



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

INTEL PRO/WIRELESS 3945ABG NETWORK CONNECTION

MODEL NUMBER: WM3945ABG

FCC ID: PD9LEN3945ABG

REPORT NUMBER: 07U10903-2

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

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



NVLAP LAB CODE 200065-0

Revision History

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: INTEL PRO/WIRELESS 3945ABG NETWORK CONNECTION

MODEL: WM3945ABG

SERIAL NUMBER: LV-00452

DATE TESTED: MARCH 6, 9, 11, AND 12, 2007

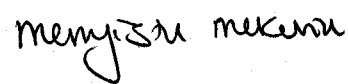
| APPLICABLE STANDARDS | |
|-----------------------|-------------------------|
| STANDARD | TEST RESULTS |
| FCC PART 15 SUBPART E | NO NON-COMPLIANCE NOTED |

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

MENGISTU MEKURIA
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 transceiver that is installed inside an IBM Thinkpad (Lenovo) Laptop of model ThinkPad X61 Tablet Series.

The radio module is manufactured by Intel Corporation.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The change filed under this application is:

1. Add WLAN Main 25.90424.001 Ant
2. Add ThinkPad X61 Tablet (DL2-12.1inch)

5.3. MAXIMUM OUTPUT POWER

The transmitter has the same maximum conducted output power as original.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two PIFA for diversity with a maximum peak gain of 2.78dBi.

5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was CRTU, rev. 10.0.0.111.

The test utility software used during testing was CRTU Version 4.0.14.0000

5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power for a mode of 5.2GHz band was at the high channel.

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

For this mode, the worst-case configuration has been evaluated at which the EUT was in Y position.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|-----------------------------------|--------------|------------|-----------------------|--------|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Laptop | IBM | Lenovo X61 | LV-00452 | DoC |
| AC Adapter | IBM | 92P1156 | 11S92P1156Z1ZBGFCKH7G | DoC |

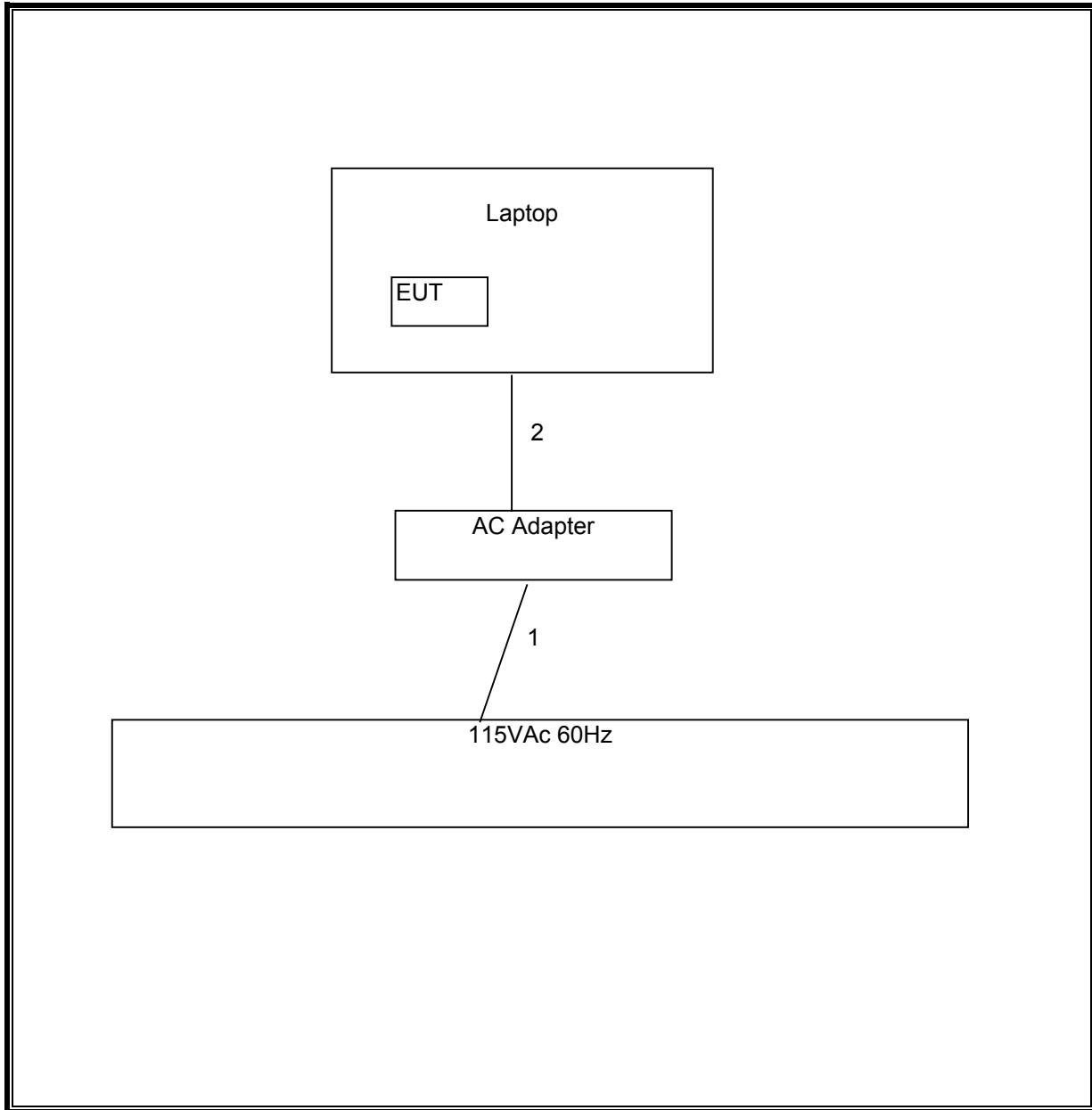
I/O CABLES

| I/O CABLE LIST | | | | | | |
|----------------|------|----------------------|----------------|-------------|--------------|---------|
| Cable No. | Port | # of Identical Ports | Connector Type | Cable Type | Cable Length | Remarks |
| 1 | AC | 2 | US 115V | Un-shielded | 2m | N/A |
| 2 | DC | 1 | DC | Un-shielded | 2m | N/A |

TEST SETUP

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

SETUP DIAGRAM FOR TESTS



5.8. CHANNEL TESTS FOR THE 5150 TO 5350 MHz BAND

5.8.1. 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 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Mode

| Channel | Frequency (MHz) | Average Power (dBm) |
|---------|-----------------|---------------------|
| Low | 5180 | 16.23 |
| Middle | 5260 | 17.33 |
| High | 5320 | 17.54 |

5.9. RADIATED EMISSIONS

5.9.1. 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 |
| ¹ 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 | (²) |
| 13.36 - 13.41 | | | |

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² 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.

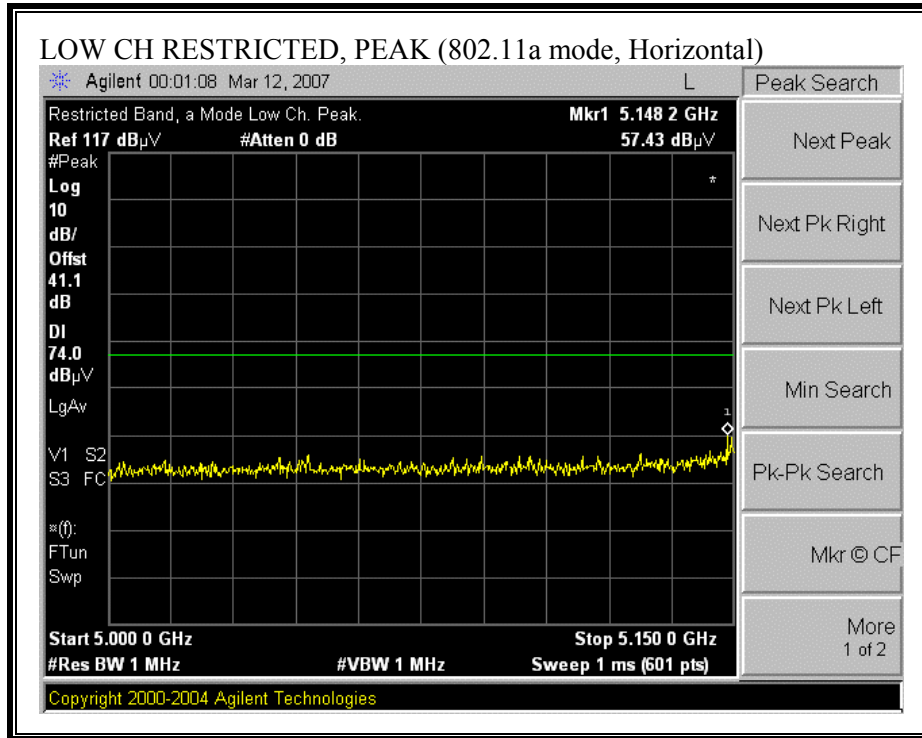
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

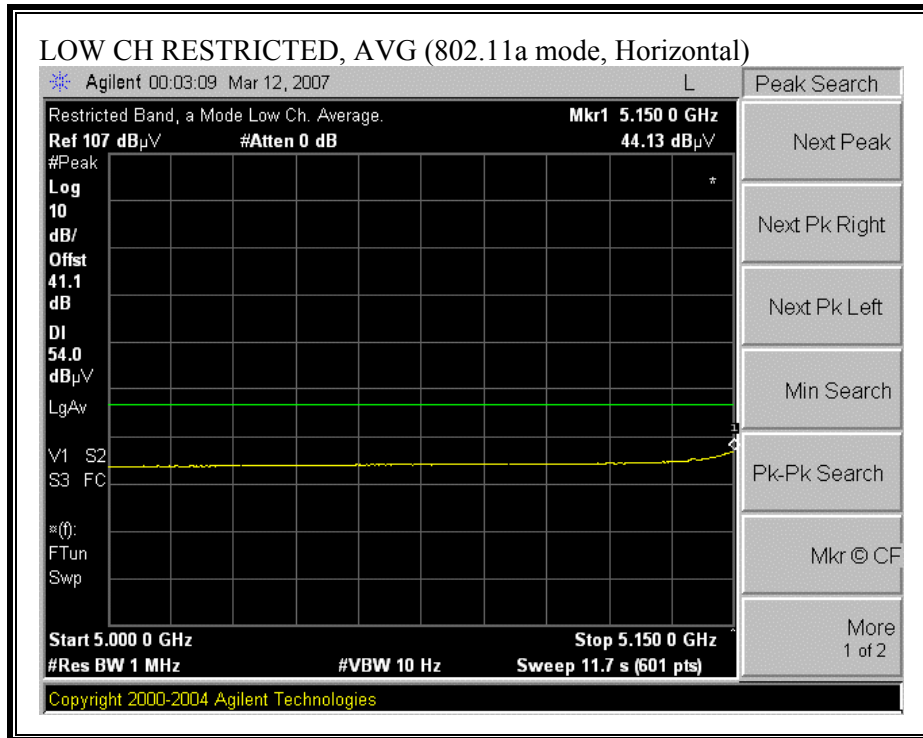
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each band.

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.

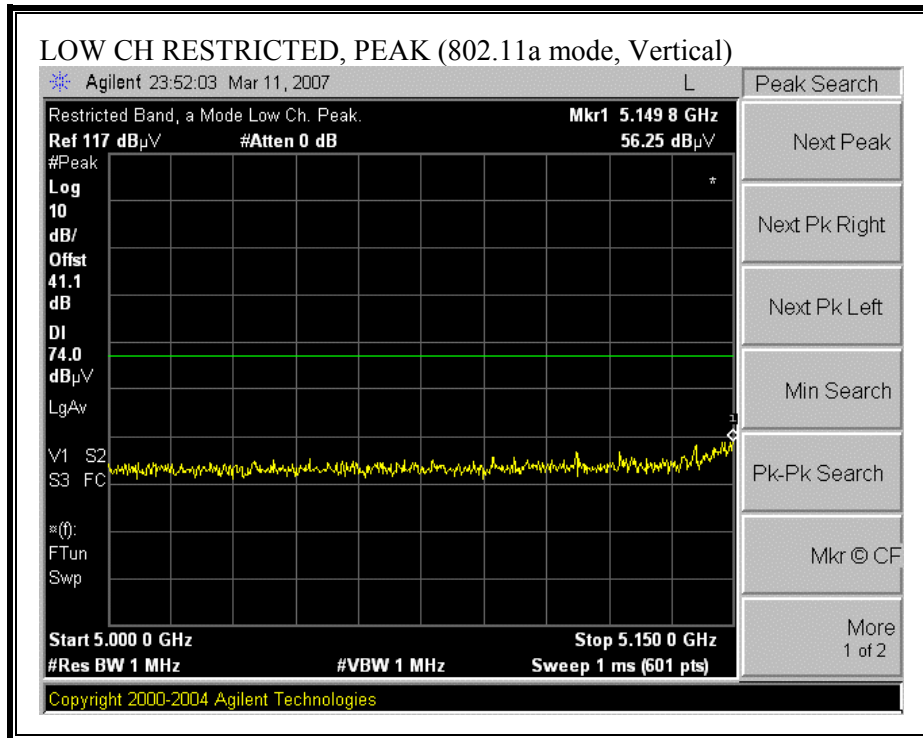
5.9.2. TRANSMITTER ABOVE 1 GHZ FOR 5150 TO 5350 MHz BAND

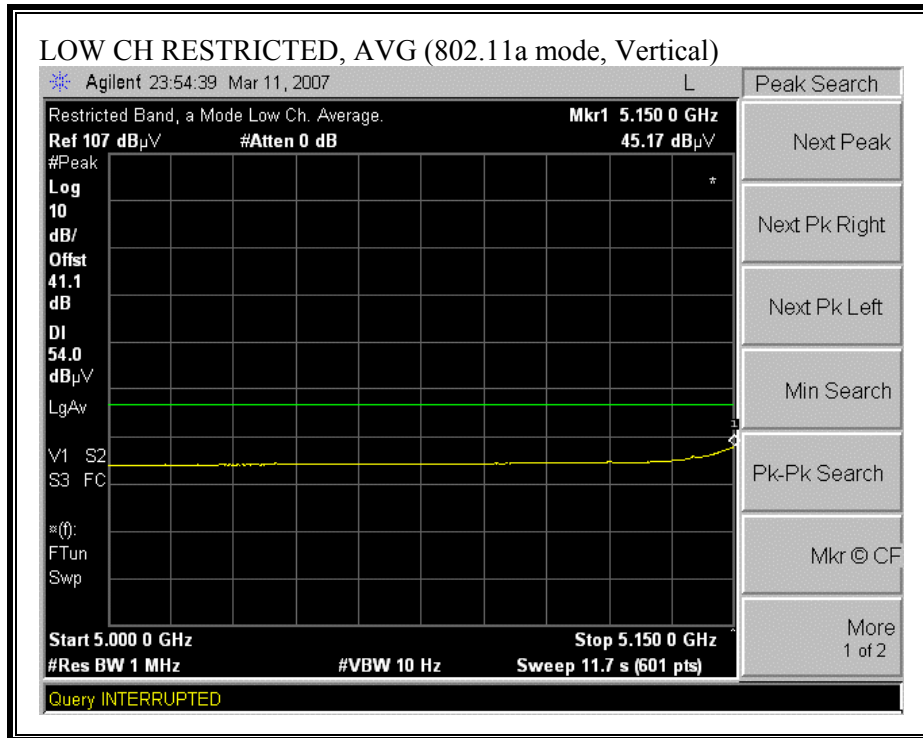
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)



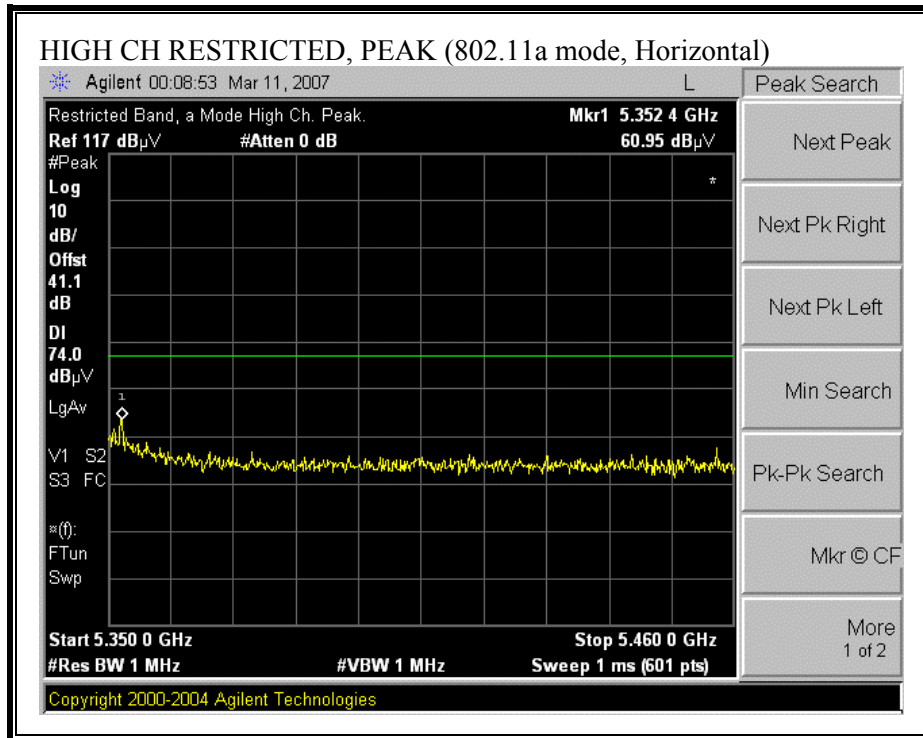


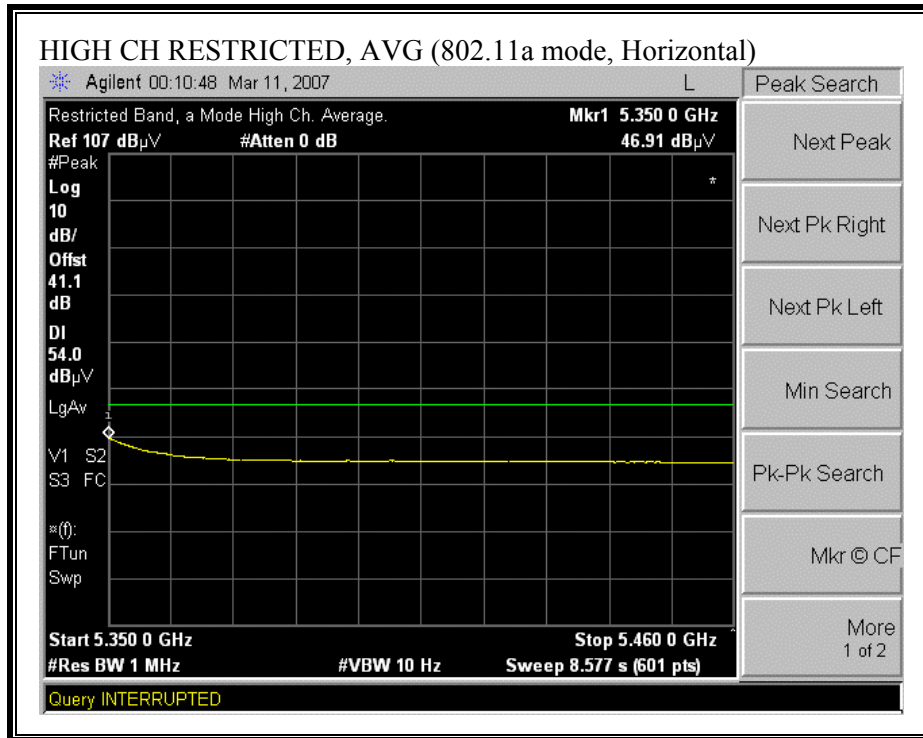
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)



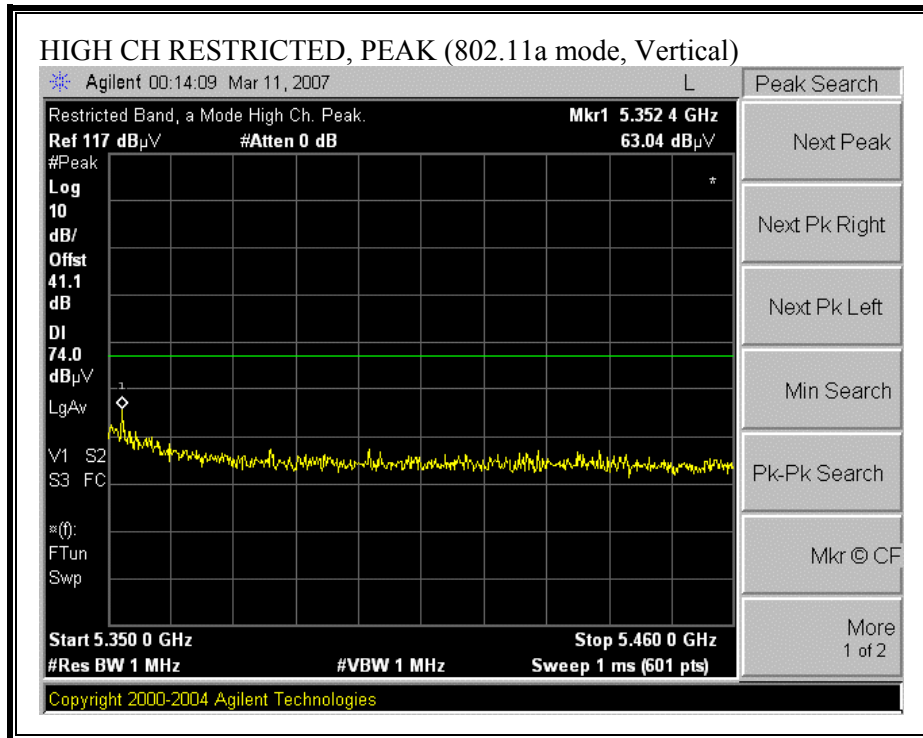


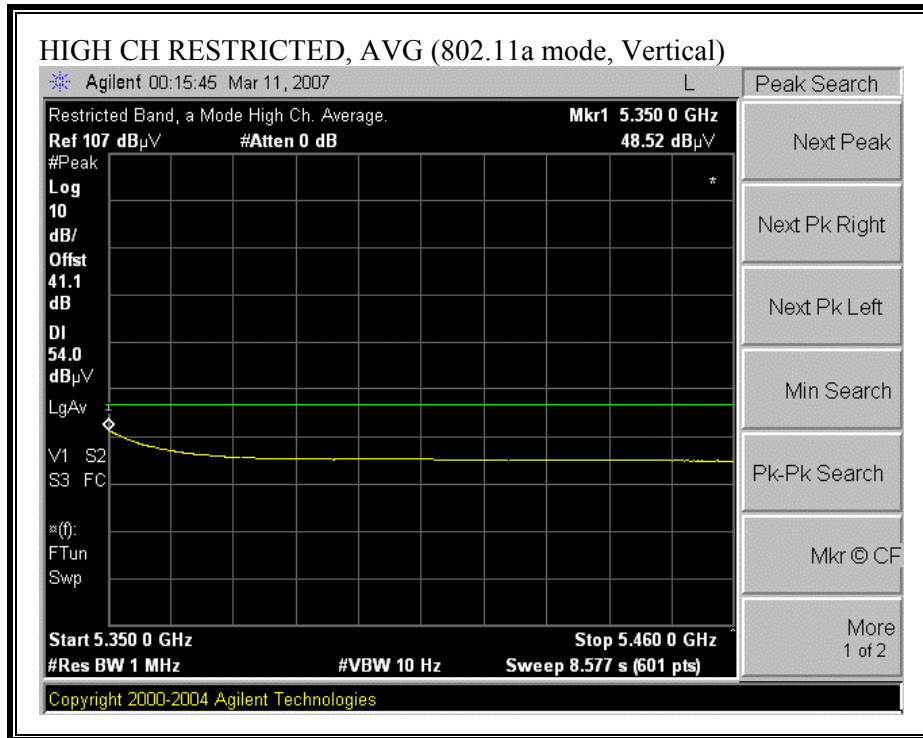
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

High Frequency Measurement
 Compliance Certification Services, Fremont Chamber A

Company: Intel
 Project #: 07U10903
 Date: 03/11/07
 Test Engineer: Mergsita Mekuria
 Configuration: EUT Only
 Mode of Operation: Transmitting in 11a Mode, 5.2GHz Band

Test Equipment:

| | | | |
|--------------------------------------|--|------------------------|---|
| Horn 1-18GHz T119; S/N: 29301 @3m | Pre-amplifier 1-26GHz T144 Miteq 3008A00931 | Pre-amplifier 26-40GHz | Horn > 18GHz T89; ARA 18-26GHz; S/N:1049 |
|--------------------------------------|--|------------------------|---|

Hi Frequency Cables

| | | | | |
|--------------|--------------|-----------------------------------|-------------------|---------------|
| 2 foot cable | 3 foot cable | 12 foot cable Gordon 203134001 | HPF HPF_7.6GHz | Reject Filter |
|--------------|--------------|-----------------------------------|-------------------|---------------|

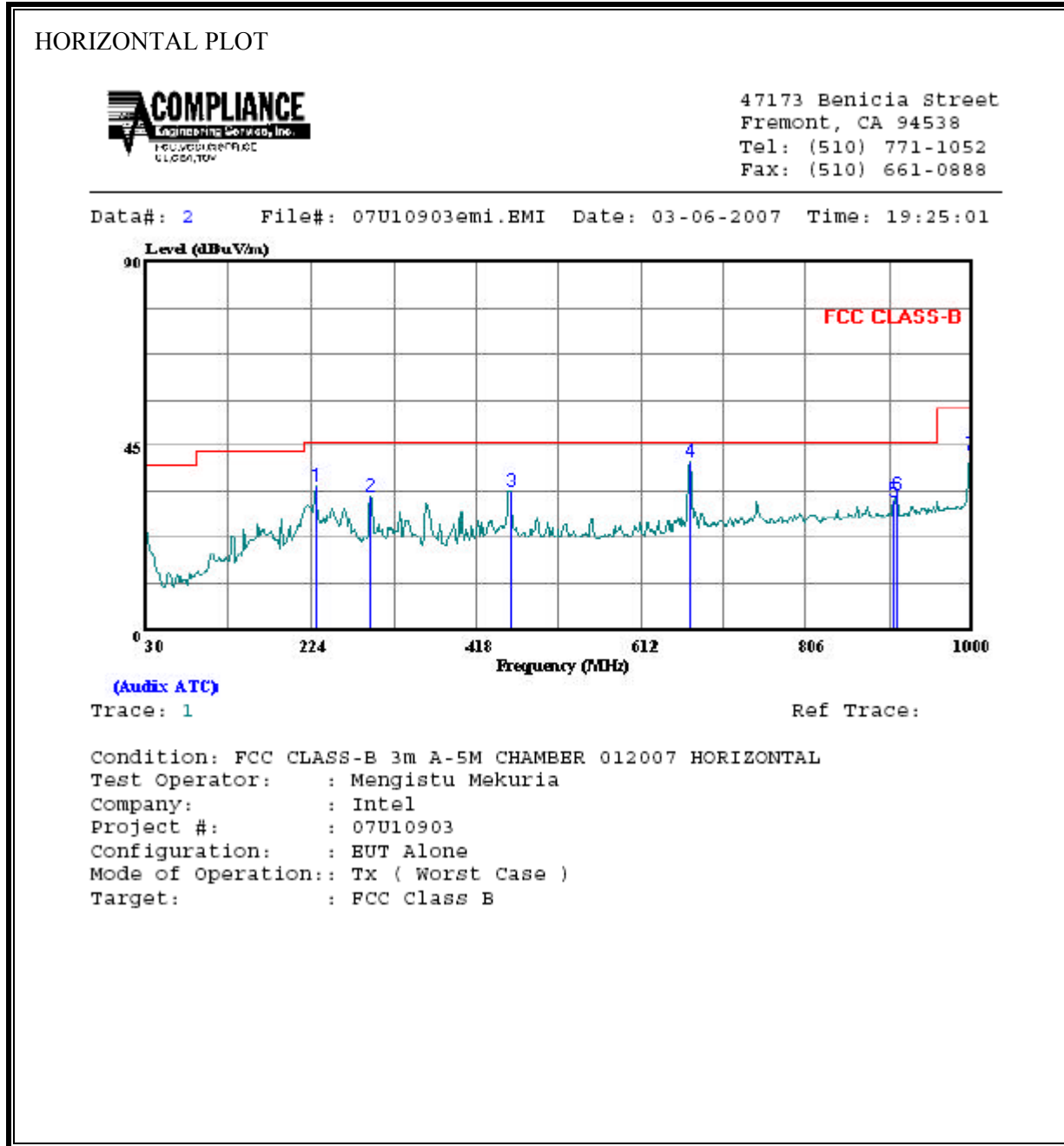
Peak Measurements
 RBW-VBW=1MHz
Average Measurements
 RBW=1MHz; VBW=10Hz

| 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) |
|----------------|----------|--------------|----------------|---------|-------|--------|-----------|----------|-------------|------------|---------------|----------------|-----------|------------|-------------|
| Low Ch | | | | | | | | | | | | | | | |
| 15.540 | 1.0 | 44.1 | 31.2 | 38.7 | 12.7 | -34.8 | -9.5 | 0.7 | 51.9 | 38.9 | 74 | 54 | -22.1 | -15.1 | V |
| 15.540 | 1.0 | 44.6 | 32.5 | 38.7 | 12.7 | -34.8 | -9.5 | 0.7 | 52.3 | 40.2 | 74 | 54 | -21.7 | -13.8 | H |
| Mid Ch | | | | | | | | | | | | | | | |
| 15.780 | 1.0 | 43.9 | 31.5 | 38.8 | 12.8 | -34.6 | -9.5 | 0.7 | 52.0 | 39.5 | 74 | 54 | -22.0 | -14.5 | V |
| 15.780 | 1.0 | 48.3 | 35.7 | 38.8 | 12.8 | -34.6 | -9.5 | 0.7 | 56.4 | 43.7 | 74 | 54 | -17.6 | -10.3 | H |
| High Ch | | | | | | | | | | | | | | | |
| 10.640 | 1.0 | 47.6 | 36.2 | 36.8 | 10.7 | -36.6 | -9.5 | 0.8 | 49.8 | 38.4 | 74 | 54 | -24.2 | -15.6 | V |
| 15.960 | 1.0 | 43.7 | 31.6 | 38.8 | 12.8 | -34.5 | -9.5 | 0.7 | 52.1 | 40.0 | 74 | 54 | -21.9 | -14.0 | V |
| 10.640 | 1.0 | 53.6 | 41.9 | 36.8 | 10.7 | -36.6 | -9.5 | 0.8 | 55.8 | 44.1 | 74 | 54 | -18.2 | -9.9 | H |
| 15.960 | 1.0 | 50.0 | 37.8 | 38.8 | 12.8 | -34.5 | -9.5 | 0.7 | 58.4 | 46.1 | 74 | 54 | -15.6 | -7.9 | H |

| | | | | | |
|------|-----------------------|--------|--------------------------------|---------|------------------------------|
| 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 | | |

5.9.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

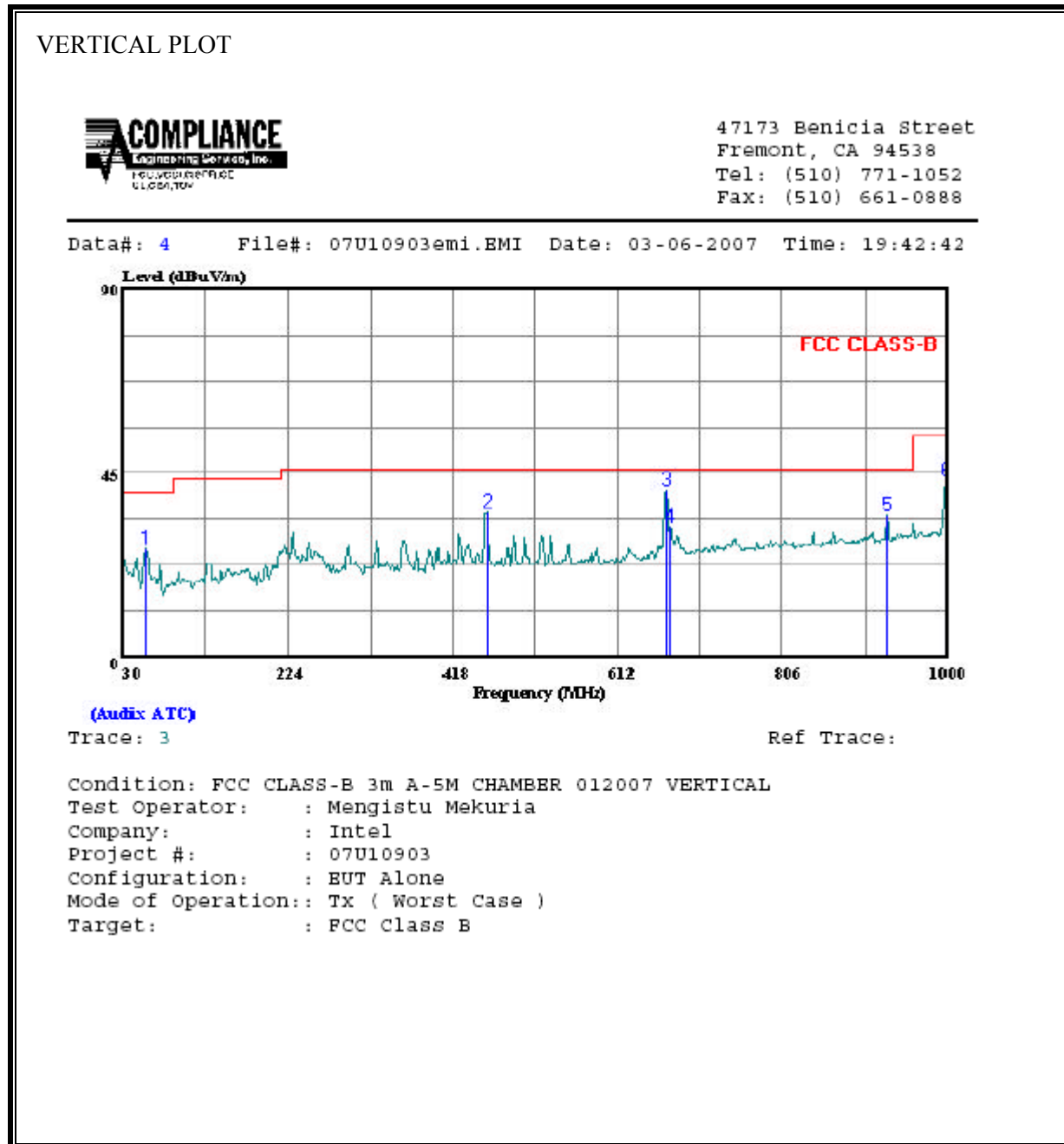
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



HORIZONTAL DATA

| | Freq | Read Level | Probe Factor | Cable Loss | Preamplifier Factor | Level | Limit Line | Over Limit | Remark |
|---|---------|------------|--------------|------------|---------------------|--------|------------|------------|--------|
| | MHz | dBuV | dB | dB | dB | dBuV/m | dBuV/m | dB | |
| 1 | 230.790 | 53.50 | 11.65 | 1.60 | 31.65 | 35.10 | 46.00 | -10.90 | Peak |
| 2 | 293.840 | 48.59 | 13.72 | 1.84 | 31.54 | 32.61 | 46.00 | -13.39 | Peak |
| 3 | 458.740 | 45.84 | 17.22 | 2.32 | 31.63 | 33.75 | 46.00 | -12.25 | Peak |
| 4 | 669.230 | 50.00 | 20.18 | 2.89 | 31.92 | 41.15 | 46.00 | -4.85 | Peak |
| 5 | 906.880 | 36.43 | 22.81 | 3.43 | 31.12 | 31.55 | 46.00 | -14.45 | Peak |
| 6 | 911.730 | 38.11 | 22.85 | 3.44 | 31.13 | 33.27 | 46.00 | -12.73 | Peak |
| 7 | 997.090 | 45.56 | 23.64 | 3.58 | 30.08 | 42.70 | 54.00 | -11.30 | Peak |

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



VERTICAL DATA

| | 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 | 58.130 | 49.66 | 7.99 | 0.79 | 31.79 | 26.65 | 40.00 | -13.36 | Peak |
| 2 | 458.740 | 47.45 | 17.22 | 2.32 | 31.63 | 35.36 | 46.00 | -10.64 | Peak |
| 3 | 669.230 | 49.63 | 20.18 | 2.89 | 31.92 | 40.78 | 46.00 | -5.22 | Peak |
| 4 | 674.080 | 40.80 | 20.25 | 2.90 | 32.03 | 31.92 | 46.00 | -14.08 | Peak |
| 5 | 929.190 | 39.18 | 23.02 | 3.53 | 30.96 | 34.77 | 46.00 | -11.23 | Peak |
| 6 | 997.090 | 45.97 | 23.64 | 3.58 | 30.08 | 43.11 | 54.00 | -10.89 | Peak |

5.10. 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 μ 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.

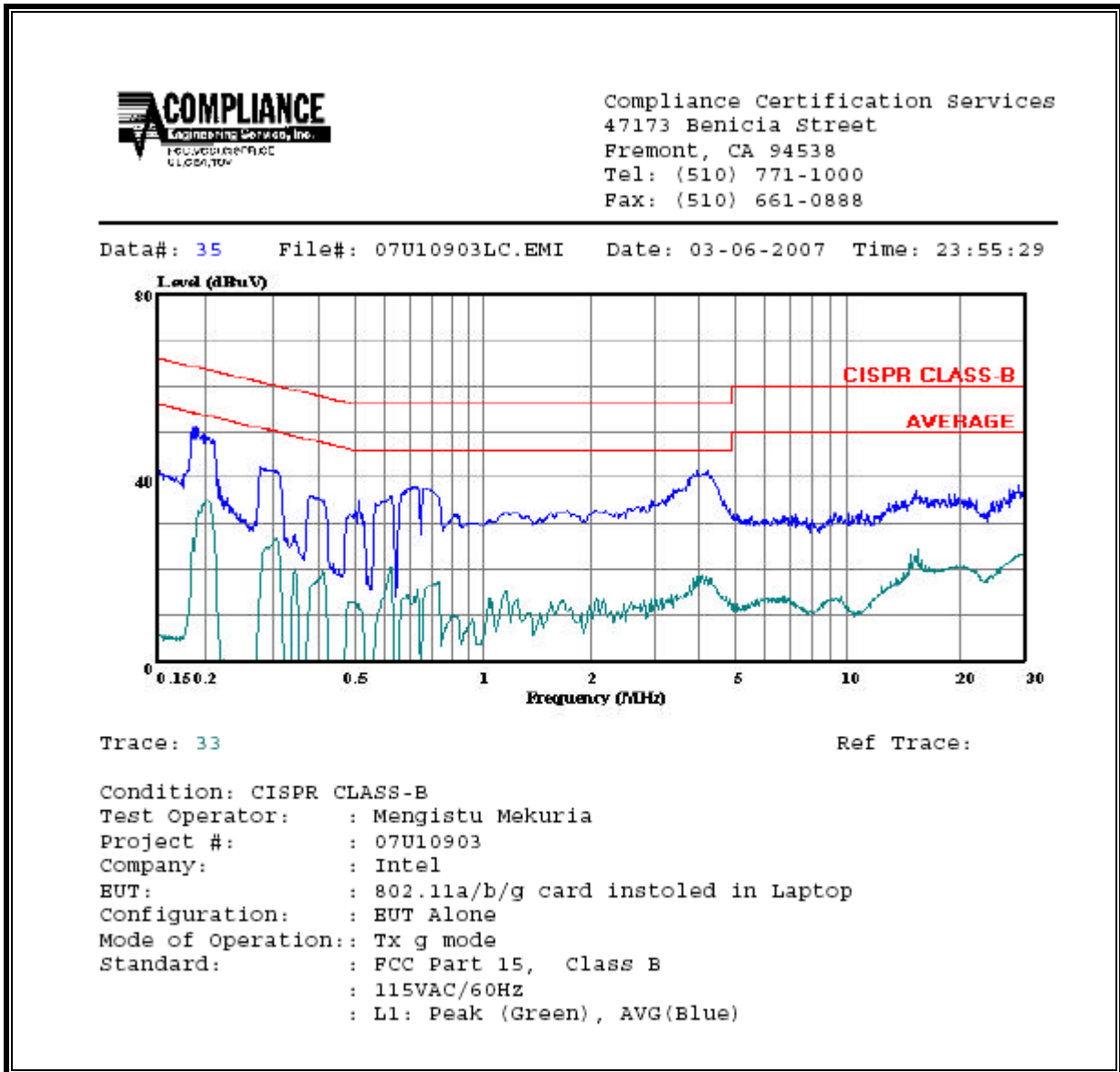
RESULTS

No non-compliance noted:

6 WORST EMISSIONS

| CONDUCTED EMISSIONS DATA (115VAC 60Hz) | | | | | | | | | |
|--|-----------|-----------|-----------|-------|-------|-------|---------|---------|---------|
| Freq. | Reading | | | Class | Limit | EN B | Margin | | Remark |
| (MHz) | PK (dBuV) | QP (dBuV) | AV (dBuV) | (dB) | QP | AV | QP (dB) | AV (dB) | L1 / L2 |
| 0.19 | 51.24 | 51.24 | -- | 0.00 | 64.08 | 54.08 | -12.84 | -2.84 | L1 |
| 0.28 | 42.12 | 42.12 | -- | 0.00 | 60.76 | 50.76 | -18.64 | -8.64 | L1 |
| 4.05 | 41.70 | 41.70 | -- | 0.00 | 56.00 | 46.00 | -14.30 | -4.30 | L1 |
| 0.19 | 53.87 | 35.62 | -- | 0.00 | 64.21 | 54.21 | -28.59 | -18.59 | L2 |
| 0.28 | 44.18 | 44.18 | -- | 0.00 | 60.73 | 50.73 | -16.55 | -6.55 | L2 |
| 4.27 | 42.84 | 42.84 | -- | 0.00 | 56.00 | 46.00 | -13.16 | -3.16 | L2 |
| 6 Worst Data | | | | | | | | | |

LINE 1 RESULTS



LINE 2 RESULTS

