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FCC Certification Test Report
For the
Strata Proximity Systems
Underground Silent Zone Generator
Model SA221200-001

FCC ID: ZQ3-SPS-USZON

WLL JOB# **12037**
November 29, 2011

Prepared for:

Strata Proximity Systems
1769 Jeff Road
Huntsville, AL 35806

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

Testing Certificate AT-1448

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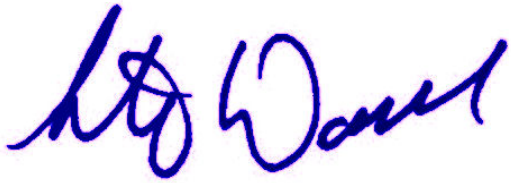

Steven Dovell
Compliance Engineer

Reviewed by:

Michael F. Violette
President

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Abstract

This report has been prepared on behalf of Strata Proximity Systems to support the attached Application for Equipment Authorization. The test report and application are submitted for a Transmitter under Part 15.209 (10/2009) of the FCC Rules and Regulations. This Certification Test Report documents the test configuration and test results for the Strata Proximity Systems Underground Silent Zone Generator.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory.

The Strata Proximity Systems Underground Silent Zone Generator complies with the limits for a Transmitter device under FCC Part 15.209.

Revision History	Description of Change	Date
Rev 0	Initial Release	November 29, 2011

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1 Introduction

1.1 Compliance Statement

The Mine Strata Proximity Systems Underground Silent Zone Generator complies with the limits for an Intentional Radiator device under Part 15.209 of the FCC Rules and Regulations.

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed according to the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Strata Proximity Systems 1769 Jeff Road Huntsville, AL 35806
Purchase Order Number:	SP5195
Quotation Number:	66219

1.4 Test Dates

Testing was performed on the following date(s):	6/15/11

1.5 Test and Support Personnel

Washington Laboratories, LTD	Steven Dovell
Client Representative	Stephen Gilbert

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1.6 Abbreviations

A	Ampere
Ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	Bandwidth
CE	Conducted Emission
Cm	centimeter
CW	Continuous Wave
dB	decibel
Dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	giga - prefix for 10^9 multiplier
Hz	Hertz
IF	Intermediate Frequency
K	kilo - prefix for 10^3 multiplier
M	Mega - prefix for 10^6 multiplier
M	Meter
μ	micro - prefix for 10^{-6} multiplier
NB	Narrowband
LISN	Line Impedance Stabilization Network
RE	Radiated Emissions
RF	Radio Frequency
Rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt

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2 Equipment Under Test

2.1 EUT Identification & Description

The Underground Silent Zone Generator is part of a complete HazardAvert proximity warning system from Strata Proximity Systems which provides warnings to both individuals and to machinery to alert them that the individual has entered too close to an operating piece of equipment and is in a dangerous situation or that vehicles or machinery are getting close enough that a collision possibility exists. The Underground Silent Zone Generator is mounted on a vehicle or piece of machinery and is connected to a central control unit. The Underground Silent Zone Generator is mounted on the vehicle or machinery in an area near where the operator would normally be while operating the vehicle or machinery.

The function of the Underground Silent Zone Generator is:

1) To transmit a 73 kHz "Silent Zone" field around a small portion of the vehicle or piece of machinery in which the operator is allowed to work or enter as part of his normal activities.

2) The Underground Silent Zone Transmitter generates a 73kHz field at the rate of 16mS at a repetition rate of approximately one second. This 73kHz field is generated to encompass only the small area of the vehicle or machine is which the operator can safely be during operation.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Strata Proximity
FCC ID:	ZQ3-SPS-USZON
EUT Name:	Underground Silent Zone Generator
Model:	SA221200-001
FCC Rule Parts:	15.209
Frequency Range:	73kHz
Occupied Bandwidth:	N/A CW
Keying:	Automatic
Type of Information:	CW
Number of Channels:	1
Power Output Level	Fixed
Antenna Type	Integral Magnetic Induction
Interface Cables:	Power
Power Source & Voltage:	Battery

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2.2 Test Configuration

The Strata Proximity Systems Underground Silent Zone Generator, Equipment Under Test (EUT), was operated from a 24VDC via a 120V AC/DC power supply.

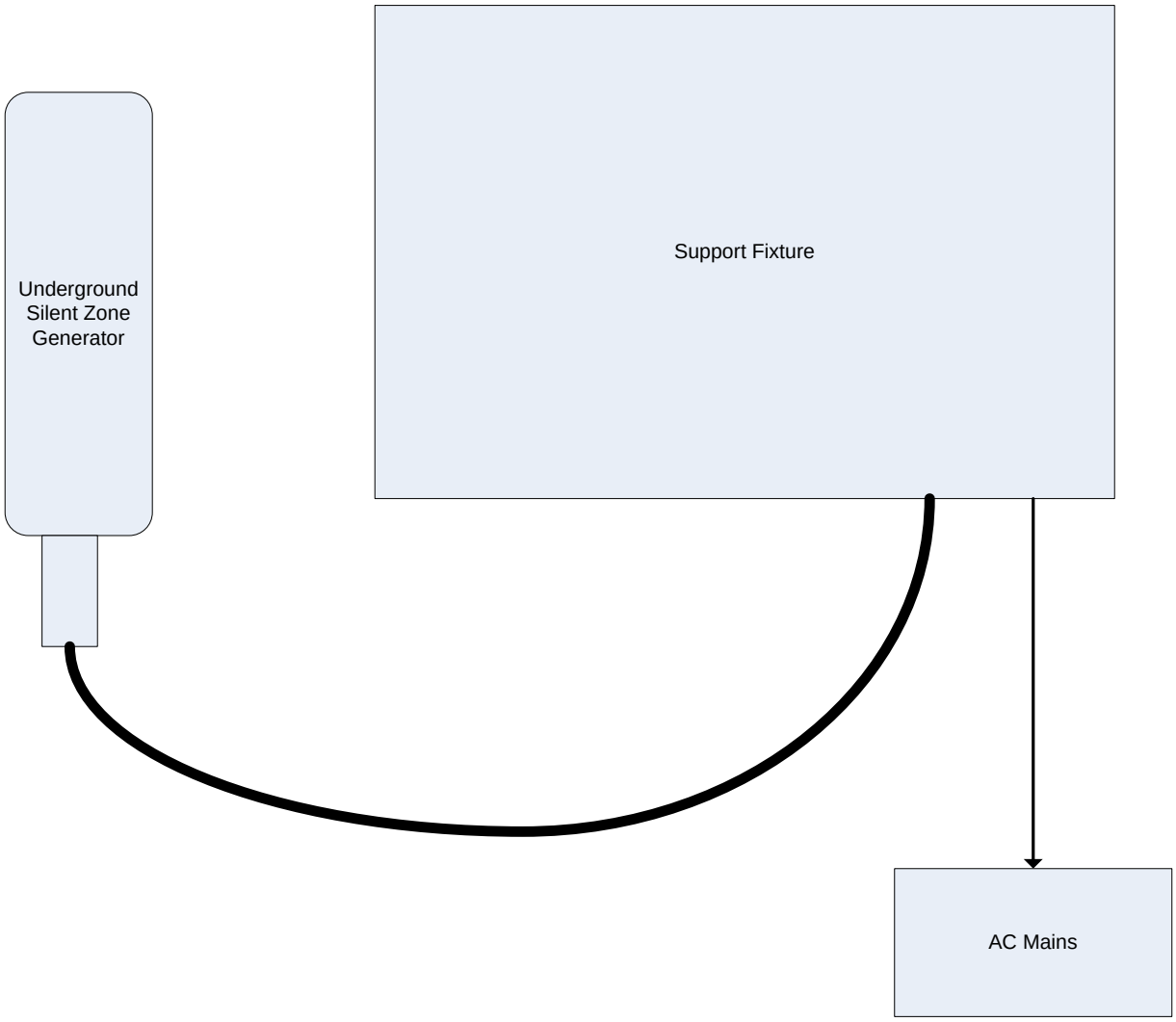

Figure 1: Test Configuration

2.3 Equipment Configuration

The EUT was set up as outlined in Figure 1. The EUT was comprised of the following equipment. (All Modules, PCBs, etc. listed were considered as part of the EUT, as tested.)

Table 2: Equipment Configuration

Name / Description	Model Number	Part Number	Serial Number	Revision
Underground Silent Zone Generator	SA221200-001	N/A	A11F005075	N/A

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2.4 Testing Algorithm

The EUT was operated continuously by being placed into a continuous transmit mode.

Worst case emission levels are provided in the test results data.

2.5 Test Location

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ACLASS under Certificate AT-1448 as an independent FCC test laboratory

2.6 Measurements

2.6.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 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

2.7 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{div_a{}^2} + \frac{b^2}{div_b{}^2} + \frac{c^2}{div_c{}^2} + ...}$$

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Where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$Div_{a, b, c}$ = the individual uncertainty element divisor based on the probability distribution

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where U = expanded uncertainty

k = coverage factor

k ≤ 2 for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 3 below.

Table 3: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR14, FCC Part 15	4.55 dB

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3 Test Equipment

Table 4 shows a list of the test equipment used for measurements along with the calibration information.

Table 4: Test Equipment List

Test Name:	**Radiated Emissions**	Test Date:	**06/15/2011**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
31	EMCO - 6502	ANTENNA ACTIVE LOOP	3/8/2012
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	1/12/2012
69	HP - 85650A	ADAPTER QP	7/1/2011
73	HP - 8568B	ANALYZER SPECTRUM	7/1/2011
71	HP - 85685A	PRESELECTOR RF	7/1/2011

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4 Test Results

4.1 Occupied Bandwidth: (FCC Part §2.1049)

Occupied bandwidth was performed by setting the EUT near the loop antenna to allow for sufficient pickup of the signal.

The transmit signal is a 73 kHz non-modulated CW signal; therefore there is no measurable bandwidth.

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Radiated Spurious Emissions: (FCC Part §15.209)

Transmitters operating under §15.209 must comply with the radiated emissions listed in the following table:

Table 5. Radiated Emissions Limits

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

4.1.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 10-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable.

For frequencies between 10 kHz and 30 MHz, a loop antenna was mounted of a tripod at a height of 1 m. The Loop antenna was rotated about its vertical and horizontal axis to determine the highest emissions.

For frequencies above 30MHz the receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. Both the horizontal and vertical field components were measured.

The EUT was scanned from 10k to 1GHz. The limit has been interpolated to 10m using the 40dB per decade roll-off for frequencies between 10k to 30MHz. The EUT was examined in three orthogonals and the orthogonal the demonstrated the highest emission was reported.

In accordance with FCC Part 15.209(d) emissions in the bands 9-90kHz and 110-490kHz are performed using an average detector. Since the peak transmit level of the EUT is >30dB below the average limit all readings < 30MHz are peak readings. All other readings below 1000MHz were taken with a quasi-peak detector.

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Resolution bandwidths used:

For frequencies measured between 9kHz – 150kHz RBW = 200Hz

For frequencies measured between 150kHz – 30MHz, RBW = 9kHz

For frequencies measured between 30MHz – 1GHz, RBW = 120kHz

Table 6. Radiated Emissions Test Data < 30MHz

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
0.0730*	X	0.0	1.00	45.10	11.3	663.9	29,589.0	-33.0
0.0730*	Y	180.0	1.00	31.00	11.3	131.0	29,589.0	-47.1
0.0730*	Z	90.0	1.00	46.90	11.3	816.8	29,589.0	-31.2
0.1460*	Z	90.0	1.00	32.20	11.1	146.5	14,794.5	-40.1
0.2190*	Z	90.0	1.00	28.70	11.0	97.2	9,863.0	-40.1
0.2920*	Z	175.0	1.00	27.10	11.0	80.2	7,397.3	-39.3
0.3650*	Z	0.0	1.00	26.30	11.0	73.0	5,917.8	-38.2
0.4380*	Z	0.0	1.00	27.80	11.0	86.8	4,931.5	-35.1

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Table 7. Radiated Emissions Test Data > 30MHz

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
35.15	V	180.00	1.00	11.00	16.9	24.8	100.0	-12.1
46.11	V	125.00	1.00	22.90	10.1	44.9	100.0	-7.0
57.96	V	270.00	1.00	15.00	8.3	14.7	100.0	-16.7
75.67	V	180.00	1.00	20.20	9.5	30.7	100.0	-10.3
100.00	V	125.00	1.00	26.20	12.0	81.0	150.0	-5.4
111.19	V	275.00	1.00	15.00	14.4	29.4	150.0	-14.2
120.00	V	180.00	1.00	17.70	15.4	45.2	150.0	-10.4
140.00	V	125.00	1.00	17.40	14.9	41.1	150.0	-11.2
160.00	V	160.00	1.00	21.85	14.8	68.0	150.0	-6.9
200.00	V	185.00	1.70	16.10	15.5	37.9	150.0	-12.0
220.00	V	200.00	2.10	17.50	14.5	39.6	200.0	-14.1
340.00	V	180.00	1.64	14.10	18.7	43.9	200.0	-13.2
700.00	V	180.00	1.00	4.40	26.2	33.8	200.0	-15.5
820.00	V	225.00	1.00	5.50	28.5	50.2	200.0	-12.0
35.70	H	180.00	2.80	6.20	16.6	13.7	100.0	-17.2
45.73	H	225.00	2.80	8.20	10.3	8.4	100.0	-21.5
50.43	H	180.00	2.88	11.90	8.6	10.6	100.0	-19.5
60.00	H	260.00	2.69	23.00	8.4	37.1	100.0	-8.6
78.41	H	90.00	2.35	16.50	9.6	20.1	100.0	-13.9
80.00	H	100.00	2.35	30.00	9.6	95.1	100.0	-0.4
85.61	H	90.00	2.20	20.90	9.7	33.9	100.0	-9.4
100.00	H	95.00	2.50	25.10	12.0	71.3	150.0	-6.5
120.00	H	200.00	2.20	18.20	15.4	47.9	150.0	-9.9
240.00	H	190.00	2.00	27.20	14.9	127.9	200.0	-3.9

Note: Since the peak readings are in excess of 30dB below the applicable 15.209 limits and the transmit occupied bandwidth is non-existent the peak measurements do not exceed the part 15.35 limit (average limit plus 20dB). Therefore the unit was not tested using a average detector in these (*) ranges and is assumed to comply with the peak requirements.

Distance correction Example @ 73kHz

Limit = 10^(((40*LOG(300/10))+(20*log(2400/f)))/20) =

29589 uV/m

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