FCC Part 15 Subpart C

Frequency Hopping
Spread Spectrum Transmitter

Class II Permissive Change
Test Report

Manufacturer: Neptune Technology Group, Inc.

Model: R900-v2
FCC ID: P2SNTGSRFV2

Rules Section: 15.247

Test Begin Date: January 10, 2003
Test End Date: January 14, 2003

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ACS Report Number: 02-0177-15C

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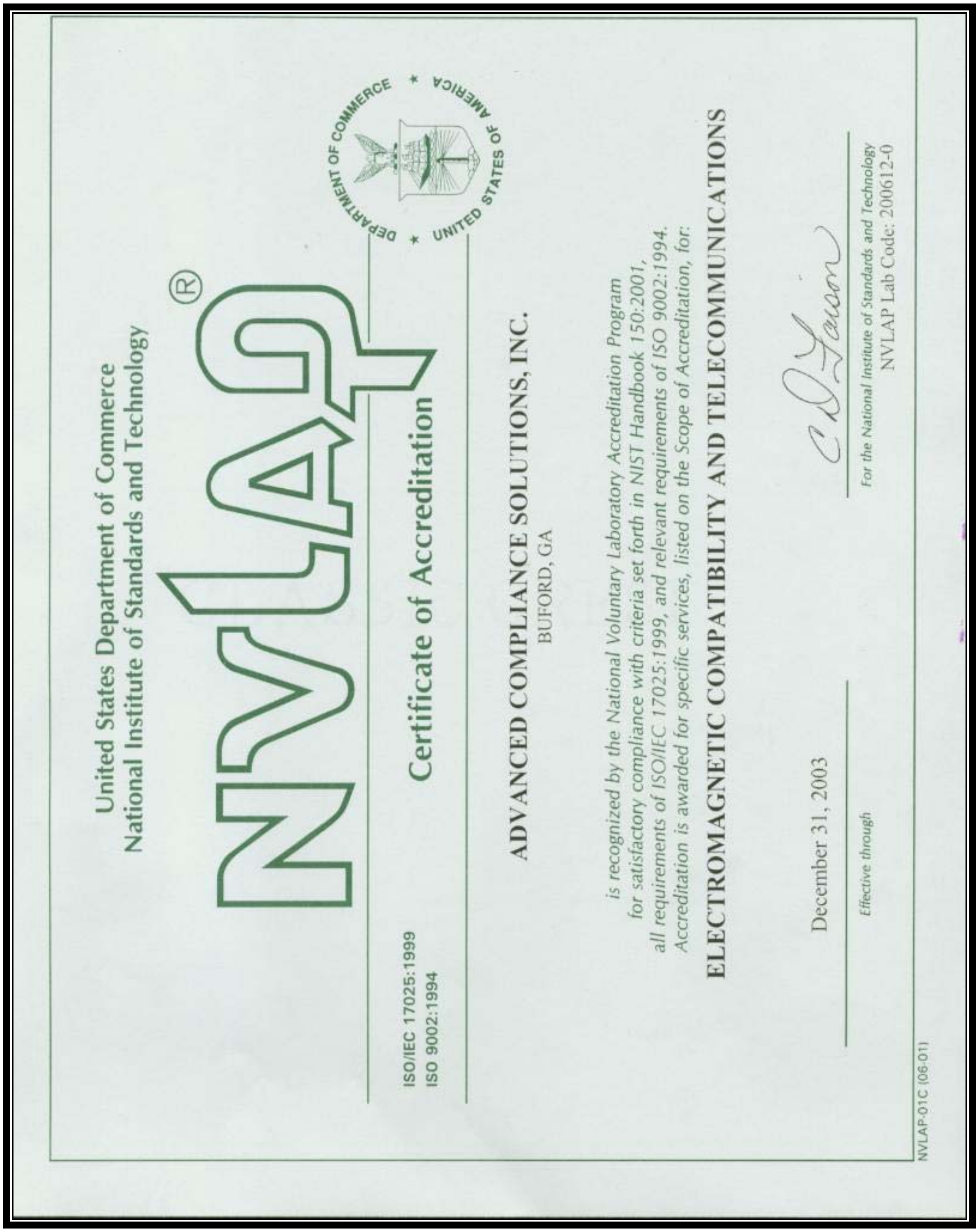
This report contains 10 pages

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612



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ADVANCED COMPLIANCE SOLUTIONS, INC.
BUFORD, GA

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ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

December 31, 2003
Effective through

For the National Institute of Standards and Technology
NVLAP Lab Code: 200612-0

NVLAP-01C (06-01)

Table of Contents

1.0 GENERAL

1.1 Introduction

The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

1.2.1 General

The Equipment Under Test(EUT) is the Model RF900-v2. The EUT is offered in two variants that are identified as the Wall Mounted Meter Interface Unit (MIU) and the Pit Mounted MIU. Both variants are electrically identical and differ only in their antennas, mounting scheme and enclosure. The Wall mounted MIU uses an integrated folded dipole antenna and is usually wall mounted. The PIT Mounted MIU is usually mounted in a pit underground and uses a durable external patch antenna that is flush mounted to the surface above the pit.

This class II permissive change report affects the Wall mounted MIU only as the new antenna is an integrated antenna that will not be used with the Pit Mounted MIU.

1.2.2 Intended Use

Wall Mount MIU

The R900 Wall Meter Interface Unit (MIU) is a compact electronic device that collects meter-usage data from an encoder register and transmits the data for collection by the meter reader. The R900 wall MIU provides water utilities with a reliable and economical RF reading solution. Data transmitted by the MIU is received by the Neptune walk-by or drive-by data collection system and stored for downloading at the utility office. The R900 wall MIU is a one-way communication device that transmits data using frequency-hopping spread-spectrum technology to ensure data security and improve meter reading accuracy. The R900 automatically detects the encoder without programming, reducing inventory and installation time. It can be easily mounted to most flat wall surfaces or pipe. The R900 wall MIU can be installed as far as 200 to 500 feet from the encoder register depending on the encoder register's manufacturer and model. The R900 wall MIU is compatible with Neptune ARB® V and ProRead AutoDetect encoder registers as well as Invensys ECR II® encoders. The MIU automatically detects the encoder type and adjusts to read the encoder. Connected to the encoder register by a three-conductor wire, the R900 Wall MIU reads the encoder register automatically, once an hour and transmits that data every four seconds. The MIU is designed to easily upgrade existing probe-based systems that use ARB V, ProRead AutoDetect, or Invensys ECR II encoder registers. The MIU simply connects to the existing three-conductor wire and will reutilize the existing mounting holes.

Pit Mount MIU

The R900 Pit Meter Interface Unit (MIU) is a compact electronic device that collects meter-usage data from an encoder register and transmits the data from the meter pit for collection by the meter reader. The R900 pit MIU provides water utilities with a reliable and economical RF reading solution. It has been specifically engineered to withstand the water meter pit environment. Data transmitted by the MIU is received by the Neptune walk-by or drive-by data collection system and stored for downloading at the utility office. The R900 pit MIU is a one-way communication device that transmits data using frequency-hopping spread-spectrum technology to ensure data security and improve meter reading accuracy. The R900 automatically detects the encoder without programming, reducing inventory and installation time. The antenna is mounted through the industry-standard 1-3/4" lid hole. Its metallic design allows installation in traffic areas. The antenna is coupled to the electronic assembly which goes under the lid. The assembly is fully potted to allow submersion (flooding of pits). The R900 pit MIU is compatible with the ARB® V and ProRead AutoDetect encoder registers as well as Invensys ECR II® encoders. The MIU automatically detects the encoder type and adjusts to read the encoder. Connected to the encoder register by a three-conductor wire, the R900 pit MIU reads the encoder register automatically once an hour and transmits that data every four seconds. The MIU is designed to easily upgrade existing probe-based systems that use ProRead pit receptacles since it can be installed in the existing predrilled 1-3/4" pit lid.

1.2.3 Technical Specifications

Table 1.2.3-1: Specifications

Frequency Band	902-928
Number of Channels	50
Channel Bandwidth	92kHz Nominal
Channel Spacing	N/A
Output power	18dBm nominal

1.2.4 Antennas

1.2.4.1 Previously approved antennas

The Wall mounted MIU was originally approved with a folded dipole antenna. Wauconda manufactures it with a Neptune Technology Group Inc. model number of 12524-00X. The maximum gain is -4dB. This antenna will be soldered to the PCB.

The Pit mounted MIU was originally approved with a patch antenna. Applied Power manufactures it with a Neptune Technology Group Inc. model number of 12527-000. The maximum gain is -5dB. This antenna has an F-type male connector with custom water seal and strain relief bracket.

1.2.4.2 New antenna

The new antenna is a closed loop antenna. The average gain of this antenna is 0dBd or 2.15dBi

2.0 LOCATION OF TEST FACILTY

All testing except for was performed at:

ACS, Inc.
B.U. Bowman Drive
Buford, GA 30518

2.1 DESCRIPTION OF TEST FACILITY

Both the Open Area Test Site(OATS) and Conducted Emissions site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 89450
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612

The open area test site consists of a 40’ x 66’ concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8” holes that are staggered every 3/16”. The individual sheets are placed to overlap each other by 1/4” and are riveted together to provide a continuous seam. Rivets are spaced every 3” in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.
The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane, however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 3.2-1 below:

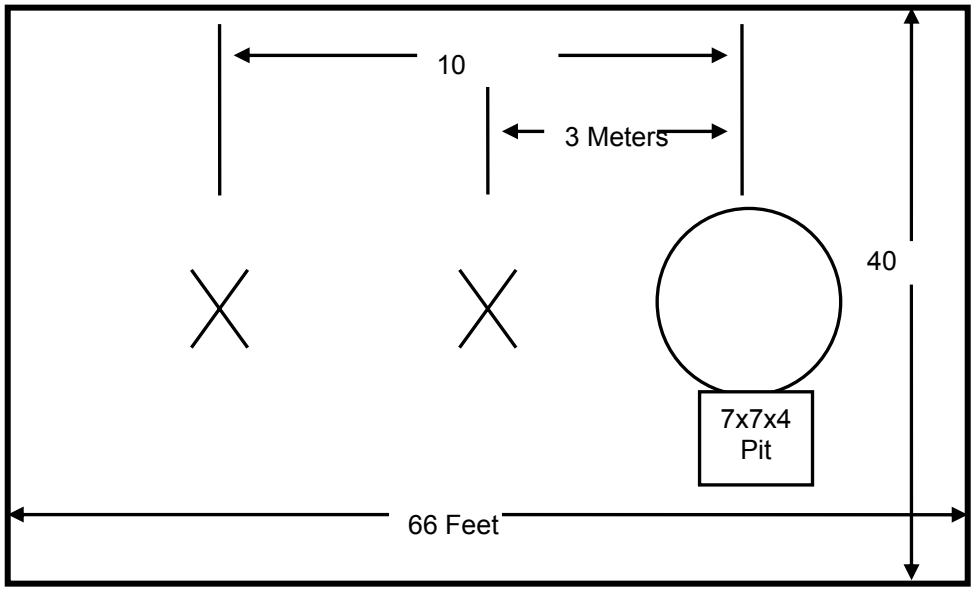

Figure 3.2-1: Open Area Test Site

3.0 APPLICABLE STANDARD REFERENCES
The following standards were used:

1 - ANSI C63.4-1992: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz

2 - US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators (October 2000)

3 - FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS #	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
4	Rohde & Schwarz	Spectrum Analyzer	ESMI	833827/003	8/16/03
3	Rohde & Schwarz	Display Unit	ESDI	839379/011	8/16/03
2	Rohde & Schwarz	Spectrum Analyzer	ESMI	839587/003	12/23/03
1	Rohde & Schwarz	Display Unit	ESDI	839379/011	12/26/03
26	Chase	Bi-Log Antenna	CBL6111	1044	8/26/03
25	Chase	Bi-Log Antenna	CBL6111	1043	9/19/03
71	Chase	LISN	ALN2070A	1028	8/23/03
152	EMCO	LISN	3825/2	9111-1905	12/11/03
153	EMCO	LISN	3825/2	9411-2268	12/11/03
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	9/17/03
16	ACS	Cable	RG8	16	3/1/03
23	ACS	Cable	RG8	23	1/3/04
24	ACS	Cable	Heliax	24	12/30/03
5	ACS	Cable	LL-335	None	7/31/03
6	ACS	Cable	LL-335	None	7/31/03
22	Agilent	Pre-Amplifier	8449B	3008A0052 6	9/21/03
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	9/17/03
105	Microwave Circuits	High Pass Filter	H1G810G1	2123-01 DC0225	6/19/03

5.0 SUPPORT EQUIPMENT

Table 5.0-1: Support Equipment

Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
	EUT Was Self Supporting			

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

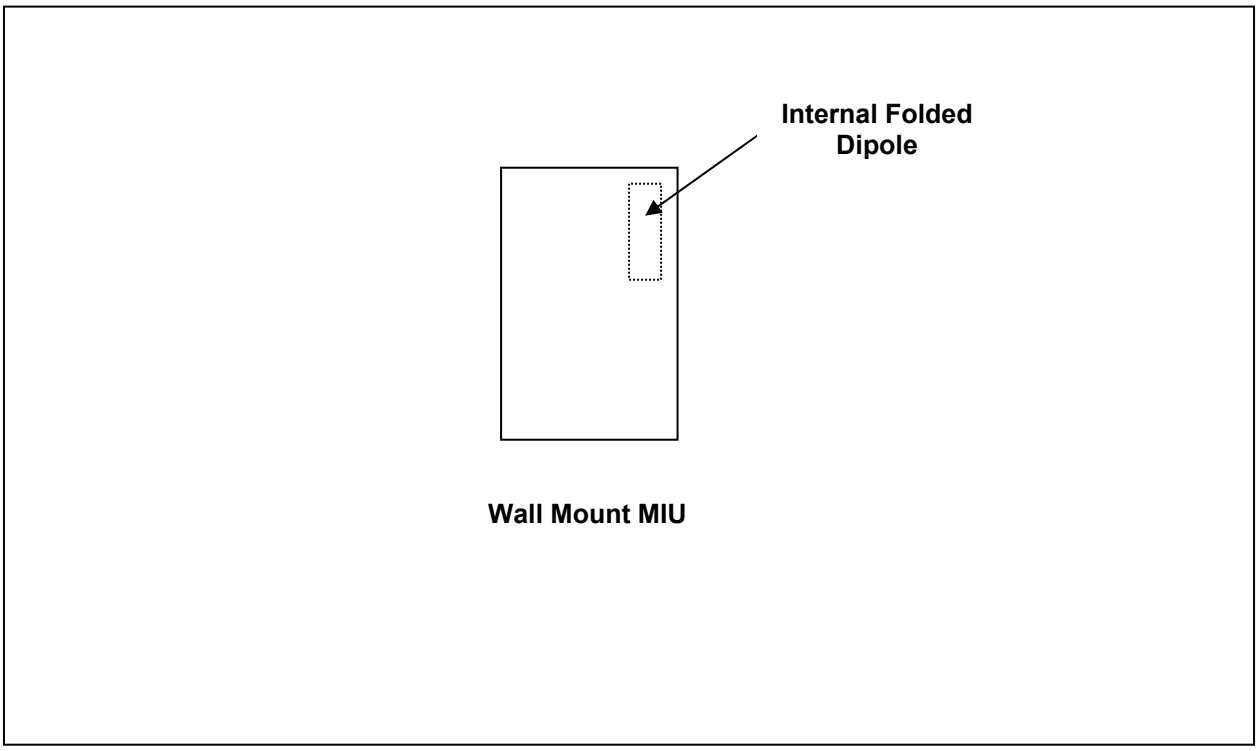

Figure 6-1: EUT Test Setup

7.0 SUMMARY OF TESTS

The change to the EUT, that requires this filing, is the addition of an external antenna. Requirements affected by this change are:

- 15.203 antenna requirement
- 15.205 & 15.209 radiated spurious emissions in the restricted bands
- 15.247(b)(4) RF Exposure requirements

7.1 Antenna Requirement - FCC Section 15.203

The wall unit antenna is integrated and soldered to the board.

7.2 Radiated Spurious Emissions(Restricted Bands) - FCC Section 15.205

7.2.1 Test Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency.

The receive antenna height was varied from 1m to 4m in both horizontal and vertical polarities so that the maximum radiated emissions level would be detected. The spectrum analyzer's resolution bandwidth was set to 1MHz and the video bandwidth set to 10Hz for average measurements.

The EUT was caused to generate a constant carrier on the high, mid and low channels of operation.

7.2.2 Duty Cycle Correction Factor

For average measurements, the measured level was reduced by a factor 23dB to account for the duty cycle of the EUT. The EUT transmits for 7.05mS on a channel and does not return to the same channel for over 500 seconds. Therefore the duty cycle is 7.05%. The duty cycle correction factor is determined using the formula: 20log(.705)=-23dB.

7.2.3 Test Results

Detectable points are reported below in table 7.2.3-1 and 7.2.3-2.

Table 7.2.3-1: Radiated Spurious Emissions – 1 to 5GHz

Frequency (MHz)	Uncorrected Reading (dBµV)	Detector (P/A)	Antenna Polarity (H/V)	Antenna Height (cm)	Total Correction Factor (dB)	Corrected Reading (dBµV)	Limit (dBµV)	Margin (dB)	Results
Low Channel									
2733	46.58	P	H	125	10.93	57.51	74	16.5	**Pass**
2733	35.38	A	V	125	-12.07	23.31	54	30.7	**Pass**
3644	41.2	P	V	125	15.79	56.99	74	17.0	**Pass**
3644	29.8	A	V	125	-7.21	22.59	54	31.4	**Pass**
4555	52.98	P	V	125	18.66	71.64	74	2.40	**Pass**
4555	41.05	A	H	125	-4.34	36.71	54	17.3	**Pass**
Middle Channel									
2745	48.79	P	V	125	10.98	59.77	74	14.2	**Pass**
2745	37.8	A	V	125	-12.02	25.78	54	28.2	**Pass**
3660	40.72	P	V	125	15.88	56.60	74	17.4	**Pass**
3660	27.61	A	H	125	-7.12	20.49	54	33.5	**Pass**
4575	52.32	P	V	100	18.81	71.13	74	2.90	**Pass**
4575	41.35	A	V	100	-4.19	37.16	54	16.8	**Pass**
High Channel									
2757	46.96	P	V	100	11.01	57.97	74	16.0	**Pass**
2757	37.29	A	V	100	-11.99	25.30	54	28.7	**Pass**
3676	40.41	P	H	100	15.94	56.35	74	17.6	**Pass**
3676	27.94	A	H	100	-7.06	20.88	54	33.1	**Pass**
4595	52.93	P	V	100	18.93	71.86	74	2.10	**Pass**
4595	43.66	A	V	100	-4.07	39.59	54	14.4	**Pass**

Table 7.2.3-2: Radiated Spurious Emissions – 5 to 10GHz

Frequency (MHz)	Level (dBuV)	Detector (P/A)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV)	Limit (dBuV)	Margin (dB)	Final Result (Pass/Fail)
Low Channel								
7289	50.01	p	H	14.25	64.26	74.00	9.74	**PASS**
7288	39.47	a	H	14.25	30.72	54.00	23.28	**PASS**
8200	51.96	p	V	13.40	65.36	74.00	8.64	**PASS**
8200	39.04	a	V	13.40	29.44	54.00	24.56	**PASS**
9110	47.72	p	V	15.34	63.06	74.00	10.94	**PASS**
9110	35.13	a	V	15.34	27.47	54.00	26.53	**PASS**
Middle Channel								
7321	45.74	p	H	14.25	59.99	74.00	14.01	**PASS**
7321	33.58	a	H	14.25	24.83	54.00	29.17	**PASS**
8236	46.53	p	V	13.40	59.93	74.00	14.07	**PASS**
8236	34.87	a	V	13.40	25.27	54.00	28.73	**PASS**
9151	45.77	p	V	15.34	61.11	74.00	12.89	**PASS**
9151	34.06	a	V	15.34	26.40	54.00	27.60	**PASS**
High Channel								
7353	45.72	p	H	14.25	59.97	74.00	14.03	**PASS**
7353	32.99	a	H	14.25	24.24	54.00	29.76	**PASS**
8272	48.31	p	V	13.40	61.71	74.00	12.29	**PASS**
8272	37.18	a	V	13.40	27.58	54.00	26.42	**PASS**
9191	45.56	p	V	15.34	60.90	74.00	13.10	**PASS**
9191	34.01	a	V	15.34	26.35	54.00	27.65	**PASS**

Correction Factors = Antenna Factor + Cable Attenuation – Amplifier Gain – Duty Cycle Correction(For average measurements only)
Margin = Limit – Corrected Level

8.0 RF EXPOSURE SECTION 15.247(b)(4)

See appendix D of this filing for MPE Calculations

9.0 CONCLUSION

In the opinion of ACS, Inc. the R900-v2 frequency hopping spread spectrum module, manufactured by Neptune Technology Group, Inc., Inc. continues to meet the requirements of FCC Part 15 subpart C with the new antenna as described in this filing.