.55	-2.66
110	-8.70	-22.43	-6.89	295	-5.03	-2.72	-2.60
115	-5.86	-6.40	-11.64	300	-4.15	-3.29	-2.50
120	-7.02	-2.88	-6.97	305	-3.93	-3.38	-1.80
125	-12.84	-4.02	-5.81	310	-4.04	-3.89	-1.52
130	-15.12	-7.20	-8.19	315	-4.20	-4.23	-2.06
135	-11.34	-9.13	-12.91	320	-4.24	-4.28	-3.06
140	-12.76	-10.32	-24.79	325	-4.65	-4.92	-3.61
145	-17.89	-10.18	-15.70	330	-5.18	-5.25	-3.88
150	-19.15	-8.90	-13.37	335	-6.03	-4.51	-3.81
155	-17.96	-9.73	-12.68	340	-7.62	-4.52	-3.82
160	-23.96	-15.72	-14.10	345	-9.19	-6.15	-4.13
165	-21.23	-20.88	-17.50	350	-12.66	-9.52	-5.64
170	-17.42	-14.53	-20.96	355	-13.41	-14.13	-10.15
175	-15.05	-14.42	-27.55				
180	-13.79	-19.38	-21.19				
MAX	<b>2.41</b>	1.49	1.35		-3.93	-2.55	-1.52

1.5

## Apple Bluetooth Module Regulatory Certification Sheet

Bluetooth  
Regulatory Certification

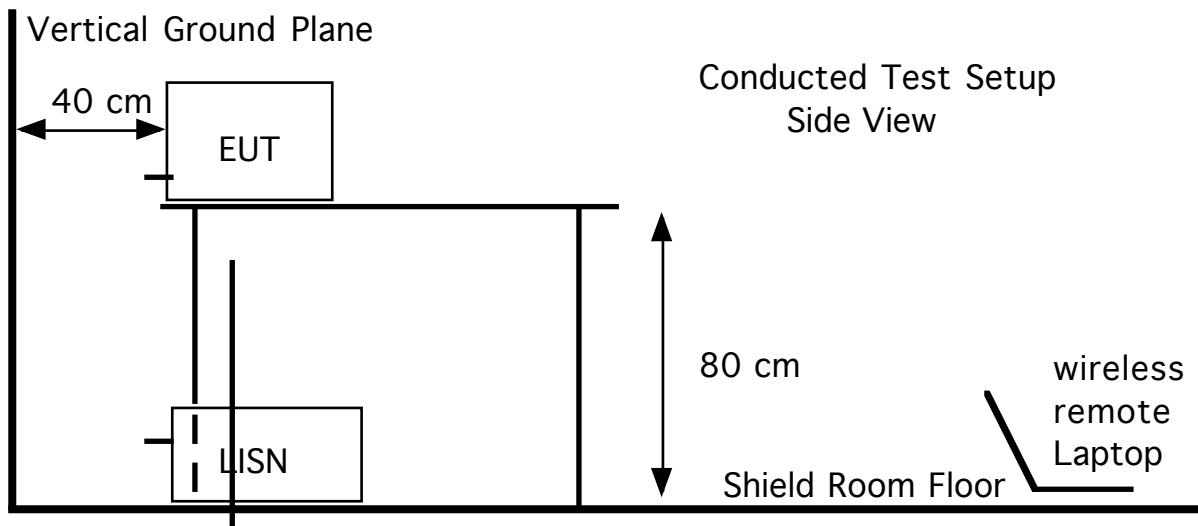
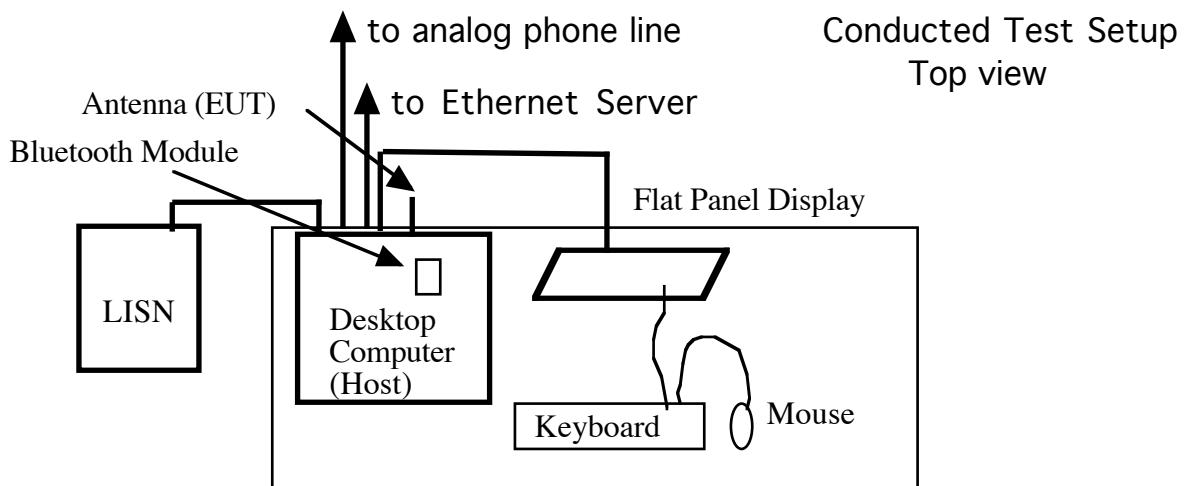
Country	Certification model number	Certification number
Argentina	A1044	16-2791
Australia	A1044	DoC
Austria, Belgium, Denmark, Finland, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom	A1044	CE0984
Canada	A1044	Industry Canada 579C-A1044. For indoor use only.
France	A1044	CE 0984. For indoor use only.
Italy	A1044	CE 0984. If used outside of own premises, general authorization is required.
Japan	A1044	DSRR: 03NYCA0006
New Zealand	A1044	DoC
United States (including Puerto Rico)	A1044	FCC ID: BCGA1044

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## 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	1838A00423	23 January, 2003	23 January 2004
Receiver	R&S	ESCS30	100140	4 January, 2003	4 January 2004
LISN/AMN	R&S	ESH3-Z5	153874	28 May, 2003	28 May, 2004

Notes: H.P. is an abbreviation for Hewlett Packard.

R&S is an abbreviation for Rhode & Schwarz.

The above equipment is traceable to NVLAP calibration standards.

### 2.3.1 CFR 15.207(a) Conducted Emissions Instrument Settings:

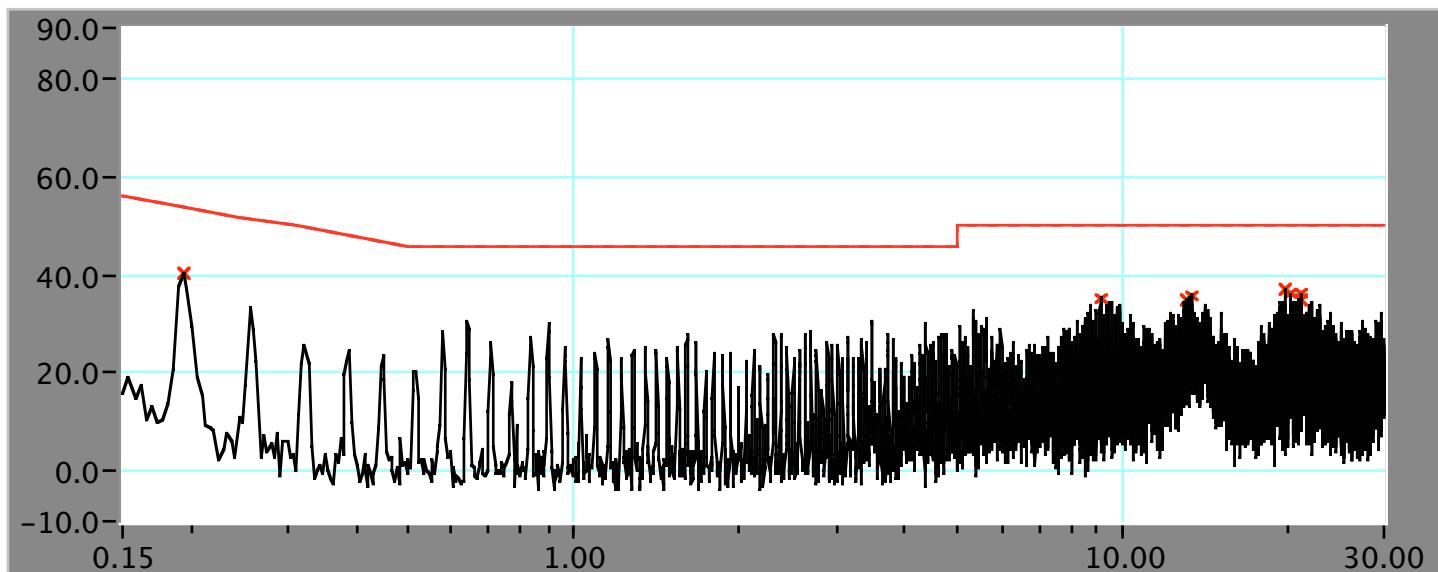
Instrument Settings				
Frequency Range	Reference Level	Attenuation	Resolution BW	Video BW
150 kHz - 30 MHz	90 dBuV	10	10 kHz	10 kHz

## 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.

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

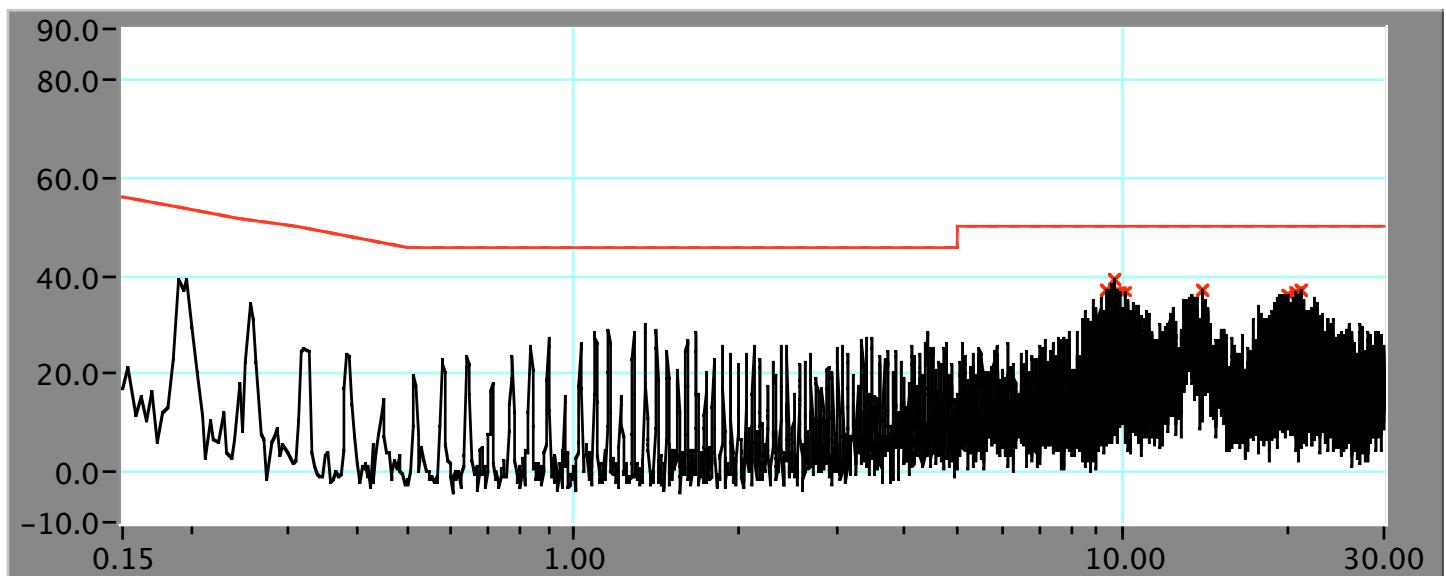
Date of test: May 30, 2003



Frequency	Level	Limit	Delta	Raw Data	LISN	Cable	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB
0.193	40.3	53.9	-13.6	38.24	1.99	0.06	-2.05
9.208	35.3	50.0	-14.7	34.57	0.46	0.30	-0.76
13.079	34.8	50.0	-15.2	33.94	0.52	0.36	-0.88
13.372	35.8	50.0	-14.2	34.87	0.52	0.36	-0.88
19.766	37.3	50.0	-12.7	36.18	0.66	0.45	-1.11
20.211	36.0	50.0	-14.0	34.91	0.67	0.45	-1.12
21.114	36.3	50.0	-13.7	35.13	0.71	0.46	-1.17
21.317	34.4	50.0	-15.6	33.16	0.76	0.47	-1.22

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
9.400	37.6	50.0	-12.4	36.82	0.43	0.30	-0.73
9.724	39.7	50.0	-10.3	39.00	0.43	0.30	-0.73
9.982	37.0	50.0	-13.0	36.27	0.42	0.30	-0.72
10.177	36.7	50.0	-13.3	35.93	0.43	0.31	-0.74
14.091	37.2	50.0	-12.8	36.36	0.47	0.37	-0.84
20.094	36.3	50.0	-13.7	35.23	0.60	0.45	-1.05
20.668	36.9	50.0	-13.1	35.83	0.61	0.46	-1.07
21.114	37.5	50.0	-12.5	36.37	0.64	0.46	-1.10

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  $\leq$  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	Rohde & Schwarz	ESIB 26	100025	30 Aug 2002	30 Aug 2003
EMI Receiver	Rohde & Schwarz	ESIB 26	100025	30 Aug 2002	30 Aug 2003
Antenna	Sunol	JB1	A122302-1	7 Jan 2003	7 Jan 2004
Amplifier	Evelyn 1 Amplifier	N/A	103	28 Jan 2003	28 Jan 2004

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:

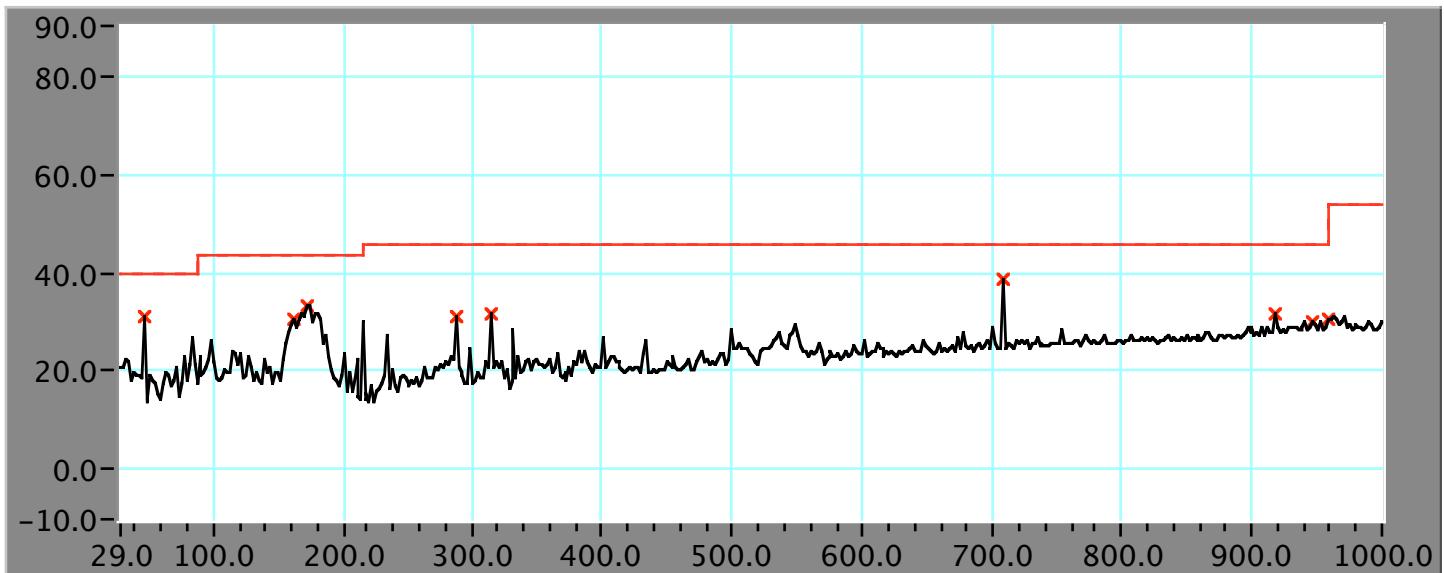
Instrument Settings				
Frequency Range	Reference Level	Attenuation	Resolution BW	Video BW
30 MHz - 1 GHz	90 dBuV	10	100 kHz	100 kHz

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

The Antenna was installed on the desktop computer and a wireless computer-to-computer network was created and the appropriate channel was selected (1, 6 or 11). Pre-testing found that the highest data rate of 54 Mbps created the worst case conditions so this data rate was selected for final testing. A large file was transferred from the desktop computer to a remote client.

## 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 2.402 GHz (Channel 1).



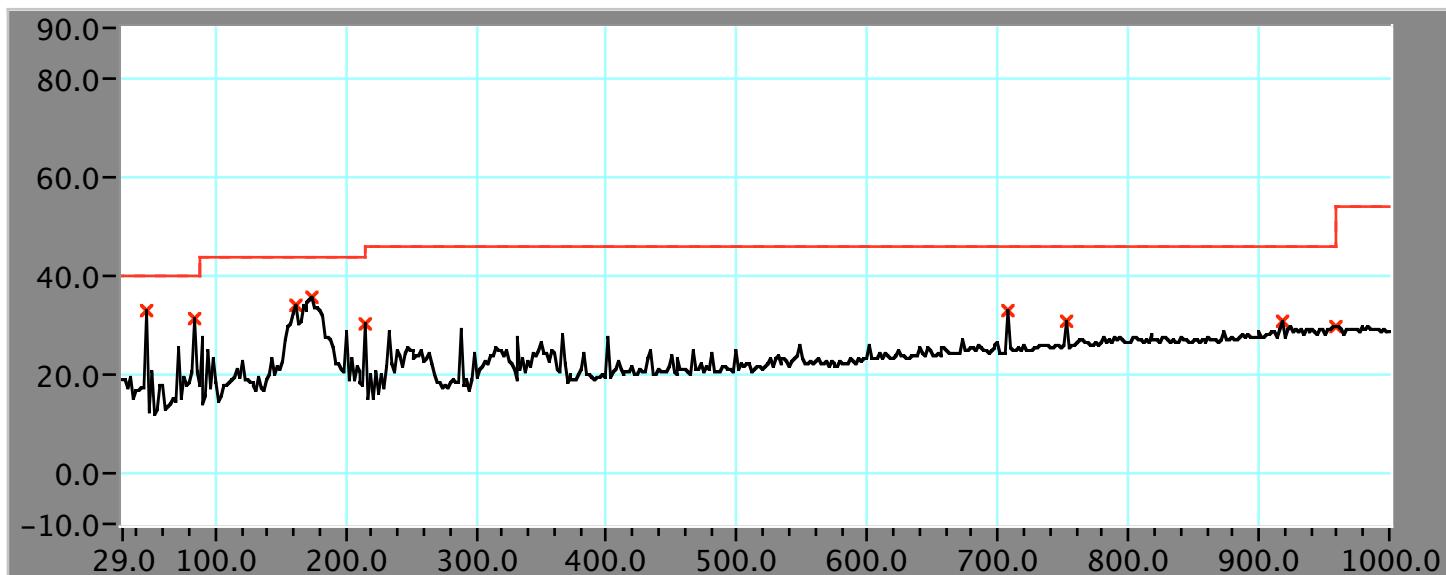
Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factor
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
46.51	30.9	40.0	-9.1	72.44	9.36	1.30	52.21	41.55
161.32	30.6	43.5	-12.9	65.59	12.72	2.21	49.95	35.02
173.00	32.9	43.5	-10.6	68.28	12.24	2.28	49.90	35.37
287.80	30.8	46.0	-15.2	63.50	13.70	3.05	49.50	32.75
315.05	31.2	46.0	-14.8	63.00	14.00	3.20	49.03	31.82
708.12	39.2	46.0	-6.8	61.94	20.60	5.14	48.51	22.77
918.27	31.5	46.0	-14.5	51.12	22.67	6.24	48.55	19.64
947.46	29.9	46.0	-16.1	48.96	22.90	6.39	48.33	19.04
959.14	30.4	46.0	-15.6	49.18	22.92	6.52	48.25	18.81

All levels are with a peak detector.

Data of test: May 30, 2003

## 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 2.402 GHz (Channel 1).



Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factor
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
46.51	32.9	40.0	-7.1	73.50	10.31	1.30	52.21	40.60
83.48	31.6	40.0	-8.4	72.82	8.39	1.70	51.33	41.24
161.32	34.2	43.5	-9.3	69.49	12.40	2.21	49.95	35.34
174.94	36.0	43.5	-7.5	71.73	11.80	2.31	49.88	35.77
215.81	30.1	43.5	-13.4	65.77	11.52	2.56	49.77	35.70
708.12	33.0	46.0	-13.0	55.43	20.96	5.14	48.51	22.41
752.87	30.7	46.0	-15.3	52.16	21.61	5.41	48.50	21.48
918.27	30.9	46.0	-15.1	49.78	23.47	6.24	48.55	18.84
959.14	29.9	46.0	-16.1	47.37	24.22	6.52	48.25	17.51

All levels are with a peak detector.

Date of Test: May 30, 2003

**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 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.

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

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

The restricted bands at the lower and upper edges of the ISM band were scanned for the maximum emissions with the transmitter set to transmit at corresponding low and highest channels. After completing the band edge tests, the frequency spectrum from 1 GHz to 25 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.

Spurious radiated emissions 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 - 2.402 GHz
- mid channel - 2.441 GHz
- high channel - 2.480 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.

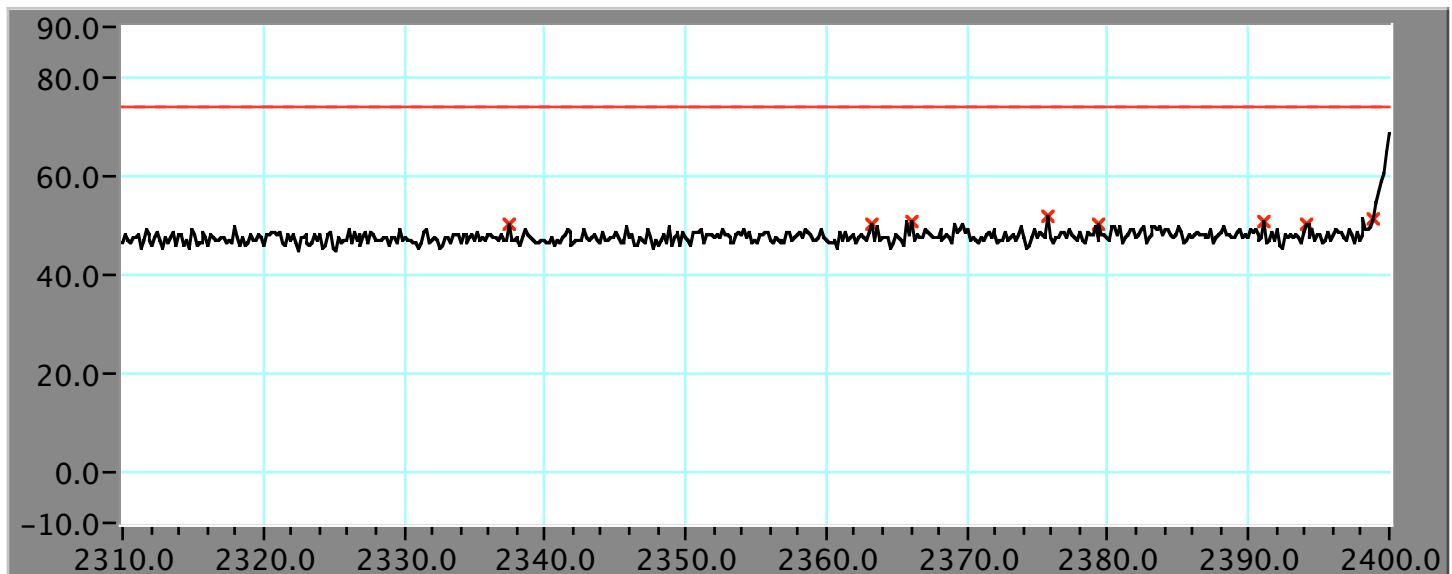
Description	Manufacturer	Model No.	Identification No.	Last Cal	Next Cal
Spectrum Analyzer	Rohde & Schwarz	ESIB	100025	30 Aug 2002	30 Aug 2003
Amplifier (18-25 GHz)	HP	8449	3008A00713	4 March 2003	4 March 2004
Amplifier (1 - 18 GHz)	Advanced Microwave	WLA614	Amp 11	19 Feb 2003	19 Feb 2004
Horn Antenna	EMCO	3160-09	011269-0041264	09/01	09/05
Horn Antenna	EMCO	3115	9904-5788	09/01	09/05

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

The Bluetooth antenna model A1067 was installed on the desktop computer. Special software was used to set the internal Bluetooth module into a continuous transmit mode at a fixed channel. Radiated emissions data is provided for the low, mid and highest channels as described in the following table.

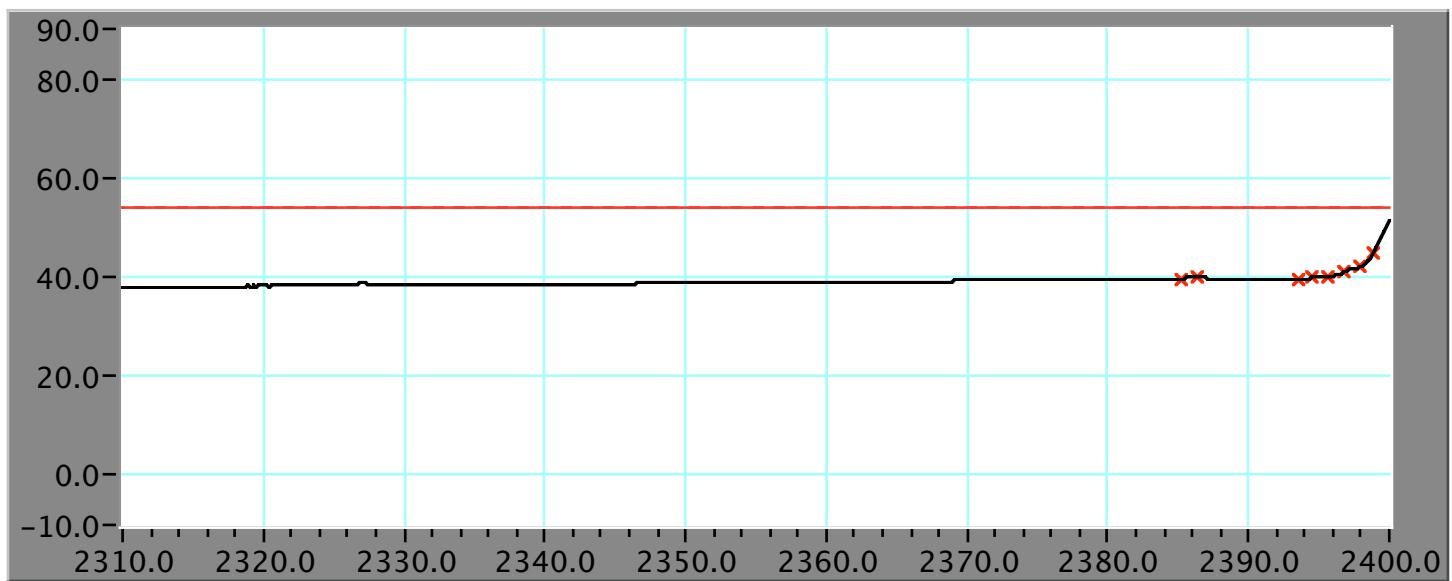
Description	Transmit Frequency	Detection	Polarity
2310 MHz - 2390 MHz Restricted Band	2402 MHz	Peak and Average	Vertical and Horizontal
2483.5 MHz - 2500 MHz Restricted Band	2480 MHz	Peak and Average	Vertical and Horizontal
1 - 25 GHz Spurious	2402 MHz 2441 MHz 2480 MHz	Peak data plotted against Average Limit	Vertical and Horizontal

## 2310 MHz - 2390 MHz Restricted Band - Vertical, channel 1 (2.402 GHz), Peak Detection



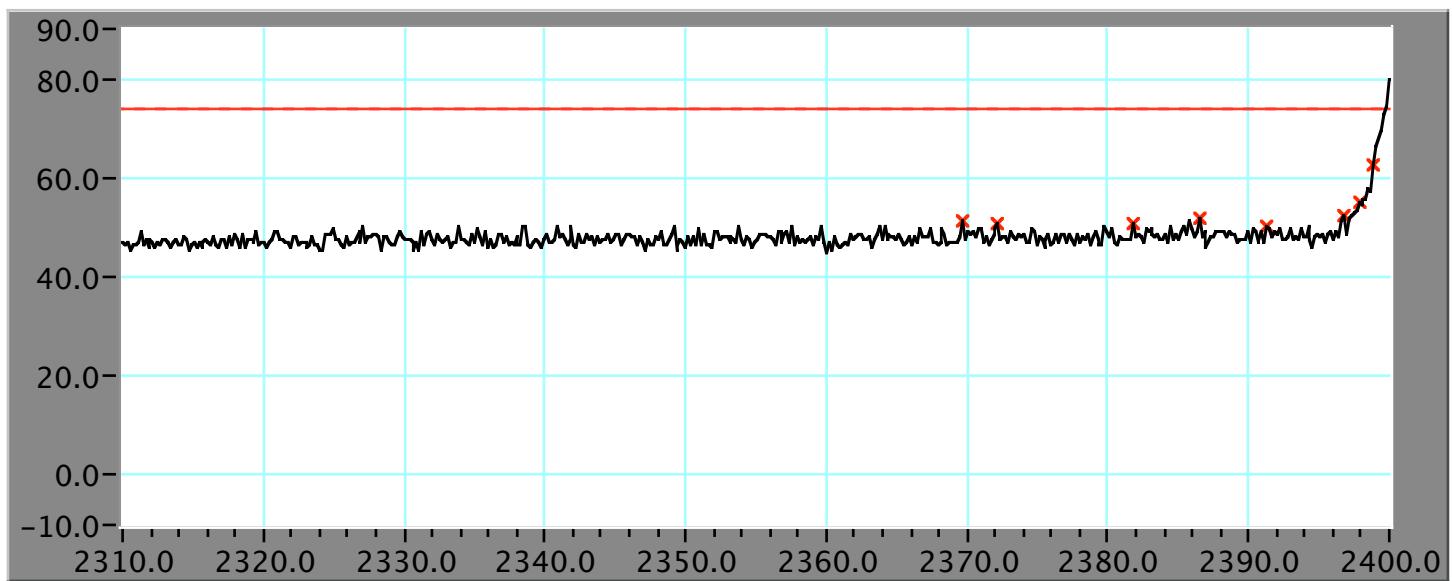
Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factor
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
2337.41	50.4	74.0	-23.6	24.94	30.11	4.84	9.50	-25.45
2363.21	50.2	74.0	-23.8	24.63	30.19	4.86	9.50	-25.55
2366.09	50.8	74.0	-23.2	25.28	30.20	4.87	9.50	-25.56
2375.83	51.7	74.0	-22.3	26.07	30.23	4.88	9.50	-25.60
2379.44	50.2	74.0	-23.8	24.60	30.24	4.88	9.50	-25.62
2391.16	50.8	74.0	-23.2	25.12	30.27	4.89	9.50	-25.66
2394.05	50.4	74.0	-23.6	24.69	30.28	4.89	9.50	-25.68
2398.92	51.5	74.0	-22.5	25.76	30.30	4.90	9.50	-25.70

## 2310 MHz - 2390 MHz Restricted Band - Vertical, channel 1 (2.402 GHz), Average Detection



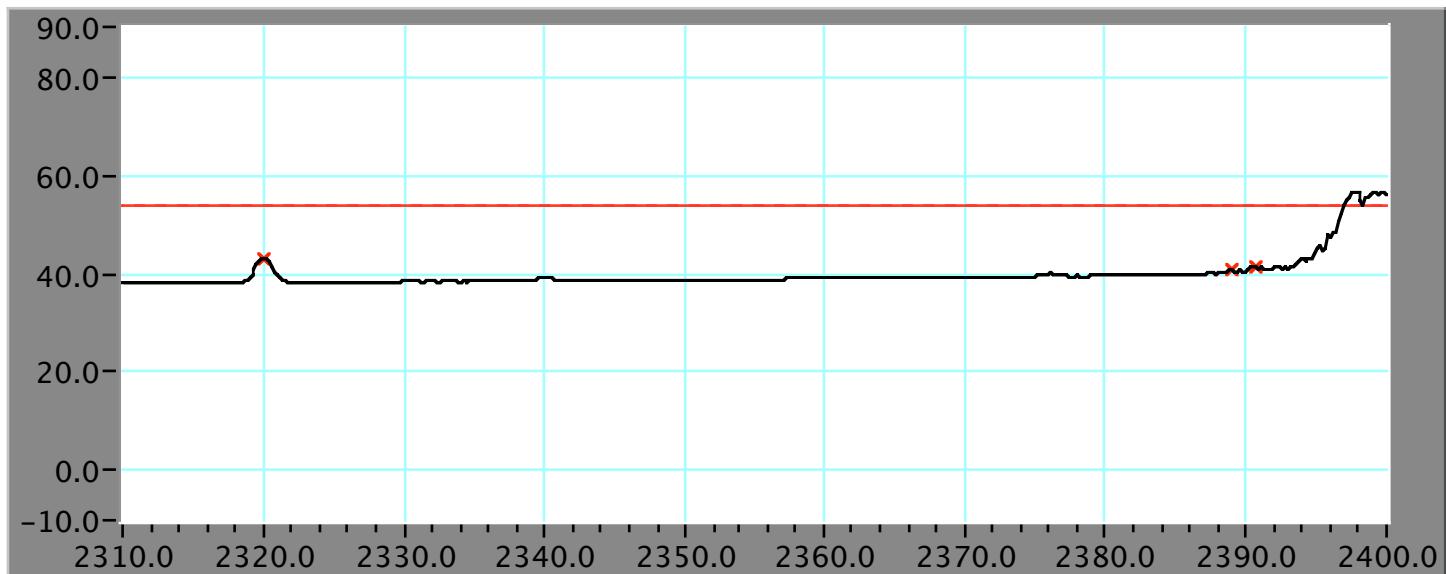
Frequency MHz	Level dBuV/m	Limit dBuV/m	Delta dB	Raw Data dBuV	Antenna dB	Cable dB	Amp dB	All Factor dB
2385.21	39.6	54.0	-14.4	14.02	30.21	4.89	9.50	-25.59
2386.29	40.1	54.0	-13.9	14.51	30.21	4.89	9.50	-25.60
2393.51	39.7	54.0	-14.3	14.06	30.24	4.89	9.50	-25.63
2394.59	39.8	54.0	-14.2	14.14	30.24	4.89	9.50	-25.64
2395.67	40.0	54.0	-14.0	14.38	30.25	4.90	9.50	-25.64
2396.75	41.0	54.0	-13.0	15.32	30.25	4.90	9.50	-25.65
2397.84	41.9	54.0	-12.1	16.24	30.25	4.90	9.50	-25.65
2398.92	44.8	54.0	-9.2	19.18	30.26	4.90	9.50	-25.66

## 2310 MHz - 2390 MHz Restricted Band - Horizontal, channel 1 (2.402 GHz), Peak Detection

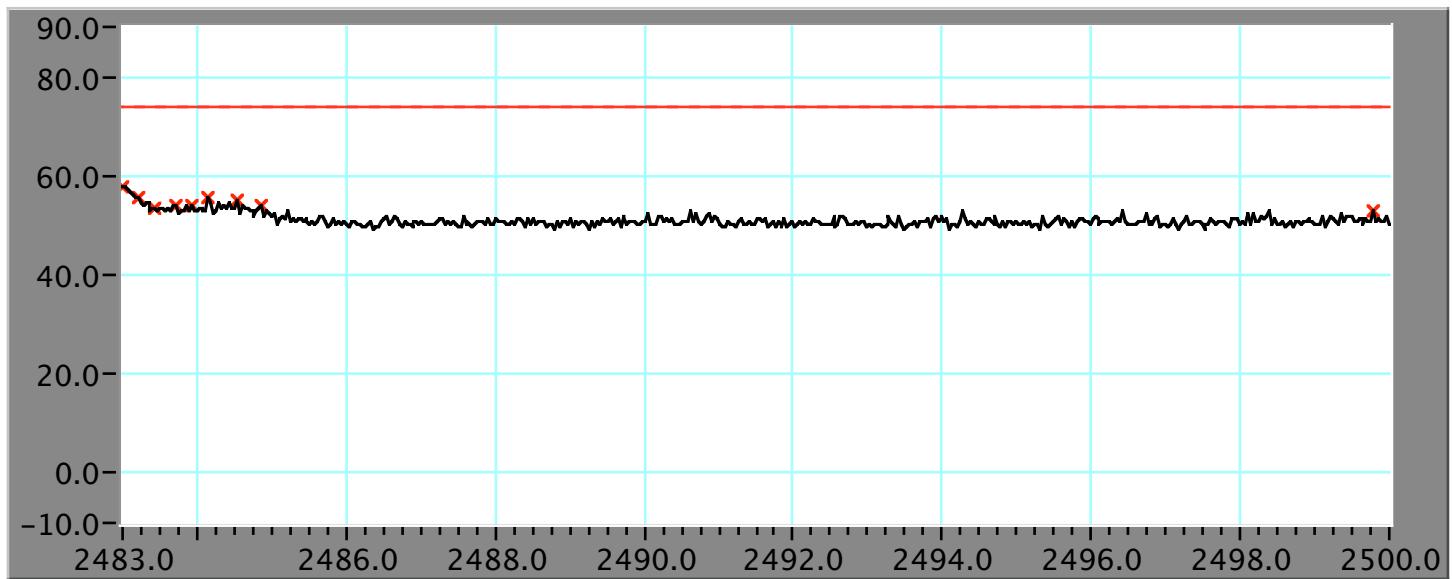


Frequency MHz	Level dBuV/m	Limit dBuV/m	Delta dB	Raw Data dBuV	Antenna dB	Cable dB	Amp dB	All Factor dB
2369.70	51.1	74.0	-22.9	25.54	30.16	4.87	9.50	-25.53
2372.22	50.8	74.0	-23.2	25.31	30.17	4.87	9.50	-25.54
2381.78	50.6	74.0	-23.4	24.97	30.20	4.88	9.50	-25.58
2386.47	52.1	74.0	-21.9	26.46	30.21	4.89	9.50	-25.60
2391.34	50.4	74.0	-23.6	24.78	30.23	4.89	9.50	-25.62
2396.75	52.6	74.0	-21.4	26.92	30.25	4.90	9.50	-25.65
2397.84	55.3	74.0	-18.7	29.61	30.25	4.90	9.50	-25.65
2398.92	62.6	74.0	-11.4	36.93	30.26	4.90	9.50	-25.66

2310 MHz - 2390 MHz Restricted Band - Horizontal, channel 1 (2.402 GHz), Average Detection

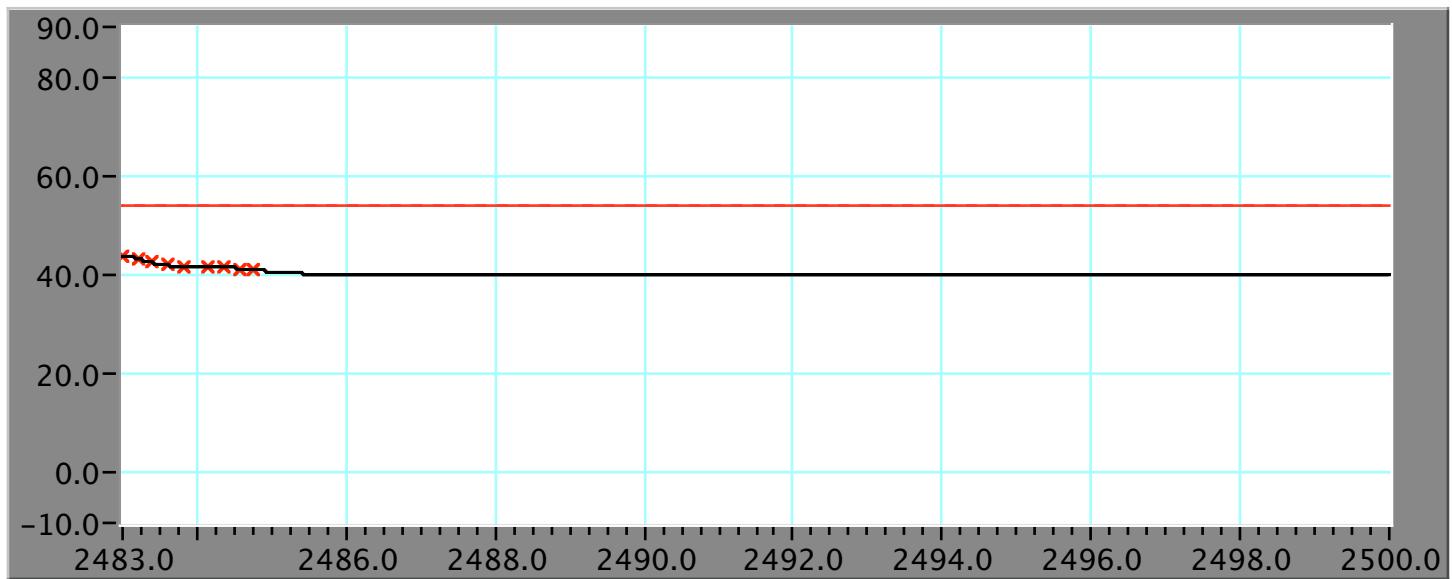


## 2483.5 MHz - 2500 MHz Restricted Band - Vertical, channel 79 (2.480 GHz), Peak Detection



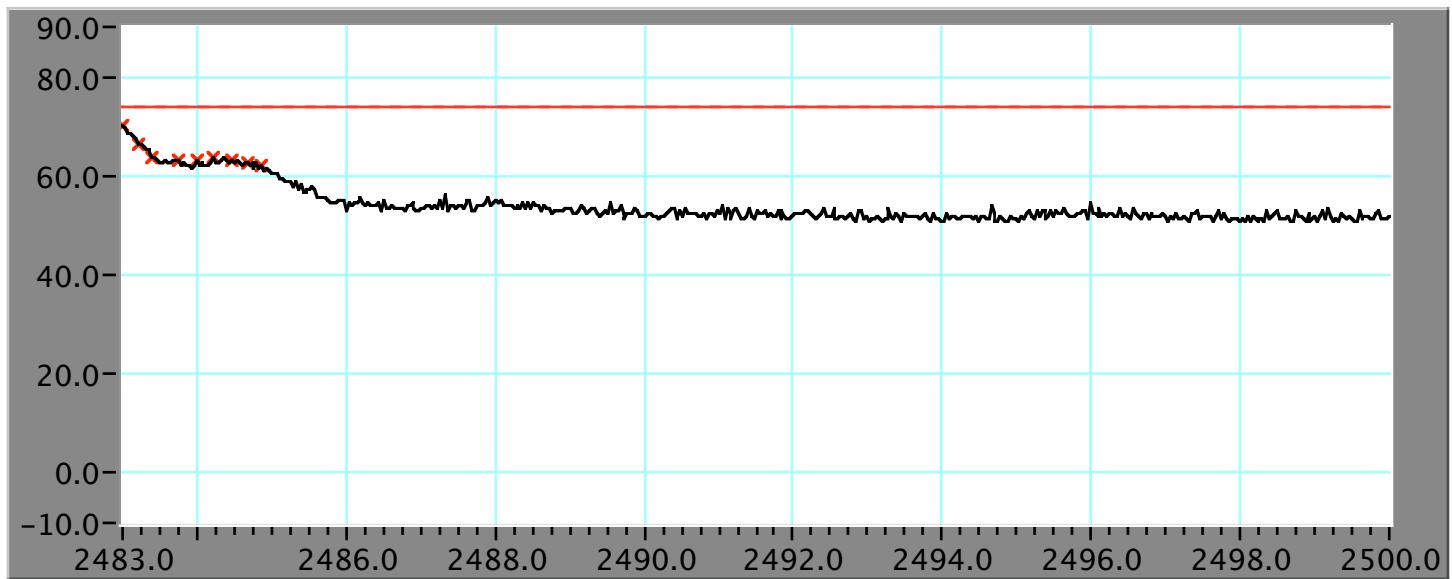
Frequency MHz	Level dBuV/m	Limit dBuV/m	Delta dB	Raw Data dBuV	Antenna dB	Cable dB	Amp dB	All Factor dB
2483.00	58.0	74.0	-16.0	31.92	30.55	4.98	9.50	-26.03
2483.20	55.7	74.0	-18.3	29.63	30.55	4.98	9.50	-26.03
2483.44	53.5	74.0	-20.5	27.44	30.55	4.98	9.50	-26.03
2483.72	54.2	74.0	-19.8	28.19	30.55	4.98	9.50	-26.03
2483.92	53.7	74.0	-20.3	27.68	30.55	4.98	9.50	-26.04
2484.16	55.4	74.0	-18.6	29.38	30.55	4.98	9.50	-26.04
2484.53	54.9	74.0	-19.1	28.83	30.55	4.98	9.50	-26.04
2484.87	53.9	74.0	-20.1	27.86	30.55	4.98	9.50	-26.04
2499.80	53.1	74.0	-20.9	26.98	30.60	5.00	9.50	-26.10

## 2483.50 MHz - 2500 MHz Restricted Band - Vertical, channel 79 (2.480 GHz), Average Detection



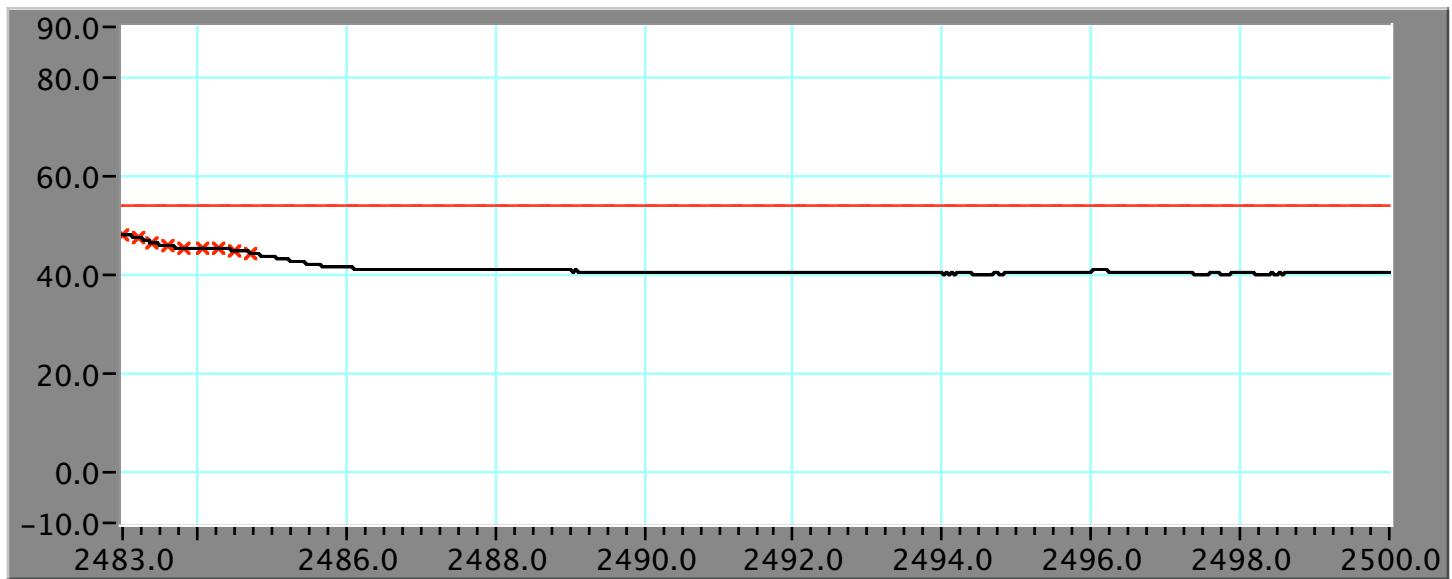
Frequency MHz	Level dBuV/m	Limit dBuV/m	Delta dB	Raw Data dBuV	Antenna dB	Cable dB	Amp dB	All Factor dB
2483.00	43.9	54.0	-10.1	17.83	30.55	4.98	9.50	-26.03
2483.20	43.2	54.0	-10.8	17.20	30.55	4.98	9.50	-26.03
2483.41	42.5	54.0	-11.5	16.42	30.55	4.98	9.50	-26.03
2483.61	41.9	54.0	-12.1	15.86	30.55	4.98	9.50	-26.03
2483.82	41.7	54.0	-12.3	15.63	30.55	4.98	9.50	-26.04
2484.16	41.6	54.0	-12.4	15.57	30.55	4.98	9.50	-26.04
2484.36	41.5	54.0	-12.5	15.44	30.55	4.98	9.50	-26.04
2484.57	41.3	54.0	-12.7	15.23	30.55	4.98	9.50	-26.04
2484.77	41.1	54.0	-12.9	15.03	30.55	4.98	9.50	-26.04

## 2483.5 MHz - 2500 MHz Restricted Band - Horizontal, channel 79 (2.480 GHz), Peak Detection



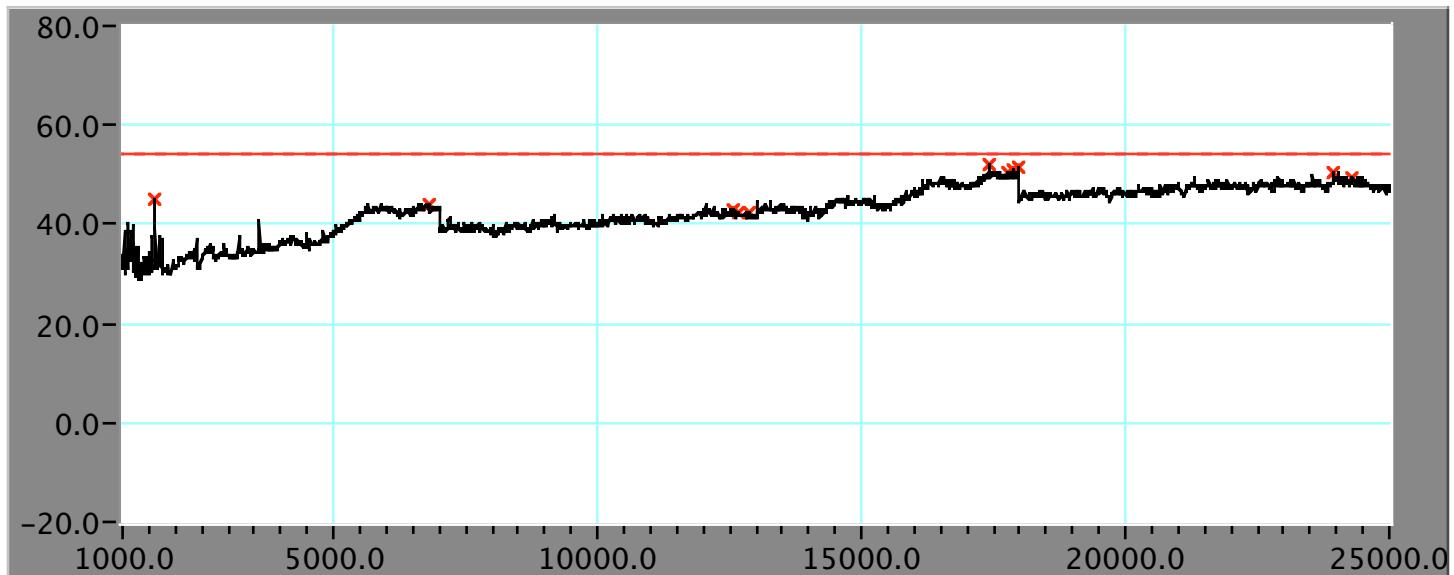
Frequency MHz	Level dBuV/m	Limit dBuV/m	Delta dB	Raw Data dBuV	Antenna dB	Cable dB	Amp dB	All Factor dB
2483.00	70.1	74.0	-3.9	44.04	30.54	4.98	9.50	-26.03
2483.20	66.6	74.0	-7.4	40.57	30.54	4.98	9.50	-26.03
2483.41	63.8	74.0	-10.2	37.74	30.54	4.98	9.50	-26.03
2483.75	63.2	74.0	-10.8	37.16	30.54	4.98	9.50	-26.03
2483.99	63.2	74.0	-10.8	37.16	30.55	4.98	9.50	-26.03
2484.23	63.6	74.0	-10.4	37.53	30.55	4.98	9.50	-26.03
2484.46	63.2	74.0	-10.8	37.16	30.55	4.98	9.50	-26.03
2484.67	62.7	74.0	-11.3	36.62	30.55	4.98	9.50	-26.03
2484.87	62.0	74.0	-12.0	35.94	30.55	4.98	9.50	-26.03

## 2483.5 MHz - 2500 MHz Restricted Band - Horizontal, channel 11 (2.462 GHz), Average Detection



Frequency MHz	Level dBuV/m	Limit dBuV/m	Delta dB	Raw Data dBuV	Antenna dB	Cable dB	Amp dB	All Factor dB
2483.00	48.2	54.0	-5.8	22.18	30.54	4.98	9.50	-26.03
2483.20	47.5	54.0	-6.5	21.43	30.54	4.98	9.50	-26.03
2483.41	46.5	54.0	-7.5	20.48	30.54	4.98	9.50	-26.03
2483.61	45.8	54.0	-8.2	19.75	30.54	4.98	9.50	-26.03
2483.82	45.5	54.0	-8.5	19.48	30.54	4.98	9.50	-26.03
2484.09	45.5	54.0	-8.5	19.44	30.55	4.98	9.50	-26.03
2484.29	45.3	54.0	-8.7	19.32	30.55	4.98	9.50	-26.03
2484.50	45.0	54.0	-9.0	18.98	30.55	4.98	9.50	-26.03
2484.70	44.5	54.0	-9.5	18.44	30.55	4.98	9.50	-26.03

## Spurious Radiated Emissions - Vertical, channel 1 (2.402 GHz)

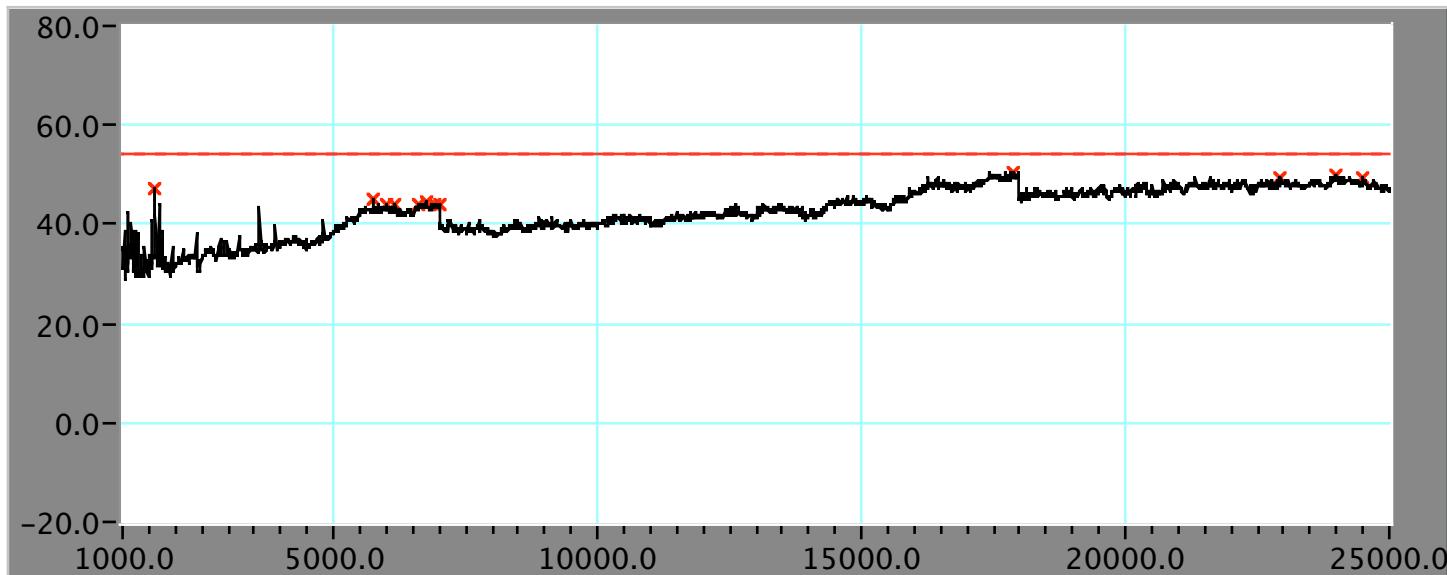


Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factor
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1613.23	45.0	54.0	-9.0	67.69	27.24	4.11	54.01	22.65
6819.64	44.0	54.0	-10.0	52.24	36.75	7.94	52.94	8.25
12591.18	43.0	54.0	-11.0	44.66	40.63	10.68	52.94	1.63
12663.33	42.5	54.0	-11.5	44.08	40.57	10.83	52.97	1.57
12855.71	42.4	54.0	-11.6	43.78	40.42	11.21	53.04	1.42
17408.82	51.8	54.0	-2.2	44.31	43.08	12.87	48.45	-7.51
17769.54	50.4	54.0	-3.6	42.53	44.47	13.05	49.69	-7.84
17879.76	50.9	54.0	-3.1	43.07	44.87	13.11	50.17	-7.81
17989.98	51.3	54.0	-2.7	43.51	45.26	13.16	50.66	-7.77
23950.00	50.2	54.0	-3.8	43.68	40.50	6.45	40.46	-6.49
24311.67	49.5	54.0	-4.5	43.05	40.50	6.51	40.56	-6.45

All levels are with a peak detector unless otherwise indicated.

Date of Test: June 2, 2003

## 3.2.6 CFR 15.209(a) Radiated Emissions - Horizontal, channel 1 (2.402 GHz)

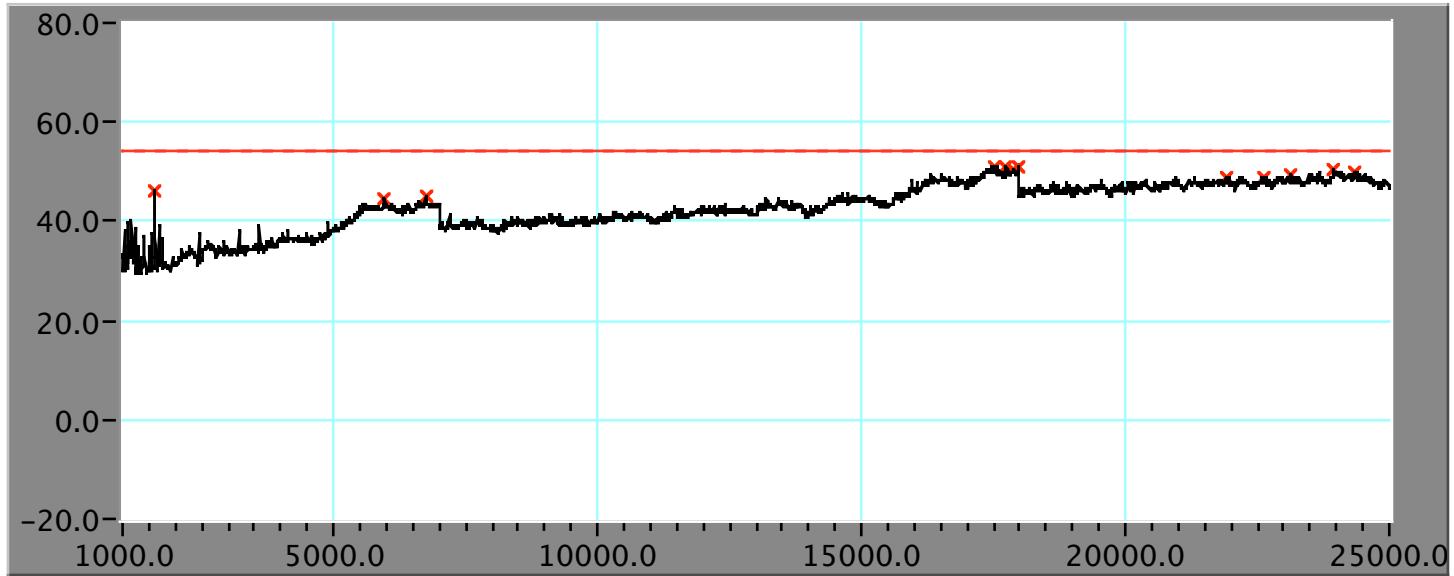


Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factor
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1613.23	47.2	54.0	-6.8	69.88	27.20	4.11	54.01	22.70
5749.50	44.9	54.0	-9.1	53.60	36.55	7.41	52.65	8.69
6002.00	44.0	54.0	-10.0	52.34	36.90	7.50	52.70	8.30
6170.34	44.0	54.0	-10.0	52.47	36.73	7.61	52.80	8.46
6615.23	44.0	54.0	-10.0	52.54	36.61	7.87	52.98	8.50
6735.47	44.4	54.0	-9.6	52.60	36.82	7.91	52.95	8.22
6927.86	43.9	54.0	-10.1	51.71	37.17	7.98	52.91	7.77
7000.00	44.2	54.0	-9.8	51.79	37.30	8.00	52.90	7.60
17899.80	50.6	54.0	-3.4	42.92	44.86	13.12	50.26	-7.72
22946.67	49.2	54.0	-4.8	83.32	0.00	6.28	40.44	34.15
23985.00	49.8	54.0	-4.2	83.84	0.00	6.45	40.46	34.00
24498.33	49.5	54.0	-4.5	83.84	0.00	6.54	40.88	34.34

All levels are with a peak detector unless otherwise indicated.

Date of Test: June 2, 2003

## 3.2.7 CFR 15.209(a) Radiated Emissions - Vertical Channel 40 (2.441 GHz)

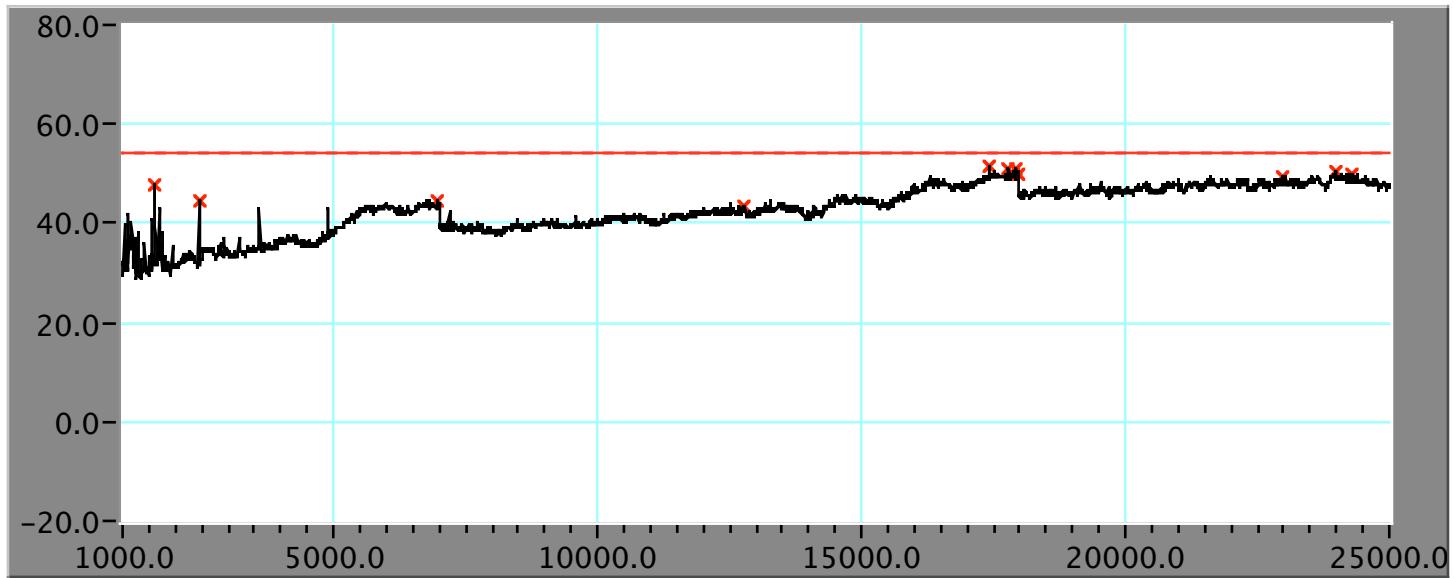


Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factor
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1613.23	46.2	54.0	-7.8	68.83	27.24	4.11	54.01	22.65
5965.93	44.4	54.0	-9.6	52.90	36.74	7.49	52.69	8.47
6735.47	44.8	54.0	-9.2	53.23	36.63	7.91	52.95	8.41
17529.06	50.9	54.0	-3.1	42.98	43.60	12.93	48.63	-7.91
17739.48	50.7	54.0	-3.3	42.86	44.36	13.04	49.55	-7.85
17899.80	50.5	54.0	-3.5	42.67	44.94	13.12	50.26	-7.80
17989.98	50.9	54.0	-3.1	43.15	45.26	13.16	50.66	-7.77
21920.00	48.8	54.0	-5.2	42.64	40.50	6.11	40.41	-6.20
22643.33	49.0	54.0	-5.0	42.69	40.50	6.23	40.42	-6.31
23145.00	49.5	54.0	-4.5	43.13	40.50	6.32	40.44	-6.37
23950.00	50.3	54.0	-3.7	43.85	40.50	6.45	40.46	-6.49
24346.67	49.8	54.0	-4.2	43.44	40.50	6.51	40.62	-6.40

All levels are with a peak detector unless otherwise indicated.

Date of Test: June 2, 2003

## 3.2.8 CFR 15.209(a) Radiated Emissions - Horizontal Channel 40 (2.441 GHz)

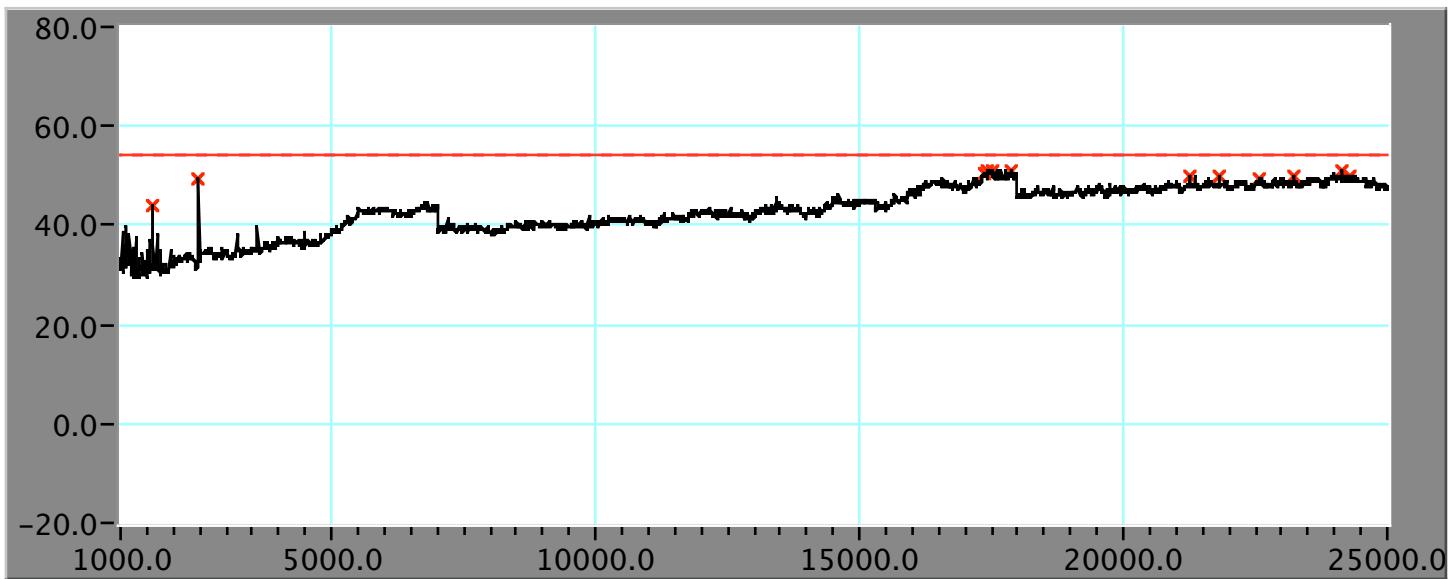


Frequency	Level	Limit	Delta	Raw Data	Antenna	Cable	Amp	All Factor
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1613.23	47.5	54.0	-6.5	70.20	27.20	4.11	54.01	22.70
2442.89	44.5	54.0	-9.5	66.00	30.41	4.94	56.89	21.54
6963.93	44.6	54.0	-9.4	52.24	37.24	7.99	52.91	7.68
12795.59	43.4	54.0	-10.6	44.78	40.55	11.09	53.02	1.38
17418.84	51.3	54.0	-2.7	44.08	42.76	12.88	48.45	-7.19
17799.60	51.1	54.0	-2.9	43.45	44.42	13.07	49.82	-7.67
17859.72	49.9	54.0	-4.1	42.16	44.68	13.10	50.08	-7.70
17919.84	51.1	54.0	-2.9	43.34	44.95	13.13	50.35	-7.73
17979.96	50.1	54.0	-3.9	42.29	45.21	13.16	50.61	-7.76
22981.67	49.5	54.0	-4.5	83.65	0.00	6.29	40.44	34.15
23996.67	50.2	54.0	-3.8	84.17	0.00	6.46	40.46	34.00
24311.67	49.7	54.0	-4.3	83.72	0.00	6.51	40.56	34.05

All levels are with a peak detector unless otherwise indicated.

Date of Test: June 2, 2003

## 3.2.9 CFR 15.209(a) Radiated Emissions - Vertical Channel 79 (2.480 GHz)

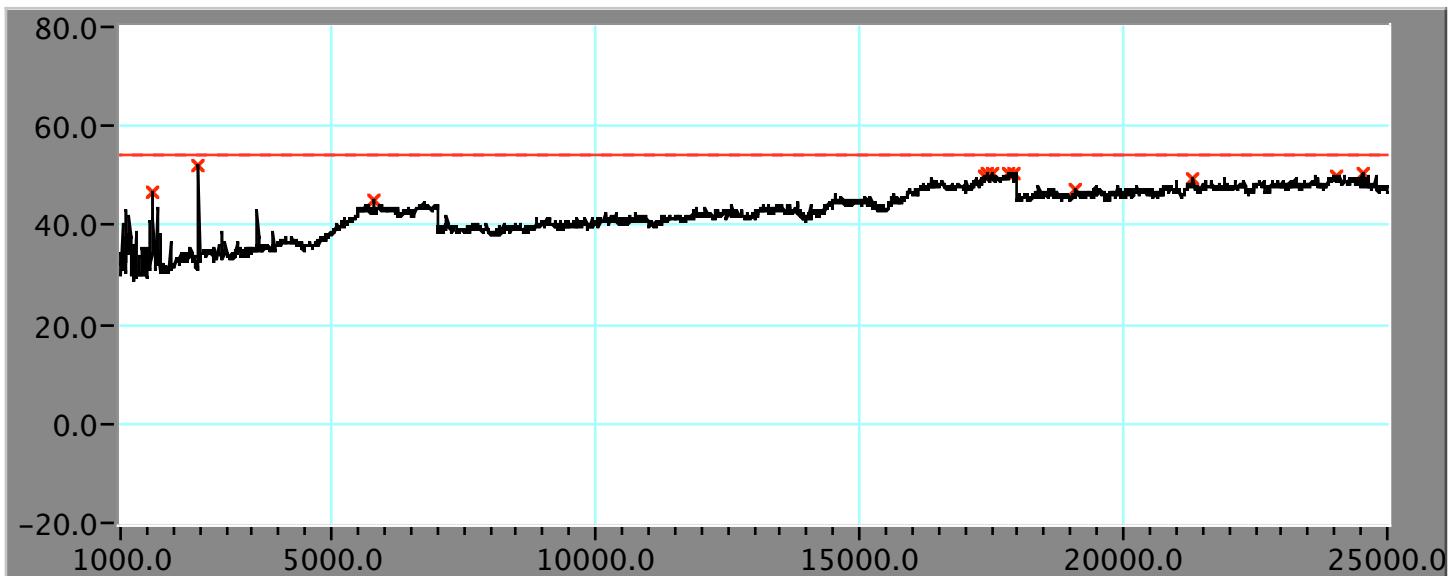


Frequency MHz	Level dBuV/m	Limit dBuV/m	Delta dB	Raw Data dBuV	Antenna dB	Cable dB	Amp dB	All Factor dB
1613.23	44.1	54.0	-9.9	66.80	27.24	4.11	54.01	22.65
2478.96	49.4	54.0	-4.6	70.99	30.54	4.98	57.15	21.63
17348.70	50.3	54.0	-3.7	43.06	42.80	12.84	48.41	-7.24
17438.88	50.8	54.0	-3.2	43.20	43.22	12.89	48.46	-7.64
17499.00	51.0	54.0	-3.0	43.05	43.50	12.92	48.50	-7.92
17889.78	51.0	54.0	-3.0	43.24	44.90	13.11	50.22	-7.80
21266.67	49.7	54.0	-4.3	43.54	40.50	6.01	40.38	-6.13
21815.00	49.7	54.0	-4.3	43.48	40.50	6.10	40.40	-6.19
22585.00	49.3	54.0	-4.7	43.04	40.50	6.22	40.42	-6.30
23226.67	49.7	54.0	-4.3	43.28	40.50	6.33	40.44	-6.39
24136.67	50.8	54.0	-3.2	44.32	40.50	6.48	40.46	-6.52
24311.67	49.7	54.0	-4.3	43.22	40.50	6.51	40.56	-6.45

All levels are with a peak detector unless otherwise indicated.

Date of Test: June 2, 2003

## 3.2.10 CFR 15.209(a) Radiated Emissions - Horizontal Channel 79 (2.480 GHz)



Frequency MHz	Level dBuV/m	Limit dBuV/m	Delta dB	Raw Data dBuV	Antenna dB	Cable dB	Amp dB	All Factor dB
1613.23	46.8	54.0	-7.2	69.55	27.20	4.11	54.01	22.70
2478.96	52.1	54.0	-1.9	73.70	30.53	4.98	57.15	21.64
5797.60	45.1	54.0	-8.9	53.75	36.62	7.43	52.66	8.61
17348.70	49.8	54.0	-4.2	42.90	42.46	12.84	48.41	-6.90
17428.86	50.3	54.0	-3.7	43.06	42.80	12.88	48.46	-7.23
17499.00	50.3	54.0	-3.7	42.76	43.10	12.92	48.50	-7.52
17849.70	50.4	54.0	-3.6	42.75	44.64	13.09	50.04	-7.69
17939.88	50.4	54.0	-3.6	42.69	45.04	13.14	50.44	-7.74
19085.00	47.0	54.0	-7.0	81.63	0.00	5.65	40.28	34.63
21336.67	49.3	54.0	-4.7	83.70	0.00	6.02	40.38	34.36
24031.67	49.8	54.0	-4.2	83.84	0.00	6.46	40.46	34.00
24521.67	50.2	54.0	-3.8	84.55	0.00	6.54	40.92	34.38

All levels are with a peak detector unless otherwise indicated.

Date of Test: June 2, 2003

**4 CFR 15.247(b)(4) RF Exposure**

SAR testing was performed against the limits defined in OET65c. The tests were performed on the Apple Airport Extreme antenna (model A1066, FCC ID: BCGA1026) which was the dominate transmitter, while co-located with an Apple Bluetooth antenna (Model A1067) transmitting simultaneously. The SAR report number is 03U2023-3. The results of this report conclude that compliance with the limits of OET65c can be achieved as long as a separation distance of at least 10 millimeters from the Airport Extreme Antenna is maintained. The following warning statement will be included in the user's manual.

\*\*\*\*\*

The FCC Rules require that the operator or a nearby person be more than 1 centimeter (0.4 inches) away from the Airport Extreme antenna during transmission. In addition, the Airport Extreme antenna must not be located with any other transmitter or antenna except for the Apple Bluetooth antenna model A1067.

\*\*\*\*\*

**5 CFR 15.247(c) -20 dBc Spurious Conducted Emissions****5.1 CFR 15.247(c) -20 dBc Spurious Conducted Emissions Test Setup**

Spurious conducted 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.

**5.2 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 - 2.402 GHz
- mid channel - 2.441 GHz
- high channel - 2.480 GHz

**5.3 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 Analyzer	HP	8563			

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

Instrument Settings			
Frequency Range	Resolution BW	Video BW	Reference Level
1 GHz - 25 GHz	100 kHz	100 kHz	20 dBm

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

The -20 dBc spurious conducted emissions tests were performed at the RF antenna connector port on the back of the tower. The Bluetooth module was activated with special software which enables continuous transmit at a single user selectable frequency. The following channels were tested.

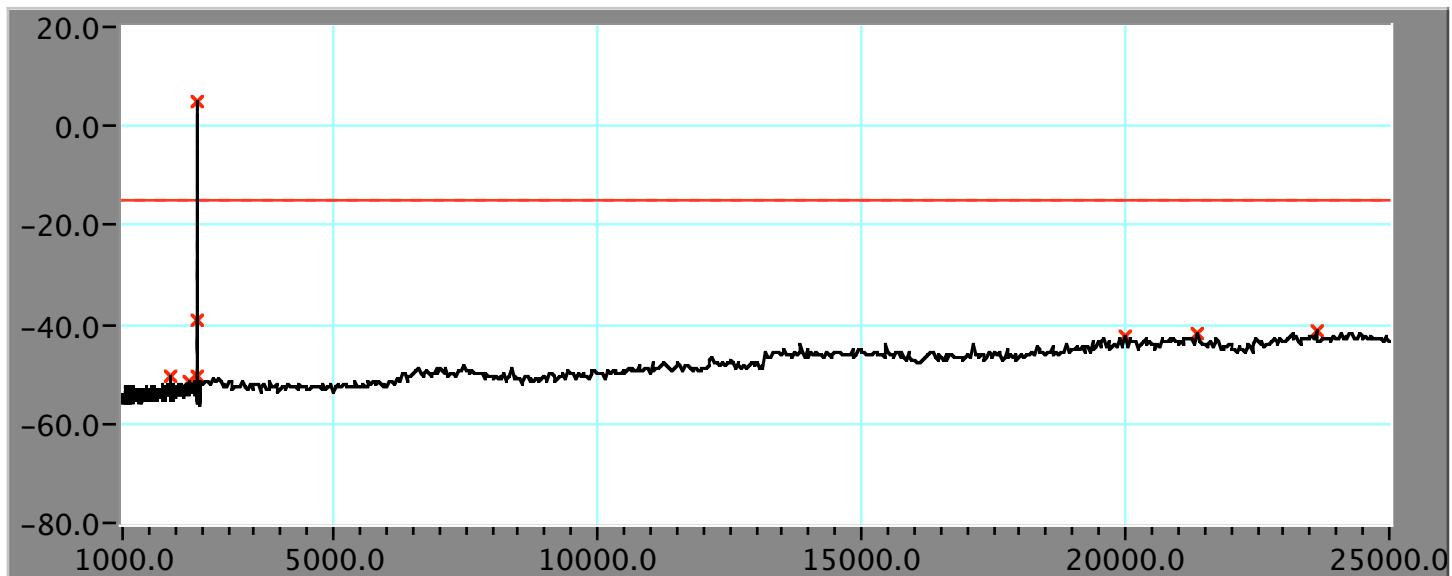
Low - 2402 MHz  
Mid - 2441 MHz  
High - 2480 MHz

The data from each of these scans is presented in the following pages.

**Results**

All of the conducted spurious emissions are under the -20dBc requirement.  
Conclusion: Pass

## CFR 15.247(c) -20 dBc Spurious Conducted Emissions -Channel 1 (2.402 GHz)

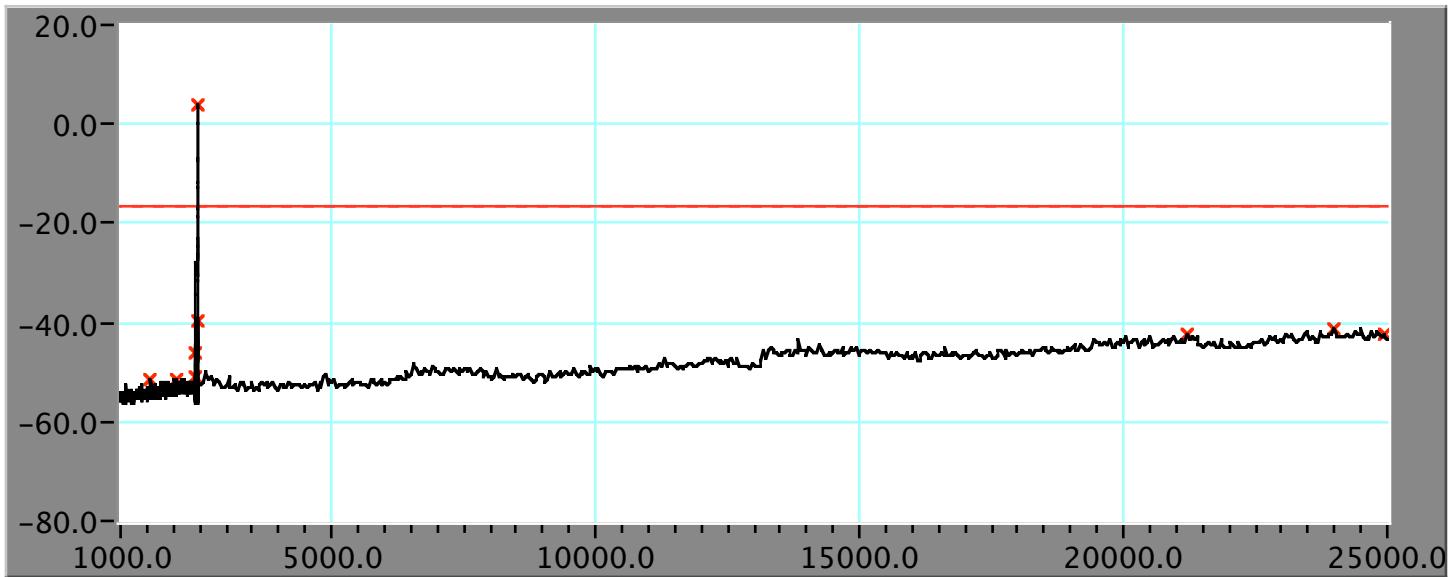


Frequency	Level	Limit	Delta	Raw Data	Cable	All Factors
MHz	dBm	dBm	dB	dBm	dB	dB
1905.33	-50.7	-15.2	-35.5	-52.73	2.07	-2.07
2288.00	-51.5	-15.2	-36.3	-53.79	2.29	-2.29
2401.95	4.8	-15.2	20.0	2.50	2.34	-2.34
2405.98	-39.3	-15.2	-24.1	-41.67	2.34	-2.34
2411.41	-50.5	-15.2	-35.3	-52.84	2.34	-2.34
20008.84	-42.2	-15.2	-27.0	-50.79	8.63	-8.63
21359.83	-41.8	-15.2	-26.6	-50.99	9.16	-9.16
23611.48	-41.2	-15.2	-26.0	-50.61	9.45	-9.45

All levels are with a peak detector.

Date of Test: June 17, 2003

## CFR 15.247(c) -20 dBc Spurious Conducted Emissions - Channel 40 (2.441 GHz)

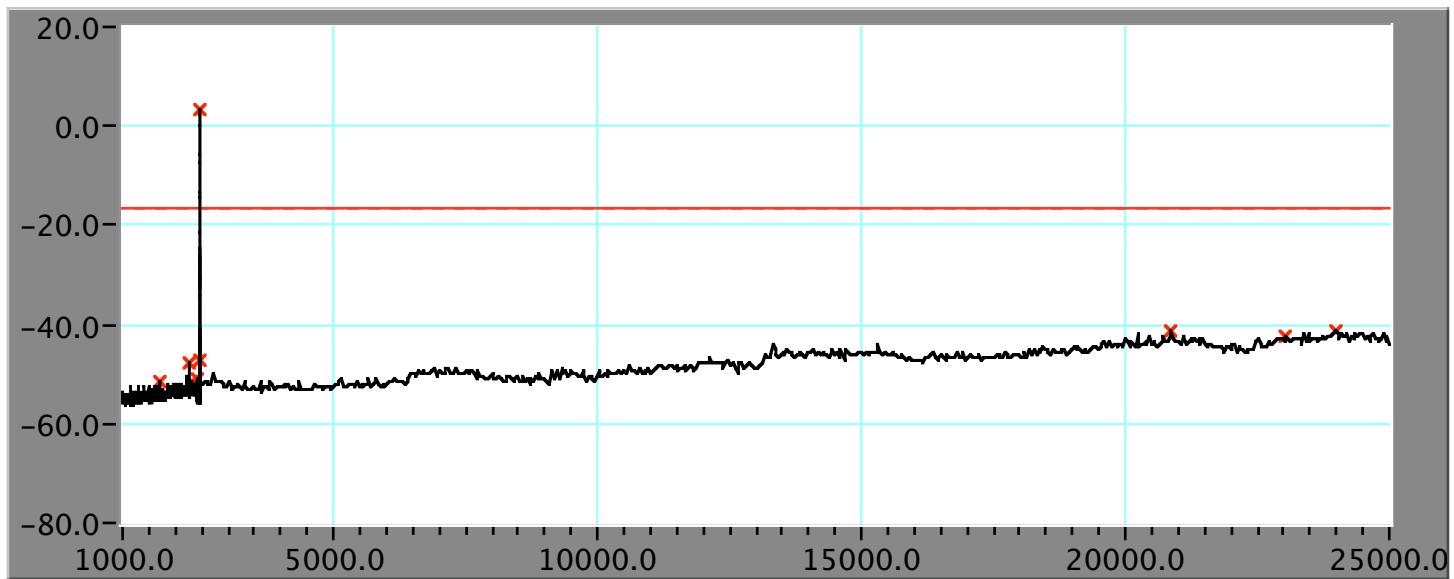


Frequency MHz	Level dBm	Limit dBm	Delta dB	Raw Data dBm	Cable dB	All Factors dB
1581.00	-51.5	-16.3	-35.2	-53.21	1.71	-1.71
2038.33	-51.3	-16.3	-35.0	-53.52	2.19	-2.19
2400.00	-51.0	-16.3	-34.7	-53.34	2.34	-2.34
2436.46	-46.0	-16.3	-29.7	-48.35	2.35	-2.35
2441.33	3.7	-16.3	20.0	1.31	2.36	-2.36
2445.79	-39.5	-16.3	-23.2	-41.86	2.36	-2.36
21209.72	-42.3	-16.3	-26.0	-51.76	9.43	-9.43
23986.76	-41.5	-16.3	-25.2	-51.18	9.68	-9.68
24924.95	-42.5	-16.3	-26.2	-51.05	8.55	-8.55

All levels are with a peak detector.

Date of Test: June 17, 2003

## CFR 15.247(c) -20 dBc Spurious Conducted Emissions Channel 79 (2.480 GHz)



Frequency MHz	Level dBm	Limit dBm	Delta dB	Raw Data dBm	Cable dB	All Factors dB
1721.00	-51.5	-16.8	-34.7	-53.37	1.87	-1.87
2248.33	-48.0	-16.8	-31.2	-50.27	2.27	-2.27
2325.33	-51.7	-16.8	-34.9	-53.97	2.31	-2.31
2419.07	-51.2	-16.8	-34.4	-53.51	2.35	-2.35
2475.57	-47.0	-16.8	-30.2	-49.37	2.37	-2.37
2480.58	3.2	-16.8	20.0	0.80	2.37	-2.37
20871.97	-41.5	-16.8	-24.7	-51.16	9.66	-9.66
23048.57	-42.2	-16.8	-25.4	-51.27	9.11	-9.11
23986.76	-41.3	-16.8	-24.5	-51.01	9.68	-9.68

All levels are with a peak detector.

Date of Test: June 17, 2003