APPLICATION FOR FCC CERTIFICATION

CLASS B DIGITAL DEVICE

Samsung Electro-Mechanics
314, Maetan-3Dong, Paldal-Gu, Suwon,
Kyunggi-Do, Korea, 442-743
+82-331-210-6662

Model: Magic Wave PCMCIA Card SWL-2000N

FCC ID: E2XSWL-2000N

August 3, 1999

This report concerns (check one): **Original Grant:** X **Class II Change:** **Equipment Type**: **PCMCIA Board**	
Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? **Yes:** **No**: X **If yes, defer until:** _____ ***Date*** **Company name agrees to notify the Commission by: _____(date) of the intended date of announcement of the product so that the grant can be issued on that date.**	
Transition Rules Request per 15.37? Yes: **No:** X **If no, assumed Part 15, subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision..**	

REPORT PREPARED BY:

EMI Technician: **Daniel W. Baltzell**
Administrative Writer: **Melissa Fleming**

Rhein Tech Laboratories, Inc.

Document Number: 990362

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1.0 GENERAL INFORMATION

The following Application for FCC Certification for a Direct Sequence Spread Spectrum Transmitter as a Digital Device is prepared on behalf of Samsung Electro-Mechanics in accordance with Part 15.247 of the Federal Communications Commissions rules and regulations. The Equipment Under Test (EUT) was the Samsung Electro-Mechanics Magic Wave PCMCIA Card SWL-2000N, FCC ID: E2XSWL-2000N. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emissions measurement were performed manually at Rhein Tech, Incorporated. The radiated emissions measurements required by the rules were performed on the three meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. Rhein Tech, Labs, Inc. is on the FCC accepted lab list as a Facility available to do measurement work for others on a contract basis.

1.1 PRODUCT DESCRIPTION

The model SWL-2000N (referred to as the EUT in this report) is a Direct Sequence Spread Spectrum wireless LAN, PCMCIA network card. The EUT provides wireless communications between computers. The EUT is designed to be installed into the PCMCIA slot of a notebook computer or desktop computer with a PCMCIA slot. The EUT communicates with other wireless LAN cards using the frequency range from 2.411 GHz to 2.462 GHz. The EUT is powered from the PCMCIA slot, and does not have an external power supply. The EUT uses a stub antenna attached to a left-turn SMA connector or an internal PCB trace antenna. The EUT uses 2-bits encoded to 4 complex code words; 2-DQPSK CCK modulation technique with 8 Chips per symbol, spread clock rate is 1.375 MHz symbol/sec, and the data rate = 11 MBPS.

1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application for certification as a digital interface device. The transmitter portion has been uploaded to the FCC under the same FCC ID: E2XSWL-2000N.

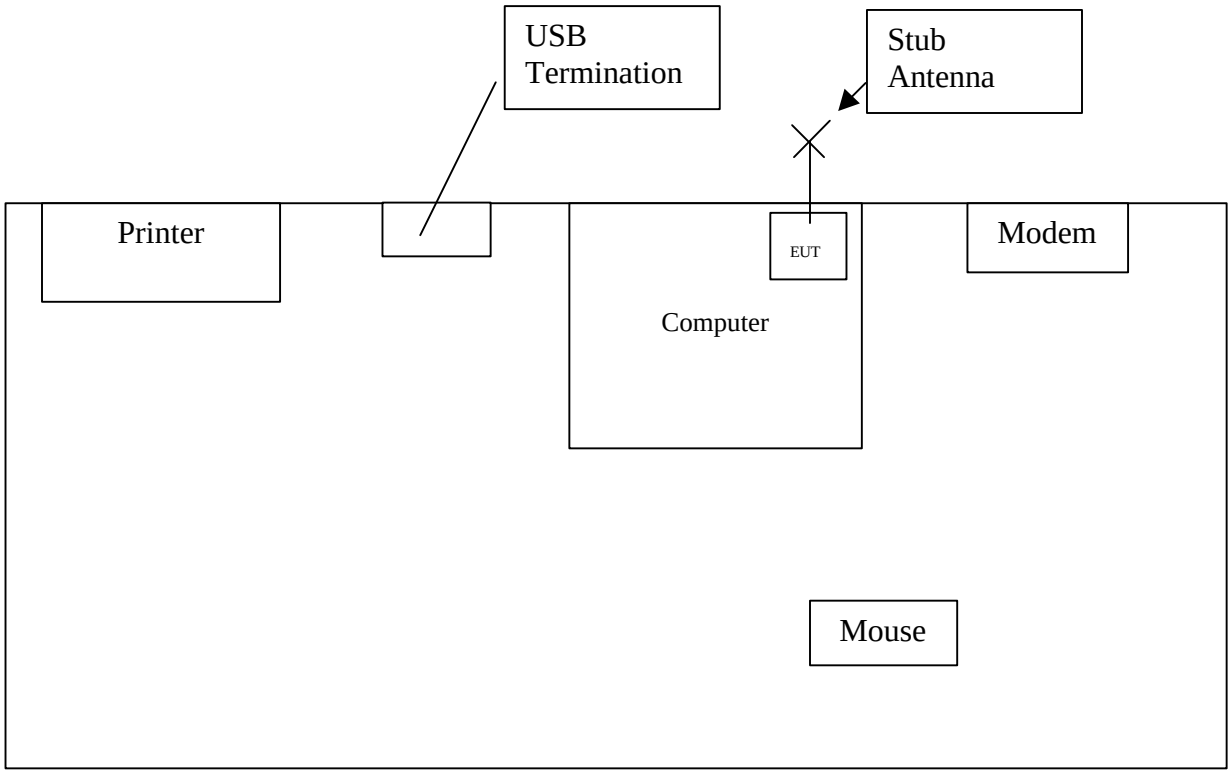
1.3 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

External Components

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
COMPUTER	COMPAQ	ARMADA 3500	3J95CBZ1B0HS	3872B746	N/A	N/A
AUDIO DEVICE	RADIO SHACK	SCP-59	N/A	N/A	SHIELDED I/O	900691
MICROPHONE	TELEX	700358	N/A	N/A	SHIELDED I/O	009578
MODEM	US ROBOTICS	0413	839032B26M4P N	DOC	SHIELDED I/O UNSHIELDED POWER	900407
MOUSE	HEWLETT PACKARD	M-S34	LCA5353508449	10:DZL21D472	SHIELDED I/O	N/A
WIRELESS LAN PCMCIA CARD	**SAMSUNG**			**E2XSWL-2000N**	**N/A**	**N/A**
PRINTER	HEWLETT PACKARD	C3941A	JPPJ-072076	B94C3941A	SHIELDED I/O UNSHIELDED POWER	10272

1.4 CONFIGURATION OF TESTED SYSTEM



1.5 TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of 3 meters. Emissions above 1 GHz were video averaged.

1.6 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 1994, submitted to and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

3.0 SYSTEM TEST CONFIGURATION

3.1 JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst case emission. Channel 11 at 2.463 GHz was tested and investigated from 30 MHz to 1 GHz. Data for channel 11 is presented in this report.

To complete the configuration required by the FCC, the transmitter was tested in a note computer with the stub antenna as well an internal antenna connected to the antenna port similar to its intended use.

The transmitter external antenna connector is a unique reverse-thread and is non-interchangeable.

The EUT was investigated with the 5" stub and internal trace antenna. The 5" stub antenna was considered the worst case configuration. The worst case radiated spurious noise data is presented in this report.

3.2 EUT EXERCISE SOFTWARE

The EUT was enabled to continuously transmit, which was verified by a receiving unit during testing. The carrier was also checked to verify that the information was being transmitted.

3.3 SPECIAL ACCESSORIES

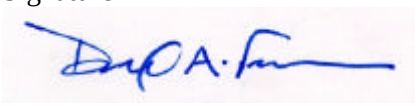
N/A.

3.4 CONFORMANCE STATEMENT

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made during testing to the equipment in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

Typed/Printed Name: Desmond A. Fraser
Signature



Date: August 3, 1999
Position: President, (NVLAP Signatory)

NVLAP *Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.*

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

6.0 Conducted Field Strength Calculation, & Radiated Test Methodology

6.1 Field Strength Calculation

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

FI(dBuV/m) = SAR(dBuV) + SCF(dB/m)
FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

SCF(dB/m) = - PG(dB) + AF(dB/m) + CL(dB)

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(uV/m) = 10^{FI(dBuV/m)/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

49.3 dBuV - 11.5 dB/m = 37.8 dBuV/m

$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$

6.2 Radiated measurement

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one meter and three-meter distances if necessary in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three-meter, open-field test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to 10GHz MHz (10^{th} harmonic of carrier frequency) using a Hewlett Packard 8566B spectrum analyzer, a Hewlett Packard 85650A quasi-peak adapter, HP11790 mixers, and EMCO log periodic, EMCO horn antennas and biconical antenna. In order to gain sensitivity, a cougar preamplifier (from 30 to 2GHZ), and an HP preamplifier (from 1GHz to 26.5 GHz) was connected in series between the antenna and the input of the spectrum analyzer.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB resolution bandwidth was set to 120 kHz for measurements below 1GHz, and 1MHz for measurements above 1GHz. The analyzer was operated in peak detection mode below 1GHz and in the peak mode with 10Hz video averaging above 1 GHz. No video filter less than 10 times the resolution bandwidth was used when measuring below 1GHz. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as daily calibration methods, technician training, and emphasis to employees on avoiding error.

7.0 CONDUCTED EMISSION DATA

The following table lists worst case conducted emission date. Specifically: Emission Frequency, Test Detector, Analyzer Reading, Site Correction Factor, corrected Emission Level, Quasi Peak Limit and Margin, and the Average Limit and Margin.

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emissions exceed the limit with the instrument set to the quasi-peak mode, then measurements are made in the average mode.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 150 kHz to 30 MHz on the NEUTRAL SIDE and HOT SIDE, herein referred to as L1 and L2, respectively.

TABLE 1: CONDUCTED EMISSIONS (CHANNEL 11 WITH THE STUB ANTENNA)

NEUTRAL SIDE (Line 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
0.465	Qp	45.2	0.6	45.8	48.0	-2.2
4.194	Pk	42.6	1.7	44.3	48.0	-3.7
4.367	Pk	44.8	1.7	46.5	48.0	-1.5
4.368	Qp	34.6	1.7	36.3	48.0	-11.7
5.049	Pk	42.1	1.9	44.0	48.0	-4.0
11.050	Pk	28.0	2.6	30.6	48.0	-17.4
24.641	Pk	25.6	3.8	29.4	48.0	-18.6

HOT SIDE (Line 2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
0.483	Qp	42.9	0.6	43.5	48.0	-4.5
4.123	Pk	44.3	1.7	46.0	48.0	-2.0
4.138	Pk	43.4	1.7	45.1	48.0	-2.9
5.018	Pk	38.6	1.9	40.5	48.0	-7.5
13.897	Pk	31.1	3.2	34.3	48.0	-13.7
24.208	Pk	23.3	4.0	27.3	48.0	-20.7

(1)Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

Typed/Printed Name: Daniel W. Baltzell **Date:** July 29, 1999

Signature:

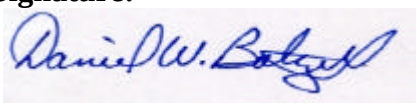


TABLE 2: CONDUCTED EMISSIONS (CHANNEL 11 WITH THE INTERNAL ANTENNA)

NEUTRAL SIDE (Line 1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
0.460	Qp	40.9	0.6	41.5	48.0	-6.5
4.526	Qp	38.3	1.8	40.1	48.0	-7.9
9.148	Pk	31.5	2.4	33.9	48.0	-14.1
11.650	Pk	31.9	2.7	34.6	48.0	-13.4
13.660	Pk	31.4	3.0	34.4	48.0	-13.6
17.920	Pk	23.4	3.4	26.8	48.0	-21.2

HOT SIDE (Line 2)

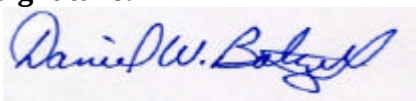
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)
0.455	Qp	40.9	0.6	41.5	48.0	-6.5
3.520	Pk	38.8	1.6	40.4	48.0	-7.6
4.576	Qp	39.7	1.8	41.5	48.0	-6.5
10.170	Pk	30.7	2.7	33.4	48.0	-14.6
11.770	Pk	31.9	2.8	34.7	48.0	-13.3
14.190	Pk	31.1	3.2	34.3	48.0	-13.7

(1)Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

Typed/Printed Name: Daniel W. Baltzell **Date:** July 29, 1999

Signature:



8.0 RADIATED EMISSION DATA

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit. Explanation of the Correction Factor is given in paragraph 6.3.

TABLE 3: RADIATED EMISSIONS (CHANNEL 11 WITH THE STUB ANTENNA)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
219.995	Qp	H	210	1.4	52.4	-19.1	33.3	46.0	-12.7
263.995	Qp	H	220	1.1	48.2	-13.9	34.3	46.0	-11.7
351.995	Qp	H	180	1.1	47.1	-12.2	34.9	46.0	-11.1
395.995	Qp	H	285	1.0	43.6	-11.4	32.2	46.0	-13.8
615.995	Qp	V	65	1.0	41.4	-5.9	35.5	46.0	-10.5
626.995	Qp	V	55	1.0	45.1	-6.3	38.8	46.0	-7.2
648.995	Qp	V	40	1.0	44.4	-6.4	38.0	46.0	-8.0
659.995	Qp	V	65	1.0	41.7	-6.3	35.4	46.0	-10.6
670.995	Qp	V	50	1.0	45.5	-5.7	39.8	46.0	-6.2
692.995	Qp	V	35	1.0	43.3	-5.7	37.6	46.0	-8.4
758.995	Qp	V	55	1.0	42.9	-4.4	38.5	46.0	-7.5
780.995	Qp	V	45	1.0	41.9	-4.8	37.1	46.0	-8.9

TEST PERSONNEL:

Typed/Printed Name: Daniel W. Baltzell **Date:** July 29, 1999

Signature:

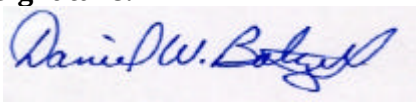


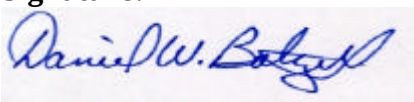
TABLE 4: RADIATED EMISSIONS (CHANNEL 11 WITH THE INTERNAL ANTENNA)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
220.000	Qp	H	260	1.0	57.4	-19.1	38.3	46.0	-7.7
253.000	Qp	H	260	1.0	47.2	-14.8	32.4	46.0	-13.6
264.000	Qp	H	250	1.0	50.3	-13.9	36.4	46.0	-9.6
275.000	Qp	H	260	1.0	48.2	-14.7	33.5	46.0	-12.5
297.000	Qp	H	200	1.0	48.7	-14.5	34.2	46.0	-11.8
352.000	Qp	V	175	1.5	55.0	-12.3	42.7	46.0	-3.3
396.000	Qp	V	175	1.0	49.5	-11.1	38.4	46.0	-7.6
429.000	Qp	V	175	1.0	47.8	-9.8	38.0	46.0	-8.0
473.000	Qp	V	155	1.0	47.0	-8.8	38.2	46.0	-7.8
484.000	Qp	H	150	1.0	46.9	-8.3	38.6	46.0	-7.4
495.000	Qp	V	165	1.0	47.5	-9.1	38.4	46.0	-7.6
506.000	Qp	H	135	1.0	42.8	-8.8	34.0	46.0	-12.0
517.000	Qp	V	170	1.0	46.2	-8.1	38.1	46.0	-7.9
539.000	Qp	V	190	1.0	46.4	-7.6	38.8	46.0	-7.2
649.000	Qp	H	350	1.5	39.3	-6.2	33.1	46.0	-12.9
660.000	Qp	H	340	1.3	40.1	-6.2	33.9	46.0	-12.1
671.000	Qp	H	230	1.3	44.0	-5.9	38.1	46.0	-7.9
682.000	Qp	H	190	2.4	38.7	-5.9	32.8	46.0	-13.2
693.000	Qp	H	190	2.4	43.3	-5.8	37.5	46.0	-8.5
693.000	Qp	V	30	2.0	45.3	-5.7	39.6	46.0	-6.4
704.000	Qp	H	190	1.1	41.6	-5.9	35.7	46.0	-10.3
715.000	Qp	V	45	1.9	47.0	-5.2	41.8	46.0	-4.2

TEST PERSONNEL:

Typed/Printed Name: Daniel W. Baltzell **Date:** July 29, 1999

Signature:



APPENDIX A: Emissions Equipment List

DESCRIPTION	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. LAB
AMPLIFIER	HEWLETT PACKARD	11975A	2304A00348	TEST EQUITY
AMPLIFIER (S/A 1)	RHEIN TECH	PR-1040	00001	RTL
AMPLIFIER (S/A 2)	RHEIN TECH	RTL2	900723	RTL
AMPLIFIER (S/A 3)	RHEIN TECH	8447F	2944A03783	RTL
AMPLIFIER (S/A 4)	RHEIN TECH	8447D	2727A05397	RTL
BICONICAL/LOG ANTENNA 1	ANTENNA RESEARCH	LPB-2520	1037	LIBERTY LABS
BICONICAL/LOG ANTENNA 2	ANTENNA RESEARCH	LPB-2520	1036	LIBERTY LABS
FIELD SITE SOURCE	EMCO	4610	9604-1313	RTL
FILTER (ROOM 1)	SOLAR	8130	947305	RTL
FILTER (ROOM 2)	SOLAR	8130	947306	RTL
HARMONIC MIXER 1	HEWLETT PACKARD	11970K	2332A00563	TELOGY
HARMONIC MIXER 2	HEWLETT PACKARD	11970A	2332A01199	TELOGY
HORN ANTENNA 1	EMCO	3160-10	9606-1033	EMCO
HORN ANTENNA 2	EMCO	3160-9	9605-1051	EMCO
HORN ANTENNA 3	EMCO	3160-7	9605-1054	EMCO
HORN ANTENNA 4	EMCO	3160-8	9605-1044	EMCO
HORN ANTENNA 5	EMCO	3160-03	9508-1024	EMCO
LISN (ROOM 1/L1)	SOLAR	7225-1	900727	ACUCAL
LISN (ROOM 1/L2)	SOLAR	7225-1	900726	ACUCAL
LISN (ROOM 2/L1)	SOLAR	7225-1	900078	ACUCAL
LISN (ROOM 2/L2)	SOLAR	7225-1	900077	ACUCAL
PRE-AMPLIFIER	HEWLETT PACKARD	8449B OPT	3008A00505	TELOGY
QUASI-PEAK ADAPTER (S/A 1)	HEWLETT PACKARD	85650A	3145A01599	ACUCAL
QUASI-PEAK ADAPTER (S/A 2)	HEWLETT PACKARD	85650A	2811A01276	ACUCAL
QUASI-PEAK ADAPTER (S/A 3)	HEWLETT PACKARD	85650A	2521A00473	ACUCAL
QUASI-PEAK ADAPTER (S/A 4)	HEWLETT PACKARD	85650A	2521A01032	ACUCAL
RF PRESELECTOR (S/A 1)	HEWLETT PACKARD	85685A	3146A01309	ACUCAL
SIGNAL GENERATOR (HP)	HEWLETT PACKARD	8660C	1947A02956	ACUCAL
SIGNAL GENERATOR (WAVETEK)	WAVETEK	3510B	4952044	ACUCAL
SPECTRUM ANALYZER 1	HEWLETT PACKARD	8566B	3138A07771	ACUCAL
SPECTRUM ANALYZER 2	HEWLETT PACKARD	8567A	2841A00614	ACUCAL
SPECTRUM ANALYZER 4	HEWLETT PACKARD	8567A	2727A00535	ACUCAL
TUNABLE DIPOLE	EMCO	3121	274	LIBERTY LABS
ANTENNA	ATM	WR08	08443-6	ATM
MIXER	OLESON	M08HW	F80814-1	OLESON
MIXER	OLESON	M05HW	G80814-1	OLESON
DIPLEXER	OLESON	M05HW	G80814-1	OLESON
MIXER	HEWLETT PACKARD	11970U	2332A01110	ACUCAL
MIXER	HEWLETT PACKARD	11970V	2521A00512	TELOGY
MIXER	HEWLETT PACKARD	11970W	2521A00710	TELOGY
ANTENNA	ATM	WR15	15-443-6	ATM
ANTENNA	ATM	WR10	10-443-6	ATM
ANTENNA	ATM	WR05	05-443-6	ATM
SWEEP GENERATOR	HEWLETT PACKARD	83752A	3610A00866	HEWLETT PACKARD

Calibration Certification available upon request.

APPENDIX B:

USER'S MANUAL I