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## Certification Test Report

In Accordance With: FCC Part 15 Subpart C, 15.231

Applicant: Green Badge LLC dba UgMO Technologies  
840 1st Ave., Ste. 300  
King of Prussia, PA 19406

Equipment Under Test (EUT): Wireless Repeater  
Model: PH100WR

FCC ID: YVAPH100WR.

Tested By: Nemko USA Inc.  
11696 Sorrento Valley Road, Suite F  
San Diego, CA 92121

Test Report Number: 2011 10165832 FCC  
Date: January 13, 2011  
Project Number: 43834  
NEX Number: 149167

Total Number of Pages: 27

## Section 1. Summary of Test Results

### 1.1 General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed:	Wireless Repeater
Model:	PH100WR
Specification:	FCC Part 15 Subpart C, 15.231
Date Received in Laboratory:	January 12, 2011
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None

## 1.2 Report Release History

REVISION	DATE	COMMENTS
-	January 13, 2010	Prepared By: Alan Laudani
-	January 13, 2010	Initial Release: Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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Alan Laudani, RF/EMC Test Engineer

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## Section 2: Equipment Under Test

### 2.1 Theory of Operation

The PH100WR is a Wireless Repeater. The EUT was exercised by putting the transmitter into a continuous transmit mode (artificial test modes) on 434 MHz for communication of data between a Soil sensor and a Base station.

See operation description for a more detailed description.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

Highest frequency generated or used: 434 MHz

The Repeater will only repeat messages it has successfully received, demodulated, decoded, and validated. The Repeater will only repeat messages with FCC ID: YVAPH100WS Sensor, any non-UGMO devices will be ignored.

The Repeater will transmit with fixed output power regardless the received sensor signal level (the variant distance between sensor and repeater). The received power cannot influence the transmit power as the incoming signal is decoded to data packets that are transmitted at a fixed output power.

### 2.2 Technical Specifications of the EUT

Manufacturer:	Green Badge LLC dba UgMO Technologies
	dba = "doing business as"
Operating Frequency:	434 MHz
Measured Power:	68.9 dBuV/m @ 3m
Modulation:	GFSK
Antenna Data:	Coil antenna
Antenna Connector:	NONE
Power Source:	120 Vac 60 Hz to 12 Vdc 100 mA Power Brick

## Section 3: Test Conditions

### 3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.231  
Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

### 3.2 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

### 3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range : 14 – 22 °C  
Humidity range : 32--76 %  
Pressure range : 102.0 kPa  
Power supply range : +/- 5% of rated voltages

### 3.4 Test Equipment

Nemko ID	Device	Mfr.	Model	Serial Number	Cal Date	Cal Due Date
110	Antenna, LPA	Electrometrics	LPA-25	1217	1/10/2009	2/10/2011
128	Antenna, Bicon	EMCO	3110	2882	2/9/2009	2/9/2011
317	Preamplifier	HP	8449A	2749A00167	5/7/2010	5/7/2011
404	Spectrum Analyzer Display	HP	85662A	2648A15448	12/8/2010	12/8/2011
421	Quasi-Peak Adapter	HP	85650A	3145A01672	12/8/2010	12/8/2011
711	Spectrum Analyzer	HP	8566B	2747A04729	12/8/2010	12/8/2011
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	7/12/2010	7/12/2011
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	8/16/2010	8/16/2012
898	EMI Receiver & filter set	HP	8546A	3625A00348	6/22/2010	6/22/2011
899	Filter Section	HP	85460A	3448A00288	6/22/2010	6/22/2011
E1019	Two Line V-Network	Rohde & Schwarz	ENV216	101045	3/12/2010	3/12/2011
E1017	9kHz to 7GHz Spectrum Analyzer	Rohde & Schwarz	FSP7	839337/0022	1/26/2010	1/26/2011

## Section 4: Observations

### 4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

### 4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

### 4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

### 4.4 Tests Deleted

No Tests were deleted from this assessment.

### 4.5 Additional Observations

There were no additional observations made during this assessment.

## Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C: Test Results.

RSS-210 Issue 8 December 2010

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No: not applicable / not relevant  
Y Yes: Mandatory i.e. the apparatus shall conform to these tests.  
N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

### 5.1 Test Results

Part 15	Test Description	Required	Result
15.207 (a)	Power line Conducted Emissions	Y	Pass
15.215 (c) 15.231(c)	Occupied Bandwidth/ 99% Bandwidth	Y	Pass
15.231 (a)	Types of Momentary Signals	Y	Pass
15.231 (d)	Frequency Stability	N	NA
15.231 (e)	Field strength of fundamental Spurious Emissions	Y	Pass
15.107 (a)	Receiver Spurious Conducted Emissions	Y	Pass
15.109 (a)	Receiver Spurious Radiated Emissions	Y	Pass



## Appendix A: Test Results

### Conducted Emissions

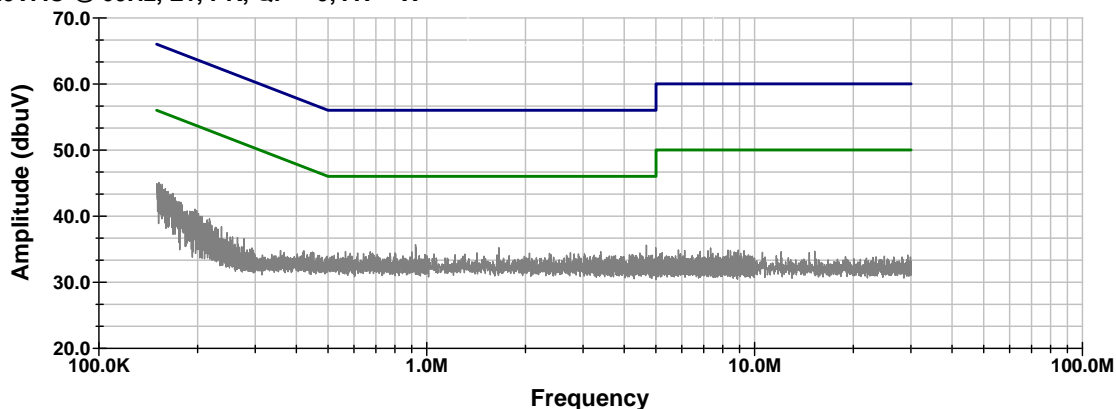
Client	Green Badge LLC dba UgMO Technologies	Temperature	24	°C
Pan #	1024420	Relative Humidity	37	%
EUT Name	Wireless Soil Sensor Repeater	Barometric Pressure	101.8	kPa
EUT Model	Advanced Sensor Repeater	Test Location	Enclosure 1	
Governing Doc	CFR 47, Part 15B	Test Engineer	Alan Laudani	
Basic Standard	Sec. 15.207 Class “B” Transmit	Date of test	1-20-2011	
Test Parameters	Peak RBW: 100kHz VBW: 100kHz Quasi-Peak: RBW 9kHz, VBW 30 kHz Average: RBW 9kHz, VBW 30 kHz Quasi-Peak Limit Blue Line, Average Limit Green Line			

Nemko USA, Inc.

Transmitting

FCC Part B, Class B Conducted Emissions

120VAC @ 60Hz, L1, PK, QP = 0, AV = X



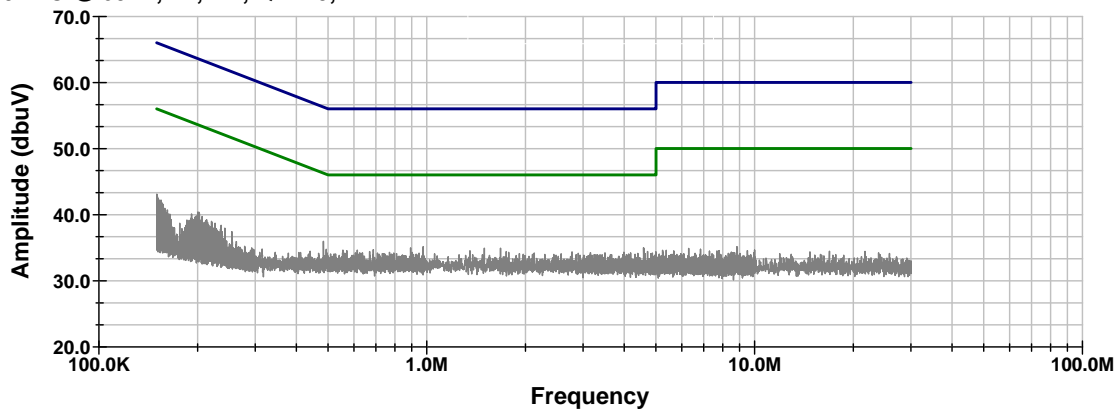
08:24:39 AM, Thursday, January 20, 2011

Nemko USA, Inc.

Transmitting

FCC Part B, Class B Conducted Emissions

120VAC @ 60Hz, L2, PK, QP = 0, AV = X



08:22:22 AM, Thursday, January 20, 2011

## Occupied Bandwidth

A1.1. The 99% bandwidth shall be no wider than 0.25% of the centre frequency for devices operating between 70-900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency.

15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sec. Sec. 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

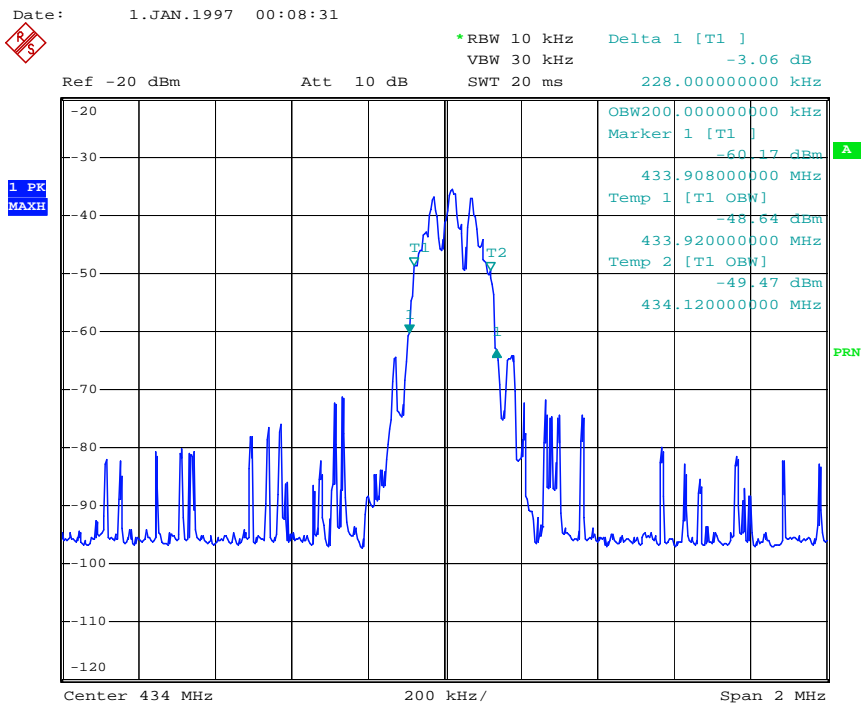
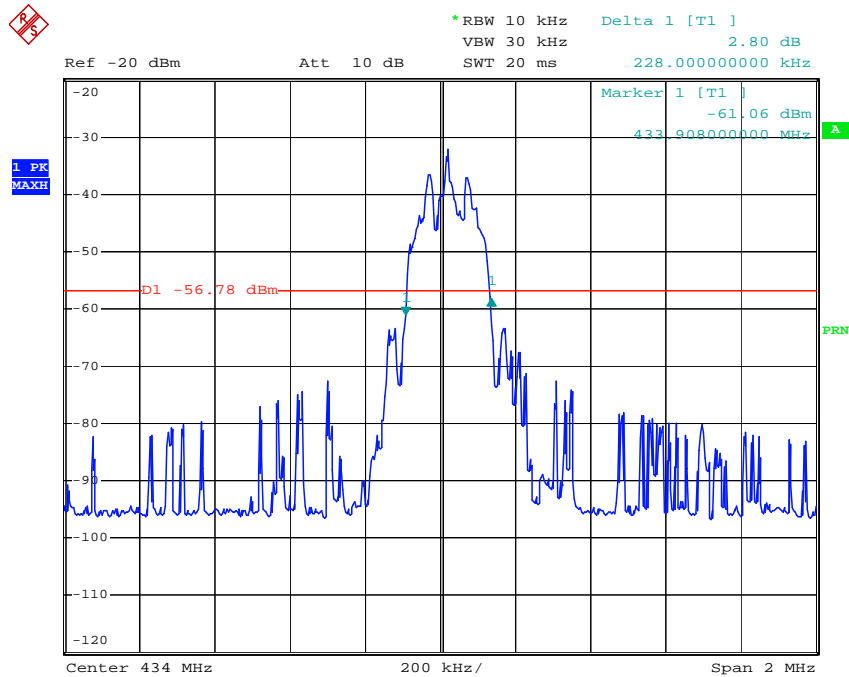
## Test Conditions:

Client	Green Badge LLC dba UgMO Technologies	Temperature	24	°C
Pan #	1024420	Relative Humidity	37	%
EUT Name	Wireless Soil Sensor Repeater			
EUT Model	Advanced Sensor Repeater	Test Location	Enclosure 2	
Governing Doc	CFR 47, Part 15C	Test Engineer	Alan Laudani	
Basic Standard	Sec. 15.231 Transmit	Date of test	December 20, 2010	

## Test Results:

Measured Occupied Bandwidth: 228 kHz

Measured 99% Bandwidth = 200 kHz



Date: 1.JAN.1997 00:09:52

## Frequency Stability

A1.1.4 Carrier frequency stability of devices momentarily operated in the band 40.66-40.70 MHz shall be maintained to  $\pm 0.01\%$  ( $\pm 100$  ppm).

15.231(d) For devices operating within the frequency band 40.66–40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be  $\pm 0.01\%$ . This frequency tolerance shall be maintained for a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltages at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### Test Conditions:

Client	Green Badge LLC dba UgMO Technologies	Temperature		°C
Pan #	1024420	Relative Humidity		%
EUT Name	Wireless Soil Sensor Repeater			
EUT Model	Advanced Sensor Repeater	Test Location		
Governing Doc	CFR 47, Part 15C	Test Engineer	Alan Laudani	
Basic Standard	Sec. 15.231 Transmit	Date of test		

### Test Results:

The EUT does not transmit within the 40.66–40.70 MHz band, therefore this test is not applicable.

## Types of Momentary Signals

RSS A1.1.1(c) Periodic transmissions at regular predetermined intervals are not permitted, except as provided in A.1.1.5. However, polling or supervision transmissions, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmission does not exceed 2 seconds per hour for each transmitter.

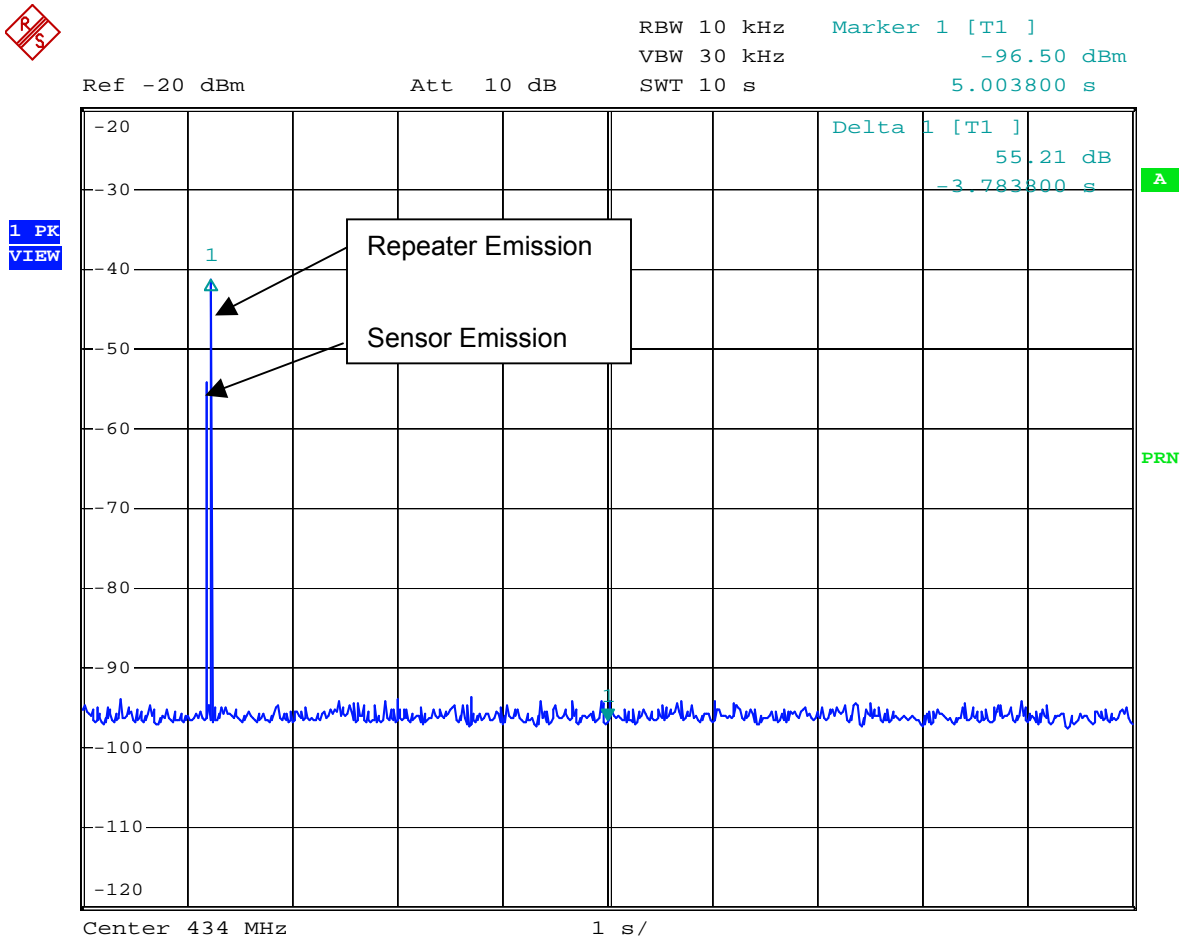
15.231(a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation

15.231(a)(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

Client	Green Badge LLC dba UgMO Technologies	Temperature	24	°C
Pan #	1024420	Relative Humidity	37	%
EUT Name	Wireless Soil Sensor Repeater			
EUT Model	Advanced Sensor Repeater	Test Location	SOATS	
Governing Doc	CFR 47, Part 15C	Test Engineer	Alan Laudani	
Basic Standard	Sec. 15.231 Transmit	Date of test	December 20, 2010	

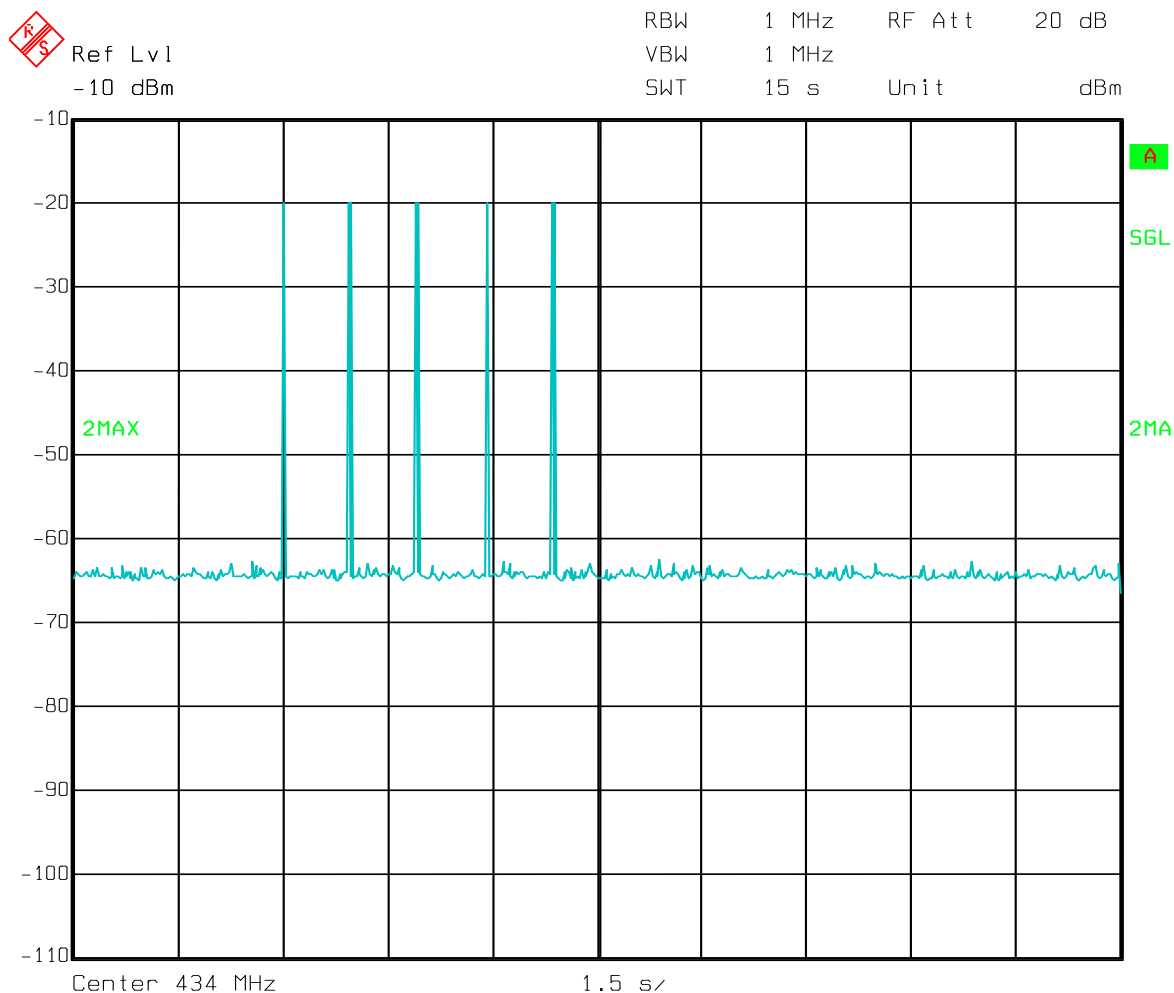
The Repeater is 'turned on' by receiving an emission from the Sensor. From that moment, the Sensor will transmit once, and shuts off within 5 seconds.

If the sensor is in climatizing mode (newly implanted), the worst case transmission is once every 10 minutes. Once per 10 minutes x 6 10-min periods per hour x 0.068 seconds = 0.408 seconds which is less than 2 seconds per hour.



Date: 1.JAN.1997 00:20:50

Set-Up Mode: transmits 5 times to announce its presence and shuts off.  
Sweep is 15 Seconds. Emissions are "regular packets" of 6.8 ms.



Date: 11.FEB.2011 13:58:20

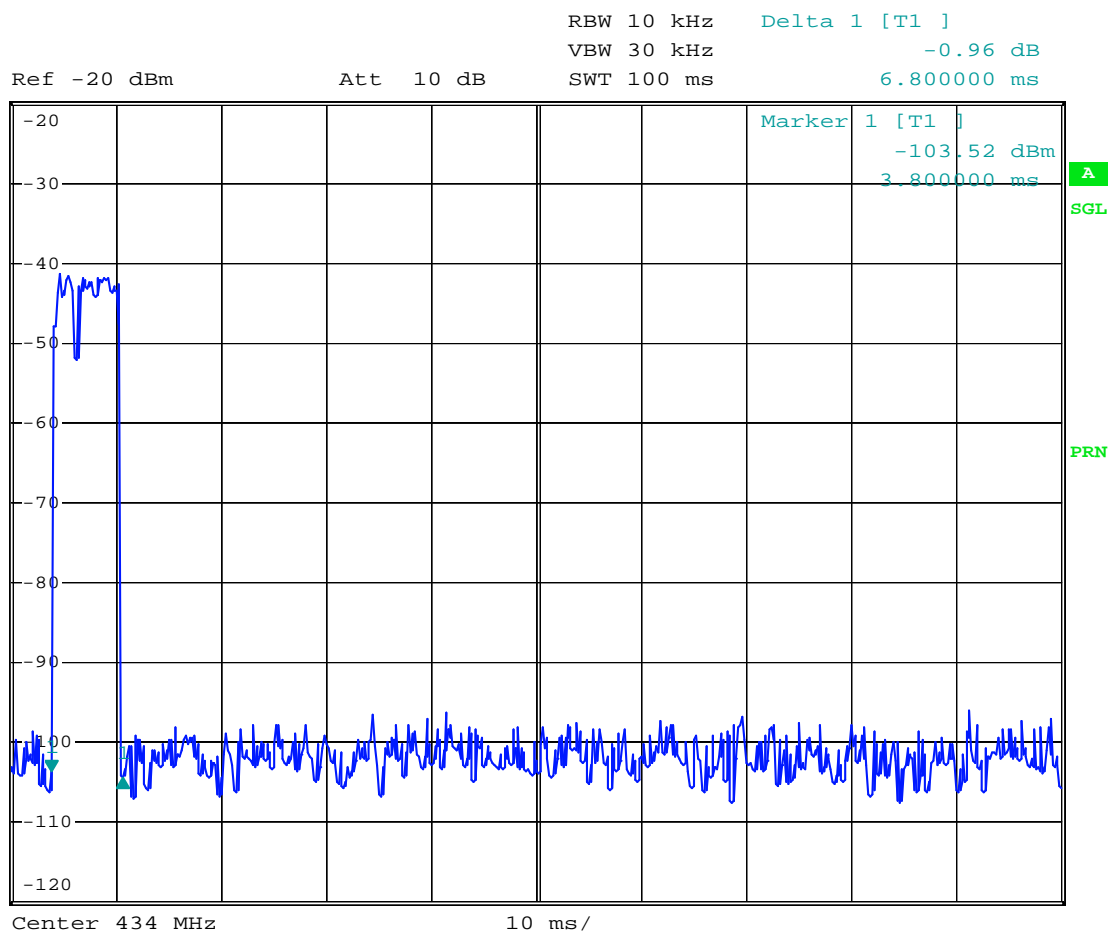
### Duty Cycle

This plot shows power on in 100 ms

Duty Cycle factor =  $20 \times \log(6.8/100) = -23.3 \text{ dB}$



1 PK  
MAXH



Date: 1.JAN.1997 00:11:16



## Field strength of fundamental

## Spurious Emissions

## RSS210 Annex 1

15.231(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66–40.70	1,000	100
70–130	500	50
130–174	500 to 1,500 <sup>1</sup>	50 to 150 <sup>1</sup>
174–260	1,500	150
260–470	1,500 to 5,000 <sup>1</sup>	150 to 500 <sup>1</sup>
Above 470	5,000	500

<sup>1</sup>Linear interpolations.

At 434 MHz this interpolates to 11000 microVolts/m or 80.8 dBuV/m at 3m  
Unwanted emissions 60.8 or FCC15.209/RSS Table 2, whatever is higher.

Client	Green Badge LLC dba UgMO Technologies	Temperature	18	°C
Pan #	1024420	Relative Humidity	35	%
EUT Name	Wireless Soil Sensor Repeater			
EUT Model	Advanced Sensor Repeater	Test Location	NOATS	
Governing Doc	CFR 47, Part 15C	Test Engineer	Jim Owen	
Basic Standard	Sec. 15.231 Transmit	Date of test	January 12, 2011	

## Test Results:

See Table. EUT complies for fundamental power and spurious emissions.

## Additional Observations:

The Spectrum was searched from 30MHz to the 10<sup>th</sup> Harmonic (4350 MHz).



These results apply to emissions that may be found in the restricted bands defined in FCC Part 15 Subpart C, 15.205.

The emissions were measured with a test mode to repeat the emission so measurements could be maximized for the rotation of the sample and height and polarity of the measurement antenna.

All Measurements below 1GHz were performed at 3m employing a CISPR quasi-peak detector, except for the radio's fundamental. Peak measurements above 1GHz were done utilizing RBW of 1MHz and VBW of 3MHz. Average measurements above 1GHz were done utilizing RBW of 1MHz and VBW of 10Hz as the duty cycle was 100%.

Measurements made at the 3 meter Outside Area Test Site, all measurements max hold after peaking for EUT rotation and antenna height from 1 to 4 meters.

Fundamental power was measured at 1 MHz RBW, 3 MHz VBW to ensure capture of entire emissions envelope. Average reading of Fundamental power therefore was peak + duty cycle factor. Varying the 120 VAC input to the power brick by  $\pm 15\%$  had no effect on the RF output power.

No other emissions found within 20 dB of the limits.



Mode: meeting Limits of 15.231(a), table in (b)

Special test mode to broadcast once per second.

Normal operation: EUT stops transmitting within 5 seconds of receiving a sensor transmission.

*Note: Corrected Reading Computations*

$$\text{Average} = \text{Peak Maximum Meter Reading} + \text{Antenna Factor} + \text{Path Loss} + \text{DUTY CYCLE FACTOR}$$
$$68.9 = 72.6 + 16.6 + 3.0 - 23.3$$

Peak limit = 20 dB above the average limit.

EUT passes

Limit paragraph 231(e) = 4400 uV/m

Corrected Average Reading = 68.9 dBuV/m;  $10^{(68.9/20)} = 2786 \text{ uV/m}$

## Radiated Emissions Data

Job # : 165832 Date : 1/12/2011  
NEX #: 1022420 Time : 8:00 AM  
Staff : JO

Page 1 of 1

Client Name :	Green Badge LLC dba UgMO Technologies
EUT Name :	Wireless Repeater
EUT Model # :	PH100WR
EUT Serial # :	NA
EUT Config. :	Transmitter on table

EUT Voltage :	120
EUT Frequency :	60
Phase:	1
NOATS	X
SOATS	
Distance < 1000 MHz:	3 m
Distance > 1000 MHz:	3 m

	Horizontal	
	CFR47 Part 15.231	CFR47 Part 15.205
Specification :	CFR47 Part 15, Subpart B, Class B	

Loop Ant. #:	NA		
Bicon Ant. #:	128 3m	Temp. (°C) :	18
Log Ant. #:	110 3m	Humidity (%) :	35
DRG Ant. #	877	Spec Analyzer #:	898
Cable LF#:	NOATS	Analyzer Display #:	898
Cable HF#:	NOATS	Quasi-Peak Detector #:	898
Preamp LF#:	NA	Duty Cycle (%):	0.068
Preamp HF#	317		Meas

Quasi-Peak	RBW: 120 kHz
	Video Bandwidth 300 kHz
Peak	RBW: 1 MHz
	Video Bandwidth 3 MHz
Average = Peak + Duty Cycle Factor	
DCF = 20 x log(duty cycle)	

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.

Measurements above 1 GHz are Average values, unless otherwise stated.

[illegible]

## Conducted Emissions Test Data—Receive Mode

Part 15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

7.2.2 The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network. Except when the requirements applicable to a given device state otherwise, for any license-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries. The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

Test Results: EUT complies

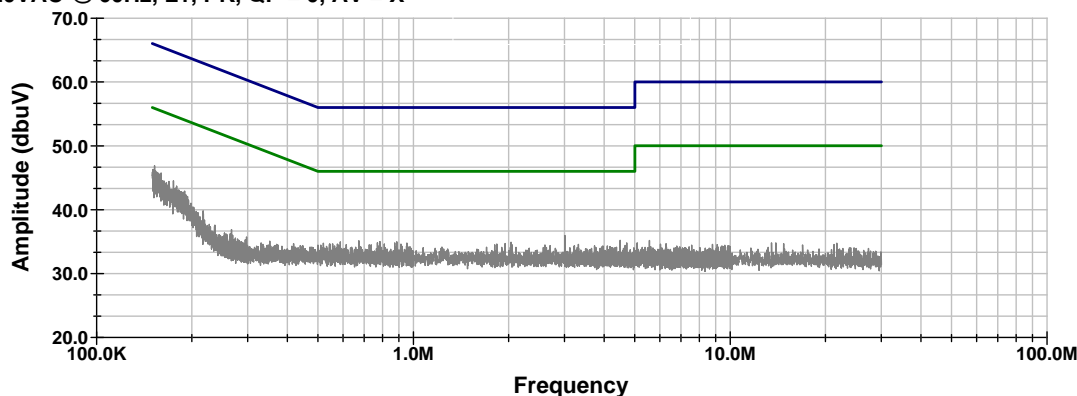
Client	Green Badge LLC dba UgMO Technologies	Temperature	24	°C
Pan #	1024420	Relative Humidity	37	%
EUT Name	Wireless Soil Sensor Repeater			
EUT Model	Sensor	Test Location	Enclosure 1	
Governing Doc	CFR 47, Part 15B	Test Engineer	Alan Laudani	
Basic Standard	Sec. 15.107 Class “B”	Date of test	7-2-2010	
Test Parameters	Peak RBW: 100kHz VBW: 100kHz Quasi-Peak: RBW 9kHz, VBW 30 kHz Average: RBW 9kHz, VBW 30 kHz Quasi-Peak Limit Blue Line. Average Limit Green Line			

Nemko USA, Inc.

Receiving

FCC Part B, Class B Conducted Emissions

120VAC @ 60Hz, L1, PK, QP = 0, AV = X



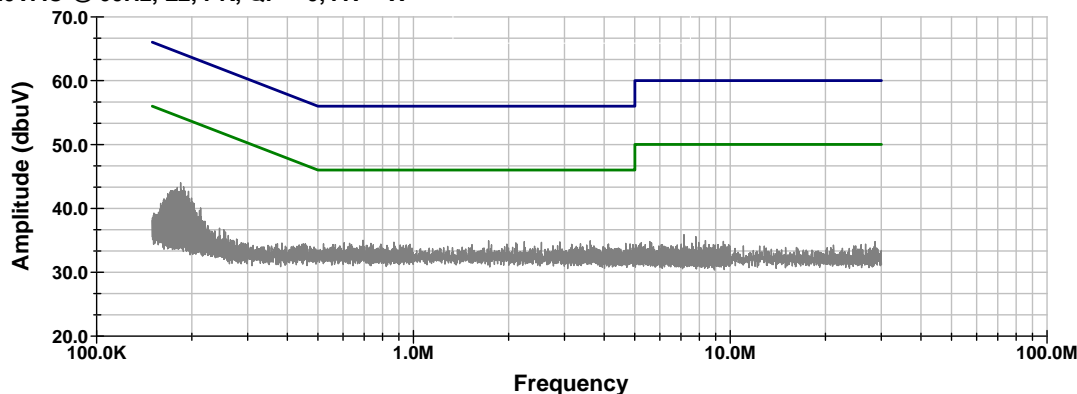
09:31:51 AM, Thursday, January 20, 2011

Nemko USA, Inc.

Receiving

FCC Part B, Class B Conducted Emissions

120VAC @ 60Hz, L2, PK, QP = 0, AV = X



09:34:01 AM, Thursday, January 20, 2011

**Radiated Emissions Test Data—Receive Mode**

The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

Table 1 - Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

Client	Green Badge LLC dba UgMO Technologies	Temperature	18	°C
Pan #	1024420	Relative Humidity	35	%
EUT Name	Wireless Soil Sensor Repeater			
EUT Model	Advanced Sensor Repeater	Test Location	Enclosure 1	
Governing Doc	CFR 47, Part 15B	Test Engineer	Jim Owen	
Basic Standard	Sec. 15.207 Class "B"	Date of test	1-12-2011	

No emissions evident while in receive mode

## APPENDIX B

### B. Radiated Emissions Measurement Uncertainties

#### 1. Introduction

ISO/IEC 17025:2005 and ANSI/NCSL Z540.3: 2006 require that all measurements contained in a test report be "traceable". "Traceability" is defined in the *International Vocabulary of Basic and General Terms in Metrology* (ISO: 1993) as: "the property of the result of a measurement... whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons, *all having stated uncertainties*".

The purposes of this Appendix are to "state the *Measurement Uncertainties*" of the conducted emissions and radiated emissions measurements contained in Section 5 of this Test Report, and to provide a practical explanation of the meaning of these measurement uncertainties.

#### 2. Statement of the Worst-Case Measurement Uncertainties for the Conducted and Radiated Emissions Measurements Contained in This Test Report

Table 1: Worst-Case Expanded Uncertainty "U" of Measurement for a k=2 Coverage Factor

Radiated Emissions Measurement Detection Systems	Applicable Frequency Range	"U" for a k=2 Coverage Factor
Spectrum Analyzer with QPA & Preamplifier	30 MHz - 200 MHz	+3.9 dB, -4.0 dB
Spectrum Analyzer with QPA & Preamplifier	200 MHz-1000 MHz	+/- 3.5 dB
Spectrum Analyzer with Preamplifier	1 GHz - 18 GHz	+2.5 dB, -2.6 dB
Spectrum Analyzer with Preamplifier	18 GHz - 40 GHz	+/- 3.4 dB

NOTES:

1. Applies to 3 and 10 meter measurement distances
2. Applies to all valid combinations of Transducers (i.e. LISNs, Line Voltage Probes, and Antennas, as appropriate)
3. Excludes the Repeatability of the EUT

### 3. Practical Explanation of the Meaning of Radiated Emissions Measurement Uncertainties

In general, a "Statement of Measurement Uncertainty" means that with a certain (specified) confidence level, the "true" value of a measurand will be between a (stated) upper bound and a (stated) lower bound.

In the specific case of EMC Measurements in this test report, the measurement uncertainties of the conducted emissions measurements and the radiated emissions measurements have been calculated in accordance with the method detailed in the following documents:

- *ANSI Z540.2 (2002) Guide to the Expression of Uncertainty in Measurement*
- NIS 81:1994, *The Treatment of Uncertainty in EMC Measurements* (NAMAS, 1994)
- NIST Technical Note 1297(1994), *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results* (NIST, 1994)

The calculation method used in these documents requires that the stated uncertainty of the measurements be expressed as an "expanded uncertainty",  $U$ , with a  $k=2$  coverage factor. The practical interpretation of this method of expressing measurement uncertainty is shown in the following example:

EXAMPLE: Assume that at 39.51 MHz, the (measured) radiated emissions level was equal to +26.5 dBuV/m, and that the +/- 2 standard deviations (i.e. 95% confidence level) measurement uncertainty was +/- 3.4 dB.





## APPENDIX C

### C. Nemko USA, Inc. Test Equipment & Facilities Calibration Program

Nemko USA, Inc. operates a comprehensive Periodic Calibration Program in order to ensure the validity of all test data. Nemko USA's Periodic Calibration Program is fully compliant to the requirements of NVLAP Policy Guide PG-1-1988, ANSI/NCSL Z540.3: 2006, ISO 10012:2003, ISO/IEC 17025:2005, and ISO-9000: 2000. Nemko USA, Inc.'s calibrations program therefore meets or exceeds the US national commercial and military requirements [N.B. ANSI/NCSL Z540.1-1994 replaced MIL-STD-45662A].

Specifically, all of Nemko USA's *primary reference standard devices* (e.g. vector voltmeters, multimeters, attenuators and terminations, RF power meters and their detector heads, oscilloscope mainframes and plug-ins, spectrum analyzers, RF preselectors, quasi-peak adapters, interference analyzers, impulse generators, signal generators and pulse/function generators, field-strength meters and their detector heads, etc.) and certain *secondary standard devices* (e.g. RF Preamplifiers used in CISPR 11/22 and FCC Part 15/18 tests) are periodically recalibrated by:

- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Guide 25-accredited as a calibration laboratories by NIST; or,
- A Nemko USA-approved independent (third party) metrology laboratory that uses NIST-traceable standards and that is ISO Guide 25-accredited as a calibration laboratory by another accreditation body (such as A2LA) that is mutually recognized by NIST; or,
- A manufacturer of Measurement and Test Equipment (M&TE), if the manufacturer uses NIST-traceable standards and is ISO Guide 25-accredited as calibration laboratory either by NIST or by another accreditation body (such as A2LA) that is mutually recognized by NIST; or
- A manufacturer of M&TE (or by a Nemko USA-approved independent third party metrology laboratory) that is not ISO Guide 25-accredited. (In these cases, Nemko USA conducts an annual audit of the manufacturer or metrology laboratory for the purposes of proving traceability to NIST, ensuring that adequate and repeatable calibration procedures are being applied, and verifying conformity with the other requirements of ISO Guide 25).



In all cases, the entity performing the Calibration is required to furnish Nemko USA with a calibration test report and/or certificate of calibration, and a "calibration sticker" on each item of M&TE that is successfully calibrated.

Calibration intervals are normally one year, except when the manufacture advises a shorter interval or if US Government directives or client requirements demand a shorter interval. Items of instrumentation/related equipment which fail during routine use, or which suffer visible mechanical damage (during use or while in transit), are sidelined pending repair and recalibration. (Repairs are carried out either in-house [if minor] or by a Nemko USA-approved independent [third party] metrology laboratory, or by the manufacturer of the item of M&TE).

Each antenna used for CISPR 11 and CISPR 22 and FCC Part 15 and Part 18 radiated emissions testing (and for testing to the equivalent European Norms) is calibrated annually by either a NIST (or A2LA) ISO Standard 17025-Accredited third-party Antenna Calibration Laboratory or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory. The antenna calibrations are performed using the methods specified in Annex G.5 of CISPR 16-1(2003) or ANSI C63.5-2004, including the "Three-Antenna Method". Certain other kinds of antennas (e.g. magnetic-shielded loop antennas) are calibrated annually by either a NIST (or A2LA) ISO Standard 17025-accredited third-party antenna calibration laboratory, or by the antenna's OEM if the OEM is NIST or A2LA ISO Standard 17025-accredited as an antenna calibration laboratory using the procedures specified in the latest version of SAE ARP-958.

In accordance with FCC and other regulations, Nemko USA recalibrates its suite of antennas used for radiated emissions tests on an annual basis. These calibrations are performed as a precursor to the FCC-required annual revalidation of the Normalized Site Attenuation properties of Nemko USA's Open Area Test Site. Nemko USA, Inc. uses the procedures given in both Sub clause 16.6 and Annex G.2 of CISPR 16-1 (2003), and, ANSI C63.4-2003 when performing the normalized site attenuation measurements.

## APPENDIX D

### D. NVLAP Accreditation

United States Department of Commerce  
National Institute of Standards and Technology

**NVLAP<sup>®</sup>**

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**Certificate of Accreditation to ISO/IEC 17025:2005**

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NVLAP LAB CODE: 200116-0

**Nemko USA, Inc. - San Diego EMC Division**  
San Diego, CA

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,  
listed on the Scope of Accreditation, for:*

**ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.  
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality  
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2011-01-01 through 2011-12-31  
*Effective dates*



*Jelly S. Bruce*  
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)