TEST REPORT

Report Number: 3108756LEX-003
Project Number: 3108756

Evaluation of the Lexmark N2000 Series
Model Number: LEX-M01-001

FCC ID: *IYLN2050*

Industry Canada ID: *2376A-N2050*

Tested to the Criteria in FCC Part 15 Subpart C (15.247),
FCC Part 15 Subpart B (15.109),
ICES-003 and RSS-210 Issue 6

For

Lexmark International

Test Performed by:	Test Authorized by:
Intertek	Lexmark International
731 Enterprise Drive	740 West New Circle Road
Lexington, KY 40510	Lexington, KY 40550

Prepared By:_____**Date:**____4/19/2007_____

Bryan C. Taylor, EMC Team Leader

Approved By:_____**Date:**____4/19/2007_____

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1 JOB DESCRIPTION

1.1 Test Sample Information

The LEX-M01-001 is an 802.11b and g wireless print server. It allows the printer it is installed in to be shared on a wireless network without the use of CAT5, USB, or Serial connections. It is sold as an option on some printer models.

Company Information	
Manufacturer:	Lexmark International
Address:	740 West New Circle Road Lexington KY 40550
Contact Name:	Michael Klave
Telephone Number:	(859)-232-3512
Fax Number:	(859)-232-3014
Email Address:	klavem@lexmark.com

Test sample		
Lexmark Model Number:	LEX-M01-001	
Serial Number:	Not Labled	
FCC ID:	IYLN2050	
Industry Canada ID:	2376A-N2050	
Device Category:	Mobile	
RF Exposure Category:	General Population/Uncontrolled Environment	
Transmission Modes:	**802.11b**	**802.11g**
Frequency Range, MHz:	2412MHz – 2462MHz	2412MHz – 2462MHz
Type of Transmission:	QPSK, BSK, CCK	BPSK, QPSK, 16QAM, 64QAM
Maximum Peak Conducted Output Power:	19.4 dBm	21 dBm
Antenna Type:	Centurion 90 Degree with Swivel Joint	
Antenna Location:	External Back Side of the N2000 Series	
Antenna Gain:	2.4dBi	
Sample Receive Date:	11/27/2006	

Test Signal Mode	
Test Commands:	X
Base Station Simulator:	

1.2 System Support Equipment

Other than the laptop used to configure the transmit mode of the N2000 Series prior to each test, no support equipment was used. The laptop was not physically connected during the actual testing.

1.3 Cables associated with EUT

Table 1-1 contains the details of the cables associated with the EUT.

Table 1-1: Interconnecting cables between modules of EUT

Cables					
Description	**Length**	**Shielding**	**Ferrites**	**Connection**	
				From	**To**
DC Cable	12cm	None	None	DC Pins on Card Edge Connector	DC Power Source

1.4 System Block Diagram

The diagram shown below details the interconnection of the EUT and its accessories during the testing.

1.5 Mode(s) of operation

The N2000 Series was powered by an external DC power supply and was tested in a stand alone configuration. In order to force the N2000 Series to transmit during the evaluation a control program was used to communicate with the printer via a serial cable connected to a laptop computer. This software enabled the user to adjust the output power of the transmitter, change the transmission modulation scheme, and to select the transmit channel. During the evaluation the N2000 Series was set to transmit at maximum output power. The laptop computer was strictly used to configure the transmit mode prior to testing and was removed during the actual test.

1.6 Modifications required for compliance

No modifications were implemented by Intertek. All results in this report pertain to the un-modified sample provided to Intertek.

1.7 Related Submittal(s) Grants

None

2 EXECUTIVE SUMMARY

Testing performed for Lexmark International on the model LEX-M01-001 starting on 11/27/2006 and ending on 3/27/2007. All testing was performed by Bryan Taylor and Jason Centers at the Intertek laboratory located at 731 Enterprise Drive, Lexington Kentucky, 40510. The Lexmark International model number LEX-M01-001 encompasses the following products:

Lexmark 2000 Series Wireless Products

Brand	Trade Name, (Product ID)	Product Variance
Lexmark	**N2060 (2010-012)**	Base Product
Lexmark	**N2052 (2010-011)**	Ethernet Port Removed
Lexmark	**N2050 (2010-001)**	Ethernet Port Removed, Less Memory

Dell 1000 Series Wireless Products

Brand	Trade Name, (Product ID)	Product Variance
Dell	**1150 (1150)**	Same as Lexmark N2060
Dell	**1000 (1000)**	Same as Lexmark N2050

The Lexmark International model LEX-M01-001 meets the requirements for modular approval. The following results apply to all products listed above:

IC RULE	FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
RSS-210 (A8.2, A8.2, A8.4(4))	§15.247(a)(b)(d)	Conducted RF Power, 6dB Bandwidth, and Power Density	**Compliant**	9
RSS-210 A8.4(4)	§15.247(b)	Radiated RF Power	**Compliant**	11
RSS-102	§15.247(b)(5)	Maximum Permissible Exposure (MPE) Calculations	**Compliant**	12
RSS-210 A8.5	§15.247(c)	Out of Band Emissions at Antenna Terminals	**Compliant**	14
RSS-210 2.2	c15.247(c) and §15.209(f)	Field Strength of Spurious Radiation (General Requirements and Restricted Band Requirements)	**Compliant**	15
ICES-003	§15.109	Receiver Spurious Emissions	**Compliant**	24
ICES-003	§15.107, §15.207	Conducted Voltage Emissions on the Mains Connections	**Compliant**	27

3 TEST FACILITY

The INTERTEK-Lexington is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

The test site is listed with the FCC under registration number 485103.

The test site is listed with Industry Canada under site number IC 2055.

The conducted emissions for mains ports, radiated emissions, and telco ports conducted emissions sites are listed with the VCCI under registration numbers C-2214, R2056, and T-195.

3.1 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration due date
RF Power Meter	Boonton	5232	13601	2/28/2007
Signal Generator	Hewlett Packard	83620B	3614A00199	8/15/2007
Amplifier	Keltek	LR610-20	96637-05019	Verify at Time of Use
Environmental Chamber	Thermotron	SM-8C	32692	1/19/2007
EMI Receiver	Rohde & Schwarz	ESI 26	1088.7490	9/6/2007
EMI Receiver	HP	7405A	US39150114	3/26/2007
Horn Antenna	Antenna Research	DRG-118/A	1086	7/20/2007
Horn Antenna	EMCO	3115	6556	7/28/2007
Horn Antenna	EMCO	3116	9310-2222	3/22/2007
Bilog Antenna	ETS	3142C	00051864	11/14/2007
High Pass Filter	Microwave Circuits	H3G020G2	3986-01 DC0408	Verify at Time of Use
LISN	Fischer Custom Communication	FCC-LISN-50-50-2M	1026	5/9/2007

4 CONDUCTED RF POWER, 6DB BANDWIDTH, AND POWER DENSITY

4.1 Test Procedure (FCC Rule: §15.247(b) Conducted RF Power)

The antenna port of the N2000 Series was connected to the input of a peak power meter. The power was read directly from the power meter and corrected for cable loss to obtain the power at the antenna terminals. Conducted power was measured on the high, middle and low channels for all data rates and modulation modes.

4.2 Conducted Output Power Criteria

The maximum allowable transmitter power for antennas with gains of 6dBi or less is 1watt (30dBm).

4.3 Test Procedure (FCC Rule: §15.247(a), 6dB Bandwidth)

The antenna port of the N2000 Series was connected to the input of a spectrum analyzer. The analyzer amplitude was offset for the associated cable loss. The analyzer resolution and video bandwidths were set to 100kHz and the max hold function was turned on. A marker peak search was performed on the resultant trace to find the peak amplitude. Markers were then positioned on either side of the peak amplitude such that they were 6dB lower than that amplitude. The 6dB bandwidth was the frequency difference between the marker on the lower side and the marker on the higher side of the peak amplitude. The 6dB bandwidth was measured for the highest data rate for each possible modulation mode on the high, middle, and low channels.

4.4 6dB Bandwidth Criteria

The minimum 6dB bandwidth shall be at least 500kHz

4.5 Test Procedure (FCC Rule: §15.247(d) (b) Power Density)

The antenna port of the N2000 Series was connected to the input of a spectrum analyzer. The analyzer amplitude was offset for the associated cable loss. The analyzer resolution and video bandwidths were set to 3kHz and the max hold function was turned on. The frequency span was set to 600kHz around the highest amplitude occurring in the peak emission envelope. The total sweep time was calculated as follows:

Sweep time (Sec.) = (Fstop – Fstart)/Resolution Bandwidth

Sweep time (Sec) = 600kHz / 3kHz

Sweep time (Sec) = 200 Seconds

A peak search was then performed on the resultant trace. The amplitude of that peak was recorded as the maximum power density in dBm. Power density was measured for all data rates and modulation modes on the middle channel. For the high and low channels, power density was measured at the data rate and modulation mode that resulted in the highest and lowest conducted power for that channel.

4.6 Power Density Criteria

The peak power spectral density shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

4.7 Test Results

The N2000 Series met the RF power output, 6dB bandwidth, and power density requirements of FCC Part 15 Subpart C (15.247). The test results are located in Table 4-1.

Table 4-1 RF Output Power, 6dB Bandwidth, Power Density Measurements

Frequency MHz	Mode	Modulation	Data Rate (Mbps)	Conducted Power (dBm)	Conducted Power (mW)	Power Density (dBm)	6dB Bandwidth MHz
2437 Channel 6	802.11b	BPSK	1	17.5	56.23	0.784	10.25
		QPSK	2	17.3	53.70	4.367	10.25
		CCK	5.5	16.8	47.86	-3.8	10
		CCK	11	16.4	43.65	-14.42	16.625
	802.11g	OFDM	6	21	125.89	-11.64	
		OFDM	9	19.3	85.11	-11.64	
		OFDM	12	18.9	77.62	-14.51	
		OFDM	18	17.3	53.70	4.175	
		OFDM	24	18.4	69.18	-11.31	
		OFDM	36	15.8	38.02	4.03	
		OFDM	48	17.4	54.95	1.448	
		OFDM	54	18.8	75.86	-12.05	16.625
2412 Channel 1	802.11b	BPSK	1	17.6	57.54		10.25
		QPSK	2	17.6	57.54		10.25
		CCK	5.5	16.8	47.86		9.12
		CCK	11	19.4	87.10		16.625
	802.11g	OFDM	6	19.8	95.50	-11.62	
		OFDM	9	19.3	85.11		
		OFDM	12	19.6	91.20		
		OFDM	18	17.4	54.95		
		OFDM	24	19.6	91.20		
		OFDM	36	16.1	40.74	3.9	
		OFDM	48	17.5	56.23		
		OFDM	54	19.1	81.28		16.625
2462 Channel 11	802.11b	BPSK	1	17.1	51.29		10.25
		QPSK	2	17.1	51.29		10.3
		CCK	5.5	16.9	48.98		10.0
		CCK	11	19.2	83.18		16.625
	802.11g	OFDM	6	19.4	87.10	-11.54	
		OFDM	9	18.8	75.86		
		OFDM	12	19.1	81.28		
		OFDM	18	17.2	52.48		
		OFDM	24	17.3	53.70		
		OFDM	36	16	39.81	3.735	
		OFDM	48	17.4	54.95		
		OFDM	54	19	79.43		16.625

5 RADIATED RF POWER

5.1 Test Procedure (FCC Rule: §15.247(b) Radiated RF Power)

The N2000 Series was placed on a non-conductive turntable. It was then set to operate at the maximum output power and data rate that produced the highest conducted output power in both 802.11b and 802.11g modes.

The radiated emission at the fundamental frequency was measured at 3m with a test antenna and EMI receiver. This was performed with the antenna in both vertical and horizontal polarities.

During the measurement of the EUT, the receiver resolution bandwidth was set to 3 MHz and the video bandwidth was set to 3 MHz. The highest emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. The receiver reading was recorded (E in dBuV).

The radiated power was measured using a substitution method as described in TIA-603-B Section 2.2.17 (Radiated Power Output). The EUT was replaced with a substitution antenna (tuned dipole below 1 GHz; Horn antenna above 1 GHz) and was fed with an input power from a signal generator set to output 0 dBm. The cable loss between the signal generator and substituting antenna was a known value. The receiver reading was recorded and EIRP was calculated as follows:

$$EIRP = E_1 - E_2 + Vsub + G$$

where,

E_1 is the receiver reading in dBμV when measuring the field strength of the EUT

E_2 is the receiver reading in dBμV when measured field strength from the generator

V_{sub} is the power delivered to the substitution antenna (generator output in dBm – cable loss between the generator and the substitution antenna)

G is the gain of the transmitting antenna in dBi.

5.2 Radiated Output Power Criteria

The maximum allowable transmitter power for antennas with gains of 6dBi or less is 1watt (30dBm).

5.3 Test Results

The N2000 Series met the radiated power requirements of FCC §15.247(b). The test results are located in Table 5-1. All results are less than the 30dBm limit.

Table 5-1 Radiated RF Power

EUT Mode	TX Channel	Polarity	TX Frequency (MHz)	Device Reading (dBuV)	Sub. Reading (dBuV)	Cable Loss (dB)	Tx Antenna Gain (dBi)	Signal Generator Output (dBm)	EIRP (dBm)
1Mbps (802.11b)	1	V	2412	76.8	61.1	4.5	9	0	20.2
1Mbps (802.11b)	6	V	2437	77.3	61	4.5	9	0	20.8
1Mbps (802.11b)	11	V	2462	74.4	61.1	4.5	9	0	17.8
1Mbps (802.11b)	1	H	2412	69.4	63.2	4.5	9.1	0	10.8
1Mbps (802.11b)	6	H	2437	71.2	62.3	4.5	9.1	0	13.5
1Mbps (802.11b)	11	H	2462	67.8	61.7	4.5	9.1	0	10.7
6 Mbps (802.11g)	1	V	2412	75.97	61.1	4.5	9	0	19.37
6 Mbps (802.11g)	6	V	2437	76.42	61	4.5	9	0	19.92
6 Mbps (802.11g)	11	V	2462	75.81	61.1	4.5	9	0	19.21
6 Mbps (802.11g)	1	H	2412	69.95	63.2	4.5	9.1	0	11.35
6 Mbps (802.11g)	6	H	2437	70.1	62.3	4.5	9.1	0	12.4
6 Mbps (802.11g)	11	H	2462	69.3	61.7	4.5	9.1	0	12.2

6 MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATIONS

The § 1.1310 Radiofrequency radiation exposure limits are listed in the table below.

	Frequency Range (MHz)	Power Density Limit (mW/cm^2)
Limits for Occupational/Controlled Exposures	0.3-3.0	100
	3.0-30	900/ Frequency2
	30-300	1.0
	300-1500	Frequency/300
	1500-100,000	5.0
Limits for General Population/Uncontrolled Exposure	0.3-1.34	100
	1.34-30	180/Frequency2
	30-300	0.2
	300-1500	Frequency/1500
	1500-100,000	1.0

6.1 Test Procedure (FCC Rule: §15.247(b)(5))

The ERP and EIRP were measured in section 5, Radiated RF Power The radiated RF power was used to calculate the maximum RF exposure at a 20 cm distance using the formula:

$$\text{Maximum RF Exposure at 20cm} = (\text{EIRP in mW})/(4\text{Pi}(20\text{cm})^2)$$

Where ERP was measured in section 5, Radiated RF Power, a 2.15dB conversion factor was added to the reading to convert it to EIRP before applying the Maximum RF Exposure formula above. Once the Maximum RF Exposure calculations were complete the results were compared to the MPE limits above.

6.2 Test Results

The following calculations show the Maximum RF Exposure from the N2000 Series at 20cm for the worst case measured EIRP. The MPE level is well below the limits for the general population described in the table above.

$$\text{Maximum Measured EIRP} = 20.8\text{dBm} = 120.2\text{mW}$$

$$\text{MPE} = 120.2\text{mW} / (4\text{Pi}(20\text{cm})^2) = 0.024\text{mW/cm}^2$$

7 OUT OF BAND EMISSIONS AT ANTENNA TERMINALS

7.1 Test Procedure (FCC Rule §15.247(c))

The antenna port of the N2000 Series was connected to the input of a spectrum analyzer. The analyzer resolution and video bandwidths were set to 3MHz. The N2000 Series was set to transmit at its highest output power level and with the modulation scheme that produced the highest conducted output power level. The spectrum analyzer was scanned from 30MHz to 25GHz using the max hold function to detect any out of band spurious emissions. The resulting trace was corrected for the cable loss between the test sample and the spectrum analyzer.

7.2 Out of Band Emissions at Antenna Terminals Criteria

In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, the RF power shall be at least 20dB below that of the carrier.

7.3 Test Results

The N2000 Series met the out of band emission at antenna terminal requirements. The following plots illustrate the output power of channels 1, 6, and 11and also show that there are no spurious emissions within 20dB of the peak carrier power.

Figure 7-1: Out of band emissions at antenna terminals – Channel 1, 6, and 11 (802.11b Mode)

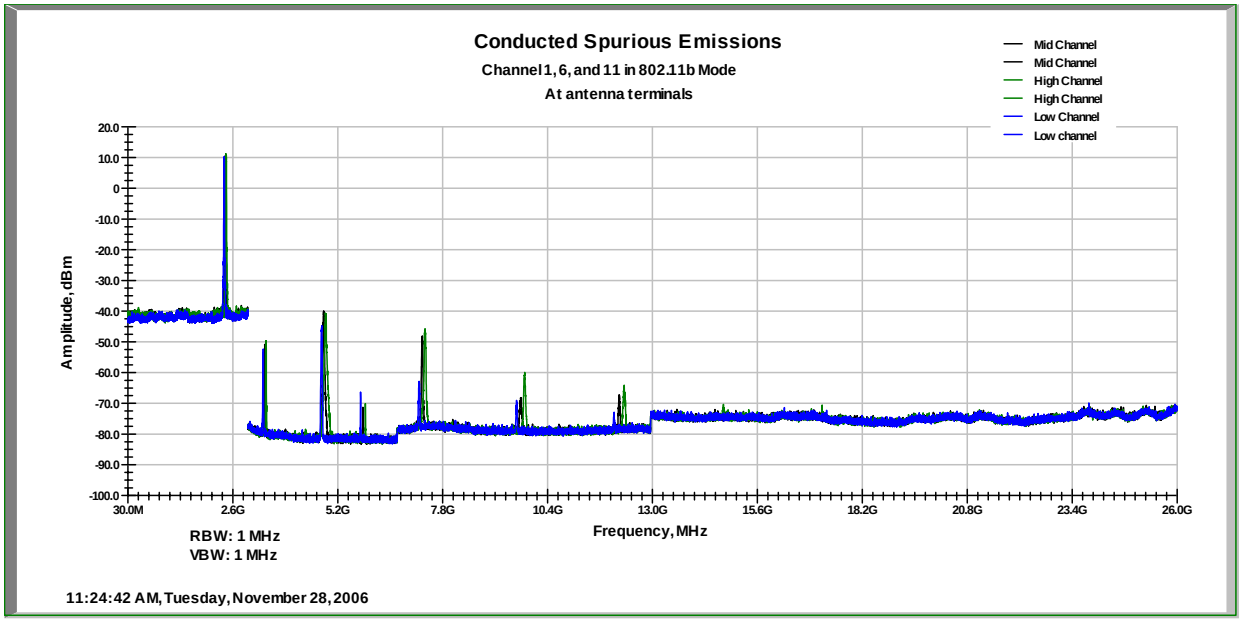
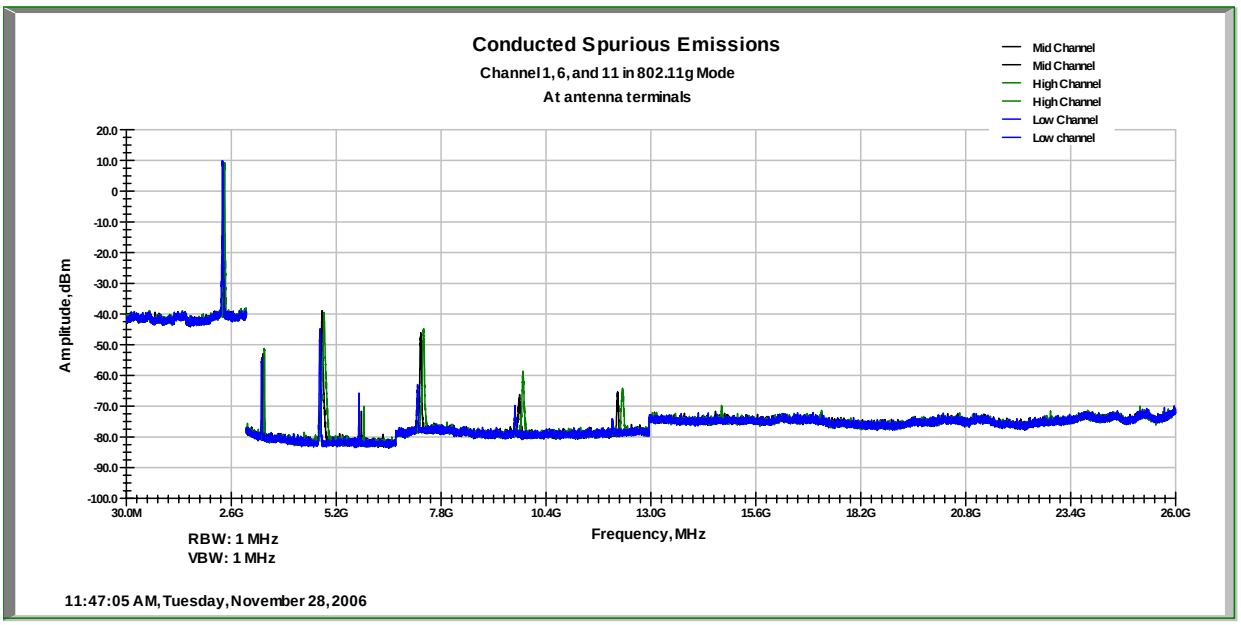


Figure 7-2: Out of band emissions at antenna terminals – Channel 1, 6, and 11 (802.11g mode)



8 FIELD STRENGTH OF SPURIOUS RADIATION (GENERAL REQUIREMENTS AND RESTRICTED BAND REQUIREMENTS)

8.1 Test Procedure (FCC Rule §15.247(c) for Radiated Measurements)

The N2000 Series was placed on a non-conductive turntable. It was then set to transmit at its highest output power level and with the modulation scheme that produced the highest conducted output power level. The 30MHz – 1GHz range was measured with a bilog antenna, no external preamplifier, and no external filtering in the measurement path. The 1GHz – 3GHz range was measured with a horn antenna with no external preamplifier, and no external filtering in the measurement path. The 3GHz-26GHz range was measured with an in line preamplifier and high pass filter with a pass band above 3GHz in order to keep the fundamental transmission from overloading the receiver. All measurements were performed with the receiving antenna 3 meters from the EUT with the exception of the 20-26GHz range which was performed at a distance of 1m. During the tests, the antenna height and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic was investigated for each of three fundamental frequencies (low, middle, and high channels) in each operating band. Once spurious emissions were identified, the power of the emission was determined using the substitution method described in TIA-603-B section 2.2.12 (Radiated Spurious Emissions).

The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and at the spurious emissions frequency.

Also, a scan was performed looking specifically at the band edge of channels 1 and 11 in order to show that the restricted bands ranging from 2310MHz to 2390MHz and 2483.5MHz to 2500 MHz were not intruded upon. To perform this measurement, the spectrum analyzer was manually set to show the band edge of channels 1 and 11 and the entire restricted band. The amplitude was offset to account for cable loss, antenna factor, and preamplifier gain. The turntable and tower were maximized with the analyzer set to max hold. These scans were performed in average detection mode.

8.2 Field Strength of Spurious Radiation Criteria

In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, the RF power shall be at least 20dB below that of the carrier. In addition, emissions within the restricted bands as specified in §15.205(a), must also comply with the limits specified in §15.209(a). Those Limits are in the table below.

Table 8-1 Radiated Emission Limit for FCC §15.209(a)

Radiated Emission Limits at 3 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (µV/m)**
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 and up	54.0

8.3 Test Results

The N2000 Series met the field strength of spurious radiation requirements of FCC §15.209 and §15.247(c). The following graphs in Figure 8-1 through Figure 8-10 show that all harmonics and spurious emissions are at least 20dB below the carrier and that there are no emissions within the restricted bands exceeding the limits specified in §15.209(a).

Table 8-2 Spurious Radiated Emissions

Frequency (MHz)	TX Mode (Chan., Mode)	Detector (Peak, QP, Avg.)	Corr. Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
7.236 GHz	Low 802.11g	Peak	42.1	74	54	**Compliant**	
7.311 GHz	Mid 802.11g	Peak	41	74	54	**Compliant**	
7.386 GHz	High 802.11g	Peak	39.2	74	54	**Compliant**	
4.824 GHz	Low 802.11b	Avg.	53.5	74	54	**Compliant**	
4.824 GHz	Low 802.11b	Peak	52.7	74	54	**Compliant**	
4.8241 GHz	Low 802.11g	Avg.	39.95	74	54	**Compliant**	
4.8241 GHz	Low 802.11g	Peak	45.3	74	54	**Compliant**	
4.8739 GHz	Mid 802.11g	Avg.	37.11	74	54	**Compliant**	
4.8739 GHz	Mid 802.11g	Peak	44.8	74	54	**Compliant**	
4.874 GHz	Mid 802.11b	**Avg.**	52.5	74	**54**	**Compliant**	Meets the avg. limit with avg. detection
4.874 GHz	Mid 802.11b	**Peak**	54.2	**74**	54	**Compliant**	Meets the peak limit with peak detection
4.9239 GHz	High 802.11g	Avg.	34.8	74	54	**Compliant**	
4.9239 GHz	High 802.11g	Peak	43.2	74	54	**Compliant**	
4.924 GHz	High 802.11b	Avg.	49.45	74	54	**Compliant**	
4.924 GHz	High 802.11b	Peak	50.3	74	54	**Compliant**	
7.236 GHz	Low 802.11b	Peak	43.8	74	54	**Compliant**	
7.311 GHz	Mid 802.11b	Peak	42.3	74	54	**Compliant**	
7.386 GHz	High 802.11b	Peak	38.8	74	54	**Compliant**	

Figure 8-1: Field Strength of Spurious Radiation Channel 1 (30MHz – 26GHz) – 802.11b

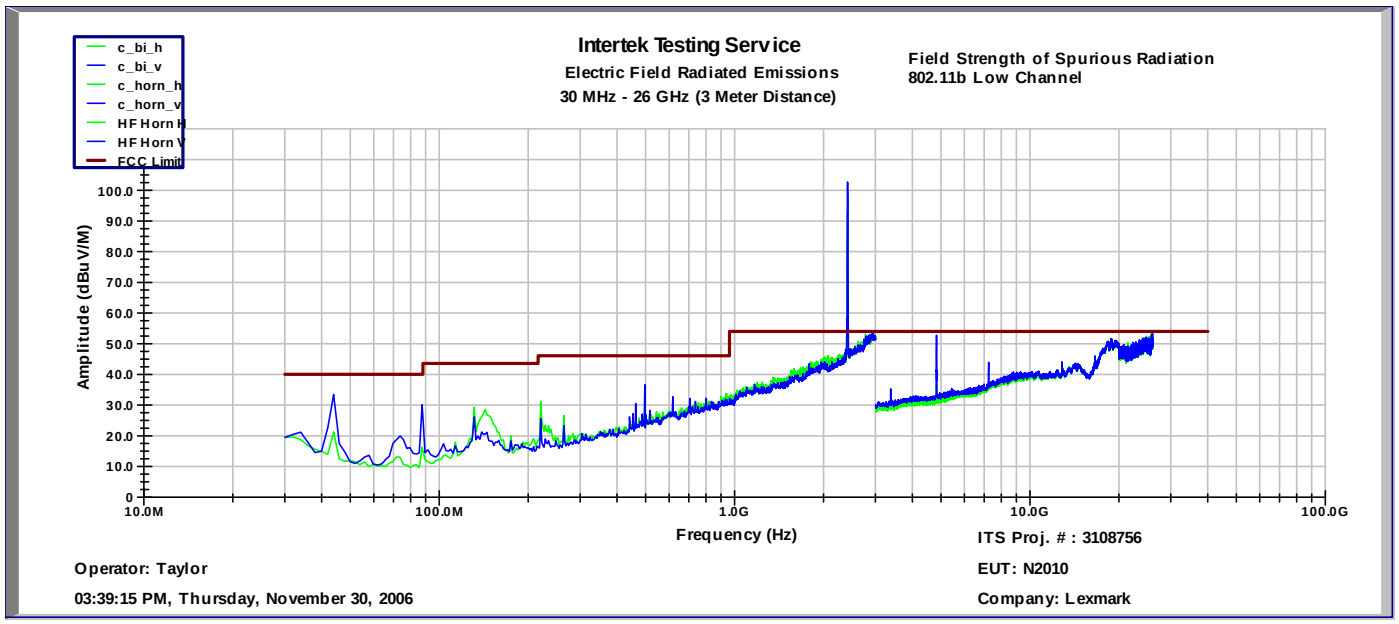


Figure 8-2: Field Strength of Spurious Radiation Channel 6 (30MHz – 26GHz) – 802.11b

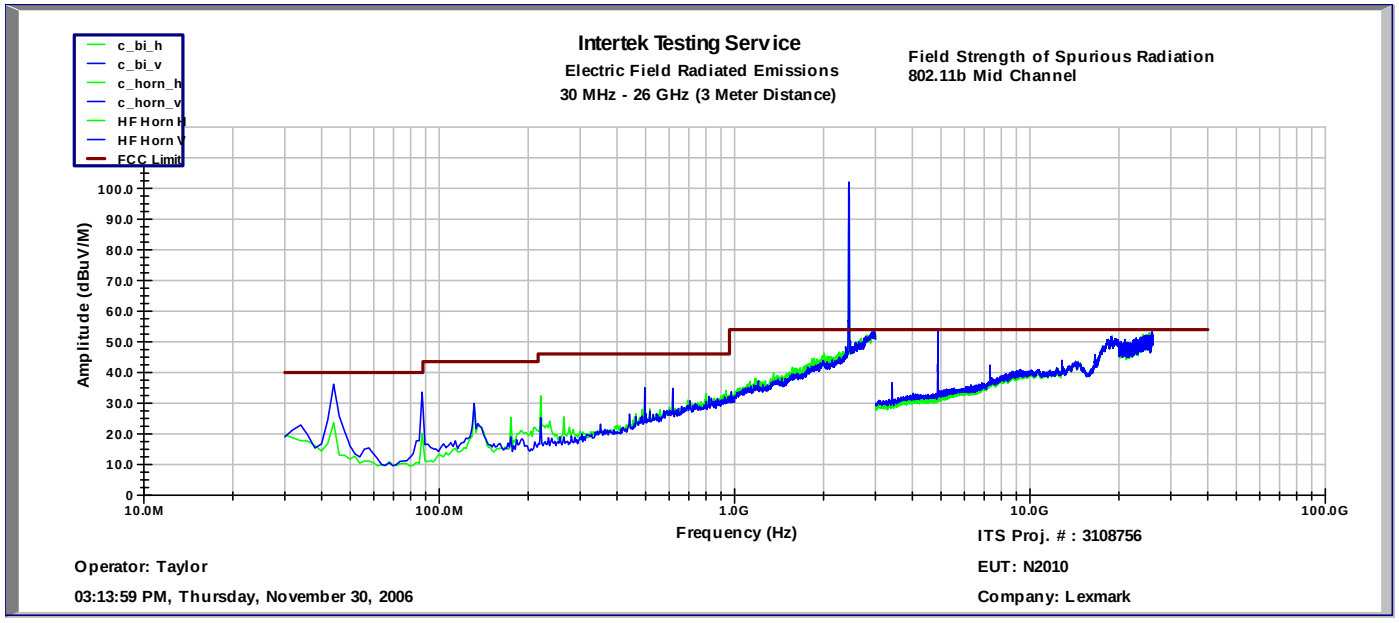


Figure 8-3: Field Strength of Spurious Radiation Channel 11 (30MHz – 26GHz) – 802.11b

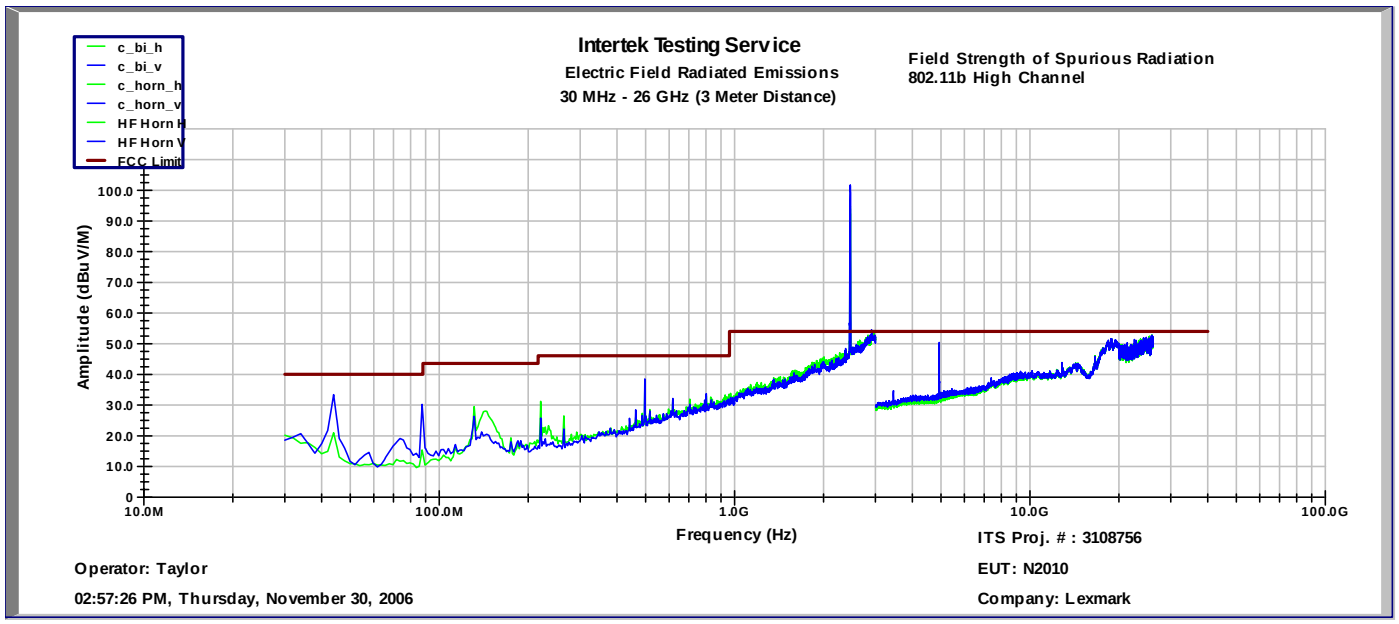


Figure 8-4: Field Strength of Spurious Radiation Channel 1 (30MHz – 26GHz) – 802.11g

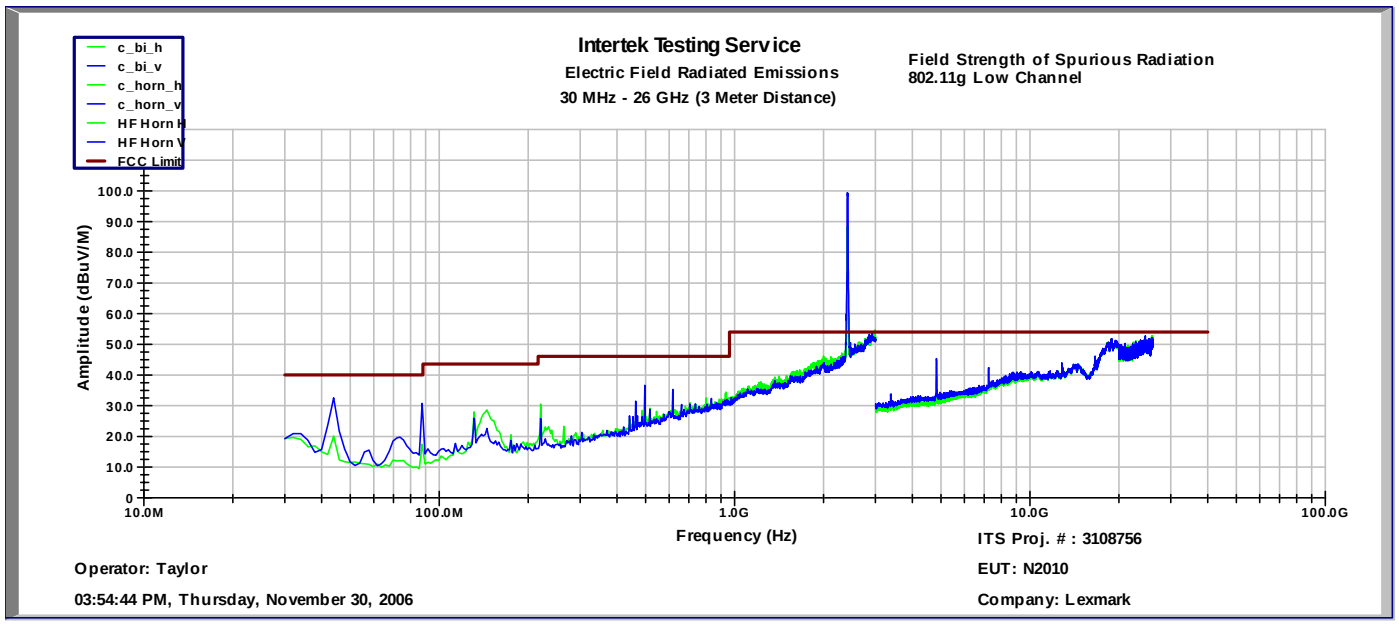


Figure 8-5: Field Strength of Spurious Radiation Channel 6 (30MHz – 26GHz) – 802.11g

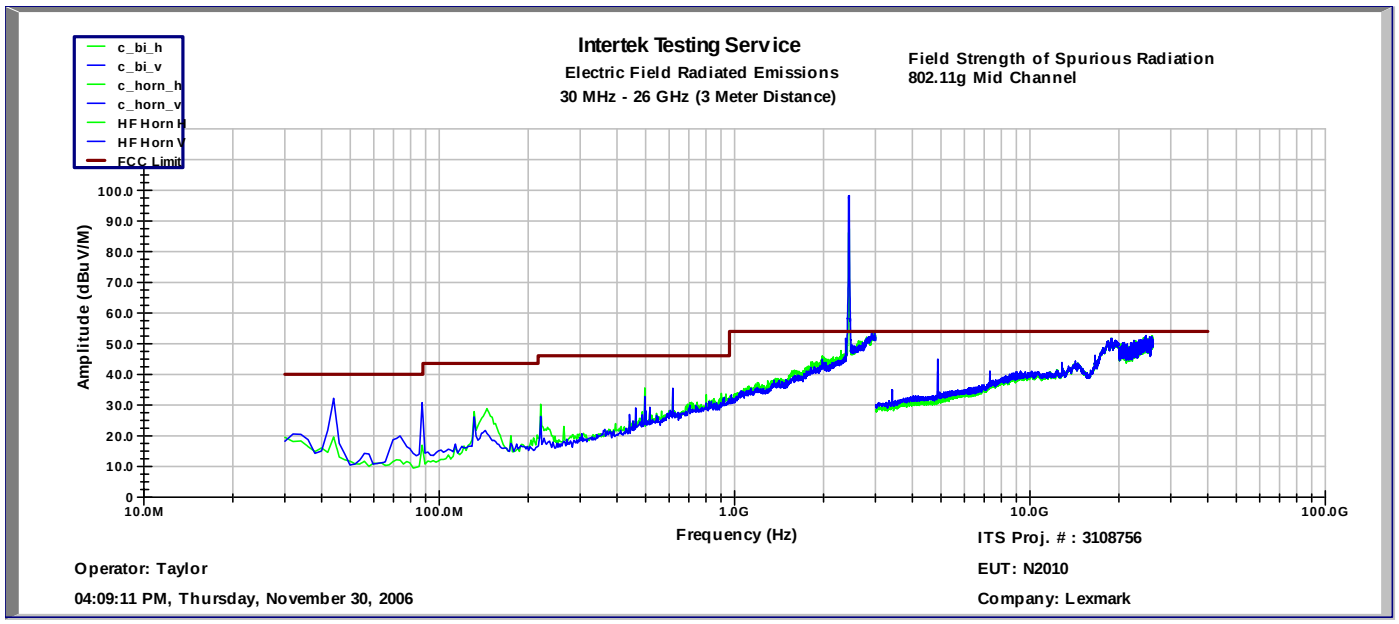


Figure 8-6: Field Strength of Spurious Radiation Channel 11 (30MHz – 26GHz) – 802.11g

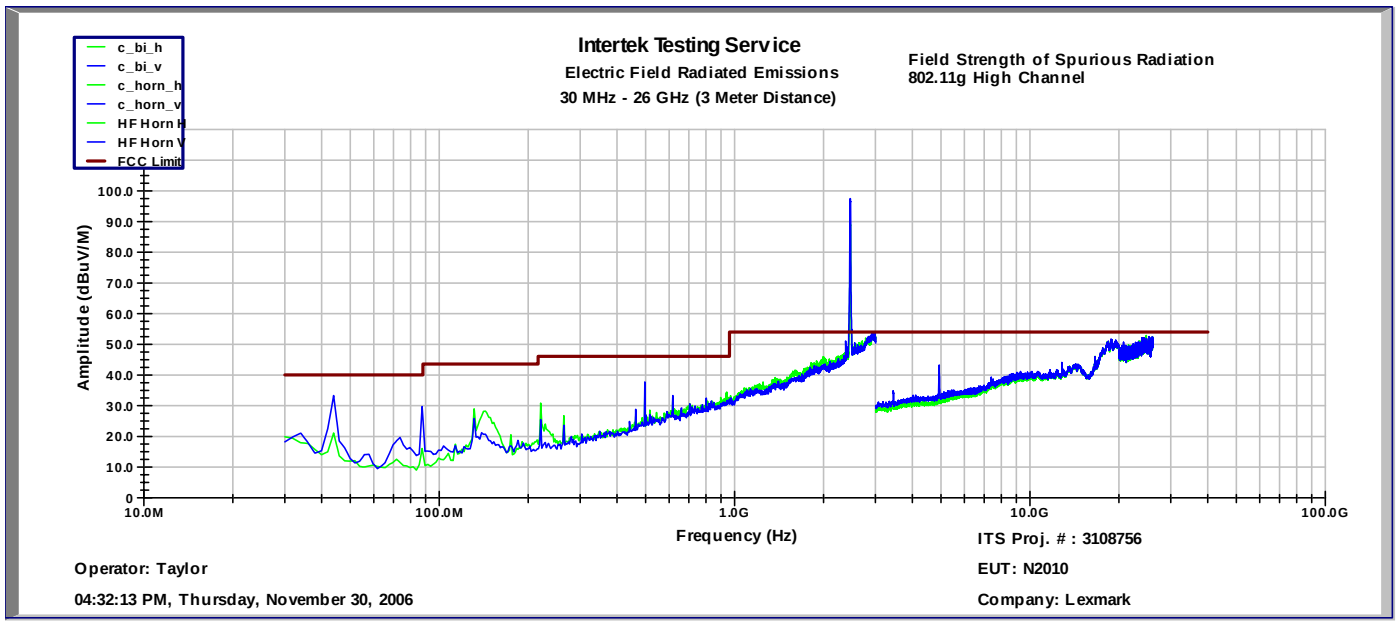


Figure 8-7: Channel 1 Band Edge Showing the Restricted Band from 2310 to 2390 MHz (802.11b)

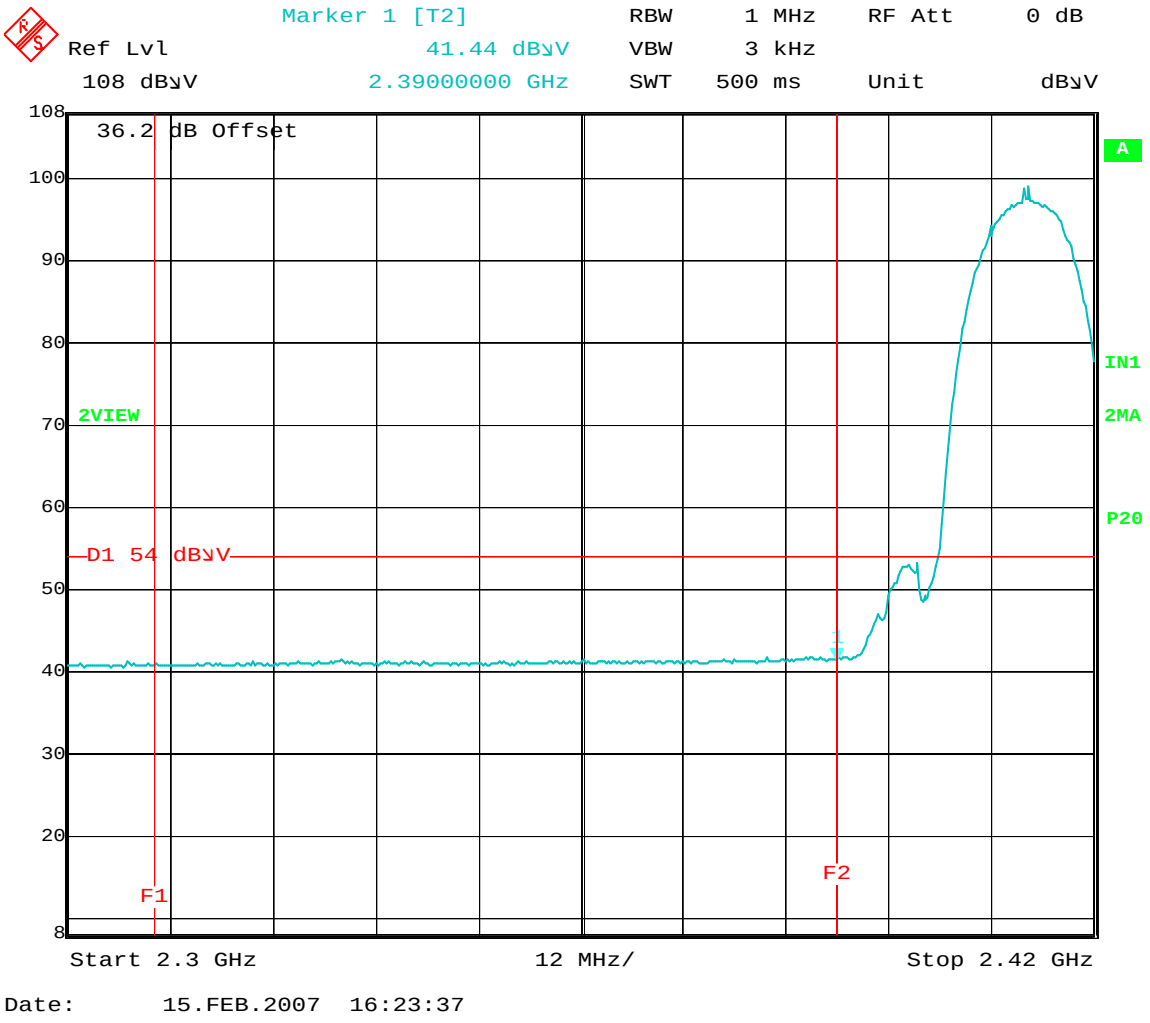


Figure 8-8: Channel 1 Band Edge Showing the Restricted Band from 2310 to 2390 MHz (802.11g)

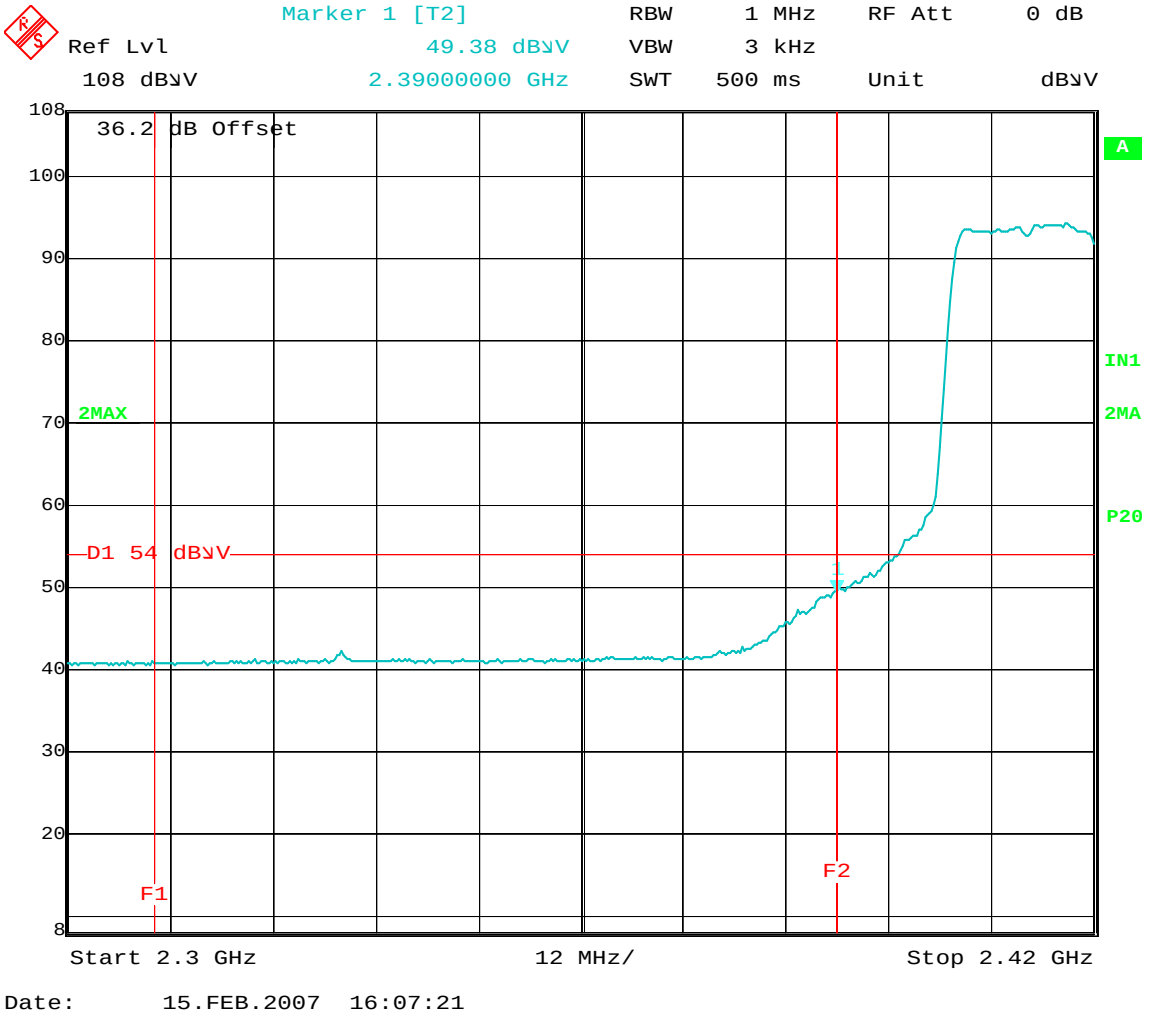


Figure 8-9: Channel 11 Band Edge Showing the Restricted Band from 2483.5 to 2500 MHz (802.11b)

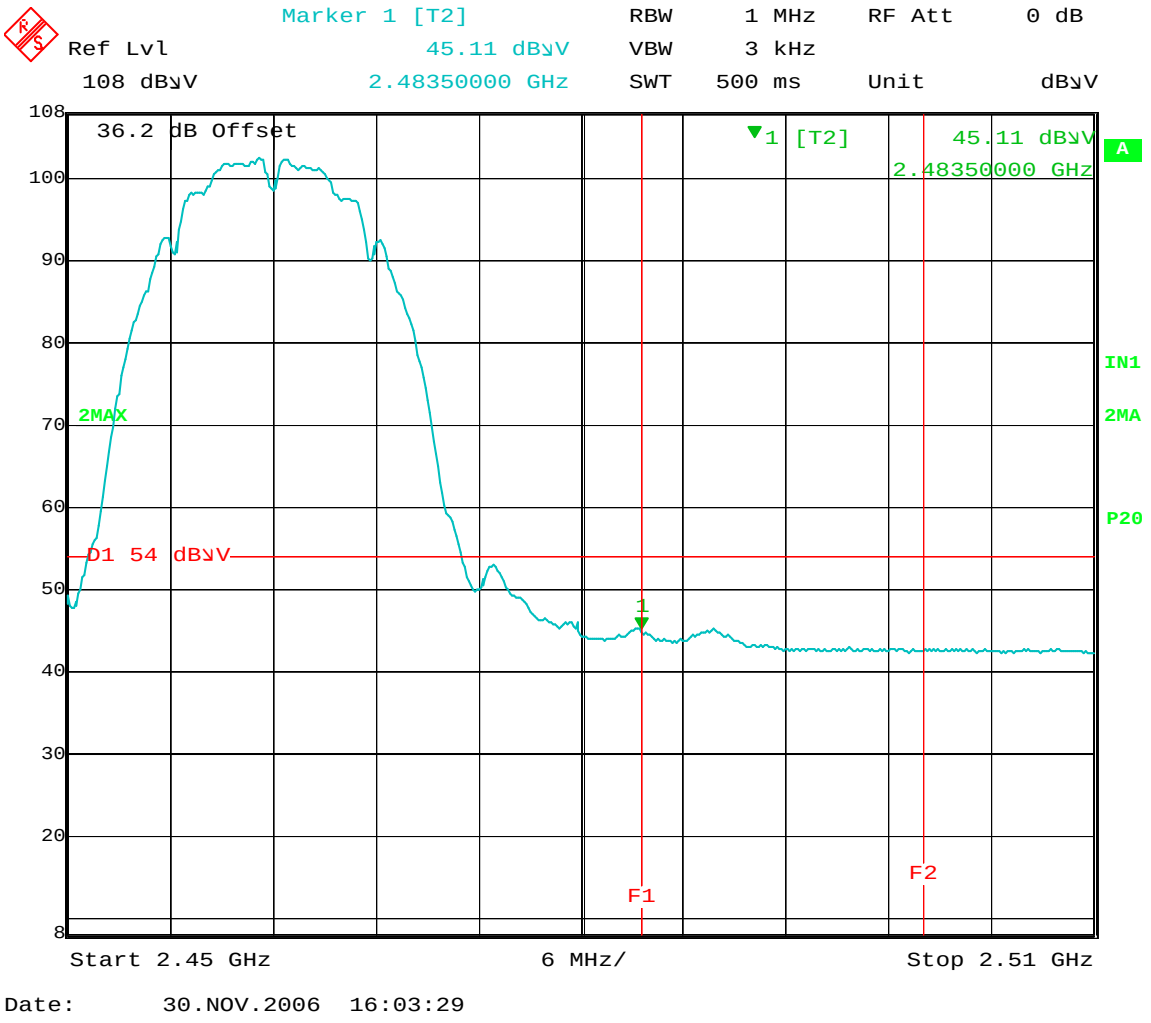
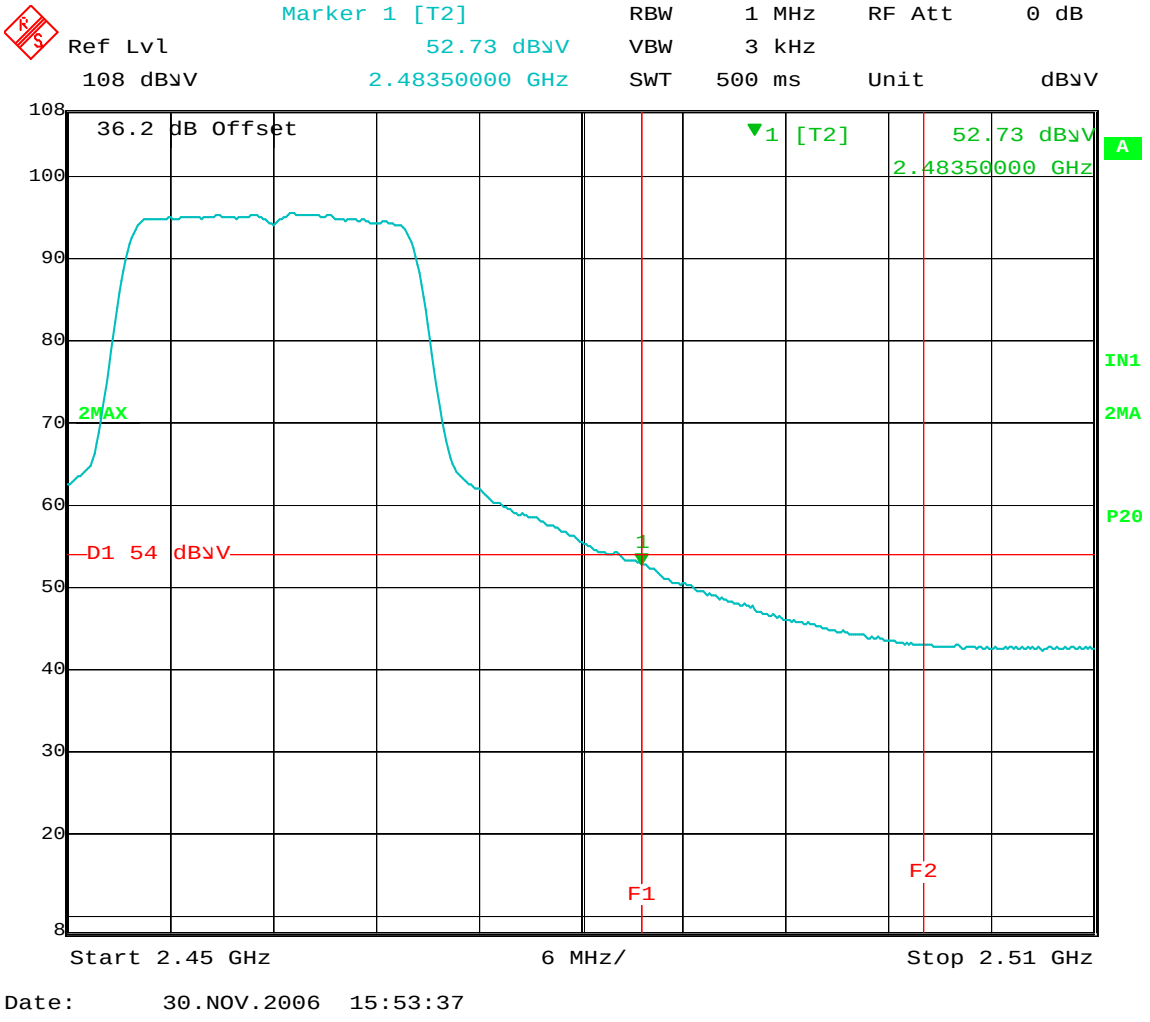


Figure 8-10: Channel 11 Band Edge Showing the Restricted Band from 2483.5 to 2500 MHz (802.11g)



9 RECEIVER SPURIOUS EMISSIONS

9.1 Test Procedure (FCC §15.109, ICES-003 §5.6)

Measurements are made over the frequency range of 30 MHz to five times the highest frequency operating within the device. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole. From 30 to 1000 MHz, a quasi-peak detector was used for measurement. Above 1000 MHz, average measurements were performed.

Measurements of the radiated field are made with the antenna located at a distance of 3 meters from the EUT. If the field-strength measurements at 3m cannot be made because of high ambient noise level or for other reasons, measurements may be made at a closer distance, for example 1m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4.

9.2 Receiver Spurious Emissions Criteria

Table 9-1 Radiated Emission Limit for FCC §15.109

Radiated Emission Limits at 3 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (µV/m)**
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 and up	54.0

9.3 Test Results

The N2000 Series is **compliant** with the radiated disturbance requirements of FCC §15.109 for a class B device. The table in Figure 9-1 and the graph in Figure 9-2 show that the model without the Ethernet option installed (Trade Name N2050) has no emissions above the limits specified in §15.109.

This test was repeated with the Ethernet option installed (Trade Name N2060). The table in Figure 9-3 and the graph in Figure 9-4 show that the installation of the Ethernet option also meets the limits imposed by Part 15.109.

Figure 9-1 FCC §15.109 Receiver Spurious Emission (Ethernet Not Installed)

Frequency (MHz)	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (m)	Results
495.24 MHz	H	3.36	18.3	29.39	46.02	-16.63	124	1	**Compliant**
44.006 MHz	V	0.88	8.87	36.36	40	-3.64	109	1	**Compliant**
88.001 MHz	V	1.29	8.03	33.6	43.52	-9.92	75	1	**Compliant**
616.0 MHz	V	3.77	20	34.8	46.02	-11.22	252	1	**Compliant**

Figure 9-2 FCC §15.109 Receiver Spurious Emission (Ethernet Not Installed)

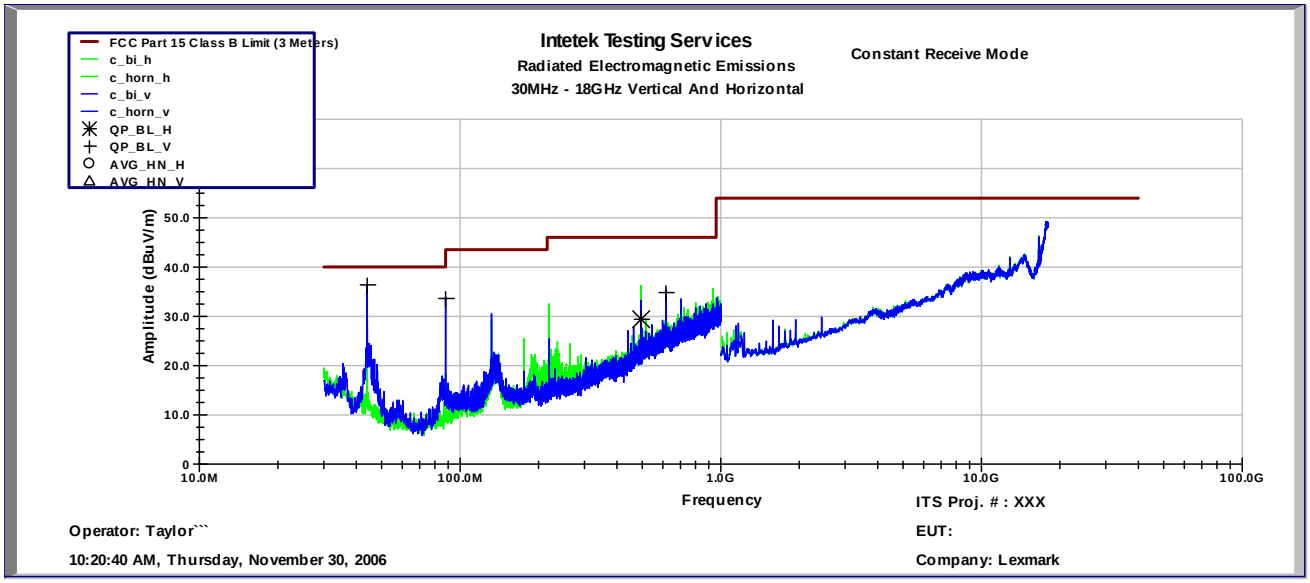
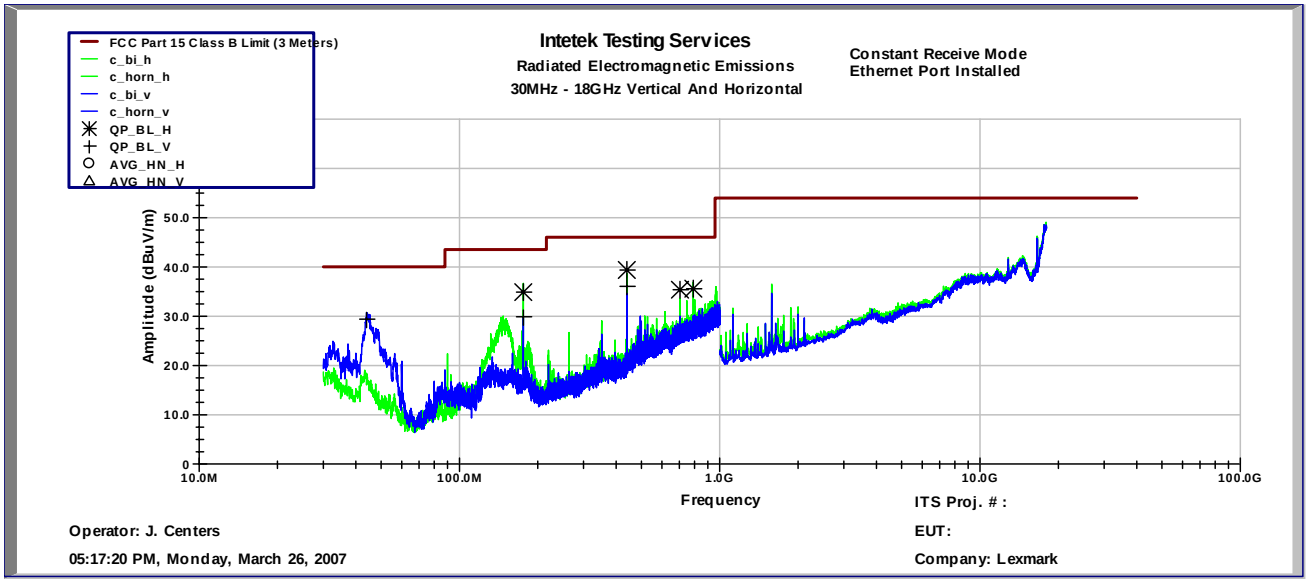


Figure 9-3 FCC §15.109 Receiver Spurious Emission (Ethernet Option Installed)

Frequency (MHz)	Polarity (H/V)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Azimuth (deg)	Tower (m)	Results
176.0 MHz	H	2.02	9.54	34.87	43.52	-8.65	13	2	**Compliant**
440.0 MHz	H	3.2	16.8	39.37	46.02	-6.65	302	2	**Compliant**
703.99 MHz	H	4.06	21.8	35.35	46.02	-10.67	355	1	**Compliant**
791.99 MHz	H	4.31	22	35.57	46.02	-10.45	195	1	**Compliant**
44.0 MHz	V	0.88	8.87	29.38	40	-10.62	91	1	**Compliant**
176.0 MHz	V	2.02	10.12	29.87	43.52	-13.65	125	2	**Compliant**
440.0 MHz	V	3.2	16.3	36.04	46.02	-9.98	265	1	**Compliant**

Figure 9-4 FCC §15.109 Receiver Spurious Emission (Ethernet Option Installed)



10 POWER LINE CONDUCTED EMISSIONS

10.1 Test Procedure (FCC §15.207, ICES-003 §5.3)

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

10.1.1 Power Line Conducted Emissions Criteria

The RF energy radiated back onto the public utility (AC Power Lines) shall not exceed the values in the following table when measured with the corresponding detector function.

Table 10-1 Conducted Emission Limit for FCC §15.207(a)

Frequency Range (MHz)	FCC Part 15.207(a) Quasi Peak Limit (dBuV)	FCC Part 15.207(a) Average Limit (dBuV)
0.15 – 0.5 MHz	66 to 56	56 to 46
0.5 – 5.0 MHz	56	46
5.0 - 30 MHz	60	50

10.2 Test Results

The N2000 Series met the power line conducted emission requirements of §15.207. The graphical data, measured with peak detection, was all below the class B quasi-peak and average limits. The test was performed on the AC input to the power supply providing the DC voltage that the N2000 Series was using. Also tested, was the N2000 Series with the Ethernet option installed in order to verify that this option did not force any emissions above the Part 15.207 limit.

Figure 10-1: FCC §15. Power Line Conducted Emissions 802.11b Mode (Lines 1 and 2)

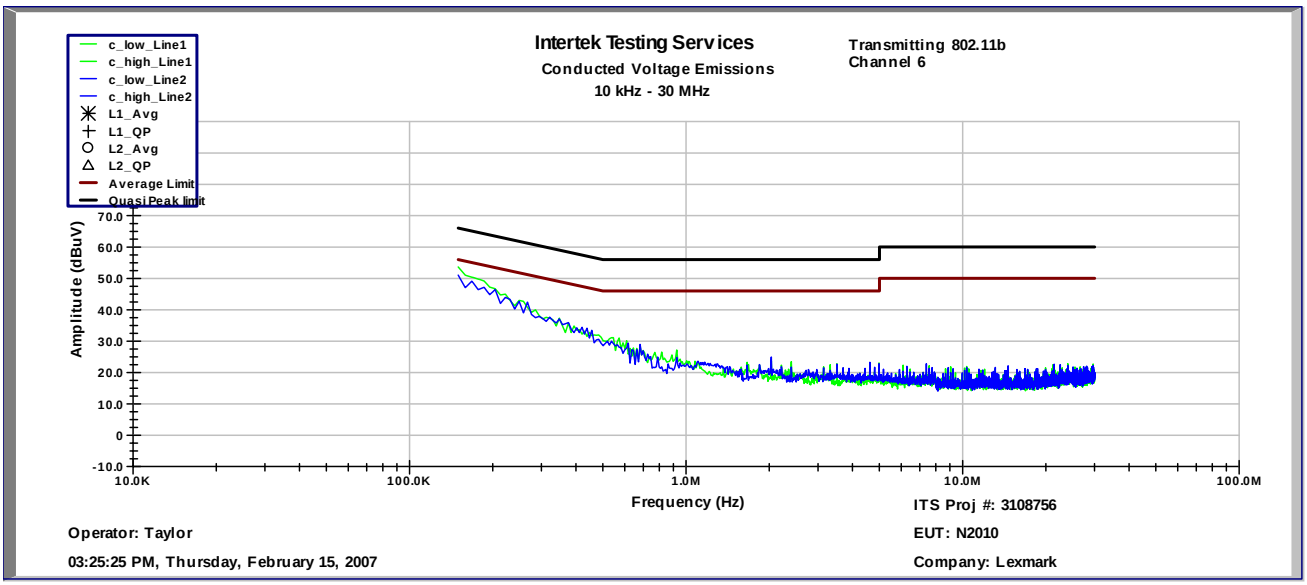


Figure 10-2: FCC §15. Power Line Conducted Emissions 802.11g Mode (Lines 1 and 2)

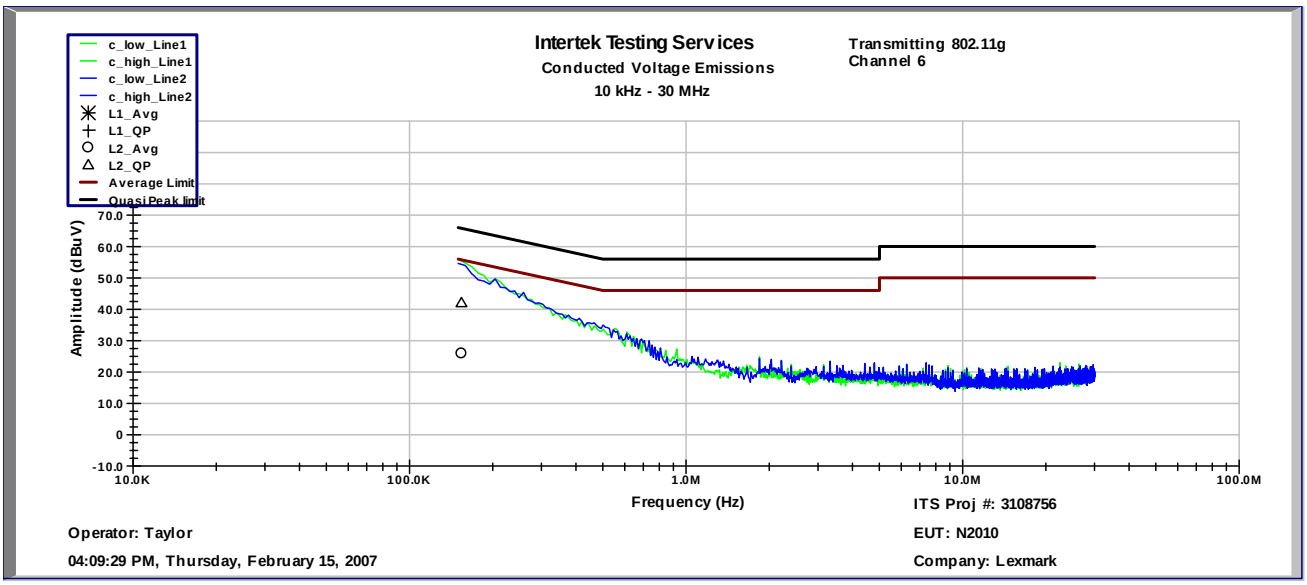
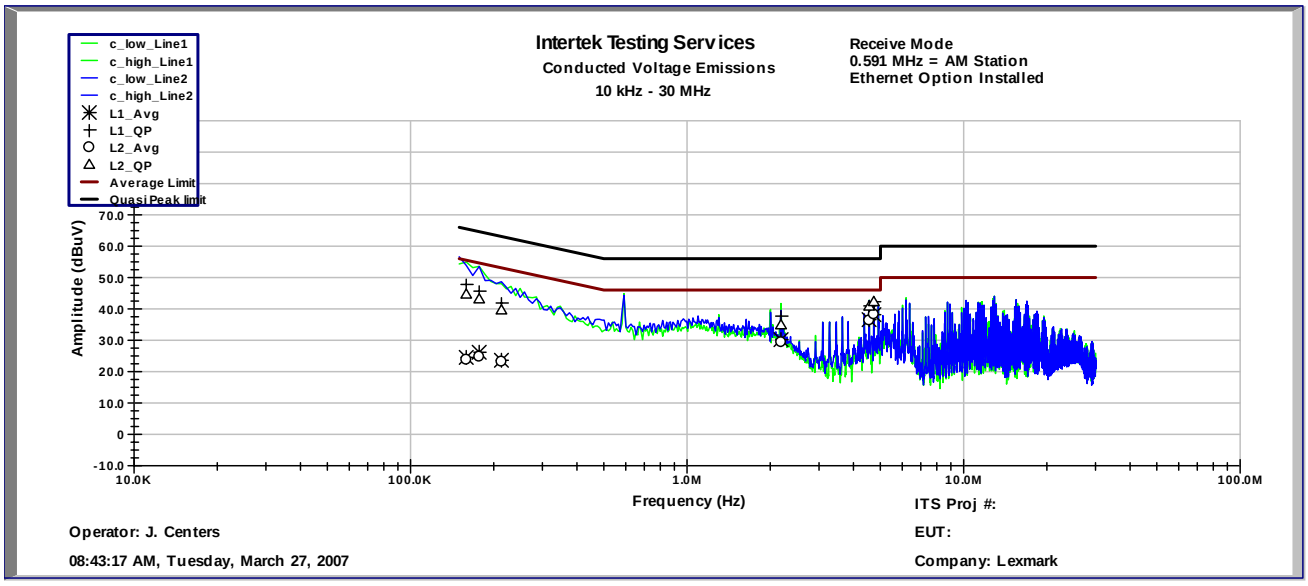


Figure 10-3: FCC §15. Power Line Conducted Emissions Ethernet Option Installed (Lines 1 and 2)[1]



[1] In this plot, the emission at 590kHz originates from a local AM radio station, not the product under test.

Figure 10-4: FCC §15. Power Line Conducted Emissions (Ethernet Option Installed)

Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
Line 1	159.0 KHz	47.78	65.52	-17.73	24.51	55.74	-31.23	**Compliant**
Line 1	177.0 KHz	45.67	64.63	-18.96	26.17	55.23	-29.06	**Compliant**
Line 1	213.0 KHz	41.86	63.09	-21.22	23.59	54.2	-30.61	**Compliant**
Line 1	2.184 MHz	37.67	56	-18.33	30.18	46	-15.82	**Compliant**
Line 1	4.549 MHz	40.93	56	-15.07	36.58	46	-9.42	**Compliant**
Line 1	4.7311 MHz	42.27	56	-13.73	38.12	46	-7.88	**Compliant**
Line 2	159.0 KHz	44.67	65.52	-20.84	23.8	55.74	-31.94	**Compliant**
Line 2	177.0 KHz	43.12	64.63	-21.51	24.75	55.23	-30.48	**Compliant**
Line 2	213.0 KHz	39.63	63.09	-23.45	23.16	54.2	-31.04	**Compliant**
Line 2	2.184 MHz	34.86	56	-21.14	29.39	46	-16.61	**Compliant**
Line 2	4.5515 MHz	40.79	56	-15.21	36.33	46	-9.67	**Compliant**
Line 2	4.7327 MHz	42.27	56	-13.73	38.27	46	-7.73	**Compliant**