Excellence in Compliance Testing

Certification Test Report

Low Power Unlicensed Transmitter

FCC ID: P2SNTGECDR900D
IC: 4171B-ECDR900Z

FCC Rule Part: 15.249
IC Radio Standards Specification: RSS-210

ACS Report Number: 07-0481 - 15C - DXX

Manufacturer: Neptune Technology Group, Inc.
Model: E-Coder)R900i

Test Begin Date: November 19, 2007
Test End Date: November 20, 2007

Report Issue Date: January 9, 2008

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

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This report contains 14 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product Description

1.2.1 General

The E-Coder)R900i is combination encoder register and transmitter which collects meter-usage data and transmits the data for collection by the meter reader. The E-Coder)R900i provides water utilities with a reliable and economical RF reading solution. Data transmitted by the E-Coder)R900i is received by the Neptune walk-by or drive-by data collection system and stored for downloading at the utility office. The E-Coder)R900i 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 E-Coder)R900i also communicates using a single channel data logging mode.

Manufacturer Information:
Neptune Technology Group, Inc.
1600 Alabama Highway 229
Tallassee, AL 36078

Test Sample Condition:
The EUT sample was received in working order with no visible defects.

Detailed photographs of the EUT are filed separately with this filing.

1.2.2 Intended Use

The E-Coder)R900i's intended use is to transmit meter-usage data for collection by water utility companies.

1.3 Test Methodology and Considerations

The device uses two modes of operations. There is a frequency hopping mode and a single channel data log mode. The frequency hopping mode is compliant to FCC 15.247 and is covered under a separate test report. This report covers the signal channel data mode under 15.249 only.

The E-Coder)R900i utilizes 3 antennas for different installation configurations. The installation configurations consist of a basement and below ground pit configuration. The basement transmitter antenna type is a monopole Wire Inside Antenna (Neptune Technology Group, Inc. model number 12641-001) which is sealed inside the enclosure. The PIT transmitter is designed for an external antenna. There are two antenna types. One is a patch antenna (Lid Mount Pit Antenna (Neptune Technology Group, Inc. model number 12527-200)). The second is a Slip On Pit Antenna (Neptune Technology Group, Inc. model number 12690-001). It is a monopole antenna. Both antennas connect to the transmitter with the same custom sealed structure with an F-type male connector. All antenna types where evaluated and data presented in this report.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, 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: 894540
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: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' 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.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit 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.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

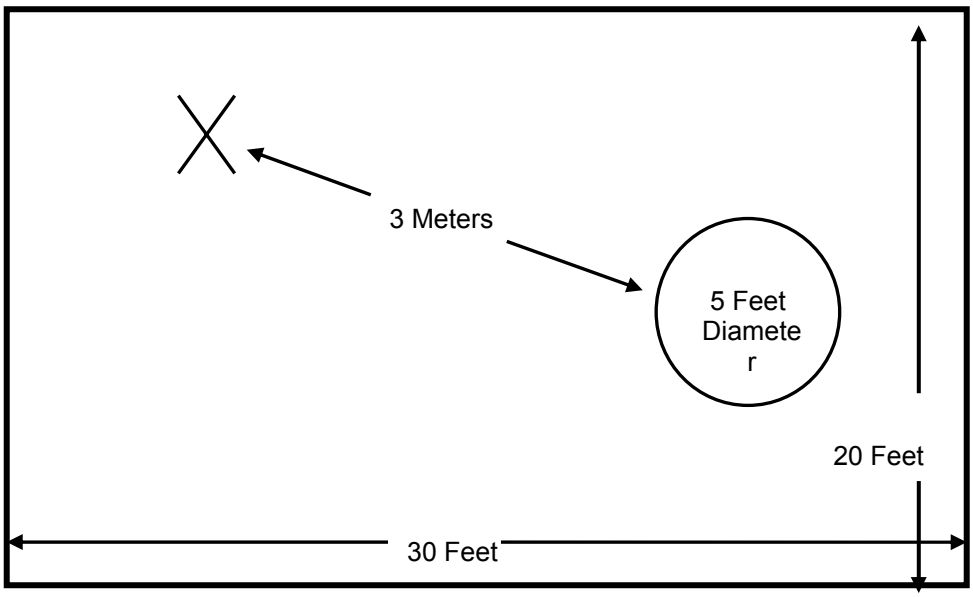

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

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 2.3-2 below:

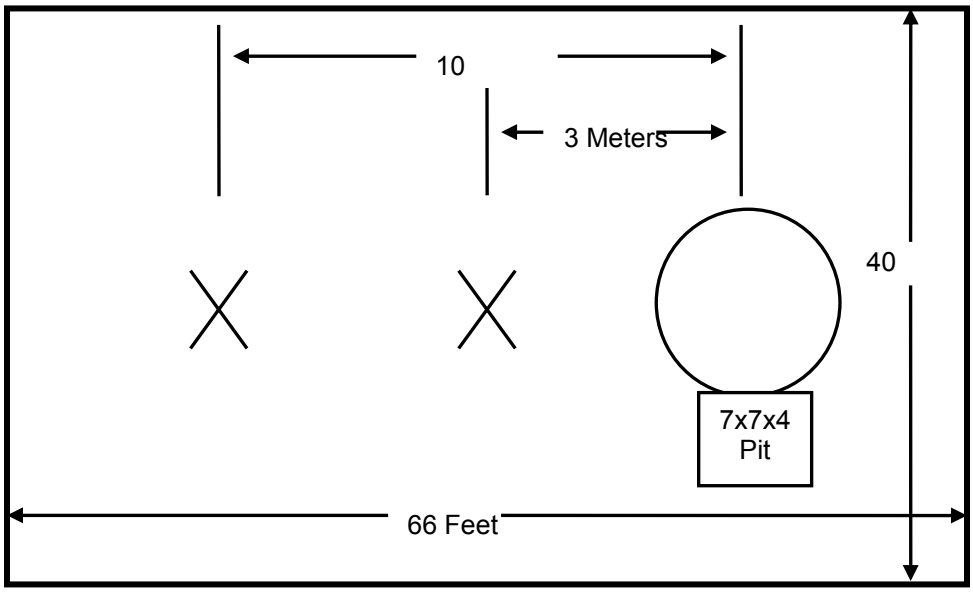

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

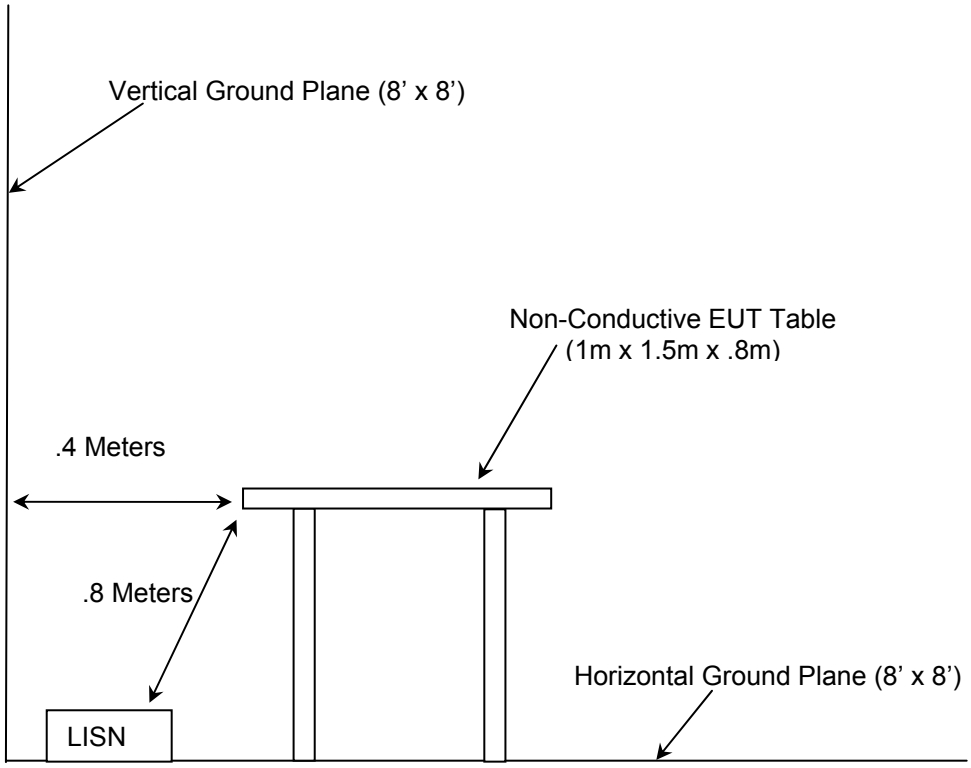

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2006
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, 2001
- FCC KDB Publication No. 558074 - Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), March 2005
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 7 June 2007

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**
22	Agilent	Amplifiers	8449B	3008A00526	04-10-2008
25	Chase	Antennas	CBL6111	1043	06-06-2008
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-10-2008
193	ACS	Cable Set	OATS cable Set	193	02-16-2008
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	11-09-2008
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	05-15-2008
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	07-17-2008
337	Microwave Circuits	Filters	H1G513G1	282706	08-28-2008
343	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	N/A	12-21-2007
344	Florida RF Cables	Cables	SMS-290AW-480.0-SMR	N/A	12-21-2007

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
EUT Was Stand-Alone and Self Supporting				

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

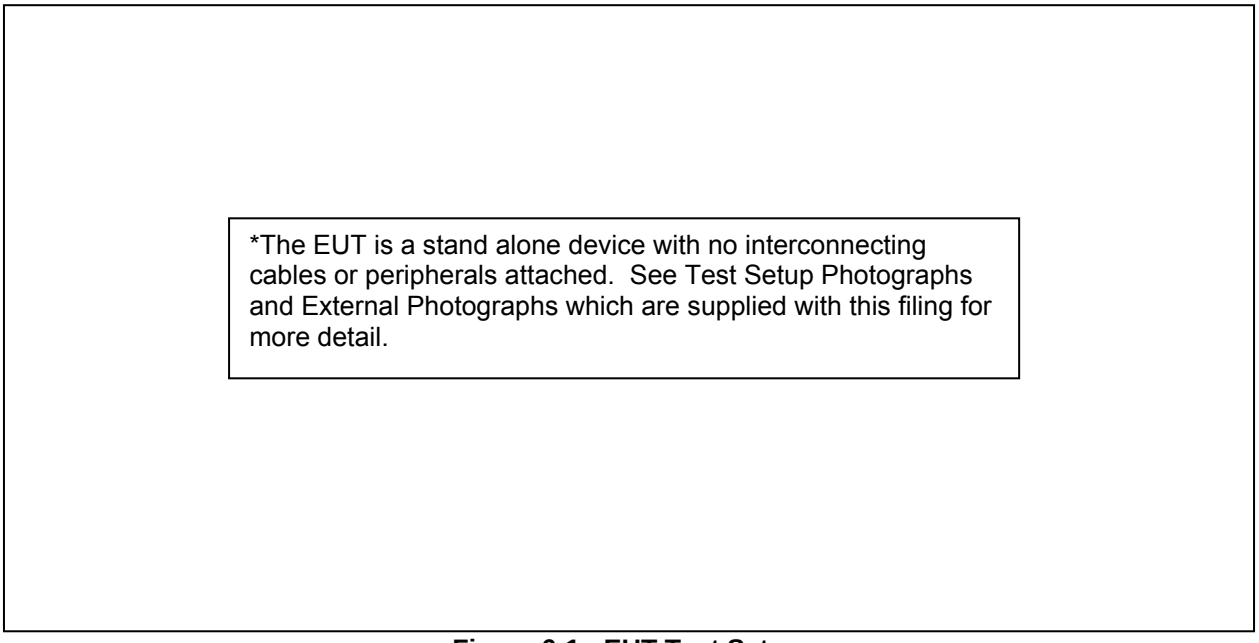

Figure 6-1: EUT Test Setup

*See Test Setup photographs for additional detail.

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement - FCC Section 15.203

The EUT is professionally installed.

7.2 Power Line Conducted Emissions

The EUT is powered by an internal battery and is therefore not designed to be connected to the public utility (AC) power line. No Power line conducted emissions testing was performed.

7.3 Radiated Emissions - (Unintentional Radiation)

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 5000 MHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz a Quasi-peak detector was enabled and measurements were taken with the Spectrum Analyzer's resolution bandwidth set to 120 KHz. For frequencies above 1000MHz, average measurements were made using an RBW of 1 MHz and a VBW of 10 Hz and peak measurements were made with RBW of 1 MHz and a VBW of 1 MHz.

7.3.2 Test Results

Results of the test are given in Table 7.3.2-1 below:

Table 7.3.2-1 – Radiated Emissions (Unintentional)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
31.07	---------	21.63	H	-7.24	---------	14.40	--------	40.0	---------	25.61
42.93	---------	21.25	H	-13.07	---------	8.19	--------	40.0	---------	31.82
81.73	---------	21.58	V	-17.78	---------	3.80	--------	40.0	---------	36.20
112.98	---------	21.81	V	-13.42	---------	8.39	--------	43.5	---------	35.11
135.62	---------	21.40	V	-12.81	---------	8.59	--------	43.5	---------	34.91
206.75	---------	21.81	V	-14.27	---------	7.54	--------	43.5	---------	35.96
346.86	---------	22.22	H	-9.19	---------	13.03	--------	46.0	---------	32.97
494.52	---------	22.98	H	-5.66	---------	17.32	--------	46.0	---------	28.68
690.67	---------	22.09	V	-1.60	---------	20.49	--------	46.0	---------	25.51
959.04	---------	22.12	V	3.26	---------	25.38	--------	46.0	---------	20.62

* Note: All emissions above 959.04MHz were not detected above the noise floor of the measurement equipment and therefore attenuated below the permissible limit.

7.4 20dB & 99% Bandwidth

7.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated 20 dB bandwidth of the emission. The RBW was to ≥ 1% of the estimated 20 dB bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

7.4.2 Test Results

The 20dB bandwidth was determined to be 105 kHz. The frequency band designated under Part 15.249 is 902 to 928 MHz, therefore the 20dB bandwidth is contained within the frequency band designated under this rule part. Results are shown below in Table 7.4.2-1 and Figures 7.4.2-1 through 7.4.2-2.

Table 7.4.2-1 - Bandwidth

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
914	105	159.5

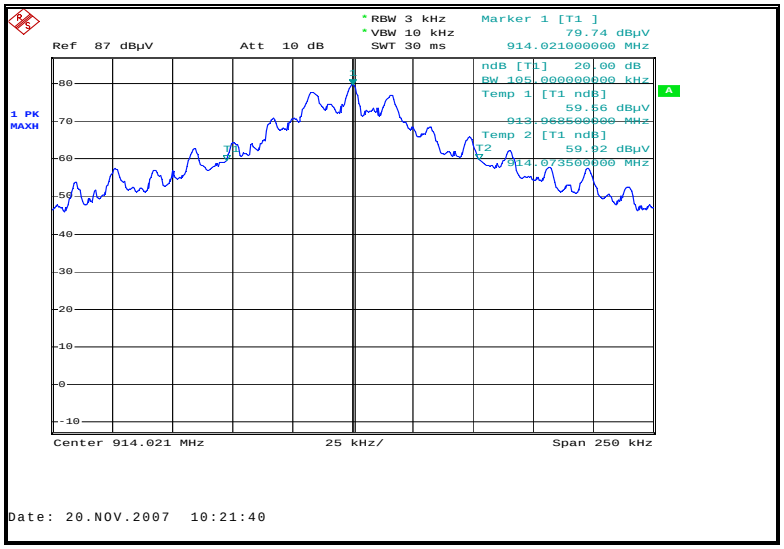

Figure 7.4.2-1: 20dB Bandwidth

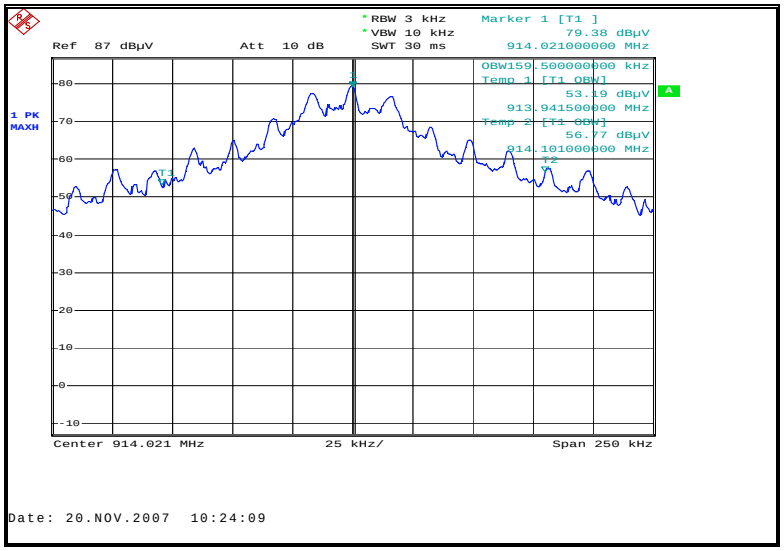

Figure 7.4.2-2: 99% Bandwidth

7.5 Fundamental Field Strength

7.5.1 Test Methodology

Radiated emissions tests were made on the single 914 MHz channel for all antenna types.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz.

7.5.2 Test Results

Results are shown below in tables 7.5.2-1 through 7.5.2-3 below:

Table 7.5.2-1: Fundamental Field Strength – Basement Wire Antenna (model number 12641-001)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
914	---------	50.73	H	28.54	---------	79.27	--------	94.0	---------	14.71
914	---------	55.13	V	27.92	---------	83.05	--------	94.0	---------	10.93

Table 7.5.2-2: Fundamental Field Strength – Pit Patch Antenna (model number 12527-200)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
914	---------	49.52	H	28.54	---------	78.06	--------	94.0	---------	15.92
914	---------	50.28	V	27.92	---------	78.20	--------	94.0	---------	15.78

Table 7.5.2-3: Fundamental Field Strength – Pit Monopole Antenna (model number 12690-001)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
914	---------	45.83	H	28.54	---------	74.37	--------	94.0	---------	19.61
914	---------	50.10	V	27.92	---------	78.02	--------	94.0	---------	15.96

7.6 Band-Edge Compliance and Spurious Emissions

7.6.1 Band-Edge Compliance

7.6.1.1 Test Methodology

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

The EUT was investigated to determine band-edge compliance. Band-edge compliance for the upper band-edge was determined using the radiated mark-delta method as outlined in FCC DA 00-705. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions as compared to the emission limits of 15.209.

Based on figure 7.6.1.1-1 below, the emission limit at the lower band-edge is equivalent to the upper band-edge.

7.6.1.2 Test Results

Band-edge compliance is displayed in Tables 7.6.1.2-1 and Figure 7.6.1.2-1.

Table 7.6.1.2-1: Upper Band-edge Marker Delta Method

Frequency (MHz)	Level (dBuV)	Antenna Polarity (H/V)	Correction Factors (dB)	Fundamental Field Strength (dBuV/m)	Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)	Band-edge Margin to Limit (dBuV/m)
Fundamental Frequency							
914	55.13	V	27.92	83.05	53.85	29.20	16.80

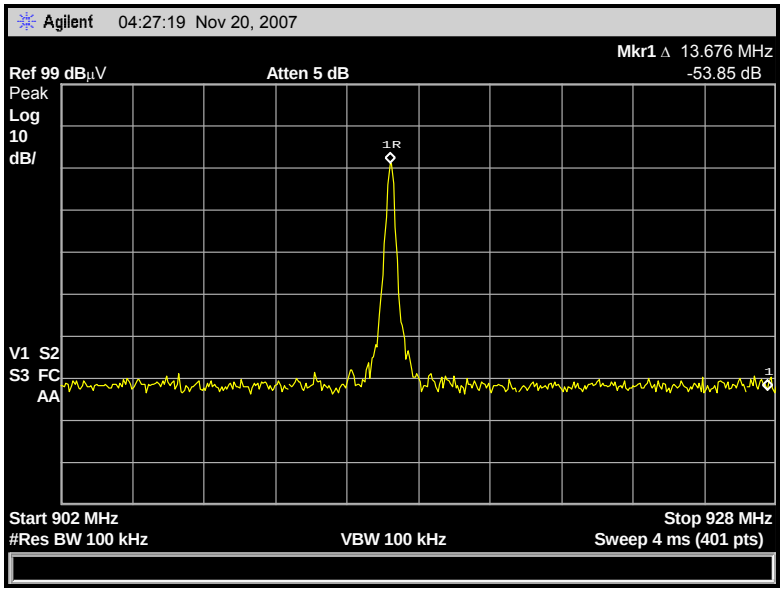

Figure 7.6.1.2-1 Upper Band-edge – Marker Delta

7.6.2 Radiated Spurious Emissions

7.6.2.1 Test Methodology

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

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, average measurements were made using an RBW of 1 MHz and a VBW of 10 Hz and peak measurements were made with RBW of 1 MHz and a VBW of 1 MHz.

7.6.2.2 Test Results

Results are shown below in Table 7.6.2.2-1 to 7.6.2.2-3. Emissions not reported were below the noise floor of the measurement system.

Table 7.6.2.2-1 - Radiated Spurious Emissions – Basement Antenna (model number 12641-001)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
1828	52.32	48.67	H	-3.62	48.70	45.05	74.0	54.0	25.30	8.95
1828	48.34	42.26	V	-3.61	44.73	38.65	74.0	54.0	29.27	15.35
2742	45.34	35.26	H	-0.03	45.31	35.23	74.0	54.0	28.69	18.77
2742	46.92	38.32	V	-0.28	46.64	38.04	74.0	54.0	27.36	15.96
3656	48.43	37.13	H	2.98	51.41	40.11	74.0	54.0	22.59	13.89
3656	48.17	36.55	V	3.01	51.18	39.56	74.0	54.0	22.82	14.44

Table 7.6.2.2-2 - Radiated Spurious Emissions – Pit Patch Antenna (model number 12527-200)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
1828	47.95	38.98	H	-3.62	44.33	35.36	74.0	54.0	29.67	18.64
1828	50.40	44.83	V	-3.61	46.79	41.22	74.0	54.0	27.21	12.78
2742	46.13	35.59	H	-0.03	46.10	35.56	74.0	54.0	27.90	18.44
2742	46.09	35.18	V	-0.28	45.81	34.90	74.0	54.0	28.19	19.10
3656	48.11	35.22	V	3.01	51.12	38.23	74.0	54.0	22.88	15.77

Table 7.6.2.2-3 - Radiated Spurious Emissions – Pit Monopole Antenna (model number 12690-001)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
1828	54.43	47.71	H	-3.62	50.81	44.09	74.0	54.0	23.19	9.91
1828	50.65	45.43	V	-3.61	47.04	41.82	74.0	54.0	26.96	12.18
2742	48.33	37.51	H	-0.03	48.30	37.48	74.0	54.0	25.70	16.52
2742	46.15	35.77	V	-0.28	45.87	35.49	74.0	54.0	28.13	18.51
3656	47.34	37.72	H	2.98	50.32	40.70	74.0	54.0	23.68	13.30
3656	48.68	35.47	V	3.01	51.69	38.48	74.0	54.0	22.31	15.52

7.6.2.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation

PEAK:
Corrected Level: 52.32 - 3.62 = 48.70dBuV
Margin: 74dBuV – 48.70dBuV = 25.30dB

AVERAGE:
Corrected Level: 38.98 - 3.62 = 45.05dBuV
Margin: 54dBuV – 45.05dBuV = 8.95dB

8.0 CONCLUSION

In the opinion of ACS, Inc. the E-Coder)R900i manufactured by Neptune Technology Group, Inc. meets the requirements of FCC Part 15 subpart C.

END REPORT