Engineering and Testing for EMC and Safety Compliance

APPLICATION FOR FCC CERTIFICATION

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

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

Model: Magic Wave PCMCIA Card SWL-2100N

FCC ID: E2XSWL-2100N

July 7, 2000

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 1999	RADIO FREQUENCY DEVICES
FCC 97-114	GUIDANCE ON MEASUREMENTS FOR DIRECT SEQUENCE SPREAD SPECTRUM SYSTEMS
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
RSS-210, Issue 3: 2000	LOW POWER LICENCE-EXEMPT RADIOCOMMUNICATION DEVICES (ALL FREQUENCY BANDS)
RSS-102, Issue 1: 1999	EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS

This report concerns (check one): **Original Grant:** X **Class II Change:**
Equipment Type: PCMCIA Board

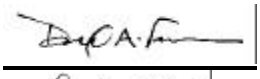
Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? Yes: **No**: X
If yes, defer until: _____

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.

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described above. 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.

REPORT PREPARED BY:

Supervising Engineer:	**Desmond A. Fraser**	
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360 Herndon Parkway, Suite 1400
Herndon, VA 20170
Phone: 703-689-0368; Fax: 703-689-2056; Metro: 703-471-6441

Equipment Model:	Test Report Page
Transmitter tested to: Field Strength _____ uV/m at a Distance of _____ meters ***Or*** RF Power 0.009863Watts Peak-to-average ratio _____ dB or CISPR No. Test Conditions: ☑ Radiated ☐ At ☐ DC Input Power	20
Transmitter Frequency 2462 MHz Bandwidth 11.2 MHz and ITU emission designation Frequency Tuning Range Min _____ Max _____ MHz Frequency Stability _____ ppm	20
Transmitter Spurious (Worst Case) Field Strength 335.0 uV/m at a distance of 3 meters Frequency 9853.0 MHz Or RF Power _____ Nanowatts Frequency _____ MHz	19
Momentary Operation No Holdover time after release Seconds Or Duration of transmission after automatic activation Seconds	
Transmitter/Receiver AC Wireline Conducted Emissions (worst case) Transmitter: RF Level 150 microvolts Frequency 0.453 MHz RF Level 150 microvolts Frequency 0.453 MHz	13
Receiver Spurious (worst case) Field Strength 136.5 uV/m at a distance of 3 meters Or RF Power _____ nanowatts Frequency 352.0 MHz	19

FCC Rules Parts	Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
15.247	2411-2462	0.009863		

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1.0 GENERAL INFORMATION

The following Application for FCC Certification for a Direct Sequence Spread Spectrum transmitter is prepared on behalf of Samsung Electro-Mechanics in accordance with Part 15.247 of the Federal Communications Commissions Rules and Regulations and with Industry Canada RSS-210. The Equipment Under Test (EUT) was the Samsung Electro-Mechanics Magic Wave PCMCIA Card SWL-2100N, FCC ID: E2XSWL-2100N. 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 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application for certification.

1.2 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.

1.3 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).

1.4 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	0001	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

2.0 SYSTEM TEST CONFIGURATION

2.1 JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst case emission. Channel 1 at 2.411GHz, Channel 6 at 2.437GHz and Channel 11 at 2.463GHz were tested and investigated from 9kHz to 24GHz. All three channels were investigated and tested. Data for all three channels are presented in this report.

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

The EUT was investigated with the internal trace antenna. The worst case data taken in this report represents the highest data rate at 11 MBPS. Data rates of 5.5MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance. The change in envelope did not cause the EUT to be non-compliant in any of the aforementioned modes.

Note: The EUT was tested as a digital device as well as a receiver. A DOC report is on file for the device as a digital interface and a receiver device**.**

2.2 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.

2.3 SPECIAL ACCESSORIES

N/A.

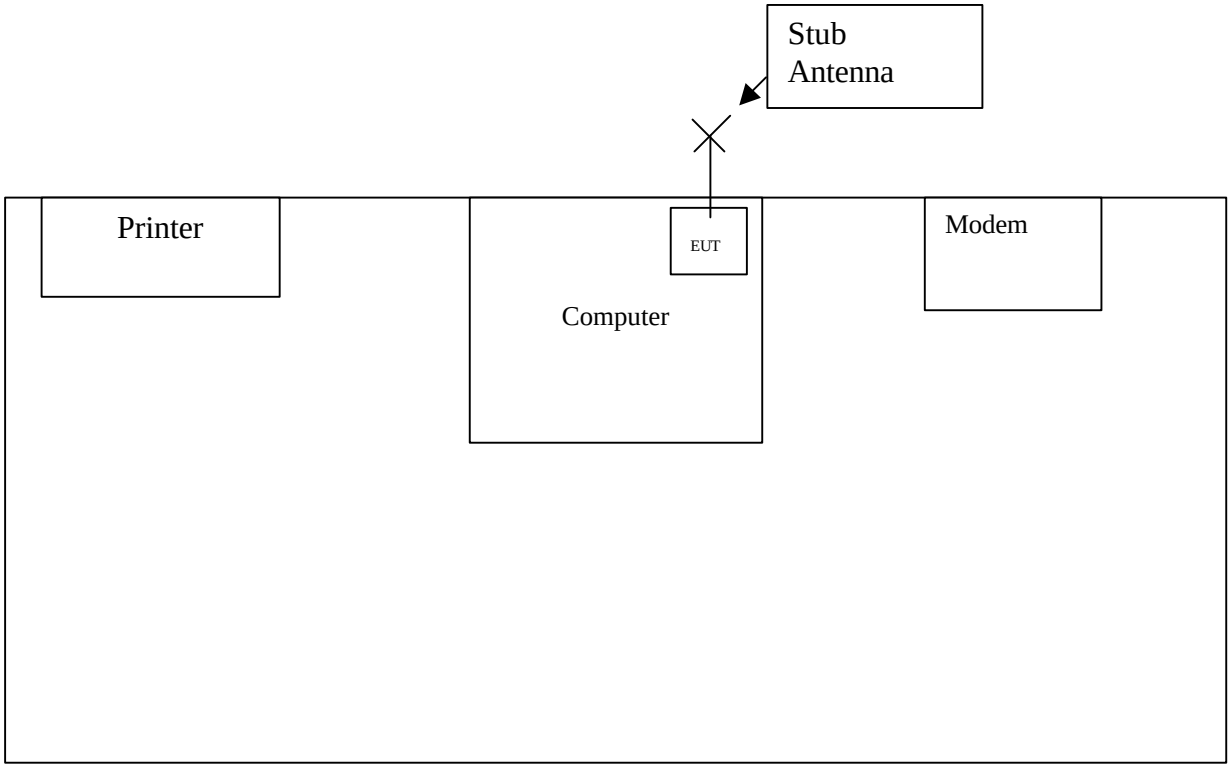
2.4 TEST SYSTEM DETAILS

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	METROBOOK		91BJ5004867	A3LS590	SHIELDED	
MODEM	US ROBOTICS	0413	839032B26M4PN	DOC	SHIELDED I/O UNSHIELDED POWER	900407
WIRELESS LAN PCMCIA CARD	**SAMSUNG**	**SWL-2100N**		**E2XSWL-2100N**	**N/A**	**12156**
PRINTER	HEWLETT PACKARD	682C	MV67Q1T22K	B94C2164X	SHIELDED I/O UNSHIELDED POWER	10272

2.5 CONFIGURATION OF TESTED SYSTEM



3.0 TEST RESULTS

3.1 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

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

EIRP calculation: Power from power meter in (dBm) + antenna gain in (dBi)

CONDUCTED EMISSIONS MEASUREMENTS

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 7 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 7 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or average mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

3.2 CONDUCTED EMISSIONS TEST

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 1 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)	AV Limit (dBuV)	AV Margin (dBuV)
0.473	Qp	42.9	0.6	43.5	48.0	-4.5	48.0	-4.5
0.473	Av	12.2	0.6	12.8	48.0	-35.2	48.0	-35.2
4.530	Qp	38.6	1.8	40.4	48.0	-7.6	48.0	-7.6
4.530	Av	23.3	1.8	25.1	48.0	-22.9	48.0	-22.9
9.140	Pk	31.3	2.4	33.7	48.0	-14.3	48.0	-14.3
11.530	Pk	33.9	2.7	36.6	48.0	-11.4	48.0	-11.4
13.660	Pk	33.4	3.0	36.4	48.0	-11.6	48.0	-11.6
17.940	Pk	24.8	3.4	28.2	48.0	-19.8	48.0	-19.8

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)	AV Limit (dBuV)	AV Margin (dBuV)
0.453	Qp	42.9	0.6	43.5	48.0	-4.5	48.0	-4.5
0.453	Av	13.3	0.6	13.9	48.0	-34.1	48.0	-34.1
4.722	Qp	40.9	1.8	42.7	48.0	-5.3	48.0	-5.3
4.722	Av	22.8	1.8	24.6	48.0	-23.4	48.0	-23.4
9.200	Pk	32.3	2.5	34.8	48.0	-13.2	48.0	-13.2
11.530	Pk	34.9	2.8	37.7	48.0	-10.3	48.0	-10.3
13.570	Pk	36.2	3.2	39.4	48.0	-8.6	48.0	-8.6
15.400	Pk	32.4	3.4	35.8	48.0	-12.2	48.0	-12.2

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

TEST PERSONNEL:

Typed/Printed Name: Desmond Fraser **Date:** June 28, 2000

TABLE 2: CONDUCTED EMISSIONS (CHANNEL 6 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)	AV Limit (dBuV)	AV Margin (dBuV)
0.513	Qp	41.0	0.6	41.6	48.0	-6.4	48.0	-6.4
0.513	Av	18.0	0.6	18.6	48.0	-29.4	48.0	-29.4
3.544	Pk	40.4	1.5	41.9	48.0	-6.1	48.0	-6.1
4.745	Qp	41.6	1.8	43.4	48.0	-4.6	48.0	-4.6
4.745	Av	23.7	1.8	25.5	48.0	-22.5	48.0	-22.5
9.110	Pk	31.3	2.4	33.7	48.0	-14.3	48.0	-14.3
11.270	Pk	33.1	2.7	35.8	48.0	-12.2	48.0	-12.2
13.660	Pk	33.0	3.0	36.0	48.0	-12.0	48.0	-12.0

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)	AV Limit (dBuV)	AV Margin (dBuV)
0.457	Qp	42.5	0.6	43.1	48.0	-4.9	48.0	-4.9
0.457	Av	12.2	0.6	12.8	48.0	-35.2	48.0	-35.2
3.140	Pk	40.0	1.5	41.5	48.0	-6.5	48.0	-6.5
4.676	Qp	41.3	1.8	43.1	48.0	-4.9	48.0	-4.9
4.676	Av	41.6	1.8	43.4	48.0	-4.6	48.0	-4.6
9.430	Pk	32.4	2.6	35.0	48.0	-13.0	48.0	-13.0
10.790	Pk	29.9	2.7	32.6	48.0	-15.4	48.0	-15.4
13.630	Pk	32.6	3.2	35.8	48.0	-12.2	48.0	-12.2

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

TEST PERSONNEL:

Typed/Printed Name: Desmond Fraser **Date:** June 28, 2000

TABLE 3: 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)	AV Limit (dBuV)	AV Margin (dBuV)
0.460	Qp	40.9	0.6	41.5	48.0	-6.5	48.0	-6.5
0.460	Av	13.3	0.6	13.9	48.0	-34.1	48.0	-34.1
4.526	Qp	38.3	1.8	40.1	48.0	-7.9	48.0	-7.9
4.526	Av	21.3	1.8	23.1	48.0	-24.9	48.0	-24.9
9.148	Pk	31.5	2.4	33.9	48.0	-14.1	48.0	-14.1
11.650	Pk	31.9	2.7	34.6	48.0	-13.4	48.0	-13.4
13.660	Pk	31.4	3.0	34.4	48.0	-13.6	48.0	-13.6
17.920	Pk	23.4	3.4	26.8	48.0	-21.2	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)	AV Limit (dBuV)	AV Margin (dBuV)
0.455	Qp	40.9	0.6	41.5	48.0	-6.5	48.0	-6.5
0.455	Av	9.6	0.6	10.2	48.0	-37.8	48.0	-37.8
3.520	Pk	38.8	1.6	40.4	48.0	-7.6	48.0	-7.6
4.576	Qp	39.7	1.8	41.5	48.0	-6.5	48.0	-6.5
4.576	Av	24.9	1.8	26.7	48.0	-21.3	48.0	-21.3
10.170	Pk	30.7	2.7	33.4	48.0	-14.6	48.0	-14.6
11.770	Pk	31.9	2.8	34.7	48.0	-13.3	48.0	-13.3
14.190	Pk	31.1	3.2	34.3	48.0	-13.7	48.0	-13.7

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

TEST PERSONNEL:

Typed/Printed Name: Desmond Fraser **Date:** June 28, 2000

RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range; the EUT was scanned indoors at one and three meter distances. This was done 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/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane.

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 bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report. . **For radiated measurements above 1 GHz, a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz are used.**

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 well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

3.3 Radiated Emissions Test

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit.

TABLE 4: RADIATED EMISSIONS (CHANNEL 1 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)	Pass/ Fail	Comments
219.995	Qp	H	220	1.2	50.9	-19.1	31.8	46.0	-14.2	Pass	
263.965	Qp	H	215	1.1	47.4	-13.9	33.5	46.0	-12.5	Pass	
307.975	Qp	H	225	1.0	64.8	-13.2	51.6	64.4	-12.8	Pass	
319.100	Qp	V	180	1.0	45.2	-13.2	32.0	46.0	-14.0	Pass	
330.000	Qp	V	180	1.0	43.7	-13.2	30.5	46.0	-15.5	Pass	
341.000	Qp	V	175	1.0	43.1	-12.5	30.6	46.0	-15.4	Pass	
352.000	Qp	V	175	1.0	44.5	-11.7	32.8	46.0	-13.2	Pass	
396.000	Qp	V	140	1.0	44.8	-11.1	33.7	46.0	-12.3	Pass	
627.100	Qp	V	80	1.0	40.0	-5.8	34.2	46.0	-11.8	Pass	
649.000	Qp	V	200	1.0	38.7	-5.7	33.0	46.0	-13.0	Pass	
670.998	Qp	V	80	1.0	40.3	-5.6	34.7	46.0	-11.3	Pass	
692.958	Qp	V	80	1.0	38.5	-5.8	32.7	46.0	-13.3	Pass	
747.998	Qp	V	180	1.0	44.0	-4.3	39.7	46.0	-6.3	Pass	
748.200	Qp	V	305	1.0	47.1	-4.3	42.8	64.4	-21.6	Pass	
2038.000	Av	H	180	1.0	33.2	-3.2	30.0	64.4	-34.4	Pass	
2411.000	Av	V	180	1.0	85.2	-0.8	84.4				Fundamental
4075.000	Av	H	180	1.0	39.3	-4.1	35.2	54.0	-18.8	Pass	
4820.000	Av	H	0	1.0	22.2	17.5	39.7	54.0	-14.3	Pass	
7233.000	Av	V	0	1.0	NF						Noise Floor
9644.000	Av	V	0	1.0	NF						Noise Floor
12055.000	Av	V	0	1.0	NF						Noise Floor
14466.000	Av	V	0	1.0	NF						Noise Floor
16877.000	Av	V	0	1.0	NF						Noise Floor
192888.000	Av	V	0	1.0	NF						Noise Floor

QUASI PEAK =120 KHZ
AVERAGE: RES. =1 MHZ, VID= 10HZ; NF = NOISE FLOOR
TEST PERSONNEL:

Typed/Printed Name: Desmond Fraser **Date:** June 28, 2000

TABLE 5: RADIATED EMISSIONS (CHANNEL 6 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)	Pass/ Fail	Comments
131.998	Qp	V	150	1.0	40.9	-18.2	22.7	43.5	-20.8	Pass	
219.998	Qp	V	270	1.0	49.4	-17.8	31.6	46.0	-14.4	Pass	
308.000	Qp	H	250	1.0	61.7	-13.9	47.8	63.7	-15.9	Pass	
351.998	Qp	V	180	1.0	44.0	-12.3	31.7	46.0	-14.3	Pass	
395.998	Qp	V	175	1.0	47.9	-11.1	36.8	46.0	-9.2	Pass	
538.998	Qp	V	190	1.0	43.8	-7.6	36.2	46.0	-9.8	Pass	
715.000	Qp	H	280	1.0	34.3	-5.6	28.7	46.0	-17.3	Pass	
748.000	Qp	H	150	1.0	44.8	-4.8	40.0	63.7	-23.7	Pass	
2062.000	Av	H	180	1.0	33.7	-3.0	30.7	63.7	-33.0	Pass	
2436.000	Av	V	180	1.0	89.5	-0.4	83.7				fundamental
4126.000	Av	H	180	1.0	41.9	-4.0	37.9	54.0	-16.1	Pass	
4873.480	Av	H	0	1.0	22.2	18.6	40.8	54.0	-13.2	Pass	
7308.000	Av	V	0	1.0	NF						Noise Floor
9744.000	Av	V	0	1.0	NF						Noise Floor
12180.000	Av	V	0	1.0	NF						Noise Floor
14616.000	Av	V	0	1.0	NF						Noise Floor
17052.000	Av	V	0	1.0	NF						Noise Floor
19488.000	Av	V	0	1.0	NF						Noise Floor

QUASI PEAK =120 KHZ
AVERAGE: RES. =1 MHZ, VID= 10HZ; NF = NOISE FLOOR
TEST PERSONNEL:

Typed/Printed Name: Desmond Fraser **Date:** June 28, 2000

TABLE 6: 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)	Pass/ Fail	Comments
220.000	Qp	H	260	1.0	57.4	-19.1	38.3	46.0	-7.7	Pass	
253.000	Qp	H	260	1.0	47.2	-14.8	32.4	46.0	-13.6	Pass	
264.000	Qp	H	250	1.0	50.3	-13.9	36.4	46.0	-9.6	Pass	
275.000	Qp	H	260	1.0	48.2	-14.7	33.5	46.0	-12.5	Pass	
297.100	Qp	H	200	1.0	48.7	-14.5	34.2	46.0	-11.8	Pass	
308.000	Qp	V	170	1.7	65.7	-14.0	51.7	69.9	-13.8	Pass	
352.000	Qp	V	175	1.5	55.0	-12.3	42.7	46.0	-3.3	Pass	
396.050	Qp	V	175	1.0	49.5	-11.1	38.4	46.0	-7.6	Pass	
429.000	Qp	V	175	1.0	47.8	-9.8	38.0	46.0	-8.0	Pass	
473.000	Qp	V	155	1.0	47.0	-8.8	38.2	46.0	-7.8	Pass	
484.000	Qp	H	150	1.0	46.9	-8.3	38.6	46.0	-7.4	Pass	
495.000	Qp	V	165	1.0	47.5	-9.1	38.4	46.0	-7.6	Pass	
506.000	Qp	H	135	1.0	42.8	-8.8	34.0	46.0	-12.0	Pass	
517.000	Qp	V	170	1.0	46.2	-8.1	38.1	46.0	-7.9	Pass	
539.000	Qp	V	190	1.0	46.4	-7.6	38.8	46.0	-7.2	Pass	
649.000	Qp	H	350	1.5	39.3	-6.2	33.1	46.0	-12.9	Pass	
660.000	Qp	H	340	1.3	40.1	-6.2	33.9	46.0	-12.1	Pass	
671.000	Qp	H	230	1.3	44.0	-5.9	38.1	46.0	-7.9	Pass	
682.000	Qp	H	190	2.4	38.7	-5.9	32.8	46.0	-13.2	Pass	
693.000	Qp	H	190	2.4	43.3	-5.8	37.5	46.0	-8.5	Pass	
693.000	Qp	V	30	2.0	45.3	-5.7	39.6	46.0	-6.4	Pass	
704.000	Qp	H	190	1.1	41.6	-5.9	35.7	46.0	-10.3	Pass	
715.000	Qp	V	45	1.9	47.0	-5.2	41.8	46.0	-4.2	Pass	
748.000	Qp	V	30	1.7	51.9	-4.8	47.1	69.9	-18.4	Pass	
2087.000	Av	H	180	1.0	34.1	-2.8	31.3	69.9	-34.2	Pass	
2440.010	Av	H	190	1.0	36.7	0.3	37.0	69.9	-28.5	Pass	
2462.000	Av	V	180	1.0	89.5	0.1	89.6				Fundamental
4176.015	Av	H	180	1.0	41.5	-3.9	37.6	54.0	-16.4	Pass	
4922.260	Av	V	0	1.0	29.9	19.7	49.6	54.0	-4.4	Pass	
9844.520	Av	V	0	1.0	33.0	17.0	50.5	54.0	-3.5	Pass	
12306.520	Av	V	0	1.0	NF						Noise Floor
14768.000	Av	V	0	1.0	NF						Noise Floor
17230.000	Av	V	0	1.0	NF						Noise Floor
19692.000	Av	V	0	1.0	NF						Noise Floor

QUASI PEAK =120 KHZ
AVERAGE: RES. =1 MHZ, VID= 10HZ; NF = NOISE FLOOR
TEST PERSONNEL:
Typed/Printed Name: Desmond Fraser **Date:** July 29, 1999

3.4 MODULATED BANDWIDTH

The minimum 6 dB bandwidth per FCC 15.247(a)(2) was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 100 kHz. The Minimum 6 dB modulated bandwidths are the following:

Channel	6(dB) Bandwidth (MHz)
1	10.67
6	11.20
11	11.20

The 6dB bandwidth is listed in figures ---,--- and ---.

3.5 POWER OUTPUT

The power output per FCC 15.247(b) was measured on the EUT using an HP peak power meter.

Channel	Power (mW)	EIRP (dBm)	EIRP (mW)
1	58.8	19.84	96.38
6	57.4	19.74	94.19
11	60.2	19.94	98.63

3.6 ANTENNA CONDUCTED SPURIOUS EMISSIONS

Antenna spurious emission per FCC 15.247(c) was measured from the EUT antenna port using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The modulated carrier was identified at 2.411GHz for Channel 1, 2.437GHz for Channel 6 and 2.462GHz for Channel 11. No other harmonics or spurs were found within 20 dB of the carrier level, and from 9kHz to the carriers 10th harmonic. See antenna conducted spurious noise table and plots.
Channels 1, 6, and 11 were investigated and tested, only worst case plot for channel 11 is presented in this report.

Channel = 1	Carrier power = 17.84 dBm	
Frequency (GHz)	**Spurious level (dBm)**	**FCC limit (dBm)**
2.5688	-49.67	-2.2
2.5824	-46.33	-2.2
2.7887	-48.5	-2.2
4.0730	-48.67	-2.2
9.6530	-45.83	-2.2

Channel = 6	Carrier Power = 17.6 dBm	
Frequency (GHz)	**Spurious level (dBm)**	**FCC limit (dBm)**
726.00	-61.3	-2.4
1.7650	-61.7	-2.4
2.6300	-57.00	-2.4
2.8100	-61.00	-2.4
4.1270	-52.67	-2.4
9.7530	-51.17	-2.4

Channel = 11	Carrier Power = 18.3dBm	
Frequency (GHz)	**Spurious level (dBm)**	**FCC limit (dBm)**
2.6800	-63.5	-1.7
2.8330	-51.3	-1.7
4.1730	-50.0	-1.7
4.9200	-62.5	-1.7
7.3870	-59.5	-1.7
9.8530	-51.2	-1.7

3.7 RADIATED SPURIOUS EMISSIONS

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. The restricted bands are listed in Section 15.205. The maximum permitted average field strength for the restricted band is listed in Section 15.209.

3.8 POWER SPECTRAL DENSITY

The Power spectral density per FCC 15.247(d) was measured from the antenna port of the EUT using a 50 ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 3kHz, and the sweep time set at 17 second. The spectral lines were resolved for the modulated carriers at 2.412GHz, 2.437GHz and 2.462GHz respectively. These levels are well below the +8 dBm limit. See power spectral density table and plots.

Channel	Power Spectral Density limit = +8dBm
1	-7.50
6	-7.17
11	-5.83

3.9 COMPLIANCE WITH THE RESTRICTED BAND EDGE

Compliance with the band edges was performed using the FCC's "Radiated Measurement at a Band Edge" guidance document. The final data derived below were from radiated measurements only. The data taken in this report represents the worst case at 11 MBPS. Data rates of 5.5MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance.

Bandedge Measurement						
Antenna	**Channel**	**Delta dB**	**Field Strength Level (dBuV)**	**Corrected level (dBuV)**	**FCC Limit (dBuV)**	**FCC Margin**
Internal	1	-50.7	84.4	33.6	54	-20.4
Internal	11	-48.0	89.6	41.3	54	-12.7

4.0 ANTENNA SPECIFICATIONS

Internal trace antenna

Electrical Specifications:

Model No.	Samsung Internal Antenna
Frequency Range	2.4-2.5GHz
Bandwidth	100MHz
Gain	2.15dBi
V.S.W.R	<1.9
Radiation Pattern	Omni-Directional
Polarization	Horizontal
Impedance	50ohms
Operating Temperature	-30C – 60C

Electrical Specifications:

Dimension	26 ± 2.0mm
Pulling Strength	N/A
Swivel Torque	N/A
Input Connector	Directly etched on PCB board