



**FCC CFR47 PART 15 SUBPART C  
CLASS II PERMISSIVE CHANGE  
CERTIFICATION TEST REPORT**

**FOR**

**802.11A/B/G INTEL WIRELESS WIFI LINK 4965AG**

**MODEL NUMBER: 4965AG**

**FCC ID: PD9LEN4965AG**

**REPORT NUMBER: 07U10925-4, REVISION C**

**ISSUE DATE: APRIL 17, 2007**

*Prepared for*  
**INTEL CORPORATION  
2111 N.E.25<sup>TH</sup> AVE.  
HILLSBORO, OR 97124, USA**

*Prepared by*  
**COMPLIANCE CERTIFICATION SERVICES  
47173 BENICIA STREET  
FREMONT, CA 94538, USA  
TEL: (510) 771-1000  
FAX: (510) 661-0888**



**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	04/03/07	Initial Issue	T. Chan
B	04/13/07	Corrected Sections 5.1, 7.1.1, & 7.2.1	T. Hong
C	04/17/07	Updated Sections 7.1.1 & 7.2.1	T. Hong

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS</b> .....	<b>4</b>
<b>2. TEST METHODOLOGY</b> .....	<b>5</b>
<b>3. FACILITIES AND ACCREDITATION</b> .....	<b>5</b>
<b>4. CALIBRATION AND UNCERTAINTY</b> .....	<b>5</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i> .....	5
4.2. <i>MEASUREMENT UNCERTAINTY</i> .....	5
<b>5. EQUIPMENT UNDER TEST</b> .....	<b>6</b>
5.1. <i>DESCRIPTION OF EUT</i> .....	6
5.2. <i>DESCRIPTION OF CLASS II CHANGE</i> .....	6
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i> .....	6
5.4. <i>SOFTWARE AND FIRMWARE</i> .....	6
5.5. <i>WORST-CASE CONFIGURATION AND MODE</i> .....	6
5.6. <i>DESCRIPTION OF TEST SETUP</i> .....	7
<b>6. TEST AND MEASUREMENT EQUIPMENT</b> .....	<b>9</b>
<b>7. LIMITS AND RESULTS</b> .....	<b>10</b>
7.1. <i>CHANNEL TESTS FOR THE 2400 TO 2483.5 MHz BAND</i> .....	10
7.1.1. <i>AVERAGE POWER</i> .....	10
7.2. <i>CHANNEL TESTS FOR THE 5725 TO 5850 MHz BAND</i> .....	12
7.2.1. <i>AVERAGE POWER</i> .....	12
7.3. <i>RADIATED EMISSIONS</i> .....	14
7.3.1. <i>TRANSMITTER RADIATED SPURIOUS EMISSIONS</i> .....	14
7.3.2. <i>TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND</i> .....	17
7.3.3. <i>TRANSMITTER ABOVE 1 GHz FOR 5725 TO 5850 MHz BAND</i> .....	35
7.3.4. <i>WORST-CASE RADIATED EMISSIONS BELOW 1 GHz</i> .....	36
7.3.5. <i>MAXIMUM PERMISSIBLE EXPOSURE</i> .....	40
7.3.6. <i>POWERLINE CONDUCTED EMISSIONS</i> .....	43
<b>8. SETUP PHOTOS</b> .....	<b>47</b>

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** INTEL CORPORATION  
2111 N.E. 25TH AVE.  
HILLSBORO, OR 97124, USA

**EUT DESCRIPTION:** 802.11A/B/G INTEL WIRELESS WIFI LINK 4965AG

**MODEL:** 4965AG

**SERIAL NUMBER:** LV-00161

**DATE TESTED:** MARCH 17 - 23, 2007

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

Tested By:



---

THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

---

CHIN PANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

## **5. EQUIPMENT UNDER TEST**

### **5.1. DESCRIPTION OF EUT**

The EUT is an 802.11a/b/g Wireless WiFi Link.

The radio module is manufactured by Intel.

### **5.2. DESCRIPTION OF CLASS II CHANGE**

1. Add WLAN Main Antenna-1: 25.90354.001, Main Antenna-2: 25.90424.001 and Aux Antenna: 25.90355.001
2. Add Lenovo ThinkPad X61 Tablet Notebook.

### **5.3. DESCRIPTION OF AVAILABLE ANTENNAS**

The radio utilizes two PIFA antennas for diversity, at 2.4GHz Band with maximum peak gain of 1.52dBi, and at 5.8GHz Band with maximum peak gain of 2.97dBi.

### **5.4. SOFTWARE AND FIRMWARE**

The EUT driver software installed in the host support equipment during testing was CRTU, version 9.7.34.0

The test utility software used during testing was CRTU version 4.1.26.0000

### **5.5. WORST-CASE CONFIGURATION AND MODE**

The worst-case channel is determined as the channel with the highest output power. The highest measured output powers were at 2462 MHz for 11b, g mode. For 5.8GHz Band, 5745MHz were the highest measured power for 802.11 a mode,

The worst-case data rate for this channel is determined to be 6 Mb/s, based on previous experience with 2.4GHz WLAN product design architectures.

The Mobile position and portable X, Y and Z positions have been investigated, Mobile position was determined as the worst-case position for 2.4GHz band and Y position for the 5GHz band.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	ThinkPad X61 Tablet	LV-00161	DoC
AC Adaptop	Lenovo	Lenovo	11S92P1160Z1ZBGH6C6KK0	DoC

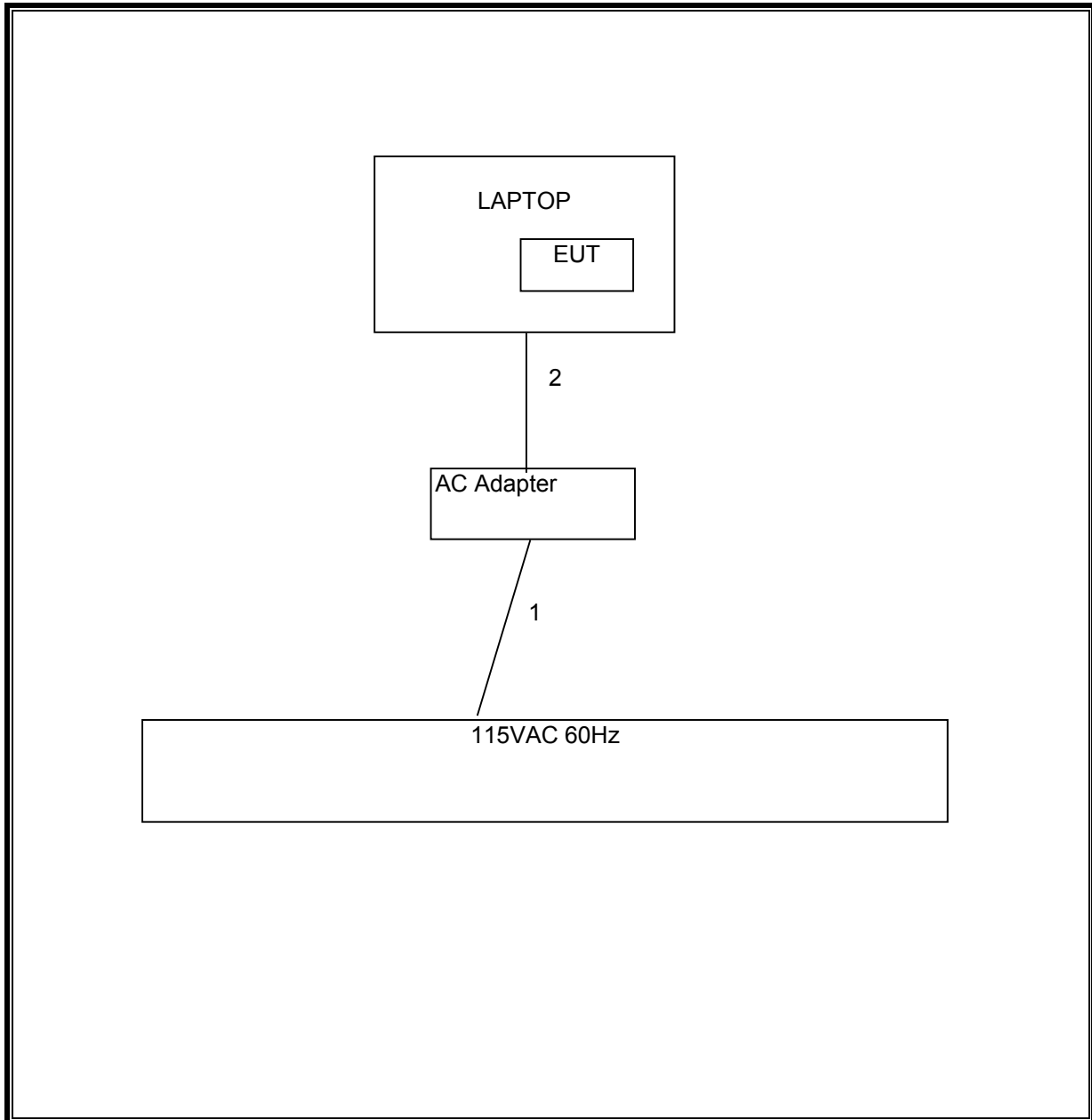
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Un-shielded	2m	NA
2	DC	1	DC	Un-shielded	2m	Ferrite on laptop end

### TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**





## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Cal Due
Antenna, Horn 1 ~ 18 GHz	ETS	3117	29301	04/22/07
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00561	10/03/07
Antenna, Horn 18 ~ 26 GHz	ARA	MWH-1826/B	1049	09/12/07
Preamplifier, 1300 MHz	Agilent / HP	8447D	1937A02062	01/23/08
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A0022704	09/03/07
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	01/07/08
SA Display Section 2	Agilent / HP	85662A	2816A16696	04/07/08
Quasi-Peak Adaptor	Agilent / HP	85650A	3145A01654	01/21/08
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	08/30/07
EMI Test Receiver	R & S	ESHS 20	827129/006	06/03/07
Peak / Average Power Sensor	Agilent	E9327A	US40440755	12/02/07
Peak Power Meter	Agilent / HP	E4416A	GB41291160	12/02/07
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	05/03/07
2.4 - 2.5 Reject Filter	Micro Tronics	BRM50702	3	N/A
7.6 GHz High Pass Filter	Micro Tronics	HPM13350	1	N/A

## 7. LIMITS AND RESULTS

### 7.1. CHANNEL TESTS FOR THE 2400 TO 2483.5 MHz BAND

#### 7.1.1. AVERAGE POWER

##### AVERAGE POWER LIMIT

None; for reporting purposes only.

##### TEST PROCEDURE

The transmitter output is connected to a power meter.

**RESULTS**

No non-compliance noted:

The cable assembly insertion loss of 11.0 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

<b>Mode Channel</b>	<b>Frequency (MHz)</b>	<b>Average Power Chain 0 (dBm)</b>	<b>Average Power Chain 2 (dBm)</b>
---------------------	------------------------	------------------------------------	------------------------------------

802.11b Mode

Low	2412	15.5	15.4
Middle	2437	15.7	15.6
High	2462	16.7	16.7

802.11g Mode

Low	2412	16.7	16.5
Middle	2437	17.6	17.6
High	2462	16.3	16.4

## **7.2. CHANNEL TESTS FOR THE 5725 TO 5850 MHz BAND**

### **7.2.1. AVERAGE POWER**

#### **AVERAGE POWER LIMIT**

None; for reporting purposes only.

#### **TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

No non-compliance noted:

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

<b>Mode Channel</b>	<b>Frequency (MHz)</b>	<b>Average Power Chain 0 (dBm)</b>	<b>Average Power Chain 2 (dBm)</b>
---------------------	------------------------	------------------------------------	------------------------------------

802.11a Mode

Low	5745	17.6	17.5
Middle	5785	17.6	17.6
High	5825	17.6	17.6

### 7.3. RADIATED EMISSIONS

#### 7.3.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

##### LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

## **TEST PROCEDURE**

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

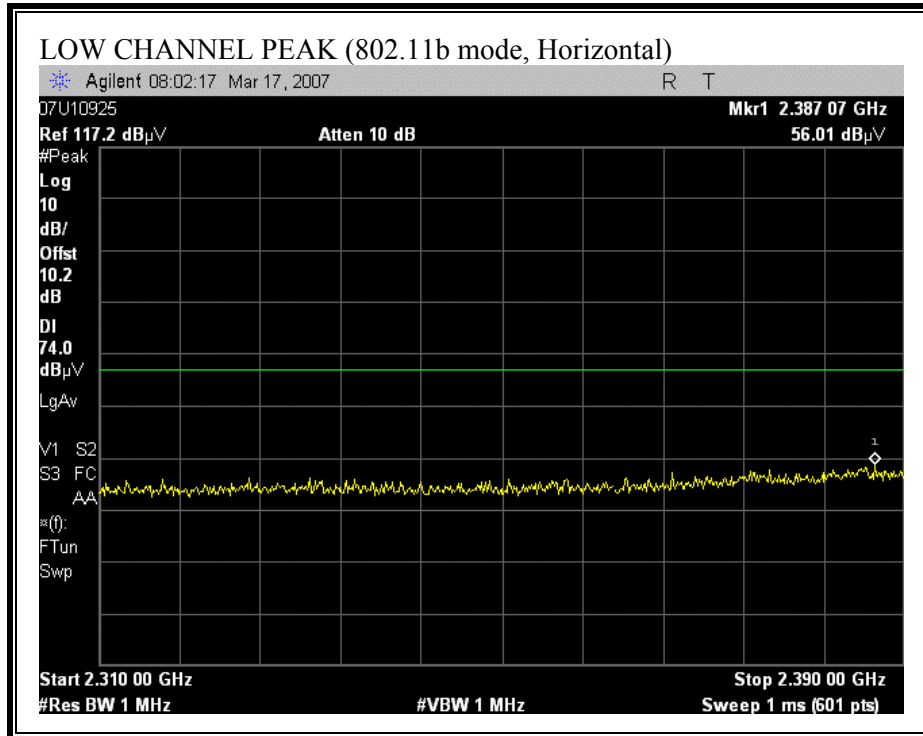
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

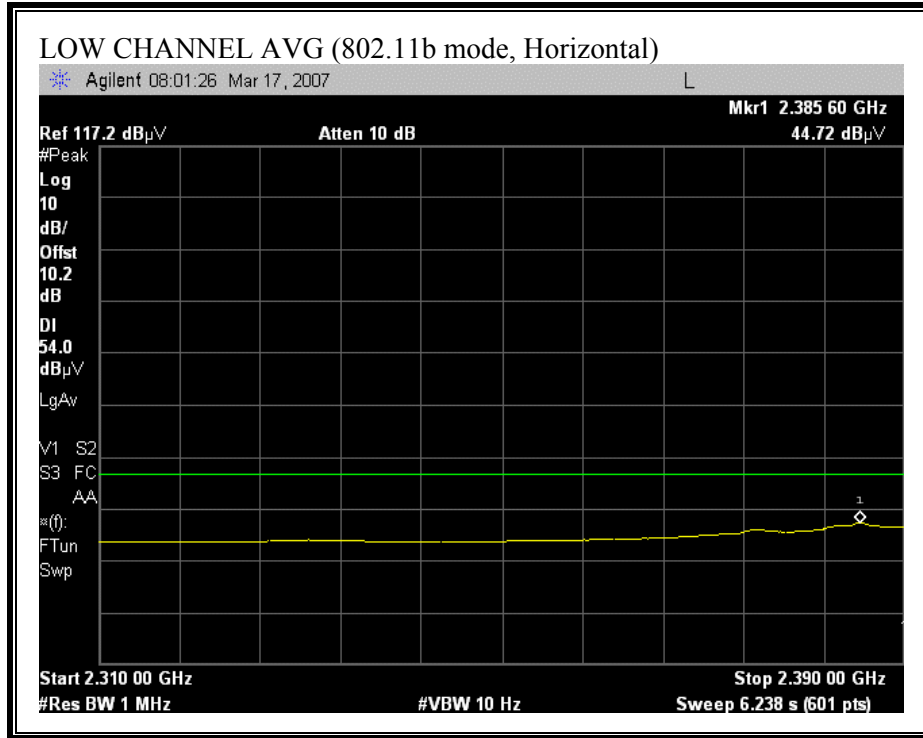
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

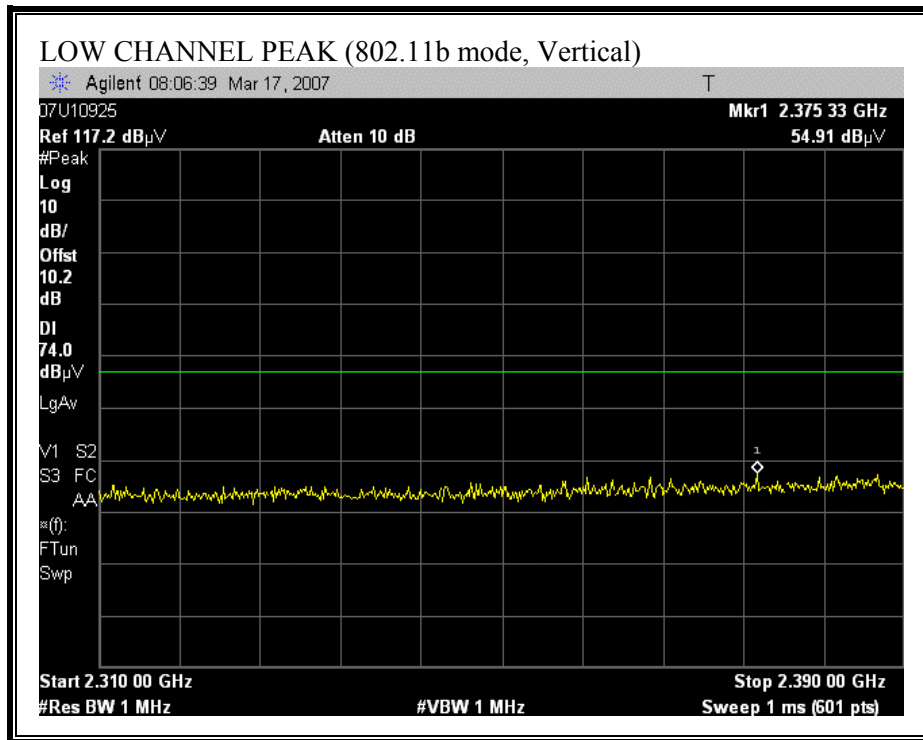


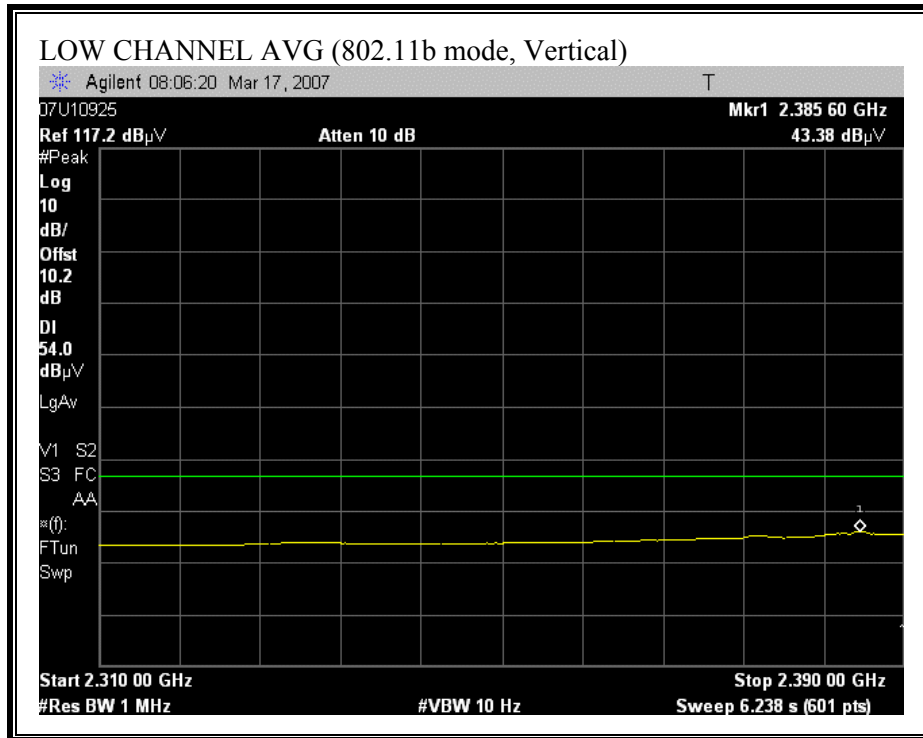
### 7.3.2. TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND

#### RESTRICTED BANDEDGE (802.11b MODE, LOW CHANNEL)

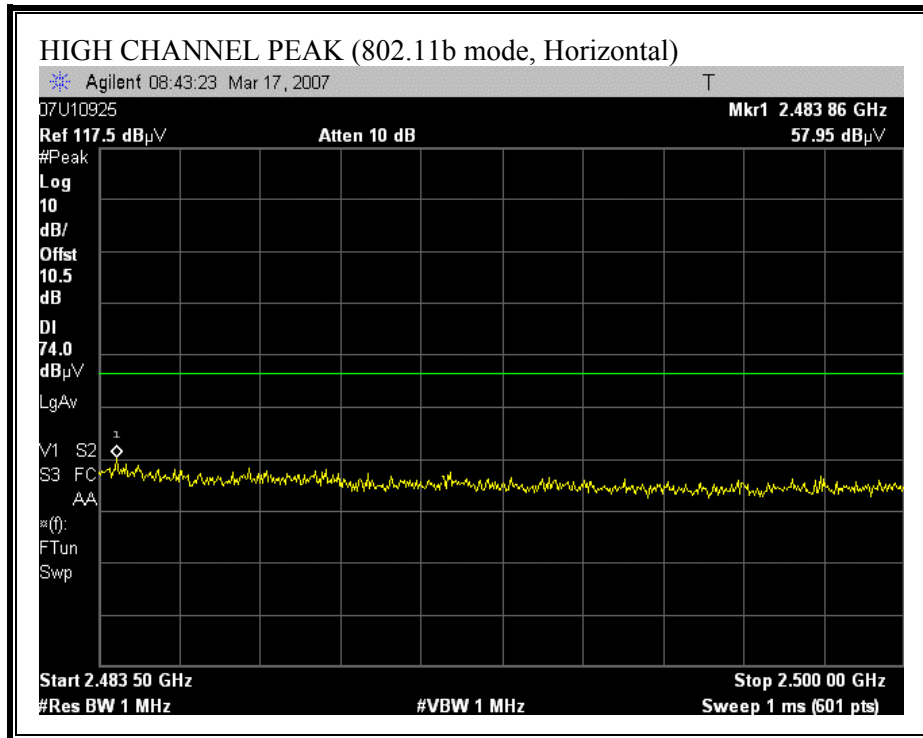


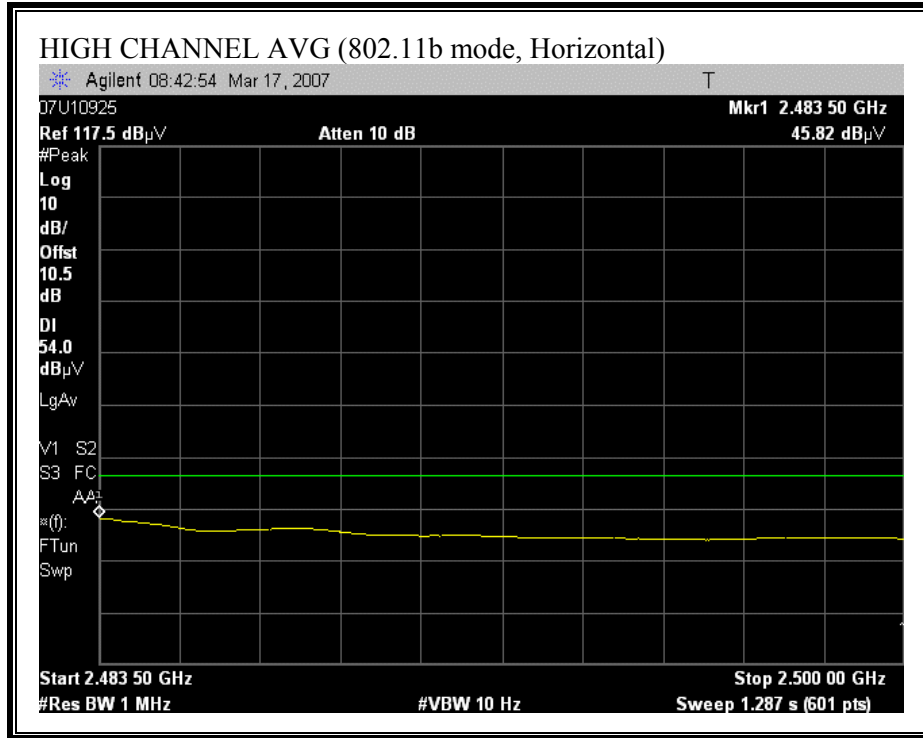


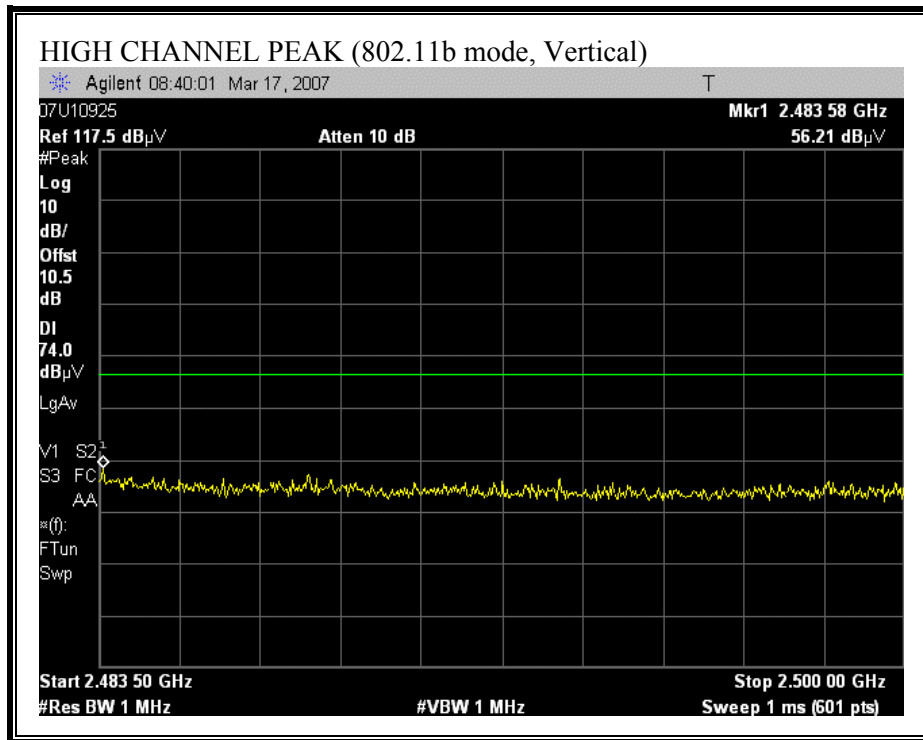


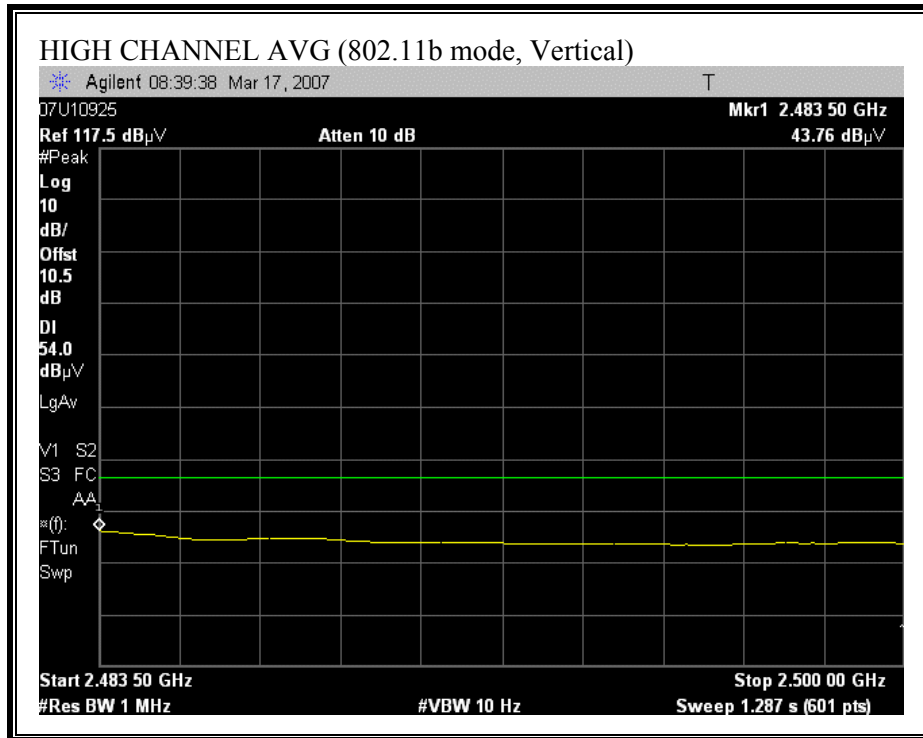


**RESTRICTED BANDEDGE (802.11b MODE, HIGH CHANNEL)**











**HARMONICS AND SPURIOUS EMISSIONS (802.11b MODE)**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont Chamber B

Company: Intel  
 Project #: 07U10925  
 Date: 3/22/2007  
 Test Engineer: Mengistu Mekuria  
 Configuration: EUT Only  
 Mode: Transmit, 11b mode 2.4GHz

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T145 Agilent 3008A005t			FCC 15.205

Hi Frequency Cables

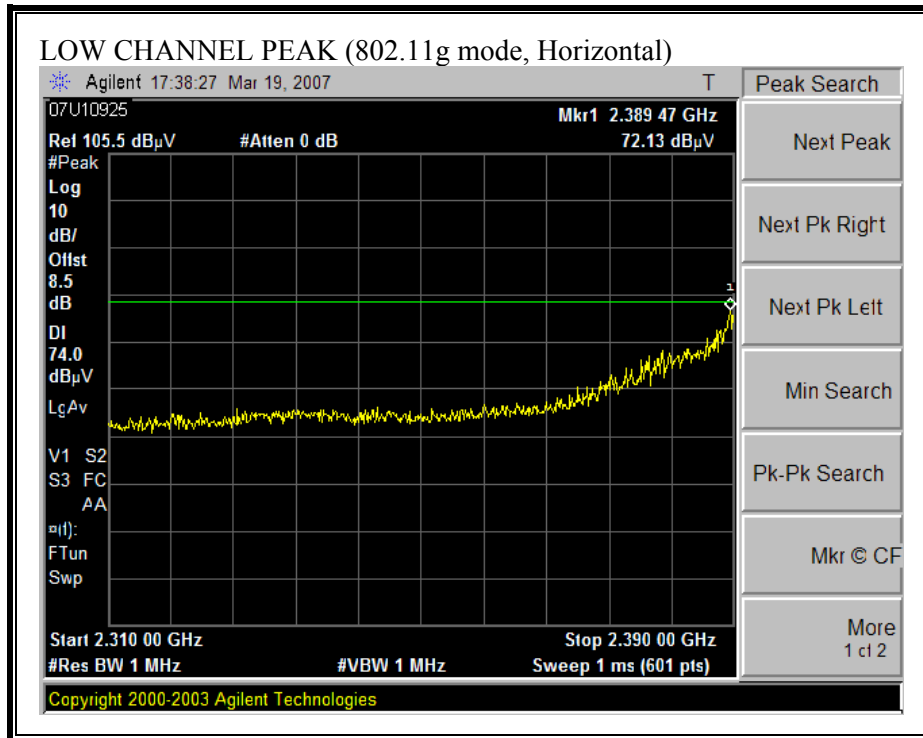
2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	<b>Peak Measurements</b> RBW=VBW=1MHz <b>Average Measurements</b> RBW=1MHz ; VBW=10Hz
		Gordon 203134001	HPF_4.0GHz		

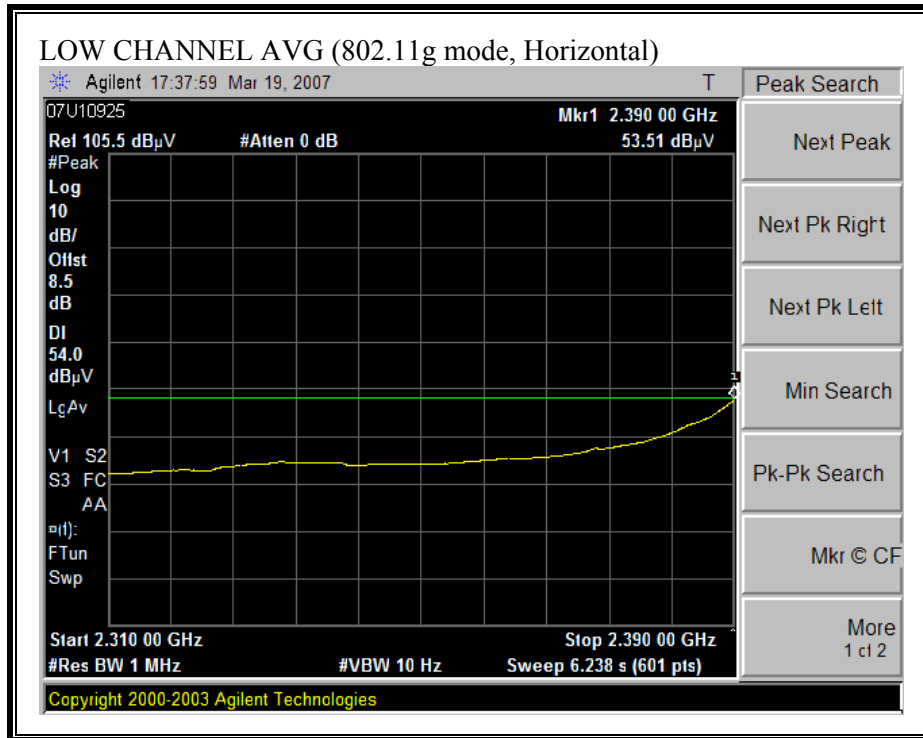
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>Low Ch, 2412MHz</b>															
4.824	3.0	41.8	31.1	33.3	6.9	-34.8	0.0	0.6	47.8	37.1	74	54	-26.2	-16.9	V
4.824	3.0	43.0	31.3	33.3	6.9	-34.8	0.0	0.6	48.9	37.2	74	54	-25.1	-16.8	H
<b>Mid Ch, 2437MHz</b>															
4.874	3.0	42.6	33.9	33.4	6.9	-34.9	0.0	0.6	48.7	39.9	74	54	-25.3	-14.1	V
7.311	3.0	43.2	33.5	35.0	8.4	-34.7	0.0	0.6	52.6	42.9	74	54	-21.4	-11.1	V
4.874	3.0	43.2	34.6	33.4	6.9	-34.9	0.0	0.6	49.3	40.6	74	54	-24.7	-13.4	H
7.311	3.0	44.5	38.9	35.0	8.4	-34.7	0.0	0.6	53.9	48.3	74	54	-20.1	-5.7	H
<b>High Ch 2462 MHz</b>															
4.924	3.0	45.0	37.7	33.4	7.0	-34.9	0.0	0.6	51.1	43.8	74	54	-22.9	-10.2	V
7.386	3.0	45.0	40.0	35.0	8.4	-34.6	0.0	0.6	54.5	49.5	74	54	-19.5	-4.5	V
4.924	3.0	43.4	34.5	33.4	7.0	-34.9	0.0	0.6	49.5	40.6	74	54	-24.5	-13.4	H
7.386	3.0	44.4	38.8	35.0	8.4	-34.6	0.0	0.6	53.9	48.3	74	54	-20.1	-5.7	H

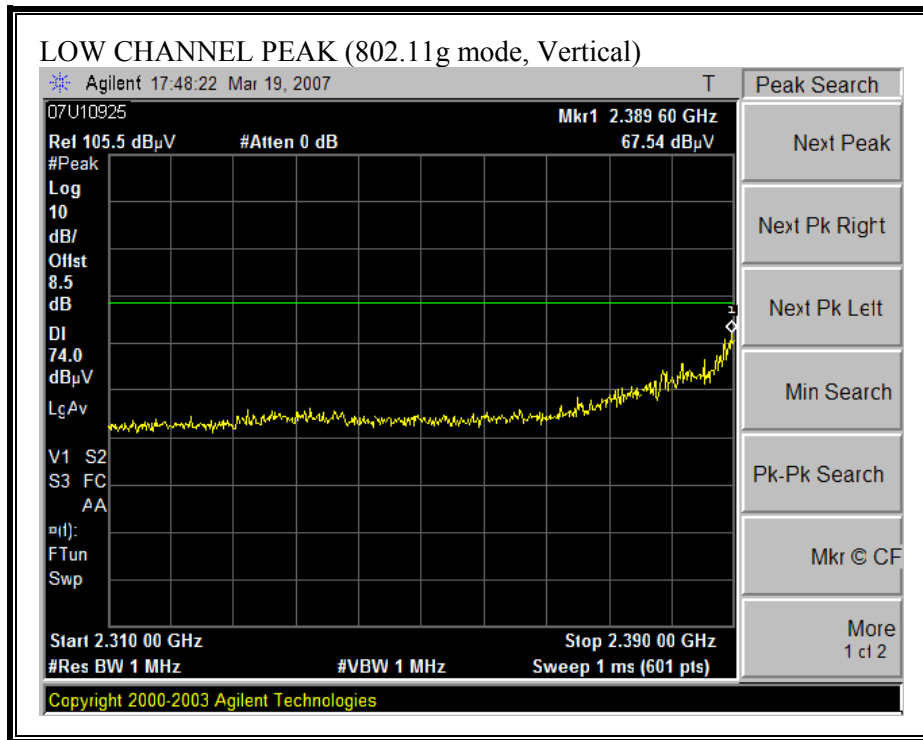
Rev. 5.1.6  
 Note: No other emissions were detected above the system noise floor.

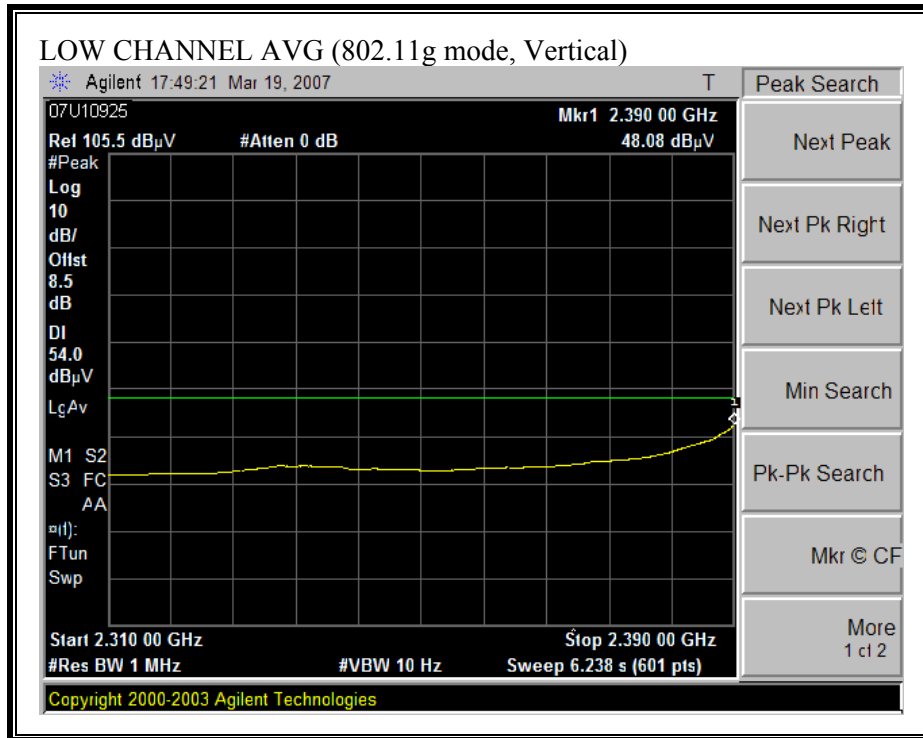
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

**RESTRICTED BANDEDGE (802.11g MODE, LOW CHANNEL)**

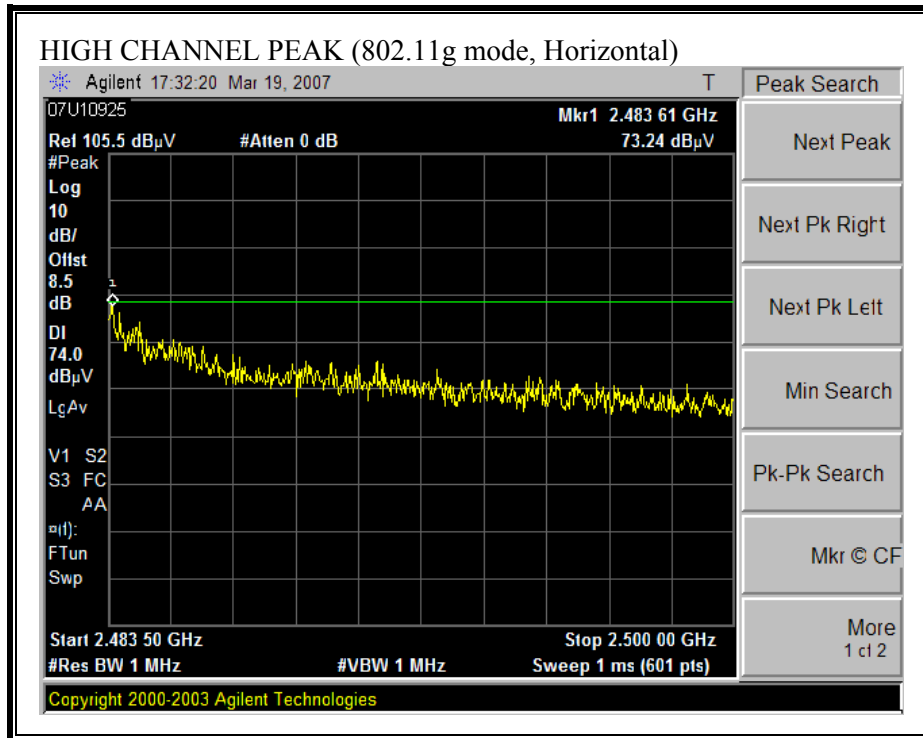


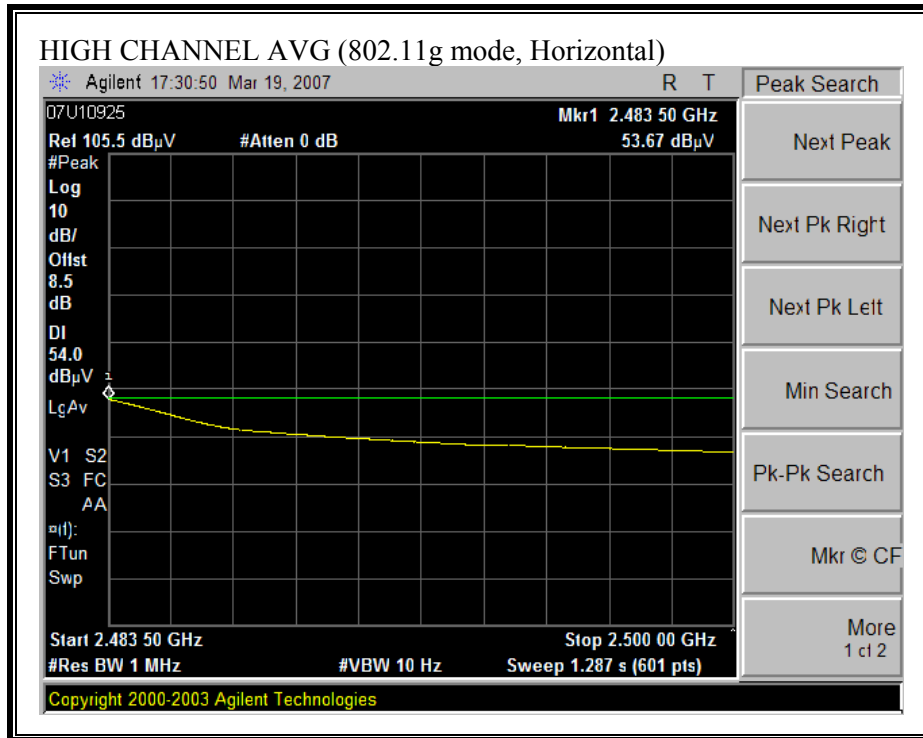


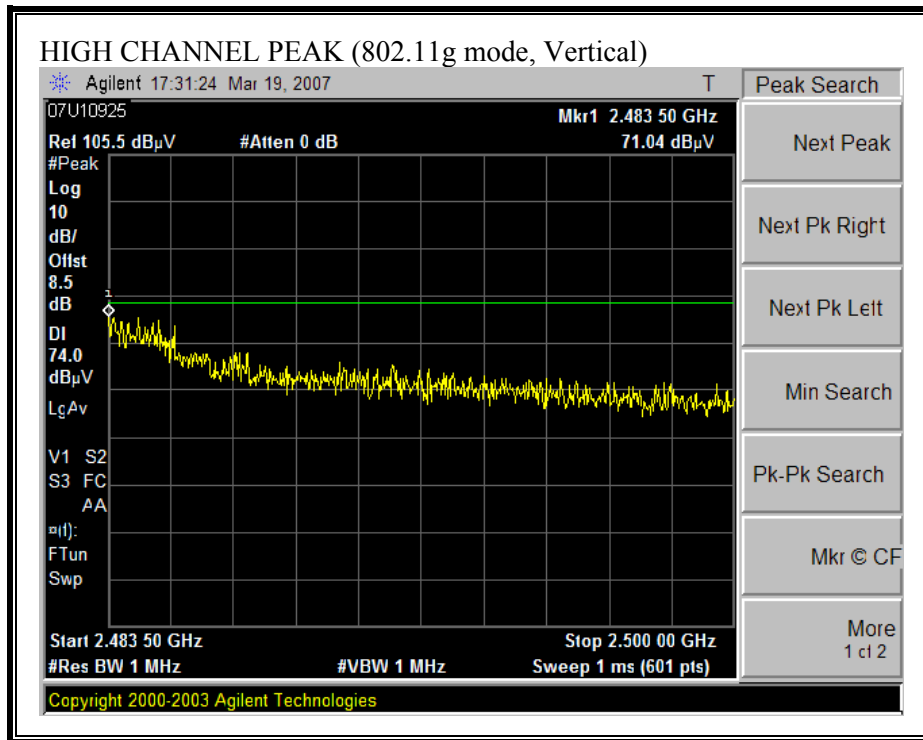




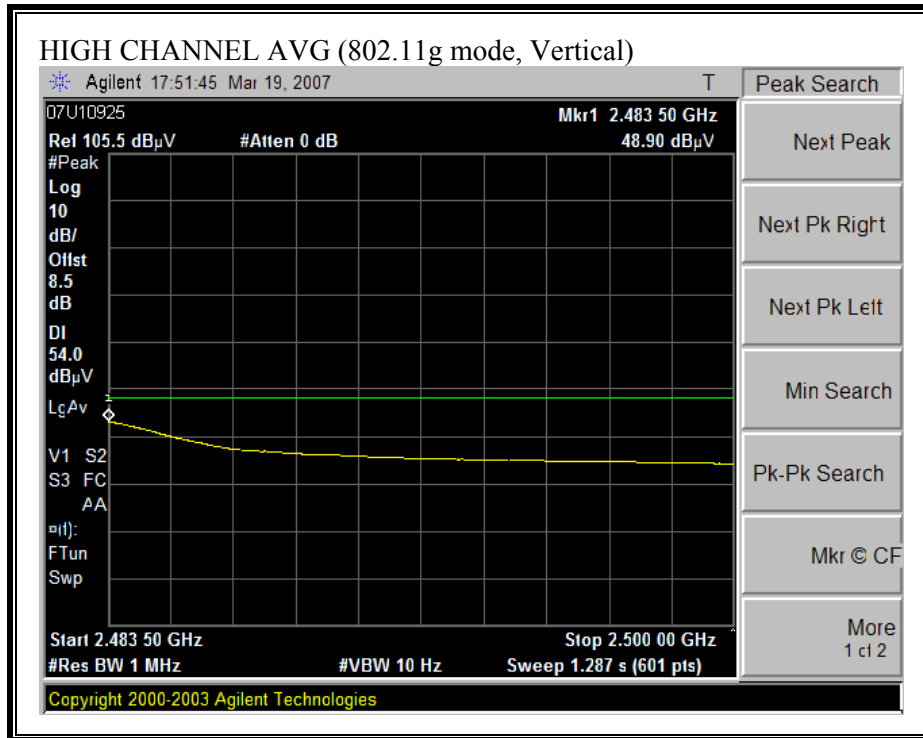
**RESTRICTED BANDEDGE (802.11g MODE, HIGH CHANNEL)**











**HARMONICS AND SPURIOUS EMISSIONS (802.11g MODE)**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont Chamber B

Company: Intel  
 Project #: 07U10925  
 Date: 3/22/2007  
 Test Engineer: Mengistu Mekuria  
 Configuration: EUT Only  
 Mode: Transmit, 11g mode 2.4GHz

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T145 Agilent 3008A005t			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	<b>Peak Measurements</b> RBW=VBW=1MHz <b>Average Measurements</b> RBW=1MHz ; VBW=10Hz
		Gordon 203134001	HPF_4.0GHz		

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>Low Ch, 2412MHz</b>															
4.824	3.0	42.4	30.5	33.3	6.9	-34.8	0.0	0.6	48.3	36.4	74	54	-25.7	-17.6	V
4.824	3.0	41.0	29.2	33.3	6.9	-34.8	0.0	0.6	46.9	35.2	74	54	-27.1	-18.8	H
<b>Mid Ch, 2437MHz</b>															
4.874	3.0	42.2	30.0	33.4	6.9	-34.9	0.0	0.6	48.2	36.1	74	54	-25.8	-17.9	V
7.311	3.0	46.4	32.6	35.0	8.4	-34.7	0.0	0.6	55.8	41.9	74	54	-18.2	-12.1	V
4.874	3.0	41.2	29.5	33.4	6.9	-34.9	0.0	0.6	47.3	35.6	74	54	-26.7	-18.4	H
7.311	3.0	44.2	31.6	35.0	8.4	-34.7	0.0	0.6	53.6	41.0	74	54	-20.4	-13.0	H
<b>High Ch 2462 MHz</b>															
4.924	3.0	43.5	31.4	33.4	7.0	-34.9	0.0	0.6	49.6	37.5	74	54	-24.4	-16.5	V
7.386	3.0	46.1	32.2	35.0	8.4	-34.6	0.0	0.6	55.6	41.7	74	54	-18.4	-12.3	V
4.924	3.0	42.5	29.4	33.4	7.0	-34.9	0.0	0.6	48.6	35.6	74	54	-25.4	-18.4	H
7.386	3.0	44.3	31.4	35.0	8.4	-34.6	0.0	0.6	53.7	40.9	74	54	-20.3	-13.1	H

Rev. 5.1.6  
 Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

### 7.3.3. TRANSMITTER ABOVE 1 GHz FOR 5725 TO 5850 MHz BAND

#### HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

**High Frequency Measurement**  
 Compliance Certification Services, Fremont Chamber B

Company: Intel  
 Project #: 07U10925  
 Date: 3/20/2007  
 Test Engineer: Chin Pang  
 Configuration: EUT Only  
 Mode: Transmit, a mode 5.8GHz

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T120; S/N: 29310 @3m	T145 Agilent 3008A005f	T88 Miteq 26-40GHz	T89; ARA 18-26GHz; S/N:1049	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz
		Gordon 203134001	HPF_7.6GHz		Average Measurements RBW=1MHz; VBW=10Hz

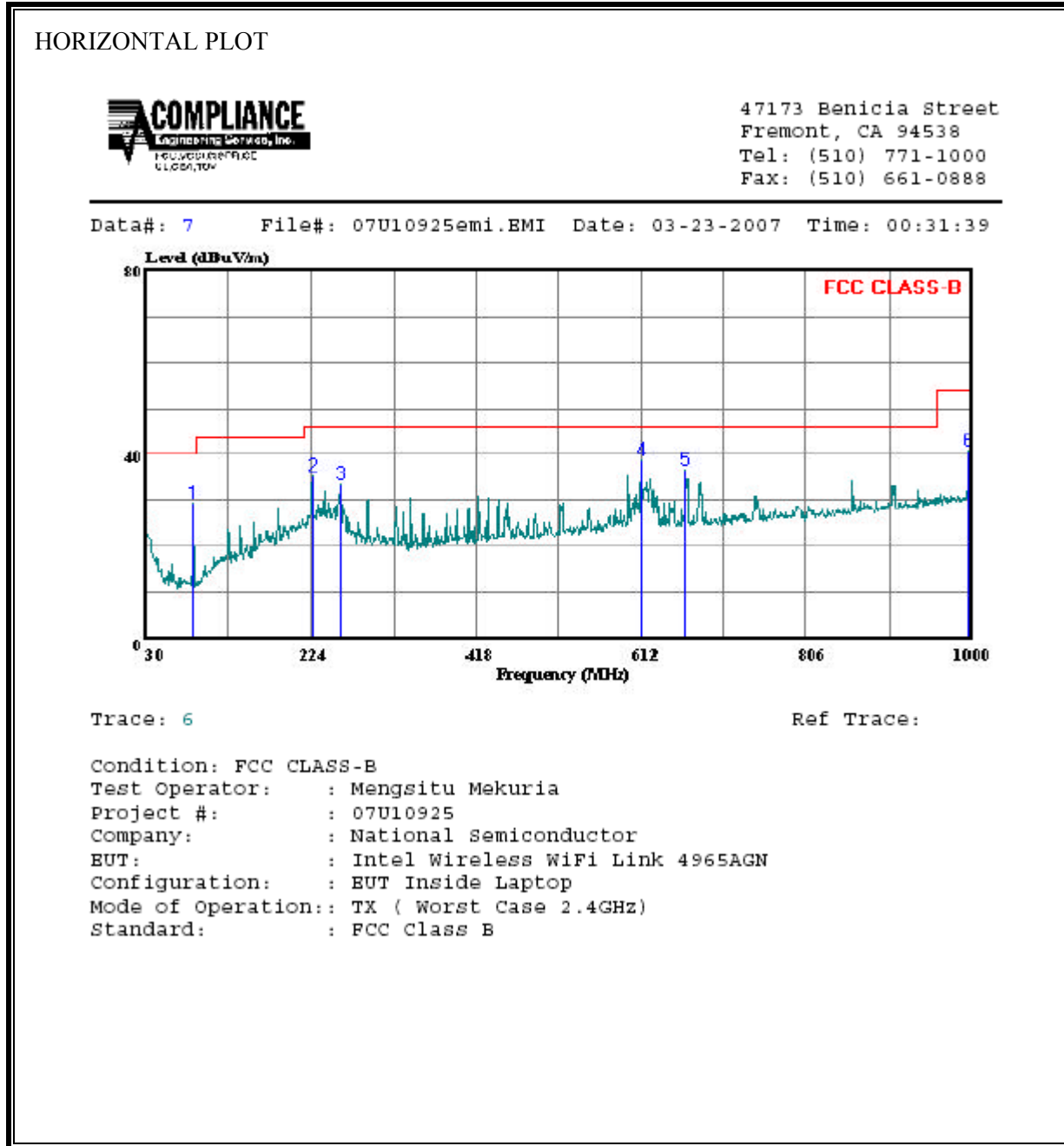
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>Low Ch. 5745MHz</b>															
11.490	3.0	45.0	33.5	37.6	11.6	-33.1	0.0	0.7	61.8	50.3	74	54	-12.2	-3.7	V
11.490	3.0	47.8	35.0	37.6	11.6	-33.1	0.0	0.7	64.6	51.8	74	54	-9.4	-2.2	H
<b>Mid Ch. 5785MHz</b>															
11.570	3.0	47.0	33.0	37.6	11.7	-33.0	0.0	0.7	64.0	50.0	74	54	-10.0	-4.0	V
11.570	3.0	47.3	33.4	37.6	11.7	-33.0	0.0	0.7	64.3	50.4	74	54	-9.7	-3.6	H
<b>High Ch</b>															
11.650	3.0	44.6	32.5	37.7	11.8	-32.9	0.0	0.7	61.8	49.7	74	54	-12.2	-4.3	V
11.650	3.0	47.0	33.2	37.7	11.8	-32.9	0.0	0.7	64.2	50.4	74	54	-9.8	-3.6	H

Rev. 5.1.6  
 Note: No other emissions were detected above the system noise floor.

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

### 7.3.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

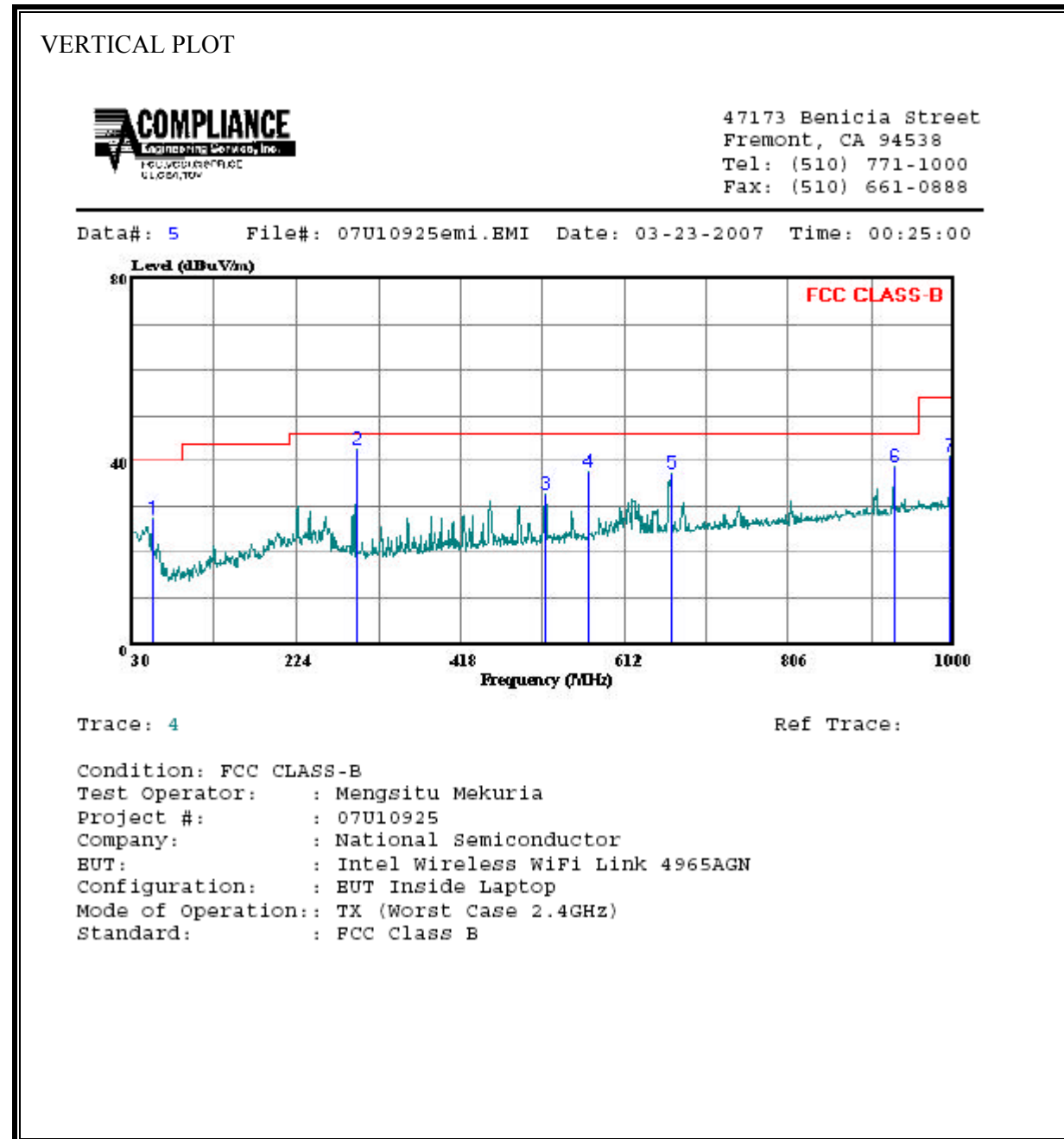


HORIZONTAL DATA

Page: 1

	Freq	Read Level	Probe Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	85.290	52.30	7.90	0.97	31.69	29.48	40.00	-10.52	Peak
2	225.940	53.90	11.50	1.60	31.58	35.42	46.00	-10.58	Peak
3	258.920	51.00	12.53	1.72	31.64	33.61	46.00	-12.39	Peak
4	612.000	48.40	19.44	2.76	31.92	38.68	46.00	-7.32	Peak
5	663.410	45.60	20.11	2.83	31.96	36.59	46.00	-9.41	Peak
6	996.120	43.80	23.64	3.60	30.14	40.89	54.00	-13.11	Peak

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**



VERTICAL DATA

Page: 1

	Freq	Read Level	Probe Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	54.250	50.20	8.27	0.75	31.75	27.47	40.00	-12.53	Peak
2	295.780	58.70	13.79	1.84	31.59	42.74	46.00	-3.26	Peak
3	518.880	43.90	18.25	2.52	31.78	32.89	46.00	-13.11	Peak
4	568.350	48.20	18.89	2.62	31.81	37.90	46.00	-8.10	Peak
5	666.320	46.50	20.15	2.85	31.94	37.56	46.00	-8.44	Peak
6	930.160	43.30	23.03	3.55	30.95	38.93	46.00	-7.07	Peak
7	996.120	44.10	23.64	3.60	30.14	41.19	54.00	-12.81	Peak

### 7.3.5. MAXIMUM PERMISSIBLE EXPOSURE

#### LIMITS

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

**Table 5**  
**Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)**

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

\* Power density limit is applicable at frequencies greater than 100 MHz.

- Notes:**
1. Frequency, *f*, is in MHz.
  2. A power density of 10 W/m<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.
  3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).



## **CALCULATIONS**

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 377$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in watts/square meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (377 * S))}$$

Changing Power to units of mW and Distance to units of cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (377 * S))}$$

$$d = 0.892 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in W/m<sup>2</sup>

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.892 * 10^{((P + G) / 20)} / \sqrt{S}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in W/m<sup>2</sup>

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.795 * 10^{((P + G) / 10)} / (d^2)$$

**LIMITS**

From IC Safety Code 6, Section 2.2 Table 5 Column 4,  $S = 10 \text{ W/m}^2$

**RESULTS**

No non-compliance noted: (MPE distance equals 20 cm)

<b>Mode</b>	<b>MPE Distance (cm)</b>	<b>Output Power (dBm)</b>	<b>Antenna Gain (dBi)</b>	<b>Power Density (<math>\text{W/m}^2</math>)</b>
2.4GHz Band	20.0	20.60	1.52	0.32
5.8GHz Band	20.0	20.60	2.13	0.37

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

### 7.3.6. POWERLINE CONDUCTED EMISSIONS

#### LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

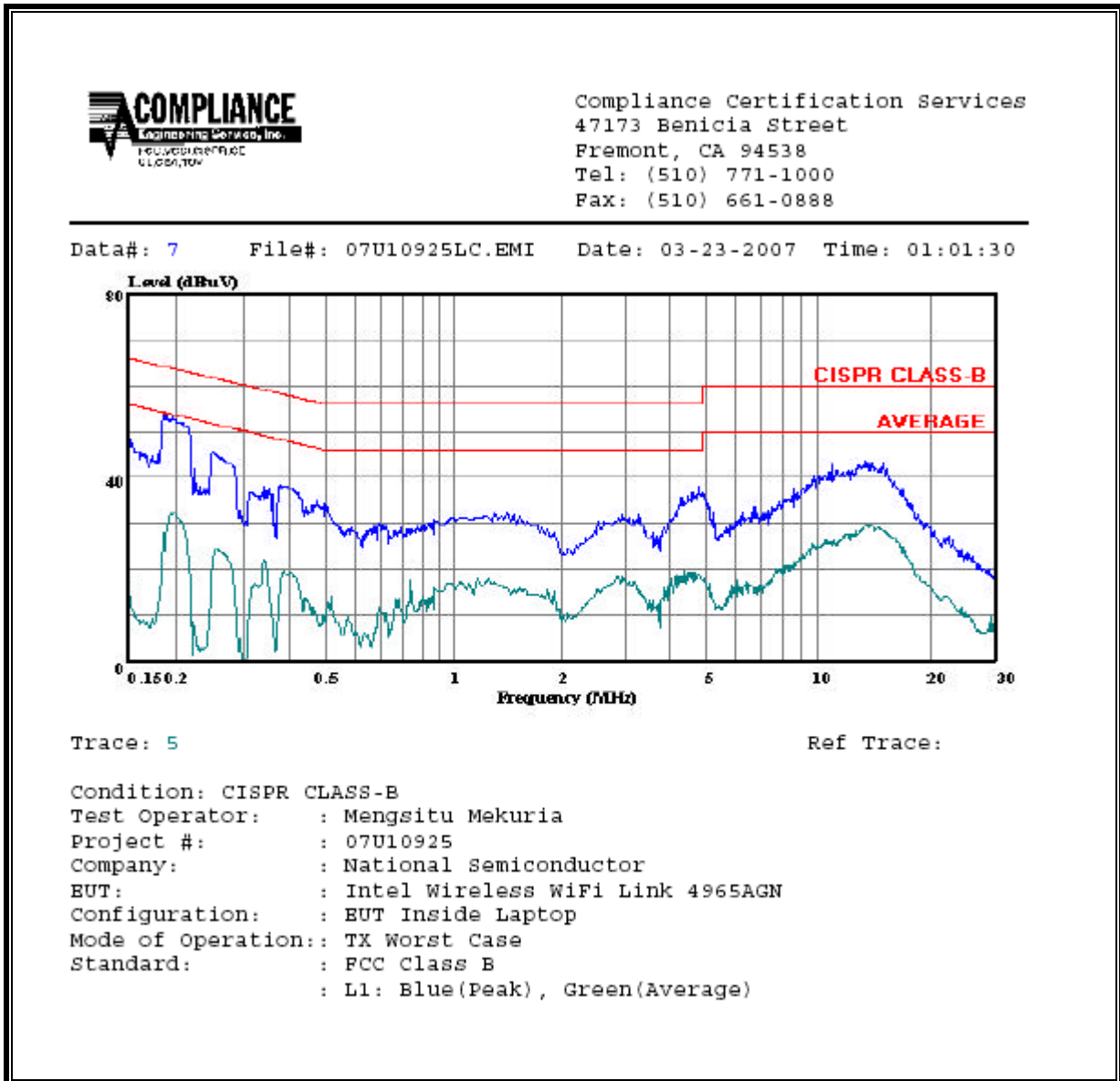
#### RESULTS

No non-compliance noted:

**6 WORST EMISSIONS**

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.19	53.62	--	32.38	0.00	64.12	54.12	-10.50	-21.74	L1
4.85	38.10	--	--	0.00	56.00	46.00	-17.90	-7.90	L1
13.62	43.12	--	--	0.00	60.00	50.00	-16.88	-6.88	L1
0.20	49.41	--	36.98	0.00	63.61	53.61	-14.20	-16.63	L2
4.53	35.88	--	--	0.00	56.00	46.00	-20.12	-10.12	L2
13.70	43.06	--	--	0.00	60.00	50.00	-16.94	-6.94	L2
6 Worst Data									

**LINE 1 RESULTS**



**LINE 2 RESULTS**

