EMC Test Report

Class B PC Peripheral

FCC Part 15
Industry Canada ICES 003

Intel® Centrino® Advanced-N + WiMAX 6250, model 622ANXHMW

FCC ID(s):	PD9622ANXH PD9622ANXHU E2K625ANXH
COMPANY:	Intel Corporation 2111 NE 25th Avenue JF3-302 Hillsboro, OR 97124
TEST SITE(S):	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
REPORT DATE:	September 17, 2009
FINAL TEST DATES:	August 7, 2009

AUTHORIZED SIGNATORY:

Mark Briggs
Staff Engineer
Elliott Laboratories.

Testing Cert #2016.01

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	September 23, 2009	First Release	

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SCOPE

Governments and standards organizations around the world have published requirements regarding the electromagnetic emissions of electronic equipment. Electromagnetic emissions testing has been performed on the Intel Corporation Intel® Centrino® Advanced-N + WiMAX 6250, model 622ANXHMW, to establish compliance with these requirements.

Electromagnetic emissions data has been taken pursuant to the following standards. All measurements and evaluations have been taken in accordance with these specifications, test procedures, and measurement guidelines as outlined in Elliott Laboratories test procedures and in accordance with the standards referenced therein.

Standard	Title	Standard Date
FCC Part 15, Subpart B	Radio Frequency Devices	October 2008 as Amended
ICES-003, Issue 4	Digital apparatus	2004

In order to demonstrate compliance with the requirements, the company or a contracted laboratory makes measurements and takes the necessary steps to ensure that the equipment complies with the appropriate technical standards.

OBJECTIVE

The objective of Intel Corporation is to determine compliance with FCC requirements for digital devices and Canada's requirements for digital devices.

STATEMENT OF COMPLIANCE

The tested sample of Intel Corporation Intel® Centrino® Advanced-N + WiMAX 6250, model 622ANXHMW complied with the requirements of:

Standard/Regulation	Equipment Type/Class	Standard Date
Subpart B of Part 15 of the FCC Rules (CFR title 47)	Class B	2008 as amended
ICES-003, Issue 4	Class B	2004

The test results recorded herein are based on a single type test of the Intel Corporation Intel® Centrino® Advanced-N + WiMAX 6250, model 622ANXHMW and therefore apply only to the tested sample. The sample was selected and prepared by Steve Hackett of Intel Corporation.

Maintenance of compliance is the responsibility of the company. Any modification of the product that could result in increased emissions or susceptibility should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different enclosure, different line filter or power supply, harnessing and/or interface cable changes, etc.).

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

INFORMATION TECHNOLOGY EQUIPMENT EMISSIONS TEST RESULTS

The following emissions tests were performed on the Intel Corporation Intel® Centrino® Advanced-N + WiMAX 6250, model 622ANXHMW. The measurements were extracted from the data recorded during testing and represent the highest amplitude emissions relative to the specification limits. The actual test results are contained in an appendix of this report.

CONDUCTED EMISSIONS (MAINS PORT)

Frequency Range Operating Voltage	Standard/Section	Requirement	Measurement	Margin	Status
0.15-30 MHz, 230V, 50Hz	EN 55022 Table 2 (Class B)	0.15-0.5 MHz: 66-56 dBµV QP 56-46 dBµV Av 0.5-5.0 MHz: 56 dBµV QP 46 dBµV Av 5.0-30.0 MHz: 60 dBµV QP 50 dBµV Av	49.6dBµV @ 1.916MHz	-6.4dB	Complied
0.15-30 MHz, 120V, 60Hz	FCC § 15.107(a) VCCI Table 4.2 (Class B)		43.3dBµV @ 1.906MHz	-12.7dB	Complied

RADIATED EMISSIONS

Frequency Range	Standard/Section	Requirement	Measurement	Margin	Status
30-1000 MHz	FCC §15.109(a)	30 – 88 MHz 40 dBµV/m 88 – 216 MHz 43.5 dBµV/m 216 – 960 MHz 46 dBµV/m 960 – 1000 Mhz 54 dBµV/m (3m limit)	36.8dBµV/m @192.033 MHz	-6.7dB	Complied
1000-2000 MHz Note 1	FCC §15.109(a)	54.0 dBµV/m Av 74.0 dBµV/m Pk (3m limit)	N/A – Note 1		
Note 1 Testing above 1GHz against FCC 15.109(a) requirements was not required because the highest frequency generated in the EUT was declared to be less than 108 MHz.					

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below were calculated using the approach described in CISPR 16-4-2:2003 using a coverage factor of k=2, which gives a level of confidence of approximately 95%. The levels were found to be below levels of *U*cispr and therefore no adjustment of the data for measurement uncertainty is required.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
Conducted Emissions	dBuV or dBuA	150kHz – 30MHz	± 2.2 dB
Radiated Electric Field	dBuV/m	30 – 1000 MHz	± 3.6 dB
		1000 – 40,000 MHz	± 6.0 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Intel Corporation Intel® Centrino® Advanced-N + WiMAX 6250, model 622ANXHMW is a PCI express form factor (half-mini) card that is designed to provide a 2x2 802.11abgn and 1x2 802.16e interfaces for host systems such as laptop PCs. The electrical rating of the EUT is 3.3Vdc (via mini PCI bus).

The emissions tests related to the device being a PC peripheral were performed with the card installed into the mini-PCI bus of a laptop, as would be the case in normal use.

The sample was received on August 3, 2009 and tested on August 7, 2009. The EUT consisted of the following component(s):

Company	Model	Description	MAC Address	FCC ID
Intel Corporation	622ANXHMW	2x2 802.11bgn PCIe card	001E6400E972	PD9622ANXH PD9622ANXHU E2K625ANXH

ENCLOSURE

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host computer or system.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
Hewlett Packard	IP26000	Printer	QC2-6844-DB02-01	DoC
Toshiba	PSAG8U-04001W	Host Laptop	49290792Q	DoC
Company	Model	Description	Serial Number	FCC ID
Netgear	FS108	Hub	F518H2BCB092554	-
The ethernet hub was located outside the test chamber.				

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Laptop Ethernet	Hub	Cat-5	Unshielded	10.0
Laptop USB	Printer	USB	Shielded	1.5
Laptop AC Power	AC Mains	3Wire	Unshielded	1.0

EUT OPERATION

During AC conducted emissions testing the EUT was being controlled by the CRTU tool to operate in a continuous transmit mode on the center channel. In addition the laptop was displaying a scrolling ‘H’ pattern on the screen and had link enabled to both the ethernet and USB peripherals.

EMISSIONS TESTING

GENERAL INFORMATION

Final test measurements were taken at the Elliott Laboratories Anechoic Chambers and/or Open Area Test Site(s) listed below. The test sites contain separate areas for radiated and conducted emissions testing. The sites conform to the requirements of ANSI C63.4: 2003 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* and CISPR 16-1-4:2007 - *Specification for radio disturbance and immunity measuring apparatus and methods Part 1-4: Radio disturbance and immunity measuring apparatus Ancillary equipment Radiated disturbances*. They are registered with the VCCI and are on file with the FCC and industry Canada.

Site	Registration Numbers			Location
	VCCI	FCC	Canada	
Chamber 3	R-1683 C-1795	769238	IC 2845B-3	41039 Boyce Road Fremont, CA 94538-2435

Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4 and CISPR 22. Mains port measurements are made with the EUT connected to the public power network through nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord. Telecommunication port measurements are made with the network cable connected through an ISN appropriate to the type of cable employed.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiated measurements made in a non-anechoic shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an Open Area Test Site or semi-anechoic chamber, as defined in ANSI C63.4. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1:2006 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 7 GHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000 MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer runs automated data collection programs that control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted emission measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

IMPEDANCE STABILIZATION NETWORK (ISN)

Telecommunication port conducted emission measurements utilize an Impedance Stabilization Network with a 150 ohm termination impedance and specific longitudinal conversion loss as the voltage monitoring point. This network provides for calibrated radio frequency noise measurements by the design of the internal circuitry on the EUT and measurement ports, respectively. For current measurements, a current probe with a uniform frequency response and less than 1 ohm insertion impedance is used.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz frequency range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors that are programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material up to 12 mm thick if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the company's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The standards require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS (MAINS)

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord. Emissions that have peak values close to the specification limit are also measured in the quasi-peak and average detection modes to determine compliance except when the amplitude of the emission when measured with the quasi-peak detector is more than 10 dB below the specification limit for average measurements. In this case only quasi-peak measurements are performed.

CONDUCTED EMISSIONS (TELECOMMUNICATION PORTS)

Conducted emissions voltages are measured at a point 80 cm from the EUT. If conducted emission currents are measured, the current probe is located 70 cm from the EUT. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted. Emissions that have peak values close to the specification limit are also measured in the quasi-peak and average detection modes to determine compliance except when the amplitude of the emission when measured with the quasi-peak detector is more than 10 dB below the specification limit for average measurements. In this case only quasi-peak measurements are performed.

RADIATED EMISSIONS (SEMI-ANECHOIC and/or OATS TEST ENVIRONMENT)

Radiated emissions measurements in a semi-anechoic environment are performed in two phases (preliminary scan and final maximization). Final maximization may be performed on an OATS.

Preliminary Scan

A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulations specified on page 1. One or more of these is performed with the antenna polarized vertically and one or more of these is performed with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit. A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions if required. Other methods used during the preliminary scan for EUT emissions involve scanning with near-field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final Maximization

During final maximization, the highest-amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth that results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions that have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

For measurements above 1GHz every effort is made to ensure the EUT remains within the cone of radiation of the measurement antenna (i.e. 3dB beam-width of the antenna). This may include rotating the product and/or angling the measurement antenna.

When Testing above 18 GHz, the receive antenna is located at 1 meter from the EUT and the antenna height is restricted to a maximum of 2.5m. Maximum emissions are found within this restricted range because emission levels decrease over distance and as the antenna is raised above 2.5m, the distance from the EUT increases. As a result of the increased measurement distance, at antenna heights above 2.5m, lower emission levels are measured as compared to emissions levels measured at antenna heights at 2.5m and below.

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form). The calculation is as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV
S = Specification Limit in dBuV
M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB
D_m = Measurement Distance in meters
D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m
F_d = Distance Factor in dB
R_c = Corrected Reading in dBuV/m
L_s = Specification Limit in dBuV/m
M = Margin in dB Relative to Spec

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model #	Asset #	Cal Due
AC Conducted Emissions				
EMCO	LISN, 10 kHz-100 MHz	3825/2	1293	18-Mar-10
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1593	09-Jun-10
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	26-Feb-10
Fischer Custom Comm	LISN, 25A, 150kHz to 30MHz, 25 Amp,	FCC-LISN-50-25-2-09	2001	15-Oct-09
Radiated Emissions 30 – 1000 MHz				
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	13-Jun-10
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	26-Feb-10
Com-Power Corp.	Preamplifier, 30-1000 MHz	PA-103	1632	13-Apr-10

Appendix B Radiated and Conducted Emissions Test Data

T76369 10 Pages

Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		-
Emissions Standard(s):	RSS 210 / FCC 15.247	Class:	DTS
Immunity Standard(s):	N/A	Environment:	-

EMC Test Data

For The

Intel

Model

2x2 WiFi with WiMax MiniPCI

Date of Last Test: 8/25/2009

Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS

Radiated Emissions - Module Installed in Laptop

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 8/7/2009
Test Engineer: Peter Sales
Test Location: Chamber #3

Config. Used: 1
Config Change: None
Host Unit Voltage 230V/50Hz

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing. Any remote support equipment was located outside the semi-anechoic chamber. Any cables running to remote support equipment where routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

The test distance and extrapolation factor (if applicable) are detailed under each run description.

Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 23 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1,2	RE, 30 - 1000 MHz, Maximized Emissions	FCC Class B	Pass	36.8dBµV/m @ 192.033MHz (-6.7dB)
-	RE, 1000 - 2000 MHz, Maximized Emissions	No measurements required, the highest frequency generated in the digital circuitry is less than 108 MHz.		

Modifications Made During Testing

No modifications were made to the EUT during testing

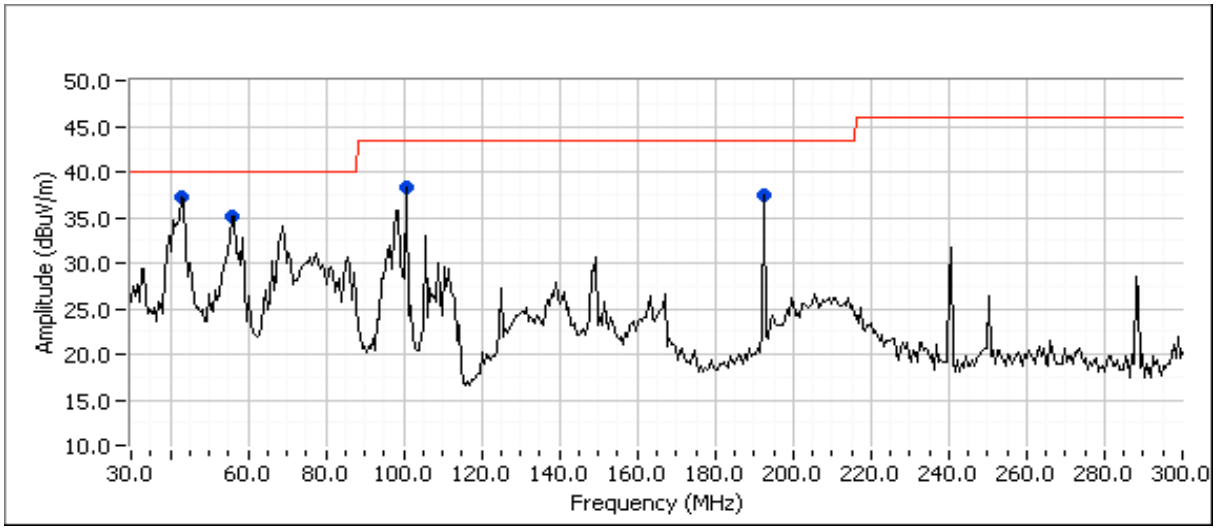
Deviations From The Standard

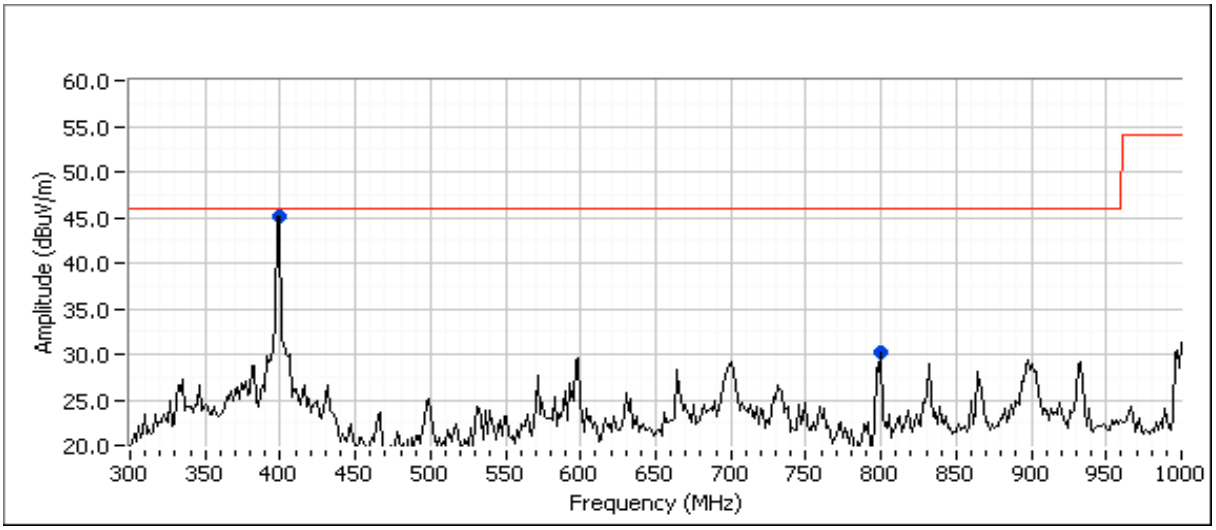
No deviations were made from the requirements of the standard.

Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS

Run #1: Preliminary Radiated Emissions, 30 - 1000 MHz

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 1000 MHz	3	3	0.0





Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS

Continuation of Run #1

Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
105.719	38.4	V	43.5	-5.1	Peak	276	1.0	
42.975	37.2	V	40.0	-2.8	Peak	223	1.0	
56.784	35.1	V	40.0	-4.9	Peak	175	1.0	
192.033	37.5	H	43.5	-6.0	Peak	180	1.0	
398.533	45.2	H	46.0	-0.8	Peak	353	1.0	
796.761	30.3	H	46.0	-15.7	Peak	290	1.0	

Preliminary quasi-peak readings (no manipulation of EUT interface cables)

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
192.033	36.8	H	43.5	-6.7	QP	181	1.0	QP (1.00s)
398.533	38.6	H	46.0	-7.4	QP	354	1.0	QP (1.00s)
105.719	35.9	V	43.5	-7.6	QP	277	1.0	QP (1.00s)
42.975	30.2	V	40.0	-9.8	QP	224	1.0	QP (1.00s)
56.784	27.9	V	40.0	-12.1	QP	175	1.0	QP (1.00s)
796.761	25.0	H	46.0	-21.0	QP	291	1.0	QP (1.00s)

Run #2: Maximized Readings From Run #1

Maximized quasi-peak readings (includes manipulation of EUT interface cables)

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
192.033	36.8	H	43.5	-6.7	QP	181	1.0	QP (1.00s)
398.533	38.6	H	46.0	-7.4	QP	354	1.0	QP (1.00s)
105.719	35.9	V	43.5	-7.6	QP	277	1.0	QP (1.00s)
42.975	30.2	V	40.0	-9.8	QP	224	1.0	QP (1.00s)
56.784	27.9	V	40.0	-12.1	QP	175	1.0	QP (1.00s)
796.761	25.0	H	46.0	-21.0	QP	291	1.0	QP (1.00s)

Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS

Conducted Emissions - Module Installed in Laptop

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 8/7/2009
Test Engineer: Peter Sales
Test Location: Chamber #3

Config. Used: 1
Config Change: None
Host Unit Voltage 230V/50Hz and 120V/Hz

General Test Configuration

For tabletop equipment, the host system was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment. Remote support equipment was located outside of the semi-anechoic chamber. Any cables running to remote support equipment where routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Ambient Conditions:

Temperature: 23 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 230V/50Hz	EN55022 Class B	Pass	49.6dBµV @ 1.916MHz (-6.4dB)
2	CE, AC Power,120V/60Hz	FCC 15.207 FCC Class B	Pass	43.3dBµV @ 1.906MHz (-12.7dB)

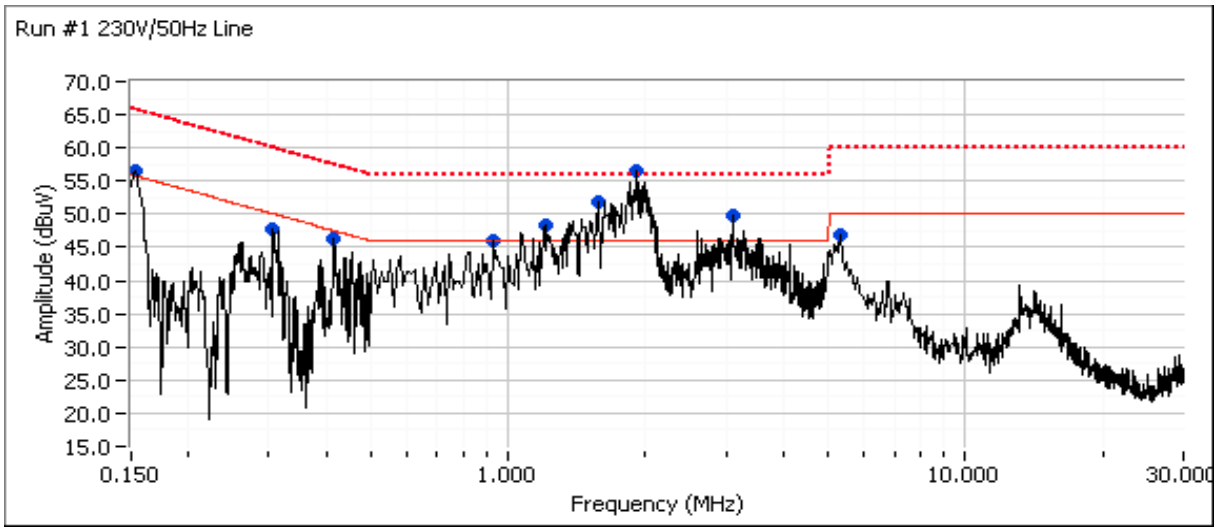
Modifications Made During Testing

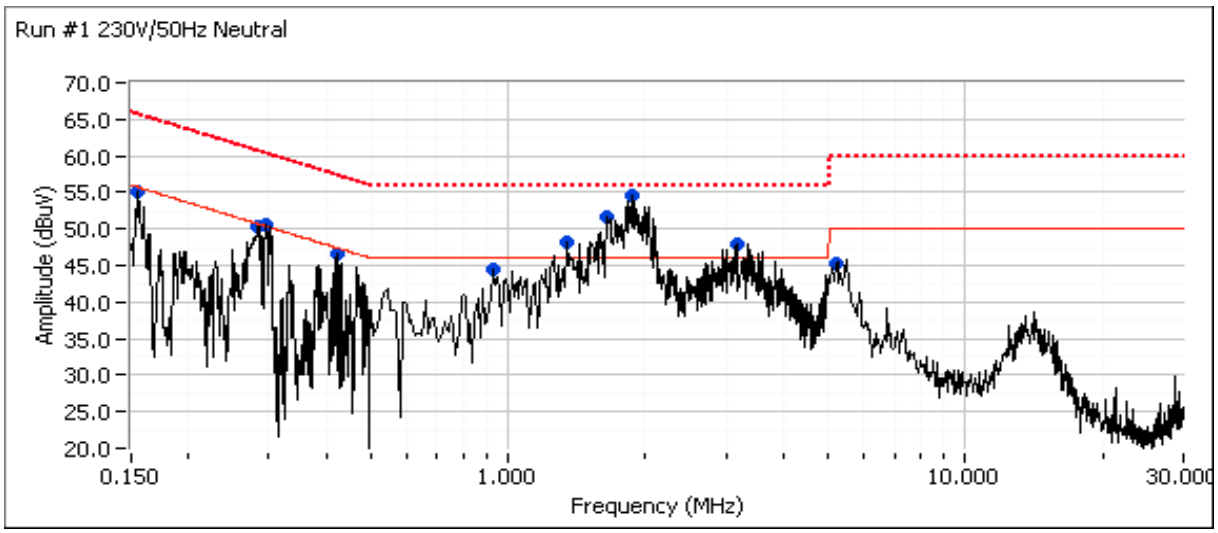
No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS





Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz Continued next page...

Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	EN 55022 Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
1.916	56.6	Line	46.0	10.6	Peak	
1.584	52.0	Line	46.0	6.0	Peak	
3.111	49.8	Line	46.0	3.8	Peak	
1.186	48.4	Line	46.0	2.4	Peak	
0.153	56.4	Line	55.8	0.6	Peak	
0.296	50.5	Neutral	50.4	0.1	Peak	
0.940	45.9	Line	46.0	-0.1	Peak	
0.284	50.4	Neutral	50.7	-0.3	Peak	
0.151	55.1	Neutral	55.7	-0.6	Peak	
0.423	46.6	Neutral	47.4	-0.8	Peak	
0.415	46.2	Line	47.5	-1.3	Peak	
0.306	47.8	Line	50.1	-2.3	Peak	
5.373	47.0	Line	50.0	-3.0	Peak	
5.241	45.3	Neutral	50.0	-4.7	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	EN 55022 Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
1.916	49.6	Line	56.0	-6.4	QP	QP (1.00s)
1.916	35.8	Line	46.0	-10.2	AVG	AVG (0.10s)
0.151	55.6	Neutral	65.9	-10.3	QP	QP (1.00s)
1.584	45.3	Line	56.0	-10.7	QP	QP (1.00s)
0.153	52.6	Line	65.8	-13.2	QP	QP (1.00s)
1.186	41.8	Line	56.0	-14.2	QP	QP (1.00s)
0.296	45.9	Neutral	60.4	-14.5	QP	QP (1.00s)
0.284	46.1	Neutral	60.7	-14.6	QP	QP (1.00s)
3.111	41.3	Line	56.0	-14.7	QP	QP (1.00s)
1.584	30.5	Line	46.0	-15.5	AVG	AVG (0.10s)
0.940	40.5	Line	56.0	-15.5	QP	QP (1.00s)
3.111	30.1	Line	46.0	-15.9	AVG	AVG (0.10s)
0.423	41.4	Neutral	57.4	-16.0	QP	QP (1.00s)
0.415	41.3	Line	57.5	-16.2	QP	QP (1.00s)
0.306	43.6	Line	60.1	-16.5	QP	QP (1.00s)
0.151	39.0	Neutral	55.9	-16.9	AVG	AVG (0.10s)
0.153	36.2	Line	55.8	-19.6	AVG	AVG (0.10s)
1.186	25.2	Line	46.0	-20.8	AVG	AVG (0.10s)
0.940	24.3	Line	46.0	-21.7	AVG	AVG (0.10s)
5.373	37.9	Line	60.0	-22.1	QP	QP (1.00s)
0.284	28.6	Neutral	50.7	-22.1	AVG	AVG (0.10s)
0.296	28.2	Neutral	50.4	-22.2	AVG	AVG (0.10s)

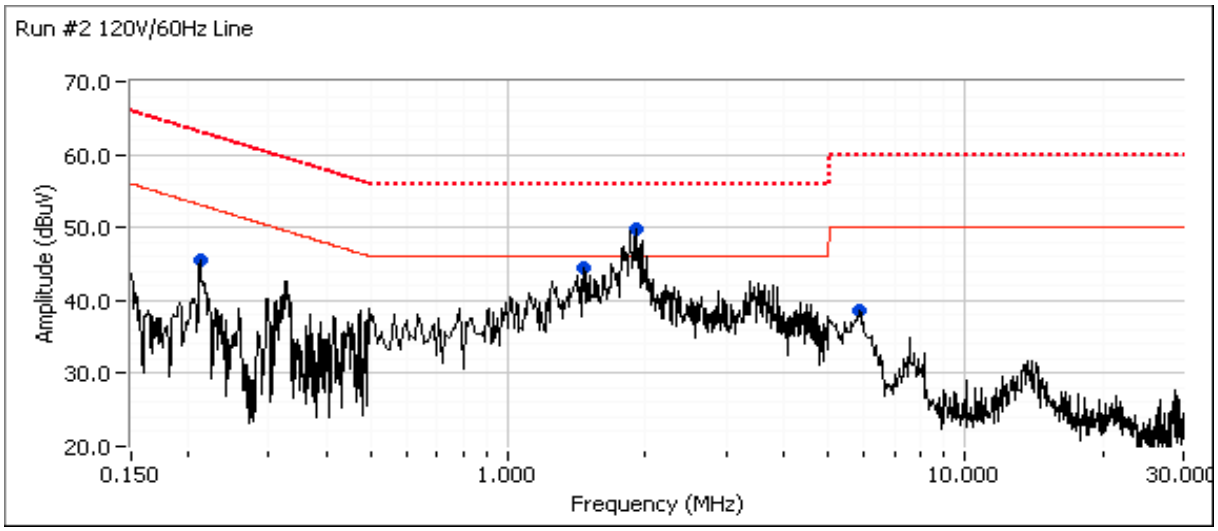
Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz Continued next page...

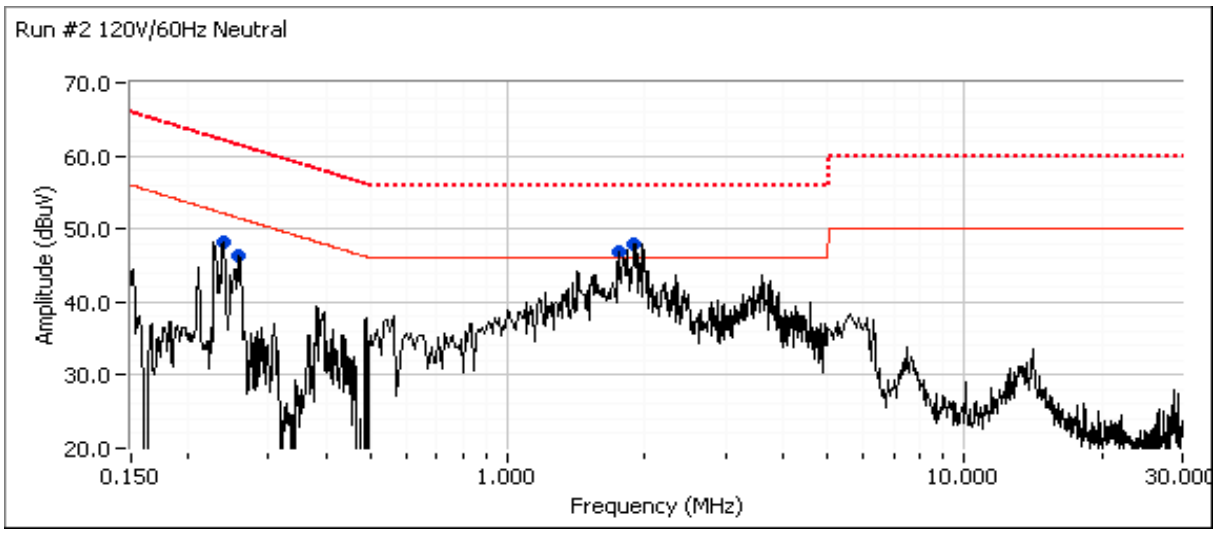
Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS

Frequency	Level	AC	EN 55022 Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
5.241	37.8	Neutral	60.0	-22.2	QP	QP (1.00s)
0.415	24.4	Line	47.5	-23.1	AVG	AVG (0.10s)
5.373	25.5	Line	50.0	-24.5	AVG	AVG (0.10s)
5.241	25.5	Neutral	50.0	-24.5	AVG	AVG (0.10s)
0.423	22.8	Neutral	47.4	-24.6	AVG	AVG (0.10s)
0.306	24.2	Line	50.1	-25.9	AVG	AVG (0.10s)

Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz





Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz Continued next page...

Client:	Intel	Job Number:	J75722
Model:	2x2 WiFi with WiMax MiniPCI	T-Log Number:	T76369
		Account Manager:	-
Contact:	S. Hackett		
Standard:	RSS 210 / FCC 15.247	Class:	DTS

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	EN 55022 Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
1.906	49.9	Line	46.0	3.9	Peak	
1.898	47.8	Neutral	46.0	1.8	Peak	
1.744	46.9	Neutral	46.0	0.9	Peak	
1.465	44.5	Line	46.0	-1.5	Peak	
0.238	48.1	Neutral	52.2	-4.1	Peak	
0.259	46.3	Neutral	51.5	-5.2	Peak	
0.212	45.4	Line	53.1	-7.7	Peak	
5.852	38.5	Line	50.0	-11.5	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	EN 55022 Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
1.906	43.3	Line	56.0	-12.7	QP	QP (1.00s)
1.898	43.1	Neutral	56.0	-12.9	QP	QP (1.00s)
1.906	30.0	Line	46.0	-16.0	AVG	AVG (0.10s)
1.744	39.9	Neutral	56.0	-16.1	QP	QP (1.00s)
1.898	29.5	Neutral	46.0	-16.5	AVG	AVG (0.10s)
1.744	28.1	Neutral	46.0	-17.9	AVG	AVG (0.10s)
1.465	37.9	Line	56.0	-18.1	QP	QP (1.00s)
0.238	44.1	Neutral	62.2	-18.1	QP	QP (1.00s)
0.259	42.4	Neutral	61.5	-19.1	QP	QP (1.00s)
1.465	26.2	Line	46.0	-19.8	AVG	AVG (0.10s)
0.212	40.4	Line	63.1	-22.7	QP	QP (1.00s)
0.259	26.7	Neutral	51.5	-24.8	AVG	AVG (0.10s)
0.238	25.9	Neutral	52.2	-26.3	AVG	AVG (0.10s)
5.852	22.5	Line	50.0	-27.5	AVG	AVG (0.10s)
0.212	25.5	Line	53.1	-27.6	AVG	AVG (0.10s)
5.852	32.0	Line	60.0	-28.0	QP	QP (1.00s)

Appendix C Radiated Emissions Test Configuration Photographs

Uploaded to the FCC/TCB as a separate exhibit

Appendix D Conducted Emissions Test Configuration Photographs

Uploaded to the FCC/TCB as a separate exhibit

Appendix E Product Labeling Requirements

The following information has been provided to clarify notification, equipment labeling requirements and information that must be included in the operator's manual. These requirements may be found in the standards/regulations listed in the scope of this report.

Label Location

The required label(s) must be in a *conspicuous location* on the product, which is defined as any location readily visible to the user of the device without the use of tools.

Label Attachment

The label(s) must be *permanently attached* to the product, which is defined as attached such that it can normally be expected to remain fastened to the equipment during the equipment's expected useful life. A paper gum label will generally not meet this condition.

United States Class B Label

FCC ID: ABC1234567 This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The FCC Identifier is comprised of the grantee code (in the example above **ABC**) that was assigned by the FCC plus a unique alpha-numeric specific to the product being certified. The ID must appear on the device.

If the device is too small or for such use that it is not practicable to place the US label statement on it, the statement shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed

Industry Canada

For ICES-003 (digital apparatus), the product must be labeled with a notice indicating compliance e.g.

This Class [*] digital apparatus complies with Canadian ICES-003 Cet appareil numérique de la classe [*] est conforme à la norme NMB-003 du Canada

The [*] should be replaced by A or B as appropriate. If there is limited space on the product then the text may be shortened (see below) but the complete text should be placed in the manual:

ICES-003 [*] NMB-003 [*]

Appendix F User Manual Regulatory Statements

Where special accessories, such as shielded cables, are required in order to meet the emission limits, appropriate instructions regarding the need to use such accessories must be contained on the first page of text concerned with the installation of the device in the operator's manual.

A requirement by FCC regulations, and recommended for all regulatory markets, is a cautionary statement to the end user that changes or modifications to the device not expressly approved by you, the manufacturer, could void their right to operate the equipment.

United States Class B Manual Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:
-Reorient or relocate the receiving antenna.
-Increase the separation between the equipment and the receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

Note: Additional information about corrective measures may also be provided to the user at the company's option.

The FCC has indicated that the radio interference statement be bound in the same manner as the operator's manual. Thus, a loose-leaf insert page in a bound or center-spine and stapled manual would not meet this condition.