



Elliott Laboratories Inc.  
www.elliottlabs.com

684 West Maude Avenue  
Sunnyvale, CA 94086-3518

408-245-7800 Phone  
408-245-3499 Fax

January 9, 2002

Sandy Pickett  
American TCB  
6731 Whittier Avenue  
Suite C110  
McLean, VA. 22101

Ms. Pickett,

The enclosed documents constitute a formal submittal and application for a Grant of Equipment Authorization pursuant to Subpart C of Part 15 of FCC Rules (CFR 47) regarding intentional radiators. Data within this report demonstrates that the equipment tested complies with the FCC limits for intentional radiators.

Some of the documentation submitted has the name Schlumberger on it as Schlumberger Indus. - Water Division has been acquired by Neptune Technology Group, Inc.

Elliott Laboratories, as duly authorized agent prepared this submittal. A copy of the letter of our appointment as agent is enclosed.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

Mark Briggs  
Director of Engineering

MB/dmg  
Enclosures: Emissions Test Report with Exhibits

*Electromagnetic Emissions Test Report  
pursuant to  
FCC Part 15, Subpart C Section 15.249 Specifications  
for an Intentional Radiator  
on the  
Neptune Technology Group, Inc.  
Model: Pocket ProReader RF*

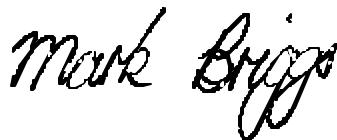
FCC ID: P2SNTGPKT1101

GRANTEE: Neptune Technology Group, Inc.  
1600 Alabama Highway 229  
Tallahassee, AL 36078

TEST SITE: Elliott Laboratories, Inc.  
684 W. Maude Avenue  
Sunnyvale, CA 94086

REPORT DATE: January 9, 2002

FINAL TEST DATE: July 2, August 27 and August 28, 2001



AUTHORIZED SIGNATORY:

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Mark Briggs  
Director of Engineering

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***SCOPE***

An electromagnetic emissions test has been performed on the Neptune Technology Group, Inc. model Pocket ProReader RF pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Neptune Technology Group, Inc. model Pocket ProReader RF and therefore apply only to the tested sample. The sample was selected and prepared by Mohammed Ali of Neptune Technology Group, Inc.

***OBJECTIVE***

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units subsequently manufactured.

**STATEMENT OF COMPLIANCE**

The tested sample of Neptune Technology Group, Inc. model Pocket ProReader RF complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any product modification resulting in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

**EMISSION TEST RESULTS**

The following emissions tests were performed on the Neptune Technology Group, Inc. model Pocket ProReader RF. The actual test results are contained in an exhibit of this report.

**LIMITS OF CONDUCTED INTERFERENCE VOLTAGE**

Conducted emissions tests were not performed because the EUT is powered from internal batteries and does not operate while connected, directly or indirectly, to an AC power source.

**LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH (FUNDAMENTAL SIGNAL)**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.249. The maximum field strength measured (using QP detection) was 79.2dBuV/m (approximately 0.025mW, or 0.000025 Watts). The maximum permitted field strength for a device operating under 15.249 is 50mV/m (94.0dBuV/m).

**LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH (SPURIOUS EMISSIONS)**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.249 and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

30-9140 MHz								
Frequency MHz	Level dBuV/m	Pol v/h	FCC 15.249 Limit	Margin	Detector Pk/QP/Avg Avg	Azimuth degrees	Height meters	Comments
1828.000	47.3	v	54.0	-6.7		250	1.0	-

**MEASUREMENT UNCERTAINTIES**

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	$\pm 2.4$
Radiated Emissions	30 to 1000	$\pm 3.2$

**EQUIPMENT UNDER TEST (EUT) DETAILS****GENERAL**

The Neptune Technology Group, Inc. model Pocket ProReader RF is a transmitter that operates at 914 MHz and designed to read utility meters remotely. Normally, the EUT would be handheld during operation. The EUT was, therefore, placed in three orientations, front, side, and back to simulate the end user environment.

The electrical rating of the EUT is 3.65Vdc. The sample was received on July 2, 2001 and tested on July 3, August 27 and August 28, 2001. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Neptune	Pocket ProReader RF	Transmitter	PRF000298	P2SNTGPKT1101

**ENCLOSURE**

The EUT enclosure is primarily constructed of fabricated plastic. It measures approximately 6.9 cm wide by 4 cm deep by 15.5 cm high.

**MODIFICATIONS**

The unit did not require any modifications during testing in order to comply with the specifications.

**SUPPORT EQUIPMENT**

No support equipment was used during emissions testing.

**INTERFACE PORTS:**

The I/O cabling configuration during emissions testing was as follows:

EUT Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
Power	Not connected	-	-	-

Note: Power port is used for charging only

**OPERATION**

The unit was transmitting continuously during testing.

**TEST SITE****GENERAL INFORMATION**

Final test measurements were taken on July 3, August 27 and August 28, 2001 at the Elliott Laboratories Open Area Test Site #3 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

**CONDUCTED EMISSIONS CONSIDERATIONS**

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal standardized RF impedance, provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

**RADIATED EMISSIONS CONSIDERATIONS**

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

**MEASUREMENT INSTRUMENTATION****RECEIVER SYSTEM**

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

**INSTRUMENT CONTROL COMPUTER**

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

**LINE IMPEDANCE STABILIZATION NETWORK (LISN)**

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

**FILTERS/ATTENUATORS**

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

**ANTENNAS**

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors, which are programmed into the test receivers.

**ANTENNA MAST AND EQUIPMENT TURNTABLE**

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

**INSTRUMENT CALIBRATION**

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

**TEST PROCEDURES****EUT AND CABLE PLACEMENT**

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

**CONDUCTED EMISSIONS**

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

**RADIATED EMISSIONS**

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

**SPECIFICATION LIMITS AND SAMPLE CALCULATIONS**

The limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

**RADIATED EMISSIONS SPECIFICATION LIMITS – FUNDAMENTAL SIGNAL**

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
902 - 928	50000	94

**RADIATED EMISSIONS SPECIFICATION LIMITS – SPURIOUS SIGNALS**

The limit for emissions falling in restricted bands is taken from 15.209 and given in the table below.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

For emissions harmonically related to the fundamental signal is 500uV/m (54 dBuV/m) at 3m. All other emissions radiated outside of the specified frequency bands shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation

**SAMPLE CALCULATIONS - RADIATED EMISSIONS**

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20 * \text{LOG10} (D_m/D_s)$$

where:

$F_d$  = Distance Factor in dB

$D_m$  = Measurement Distance in meters

$D_s$  = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_f + F_d$$

and

$$M = R_c - L_s$$

where:

$R_f$  = Receiver Reading in dBuV/m

$F_d$  = Distance Factor in dB

$R_c$  = Corrected Reading in dBuV/m

$L_s$  = Specification Limit in dBuV/m

$M$  = Margin in dB Relative to Spec

***EXHIBIT 1: Test Equipment Calibration Data***

T44045 1 Page

***EXHIBIT 2: Test Data Log Sheets***

**ELECTROMAGNETIC EMISSIONS**

**TEST LOG SHEETS**

**AND**

**MEASUREMENT DATA**

**T44045 9 Pages**

***EXHIBIT 3: Radiated Emissions Test Configuration Photographs***

**2 Pages**

***EXHIBIT 4: Theory of Operation  
for Neptune Technology Group, Inc. Model Pocket ProReader RF***

8 Pages

***EXHIBIT 5: Proposed FCC ID Label & Label Location***

2 Pages

***EXHIBIT 6:Detailed Photographs  
of Neptune Technology Group, Inc. Model Pocket ProReader RF Construction***

External Photos	2 Pages
Internal Photos	3 Pages

***EXHIBIT 7: Operator's Manual  
for Neptune Technology Group, Inc. Model Pocket ProReader RF***

1 Page

***EXHIBIT 8: Block Diagram  
of Neptune Technology Group, Inc. Model Pocket ProReader RF***

1 Page

***EXHIBIT 9: Schematic Diagrams  
for Neptune Technology Group, Inc. Model Pocket ProReader RF***

**1 Page**