



**FCC Certification Test Report
for the
MSA
GX2 Electronic Cylinder Holder
FCC ID: P9R-10105756
IC ID: 324C-10105756**

**WLL JOB# 12479-01 Rev 0
April 24, 2012**

**Re-issued
June 27, 2012
WLL JOB# 12479-01 Rev 1**

Prepared for:

Mine Safety Appliances
1000 Cranberry Woods Drive
Cranberry Township, PA 16066

Prepared By:
Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879



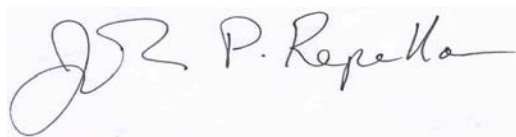
Testing Certificate AT-1448

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Prepared by:



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Abstract

This report has been prepared on behalf of MSA to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.225 of the FCC Rules and Regulations. This Certification Test Report documents the test configuration and test results for a MSA GX2 Electronic Cylinder Holder.

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 MSA GX2 Electronic Cylinder Holder complies with the limits for an Intentional Radiator device under FCC Part 15.225.

Revision History	Description of Change	Date
Rev 0	Initial Release	April 30, 2012
Rev 1	Updated Table 1&4 and Section 4.2.1 to address TCB comments	June 27, 2012

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1 Introduction

1.1 Compliance Statement

The MSA GX2 Electronic Cylinder Holder complies with the limits for an Intentional Radiator device under FCC Part 15.225.

1.2 Test Scope

Tests for radiated and conducted emissions were performed. All measurements were performed in accordance with 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:	Mine Safety Appliances 1000 Cranberry Woods Drive Cranberry Township, PA 16066
Purchase Order Number:	4501357328
Quotation Number:	66503A

1.4 Test Dates

Testing was performed on the following date(s):	3/23/2012 – 3/26/2012
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1.5 Test and Support Personnel

Washington Laboratories, LTD	John P. Repella
Client Representative	Olaedo Mbonu

1.6 Abbreviations

A	A mpere
ac	a lternating current
AM	A mplitude Modulation
Amps	A mperes
b/s	b its per second
BW	B andwidth
CE	C onducted E mission
cm	C entimeter
CW	C ontinuous W ave
dB	D ecibel
dc	d irect current
EMI	E lectromagnetic I nterference
EUT	E quipment U nder T est
FM	F requency M odulation
G	g iga - prefix for 10^9 multiplier
Hz	H ertz
IF	I ntermediate F requency
k	k ilo - prefix for 10^3 multiplier
LISN	L ine I mpedance S tabilization N etwork
M	M ega - prefix for 10^6 multiplier
m	M eter
μ	μ icro - prefix for 10^{-6} multiplier
NB	N arrowband
QP	Q uasi- P eak
RE	R adiated E missions
RF	R adio F requency
rms	r oot- m ean- s quare
SN	S erial N umber
S/A	S pectrum A nalyzer
V	V olt

2 Equipment Under Test

2.1 EUT Identification & Description

The Electronic Cylinder Holder accommodates a gas cylinder holder. The multi-color light band indicates the gas cylinder status, i.e. expired gas, empty/full cylinder. The Cylinder Holder includes a pressure sensor to measure the pressure of the gas in the cylinder and an RFID reader to read data from the RFID tag attached to the gas cylinder. The RFID tag contains gas data such as gas type, gas concentrations, expiration dates, etc.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	MSA
FCC ID:	P9R-10105756
IC ID:	324C-10105756
EUT Name:	GX2 Electronic Cylinder Holder
FCC Rule Parts:	§15.225
Industry Canada:	RSS Gen
Frequency Range:	13.56MHz
Maximum Output Power:	Fixed 70mW (18dBm)
Modulation:	None
Emission Designator	2K19NON
Occupied Bandwidth (99%):	2.1931 kHz
Keying	Automatic, Manual
Type of Information:	Data
Number of Channels:	1
Power Output Level	4836.8 μ V/m @ 10 m
Transmitter Spurious Emission	(27.13MHz) 23.2uV @ 10 m
Maximum Spurious Emission (Non-Transmitter)	(81.34MHz) 74.6uV @ 10m
Antenna Connector	On board Trace
Antenna Type	Internal PCB
Frequency Tolerance:	$>\pm 0.01\%$ (± 100 ppm)
Interface Cables:	Power and RS485
Power Source & Voltage:	AC/DC Power Supply 6VDC 3.0A

2.2 Test Configuration

The Cylinder Holder continuously scans for an RFID tag and continuously monitors the pressure of the gas cylinder.

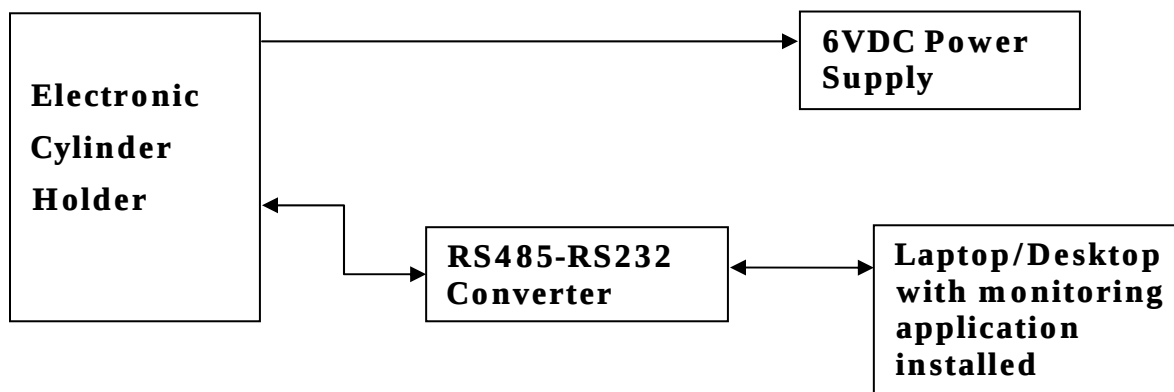


Figure 1: Test Configuration

2.3 Testing Algorithm

The GX2 Electronic Cylinder Holder operates at 13.56MHz.

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

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. 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.

2.5 Measurements

2.5.1 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

2.6 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

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

Where u_c = standard uncertainty
 $a, b, c, \dots$ = 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
 $k \leq 2$ 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 2 below.

Table 2: Expanded Uncertainty List

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

3 Test Equipment

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

Test Name: Radiated Emissions/Conducted Emissions		Test Date: 04/05/2012	
Asset #	Manufacturer/Model	Description	Cal. Due
644	SUNOL SCIENCES CORPORATION - JB1 925-833-9936	BICONALOG ANTENNA	1/12/2013
71	HP - 85685A	PRESELECTOR RF	6/26/2012
73	HP - 8568B	ANALYZER SPECTRUM	6/26/2012
69	HP - 85650A	ADAPTER QP	6/28/2012
125	SOLAR - 8028-50-TS-24-BNC	LISN	7/10/2012
126	SOLAR - 8028-50-TS-24-BNC	LISN	7/10/2012

Test Name: Temperature Stability		Test Date: 4/11/2012	
Asset #	Manufacturer/Model	Description	Cal. Due
00528	AGILENT - E4446A	ANALYZER SPECTRUM	8/30/2012
00641	HQ POWER - NONE	0-50V 5AMP DC SUPPLY	CNR
00163	WLL - CABLE F	CABLE COAXIAL 6FT RG-223	7/26/2012
00776	TENNY - TJR-A-WS4	1.22 CUFT TEMP CHAMBER	1/4/2013

4 Test Results

4.1 Occupied Bandwidth

Occupied bandwidth measurement was performed by coupling the output of the EUT to the input of a spectrum analyzer.

The occupied bandwidth was measured as shown:

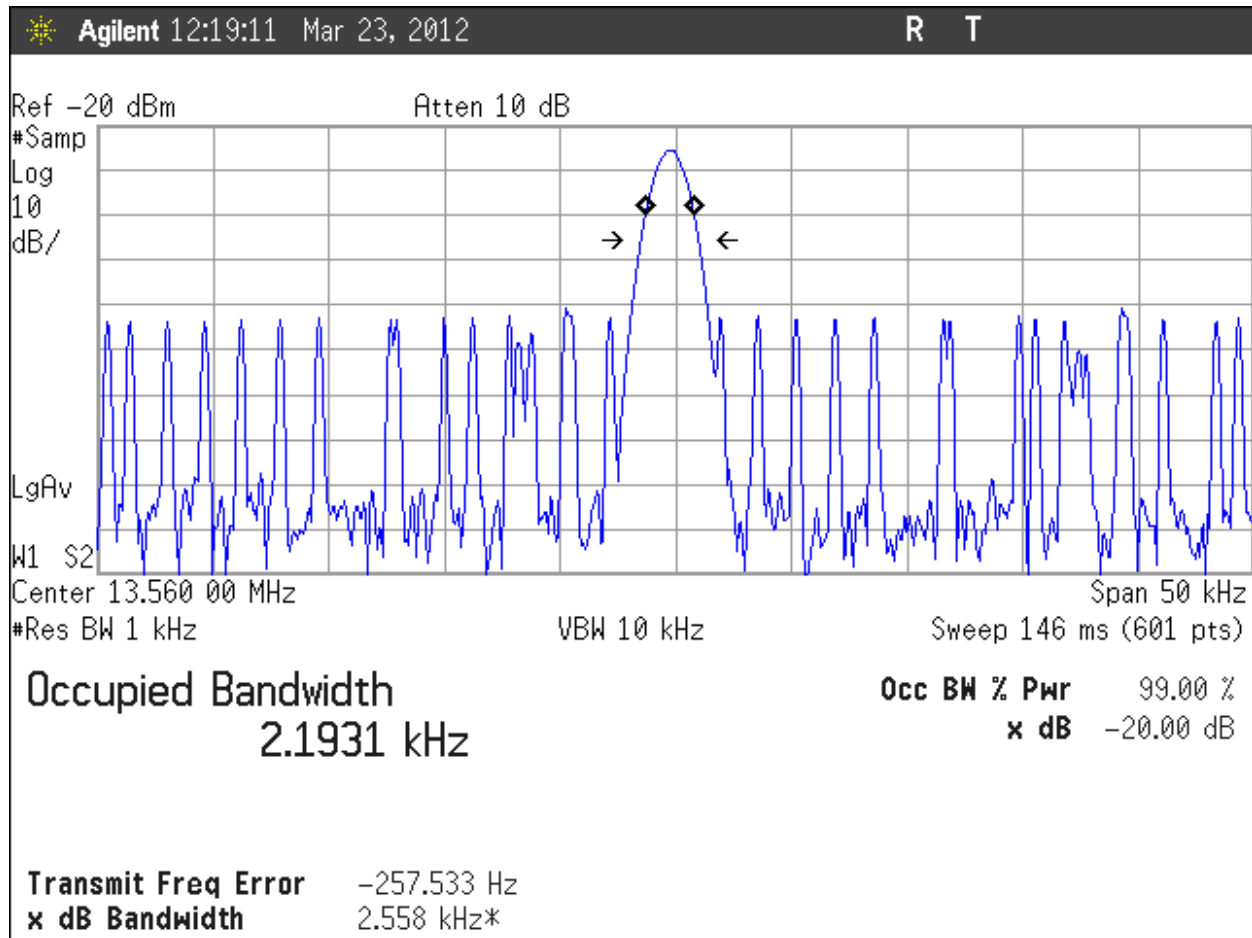


Figure 2: Occupied Bandwidth (99% Power)

Table 4: Occupied Bandwidth Results

Frequency	Bandwidth (99%)	Limit	Pass/Fail
13.560MHz	2.1931 kHz	N/A	Pass

4.2 Radiated Spurious Emissions: §15.225, §15.209

Radiated emissions from the EUT must comply with the field strength limits as specified in FCC Part 15.225 and 15.209. The limits for the radiated emissions are as shown in the following table.

Table 5: Radiated Spurious Emissions Limits

Frequency (MHz)	Limit ($\mu\text{V/m}$)	Rule Part Reference
13.553 - 13.567	15,848 (@ 30m)	§15.225(a)
13.410 – 13.553	334 (@ 30m)	§15.225(b)
13.567 – 13.710	334 (@ 30m)	§15.225(b)
13.110 – 13.410	106 (@ 30m)	§15.225(c)
13.710 – 14.010	106 (@ 30m)	§15.225(c)
1.705 – 13.110 14.010 – 30.0	30 (@ 30m)	§15.225(d), §15.209
30.00 – 88.00	100 (@ 3m)	§15.225(d), §15.209
88.00 – 216.00	150 (@ 3m)	§15.225(d), §15.209
216.00 – 960.00	200 (@ 3m)	§15.225(d), §15.209
Above 960	500 (@ 3m)	§15.225(d), §15.209

4.2.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on an Open Area Test Site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. 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. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured

Testing at frequencies below 30 MHz was performed at ten meters with a loop antenna. The 30 meter limits were normalized to 10m. Three orientations of the loop antenna were tested.

Emissions were scanned up to 1 GHz. All other emissions detected were related to digital emissions of the IUS electronics. Since the EUT is used in a commercial application, these digital emissions were compared to the Class A limit of §15.109(b). For emissions up to 30 MHz peak levels were recorded. Emissions from 30 MHz to 1000 MHz were measured using a Quasi-peak detector. Worst-case emissions are reported in the data table.

The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

Sample Calculation:

Spectrum Analyzer Voltage (SA Level): $V_{dB\mu V}$
 Antenna Factor (Ant Corr): $AF_{dB/m}$
 Cable Loss Correction (Cable Corr): CC_{dB}
 Amplifier Gain: G_{dB} (if applicable)
 Electric Field (Corr Level): $Ed_{B\mu V/m} = V_{dB\mu V} + AF_{dB/m} + CC_{dB} - G_{dB}$
 To convert to linear units: $E_{\mu V/m} = \text{antilog}(Ed_{B\mu V/m}/20)$

4.2.2 Test Results

The EUT complies with the radiated emission requirements of §15.225.

Table 6: Radiated Emission Test Data, Fundamental Frequency

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)	Comments
Unit Upright									
13.56	X	270.00	1.00	52.50	11.7	1620.2	142636.0	-38.9	
27.13	X	270.00	1.00	13.40	10.1	14.9	270.0	-25.2	
13.56	Y	180.00	1.00	55.70	11.7	2341.9	142636.0	-35.7	
27.13	Y	180.00	1.00	14.60	10.1	17.1	270.0	-24.0	
13.56	Z	180.00	1.00	62.00	11.7	4836.8	142636.0	-29.4	
27.13	Z	180.00	1.00	16.90	10.1	22.3	270.0	-21.7	
Unit on Back									
13.56	X	180.00	1.00	58.40	11.7	3195.7	142636.0	-33.0	
27.13	X	180.00	1.00	15.20	10.1	18.3	270.0	-23.4	
13.56	Y	270.00	1.00	56.00	11.7	2424.2	142636.0	-35.4	
27.13	Y	270.00	1.00	16.00	10.1	20.1	270.0	-22.6	
13.56	Z	180.00	1.00	56.00	11.7	2424.2	142636.0	-35.4	
27.13	Z	180.00	1.00	9.30	10.1	9.3	270.0	-29.3	
Unit on Side									
13.56	X	180.00	1.00	55.80	11.7	2369.0	142636.0	-35.6	
27.13	X	180.00	1.00	14.50	10.1	16.9	270.0	-24.1	
13.56	Y	180.00	1.00	56.20	11.7	2480.6	142636.0	-35.2	
27.13	Y	180.00	1.00	16.10	10.1	20.4	270.0	-22.5	
13.56	Z	270.00	1.00	59.40	11.7	3585.6	142636.0	-32.0	
27.13	Z	270.00	1.00	15.80	10.1	19.7	270.0	-22.8	

Notes: 30m limit normalized to 10m

0 degree azimuth; antenna height = one (1) meter

Table 7: Radiated Emission Test Data

Unit Upright

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)	Comments
40.66	V	180.00	1.00	9.80	13.8	15.2	100.0	-16.4	Peak Quasi
54.23	V	180.00	1.00	9.80	8.6	8.3	100.0	-21.6	
67.77	V	0.00	1.00	15.30	8.6	15.7	100.0	-16.1	
79.98	V	270.00	1.00	22.40	9.1	37.4	100.0	-8.5	
81.34	V	180.00	1.00	28.60	9.1	76.9	100.0	-2.3	
81.34	V	180.00	1.00	28.34	9.1	74.6	100.0	-2.5	
108.45	V	225.00	1.00	13.70	14.7	26.2	150.0	-15.2	
122.02	V	225.00	1.00	10.10	15.5	19.1	150.0	-17.9	
135.57	V	225.00	1.00	12.40	14.8	23.0	150.0	-16.3	
162.70	V	0.00	1.00	16.20	14.6	34.7	150.0	-12.7	
216.95	V	0.00	1.00	13.60	14.2	24.4	200.0	-18.3	
230.50	V	90.00	1.00	23.40	14.6	79.2	200.0	-8.0	
257.61	V	45.00	2.32	20.80	15.5	65.1	200.0	-9.7	
311.85	V	90.00	2.06	13.20	17.9	35.7	200.0	-15.0	
325.41	V	315.00	1.80	12.80	18.3	35.9	200.0	-14.9	
623.73	V	90.00	1.00	11.70	25.7	74.5	200.0	-8.6	
67.78	H	90.00	4.00	5.30	8.6	5.0	100.0	-26.1	
79.99	H	125.00	4.00	10.60	9.1	9.6	100.0	-20.3	
81.34	H	165.00	4.00	13.40	9.1	13.4	100.0	-17.5	
108.46	H	165.00	1.70	11.30	14.7	19.9	150.0	-17.6	
122.02	H	150.00	2.65	10.60	15.5	20.2	150.0	-17.4	
135.58	H	45.00	4.00	2.50	14.8	7.4	150.0	-26.2	
162.70	H	180.00	1.90	19.00	14.6	48.0	150.0	-9.9	
216.94	H	315.00	1.50	8.50	14.1	13.6	200.0	-23.4	
230.50	H	0.00	1.40	18.00	14.6	42.5	200.0	-13.4	
257.61	H	270.00	1.32	18.00	15.5	47.2	200.0	-12.5	
298.29	H	180.00	1.00	11.20	17.3	26.6	200.0	-17.5	
623.72	H	195.00	1.00	4.80	25.7	33.7	200.0	-15.5	

Unit on Back

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)	Comments
40.66	V	180.00	1.00	9.80	14.0	15.5	100.0	-16.2	Peak Quasi
54.23	V	180.00	1.00	9.80	8.6	8.4	100.0	-21.6	
67.77	V	0.00	1.00	16.30	8.5	17.4	100.0	-15.2	
79.98	V	270.00	1.00	22.40	8.8	36.3	100.0	-8.8	
81.34	V	180.00	1.00	28.50	8.9	74.0	100.0	-2.6	
81.34	V	180.00	1.00	26.30	8.9	57.4	100.0	-4.8	
108.45	V	225.00	1.00	14.70	14.1	27.7	150.0	-14.7	
122.02	V	225.00	1.00	10.10	14.9	17.9	150.0	-18.5	
135.57	V	225.00	1.00	12.40	14.4	21.9	150.0	-16.7	
162.70	V	0.00	1.00	16.20	14.0	32.4	150.0	-13.3	
216.95	V	0.00	1.00	13.60	13.7	23.1	200.0	-18.7	
230.50	V	90.00	1.00	25.30	14.2	94.0	200.0	-6.6	
257.61	V	45.00	2.32	24.43	15.2	95.6	200.0	-6.4	
311.85	V	90.00	2.06	13.20	17.6	34.6	200.0	-15.2	
325.41	V	315.00	1.80	12.80	17.9	34.3	200.0	-15.3	
623.73	V	90.00	1.00	13.50	24.8	82.2	200.0	-7.7	
67.78	H	90.00	4.00	5.30	8.5	4.9	100.0	-26.2	
79.99	H	125.00	4.00	10.60	8.8	9.3	100.0	-20.6	
81.34	H	165.00	4.00	21.37	8.9	32.5	100.0	-9.8	
108.46	H	165.00	1.70	18.50	14.1	42.9	150.0	-10.9	
122.02	H	150.00	2.65	10.60	14.9	18.9	150.0	-18.0	
135.58	H	45.00	4.00	12.50	14.4	22.2	150.0	-16.6	
162.70	H	180.00	1.90	22.00	14.0	63.1	150.0	-7.5	
216.94	H	315.00	1.50	19.20	13.7	44.0	200.0	-13.1	
230.50	H	0.00	1.40	23.50	14.2	76.4	200.0	-8.4	
257.61	H	270.00	1.32	22.20	15.2	73.9	200.0	-8.6	
298.29	H	180.00	1.00	13.20	17.1	32.8	200.0	-15.7	
623.72	H	195.00	1.00	4.80	24.8	30.2	200.0	-16.4	

Unit on Side

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)	Comments
40.66	V	180.00	1.00	9.80	14.0	15.5	100.0	-16.2	Peak Quasi
54.23	V	180.00	1.00	9.80	8.6	8.4	100.0	-21.6	
67.77	V	0.00	1.00	16.30	8.5	17.4	100.0	-15.2	
79.98	V	270.00	1.00	22.40	8.8	36.3	100.0	-8.8	
81.34	V	180.00	1.00	27.21	8.9	63.7	100.0	-3.9	
81.34	V	180.00	1.00	20.43	8.9	29.2	100.0	-10.7	
108.45	V	225.00	1.00	14.70	14.1	27.7	150.0	-14.7	
122.02	V	225.00	1.00	10.10	14.9	17.9	150.0	-18.5	
135.57	V	225.00	1.00	12.40	14.4	21.9	150.0	-16.7	
162.70	V	0.00	1.00	16.20	14.0	32.4	150.0	-13.3	
216.95	V	0.00	1.00	13.60	13.7	23.1	200.0	-18.7	
230.50	V	90.00	1.00	24.19	14.2	82.7	200.0	-7.7	
257.61	V	45.00	2.32	22.50	15.2	76.5	200.0	-8.3	
311.85	V	90.00	2.06	12.20	17.6	30.8	200.0	-16.2	
325.41	V	315.00	1.80	11.60	17.9	29.9	200.0	-16.5	
623.73	V	90.00	1.00	13.50	24.8	82.2	200.0	-7.7	
67.78	H	90.00	4.00	5.30	8.5	4.9	100.0	-26.2	
79.99	H	125.00	4.00	10.60	8.8	9.3	100.0	-20.6	
81.34	H	165.00	4.00	18.32	8.9	22.9	100.0	-12.8	
108.46	H	165.00	1.70	12.35	14.1	21.1	150.0	-17.0	
122.02	H	150.00	2.65	20.40	14.9	58.4	150.0	-8.2	
135.58	H	45.00	4.00	18.50	14.4	44.3	150.0	-10.6	
162.70	H	180.00	1.90	23.48	14.0	74.8	150.0	-6.0	
216.94	H	315.00	1.50	19.20	13.7	44.0	200.0	-13.1	
230.50	H	0.00	1.40	25.67	14.2	98.1	200.0	-6.2	
257.61	H	270.00	1.32	22.20	15.2	73.9	200.0	-8.6	
298.29	H	180.00	1.00	13.20	17.1	32.8	200.0	-15.7	
623.72	H	195.00	1.00	4.80	24.8	30.2	200.0	-16.4	

4.3 Frequency Stability: (FCC Part §2.1055)

Frequency as a function of temperature and voltage variation shall be maintained within the FCC-prescribed tolerances. Per §15.225(e) the frequency tolerance shall be maintained within $\pm 0.01\%$ of the reference frequency.

4.3.1 Test Procedure

The temperature stability was measured with the unit in an environmental chamber used to vary the temperature of the sample. The sample was held at each temperature step to allow the temperature of the sample to stabilize.

The frequency stability of the transmitter was examined at the voltage extremes and for the temperature range of -30°C to $+50^{\circ}\text{C}$. The carrier frequency was measured while the EUT was in the temperature chamber. The reference frequency of the EUT was measured at the ambient room temperature with the frequency counter.

The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range.

The RF carrier frequency shall not depart from the reference frequency (reference frequency is the frequency at 20°C and rated supply voltage) in excess of ± 1356 Hz.

The EUT was powered via a dedicated AC/DC adjustable power supply.

4.3.2 Test Results

The EUT complies with the temperature stability requirements of FCC §15.225(e). Test results are given in Table 8.

Table 8: Frequency Stability Test Data

Temperature (Centigrade)	Frequency (MHz)	Difference (Hz)	Deviation (%)
Ambient	13.559761	0.0	0
-30	13.559684	-77.0	0.000568
-20	13.559750	-11.0	0.000081
-10	13.559785	24.0	0.000177
0	13.559800	39.0	0.000288
10	13.559792	31.0	0.000229
20	13.559765	4.0	0.000029
30	13.559738	-23.0	0.000170
40	13.559710	-51.0	0.000376
50	13.559689	-72.0	0.000531

Voltage (Volts)	Frequency (MHz)	Difference (Hz)	Deviation (%)	Voltage (Volts)
At rated	13.559761	0	0.0	6.0
At 85%	13.559760	1	0.000007	5.1
At 115%	13.559759	2	0.000015	6.9

4.4 Conducted Emissions (AC Power Line)

4.4.1 Requirements

Test Arrangement: Table Top (The Unit is Battery Powered and has a charger)

Compliance Standard: FCC Class B

FCC Compliance Limits		
Frequency	Quasi-peak	Average
0.15 - 0.5MHz	66 to 56dB μ V	56 to 46dB μ V
0.5 - 5MHz	56dB μ V	46dB μ V
5 - 30MHz	60dB μ V	50dB μ V

4.4.2 Test Procedure

The EUT was placed on an 80 cm high 1 X 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω /50 μ H Line Impedance Stabilization Network bonded to a 3 X 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power was supplied to the peripherals through a second LISN. The peripherals were placed on the table in accordance with ANSI C63.4-2009. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth. For average measurements the post-detector filter was set to 10 Hz.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed. The Conducted emissions level to be compared to the FCC limit is calculated as shown in the following example.

Example:

Spectrum Analyzer Voltage: $V_{dB\mu V}$

LISN Correction Factor: LISN dB

Cable Correction Factor: CF dB

Electric Field: $EdB_{\mu V} = V_{dB\mu V} + LISN\ dB + CF\ dB$

4.4.3 Test Data

The EUT complied with the Class B Conducted Emissions requirements. Table 9 provides the test results for phase and neutral line power line conducted emissions.

Table 9: AC Mains Conducted Emissions Data

NEUTRAL

Frequency (MHz)	Level QP (dB μ V)	Level AVG (dB μ V)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dB μ V)	Level Corr Avg (dB μ V)	Limit QP (dB μ V)	Limit AVG (dB μ V)	Margin QP (dB)	Margin AVG (dB)
0.155	38.8	16.6	10.1	0.1	49.1	26.8	65.7	55.7	-16.7	-28.9
0.186	36.4	19.3	10.1	0.2	46.7	29.6	64.2	54.2	-17.5	-24.6
0.218	34.2	20.3	10.1	0.2	44.5	30.6	62.9	52.9	-18.4	-22.3
0.246	33.9	21.2	10.1	0.0	44.0	31.3	61.9	51.9	-17.9	-20.6
0.280	31.5	20.7	10.1	0.3	41.9	31.1	60.8	50.8	-18.9	-19.7
0.442	32.5	29.6	10.1	0.5	43.0	40.2	57.0	47.0	-14.0	-6.8

PHASE

Frequency (MHz)	Level QP (dB μ V)	Level AVG (dB μ V)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dB μ V)	Level Corr Avg (dB μ V)	Limit QP (dB μ V)	Limit AVG (dB μ V)	Margin QP (dB)	Margin AVG (dB)
0.154	40.3	18.7	10.1	0.4	50.8	29.2	65.8	55.8	-14.9	-26.6
0.186	37.2	18.8	10.1	0.2	47.4	29.1	64.2	54.2	-16.8	-25.1
0.217	35.2	19.9	10.1	0.1	45.5	30.1	63.0	53.0	-17.5	-22.8
0.246	32.9	21.0	10.1	0.1	43.0	31.2	61.9	51.9	-18.8	-20.7
0.279	31.7	20.5	10.1	0.2	42.0	30.8	60.9	50.9	-18.9	-20.0
0.437	33.0	30.1	10.1	0.7	43.7	40.8	57.1	47.1	-13.4	-6.3