Excellence in Compliance Testing

Certification Test Report

Frequency Hopping Spread Spectrum Transmitter

Test Report

FCC ID: P2SNTGECDR900D
IC: 4171B-ECDR900Z

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

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

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

Test Begin Date: February 16, 2005
Test End Date: February 21, 2005
and
Test Begin Date: August 19, 2005
Test End Date: August 19, 2005

Report Issue Date: January 28, 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 21 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.

1.2.1 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 this test report. A seperate report covers the signal channel data mode under 15.249.

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 type 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:

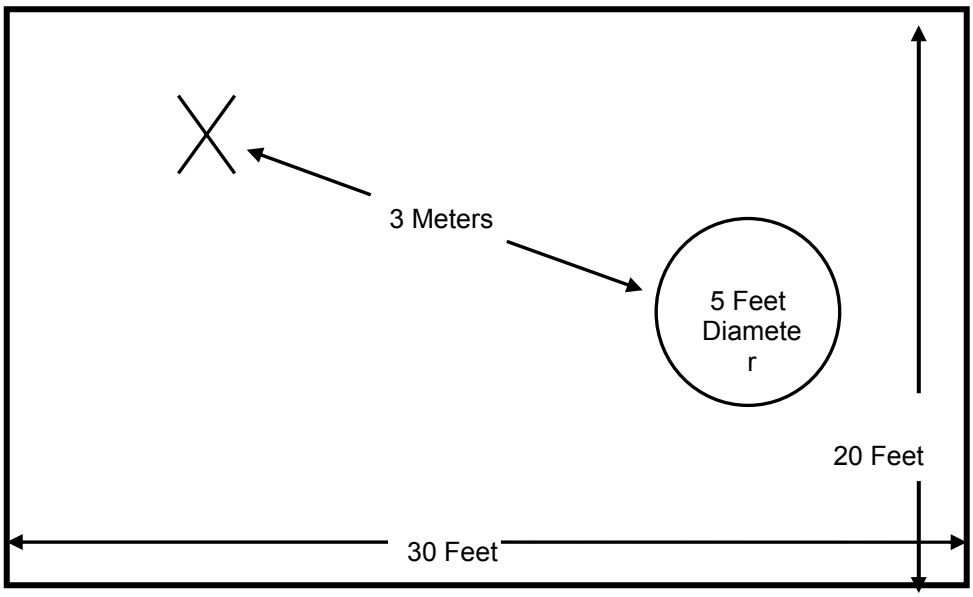

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

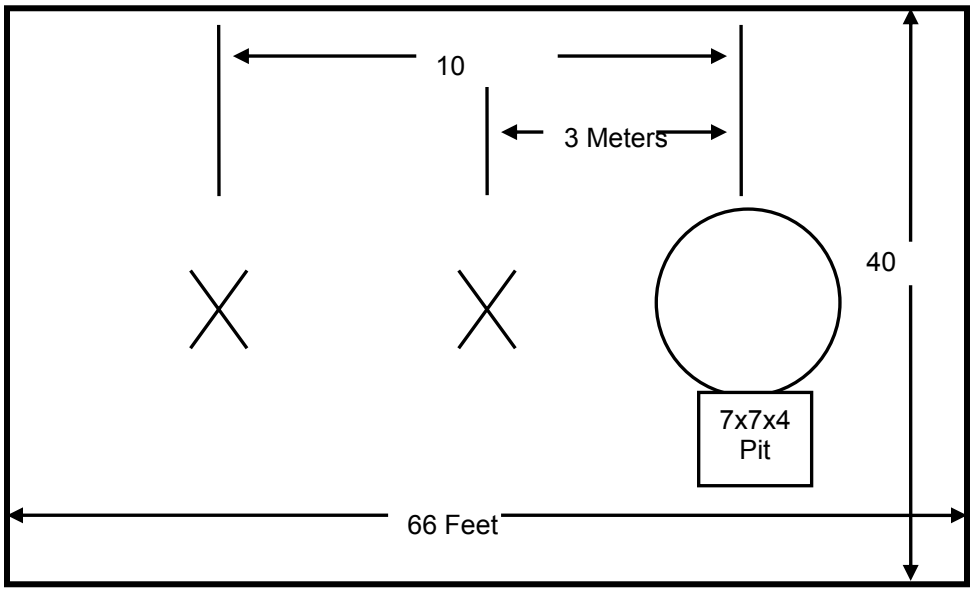

Figure 2.3-2: Open Area Test Site

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:

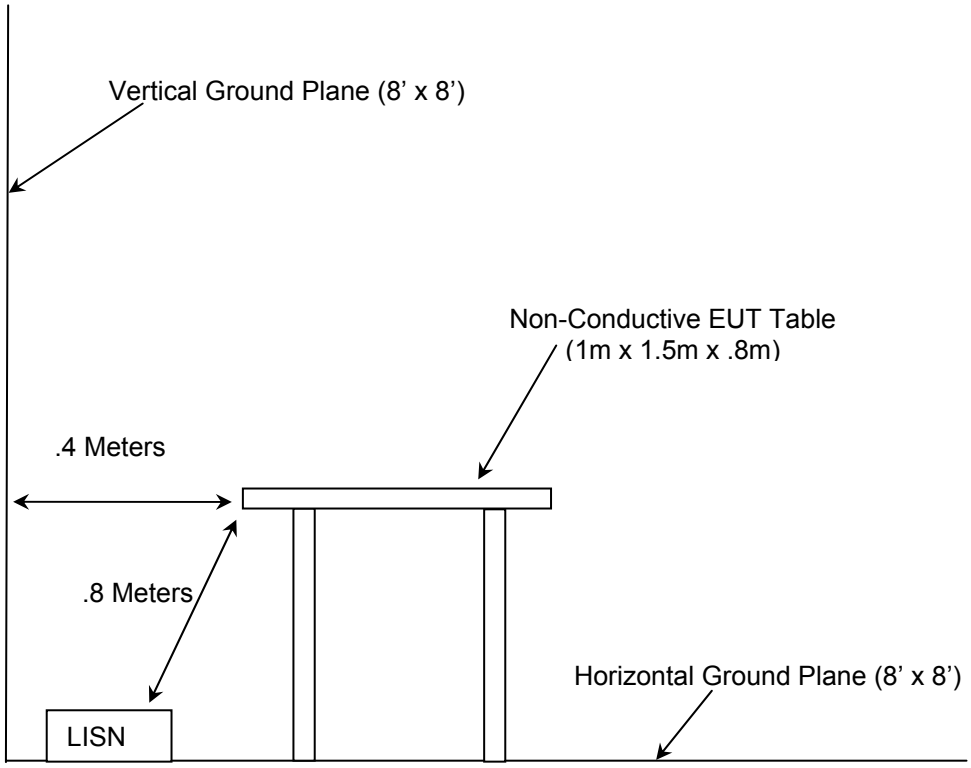

Figure 2.4-1: AC Mains Conducted EMI Site

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, 2007
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2007
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, 2001
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- 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 – Testing for February 16, 2005 to February 21, 2005

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
26	Chase	Bi-Log Antenna	CBL6111	1044	10/05/05
152	EMCO	LISN	3825/2	9111-1905	01/18/06
153	EMCO	LISN	3825/2	9411-2268	12/20/05
193	ACS	OATS Cable Set	RG8	193	01/07/06
225	Andrew	OATS RF cable	Heliax	225	01/06/06
165	ACS	Conducted EMI Cable Set	RG8	165	01/06/06
22	Agilent	Pre-Amplifier	8449B	3008A00526	05/12/05
73	Agilent	Pre-Amplifier	8447D	272A05624	04/30/05
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	05/08/05
105	Microwave Circuits	High Pass Filter	H1G810G1	2123-01 DC0225	06/09/05
209	Microwave Circuits	High Pass Filters	H3G020G2	4382-01 DC0421	06/09/05
1	Rohde & Schwarz	Receiver	804.8932.52	833771/007	02/26/05
2	Rohde & Schwarz	Receiver	1032.5640.53	839587/003	02/26/05
3	Rohde & Schwarz	ESMI Receiver	804.8932.52	839379/011	12/15/05
4	Rohde & Schwarz	ESMI Receiver	1032.5640.53	833827/003	12/15/05
213	Test Equipment Corp.	Pre-Amplifier	PA-102	44927	06/28/05
211	Eagle	Band Reject Filter	C7RFM3NFNM	n/a	06/28/05
168	Hewlett Packard	Pulse Limiter	11947A	3107A02268	04/30/05
93	Chase	EM Clamp	CIC 8101	65	01/06/06
204	ACS	Cable	RG8	204	12/29/05
169	Solar Electronics	LISN	9117-5-TS-50-N	031032	04/12/05
6	Harbour Industries	HF RF Cable	LL-335	00006	03/15/05
7	Harbour Industries	HF RF Cable	LL-335	00007	03/15/05
208	n/a	HF RF Cable	n/a	00208	06/14/05
167	ACS	Chamber EMI Cable Set	RG6	167	12/29/05
204	ACS	Chamber EMI RF cable	RG8	204	01/07/06

Table 4-2: Test Equipment – Testing for August 19, 2005 to August 19, 2005

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
26	Chase	Bi-Log Antenna	CBL6111	1044	10/15/05
193	ACS	OATS Cable Set	RG8	193	01/07/06
22	Agilent	Pre-Amplifier	8449B	3008A00526	05/06/06
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	05/09/06
209	Microwave Circuits	High Pass Filters	H3G020G2	4382-01 DC0421	06/09/06
3	Rohde & Schwarz	Receiver Display	804.8932.52	839379/011	12/15/05
4	Rohde & Schwarz	ESMI Receiver	1032.5640.53	833827/003	12/15/05
---	Agilent	Spectrum Analyzer	E7402A	US41110277	11/10/05
6	Harbour Industries	HF RF Cable	LL-335	00006	03/16/06
7	Harbour Industries	HF RF Cable	LL-335	00007	03/16/06
208	Harbour Industries	HF RF Cable	LL142	00208	60/24/06

5.0 SUPPORT EQUIPMENT

Table 5-3: 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

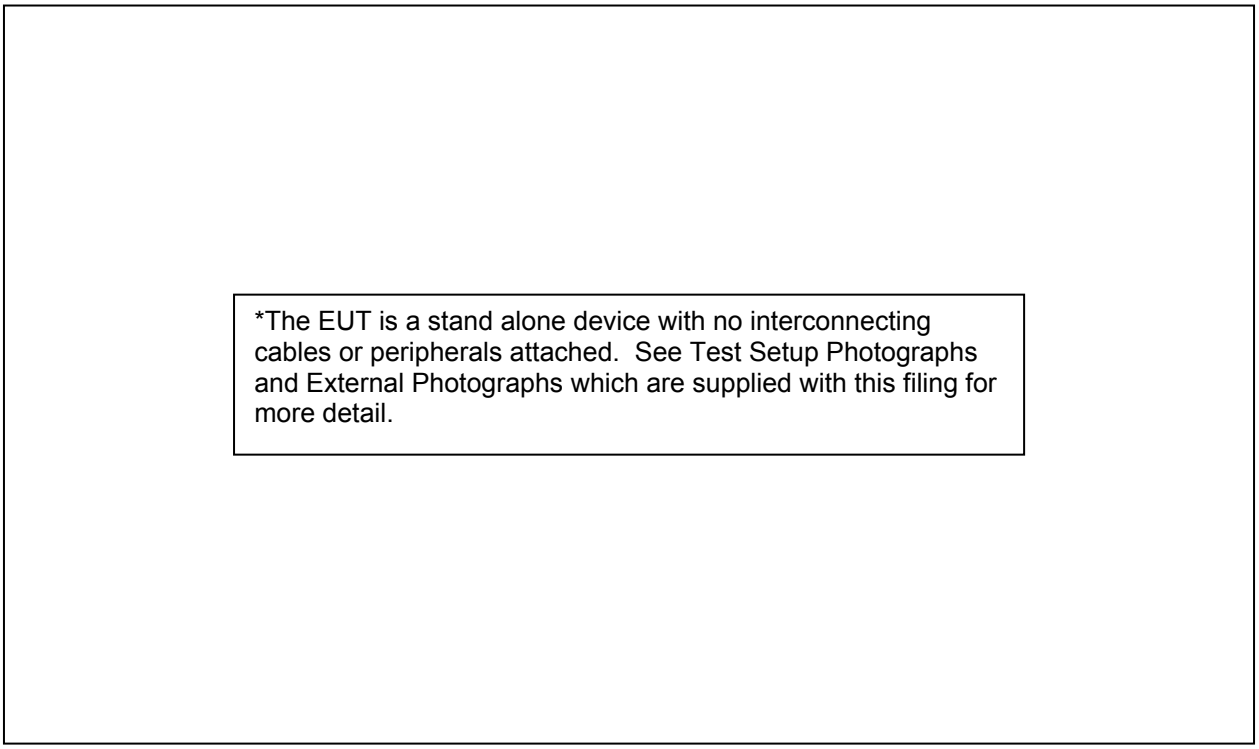

Figure 6-1: EUT Test Setup

*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

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 10GHz. 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. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz for measurements above 30MHz. Average measurements are taken with the RBW and VBW were set to 1MHz and 10 Hz respectively for measurements above 1000MHz.

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 Tabulated Data

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 959.04 MHz were attenuated below the permissible limit.

7.4 Peak Output Power

7.4.1 Test Methodology

Antenna conducted measurements could not be performed on this device, therefore radiated tests were performed to show compliance with the peak output power limit according to the alternative test methods in the FCC publication DA 00-705.

The procedures set forth in ANSI C63.4 were followed with respect to maximizing the peak emission. The resolution bandwidth of the spectrum analyzer was set to 1 MHz which was greater the 20 dB bandwidth measured in section 7.5.4. The video bandwidth was set to 3 MHz and a peak detector using the Max Hold function was utilized.

The power was calculated using the following equation:

$$P = (E * d)^2 / 30 * G$$

Where: G = Numeric Gain of the transmitting antenna with reference to an isotropic radiator
d = The distance in meters from which the field strength was measured
E = The measured maximum fundamental field strength in V/m

All antenna types were evaluated and the worst case data presented below. The results below represent the monopole Wire Inside Antenna (Neptune Technology Group, Inc. model number 12641-001).

7.4.2 Test Results

Results are shown below in tables 7.4.2-1 and 7.4.2-2 below:

Table 7.4.2-1: Fundamental Field Strength

Frequency (MHz)	Uncorrected Reading (dBµV/m)	Antenna Polarity (H/V)	Total Correction Factor (dB)	Corrected Reading (dBµV/m)
911.0815	117.56	V	1.04	118.60
915.2758	117.25	V	1.25	118.50
919.0779	116.24	V	1.44	117.68

Table 7.4.2-2: Peak Output Power

Channel	Frequency (MHz)	Numeric Gain	Distance (m)	Max. Fund. Field Strength (V/m)	Output Power (dBm)
Low	911.0815	1	3	0.85	23.37
Mid	915.2758	1	3	0.84	23.27
High	919.0779	1	3	0.77	22.45

7.5 Channel Usage Requirements

7.5.1 Carrier Frequency Separation

7.5.1.1 Test Methodology

The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to ≥ 1% of the span.

7.5.1.2 Test Results

The maximum 20dB bandwidth of the hopping channel was measured to be 92.8 kHz (See figure 7.5.4-1 to 7.5.4-3 below). The adjacent channel separation was measured to be 131.6 kHz. Results are shown in figure 7.5.1-1 below:

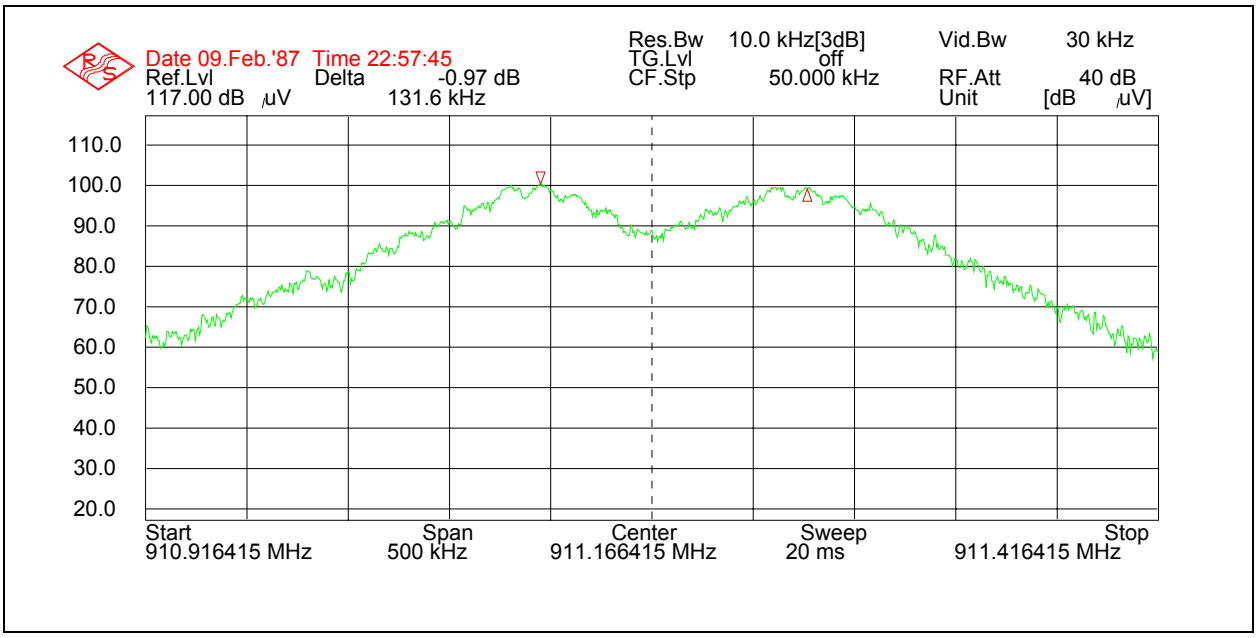

Figure 7.5.1-1: Carrier Frequency Separation

7.5.2 Number of Hopping Channels

The 20dB bandwidth of the device is less than 250 kHz. The device employs 50 hopping channels as required. Results are shown in Figure 7.5.2-1 below:

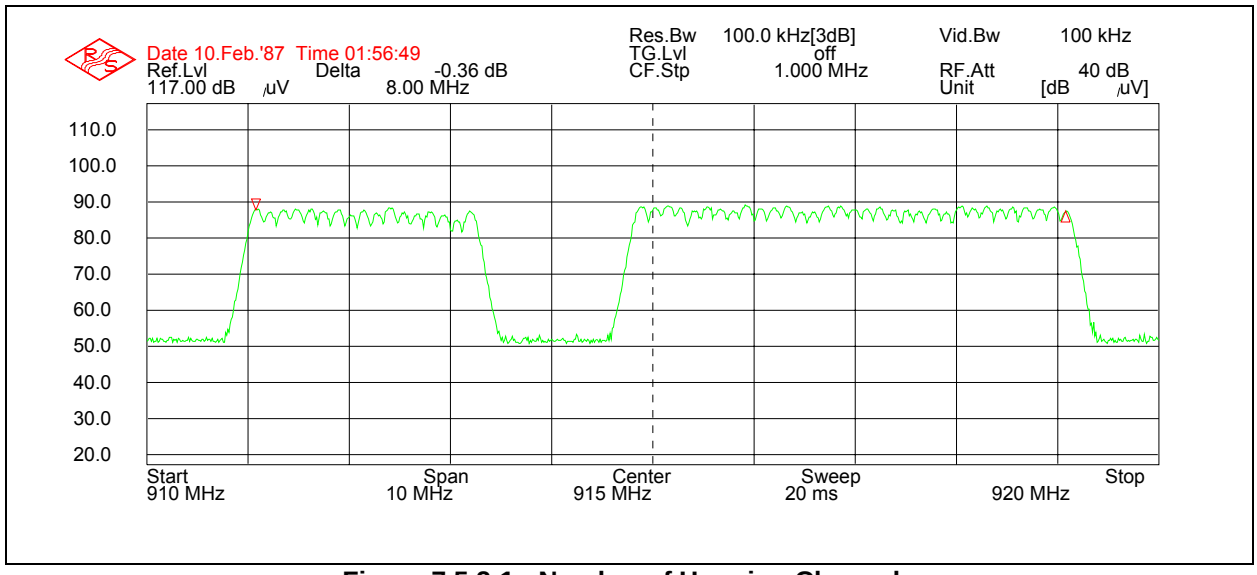

Figure 7.5.2-1: Number of Hopping Channels

7.5.3 Channel Dwell Time

7.5.3.1 Test Methodology

The emission measured centered on the analyzer and the span set to 0 Hz. The RBW was set to 1 MHz and the VBW to 1 MHz. Sweep time was set to 20 ms to capture the burst duration of the emission. The marker – delta function of the analyzer was employed to measure the burst duration.

7.5.3.2 Test Results

The duration of the RF transmission is 7.04 ms. There is a minimum 10 second rest period in which the device hops to another channel according to the pseudorandom frequency table before transmitting another 7.04 ms burst. Therefore the average time of occupancy on any channel in a 20 second period is 7.04 ms. A single transmission is shown in figure 7.5.3-1 below:

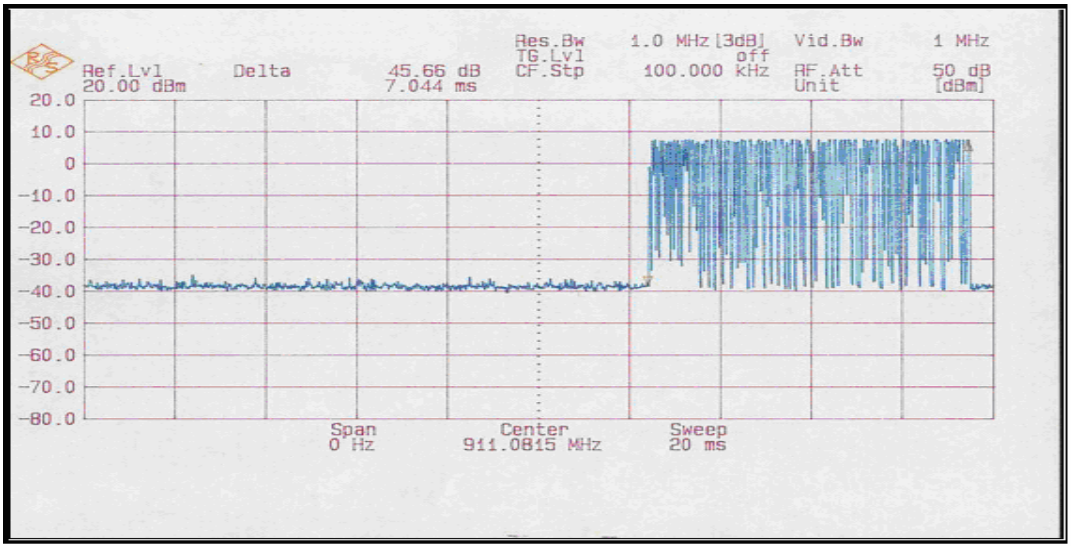

Figure 7.5.3-1: Channel Dwell Time

7.5.4 20dB Bandwidth

7.5.4.1 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. The span and RBW were examined and re-adjusted if necessary to meet the requirements of 2 to 3 times the 20 bandwidth for the span and ≥ 1% of the 20 dB bandwidth for the RBW.

7.5.4.2 Test Results

The maximum 20dB bandwidth was found to be approximately 92.8 kHz. Results are shown below in Table 7.5.4-1 and Figures 7.5.4-1 through 7.5.4-3.

Table 7.5.4-1: 20dB Bandwidth

Channel	Frequency	20dB Bandwidth
Low	911.0815	92.8 kHz
Mid	915.2758	89.7 kHz
High	919.0779	92.8 kHz

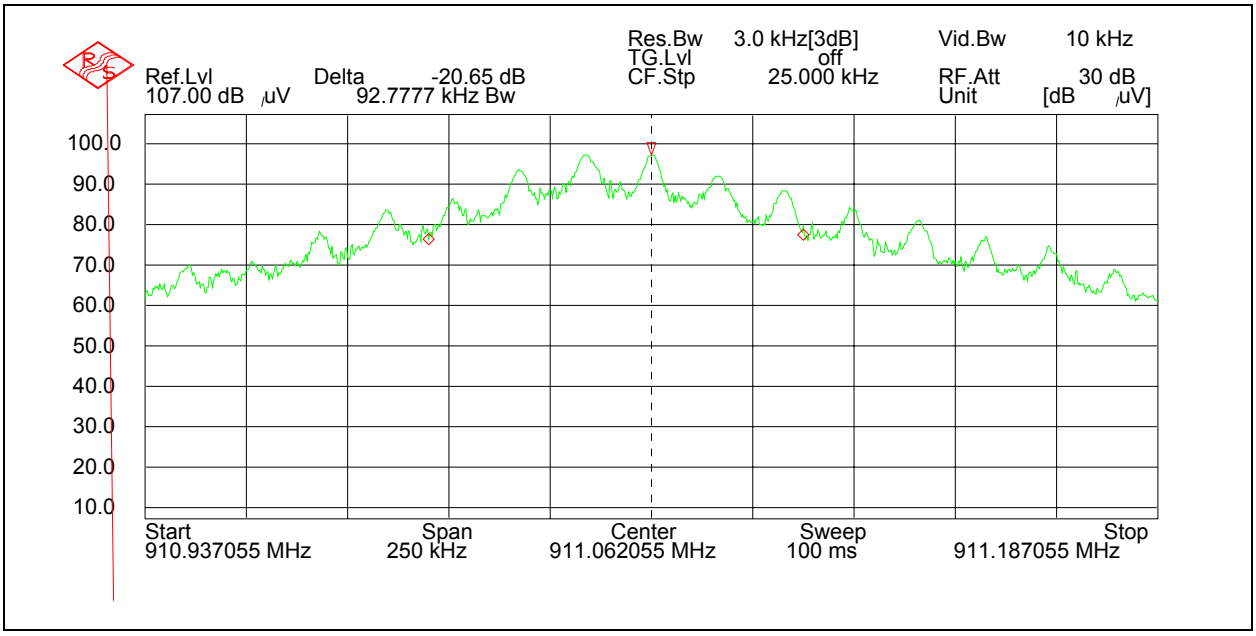

Figure 7.5.4-1: 20dB Bandwidth Low Channel

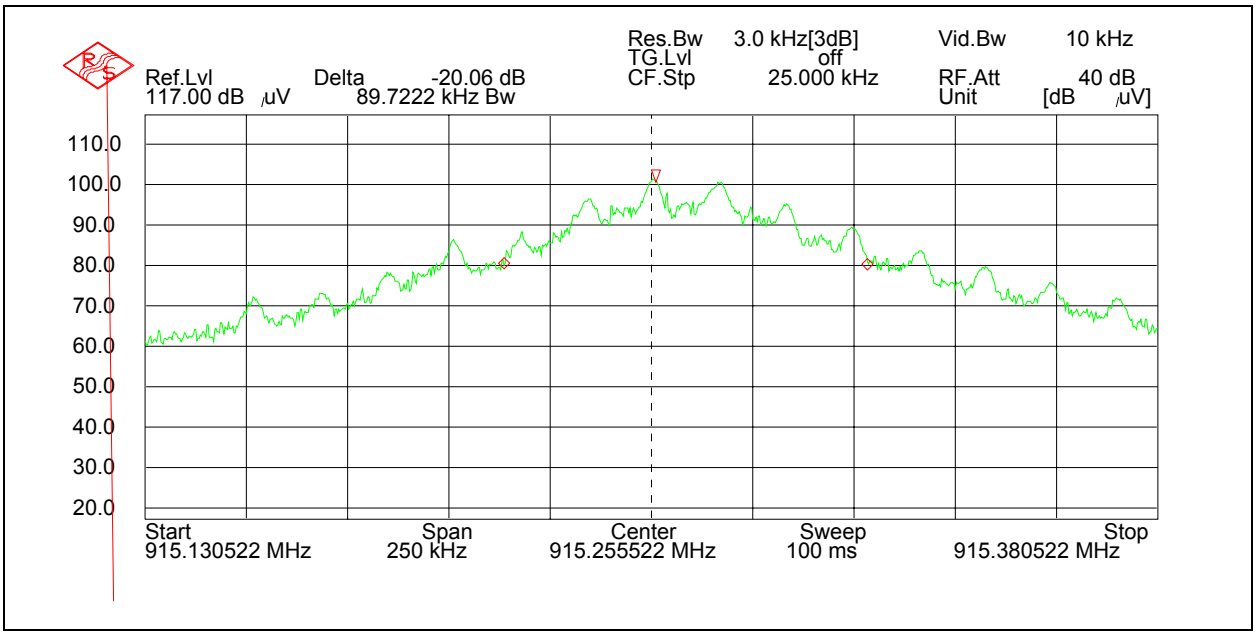

Figure 7.5.4-2: 20dB Bandwidth Mid Channel

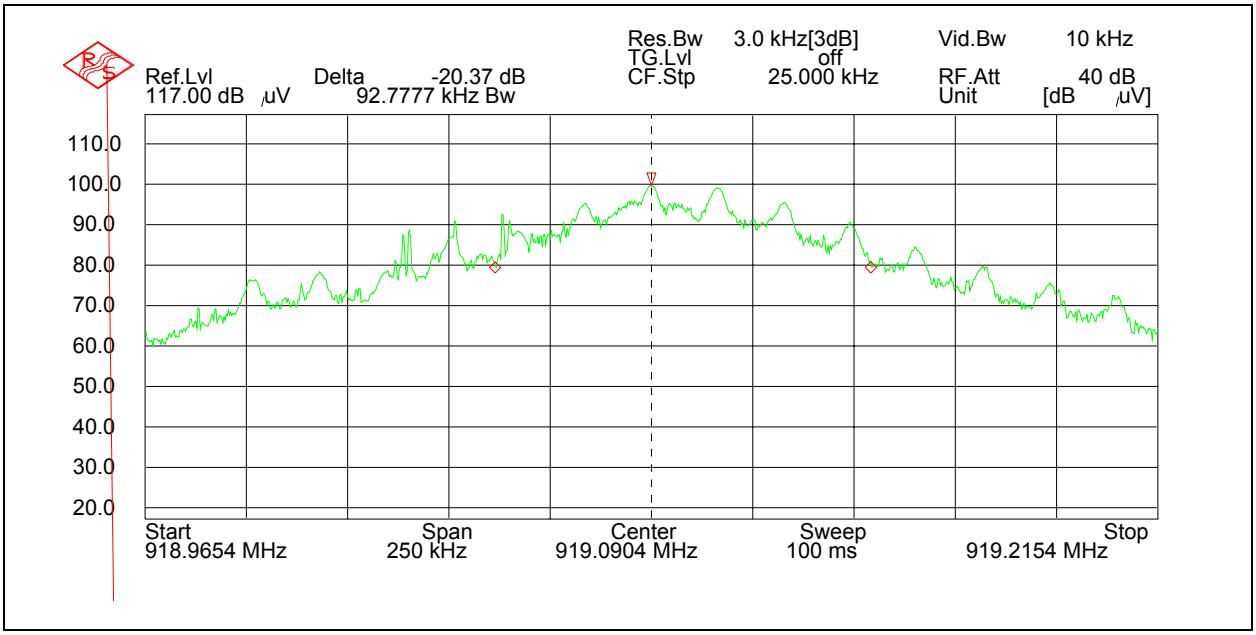

Figure 7.5.4-3: 20dB Bandwidth High Channel

7.6 Band-Edge Compliance and Spurious Emissions

7.6.1 Band-Edge Compliance of RF Emissions

7.6.1.1 Test Methodology

The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 300 kHz, which is ≥ 1% of the span, and the VBW was set to 1 MHz.

7.6.1.2 Test Results

In a 100 kHz bandwidth at the lower and upper band-edge, the radio frequency power that was produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. Band-edge compliance is displayed in Figures 7.6.1-1 and 7.6.2-2

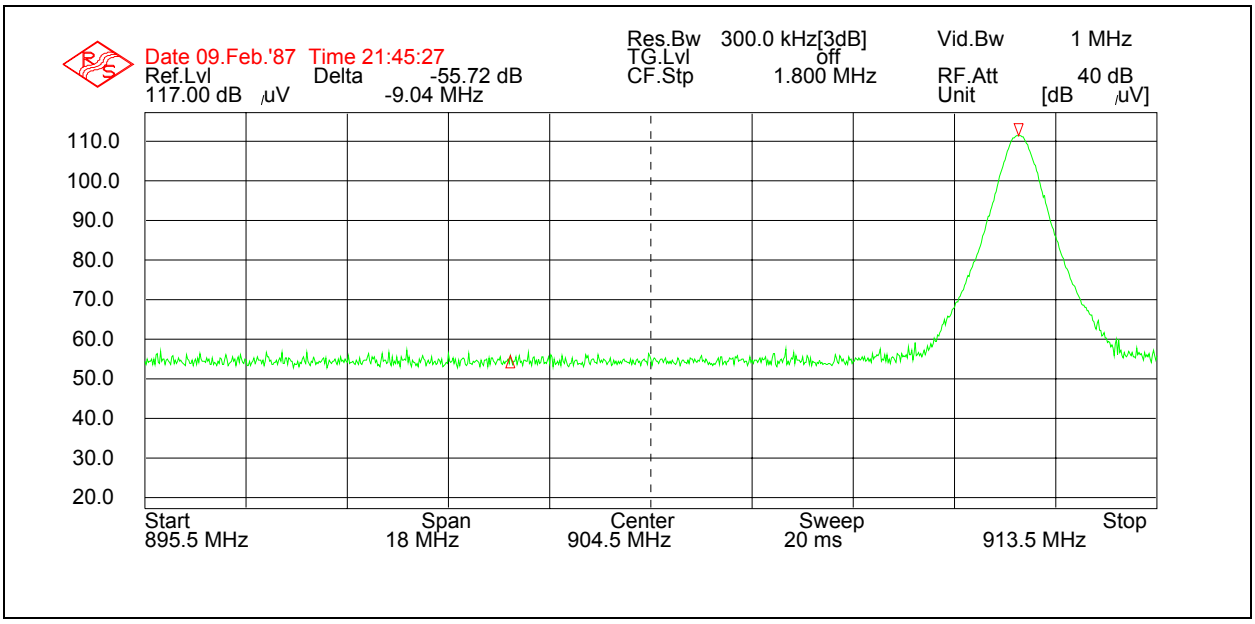

Figure 7.6.1-1: Lower Band-edge

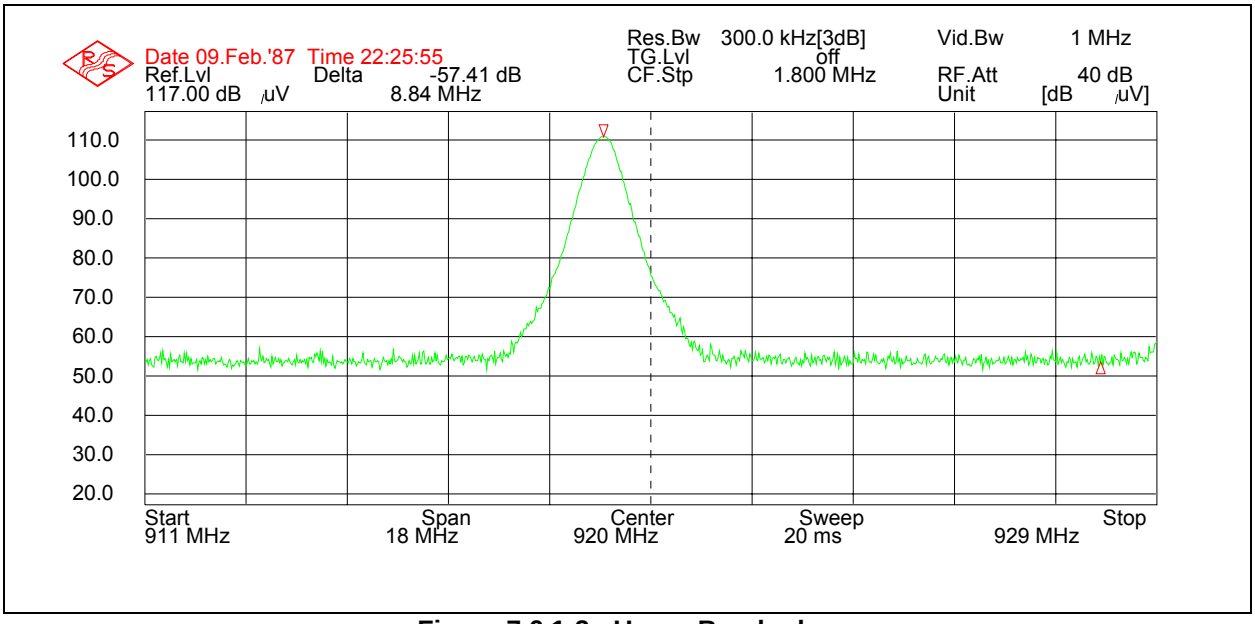

Figure 7.6.1-2: Upper Band-edge

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Test Methodology

Antenna conducted measurements could not be performed on this device, therefore radiated tests were performed to show compliance with the spurious RF conducted limit according to FCC publication DA 00-705.

For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak detector and Max Hold function of the analyzer were utilized. The field strength of both the fundamental emission and all spurious emissions were measured with these settings. Procedures in ANSI C63.4 with respect to maximizing the emissions were followed. The measured field strength of all spurious emissions must be below the measured field strength of the fundamental emission by 20dB.

7.6.2.2 Test Results

The magnitude of all emissions are reported in section 7.6.3 with the appropriate limit as referenced to 20 dB below the fundamental frequency field strength. Emissions that fell within the restricted bands were referenced to the radiated emissions limit set forth in FCC Section 15.209 and IC RSS-210 Section 2.6.

7.6.3 Radiated Spurious Emissions – Intentional Radiation

7.6.3.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 10GHz, 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, peak measurements were made using an RBW of 1 MHz and a VBW of 3 MHz and for the average emissions a VBW of 10Hz. For those frequencies that fell outside the restricted bands as defined in 15.205, the alternative test methods in the FCC publication DA 00-705 was followed using a RBW of 100kHz and VBW of 300kHz and peak detector.

The EUT was caused to generate a continuous carrier signal on the hopping channel.

7.6.3.2 Duty Cycle Correction

For average radiated measurements in restricted bands, the measured level was reduced by a factor 23 dB to account for the duty cycle of the EUT. The EUT transmits for 7.04 mS on a channel followed by a minimum 10 second rest period before hopping to the next channel. The EUT does not return to the same channel for over 500 seconds. Therefore the duty cycle is 7%. The duty cycle correction factor is determined using the formula: 20log (7.04/100) = 23dB.

See Section 7.5.3 for details.

7.6.3.3 Test Results

7.6.3.3.1 Test Results - Wire Inside Antenna (model number 12641-001)

Table 7.6.3.3-1: Radiated Spurious Emissions - Wire Inside Antenna (model number 12641-001) – Low Channel

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Fundamental Frequency										
911	117.05	---------	H	1.04	118.09	---------	--------	--------	---------	---------
911	117.56	---------	V	1.04	118.60	---------	--------	--------	---------	---------
Spurious Emissions										
1822	64.35	---------	H	-2.09	62.26	---------	98.6	---------	36.34	---------
2733	56.84	52.62	H	3.23	60.07	32.85	74.0	54.0	13.93	21.15
3644	56.58	40.00	H	7.09	63.67	23.99	74.0	54.0	10.33	30.01
4555	46.27	35.00	H	9.23	55.50	21.13	74.0	54.0	18.50	32.87
5466	41.83	---------	H	13.14	54.97	---------	98.6	---------	43.63	---------
6377	37.94	---------	V	15.24	53.18	---------	98.6	---------	45.42	---------

Table 7.6.3.3-2: Radiated Spurious Emissions - Wire Inside Antenna (model number 12641-001) – Mid Channel

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Fundamental Frequency										
915	117.18	---------	H	1.25	118.43	---------	--------	--------	---------	---------
915	117.25	---------	V	1.25	118.50	---------	--------	--------	---------	---------
Spurious Emissions										
1830	67.53	---------	H	-2.03	65.50	---------	98.5	---------	33.00	---------
2745	58.49	53.31	H	3.30	61.79	33.51	74.0	54.0	12.21	20.49
3660	59.02	41.22	H	7.17	66.19	25.29	74.0	54.0	7.81	28.71
4575	47.80	36.52	H	9.33	57.13	22.75	74.0	54.0	16.87	31.25
5490	47.01	---------	H	13.24	60.25	---------	98.5	---------	38.25	---------
6405	37.49	---------	H	15.26	52.75	---------	98.5	---------	45.75	---------

Table 7.6.3.3-3: Radiated Spurious Emissions - Wire Inside Antenna (model number 12641-001) – High Channel

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Qpk/Avg	pk	Avg
Fundamental Frequency										
919	115.83	--------	H	1.44	117.27	--------	--------	--------	---------	---------
919	116.24	--------	V	1.44	117.68	--------	--------	--------	---------	---------
Spurious Emissions										
1838	68.52	--------	H	-1.99	66.53	---------	97.7	---------	31.15	---------
2757	59.08	55.10	H	3.36	62.44	35.36	74.0	54.0	11.56	18.64
3676	58.80	41.16	H	7.23	66.03	25.29	74.0	54.0	7.97	28.71
4595	47.20	34.73	H	9.42	56.62	21.05	74.0	54.0	17.38	32.95
5514	48.52	--------	V	13.32	61.84	---------	97.7	---------	35.84	---------
6433	44.86	--------	V	15.28	60.14	---------	97.7	---------	37.54	---------

***** The magnitude of all emissions not reported were below the noise floor of the measurement system.

7.6.3.3.2 Test Results - Lid Mount Pit Antenna (model number 12527-200)

Table 7.6.3.3-4: Radiated Spurious Emissions - Lid Mount Pit Antenna (model number 12527-200) - Low Channel

Frequency	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(MHz)	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Fundamental Frequency										
911	84.28	---------	H	27.66	111.94	---------	---------	---------	---------	---------
911	82.27	---------	V	28.30	110.57	---------	---------	---------	---------	---------
Spurious Emissions										
1822	72.61	---------	H	-2.55	70.06	----------	91.94	---------	21.88	---------
1822	69.76	---------	V	-2.55	67.21	----------	91.94	---------	24.73	---------
2733	63.11	61.33	H	1.50	64.61	39.73	74	54	9.39	14.27
2733	60.42	57.95	V	1.50	61.92	36.35	74	54	12.08	17.65
3644	58.28	47.29	H	4.82	63.10	29.01	74	54	10.90	24.99
3644	48.38	35.81	V	4.82	53.20	17.53	74	54	20.80	36.47
4555	50.69	38.73	H	6.66	57.35	22.29	74	54	16.65	31.71
4555	44.88	32.74	V	6.66	51.54	16.30	74	54	22.46	37.70
5466	45.56	---------	H	10.08	55.64	----------	91.94	---------	36.30	---------
5466	48.88	---------	V	10.08	58.96	----------	91.94	---------	32.98	---------
6377	37.74	---------	H	11.34	49.08	----------	91.94	---------	42.86	---------
6377	44.45	---------	V	11.34	55.79	----------	91.94	---------	36.15	---------
7288	43.66	30.58	V	14.13	57.79	21.62	74	54	16.21	32.38

Table 7.6.3.3-5: Radiated Spurious Emissions - Lid Mount Pit Antenna (model number 12527-200) - Mid Channel

Frequency	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(MHz)	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Fundamental Frequency										
915	84.23	---------	H	27.90	112.13	---------	---------	---------	---------	---------
915	82.91	---------	V	28.30	111.21	---------	---------	---------	---------	---------
Spurious Emissions										
1830	76.29	---------	H	-2.50	73.79	----------	92.13	---------	18.34	---------
1830	73.44	---------	V	-2.50	70.94	----------	92.13	---------	21.19	---------
2745	60.29	55.90	H	1.54	61.83	34.34	74	54	12.17	19.66
2745	61.18	55.75	V	1.54	62.72	34.19	74	54	11.28	19.81
3660	55.31	43.84	H	4.88	60.19	25.62	74	54	13.81	28.38
3660	48.05	34.85	V	4.88	52.93	16.63	74	54	21.07	37.37
4575	51.30	38.17	H	6.75	58.05	21.82	74	54	15.95	32.18
4575	44.75	38.30	V	6.75	51.50	21.95	74	54	22.50	32.05
5490	45.56	---------	H	10.16	55.72	----------	92.13	---------	36.41	---------
5490	49.85	---------	V	10.16	60.01	----------	92.13	---------	32.12	---------
6405	38.86	---------	H	11.41	50.27	----------	92.13	---------	41.86	---------
6405	45.95	---------	V	11.41	57.36	----------	92.13	---------	34.77	---------
7320	42.74	31.29	V	14.16	56.90	22.35	74	54	17.10	31.65

Table 7.6.3.3-6: Radiated Spurious Emissions - Lid Mount Pit Antenna (model number 12527-200) - High Channel

Frequency	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(MHz)	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Fundamental Frequency										
919	84.17	---------	H	28.14	112.31	---------	---------	---------	---------	---------
919	81.33	---------	V	28.30	109.63	---------	---------	---------	---------	---------
Spurious Emissions										
1838	75.15	---------	H	-2.45	72.70	----------	92.31	---------	19.61	---------
1838	69.58	---------	V	-2.45	67.13	----------	92.31	---------	25.18	---------
2757	65.22	63.69	H	1.57	66.79	42.17	74	54	7.21	11.83
2757	62.25	60.80	V	1.57	63.82	39.28	74	54	10.18	14.72
3676	53.36	43.45	H	4.93	58.29	25.28	74	54	15.71	28.72
3676	47.67	38.73	V	4.93	52.60	20.56	74	54	21.40	33.44
4595	49.88	35.51	H	6.83	56.71	19.24	74	54	17.29	34.76
4595	43.12	30.63	V	6.83	49.95	14.36	74	54	24.05	39.64
5514	42.11	---------	H	10.19	52.30	----------	92.31	---------	40.01	---------
5514	45.94	---------	V	10.19	56.13	----------	92.31	---------	36.18	---------
6433	36.22	---------	H	11.49	47.71	----------	92.31	---------	44.60	---------
6433	40.99	---------	V	11.49	52.48	----------	92.31	---------	39.83	---------

***** The magnitude of all emissions not reported were below the noise floor of the measurement system.

7.6.3.3.3 Test Results - Slip On Pit Antenna (model number 12690-001)

Table 7.6.3.3-7: Radiated Spurious Emissions - Slip On Pit Antenna (model number 12690-001) – Low Channel

Frequency	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(MHz)	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Fundamental Frequency										
911	76.75	---------	H	27.66	104.41	---------	---------	---------	---------	---------
911	83.63	---------	V	28.30	111.93	---------	---------	---------	---------	---------
Spurious Emissions										
1822	67.91	---------	H	-2.55	65.36	----------	91.93	---------	26.57	---------
1822	71.79	---------	V	-2.55	69.24	----------	91.93	---------	22.69	---------
2733	70.04	65.06	H	1.50	71.54	43.46	74	54	2.46	10.54
2733	67.30	62.63	V	1.50	68.80	41.03	74	54	5.20	12.97
3644	53.23	47.37	H	4.82	58.05	29.09	74	54	15.95	24.91
3644	49.27	45.66	V	4.82	54.09	27.38	74	54	19.91	26.62
4555	50.44	36.85	H	6.66	57.10	20.41	74	54	16.90	33.59
4555	46.30	49.16	V	6.66	52.96	32.72	74	54	21.04	21.28
5466	34.77	---------	H	10.08	44.85	----------	91.93	---------	47.08	---------
5466	39.24	---------	V	10.08	49.32	----------	91.93	---------	42.61	---------
6377	37.23	---------	V	11.34	48.57	----------	91.93	---------	43.36	---------
7288	43.07	33.86	V	14.13	57.20	24.90	74	54	16.80	29.10

Table 7.6.3.3-8: Radiated Spurious Emissions - Slip On Pit Antenna (model number 12690-001) – Low Channel

Frequency	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(MHz)	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Fundamental Frequency										
915	77.61	---------	H	27.90	105.51	---------	---------	---------	---------	---------
915	84.01	---------	V	28.30	112.31	---------	---------	---------	---------	---------
Spurious Emissions										
1830	69.46	---------	H	-2.50	66.96	----------	92.31	---------	25.35	---------
1830	71.39	---------	V	-2.50	68.89	----------	92.31	---------	23.42	---------
2745	69.56	64.51	H	1.54	71.10	42.95	74	54	2.90	11.05
2745	66.60	58.56	V	1.54	68.14	37.00	74	54	5.86	17.00
3660	52.39	47.47	H	4.88	57.27	29.25	74	54	16.73	24.75
3660	49.42	41.14	V	4.88	54.30	22.92	74	54	19.70	31.08
4575	49.85	37.13	H	6.75	56.60	20.78	74	54	17.40	33.22
4575	45.03	39.34	V	6.75	51.78	22.99	74	54	22.22	31.01
5490	46.98	---------	H	10.16	57.14	----------	92.31	---------	35.17	---------
5490	39.70	---------	V	10.16	49.86	----------	92.31	---------	42.45	---------
6405	37.75	---------	V	11.41	49.16	----------	92.31	---------	43.15	---------
7320	42.14	33.89	V	14.16	56.30	24.95	74	54	17.70	29.05

Table 7.6.3.3-9: Radiated Spurious Emissions - Slip On Pit Antenna (model number 12690-001) – Low Channel

Frequency	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
(MHz)	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Fundamental Frequency										
919	77.13	---------	H	28.14	105.27	---------	---------	---------	---------	---------
919	84.44	---------	V	28.30	112.74	---------	---------	---------	---------	---------
Spurious Emissions										
1838	68.34	---------	H	-2.45	65.89	----------	92.74	---------	26.85	---------
1838	69.86	---------	V	-2.45	67.41	----------	92.74	---------	25.33	---------
2757	69.94	64.40	H	1.57	71.51	42.88	74	54	2.49	11.12
2757	65.19	60.21	V	1.57	66.76	38.69	74	54	7.24	15.31
3676	55.26	44.75	H	4.93	60.19	26.58	74	54	13.81	27.42
3676	50.87	40.69	V	4.93	55.80	22.52	74	54	18.20	31.48
4595	51.43	39.65	H	6.83	58.26	23.38	74	54	15.74	30.62
4595	46.05	34.01	V	6.83	52.88	17.74	74	54	21.12	36.26
5514	34.69	---------	H	10.19	44.88	----------	92.74	---------	47.86	---------
5514	39.42	---------	V	10.19	49.61	----------	92.74	---------	43.13	---------
6433	37.79		V	11.49	49.28	----------	92.74	---------	43.46	---------
7352	42.49	31.14	V	14.18	56.67	22.22	74	54	17.33	31.78

***** The magnitude of all emissions not reported were below the noise floor of the measurement system.

7.6.3.4 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: 56.84 + 3.23= 60.07dBuV
Margin: 74dBuV – 60.07dBuV = 13.93dB

AVERAGE:
Corrected Level: 52.62 + 3.23 - 23 = 32.85dBuV
Margin: 54dBuV – 32.85dBuV = 21.15dB

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 and Industry Canada's Radio Standards Specification RSS-210.

END REPORT