7.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Assume a receiver reading of 49.5 dBuV is obtained. The Antenna Factor of 8.1 and a Cable Factor of 1.7 is added. The Amplifier Gain of 23.3 dB is subtracted, giving a field strength of 36 dBuV/m. The 36 dBuV/m can be mathematically converted to its corresponding level in uV/m.

FS = 49.5 + 8.1 + 1.7 - 23.3 = 36.0 dBuV/m

Level in uV/m = Common Antilogarithm [(36 dBuV/m)/20] = 63.1 uV/m

8.0 Photos of Tested EUT

The following photos are attached:

8 x 10 inch copies of the photographs are presented in the transmitter submittal for this product.

Figure 8.1 Top and Bottom View
The top and bottom of two cards are shown

Figure 8.2 Top of Circuit Board

Figure 8.3 Bottom of Circuit Board

1.5 Test Methodology

The test procedures used are in accordance with the ANSI document C63.4-1992, (July 17, 1992) "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.6 Test Facility

The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. Details of the site characteristics are on file with the FCC. Conducted emission measurements and preliminary radiated emission scans were performed in shielded enclosure "B" at Radiometrics' Romeoville, Illinois EMI test lab. These sites have been fully described in a report and accepted by the FCC in a letter dated October 1, 1996 (31040/SIT 1300F2).

Conducted emission measurements were performed using an Electrometrics Model FCC/VDE 50/2 Line Impedance Stabilization Network (LISN) as the pick-up device. This device is constructed in accordance with the circuit diagram provided in Figure 3 of ANSI document C63.4-1992.

1.7 Test Equipment

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun.

The radiated emission measurements were performed with a spectrum analyzer. The bandwidths of the spectrum analyzers are adjusted to the correct bandwidths as specified by the FCC Rules. The bandwidth used from 450 kHz to 30 MHz is 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. From 1 to 12.5 GHz a 1 MHz bandwidth is used. In order to increase the sensitivity of the spectrum analyzer, a preamplifier was used. The preamplifiers used had sufficient dynamic range that ensured that an overload condition was not present during the tests. When measuring the transmitter signals above 2000 MHz, a preselector was used.

3.0 System Test Configuration

3.1 Test System and Justification

The EUT was tested in a typical configuration. The EUT is powered from the notebook computer. The EUT can only be operated from a PCMCIA slot in a notebook type computer. The EUT has no ports for external cabling.

3.2 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was contained on the hard drive of the host computer. The program sequentially exercises each system component in turn. The following sequence was used: (1) 1000 full lines of H's are printed on the monitor, (2) disk drive was read from and written to, (3) printer prints a full line of H's. The complete cycle takes about 10 seconds and is repeated continuously. The software continuously fills the screens with capitol H's. No data was sent to the keyboard and mouse during the tests. This program ran until it was manually stopped at the end of each test.

The EUT was in receive mode during the tests.

3.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

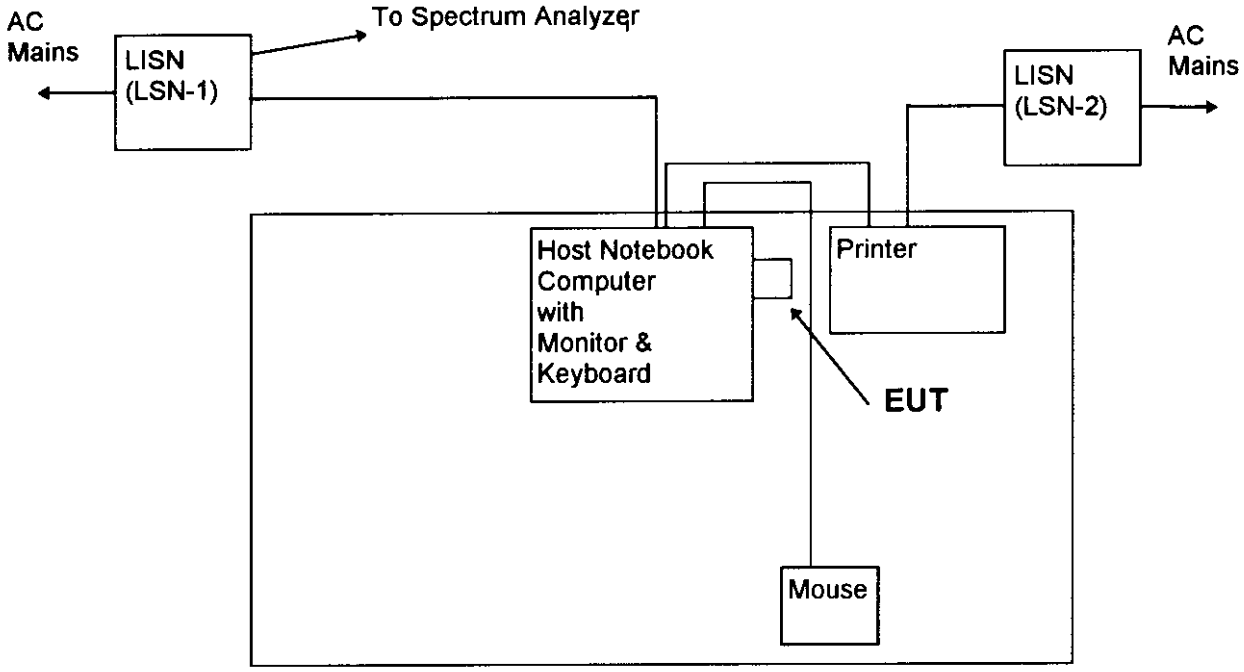
3.4 Equipment Modifications

No modifications to the EUT were made by Radiometrics Midwest Corp. prior to or during the testing in order to achieve compliance with Class B limits.

Figure 3.1 Configuration of Tested System

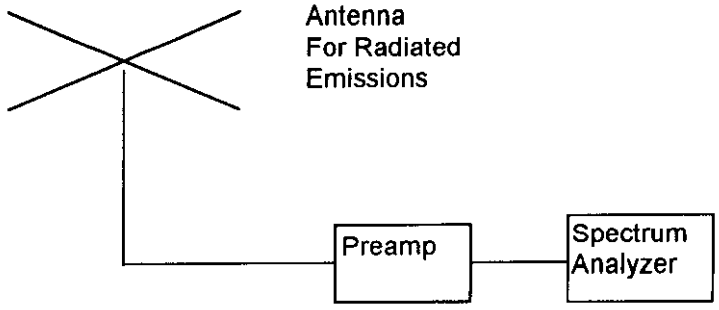
Conducted Emissions:
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled
- Test platform is not rotated

Radiated Emissions:
- LISN's not used
- AC outlet with low-pass filter at the base of the turntable
- No vertical conductive wall



Notes:
- Not to Scale
- Antenna height varied 1-4 mtrs
- Distance from antenna to tested system is 3 meters
- LISN=Line Impedance Stablization Network

Rotating Platform:
1x1.5m surface above GND plane



6.0 Conducted Emission Data

The initial step in collecting conducted data is a spectrum analyzer peak scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the host computer (with the EUT connected) power cord, after testing all modes of operation.

Model : SWL-1000N
Test Date : 1/19/98

Line Tested	Freq. MHz	Meter* Reading dBuV	Cable Loss dB	Strength of Signal dBuV	Limit dBuV	Margin Under Limit dB
Neutral	0.45	32.3	0.1	32.4	48.0	15.6
Neutral	0.54	36.8	0.1	36.9	48.0	11.1
Neutral	0.73	26.1	0.1	26.2	48.0	21.8
Neutral	1.78	27.6	0.1	27.7	48.0	20.3
AC Hot	0.45	40.3	0.1	40.4	48.0	7.6
AC Hot	0.49	36.3	0.1	36.4	48.0	11.6
AC Hot	0.58	32.3	0.1	32.4	48.0	15.6
AC Hot	0.73	28.4	0.1	28.5	48.0	19.5

* All reading are quasi-peak with a 9 kHz bandwidth and no video filter.

Changing the frequency of the transmitter did not affect the emissions listed above.
Judgment: Passed by 7.6 dB

Test Personnel: Joseph Strzelecki Date 3-28-98

Joseph Strzelecki
Senior EMC Engineer

7.0 Radiated Emissions Data

The following table lists the highest measured emission frequencies, and measured levels and the Class B limit. A sample calculation is given in paragraph 7.1. . The analyzer readings are quasi-peak with a 120 kHz bandwidth and no video filter.

Model : SWL-1000D
Test Date : March 20, 1998
Test Distance : 3 Meters
Notes: Pol = Antenna Polarization; V = Vertical; H = Horizontal
BC = Biconical; LP = Log Periodic; DP = Dipole; P = Peak; Q = QP
Corr. Factors = cable loss - preamp gain

Freq. MHz	Analyzer Reading dBuV	Antenna Factor dB	Antenna Polarity/ Type	Correction Factors dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m	Margin Under Limit dB
38.0	40.0	12.2	V/BC	-17.9	34.3	40.0	5.7
67.6	42.6	7.5	V/BC	-14.4	35.7	40.0	4.3
69.0	42.7	6.9	V/BC	-14.4	35.2	40.0	4.8
73.5	44.0	7.1	V/BC	-15.1	36.0	40.0	4.0
74.0	43.4	7.2	V/BC	-15.2	35.4	40.0	4.6
75.1	44.9	7.3	V/BC	-15.4	36.8	40.0	3.2
144.0	41.0	13.6	V/BC	-16.3	38.3	43.5	5.2
160.0	36.0	15.6	V/BC	-16.2	35.4	43.5	8.1
300.0	40.0	14.3	V/LP	-15.5	38.8	46.0	7.2
480.0	36.0	17.3	V/LP	-15.0	38.3	46.0	7.7
510.0	38.0	18.9	V/LP	-15.0	41.9	46.0	4.1
520.2	36.0	18.3	V/LP	-15.0	39.3	46.0	6.7
550.6	37.0	17.8	V/LP	-15.0	39.8	46.0	6.2
567.0	36.1	18.8	V/LP	-14.9	40.0	46.0	6.0
645.0	32.0	19.6	V/LP	-14.3	37.3	46.0	8.7
58.0	40.3	11.2	H/BC	-15.8	35.7	40.0	4.3
62.7	41.0	9.6	H/BC	-14.5	36.1	40.0	3.9
140.0	38.0	13.2	H/BC	-16.3	34.9	43.5	8.6
176.0	33.4	16.9	H/BC	-16.0	34.3	43.5	9.2
192.0	37.1	17.8	H/BC	-15.8	39.1	43.5	4.4
208.1	41.0	12.5	H/LP	-15.8	37.7	43.5	5.8
510.2	36.0	18.9	H/LP	-15.0	39.9	46.0	6.1
550.6	35.8	17.8	H/LP	-15.0	38.6	46.0	7.0
715.9	32.5	20.9	H/LP	-13.8	39.6	46.0	6.4

Judgment: Passed by 3.2 dB
No Emissions were detected from 720 to 12500 MHz within 12 dB of the limits.

Test Personnel: _____ Date 3-28-98

Joseph Strzelecki
Senior EMC Engineer

7.2 Transmitter Harmonics/Spurious Radiated Emissions Data

The following table lists the highest emission frequencies, measured levels, correction factors plus the limit. The following lists the worst case emissions up to the 10th harmonic. The analyzer was set with a RBW of 1 MHz with a 3.0 MHz VBW. The EUT was set to continuous transmission mode.

Sample Calculations:

Field Intensity dBuV/m = Analyzer Reading (dBuV) + Ant. Factor (dB/m) + Correction Factor (dB)

37.0 dBuV + 34.4 dB/m - 28.4 dB = 43.0 dBuV/m

Model : SWL-1000N
Test Date : 3/17/98
Notes: Pol = Antenna Polarization; V = Vertical; H = Horizontal
HN = Double Ridged Guide Horn Antenna; Corr. Factors = cable loss - preamp gain.

Freq. MHz	Analyzer Reading dBuV	Antenna Factor dB/m	Antenna Polarity/ Type	Correction Factors dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m	Margin Under Limit dB
TX = 2.412 GHz							
4824	37*	34.4	V/HN	-28.4	43	74	31
7236	37*	36.9	V/HN	-27.2	46.7	74	27.3
9648	38*	38.3	V/HN	-26.7	49.6	74	24.4
12060	39*	38.9	V/HN	-26	51.9	74	22.1
14472	40*	39.5	V/HN	-25.6	53.9	74	20.1
16884	40*	39.9	V/HN	-25.3	54.6	74	19.4
4824	37*	34.4	H/HN	-28.4	43	74	31
7236	37*	36.9	H/HN	-27.2	46.7	74	27.3
9648	38*	38.3	H/HN	-26.7	49.6	74	24.4
12060	39*	38.9	H/HN	-26	51.9	74	22.1
14472	40*	39.5	H/HN	-25.6	53.9	74	20.1
16884	40*	39.9	H/HN	-25.3	54.6	74	19.4

*-ambient Emission
No emissions were detected from 3000 MHz to 25 GHz within 10 dB of the limit.

7.2 Transmitter Harmonics/Spurious Radiated Emissions Data (Continued)

Model : SWL-1000N
Test Date : 3/17/98
Notes: Pol = Antenna Polarization; V = Vertical; H = Horizontal
HN = Double Ridged Guide Horn Antenna; Corr. Factors = cable loss - preamp gain.

Freq. MHz	Analyzer Reading dBuV	Antenna Factor dB/m	Antenna Polarity/ Type	Correction Factors dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m	Margin Under Limit dB
TX = 2.437 GHz							
4874	37*	34.4	V/HN	-28.4	43	74	31
7311	37*	36.9	V/HN	-27.2	46.7	74	27.3
9748	38*	38.3	V/HN	-26.7	49.6	74	24.4
12185	39*	38.9	V/HN	-26	51.9	74	22.1
14622	40*	39.5	V/HN	-25.6	53.9	74	20.1
17059	40*	39.9	V/HN	-25.3	54.6	74	19.4
4874	37*	34.4	H/HN	-28.4	43	74	31
7311	37*	36.9	H/HN	-27.2	46.7	74	27.3
9748	38*	38.3	H/HN	-26.7	49.6	74	24.4
12185	39*	38.9	H/HN	-26	51.9	74	22.1
14622	40*	39.5	H/HN	-25.6	53.9	74	20.1
17059	40*	39.9	H/HN	-25.3	54.6	74	19.4
TX = 2.467 GHz							
4934	37*	34.4	V/HN	-28.4	43	74	31
7401	37*	36.9	V/HN	-27.2	46.7	74	27.3
9868	38*	38.3	V/HN	-26.7	49.6	74	24.4
12335	39*	38.9	V/HN	-26	51.9	74	22.1
14802	40*	39.5	V/HN	-25.6	53.9	74	20.1
17269	40*	39.9	V/HN	-25.3	54.6	74	19.4
4934	37*	34.4	H/HN	-28.4	43	74	31
7401	37*	36.9	H/HN	-27.2	46.7	74	27.3
9868	38*	38.3	H/HN	-26.7	49.6	74	24.4
12335	39*	38.9	H/HN	-26	51.9	74	22.1
14802	40*	39.5	H/HN	-25.6	53.9	74	20.1
17269	40*	39.9	H/HN	-25.3	54.6	74	19.4

*-ambient Emission
No emissions were detected from 3000 MHz to 25 GHz within 10 dB of the limit.
Judgment: Peak emissions passed by at least 19.4 dB

1.4 Test Facility

The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. Details of the site characteristics are on file with the FCC. Conducted emission measurements and preliminary radiated emission scans were performed in shielded enclosure number 1 at Radiometrics' Romeoville, Illinois EMC test lab. These sites have been fully described in a report and accepted by the FCC in a letter dated October 1, 1996 (31040/SIT 1300F2).

Conducted emission measurements were performed using an Electrometrics Model FCC/VDE 50/2 Line Impedance Stabilization Network (LISN) as the pick-up device. This device is constructed in accordance with the circuit diagram provided in Figure 3 of ANSI document C63.4-1992.

1.5 Test Equipment

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun.

The radiated emission measurements were performed with a spectrum analyzer. The bandwidths of the spectrum analyzers are adjusted to the correct bandwidths as specified by the FCC Rules. The bandwidth used from 450 kHz to 30 MHz is 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. From 1 to 25 GHz a 1 MHz bandwidth is used. In order to increase the sensitivity of the spectrum analyzer, a preamplifier was used. The preamplifiers used had sufficient dynamic range that ensured that an overload condition was not present during the tests. When measuring the transmitter signals above 2000 MHz, a preselector was used. For radiated emissions above 18 GHz, an external mixer was used with a standard gain horn antenna.

1.6 Test Methodology

The test procedures used are in accordance with the ANSI document C63.4-1992, (July 17, 1992) "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". There were no deviations from this standard.

The test procedures for measuring the spread spectrum transmitters were in accordance with the FCC's "Guidance on Measurements for Direct Sequence Spread Spectrum Systems" Located in FCC Document 97-114.

Since the PCMCIA card has no external antenna, no antenna conducted emissions were performed.

1.6.1 Processing Gain Measurement Procedure

The Processing Gain was measured using the CW jamming margin method. Figure 1.1 shows the test configuration.

3.0 SYSTEM TEST CONFIGURATION

3.1 Justification

The EUT was tested in a typical configuration. The EUT is powered from the notebook computer. The EUT can only be operated from a PCMCIA slot in a notebook type computer. The EUT has no ports for external cabling.

3.2 EUT Test Configurations

The program used to exercise the EUT, first put into EUT into a continuous transmit mode and then continuous receiving mode.

The host notebook computer for these tests was an IBM Thinkpad. The host computer was an IBM Thinkpad Notebook with an external mouse & printer. The EUT was tested in the following configurations.

(a) EUT in transmit mode at three frequencies: 2.412, 2.437 and 2.467 GHz.
(b) EUT in receive mode.
(c) EUT in network communication mode.

The diagnostic software used allowed the transmit frequency to be set to any of the channels, and to measure the BER of the communications.

3.3 Special Accessories

No special accessories were used to achieve compliance.

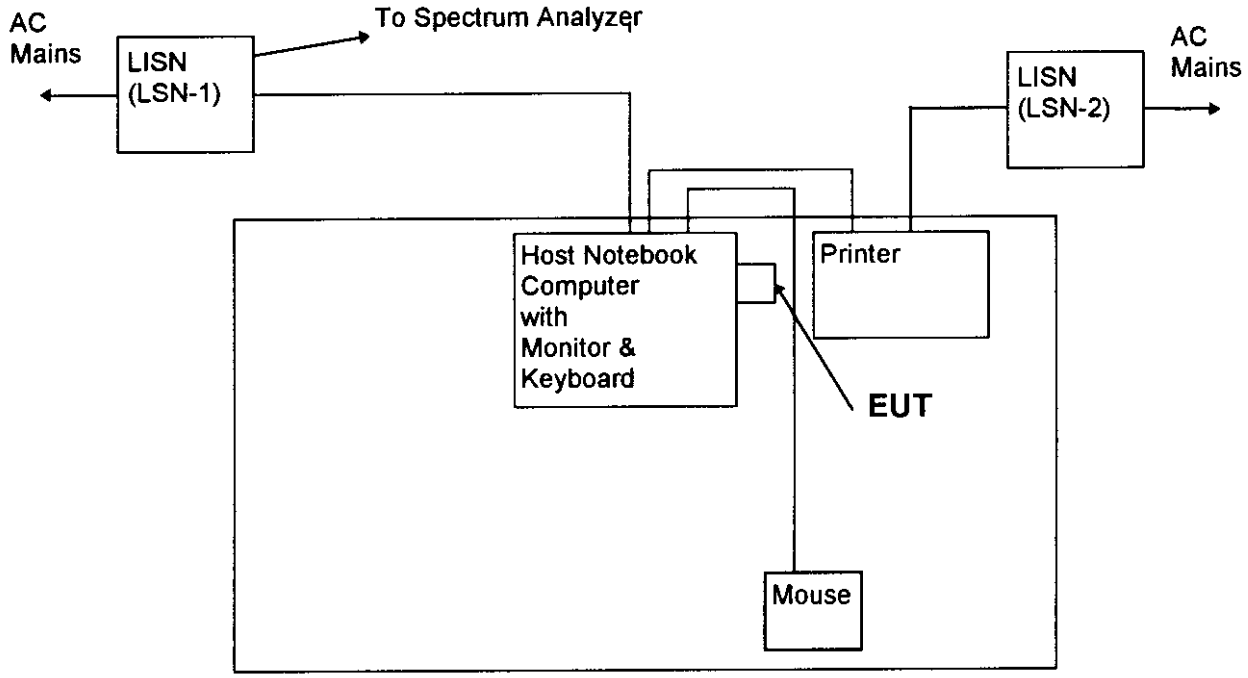
3.4 Equipment Modifications

There were no modifications made to the EUT by Radiometrics in order to achieve compliance with the FCC part 15 rules. Radiometrics made no changes to the EUT prior to or during compliance testing.

Figure 3.1 Configuration of Tested System

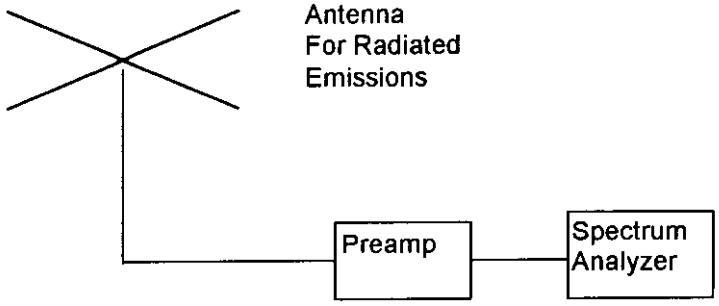
Conducted Emissions:
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled
- Test platform is not rotated

Radiated Emissions:
- LISN's not used
- AC outlet with low-pass filter at the base of the turntable
- No vertical conductive wall



Notes:
- Not to Scale
- Antenna height varied 1-4 mtrs
- Distance from antenna to tested system is 3 meters
- LISN=Line Impedance Stablization Network

Rotating Platform:
1x1.5m surface above GND plane



6.0 AC CONDUCTED EMISSION DATA

The initial step in collecting conducted data is a spectrum analyzer peak scan and plotting the measurement range. The emissions are then maximized by moving all system and peripheral cables and cords in relation to each other and the EUT. The EUT and its power cord did not move. The emissions were then plotted using the peak detector. The highest emissions were also plotted using a quasi-peak detector. The worst case emissions from the different configurations and operating modes are presented below.

The data below shows compliance to FCC sections 15.107(a) and 15.207(a).

Model : SWL-1000N
Test Date : 1/19/98

Line Tested	Freq. MHz	Meter* Reading dBuV	Cable Loss dB	Strength of Signal dBuV	Limit dBuV	Margin Under Limit dB
Neutral	0.45	32.3	0.1	32.4	48.0	15.6
Neutral	0.54	36.8	0.1	36.9	48.0	11.1
Neutral	0.73	26.1	0.1	26.2	48.0	21.8
Neutral	1.78	27.6	0.1	27.7	48.0	20.3
AC Hot	0.45	40.3	0.1	40.4	48.0	7.6
AC Hot	0.49	36.3	0.1	36.4	48.0	11.6
AC Hot	0.58	32.3	0.1	32.4	48.0	15.6
AC Hot	0.73	28.4	0.1	28.5	48.0	19.5

* All reading are quasi-peak with a 9 kHz bandwidth and no video filter.

Changing the frequency of the transmitter did not affect the emissions listed above.
Judgment: Passed by 7.6 dB

Test Personnel: Joseph Strzelecki Date 3-30-98

Joseph Strzelecki
Senior EMC Engineer

7.0 RADIATED EMISSION DATA

This section shows compliance to FCC sections 15.109(a), 15.209(a) and 15.247(c). All harmonics of the transmitter complied with the 15.209(a) limits. The receiver emissions are listed as spurious emissions. The worst case spurious emissions from the both the receive and transmit mode are reported in this section.

7.1 Spurious Radiated Emissions Data (30-1000MHz)

The following lists the worst case emissions for both transmit (at three transmit frequencies) and receive mode. The transmitter and harmonics are listed in 7.2.

Model : SWL-1000N
Test Date : March 20, 1998
Test Distance : 3 Meters
Notes: Pol = Antenna Polarization; V = Vertical; H = Horizontal
BC = Biconical; LP = Log Periodic; DP = Dipole; P = Peak; Q = QP
Corr. Factors = cable loss - preamp gain

Freq. MHz	Analyzer Reading dBuV	Antenna Factor dB	Antenna Polarity/ Type	Correction Factors dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m	Margin Under Limit dB
40.1	36.9 P	12.5	V/BC	-17.8	31.6	40.0	8.4
48.3	38.1 P	12.8	V/BC	-17.3	33.6	40.0	6.4
71.6	40.9 P	6.8	V/BC	-14.8	32.9	40.0	7.1
78.7	38.6 P	7.9	V/BC	-15.8	30.7	40.0	9.3
85.9	38.9 P	9.6	V/BC	-16.3	32.2	40.0	7.8
120.3*	44.0 P	13.6	V/BC	-16.5	41.2	43.5	2.3
147.1	38.2 P	14.0	V/BC	-16.3	35.9	43.5	7.6
151.1	40.0 P	14.4	V/BC	-16.2	38.2	43.5	5.3
280.8	41.9 P	14.6	V/LP	-15.7	40.9	46.0	5.1
300.0	40.1 P	14.3	V/LP	-15.5	38.9	46.0	7.1
356.8*	42.2 P	16.1	V/LP	-15.4	42.9	46.0	3.1
360.4	37.5 P	15.9	V/LP	-15.4	38.0	46.0	8.0
398.4	36.8 P	15.4	V/LP	-15.2	37.0	46.0	9.0
120.3	42.1 P	13.6	H/BC	-16.5	39.2	43.5	4.3
200.4	40.8 P	13.3	H/LP	-15.8	38.3	43.5	5.2
211.2	42.9 P	12.1	H/LP	-15.8	39.2	43.5	4.3
240.8	43.4 P	11.7	H/LP	-15.6	39.5	46.0	6.5
266.8	42.4 P	13.9	H/LP	-15.7	40.7	46.0	5.3
280.7*	45.6 Q	14.6	H/LP	-15.7	44.5	46.0	2.5
288.8	42.4 P	14.5	H/LP	-15.6	41.3	46.0	4.7
300.0	42.3 P	14.3	H/LP	-15.5	41.2	46.0	4.8
322.0	42.8 P	14.3	H/LP	-15.5	41.6	46.0	4.4
356.8	38.7 P	16.1	H/LP	-15.4	39.4	46.0	6.6

* Emission source is the host computer.
Judgment: Passed by 2.3 dB

Test Personnel: Joseph Strzelecki Date 3-30-98

Joseph Strzelecki
Senior EMC Engineer

7.2 Transmitter Harmonics/Spurious Radiated Emissions Data

The following table lists the highest emission frequencies, measured levels, correction factors plus the limit. The following lists the worst case emissions up to the 10th harmonic. The analyzer was set with a RBW of 1 MHz with a 10 Hz VBW. The EUT was set to continuous transmission mode.

Model : SWL-1000N
Test Date : 3/17/98
Notes: Pol = Antenna Polarization; V = Vertical; H = Horizontal
HN = Double Ridged Guide Horn Antenna; Corr. Factors = cable loss - preamp gain.

Freq. MHz	Analyzer Reading dBuV	Antenna Factor dB	Antenna Polarity/ Type	Correction Factors dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m	Margin Under Limit dB
TX = 2.412 GHz							
4824.0	23.0*	34.4	V/HN	-28.4	28.0	54.0	26.0
7236.0	26.0*	36.9	V/HN	-27.2	35.7	54.0	18.3
9648.0	26.0*	38.3	V/HN	-26.7	37.6	54.0	16.4
12060.0	26.0*	38.9	V/HN	-26.0	38.9	54.0	15.1
14472.0	26.0*	39.5	V/HN	-25.6	39.9	54.0	14.1
16884.0	26.0*	39.9	V/HN	-25.3	40.6	54.0	13.4
4824.0	23.0*	34.4	H/HN	-28.4	28.0	54.0	26.0
7236.0	26.0*	36.9	H/HN	-27.2	35.7	54.0	18.3
9648.0	26.0*	38.3	H/HN	-26.7	37.6	54.0	16.4
12060.0	26.0*	38.9	H/HN	-26.0	38.9	54.0	15.1
14472.0	26.0*	39.5	H/HN	-25.6	39.9	54.0	14.1
16884.0	26.0*	39.9	H/HN	-25.3	40.6	54.0	13.4
TX = 2.437 GHz							
4874.0	23.0*	34.4	V/HN	-28.4	28.0	54.0	26.0
7311.0	26.0*	36.9	V/HN	-27.2	35.7	54.0	18.3
9748.0	26.0*	38.3	V/HN	-26.7	37.6	54.0	16.4
12185.0	26.0*	38.9	V/HN	-26.0	38.9	54.0	15.1
14622.0	26.0*	39.5	V/HN	-25.6	39.9	54.0	14.1
17059.0	26.0*	39.9	V/HN	-25.3	40.6	54.0	13.4
4874.0	23.0*	34.4	H/HN	-28.4	28.0	54.0	26.0
7311.0	26.0*	36.9	H/HN	-27.2	35.7	54.0	18.3
9748.0	26.0*	38.3	H/HN	-26.7	37.6	54.0	16.4
12185.0	26.0*	38.9	H/HN	-26.0	38.9	54.0	15.1
14622.0	26.0*	39.5	H/HN	-25.6	39.9	54.0	14.1
17059.0	26.0*	39.9	H/HN	-25.3	40.6	54.0	13.4

*-ambient Emission
No emissions were detected from 3000 MHz to 25 GHz within 10 dB of the limit.

7.2 Transmitter Harmonics/Spurious Radiated Emissions Data (Continued)

Model : SWL-1000N
Test Date : 3/17/98
Notes: Pol = Antenna Polarization; V = Vertical; H = Horizontal
HN = Double Ridged Guide Horn Antenna; Corr. Factors = cable loss - preamp gain.

Freq. MHz	Analyzer Reading dBuV	Antenna Factor dB	Antenna Polarity/ Type	Correction Factors dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m	Margin Under Limit dB
TX = 2.467 GHz							
4934.0	23.0*	34.4	V/HN	-28.4	28.0	54.0	26.0
7401.0	26.0*	36.9	V/HN	-27.2	35.7	54.0	18.3
pr-9868.0	26.0*	38.3	V/HN	-26.7	37.6	54.0	16.4
12335.0	26.0*	38.9	V/HN	-26.0	38.9	54.0	15.1
pr-14802.0	26.0*	39.5	V/HN	-25.6	39.9	54.0	14.1
pr-17269.0	26.0*	39.9	V/HN	-25.3	40.6	54.0	13.4
4934.0	23.0*	34.4	H/HN	-28.4	28.0	54.0	26.0
7401.0	26.0*	36.9	H/HN	-27.2	35.7	54.0	18.3
9868.0	26.0*	38.3	H/HN	-26.7	37.6	54.0	16.4
12335.0	26.0*	38.9	H/HN	-26.0	38.9	54.0	15.1
14802.0	26.0*	39.5	H/HN	-25.6	39.9	54.0	14.1
17269.0	26.0*	39.9	H/HN	-25.3	40.6	54.0	13.4

*-ambient Emission
No emissions were detected from 3000 MHz to 25 GHz within 10 dB of the limit.

Judgment: Passed by 13.4 dB

Test Personnel: Joseph Strzelecki Date 3-30-98

Joseph Strzelecki
Senior EMC Engineer

7.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Assume a receiver reading of 49.5 dBuV is obtained. The Antenna Factor of 8.1 and a Cable Factor of 1.7 is added. The Amplifier Gain of 23.3 dB is subtracted, giving a field strength of 36 dBuV/m. The 36 dBuV/m can be mathematically converted to its corresponding level in uV/m.

FS = 49.5 + 8.1 + 1.7 - 23.3 = 36.0 dBuV/m

Level in uV/m = Common Antilogarithm [(36 dBuV/m)/20] = 63.1 uV/m

8.0 TRANSMITTER TESTS; FCC SECTION 15.247

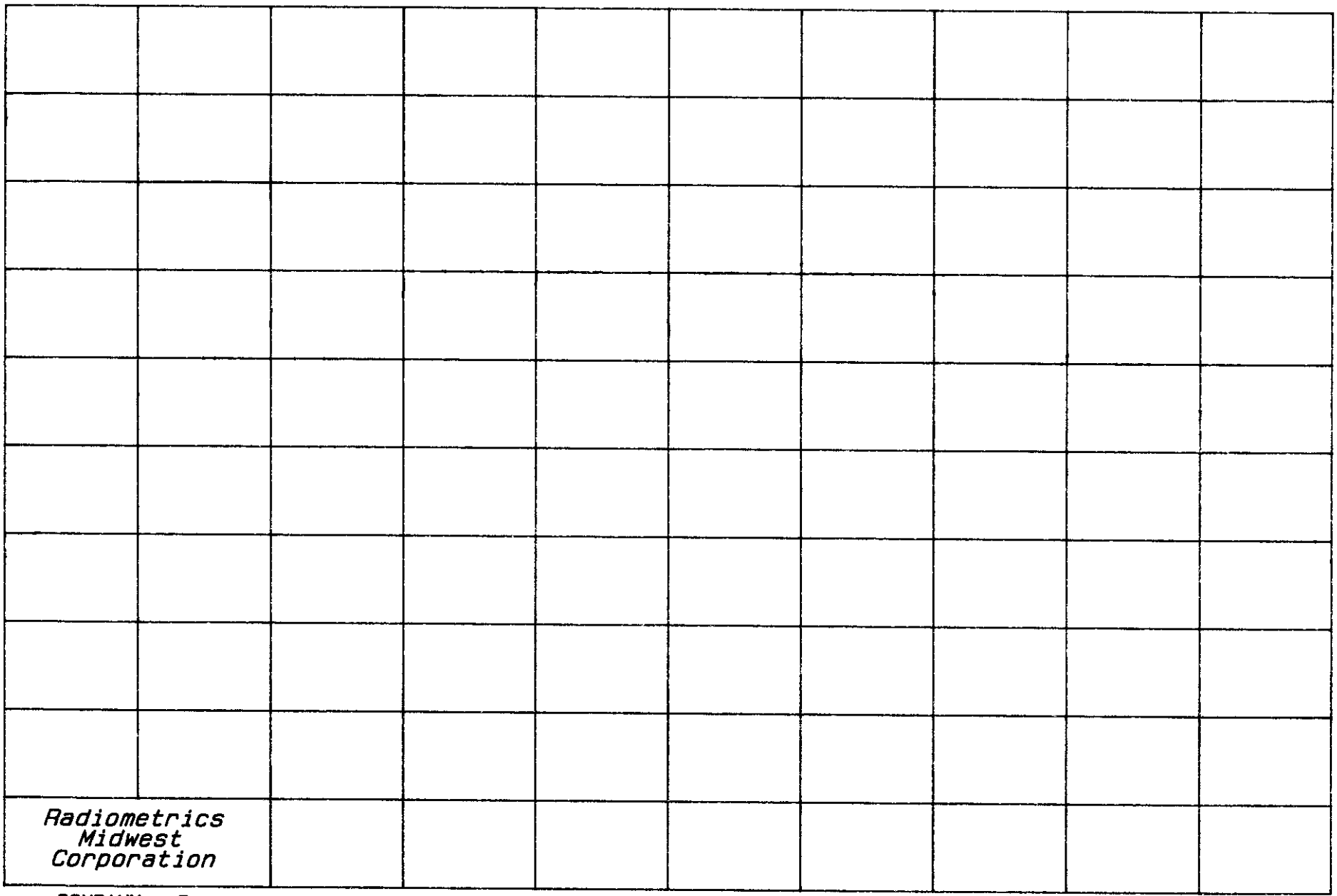
The tests in this section were performed with the transmitter connected directly to a spectrum analyzer via a short length of SMA cable and an attenuator.

8.1 Occupied Bandwidth Test; FCC 15.247(a)(2)

The occupied bandwidth of the RF output was measured using a 8566A spectrum analyzer. The bandwidth was measured using the peak detector function. The 6 dB bandwidth of the EUT must be at least 500 kHz in accordance with FCC Section 15.247(a)(2).

A broadband antenna was used to receive the modulated signal. The spectrum analyzer was set to the "MAX HOLD" mode to record the worst case of the modulation. The spectrum analyzer display was digitized and plotted. A limit was drawn on the plot based on the level of the modulated carrier. Plots of the occupied bandwidth is supplied on pages 21 to 23.

Separate plots were made at three frequencies in accordance with FCC section 15.31(m).



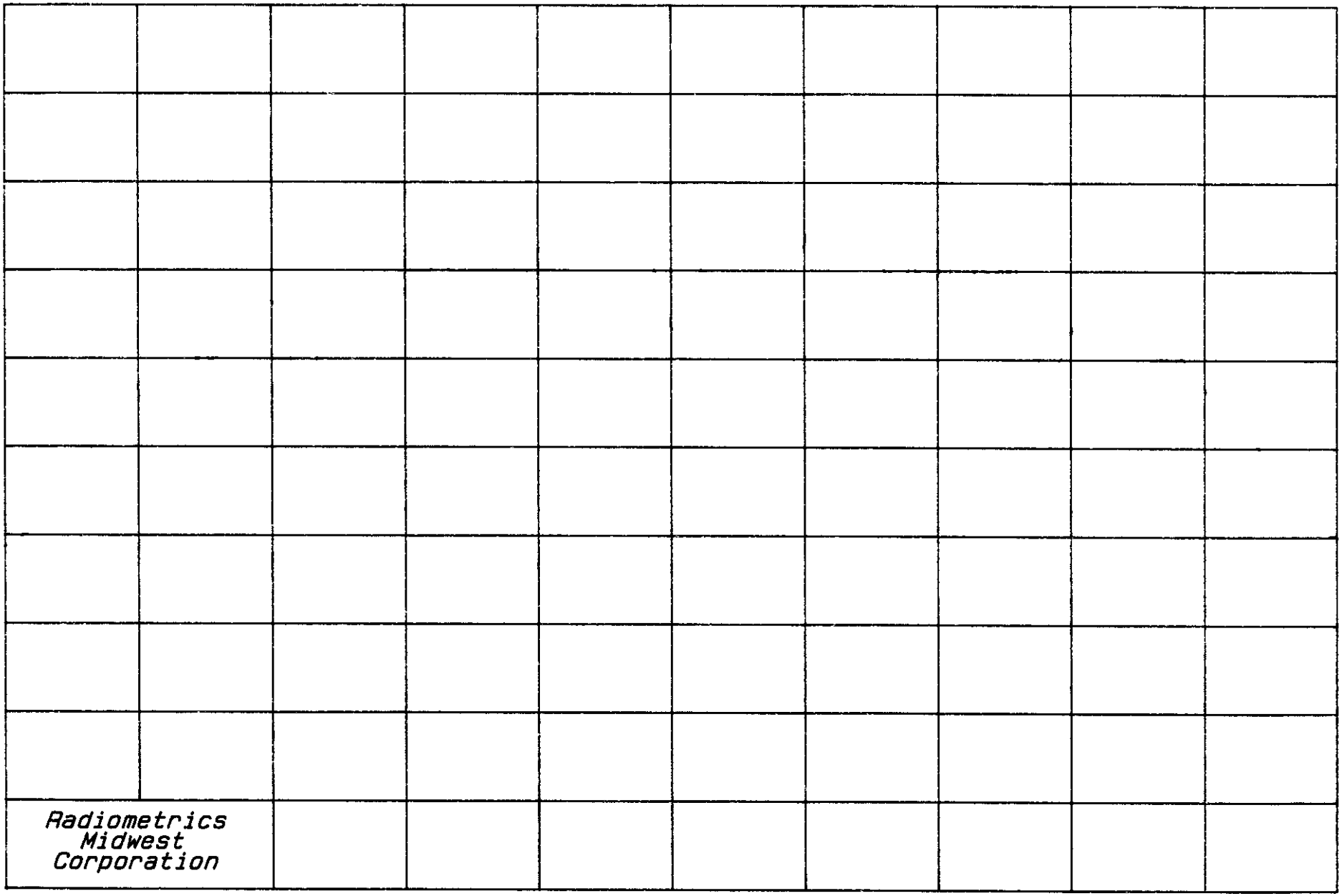
COMPANY : Samsung
CENTER 2.462 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Bandwidth Test, 15.247 (a) (2); High Freq

ITEM : SWL-1000N
REF 107.0 dBuV
VBW 300 kHz
TIME : 10:08

DATE : 03-17-1998
SPAN 20.0 MHz
ATTEN 10 dB
SWP 20.0 msec

RP-3696A

FCC ID: E2XSWL-1000N



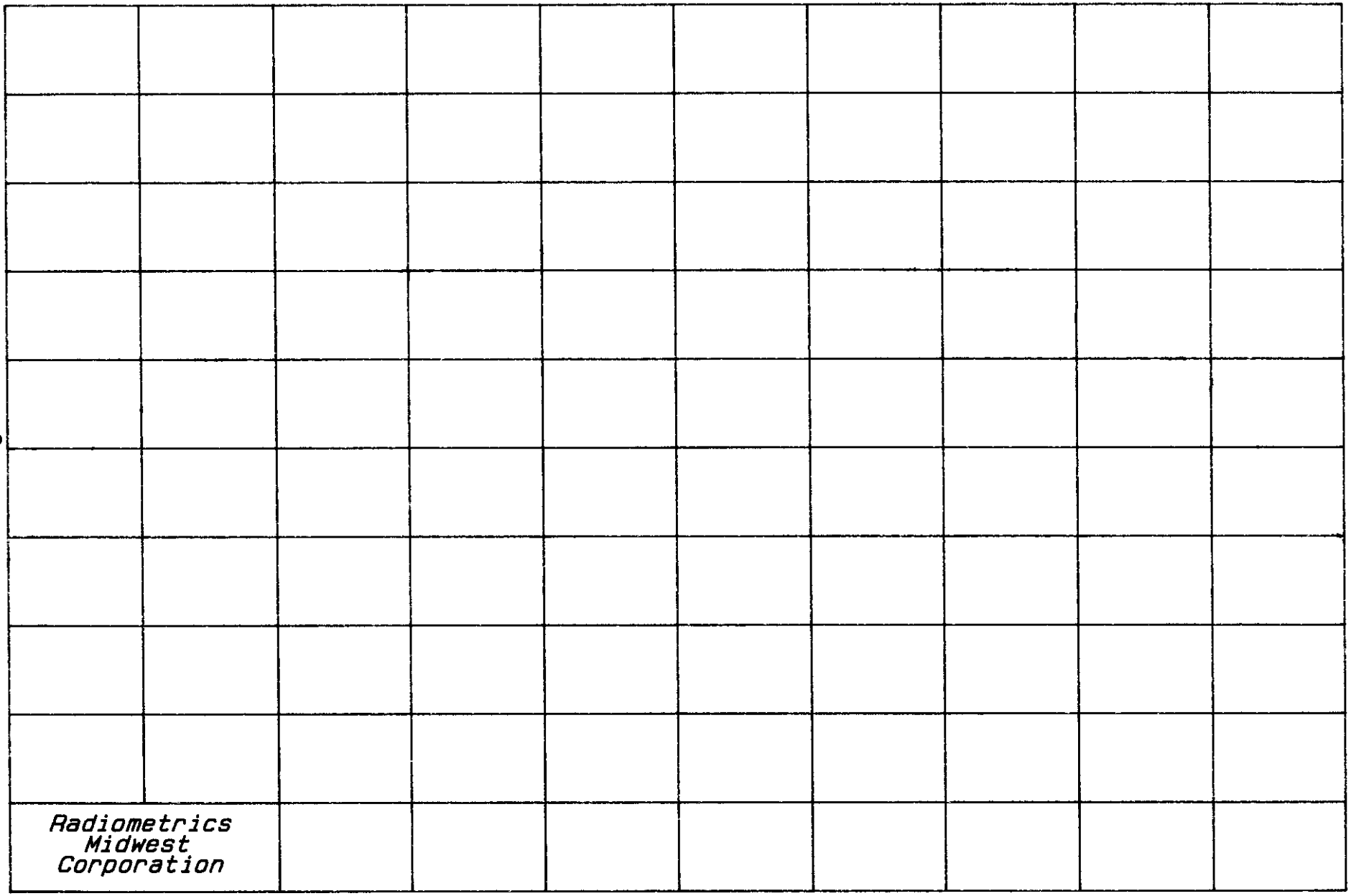
COMPANY : Samsung
CENTER 2.437 1 GHz
RES BW 100 kHz
10 dB/
NOTES : Bandwidth Test, 15.247 (a) (2); Middle Freq

ITEM : SWL-1000N
REF 107.0 dBuV
VBW 300 kHz
TIME : 10:04

DATE : 03-17-1998
SPAN 20.0 MHz
ATTEN 10 dB
SWP 20.0 msec

RP-3696A

FCC ID: E2KSWL-1000N



COMPANY : Samsung
CENTER 2.412 1 GHz
RES BW 100 kHz
10 dB/
NOTES : Bandwidth Test, 15.247 (a) (2) Low freq

ITEM : SWL-1000N
REF 107.0 dBuV
VBW 300 kHz
TIME : 10:02

DATE : 03-17-1998
SPAN 20.0 MHz
ATTEN 10 dB
SWP 20.0 msec

FCC ID: EZXSWL-1000N

KP-3696A

8.2 Peak Output Power; FCC 15.247(b)

The antenna has a gain of 2 dB. Since the PCMCIA card has no external antenna, no antenna conducted emissions were performed. The transmitter's peak power was calculated using the following equation:

$$P = \frac{(Ed)^2}{30G}$$

d = 3
G = 1.26

Where: E = measured maximum field strength in V/m using a wide band peak power meter.
G = 1.26; numeric gain of the transmitting antenna over isotropic.
D = 3.0 meters is the distance in meters from which the field strength was measured.
P = Power in watts.

Test Description: RF Power Output; Paragraph 15.247(b)
Test Date : 3/17/98
Model: **SWL-1000N**

Transmitter Channel	Measured* TX Level dBuV/m	Calculated TX Level # dBm	Limit dB(mW)
2.412 GHz	112.4	16.2	30.0
2.437 GHz	113.0	16.8 ✓	30.0
2.467 GHz	113.9	17.7 ✓	30.0

* Peak measurement at 3 meters; includes all correction factors
# Level calculated at input to antenna
Judgment: Passed by 12.3 dB

Test Personnel: Joseph Strzelecki Date 3-30-98

Joseph Strzelecki
Senior EMC Engineer

58.3 mW
17.7 dBm

8.3 Conducted Harmonics/Spurs; FCC 15.247(c)

A > sign indicates the Harmonic amplitude was lower than the dynamic range of the test equipment. The harmonics must be at least 20 dB below the fundamental.

Since the PCMCIA card has no external antenna, no antenna conducted emissions were performed. The power level was calculated using the equation from section 8.2

Test Date: 3/18/98
Model: **SWL-1000N**

Harmonic Number	2.412 GHz dBm	2.437 GHz dBm	2.467 GHz dBm
1	1.2	1.8	2.7
2	-63.0*	-63.0*	-63.0*
3	-55.5*	-55.5*	-55.5*
4	-53.6*	-53.6*	-53.6*
5	-52.3*	-52.3*	-52.3*
6	-49.3*	-49.3*	-49.3*
7	-50.6*	-50.6*	-50.6*
8	-45.0*	-45.0*	-45.0*
9	-41.0*	-41.0*	-41.0*
10	-40.0*	-40.0*	-40.0*

* noise floor measurement

Judgment: Passed by at least 21 dB

Test Personnel: Joseph Strzelecki Date 3-30-98

Joseph Strzelecki
Senior EMC Engineer

8.4 Power Density; FCC 15.247(d)

Test Description: RF Power Density; Paragraph 15.247(d)

The power spectral density was measured as follows:
A. The analyzer was set to the highest point of the maximized fundamental emission. The analyzer was then set to RBW of 3 kHz, a VBW of 30 kHz, a span of 300 kHz, and a sweep of 100 sec.
B. From the peak level obtained in (A), the field strength, E, was calculated by applying the appropriate antenna factor, cable loss, pre-amp gain. Using the following equation, a power level was calculated for comparison to the +8 dBm limit.

$$P = \frac{(Ed)^2}{30G} \qquad d = 1$$

$G = 1.26$

The Spectrum line spacing of the EUT is 7.9 kHz.

Model: **SWL-1000N**
Test Date: 3/18/98

Measured* Transmitter Channel	Calculated TX Level dBuV/m	TX Level # dBm	Limit dB(mW)
2.412 GHz	90.9	-14.8	8.0
2.437 GHz	91.3	-14.4	8.0
2.467 GHz	91.7	-14.0 ✓	8.0

* Peak measurement at 1 meter includes all correction factors
# Level calculated at input to antenna

Judgment: Passed by 22.0 dB

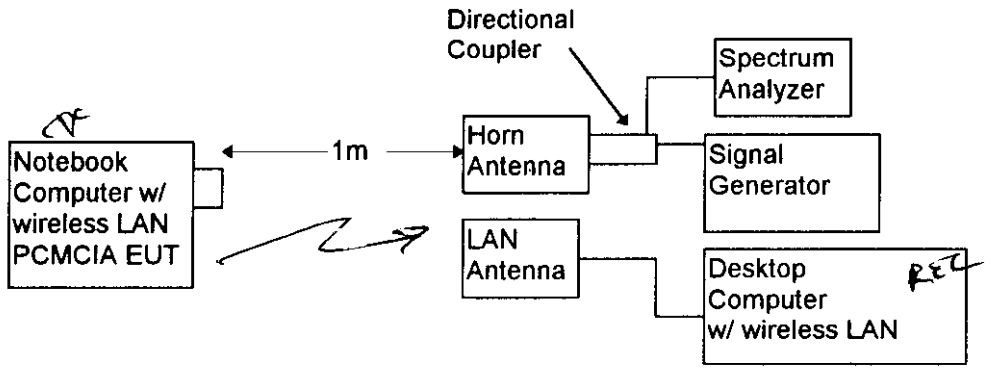
Test Personnel: Joseph Strzelecki Date 3-30-98

Joseph Strzelecki
Senior EMC Engineer

The test consists of stepping a signal generator in 50 kHz increments across the passband of the system. At each frequency, the generator level required to produce the recommended Bit Error Rate (BER) is recorded. This level is the jammer level. The output power of the transmitting unit is measured at the same point. The Jammer to Signal (J/S) ratio is then calculated. The worst 20% of the J/S data points were Discard. The lowest remaining J/S ratio is used when calculating the Processing Gain.

Since the spreading/despreading function of the EUT remains constant at all channels, the measurement was performed at a mid point within the operating band. Implementation losses of the system are limited to 2dB Max as permitted by the FCC guidelines.

Figure 1.1 Processing Gain Test Setup



The Notebook computer was sending data. The desktop computer was receiving information using wireless communications and continuously monitoring the Bit Error Rate. Since a radiated test was performed, the effective radiated peak power from an equivalent isotropic source was calculated using the following equation:

$$\text{Equation \#1: } P = \frac{(Ed)^2}{30}$$

Where: E = measured maximum field strength in V/m using a wide band peak power meter.
G = the numeric gain of the notebook transmitting antenna over isotropic.
D = 3.0 meters is the distance in meters from which the field strength was measured.
P = Power in watts.

8.5 Processing Gain; FCC 15.247(e)

The Processing Gain was measured using the CW jamming margin method. The recommended Bit Error Rate (BER) was assumed to be 1E-5, and the demodulation scheme of the receiver is DQPSK. The corresponding signal to noise ratio is 10.5 dB. Bit error rate was evaluated during the measurement using the "Packet" utility software. This software reports the frame error rate of transmission. Since a frame consists of 1024 bytes of 8 bit data, the frame error rate that corresponds with a BER of 1E-5 is approximately 8%.

Figure 1 shows the test configuration. A signal generator was stepped in 50 kHz increments across the passband of the system. At each point, the generator level required to produce the recommended BER was recorded. This level was recorded as the jammer level. The output power of the transmitting unit was measured at the same point. The Jammer to Signal (J/S) ratio was then calculated at each frequency. The worst 20% of the J/S data points were then discarded. The lowest remaining J/S ratio was used when calculating the Processing Gain. At this point, the effective radiated power of the jammer was 0.4 dBm, and the measured effective radiated power of the transmitted signal from the ISA LAN card was 1.3 dBm. The resulting value for J/S is -0.9 dB.

Total losses in the system, including transmitter and receiver, were assumed to be 2 dB.

Processing gain of the system was then calculated as follows:

$$Gp=(S/N)o+Mj+Lsys$$

where:
(S/N)o = Signal to noise ratio (10.5 dB)
Mj = J/S ratio (-0.9 dB)
Lsys = System losses. (2.0 dB)

Gp = 10.5 + (-1.1) + 2.0 = 11.6 dB

Judgment: Passed by 1.6 dB

Test Personnel: Chris W. Carlson Date 3/31/98

Chris W. Carlson
Director of Engineering

9.0 PHOTOS OF TESTED EUT

The following photos are attached:

Figure 9.1 Top and Bottom View
The top and bottom of two cards are shown

Figure 9.2 Inside of Covers

Figure 9.3 Top of Circuit Board

Figure 9.4 Bottom of Circuit Board