

**CERTIFICATE OF COMPLIANCE**  
**APPLICABLE SPECIFICATION:**  
**47 CFR PART 2, SUBPART J, PARAGRAPH 2.906**  
**FEDERAL COMMUNICATIONS COMMISSION**  
**Declaration of Conformity Equipment Authorization**  
**Part 15, Subpart B – Unintentional Radiators**  
**Paragraph 15.101(a) DoC of Class B Personal Computer Peripheral**  
**Report Number: 2326-1**  
**Date of Report: 8 October 2004**

I hereby certify that the measurements shown on this report were made in accordance with the procedures of American National Standards Institute (ANSI) Specification C63.4-1992. The voltages conducted along its power leads and electric fields radiated by the equipment listed below meets the Commissions Limits for a Class B Personal Computer Peripheral. Tests were performed on 8 September 2004.

**Company:** Socket Communications  
**Street Address:** 37400 Central Court  
**City, State & ZIP:** Newark, CA 94560  
**Equipment under Test:** Cordless GPS  
**Model Number:** BT-GPS Rev. 2  
**Serial Number:** EMI Unit

EMCE Engineering, Inc. has been placed on the Federal Communications Commission's list of recognized facilities for Parts 15 and 18 DoC approvals. Per the request of EMCE Engineering, Inc., the facility has been added to the list of those who perform Measurement Services for the public on a fee basis. This list is published periodically and is also available on the FCC World Wide Web. Additionally, EMCE Engineering, Inc. has been approved by the National Institute for Standards and Technology under the NVLAP program.

EMCE Engineering, Inc., assumes no responsibility for the continuing validity of test data when the Equipment under Test is not under the continuous physical control of EMCE. The signature below attests to the fact that all measurements reported herein were performed by myself or were made under my supervision, and are correct to the best of my knowledge and belief as of the date specified. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Tests were conducted by qualified EMCE Engineering, Inc. personnel utilizing test equipment maintained in a "current" state of calibration with traceability to NIST.

Note

- This report or certificate does not represent endorsement by NVLAP or any agency of the US Government.
- This report or certificate shall not be reproduced except in full without the written approval of the issuer.

Certified by:  
EMCE Engineering, Inc.



Bob Cole  
President

# **ELECTROMAGNETIC INTERFERENCE**

# **TEST REPORT**

**Report Number: 2326-1**  
**Report Date: 25 September 2004**  
**Applicable Specification:**

**47 CFR Part 15, Subpart B, DoC of a Class B Personal Computer Peripheral**

**Equipment under Test: Cordless GPS**  
**Model Number: BT-GPS Rev. 2**  
**Serial Number: EMI Unit**

**Prepared for: Socket Communications**  
**37400 Central Court**  
**Newark, CA 94560**

**Tested by: Scott Parr**

**Prepared by: Bob Cole**  
**EMCE Engineering, Inc.**  
**44366 S. Grimmer Blvd.**  
**Fremont, CA 94538**  
**Phone: 510-490-4307**  
**Fax: 510-490-3441**

Note:

- This report or certificate does not represent endorsement by NVLAP or any agency of the US Government.
- This report or certificate shall not be reproduced except in full without the written approval of the issuer.

## TABLE OF CONTENTS

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
<b>1.0</b>	<b>SCOPE</b>	5
1.1	Objective	5
1.2	Description of EUT	5
1.3	Results/Modifications	5
1.4	Test Limits	5
<b>2.0</b>	<b>APPLICABLE DOCUMENTS</b>	6
2.1	FCC Document	6
2.2	Other Documents	6
<b>3.0</b>	<b>GENERAL SETUP AND TEST CONDITIONS</b>	7
3.1	Test Facility	7
3.2	Description of Open- Field Test Site	7
3.3	Site Attenuation	7
3.4	Ground Plane (Ground Screen)	7
3.5	Input Power for EUT	9
3.6	Accessory Equipment Precautions	9
3.7	Ambient Interference	9
3.8	Personnel	9
3.9	Use of Interference Measuring Equipment	10
3.10	Calibration of Measuring Equipment	10
<b>4.0</b>	<b>PREPARATION OF EUT FOR TEST</b>	11
4.1	Identification of EUT	11
4.2	Setup of EUT	11
4.3	Peripherals Connected	11
<b>5.0</b>	<b>DETAILED MEASUREMENTS</b>	12
5.1	Conducted Emissions, Power Leads, 450kHz to 30MHz	12
5.1.1	Test Results	12
5.1.2	Test Instrumentation	13
5.1.3	Recommendations	13
5.2	Radiated Emissions Test, 30MHz to 1000MHz	14
5.2.1	Vertical Polarization Measurements	15
5.2.2	Horizontal Polarization Measurements	15
5.2.3	Test Results	15
5.2.4	Test Instrumentation	15
5.2.5	Recommendations	16

## **LIST OF FIGURES**

<b><u>Figure</u></b>	<b><u>Title</u></b>	<b><u>Page</u></b>
1	EMCE Test Site Layout	7

## **LIST OF APPENDICES**

<b><u>Appendix</u></b>	<b><u>Title</u></b>	<b><u>Page</u></b>
A	EMI Measurement With the Automatic Spectrum Analyzer	16
B	EMCE NVLAP Accreditation Certificates	24
C	Test Data Sheets	28
D	Photographs of Test Setup Photographs of EUT	32
E	FCC Labeling and User Information	37
F	Measurement Equipment Error Analysis	40

## 1.0 SCOPE

This test report describes the equipment setup, test methods employed and results obtained during electromagnetic interference (EMI) testing of a Class B Personal Computer peripheral as defined in Part 15, Subpart A, paragraph 15.3 (r). The tests described herein measured the RF radiated (RFI Field Strength) and power line conducted (RFI Noise Voltage) emissions of the equipment under test (EUT) as installed in a typical "Host" Personal Computer. The tests conformed to the measurement and test site requirements of ANSI C63.4-1992.

### 1.1 Objective

The tests described herein were performed to establish that the EUT is capable of compliance with the requirements of Part 15, Subpart B, paragraph 15.101 for Unintentional Radiators (a Class B Personal Computer Peripheral).

### 1.2 Description of EUT

The EUT is a **Cordless GPS** Model Number: **BT-GPS Rev. 2** Serial Number: **EMI Unit**, manufactured by Socket Communications. The EUT contained the following options: No Options.

### 1.3 Results/Modifications

The EUT passed FCC Class B conducted and radiated emissions tests. No modification was necessary. The manufacturer may declare the EUT as complying with the FCC requirements. FCC labeling and user information is found in Appendix F herein.

*Since the Radio Module PCB remained completely unchanged, the Intentional Radiator parameters Peak Power Output, 20 dB Bandwidth, CF Separation, Number of Hopping Frequencies, Band-Edge Compliance, as well as Spurious Radiated emissions were rechecked and found to be unchanged from the original data found in the 15.247 report filed in the original application for a Grant of Certification for FCC ID: LUBGPS-1.*

### 1.4 Test Limits

FCC Class B conduction and radiation limits are as follows:

<b><u>Conducted Emission Limits (Quasi-peak)</u></b>		<b><u>Radiated Emission Limits @3-meters</u></b>	
0.450 – 30 MHz	48 dBuV	30 – 88 MHz	40.0 dBuV/m
		88 – 216 MHz	43.5 dBuV/m
		216 – 960 MHz	46.0 dBuV/m
		960 – 1000 MHz	54.0 dBuV/m

**Note:** *In accordance with paragraph 15.107(e) and 15.109(g), CISPR 22 Class B limits are acceptable as an alternate to FCC Class B limits for conducted and radiated emissions.*

## **2.0 APPLICABLE DOCUMENTS**

### **2.1 FCC Documents**

<b><u>Document</u></b>	<b><u>Title</u></b>
Title 47 CFR	TELECOMMUNICATION
Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations.
Part 15	Radio Frequency Devices.

### **2.2 Other Documents**

ANSI C63.4-1992	American National Standards for Methods of Measurement of Radio-Noise Emissions From Low-Voltage Electrical and Electronic Equipment In the Range of 9kHz to 40GHz.
ANSI C63.5-1988	American National Standards for Calibration of Antennas Used for Radiated Emissions Measurement.
CISPR 22: 1997	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement. By the International Electrotechnical Commission (IEC).

### **3.0 GENERAL SETUP AND TEST CONDITIONS**

#### **3.1 Test Facility**

The tests described herein were performed at:

EMCE Engineering, Inc.  
44366 S. Grimmer Blvd.  
Fremont, CA 94538

This laboratory has one electromagnetic shielded enclosure and a 3-meter and 10-meter Open Area Test Site (OATS). The shielded room is available for preliminary determination of radiated emission frequencies and formal conducted emission measurements, or for other investigative work. A computer controlled spectrum analyzer with quasi-peak adapter, plotter and printer were used for gathering and recording test data. Figure 1 shows the test site layout for conducted and radiated measurements.

#### **3.2 Description of Open Area Test Site (OATS)**

The 3 and 10 meter site is located out-of-doors in an open field whose size is 212 feet long by 206 feet wide. The dimensions of the test area are 66 feet wide by 59 feet long (20m x 18m). The description of the 3 and 10-meter site is on file with the FCC according to the requirements of Part 2.948.

#### **3.3 Site Attenuation**

The site attenuation for radiated measurements has been determined for this test site using the method described in ANSI C63.4 Paragraph 5.4.6 and sub paragraphs. The site attenuation is measured annually. Site attenuation was last measured and reported to the FCC on 7 June 1999.

#### **3.4 Ground Plane (Ground Screen)**

The site has a 3900 square foot (20m x 18m) floor area of poured reinforced concrete, 6 to 8 inches thick. A 20m x 18m (66ft x 59ft) solid 24 gauge galvanized sheet steel ground plane is centered on the test area with its long dimension along the major axis of the test site. The antenna mast and turntable are located 3 meters apart on the centerline of the major axis so that each is greater than 3 meters from the edges of the ground plane. The ground plane is connected to a nine-foot long earth ground rod at each corner of the ground plane.





### **3.5 Input Power for EUT**

Electricity for the EUT is provided through buried power lines in metallic conduit with an outlet box placed near the EUT. Power for the EUT is taken from the outlet box of either of two “shielded enclosure” quality power line filters located on the ground plane near the EUT. The filters are electrically bonded to the ground plane.

### **3.6 Accessory Equipment Precautions**

Care was taken that accessory equipment or adjacent equipment did not produce unacceptable interference so as to contaminate the final test data. The EMI receiver and its associated computer, printer and plotter were located greater than 15 meters away from the EUT during testing and were powered from a separately filtered power source.

### **3.7 Ambient Interference**

Ambient interference from radio and television stations, vehicles, mobile radio, etc. was present at the open test site during testing. Care was taken to assure that ambient interference did not overload the measurement receiver or mask emissions from the EUT. The method of measurement used to deal with ambient noise during radiated emission testing is described in Paragraph 5.2.1.

### **3.8 Personnel**

All testing was performed by EMCE Engineering personnel who are properly trained for the instruments and procedures used. The test data sheets have been signed-off by the attending EMCE Test Engineer.

### **3.9 Use of Interference Measurement Equipment**

All of the emission measurements and field strength measurements were performed with a Hewlett-Packard 8568B Spectrum Analyzer System. The Spectrum Analyzer System utilizes the following basic instruments:

1. HP-9836 Desktop Computer/Controller
2. HP-2673A Printer
3. HP-7475A Plotter
4. HP-85650A Quasi Peak Adapter

Details of the operation of these instruments are given in Appendix A (EMI Measurement with the Automatic Spectrum Analyzer). Specific details are given in the separate sections of emission testing.

Test results are recorded on tabular data sheets and show final corrected values compared to the specification limit. Sample calculations show how the antenna factors, cable losses, amplifier gain, etc. are combined in the automatic analyzer program to produce the final corrected values shown on the graphs and data sheets.

### **3.10 Calibration of Measuring Equipment**

The EMI Receiver (spectrum analyzer) is calibrated by an outside calibration laboratory on a 12-month basis. The laboratory provides certification with traceability to NIST. Antenna factors are measured at 1-year interval by EMCE Engineering using the reference antenna method of ANSI C63.5-1988. Cable losses as well as amplifier gains are swept at least every month to verify accurate values.

## **4.0 PREPARATION OF EUT FOR TEST**

### **4.1 Identification of EUT**

Equipment under Test: **Cordless GPS**  
Model Number: **BT-GPS Rev. 2**  
Serial Number: **EMI Unit**

### **4.2 Setup of EUT**

Power to EUT: **through Host PC**  
Grounding of EUT: **through host PC**  
Special Software: **None**

### **4.2 Interfaces & Cabling**

The following cables were connected during test:

<u>Interface</u>	<u>Source</u> <u>Port</u>	<u>Load</u> <u>Port</u>	<u>Length</u> <u>Cable</u>	<u>Conductors</u> <u>Number</u>	<u>Cable</u> <u>Type</u>	<u>Connector</u> <u>Material</u>
Host	N/A	EUT	1m	6	Shld	Metal

### **4.3 Peripherals**

The following peripherals were attached and operating during the tests:

<u>Nomenclature</u>	<u>Mfgr &amp; Model</u>	<u>Serial No</u>
Host PC	HP iPAQ Pocket PC 2003 PR	N/A

## **5.0 TEST PROCEDURES**

### **5.1 Conducted Emissions, Power Leads, 450 kHz to 30 MHz**

Conducted emissions were measured from 450kHz to 30MHz on the power and return leads of the EUT according to the methods defined in ANSI C63.4, Section 7.0. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane and removed from the vertical ground plane by 40-cm as shown in Appendix D, Photographs of Test Setup. The interface cables and equipment positioning were varied within limits of reasonable application per Figure 9A of ANSI C63.4 to determine the position producing maximum conducted emissions.

The LISN and high pass filter were connected through 20 feet of RG-214 coaxial cable to the spectrum analyzer input. The switch on the LISN was set to the Supply Line position and the power was applied. The EUT was operated as described in Paragraph 4.0 in a mode, which was intended to produce maximum emissions for normal operation. The EUT power cord was folded so as not to exceed 80cm in length per C63.4 Paragraph 7.2. The test computer (HP-9836) was commanded to start the data collection process as described in Appendix A.

Correction factors for high pass filter losses are programmed and are taken into consideration. A data tabulation and graphical plot were produced by the system at the conclusion of the test scan. These are included with the data sheets contained in Appendix D. The Class B Limit of Part 15: 107 (a) is listed on the data sheets and plotted on the charts.

The switch in the LISN was then set to the Return Line position and the interference scan was repeated and an additional set of data sheets and plot charts were prepared for the return lead.

#### **5.1.1 Test Results**

The EUT passed Class B limits conducted emissions test for both power leads.

### 5.1.2 Test Instrumentation

The following equipments were used for conducted emissions test.

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal. Due Date</u>
Controller/Computer	Hewlett-Packard	9836	N/A
Spectrum Analyzer	Hewlett-Packard	8568B	12/12/04
Quasi-Peak Adapter	Hewlett-Packard	85650A	12/12/04
LISN	EMCO	3816/2	12/12/04
High pass filter	Solar	76205-0.35	N/A
Plotter	Hewlett-Packard	7475A	N/A
Printer	Hewlett-Packard	2673A	N/A

### 5.1.3 Recommendations

Due to the fact that there were no test failures, there are no recommendations.

## **5.2 Radiated Emissions Test, 30 MHz to 1000 MHz**

Radiated emissions were measured from 30 MHz to 1000 MHz. The measurement bandwidth was 120 kHz according to the methods defined in ANSI C63.4 Section 8.0. The EUT was placed on a nonmetallic stand in the open-field site, 0.8 meters above the ground plane, as shown in Appendix D, Photographs of Test Setup.

The EUT was operated as described in Paragraph 4.0, in a mode, which was intended to produce maximum emissions. Preliminary scans of the frequency range were used to determine the cable configurations and equipment positions which produce maximum emissions. These configurations were then kept intact while both angle of rotation of the EUT with respect to the antenna and antenna height were scanned for maximum readings. The angles and antenna polarization are shown on the data sheets in Appendix C.

### **5.2.1 Vertical Polarization Measurements**

Radiated emission measurements were started with the antenna in a vertical orientation at 1.5 meter in height and 1.0 meters from the EUT and with the front of the EUT facing the antenna. The measurement antenna was connected to the preamplifier and spectrum analyzer through 75 feet of RG-214 coaxial cable.

The automatic spectrum analyzer scanning procedure used for radiated measurements is a two-pass process, described in detail in Appendix A. Readings were made at this point using Signal-Sampling techniques. The first pass accumulates and stores both EUT and background ambient emissions received by the measurement antenna for 1000 samples per frequency segment. The second pass was performed with the EUT turned off, thus accumulating only background ambient emissions for 1000 samples per frequency segment. The computer was programmed to subtract the second pass data from the first pass on a point by point basis per frequency segment, thus removing steady state ambient and leaving only EUT emissions. This culling process reduces the total number of emissions that must be examined manually.

A preliminary list of possible EUT frequencies was printed at the end of the second pass after the subtraction process. This list contained both EUT emissions and background ambient, particularly ambient signals which fluctuated in amplitude or which went on and off rapidly (such as communication transmitters). At this point each listed frequency was individually examined by a manual procedure. Some of these signals were ambient and some were EUT signals. They were sorted and the EUT signals were accurately measured with the quasi-peak detector after maximizing the signal in both azimuth and height.

### 5.2.1 Vertical Polarization Measurements (continued)

A data sheet is printed out listing the “Final FCC B Radiated Results”. This lists those signals which were within X dB of the limit, where X is selectable and which were actually attributed to the EUT. Along with other information the data sheet indicates signal level, limit, turntable angle and antenna height.

Data sheets of vertical polarized radiated emissions are shown in Appendix C. A sample-calculation on the data sheet shows how antenna factors, cable loss and amplifier gains are processed by the computer.

### 5.2.2 Horizontal Polarization Measurements

The full electric field frequency range from 30 MHz to 1000 MHz was scanned with the EUT operating and the measurement antenna oriented in a horizontal polarization. A set of radiated emission readings were collected, evaluated, stored and printed out using the same procedure described above for vertical polarization. The data sheets are contained in Appendix C.

### 5.2.3 Test Results

The EUT passed both vertical and horizontal radiated emissions tests.

### 5.2.4 Test Instrumentation

The following equipments were used for radiated emissions tests.

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal. Due Date</u>
Controller/Computer	Hewlett-Packard	9836	N/A
Spectrum Analyzer	Hewlett-Packard	8568B	12/12/04
Quasi-Peak Adapter	Hewlett-Packard	85650A	12/12/04
LISN	EMCO	3816/2	12/12/04
Antenna Mast	EMCO	1050	N/A
Rotating Table	EMCO	1060	N/A
Antenna, Biconical	Electro-Metrics	BIA-30	9/13/05
Antenna, Log-periodic	Electro-Metrics	LPA-30	9/13/05
Preamplifier	Hewlett-Packard	8447D	12/12/04

### 5.2.5 Recommendations

Because there were no test failures, there are no recommendations.

# **APPENDIX A**

## **EMI Measurement with the Automatic Spectrum Analyzer**



## **A1.0 INTRODUCTION**

This document describes application of the Hewlett-Packard 8568B Automatic Spectrum Analyzer and the Hewlett-Packard 85650A Quasi-Peak Adapter for measurement of Electromagnetic Interference (EMI) emissions for FCC Compliance Testing. The measurement methods are designed to comply with FCC Measurement Procedure ANSI C63.4-1992 as well as IEC publication CISPR 22.

The measurement of EMI involves a repetitive process of collecting, analyzing and reformatting large amounts of data. It is a process that lends itself to computer-controlled automation. The benefits are: reduced setup time, reduced operation time, increased accuracy and repeatability.

The detailed description, which follows, provides insight into the programming of the analyzer and computer. The steps describe how data is collected, analyzed, displayed and reproduced.

## **A2.0 OVERVIEW**

The Hewlett-Packard 8568B is a general purpose programmable Spectrum Analyzer System and the Hewlett-Packard 85650A is a programmable accessory which sets the overall measurement bandwidth and detector time constants to those required for FCC measurements. By adding appropriate transducers such as antennas or LISNs, and with the proper software, the system becomes an interference measurement set operating under the control of Hewlett-Packard 9836 Computer. A Hewlett-Packard 7475A Plotter and a Hewlett-Packard 2673A Printer are accessories that provide hard copy output in the form of graphs and data sheets.

Several measurement sweeps are taken to characterize the interference from the Equipment under Test (EUT). The data is analyzed in the computer and later reformatted in both a semi-log graph and a measurement summary data sheet. The data sheets indicate compliance by including PASS/FAIL messages and specification limits.

## **A3.0 PROGRAM OPERATION**

### **A3.1 General Operations**

A stored program is loaded into the computer. This program determines whether the system is set for conducted or radiated emissions. It contains all of the necessary operational steps, the antenna factors, and any data needed for calculation of final emission values. The analyzer has a built-in self-calibration program. The Calibration Program is used each time the analyzer is set up for testing. It checks all of the pertinent internal parameters and displays the error value for each. A calibration data sheet is normally printed out for inclusion in the test report.

The program begins by prompting the operator to provide administrative data such as date, customer name, EUT Nomenclature, model number, and serial number. The operator is prompted to check the setup to see that the equipment is properly connected before making measurements. A blinking message on the analyzer CRT reminds the operator that program execution will continue after the "Hz" key on the analyzer keyboard is pressed.

At this time, the analyzer frequency span, resolution bandwidth, video bandwidth and sweep time are automatically set to programmed values. The quasi-peak adapter is automatically set to programmed values at this time. The quasi-peak adapter is set to the "Normal" mode with the QP detector "OFF" (passes peak signals through the quasi-peak adapter) during the automatic scans. This allows faster scans of the analyzer and produces peak values of the data. Quasi-peak adapter scans are processed manually as described in the later paragraphs on conducted and radiated emissions testing. The programmed setup values depend upon whether conducted or radiated emissions are to be measured. The system is now ready for the first measurement sweep.

The EUT is prepared for testing and is turned on and set to the operating mode selected for test. Preliminary evaluations have already been made to determine worst-case cable and equipment positioning in the EUT test setup. The analyzer sweep process is started by pressing the "Hz" key on the analyzer. The total frequency range to be measured is divided into several spans, which are each swept consecutively.

### A3.1 General Operations (Continued)

Table A-1 shows the sweep ranges and sweep times programmed for both conducted and radiated emissions measurements. The analyzer divides the spectrum-scanned sweep into 1001 separate incremental measurement points and stores these for processing. The range of the scan and the number of points per scan determine the width of each incremental segment. The column labeled “System Bandwidth with QP” in Table A-1 shows the bandwidths programmed. These have been selected to be narrow enough for the assured sensing of all EUT emissions in the presence of typical ambient signals. Scan time is slow enough to allow EUT signals to reach a peak value and be sensed.

**TABLE A-1**

Analyzer Bandwidth Setting	System Bandwidth With QP (Note 1)	Range of Band Swept	Span of Stored Segment (Note 2)	Range of Band Swept	Span of Stored Segment (Note 2)	Sweep Time (Note 3)
<u>MHz</u>	<u>kHz</u>	<u>MHz</u>	<u>MHz</u>	<u>MHz</u>	<u>MHz</u>	<u>Seconds</u>
<b>CONDUCTED EMISSIONS</b>		<b><u>FCC</u></b>		<b><u>CISPR</u></b>		
0.1	9	0.45-1.6	1.15	0.15- 0.5	0.35	90
0.1	9	1.6- 8.0	6.4	0.5- 5.0	4.5	90
0.1	9	8.0-30.0	22.0	5.0- 30.0	25.0	90
<b>RADIATED EMISSIONS (Same for FCC and CISPR)</b>						
1.0	120	30- 60	30			90
1.0	120	60- 88	28			90
1.0	120	88- 108	20			90
1.0	120	108- 200	92			90
1.0	120	200- 400	200			90
1.0	120	400- 700	300			90
1.0	120	700-1000	300			90

**Note 1.** System Bandwidth is determined by the quasi-peak adapter when it’s function is selected. The automatic scans are made with the quasi-peak adapter in the bypass mode. Data values are peak readings.

### **A3.1 General Operations (Continued)**

**Note 2.** Span of stored segment is equal to the range of band scanned divided by the number of data points. The analyzer provides 1001 points. For example, the scan from 150 kHz to 1600 kHz equals the scanned range of 1450 kHz. When this is divided by 1001, the span of the stored segment is 1.45kHz.

**Note 3.** The analyzer system is set up to process peak signals during the automatic scan and when the quasi-peak adapter is in “normal”, signals are analyzed manually with the quasi-peak function using the procedures described in paragraphs on conducted and radiated emissions testing.

Upon completion of the first measurement sweep the analyzer sends an “End of Sweep” interrupt message along the bus which tells the computer that the analyzer is ready to output its trace data.

A fast Read/Write routine then transfers the 1001 data points from the analyzer buffer to the computer memory and the analyzer is set for a second measurement sweep. While the analyzer is collecting data during the next sweep, the computer is analyzing and reformatting the previous sweep data, ultimately reducing the number of data points in the sweep from 1001 to 100. This makes room for the processing of additional sweeps. The final formatted trace data contains up to 1000 data points overall after all of the sweeps are combined and includes all significant EUT emissions.

### **A3.2 Conducted Emission Measurements**

Measurements of conducted emissions on the power input lines from are made using a Line Impedance Stabilization Network (LISN). A Solar 7205-0.35 high pass Filter having a cutoff frequency of 350 Hz is used to prevent power frequency harmonics from overloading the analyzer.

The LISN and high pass filter are connected through 20 feet of RG-214 coaxial cable to the Spectrum Analyzer input. The switch on the LISN is set to the Supply Line position and the power is applied to the EUT.

The computer is commanded to begin the data collection scanning process as described in Paragraph 3.1. Correction factors for filter loss are programmed and are taken into consideration. Data tabulations and graphical plots of peak values are produced by the system at the conclusion of the test scans.

### **A3.2 Conducted Emission Measurements (Continued)**

Sample calculations of conducted emissions are shown on the data sheets. The switch in the LISN is then set to the Return Line position and the interference scan is repeated and an additional set of data sheets and plot charts are prepared. The six highest EUT emission measurement values, two from each of the three scan ranges are listed out on the data sheet.

This completes the automatic scans of conducted emissions. If the test results and EUT characteristics indicate a need, additional manual scans of maximum value readings will be made with the quasi-peak detector ON. If readings exceed the Conducted Emissions Limit, and if broadband noise is evident, then the provisions of MP-4, Paragraph 4.2.2.2, Note 2, will be applied.

### **A3.3 Radiated Emission Measurements**

Radiated emissions from the EUT are measured over the frequency range of 30 MHz to 1000 MHz using a combination of automatic and manual methods, which conform to ANSI C63.4, Paragraph 6.0. The EUT is placed on a nonmetallic stand 0.8 meters above the ground plane in an open-field test site. The interface cables and equipment positions are varied within limits of reasonable applications to determine the positions producing maximum radiated emissions.

Preliminary manual scans of the frequency range are needed to determine the cable configurations and equipment positions that produce maximum emissions. These configurations are then kept intact while both angle of rotation of the EUT with respect to the antenna and antenna height is scanned for maximum readings.

Automatic scans with the antenna first vertically polarized and then horizontally polarized are made to determine a set of preliminary maximum peak values. These are then processed manually with the quasi-peak adapter to determine exact emission values from the EUT. The automatic scanning proceeds in general as described in Paragraph 3.1.

Radiated emission measurements are started with the test antenna in a vertical orientation at 1.5 meters in height and with the front of the EUT facing the antenna. The measurement antenna is connected to the preamplifier and spectrum analyzer through 75-foot long RG-214 coaxial cable. The EUT is placed in operation.

### **A3.3 Radiated Emission Measurements (Continued)**

The automatic spectrum analyzer scanning procedure used for radiated measurements is a two-step process. Two separate scans of each frequency range are made. The test operator has the choice of selecting either the analyzer peak detector or signal sample techniques.

The first pass accumulates and stores both EUT and background ambient emissions received by the measurement antenna. The second pass is ran with the EUT turned OFF and accumulates only background ambient emissions. The quasi-peak adapter is in "Normal Mode" and the readings are peak values. The computer and analyzer are programmed to subtract the second scan from the first scan, removing steady state ambient and leaving only EUT emissions and fluctuating ambient. This reduces the total number of emissions that must be examined manually.

The automatic scanning procedure divides the total frequency range of 30 MHz to 1000 MHz into 7 sweeps, which are arranged to yield the greatest resolution possible over the entire frequency range of the test. These are listed in Table A-1. In the signal-sampling mode, each sweep consists of 260 averages done automatically by the analyzer. This tends to reduce the effect of random or short- term ambient signals. Antenna changes are made as required at the end of each sweep.

A preliminary list of residual frequencies is printed at the end of the second pass after the subtraction process. This list contains both EUT emissions and background ambient. At this point, each listed frequency is individually examined with manual procedure consisting of maximizing the signal in direction and antenna height. The dipole antenna is "cut" for the frequency of interest and the quasi-peak detector is engaged. The final reading of the signal under these conditions is then modified to account for antenna factor, cable loss and pre-amplifier gain.

The EUT is turned on again and the computer is set to display each frequency from the preliminary list on the spectrum analyzer starting at the 30 MHz end of the range. A manual command is used to end investigation of a listed frequency and then goes on to the next. This allows sufficient time to evaluate each suspected signal. Several methods are used to separate residual ambient from EUT signals:

### **A3.3 Radiated Emission Measurements (Continued)**

1. If the signal disappears from the screen when the analyzer is tuned to the indicated frequency with the EUT operating, then the signal is not caused by the EUT and is considered to be an ambient.
2. With the EUT operating and the analyzer tuned to the indicated frequency, if the demodulated signal from the speaker on the quasi-peak adapter is voice or music, then the signal is recognized as a radio or TV station and is considered ambient.
3. If either step 1 or 2 above is inconclusive, then with the analyzer tuned to the indicated frequency the EUT power is turned OFF. If the signal on the analyzer remains unchanged, then the signal is considered to be an ambient.
4. Sometimes, it is helpful to decrease the analyzer resolution bandwidth so that resolution of close-together frequencies can be achieved.

As the evaluation process continues, each signal attributed to the EUT is further examined for maximum value. The dipole antenna is adjusted to the proper length, the height of the measurement antenna is searched from one to four meters, and the angle of rotation of the EUT with respect to the antenna is varied from 0 to 360 degrees.

The quasi-peak detector is engaged and the analyzer is set to a sweep time of 50 seconds. The analyzer display is cleared and signal is traced on the screen. After the maximum quasi-peak signal is displayed, the "Continue" button on the computer is pressed and the interference signal amplitude and frequency information is stored in the computer for later printout and plotter display. The angle of the EUT and height of the antenna are also stored for print out on the data sheet.

If the four steps above indicate that the signal is not an EUT signal, then that signal is passed over and not recorded for final printout. The screen is cleared and manual actuation of the "Continue" button steps the analyzer to the next signal for evaluation. Evaluation of the preliminary frequency list continues until all of the signals are confirmed, maximized and measured, or are rejected as not originating from the EUT. Then the computer prints out a final data sheet showing frequency, amplitude, Specification Limit, antenna height and angle of rotation of the EUT. A graph of the data is also drawn by the plotter.

# **APPENDIX B**

## **Certifications**

EMCE NVLAP Accreditation





ISO/IEC 17025:1999  
ISO 9002:1994

## Scope of Accreditation



Page: 1 of 2

**ELECTROMAGNETIC COMPATIBILITY  
AND TELECOMMUNICATIONS**

NVLAP LAB CODE 200092-0

**UNIVERSAL COMPLIANCE LABS DBA EMCE ENGINEERING**

44366 South Grimmer Boulevard  
Fremont, CA 94538-6385

Mr. Bob Cole

Phone: 510-490-4307 Fax: 510-490-3441

E-Mail: bob@universalcompliance.com

URL: <http://www.universalcompliance.com>

*NVLAP Code Designation / Description*



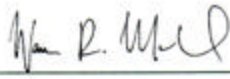
**Emissions Test Methods:**

- |           |  |
|-----------|--|
| 12/CIS22  | IEC/CISPR 22 (1997) and EN 55022 (1998): Limits and methods of measurement of radio disturbance characteristics of information technology equipment                        |
| 12/CIS22a | IEC/CISPR 22 (1993): Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1 (1995) and Amendment 2 (1996) |
| 12/CIS22b | CNS 13438 (1997): Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment  |
| 12/FCC15b | ANSI C63.4 (2001) with FCC Method - 47 CFR Part 15, Subpart B: Unintentional Radiators   |
| 12/T51    | AS/NZS CISPR 22 (2002) and AS/NZS 3548 (1997): Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment                        |

December 31, 2004

*Effective through*

*For the National Institute of Standards and Technology*

 National Institute of Standards and Technology      National Voluntary Laboratory Accreditation Program		
ISO/IEC 17025:1999 ISO 9002:1994	<b>Scope of Accreditation</b>	 Page: 2 of 2
<b>ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS</b>		<b>NVLAP LAB CODE 200092-0</b>
<b>UNIVERSAL COMPLIANCE LABS DBA EMCE ENGINEERING</b>		
<i>NVLAP Code    Designation / Description</i>		
<b>Immunity Test Methods:</b>		
12/101	IEC 61000-4-2, Edition 2.1 (2001) including Amds. 1 & 2 and EN 61000-4-2: Electrostatic Discharge Immunity Test	
12/103	IEC 61000-4-4 (1995) + Amd. 1 (2000) & Amd. 2 (2001) and EN 61000-4-4: Electrical Fast Transient/Burst Immunity Test	
12/104	IEC 61000-4-5 (1995) + Amd. 1 (2000) and EN 61000-4-5: Surge Immunity Test	
12/105	IEC 61000-4-6, Edition 2.0 (2003) and EN 61000-4-6: Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields	
12/106	IEC 61000-4-8, Edition 1.1 (2001) and EN 61000-4-8: Power Frequency Magnetic Field Immunity Test	
12/107	IEC 61000-4-11 (1994) + Amd. 1 (2000) and EN 61000-4-11: Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests	
December 31, 2004		
Effective through		For the National Institute of Standards and Technology

United States Department of Commerce  
National Institute of Standards and Technology

**NVLAP**<sup>®</sup>

Certificate of Accreditation

ISO/IEC 17025:1999  
ISO 9002:1994

**UNIVERSAL COMPLIANCE LABS DBA EMCE ENGINEERING**  
FREMONT, CA

*is recognized by the National Voluntary Laboratory Accreditation Program  
for satisfactory compliance with criteria set forth in NIST Handbook 150:2001,  
all requirements of ISO/IEC 17025:1999, and relevant requirements of ISO 9002:1994.  
Accreditation is awarded for specific services, listed on the Scope of Accreditation, for:*

**ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS**

December 31, 2004  
Effective through

*[Signature]*  
For the National Institute of Standards and Technology  
NVLAP Lab Code: 200092-0

NVLAP-01C (06-01)

# **APPENDIX C**

**Test Data Sheets**  
Conducted Emissions  
Radiated Emissions

CONDUCTED EMISSIONS TEST

<b>CLIENT:</b> Socket Communications	<b>TEST REF:</b> FCC Part 15 (Class B)
<b>EUT MODEL:</b> BT-GPS Rev. 2	<b>PRODUCT:</b> Cordless GPS
<b>SERIAL NUMBER:</b> EMI Unit	<b>EUT DESIGNATION:</b> Light industrial
<b>TEMPERATURE (°F):</b> 82°	<b>HUMIDITY:</b> 34%
<b>ATM PRESSURE:</b>	<b>GROUNDING:</b> Grounded through power cord
<b>TESTED BY:</b> Scott Parr	<b>DATE OF TEST:</b> 9/8/04

<b>METHOD</b>	FCC Part 15 (Class B)
<b>PROCEDURE</b>	Test performed in accordance with method. Scan from 150Hz to 30MHz
<b>TEST VOLTAGE</b>	120 VAC @ 60Hz
<b>RESULTS</b>	Passed

Line/Detection Mode	Frequency (MHz)	Amplitude (uV)	Amplitude (dBuV)	Limiter Attenuation	Class B Limit	Margin
Hot/Quasi Peak	0.577	19.586	25.84	10.00	46.00	-10.16
Hot/Quasi Peak	2.471	7.849	17.90	10.00	46.00	-18.10
Hot/Quasi Peak	6.880	20.754	26.34	10.00	50.00	-13.66
Neutral/Quasi Peak	0.577	23.564	27.44	10.00	46.00	-8.56
Neutral/Quasi Peak	6.730	9.854	19.87	10.00	50.00	-20.13
Neutral/Quasi Peak	19.880	9.828	19.85	10.00	50.00	-20.15

VERIFIED BY: 

RADIATED EMISSIONS TEST

<b>CLIENT:</b> Socket Communications	<b>TEST REF:</b> FCC Part 15 (Class B)
<b>EUT MODEL:</b> BT-GPS Rev. 2	<b>PRODUCT:</b> Cordless GPS
<b>SERIAL NUMBER:</b> EMI Unit	<b>EUT DESIGNATION:</b> Light industrial
<b>TEMPERATURE (°F):</b> 82°	<b>HUMIDITY:</b> 34%
<b>ATM PRESSURE:</b>	<b>GROUNDING:</b> Grounded through power cord
<b>TESTED BY:</b> Scott Parr	<b>DATE OF TEST:</b> 9/8/04

<b>METHOD</b>	FCC Part 15 (Class B)
<b>PROCEDURE</b>	Test performed in accordance with method. Scan from 30MHz to 1GHz
<b>TEST VOLTAGE</b>	120 VAC @ 60Hz
<b>RESULTS</b>	Passed

Frequency [MHz]	Polarity [V/H]	Corrected Reading [dB (uV/m)]	Margin [dB]	Meter Limit [dB(uV/m)]	Correction Factor [dB]	Ht (m)	Angle (Deg)
72.50	V	22.70	-7.30	30.00	10.90	1.00	0.00
113.75	V	21.00	-12.50	33.50	13.10	1.00	0.00
184.33	V	20.70	-12.80	33.50	16.90	1.00	0.00
192.32	V	23.50	-10.00	33.50	17.20	1.00	0.00
192.32	H	17.80	-15.70	33.50	17.20	1.00	0.00
248.85	V	26.00	-10.00	36.00	19.10	1.00	0.00

1. The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the amplifier Gain from the measured reading.
2. All readings are quasi-peak unless stated otherwise, using a QPA bandwidth of 120kHz, with a 30 mS sweep time. A video filter was not used.

VERIFIED BY: 

RADIATED SPURIOUS EMISSIONS TEST

<b>CLIENT:</b> Socket Communications	<b>TEST REF:</b> FCC Part 15 (Class B)
<b>EUT MODEL:</b> BT-GPS Rev. 2	<b>PRODUCT:</b> Cordless GPS
<b>SERIAL NUMBER:</b> EMI Unit	<b>EUT DESIGNATION:</b> Light industrial
<b>TEMPERATURE (°F):</b> 76°	<b>HUMIDITY:</b> 34%
<b>ATM PRESSURE:</b>	<b>GROUNDING:</b> Grounded through power cord
<b>TESTED BY:</b> Scott Parr	<b>DATE OF TEST:</b> 10/8/04

<b>METHOD</b>	FCC Part 15 (Class B)
<b>PROCEDURE</b>	Test performed in accordance with method. Test Distance at 1 Meter. Scan from 1GHz to 18GHz Bluetooth transmitter continuously hopping at maximum power
<b>TEST VOLTAGE</b>	120 VAC @ 60Hz
<b>RESULTS</b>	Passed

Frequency [MHz]	Polarity [V/H]	Corrected Reading [dB (uV/m)]	Margin [dB]	Meter Limit [dB(uV/m)]
1645.631	V	57.9	-6.1	64.00
1655.656	H	57.8	-6.2	64.00
1743.876	H	57.6	-6.4	64.00
1753.901	H	57.6	-6.4	64.00
1722.623	H	57.2	-6.8	64.00
1706.861	H	57.0	-7.0	64.00
7215.028	V	56.5	-7.5	64.00
7255.051	V	56.4	-7.6	64.00
7211.548	V	56.2	-7.8	64.00
7258.531	H	56.0	-8.0	64.00
7218.508	V	55.6	-8.4	64.00

1. The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the amplifier Gain from the measured reading.
2. All readings are quasi-peak unless stated otherwise, using a QPA bandwidth of 120kHz, with a 30 mS sweep time. A video filter was not used.

VERIFIED BY: 

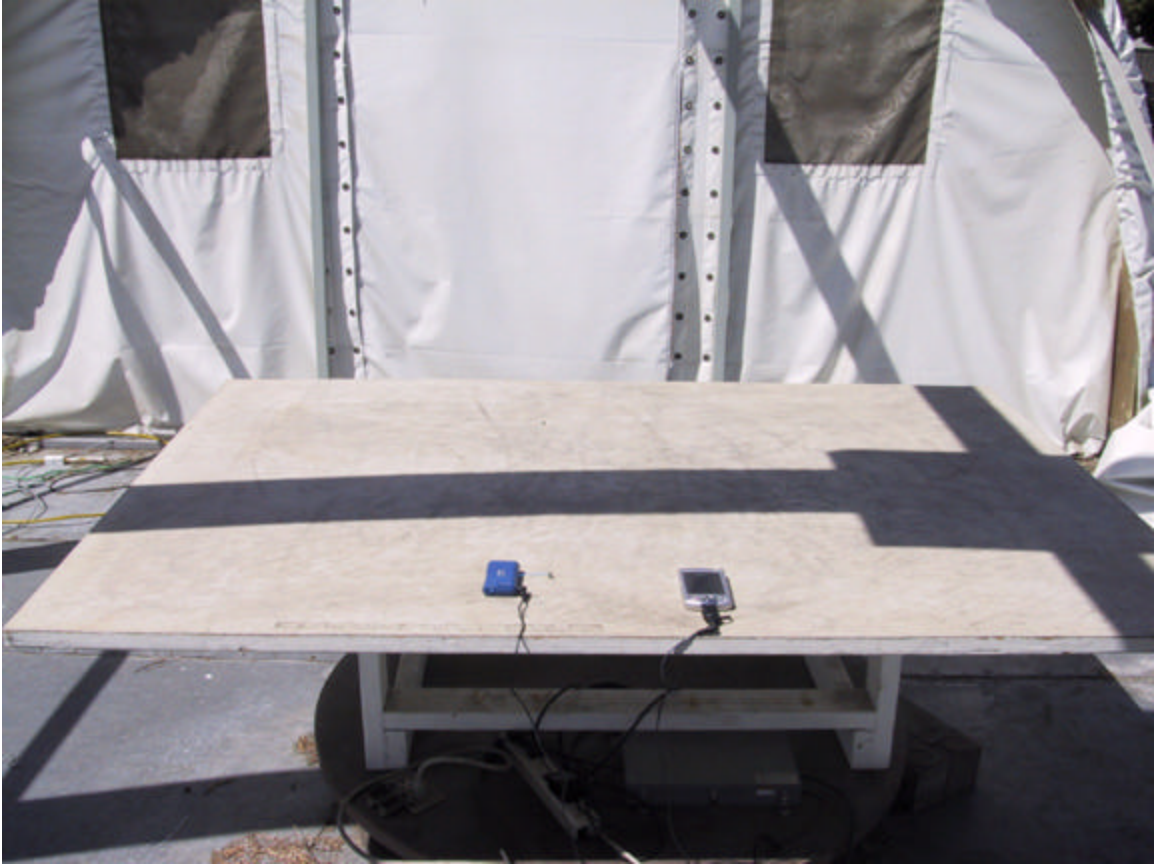
## **APPENDIX D**

### **PHOTOGRAPHS OF TEST SETUPS PHOTOGRAPHS OF EUT**





**Photograph 1. Radiated Emissions Test Setup (Front View)**



**Photograph 2. Radiated Emissions Test Setup (Rear View)**



**Photograph 3. Conducted Emissions Test Setup.**



**Photograph 4. EUT**

# **APPENDIX E**

## **DoC LABELING AND COMPLIANCE INFORMATION**

E1.0 DoC LABELING AND COMPLIANCE INFORMATION

E1.1 Compliance Information Statement

If a product must be tested and authorized under a Declaration of Conformity, a Compliance Information Statement shall be supplied with the product at the time of marketing or importation. The compliance information statement shall contain the information as shown:

**COMPLIANCE INFORMATION STATEMENT**

Product Name: Cordless GPS  
Product Model Number: BT-GPS Rev. 2

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.

**RESPONSIBLE PARTY**

Responsible Party's Name: \_\_\_\_\_  
Signature: \_\_\_\_\_  
Responsible Party's Phone Number: \_\_\_\_\_

Company Name: Socket Communications  
Street Address: 37400 Central Court  
City, State & ZIP: Newark, CA 94560

E1.2 Identification

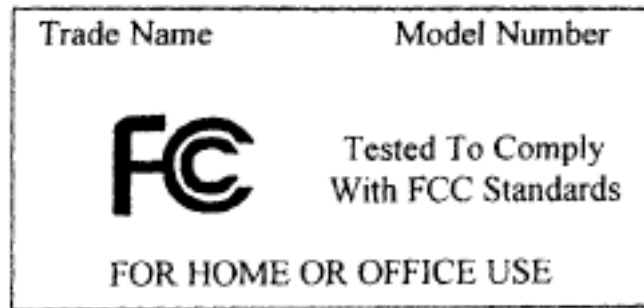
Devices subject only to a Declaration of Conformity shall be uniquely identified by the responsible party. This identification shall not be of a format which could be confused with the FCC Identifier required on certified, notified, type accepted or type approved equipment. The responsible party shall maintain adequate identification records to facilitate positive identification for each device.



### E1.3 Labeling Requirements

Product authorizations under a Declaration of Conformity shall have a label as follows:

The label shall be located in a conspicuous location on the device and shall contain as a minimum the unique identification of "Trade Name" and "Model Number" along with the FCC logo.



### E1.4 Retention of Records

For each product subject to a Declaration of Conformity, the responsible party shall maintain the records listed below:

- A) A record of the original design drawings and specifications and all changes that have been made that may affect compliance with the FCC requirements.
- B) A record of the procedures used for production inspection and testing (if tests were performed) to insure the continuous conformance required. (Statistical production line emission testing is not required).
- C) A record of the measurements made on an appropriate test site that demonstrates compliance with the applicable regulations.

# **APPENDIX F**

## **Measuring Equipment Error Analysis**



F1.0 MEASURING EQUIPMENT ERROR ANALYSIS

F1.1 Radiated Emissions Measurement

Table 1 shows the calculated measurement accuracy for radiated emissions test (30MHz-1000MHz). The radiated emissions amplitude accuracy is determined as follows: Antenna Factor Error + Cable Loss Error + Pre-amplifier Gain Error + Spectrum Analyzer Amplitude Error. The spectrum analyzer amplitude error is obtained from the manufacturer’s specification sheet. Antenna factors are measured at 1 year intervals by EMCE Engineering, and cable losses as well as amplifier gains are swept at least every month by EMCE Engineering to verify accurate values. The measurement accuracy for these are determined by EMCE.

Table F1  
Radiated Emissions Measurement Accuracy

<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>
Spectrum Analyzer	Hewlett-Packard	8568B	+/- 1.6dB
Antennas	EMCO/Roberts	3104/Roberts	+/- 1.0dB
Pre-amplifier	Hewlett-Packard	8447D	+/- 0.5dB
Double Shielded Coax Cable	50 ohm, Type N	50 feet	___ +/- 0.5dB
			= +/- 3.6dB

F1.2 Conducted Emissions Measurement

Table 2 shows the calculated measurement accuracy for conducted emissions test (150kHz-30MHz). The conducted emissions amplitude accuracy is determined as follows: LISN Attenuation Error + Cable Loss Error + Spectrum Analyzer Amplitude Error. The spectrum analyzer amplitude error and LISN attenuation error are obtained from the manufacturer’s specification sheet. Cable loss below 30MHz is negligible therefore error presented by the cable is not considered.

Table F2  
Conducted Emissions Measurement Accuracy

<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>
Spectrum Analyzer	Hewlett-Packard	8568B	+/- 1.6dB
LISN	Solar	8012-50-R-24	+/- 0.5dB
			= +/- 2.1dB