

## COMPLIANCE WORLDWIDE INC. TEST REPORT 397-09

In Accordance with the Requirements of

Industry Canada RSS 210, Issue 7  
Federal Communications Commission CFR Title 47 Part 15.249, Subpart C  
Low Power License-Exempt Radio Communication Devices  
Intentional Radiators

Issued to

**NeuroMetrix, Inc.**  
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for

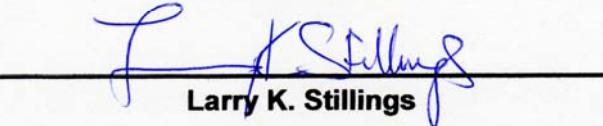
**ASCEND Stimulator**

**FCC ID: XUL-RF-SYNC**  
**IC: 3278A-RFSYNC**

**Report Issued on October 16, 2009**

  
\_\_\_\_\_  
**Brian F. Breault**

Reviewed By

  
\_\_\_\_\_  
**Larry K. Stillings**

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## 1. Scope

This test report certifies that the NeuroMetrix ASCEND Stimulator, as tested, meets the FCC Part 15, Subpart C and Industry Canada RSS 210, Issue 7 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

## 2. Product Details

**2.1. Manufacturer:** NeuroMetrix

**2.2. Model Number:** ASCEND Stimulator

**2.3. Serial Number:** N/A

**2.4. Description:** The NeuroMetrix ASCEND (hereafter referred to as "ASCEND") is a battery powered peripheral nerve stimulator with a 3.5" color LCD. It delivers single, 1 Hz or 2 Hz constant current stimulation pulses to a patient with either 50, 100, 200, 500 or 1000 us pulse width. The stimulation current magnitude can be adjusted from 0 to 5 mA. The device also measures and displays impedance between the stimulation electrode (a needle and a tab surface electrode), and generates an audio tone for each stimulation, button press or error message.

ASCEND may be wirelessly linked to an optional bioamplifier for measurement of Electromyographic (EMG) signals. The Bioamplifier uses a sensor placed on the patient's skin to pick up the very low level EMG signals and perform an analog-to-digital conversion of the EMG signals. It then sends the digitized signals to ASCEND via Bluetooth and /or the RF Sync Link.

**2.5. Power Source:** One 3.7 Volt, 2000 mAh Li-Polymer Rechargeable Battery

**2.6. Hardware Rev.:** X5

**2.7. Software Rev.:** Per FCC test protocol, both Stimulator and Bioamplifier under test are programmed to work as a transmitter:

(1) When device powers up, it continuously transmits RF Sync with the interval of 250ms. (2) When no ACK received from receiver, retry twice, resulting 3 RF Sync pulses in total each time. (3) Frequency: Channel 6 (916MHz) (4) TX power level: Level 20 (9dBm) Another Bioamplifier is programmed as a receiver to receive RF Sync. The LED of the receiver will flash if RF Sync is received. Note: Stimulator Firmware Base Version: Rev 0.2.3, Bioamplifier Firmware Base Version: Rev 1.2.0

**2.8. EMC Modifications:** None

## 3. Product Configuration

### 3.1. Support Equipment

Device	Manufacturer	Model	Serial No.	Comment
Disposable Hypodermic Needle Electrode	Neurometrix	RA-2550	N/A	See Section 3.3
Red Tab Electrode wire	Chalgren	256-A-24RTP	N/A	See Section 3.3
Bioamplifier	Neurometrix	AS-B01	N/A	See Section 3.3
Saline Solution	CVS	Saline Wound Wash	N/A	See Section 3.3

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### 3. Product Configuration (continued)

#### 3.2. Cables

Cable Type	Length	Shield	From	To
Stimulation cable with Yoke	1 meter	No	ASCEND Stimulator	See Section 3.3

#### 3.3. Operational Characteristics & Software

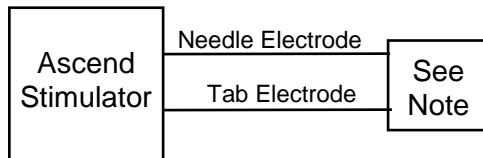
##### **Test Configuration #1 – ASCEND Stimulator only**

1. Press and release the ON/OFF button on the front of the ASCEND Stimulator.
2. Plug the Stimulation cable with Yoke into the connector located near the top right corner of the ASCEND.
3. Connect the Neurometrix Disposable Hypodermic Needle Electrode (P/N RA-2550) plug (non-needle end) into the black connector on the Yoke.
4. Connect the red Tab Electrode wire (non-alligator clip end) into the red connector on the Yoke.
5. Soak a sponge with Saline solution (CVS Saline Wound Wash, 0.9% Sodium Chloride Solution, for example).
6. Clip the Tab Electrode alligator clip onto the sponge.
7. Stick the hypodermic needle electrode (needle end) into the sponge.
8. Plug a Universal Electrode into the Bioamplifier labeled “RX” Sensor connector if not already done.
9. Verify that the blue LED on the Bioamplifier labeled “RX” is flashing indicating that the ASCEND is transmitting.

##### **End of Test #1**

1. Turn off the ASCEND Stimulator by doing the following:
  - a. With the stylus (or pencil), strike twice in rapid succession (referred to as “double-click”) the “My Device” icon on the ASCEND Stimulator LCD display.
  - b. Double-click the “NOR\_FLASH” icon on the LCD display.
  - c. Double-click the “Application” folder icon on the LCD display.
  - d. Double-click the “AscendRA” icon on the LCD display. Wait for the Windows “hour-glass”.
  - e. Power-down the ASCEND by pressing and holding the ON/OFF button located in the lower left corner on the front of the ASCEND for at least five seconds.
2. Remove the Stimulation cable from the ASCEND.
3. Place the ASCEND into the Recharge cradle.
4. Remove the Universal Electrode from the Bioamplifier labeled “RX”.
5. Place the Bioamplifier labeled “RX” into the Recharge cradle.

#### 3.4. Block Diagram



Note: The needle electrode and tab electrode were connected to a sponge saturated with saline solution to simulate an actual test.

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#### 4. Measurements Parameters

##### 4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
Spectrum Analyzer	Agilent	E4407B	MY4510449	7/09/2010
Microwave Preamp	Hewlett Packard	8449B	3008A01323	9/22/2010
Bilog Antenna	Com-Power	AC-220	25509	8/6/2010
Horn Antenna	Electro-Metrics	EM-6961	6337	7/22/2010

##### 4.2. Measurement & Equipment Setup

Test Date:	10/12/2009
Test Engineer:	Brian Breault
Normal Site Temperature (15 - 35°C):	21.6
Relative Humidity (20 -75%RH):	35
Frequency Range:	30 MHz to 9.6 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	100 kHz - 30 MHz to 1 GHz 1 MHz - Above 1 GHz
EMI Receiver Avg Bandwidth:	300 kHz - 30 MHz to 1 GHz 3 MHz - Above 1 GHz
Detector Function:	Peak, Quasi-Peak & Average

##### 4.3. Measurement Procedure

Test measurements were made in accordance FCC Part 15.249, IC RSS-210 Annex II: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

The test methods used to generate the data in this test report is in accordance with ANSI C63.4: 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

In accordance with ANSI C63.4-2003, section 13.1.4.1, c), the device under test was rotated through three orthogonal axes to determine which attitude produced the highest emission relative to the limit. The attitude that produced the highest emission relative to the limit was used for all radiated emission measurements.

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## 5. Measurement Summary

Test Requirement	FCC Rule Requirement	Test Report Section	Result	Comment
Antenna Requirement	15.203	N.A	Compliant	Unit has an internal PCB antenna.
Radiated Field Strength of Fundamental	15.249 (a)	6.1	Compliant	
Radiated Field Strength of Harmonics	15.249 (a)	6.2	Compliant	
Occupied Bandwidth	IC RSS-GEN	6.3	Compliant	
99% Bandwidth	IC RSS-GEN	6.4	Compliant	
Band Edge Measurements	15.249 (d), 15.209	6.5	Compliant	
Spurious Radiated Emissions	15.249 (d), 15.209	6.6	Compliant	No measurable spurious emissions.
Public Exposure to Radio Frequency Energy Levels	15.407(f)	6.7	Compliant	Battery operated device.
Conducted Emissions	15.207	N/A	---	Battery operated device.

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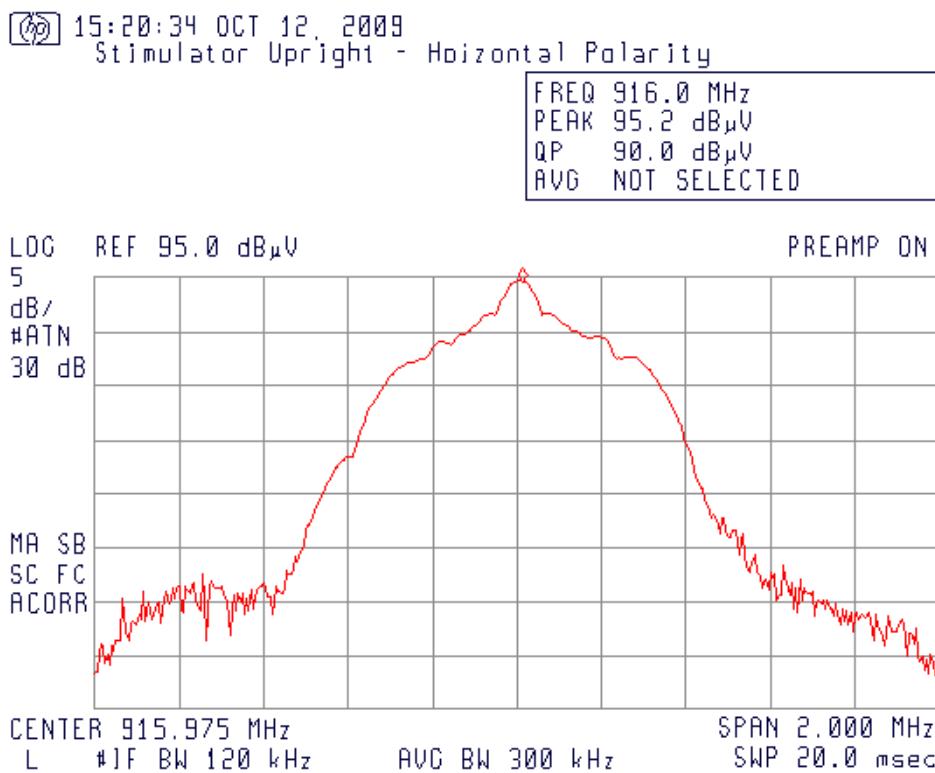
## 6. Measurement Data

### 6.1. Radiated Field Strength of Fundamental (15.249, Section (a)), IC RSS-210 A2.9

Requirement: The 3 meter field strength of the fundamental emissions from intentional radiators operated within the 902-928 MHz frequency bands shall comply with the following requirement: 50 millivolts/meter (94 dB $\mu$ V/m), quasi-peak mode measurement.

Frequency (MHz)	Amplitude (dB $\mu$ V/m)		Q-Peak Limit	Margin (dB)	Ant Pol	Ant Ht	TT Pos	Result
	Peak	Q-Peak			H/V	cm	Deg	P/F
916.16	95.2	90.0	94.0	-4.0	H	156	8	Passed

#### 6.1.1. Radiated Field Strength of Fundamental



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## 6. Measurement Data (continued)

### 6.2. Radiated Field Strength of Harmonics (15.249, Section (a)), IC RSS-210 A2.9

Requirement: The 3 meter field strength of the harmonic emissions from intentional radiators operated within the 902-928 MHz frequency bands shall comply with the following: 500 microvolts/meter (54 dB $\mu$ V/m), average mode measurement. Peak field strength may not be greater than 20 dB above the average limit (74 dB $\mu$ V/m).

Frequency (MHz)	Amplitude <sup>1</sup> (dB $\mu$ V/m) (Peak)	Peak Limit	Amplitude <sup>1</sup> (dB $\mu$ V/m) (Avg)	Average Limit	Margin (dB)	Ant Pol (H/V)	Ant Ht (cm)	TT Pos (Deg)	Result
1832.00	51.39	74	34.53	54	-19.47	V	104	170	Passed
2748.00 <sup>2</sup>	52.78	74	33.23	54	-20.77	H	108	270	Passed
3664.00 <sup>2</sup>	61.87	74	40.98	54	-13.02	V	118	0	Passed
4580.00 <sup>2</sup>	51.99	74	33.87	54	-20.13	Noise Floor			Passed
5496.00	47.45	74	36.24	54	-17.76	Noise Floor			Passed
6412.00	48.95	74	36.98	54	-17.02	Noise Floor			Passed
7328.00 <sup>2</sup>	50.35	74	39.53	54	-14.47	Noise Floor			Passed
8244.00 <sup>2</sup>	50.77	74	41.05	54	-12.95	Noise Floor			Passed
9160.00 <sup>2</sup>	52.44	74	42.24	54	-11.76	Noise Floor			Passed

<sup>1</sup> Value includes all correction factors.

<sup>2</sup> Frequency falls within the restricted bands of operation. See FCC Part 15, Section 15.205 for additional information.

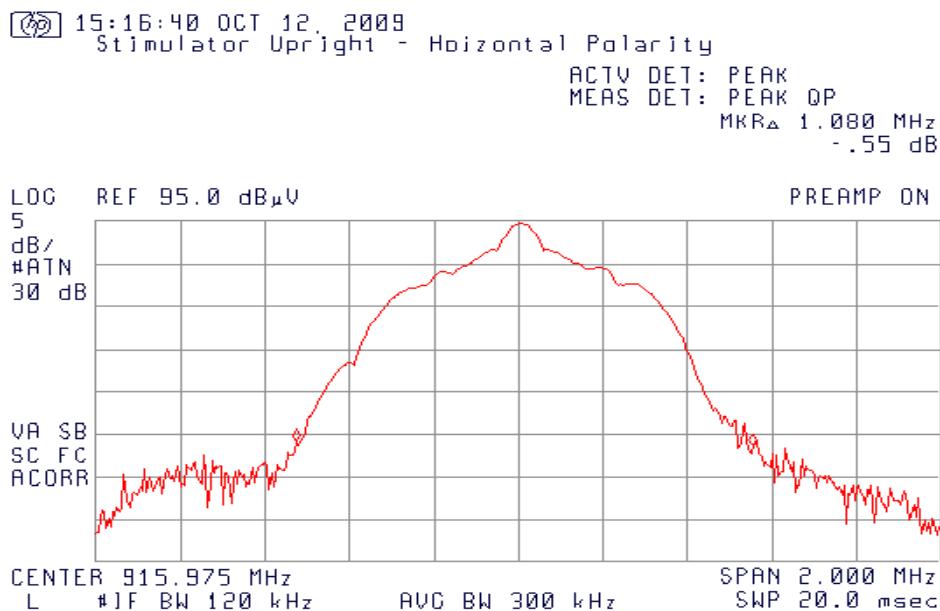
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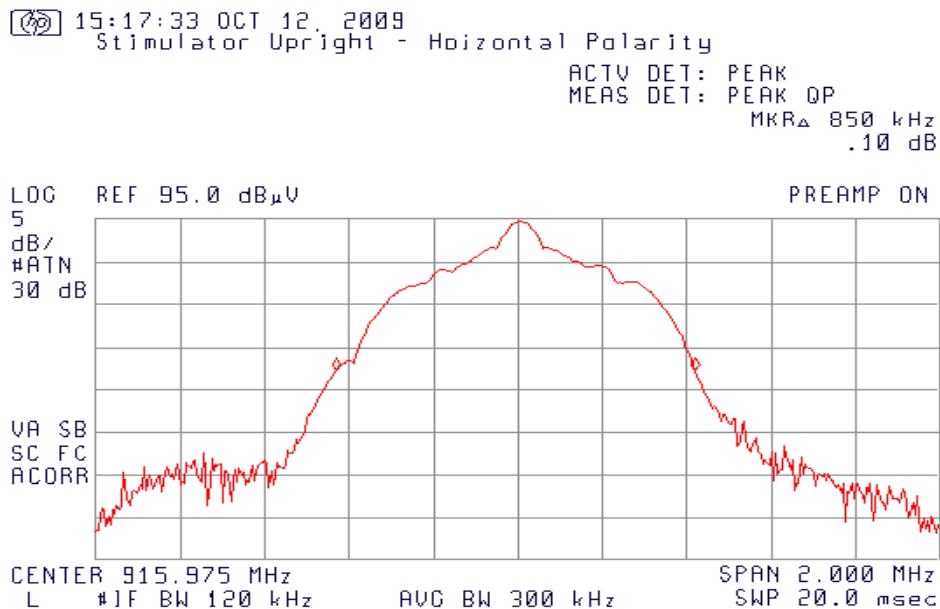
## 6. Measurement Data (continued)

### 6.3 Occupied (-26 dB) Bandwidth = 1.080 MHz

Requirement: The occupied bandwidth measurements on an intentional radiator shall be made in accordance with the requirements outlined in ANSI C63.4-2003, Section 13.1.7.



### 6.4. 99% Bandwidth = 850 kHz



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## 6. Measurement Data (continued)

### 6.5. Band Edge Measurements

Requirement: Emissions radiated outside of the specified frequency band of 902 MHz to 928 MHz, 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 Section 15.209, whichever is the lesser attenuation.

Frequency (MHz)	Band Edge (dB $\mu$ V/m)		Limit (dB $\mu$ V/m)	Margin (dB)	Result
	Freq MHz	Q-Peak	Q-Peak	Deg	P/F
916.6	900.3	25.1	54	-28.9	Passed
	928.1	23.0	54	-31.0	Passed

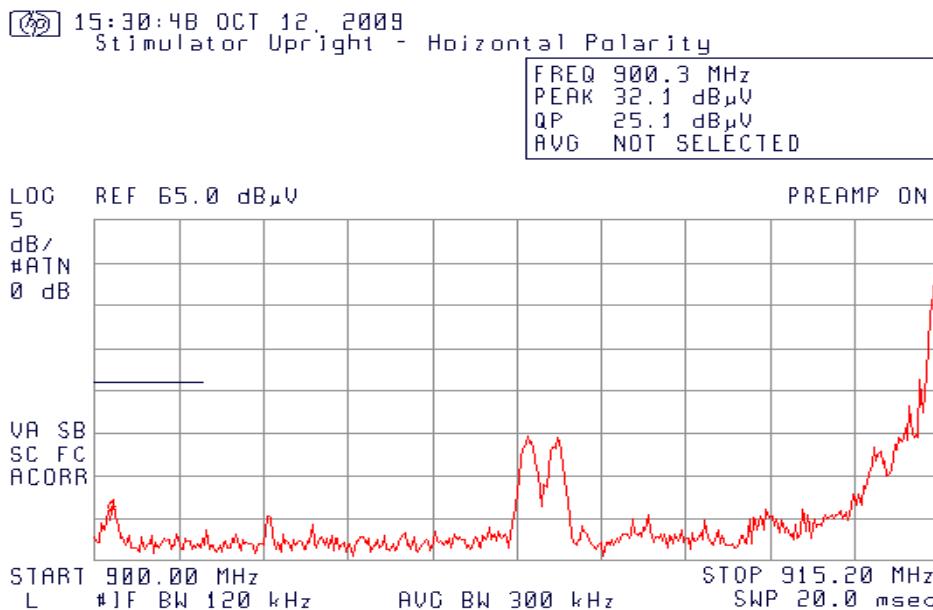
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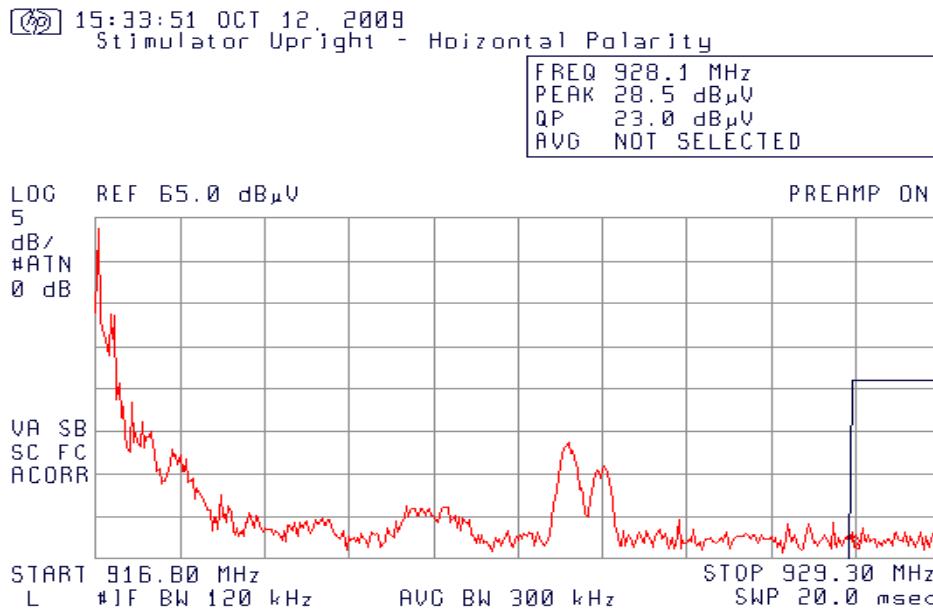
## 6. Measurement Data (continued)

### 6.5. Band Edge Measurements (continued)

#### 6.5.1. Measurement Results – Lower Band Edge



#### 6.5.2. Measurement Results – Upper Band Edge



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## 6. Measurement Data (continued)

### 6.6. Spurious Radiated Emissions, 30 MHz to EUT 10<sup>th</sup> Harmonic (15.249, Section (d)), IC RSS-GEN

Requirement: 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 Section 15.209, whichever is the lesser attenuation.

#### 6.6.1. Regulatory Limit: FCC Part 209, Quasi-Peak & Average

Frequency Range (MHz)	Distance (Meters)	Limit (dB $\mu$ V/m)
30 to 88	3	40.0
88 to 216	3	43.5
216 to 960	3	46.0
Above 960	3	54.0

#### 6.6.2. Measurement & Equipment Setup

Test Date:	10/13/2009
Test Engineer:	Brian Breault
Site Temperature (°C):	21.0
Relative Humidity (%RH):	36
Frequency Range:	30 MHz to 1 GHz
EMI Receiver IF Bandwidth :	120 kHz
EMI Receiver Avg Bandwidth:	300 kHz
Detector Functions:	Peak and Quasi-Peak
Frequency Range:	1 GHz to 10 <sup>th</sup> Harmonic
EMI Receiver IF Bandwidth :	1 MHz
EMI Receiver Avg Bandwidth:	3 MHz
Detector Functions:	Peak and Average
Antenna Height:	1 to 4 meters
Measurement Distance:	3 Meters

#### 6.6.3. Test Procedure

Test measurements were made in accordance with ANSI C63.4-2003, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

#### 6.6.4. Test Results, 30 MHz to 1 GHz

Frequency (MHz)	Pk Amp (dB $\mu$ V/m)	QP Amp (dB $\mu$ V/m)	QP Limit (dB $\mu$ V/m)	Margin (dB)	Ant Pol (H/V)	Ant Ht (cm)	Table (Deg)	Comments
73.726	31.38	29.04	40.0	-10.96	H	267	278	Passed
134.079	35.49	32.51	43.5	-10.99	H	323	254	Passed
308.625	39.13	35.14	46.0	-10.86	V	100	144	Passed
682.482	38.92	35.78	46.0	-10.22	H	197	158	Passed
877.512	43.19	40.48	46.0	-5.52	H	239	168	Passed

#### 6.6.5. Test Results, Above 1 GHz

There were no measurable emissions other than the emissions tabled in Section 6.2.

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**Note:** In order to demonstrate whether the device under test met the radio frequency energy level requirement for a SAR evaluation, the following equation was used to determine the device output power from the peak field strength measured in section 6.1.

$$P = \frac{(E \times d)^2}{(30 \times G)}$$

P = the power in Watts.

E = the measured maximum field in V/m

G = the numeric gain of the transmitting antenna over an isotropic radiator.

d = the distance in meters of the field strength measurement.

Resolution Bandwidth : 120 kHz

Video Bandwidth : 300 kHz

Sweep Time : 20 mSec

Frequency	Peak Field Strength	Distance	Antenna Gain <sup>1</sup>	Measured Output Power
(mHz)	(dB $\mu$ V/m)	(m)	(dBi)	(mW)
916.000	95.20	3.0	0.500	0.8853628

FCC OET 65, page 16 states: If a device, its antenna or other radiating structures are operating at closer than 2.5 cm from a person's body or in contact with the body, SAR evaluation may be necessary when the output is more than 50 – 100 mW, depending on the device operating configurations and exposure conditions.

The device under test has a power output of 885 microwatts and therefore SAR evaluation is not necessary.



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## **7. Test Site Description**

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with Federal Communications Commission (FCC) and Industry Canada standards. A description of the test sites is on file with the FCC (registration number **96392**) and Industry Canada (file number **IC 3023A-1**).

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane required by EN 55022.

Both sites are designed to test products or systems 1.5 meter W x 1.5 meter L x 2.0 meter H, floor standing or table top.