EMC COMPLIANCE ENGINEERING AND TESTING

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APPLICATION FOR FCC CERTIFICATION

CLASS B TRANSMITTER DEVICE

Microsoft Corporation
1 Microsoft Way
Redmond, WA 98052
425-882-8080

MODEL: Wireless IntelliMouse Explorer and Wireless IntelliMouse Explorer 1.0A

FCC ID: C3KMS7

April 9, 2001

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

REPORT PREPARED BY:
EMI Technician: Elizabeth Szrajer

Rhein Tech Laboratories, Inc.

Document Number: 2001078

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1.0 GENERAL INFORMATION

The following Application for FCC Certification of a Class B transmitter is prepared on behalf of Microsoft Corporation in accordance with Part 2, and Part 15, Subparts A and C of the Federal Communications Commissions rules and regulations. The Equipment Under Test (EUT) was the Wireless IntelliMouse Explorer and Wireless IntelliMouse Explorer 1.0A, FCC ID: C3KMS7. The test results reported in this document relate only to the item that was tested. The item consists of a wireless mouse and a wireless receiver hub.

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 conform with the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instruments. 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 emission measurements were performed manually at Rhein Tech Laboratories, Inc. The radiated emission measurements required by the rules were performed on the 3/10-meter open field test ranges 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. The FCC accepts Rhein Tech Laboratories as a facility available to do measurement work for others on a contract basis.

1.1 RELATED SUBMITTAL(S)/GRANT(S)/DOC(S)

This is an original submission for Certification. A class B DOC report is on file for the Cordless Wheel Receiver as a digital interface device. A copy of the cordless wheel receiver class B DoC label is included in the report. The device operating frequency as a receiver falls below 30 MHz; therefore it is exempted from FCC technical requirement (15.101 b) but must adhere to the General Conditions of Operations section 15.5 of the FCC rules and regulations.

1.2 PRODUCT DESCRIPTION

Microsoft Wireless IntelliMouse Explorer: Expository Statement

Grantee: Microsoft Corporation
FCC ID: **C3KMS7**
Model: Microsoft Wireless IntelliMouse® Explorer™

The Microsoft Wireless IntelliMouse® Explorer™ is a computer input device typically used for both cursor positioning on the computer's video display screen and also for scrolling through and magnification of application documents

When a user moves the mouse enclosure on a flat surface, the circuitry within the mouse detects this motion and translates it into a form usable by the host computer to move the cursor. When the user moves the wheel on the top of the device, the circuitry within the mouse detects this motion and translates it into a form usable by the host computer to scroll through and magnify application documents. Additionally, the mouse contains five push button switches, which can be actuated at the user's discretion to generate an asynchronous event, typically used to alter the program's control flow in the host computer.

1.3 TEST SYSTEM DETAILS

Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test.

TABLE 1: TEST SYSTEM DETAILS

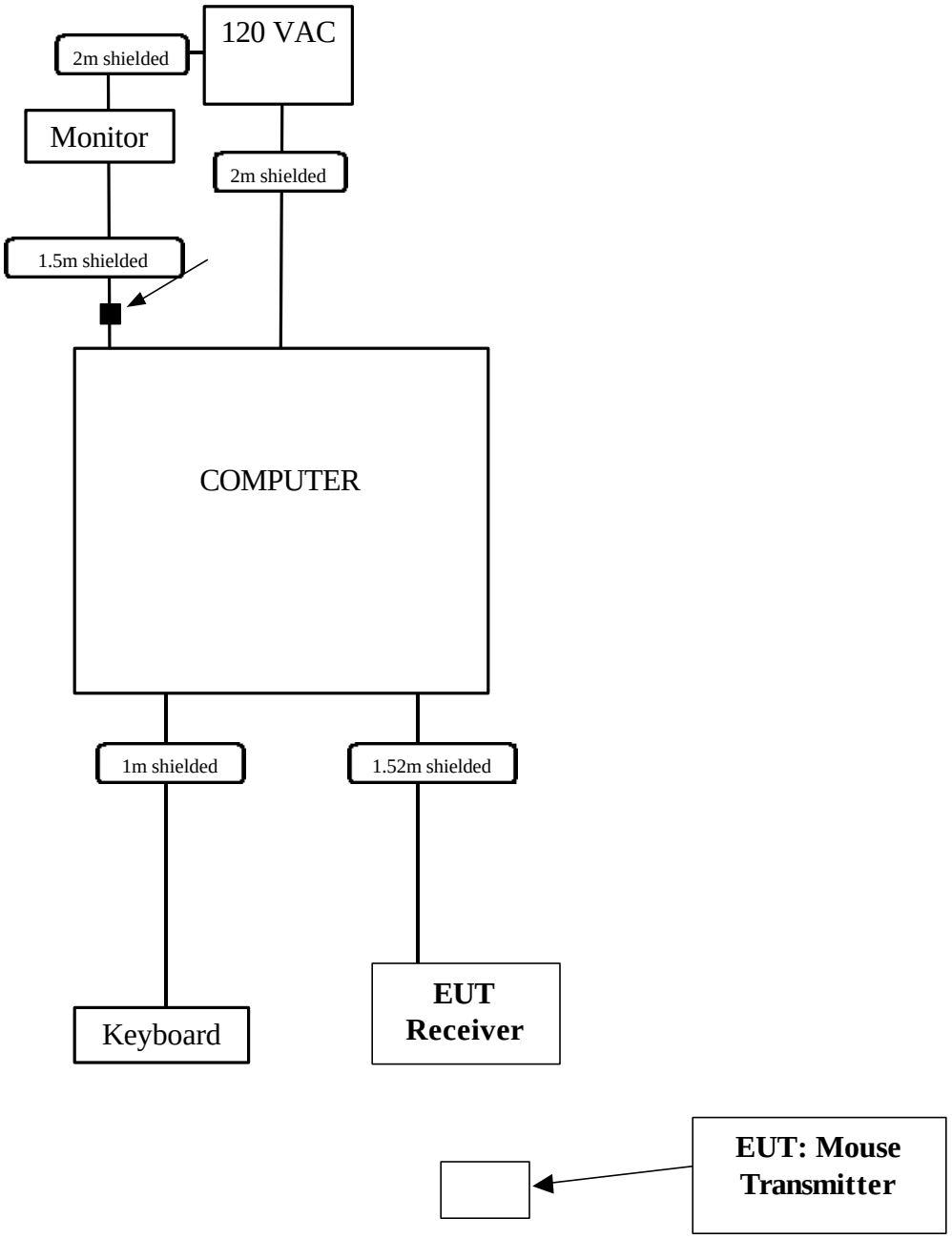
EXTERNAL COMPONENTS

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
RECEIVER (EUT)	**MICROSOFT CORPORATION**	**CYLON RECEIVER**	**1718-A**	**SAMPLE**	**1.52M SHIELDED WITH FERRITE ON CONNECTOR END OF I/O**	**013193**
MOUSE (EUT)	**MICROSOFT CORPORATION**	**CYLON**	**1718-A**	**SAMPLE**	**WIRELESS**	**013189**
KEYBOARD	MICROSOFT CORPORATION	E06401C0MB	71305-584-7628174-39319	DOC	2 METER WITH FERRITE AT COMPUTER I/O	012091
PRINTER	HEWLETT PACKARD	C3990A	JPHR043528	DOC	SHIELDED I/O SHIELDED POWER	009906
MONITOR	DELL	ULTRASCAN P991	8164561	DOC	SHIELDED W/FERRITE @ COMPUTER END I/O UNSHIELDED POWER	012292
SYSTEM	DELL	XPS-B800R	E1UQO	N/A		012061

INTERNAL COMPONENTS

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
MEMORY	SAMSUNG	128MB / 8ECC	KMMR18R88AC1-RK7	N/A	N/A	012066
MEMORY	DELL	MEMORY TERMINATION	14264	N/A	N/A	012067
NETWORK CARD	3COM	00036EPC REV AOC	6VQ1CFF1CA	DOC	UNSHIELDED I/O	012070
CPU	INTEL CORPORATION	800MHz P3	90010338-0356	N/A	N/A	012065
MOTHERBOARD	DELL	AA-734629-403	00022TGE-12464-9CU-007Q	N/A	INTERNAL I/O INTERNAL POWER	012068
SOUND CARD	TURTLE BEACH	TB400-3356-01	28881-9C2-81C5	DOC	N/A	012071
VIDEO CARD	DELL	44571-9CR-2172	0000040U REV A00	DOC	N/A	012069
CD-ROM DRIVE	LITE-ON	LTN-4835	7819500341	DOC	INTERNAL I/O INTERNAL POWER	012063
POWER SUPPLY	DELL	17972-9BR-JKUL	0009228C REV N02	N/A	UNSHIELDED POWER	012062
HARD DRIVE	IBM	DPTA-372730 (27.3GB)	A14111	N/A	INTERNAL I/O INTERNAL POWER	012072
FLOPPY DRIVE	NEC AMERICA	134-506790-286-3	D9HM9BAI1287	N/A	INTERNAL I/O INTERNAL POWER	012064

1.4 CONFIGURATION OF TESTED SYSTEM)



1.5 TEST METHODOLOGY

Radiated testing was performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of one and three meters. The one-meter test distance was used when there were strong ambient signals or extremely low spurious emissions that inhibited measuring at three meters per FCC 15.31 *f* (2). The EUT was tested from 9 KHz to the 10th harmonic of channel 1 at 27.045 MHz and channel 2 at 27.145 MHz as well as up to 1000 MHz since the EUT contains an 8 MHz microcontroller. Section 3.1 contains other clocks and oscillators measured. FCC 15.227 average limit was used to determine the transmitter carrier amplitude. FCC 15.31 *f* (2) the square of an inverse linear distance extrapolation factor was used to extrapolate the new limit whenever a EUT to antenna distance other than the given FCC test distance for frequencies below 30 MHz per FCC 15.209 general radiation emission limit. Conducted emission testing was not performed on the host computer power line since the EUT does not have a power supply. The USB port provides the EUT's DC power.

1.6 TEST FACILITY

The open area test sites and conducted measurement facility used to collect the radiated data is located on the rear lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400 in Herndon, Virginia. Our open area test sites 1 and 2 are approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

2.0 PRODUCT LABELING

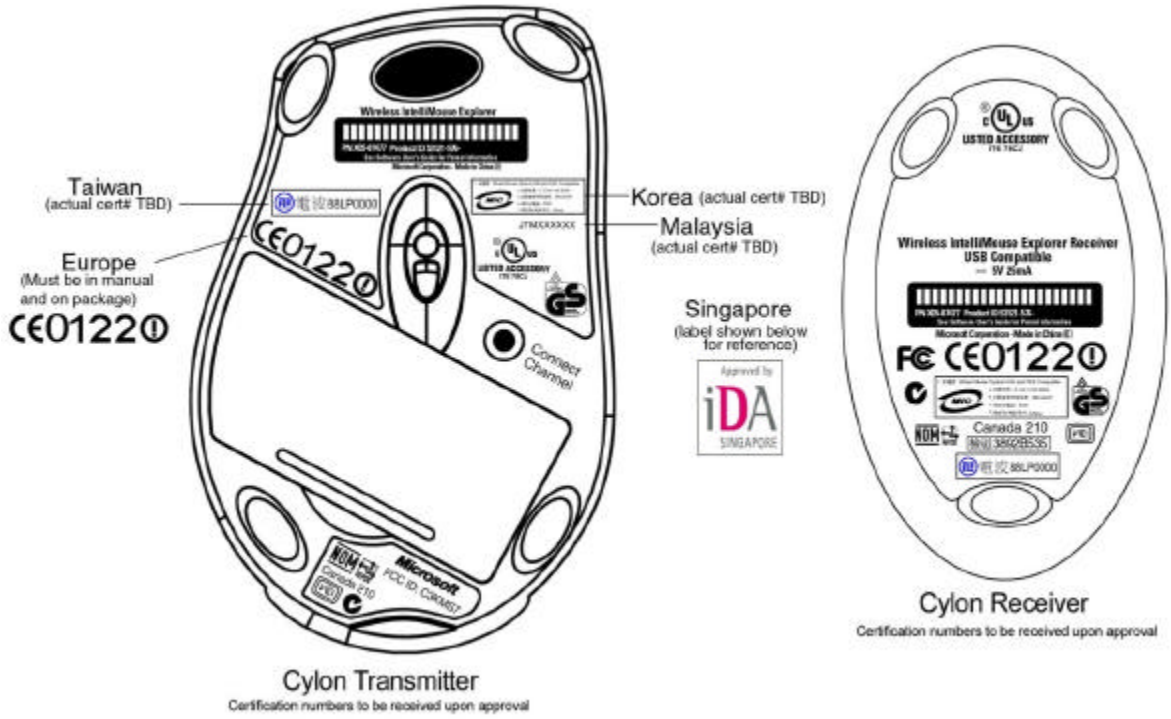
FIGURE 1: FCC LABEL STATEMENT IN MICROSOFT MANUAL PAGE 3

Microsoft Corporation does not have sufficient space on the product; so Microsoft Corporation places the statement below in their users manual, see Appendix F.

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

FIGURE 2: LOCATION AND LABEL SAMPLE ON EUT

Back of Mouse and Receiver



3.0 SYSTEM TEST CONFIGURATION

3.1 JUSTIFICATION

Conducted emissions measurements are not applicable since the EUT is battery operated and does not have a power supply for AC power. The EUT was also tested in two orthogonal planes, namely vertical and horizontal. The following local oscillators, crystals and IF were investigated and measured:

1 Transmitter channel 1 = 27.045 MHz,
2 Transmitter channel 2 = 27.145 MHz,
3 Transmitter channel 1 LO = 13.5225 MHz,
4 Transmitter channel 2 LO = 13.5725 MHz
5 Transmitter microcontoller oscillator = 8 MHz
6 Imaging IC (Expedition) oscillator = 20 MHz
7 Receiver channel 1 LO = 26.59 MHz
8 Receiver channel 2 LO= 26.69 MHz
9 Receiver microcontroller 6 MHz
10 Receiver IF = 455 KHz

An active loop antenna was used to measure emissions below 30 MHz.

3.2 EUT EXERCISE SOFTWARE

The EUT was installed as a USB peripheral device using Microsoft Windows device drivers. The EUT's firmware was modified so that the carrier was always on. An exercise program was also used to exercise other peripherals of the system configuration during radiated and conducted testing in a manner similar to typical use. The software, contained on the hard disk drive, sequentially exercises each system component as follows:

1) An H prints on the monitor
2) An H prints on the printer
3) A file is read from the floppy diskette
4) A file is read from the hard drive and any other hard drive present
5) A file is read from the CD-ROM drive.

Additionally, a looped batch program was initiated to render a continuous flow of data through the USB ports. No data from the keyboard was transmitted to the PC during testing, as it is strictly an input device. However, it was continuously scanned for data input activity.

Worst-case emissions are recorded in the data tables for channel 1 and channel 2.

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3.3 SPECIAL ACCESSORIES

N/A

3.4 CERTIFICATION 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.

Signature:  Date: April 9, 2001

Typed/Printed Name: Desmond A. Fraser Position: President (NVLAP Signatory)

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.

5.0 RADIATED EMISSION DATA

The following data lists the worst-case 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 6.1.

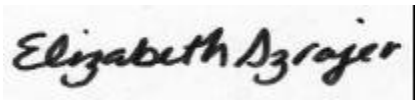
TABLE 2: RADIATED EMISSIONS; CHANNEL 1 - TRANSMITTER

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.523	Qp	V	90	1.0	38.6	-15.0	23.6	69.5	-45.9
27.045	Av	H	305	1.0	56.3	-14.3	42.0	80.0	-38.0
27.045	Pk	H	305	1.0	59.4	-14.3	45.1	80.0	-34.9
40.570	Qp	H	295	2.0	40.0	-11.6	28.4	40.0	-11.6
54.096	Qp	H	210	2.0	37.4	-17.2	20.2	40.0	-19.8
67.614	Qp	H	290	1.9	29.9	-18.0	11.9	40.0	-28.1
81.137	Qp	H	245	1.8	35.1	-16.6	18.5	40.0	-21.5
108.182	Qp	H	245	1.9	30.3	-11.5	18.8	43.5	-24.7
121.704	Qp	H	195	1.7	26.4	-10.6	15.8	43.5	-27.7
135.227	Qp	H	315	1.6	25.9	-10.6	15.3	43.5	-28.2
162.272	Qp	H	0	1.5	26.1	-11.7	14.4	43.5	-29.1
189.328	Qp	H	310	1.4	25.2	-12.1	13.1	43.5	-30.4
216.374	Qp	H	275	1.4	26.8	-11.0	15.8	46.0	-30.2
243.421	Qp	H	300	1.5	26.4	-8.6	17.8	46.0	-28.2
270.468	Qp	H	180	1.3	25.2	-6.7	18.5	46.0	-27.5

Peak RBW = 100kHz ; VBW = 100kHz
Avg RBW = 1MHz ; VBW = 10Hz

See Appendix D for Radiated Test Methodology.
Note: A Loop antenna was used for measurements below 30 MHz.

TEST PERSONNEL:

Signature: 

Date: March 28, 2001

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TABLE 3: RADIATED EMISSIONS; CHANNEL 2 - TRANSMITTER

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.573	Qp	V	180	1.0	37.0	-15.0	22.0	69.5	-47.5
27.145	Av	H	320	1.0	56.2	-14.3	41.9	80.0	-38.1
27.145	Pk	H	315	1.0	58.6	-14.3	44.3	80.0	-35.7
40.721	Qp	H	320	2.0	39.7	-11.7	28.0	40.0	-12.0
54.294	Qp	H	270	2.0	38.7	-17.2	21.5	40.0	-18.5
67.862	Qp	H	90	2.6	29.1	-18.0	11.1	40.0	-28.9
81.435	Qp	H	310	1.8	34.7	-16.5	18.2	40.0	-21.8
95.008	Qp	H	225	2.0	26.4	-14.0	12.4	43.5	-31.1
108.591	Qp	H	295	1.7	30.6	-11.4	19.2	43.5	-24.3
122.152	Qp	H	195	2.0	25.6	-10.6	15.0	43.5	-28.5
135.736	Qp	H	350	1.4	25.4	-10.6	14.8	43.5	-28.7
162.881	Qp	H	10	1.4	25.8	-11.7	14.1	43.5	-29.4
190.026	Qp	H	270	1.3	25.4	-12.1	13.3	43.5	-30.2
217.171	Qp	H	355	1.3	25.6	-11.0	14.6	46.0	-31.4
244.316	Qp	H	275	1.3	25.5	-8.5	17.0	46.0	-29.0
271.461	Qp	H	325	1.3	24.4	-6.7	17.7	46.0	-28.3

Peak RBW = 100kHz ; VBW = 100kHz
Avg RBW = 1MHz ; VBW = 10Hz

See Appendix D for Radiated Test Methodology.
Note: A Loop antenna was used for measurements below 30 MHz.

TEST PERSONNEL:

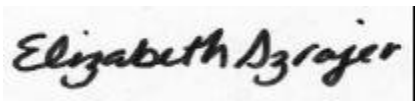
Signature: 

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TABLE 4: RADIATED EMISSIONS; CHANNEL 1 - RECEIVER

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
26.590	Qp	V	210	1.0	38.6	-14.4	24.2	69.5	-45.3
53.180	Qp	H	295	2.0	26.5	-16.9	9.6	40.0	-30.4
79.770	Qp	H	310	2.0	28.1	-16.7	11.4	40.0	-28.6
106.360	Qp	H	255	1.9	25.7	-11.8	13.9	43.5	-29.6
132.950	Qp	H	315	1.8	26.9	-10.6	16.3	43.5	-27.2
159.540	Qp	H	95	1.7	25.2	-11.6	13.6	43.5	-29.9
186.130	Qp	H	180	1.5	27.0	-12.2	14.8	43.5	-28.7
212.720	Qp	H	210	1.5	26.4	-10.9	15.5	43.5	-28.0
239.310	Qp	H	245	1.3	25.7	-9.1	16.6	46.0	-29.4
265.900	Qp	H	300	1.2	26.3	-6.4	19.9	46.0	-26.1

Peak RBW = 100kHz ; VBW = 100kHz
Avg RBW = 1MHz ; VBW = 10Hz

See Appendix D for Radiated Test Methodology.
Note: A Loop antenna was used for measurements below 30 MHz.

TEST PERSONNEL:

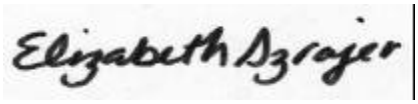
Signature: 

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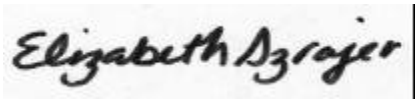
TABLE 5: RADIATED EMISSIONS; CHANNEL 2 - RECEIVER

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
26.690	Qp	V	215	1.0	38.8	-14.4	24.4	69.5	-45.1
53.380	Qp	H	145	2.4	27.3	-17.0	10.3	40.0	-29.7
80.070	Qp	H	195	2.0	27.8	-16.7	11.1	40.0	-28.9
133.450	Qp	H	45	2.0	24.0	-10.6	13.4	43.5	-30.1
160.140	Qp	H	90	2.0	24.3	-11.6	12.7	43.5	-30.8
186.830	Qp	H	100	1.9	26.3	-12.2	14.1	43.5	-29.4
213.520	Qp	H	165	1.7	25.7	-10.9	14.8	43.5	-28.7
240.210	Qp	H	90	1.5	26.1	-9.0	17.1	46.0	-28.9
266.900	Qp	H	0	1.5	24.1	-6.5	17.6	46.0	-28.4

Peak RBW = 100kHz ; VBW = 100kHz
Avg RBW = 1MHz ; VBW = 10Hz

See Appendix D for Radiated Test Methodology.
Note: A Loop antenna was used for measurements below 30 MHz.

TEST PERSONNEL:

Signature: 

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5.1 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 = 37.8 dBuV/m

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

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6.0 20dB BANDWIDTH DATA

TABLE 6: 20dB Bandwidth CHANNEL 1

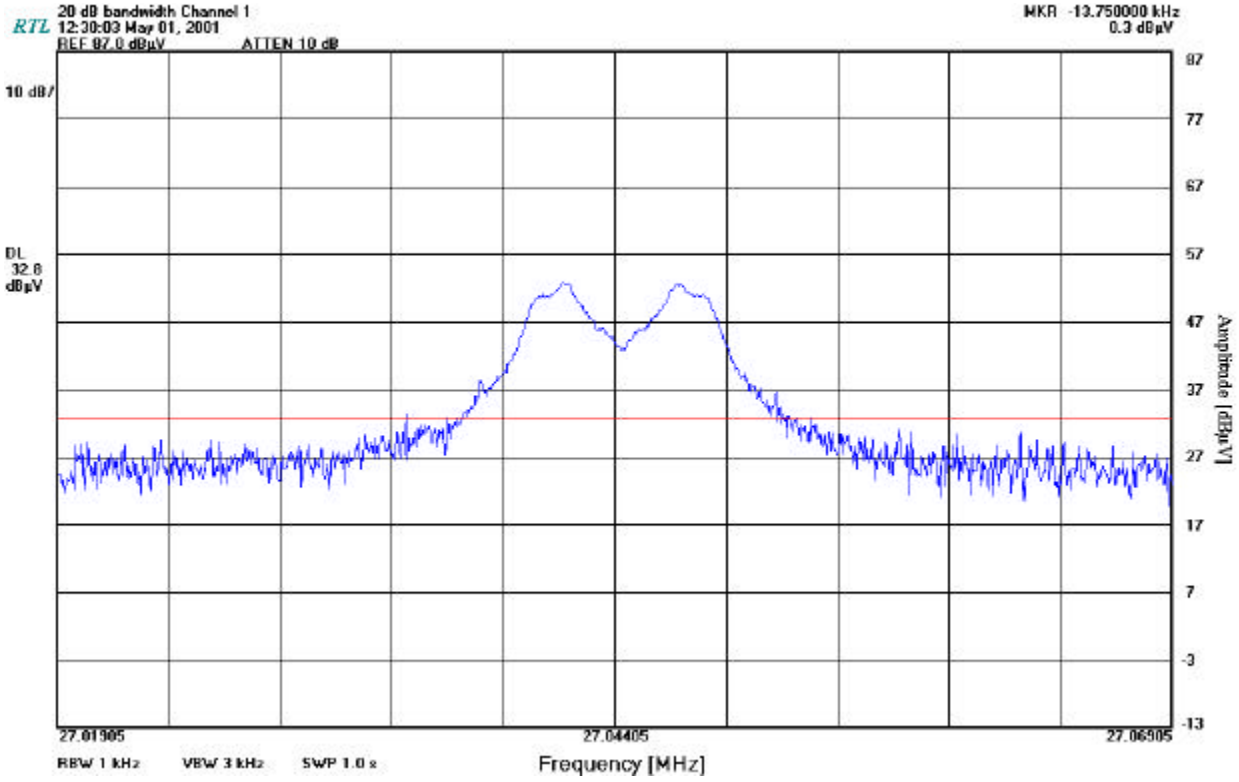
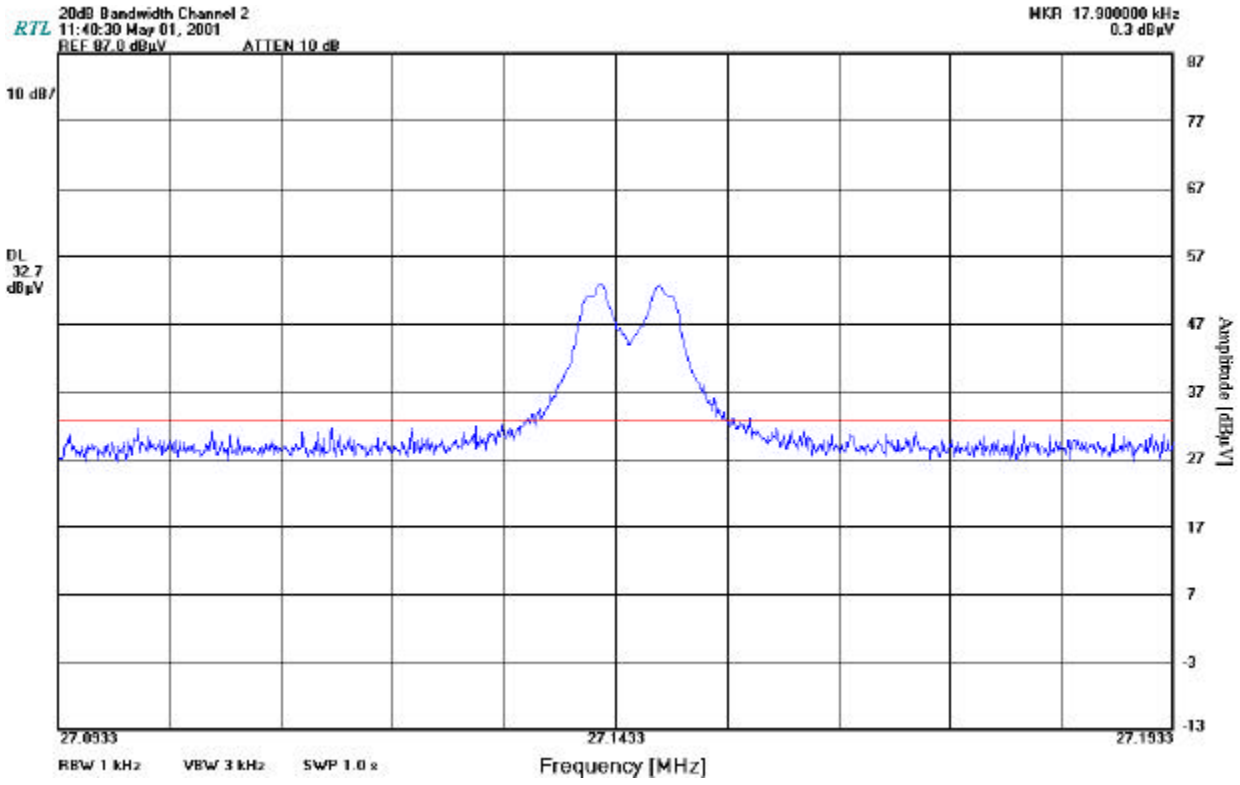


TABLE 7: 20dB Bandwidth CHANNEL 2



7.0 BAND EDGE DATA

TABLE 8: Lower Band Edge CHANNEL 1

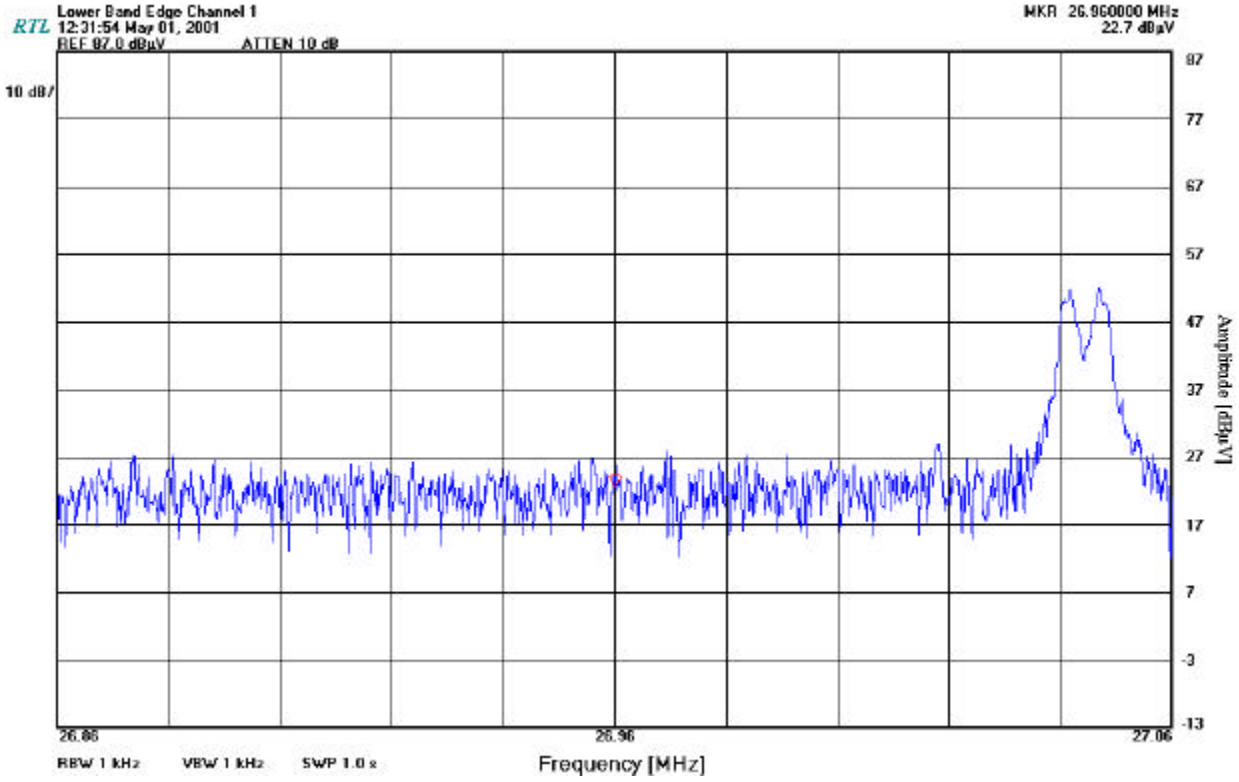
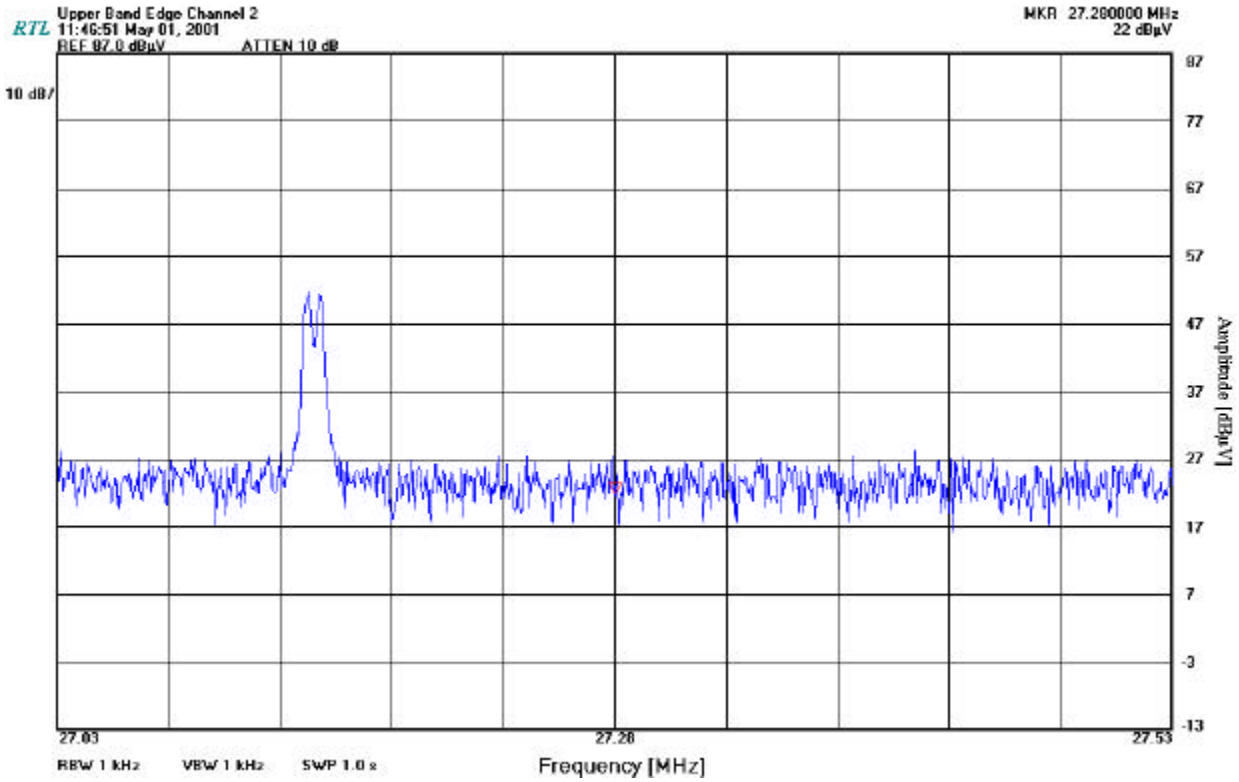


TABLE 9: Upper Band Edge CHANNEL 2



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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
MONOPOLE ANTENNA	EMCO	3301B	9809-4071	LIBERTY LABS
LOOP ANTENNA	RHODE&SCHWARZ	HFH 2 - Z 2	827525 / 019	LIBERTY LABS
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	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

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APPENDIX D:

Conducted and Radiated Test Methodology

Conducted and Radiated Test Methodology

CONDUCTED EMISSIONS MEASUREMENTS

Note: The conducted emissions measurements are not applicable since the device is battery operated.

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-meter distance. 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 at one-meter distance 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 open-field test site at an antenna to EUT distance of 3 meter for emissions between 30 MHz and 1000 MHz. Since the EUT transmits at Channel 1 = 27.045 MHz and Channel 2 = 27.145 MHz an active loop antenna was used to measure the carrier frequency and all other emissions between 9kHz and 30 MHz per ANSI 63.4. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to 1000 MHz. All other spurious noise with in and outside the restricted band was investigated. The square of inverse linear distance was used to extrapolate the new limit since the limit per FCC 15.209 is given at 30 meters.

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 200 Hz for frequencies between 10 kHz and 150 kHz, 9 kHz for frequencies between 150 kHz and 30 MHz, and 120 kHz for frequencies between 30 MHz and 1000 MHz. No video filter less than 10 times the resolution bandwidth was used. When any clock exceeds 108 MHz, the EUT was tested between 1 to 2 Gigahertz in peak mode with the resolution bandwidth set at 1 MHz as stated in ANSI C63.4. 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 well as daily calibration methods, technician training, and emphasis to employees on avoiding error.

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APPENDIX E

User's Manual