



Irrigreen, Inc.
Irrigreen Genius System - Handheld Programmer
FCC 15.231:2014
Report #: IRRI0002



Report Prepared By Northwest EMC Inc.

NORTHWEST EMC – (888) 364-2378 – www.nwemc.com

California – Minnesota – Oregon – New York – Washington

CERTIFICATE OF TEST

Last Date of Test: May 20, 2014

IrriGreen, Inc.

Model: IrriGreen Genius System - Handheld Programmer

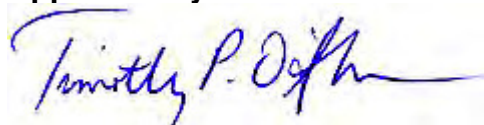
Emissions

Test Description	Specification	Test Method	Pass/Fail
Duty Cycle	FCC 15.231:2014	ANSI C63.10:2009	Pass
Occupied Bandwidth	FCC 15.231:2014	ANSI C63.10:2009	Pass
Field Strength of Fundamental	FCC 15.231:2014	ANSI C63.10:2009	Pass
Spurious Radiated Emissions	FCC 15.231:2014	ANSI C63.10:2009	Pass

Deviations From Test Standards

None

Approved By:



Tim O'Shea, Operations Manager



NVLAP Lab Code: 200881-0

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

KCC / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Hong Kong

OFTA – Recognized by OFTA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

Russia

GOST – Accredited by Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC to perform EMC and Hygienic testing for Information Technology products to GOST standards.

SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/accreditations/>

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

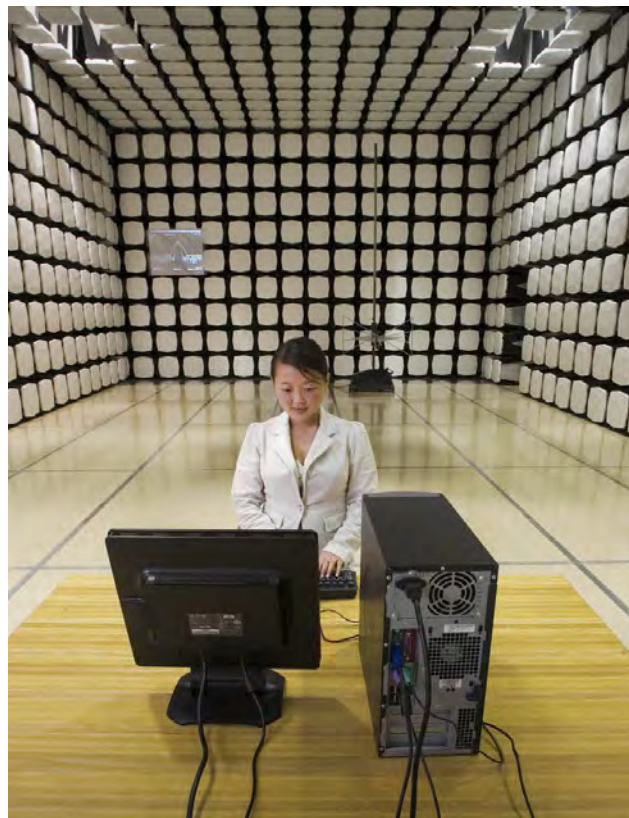
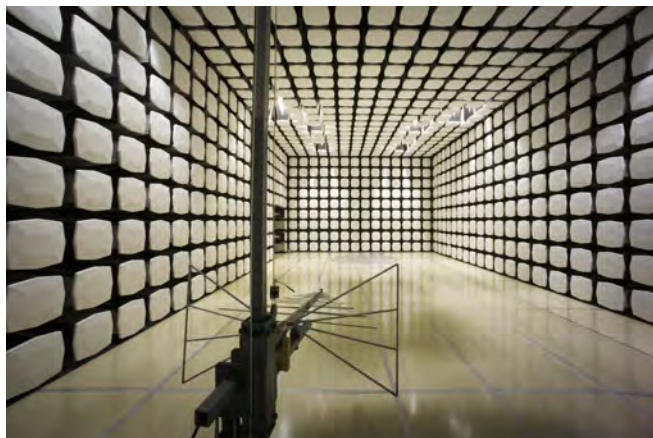
A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is listed below. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-1 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.12	-0.01
Amplitude Accuracy (dB)	0.49	-0.49
Conducted Power (dB)	0.41	-0.41
Radiated Power via Substitution (dB)	0.69	-0.68
Temperature (degrees C)	0.81	-0.81
Humidity (% RH)	2.89	-2.89
Field Strength (dB)	3.80	-3.80
AC Powerline Conducted Emissions (dB)	2.94	-2.94



Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	California Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Minnesota Labs MN01-08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	Washington Labs NC01-05, SU02, SU07 19201 120 th Ave. NE Bothell, WA 98011 (425) 984-6600
VCCI				
A-0108	A-0029		A-0109	A-0110
Industry Canada				
2834D-1, 2834D-2	2834B-1, 2834B-2, 2834B-3		2834E-1	2834F-1
NVLAP				
NVLAP Lab Code: 200630-0	NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200629-0



Client and Equipment Under Test (EUT) Information

Company Name:	IrriGreen, Inc.
Address:	5250 W. 73rd Street, Suite I
City, State, Zip:	Edina, MN 55439
Test Requested By:	Gary Klinefelter
Model:	IrriGreen Genius System - Handheld Programmer
First Date of Test:	April 22, 2014
Last Date of Test:	May 20, 2014
Receipt Date of Samples:	April 22, 2014
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):
Low power transceiver operating in the range of 433.92 - 443.92 MHz.
Testing Objective:
To demonstrate compliance to FCC 15.231 specifications.

Configuration IRRI0002- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Watch	IrriGreen, Inc	600101	None

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	4/22/2014	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	4/22/2014	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	4/22/2014	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	4/22/2014	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	5/19/2014	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	5/19/2014	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	5/19/2014	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
8	5/20/2014	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Near Field Probe Set	ETS	7405	IPO	NCR	0
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo

TEST DESCRIPTION

For software controlled or pre-programmed devices, the manufacturer shall declare the duty cycle class or classes for the equipment under test. For manually operated or event dependant devices, with or without software controlled functions, the manufacturer shall declare whether the device once triggered, follows a pre-programmed cycle, or whether the transmission is constant until the trigger is released or manually reset. The manufacturer shall also give a description of the application for the device and include a typical usage pattern. The typical usage pattern as declared by the manufacturer shall be used to determine the duty cycle and hence the duty class.

Where an acknowledgement is required, the additional transmitter on-time shall be included and declared by the manufacturer.

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" = $N1L1 + N2L2 + \dots$

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = $(N1L1 + N2L2 + \dots)/100\text{ms}$ or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT's pulse train are as follows:

Actual Period = 395.2 mSec

Measurement Period = 100 mSec

Pulsewidth of Type 1 Pulse = 8.216 mSec

Number of Type 1 Pulses = 1

Duty Cycle = $20 \log [(8.216)(1) / 100] = -21.7 \text{ dB}$

The duty cycle correction factor of -21.7 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(b). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

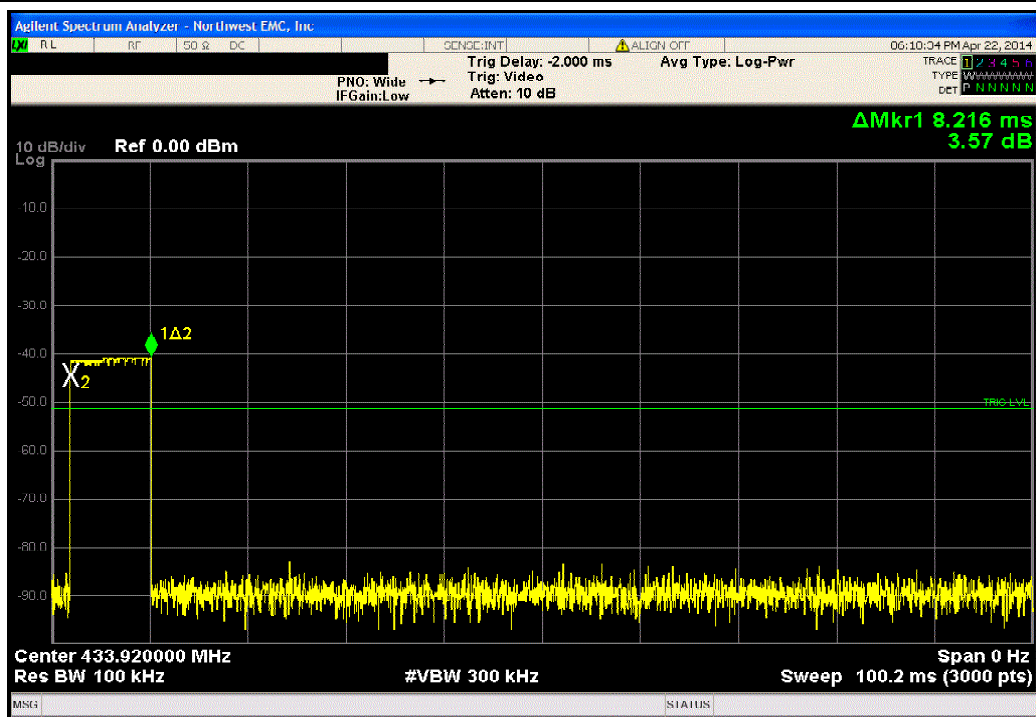


DUTY CYCLE

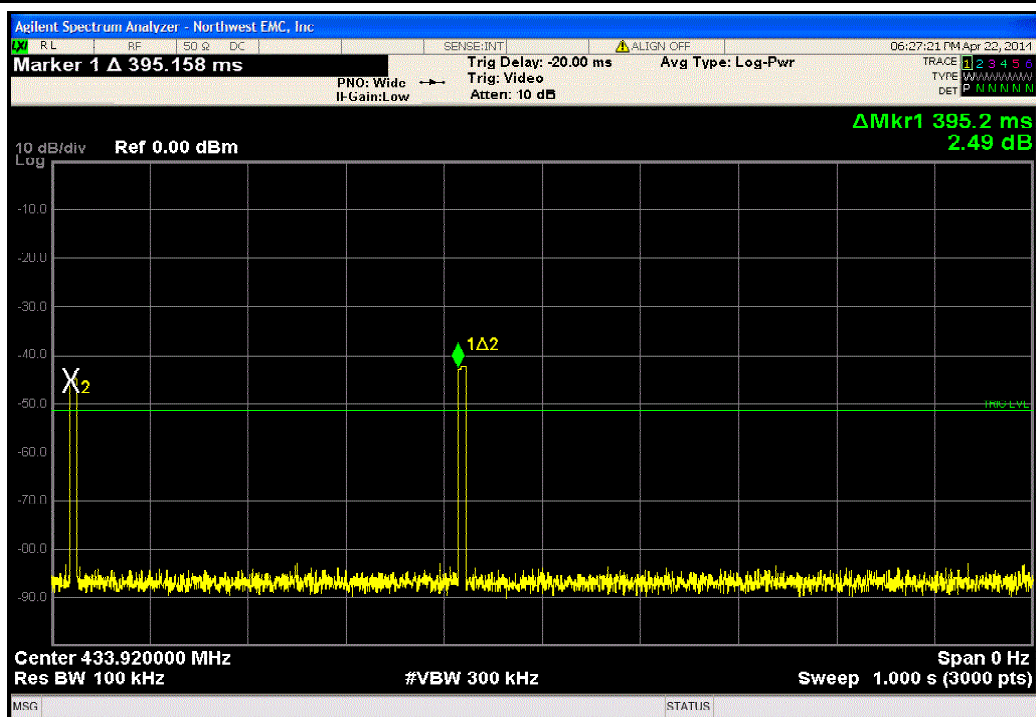
XMit 2013.08.15

EUT: IrriGreen Genius System - Handheld Programmer		Work Order: IRR0002			
Serial Number: None		Date: 04/22/14			
Customer: IrriGreen, Inc		Temperature: 23.1°C			
Attendees: None		Humidity: 27%			
Project: None		Barometric Pres.: 1022			
Tested by: Trevor Buls		Power: Battery			
Job Site: MN08		Test Method			
FCC 15.231:2014		ANSI C63.10:2009			
COMMENTS					
None					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1	Signature <i>Trevor Buls</i>			
		Pulse Width (mS)	Period (mS)	Limit	Result
100 mS Window		8.216	N/A	N/A	N/A
1 S Window		N/A	395.2	N/A	N/A
10 S Window		N/A	N/A	N/A	N/A

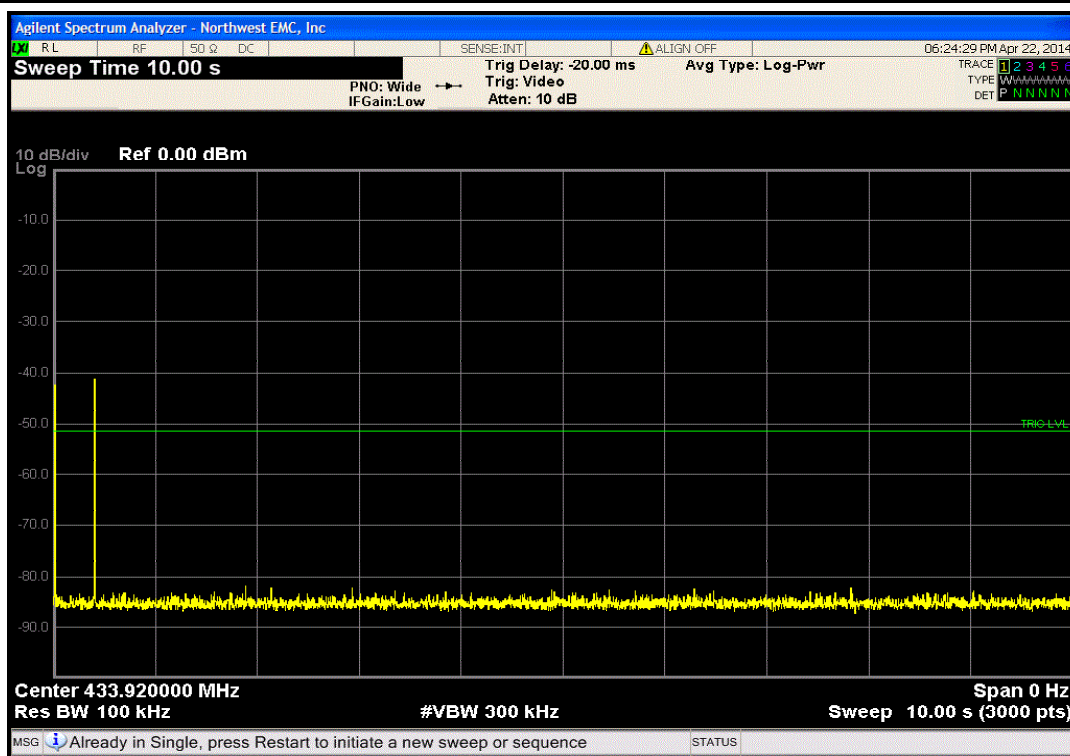
100 mS Window						
	Pulse Width	Period	Limit	Result		
	(mS)	(mS)				
	8.216	N/A	N/A	N/A		



1 S Window						
	Pulse Width	Period	Limit	Result		
	(mS)	(mS)				
	N/A	395.2	N/A	N/A		



10 S Window						
			Pulse Width	Period	Limit	Result
			(mS)	(mS)		
			N/A	N/A	N/A	N/A



DUTY CYCLE

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	3/14/2014	12 mo
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo

TEST DESCRIPTION

For software controlled or pre-programmed devices, the manufacturer shall declare the duty cycle class or classes for the equipment under test. For manually operated or event dependant devices, with or without software controlled functions, the manufacturer shall declare whether the device once triggered, follows a pre-programmed cycle, or whether the transmission is constant until the trigger is released or manually reset. The manufacturer shall also give a description of the application for the device and include a typical usage pattern. The typical usage pattern as declared by the manufacturer shall be used to determine the duty cycle and hence the duty class.

Where an acknowledgement is required, the additional transmitter on-time shall be included and declared by the manufacturer.

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" = $N1L1 + N2L2 + \dots$

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = $(N1L1 + N2L2 + \dots)/100\text{ms}$ or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT's pulse train are as follows:

Actual Period = 301.1 mSec

Measurement Period = 100 mSec

Pulsewidth of Type 1 Pulse = 8.216 mSec

Number of Type 1 Pulses = 1

Duty Cycle = $20 \log [(8.216)(1) / 100] = -21.7 \text{ dB}$

The duty cycle correction factor of -21.7 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(b). It also meets the

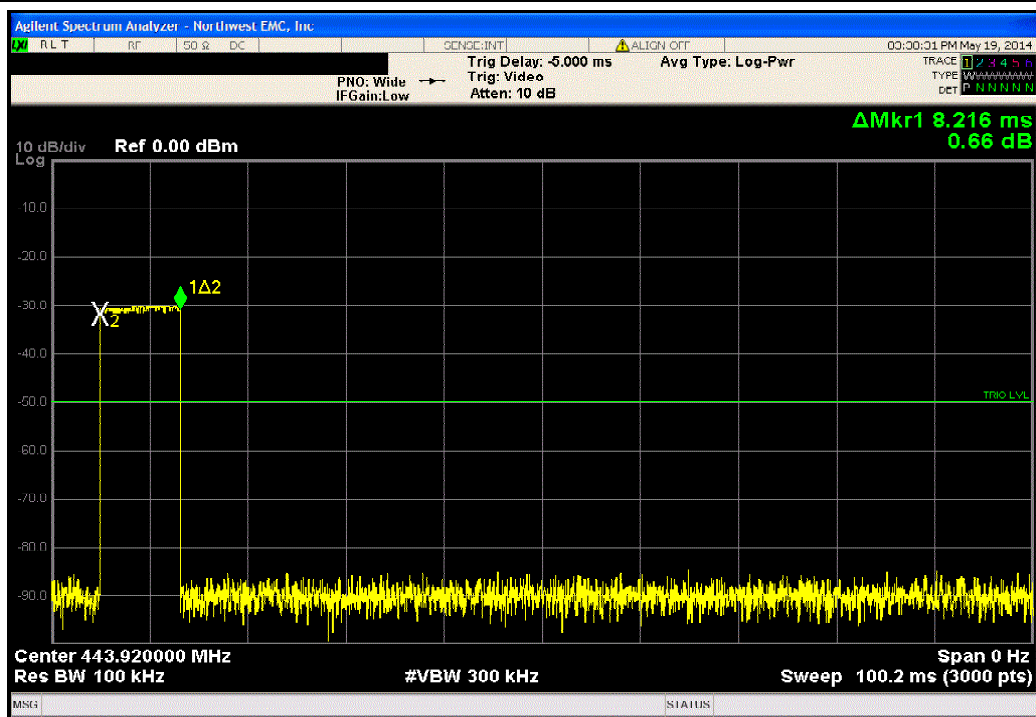


DUTY CYCLE

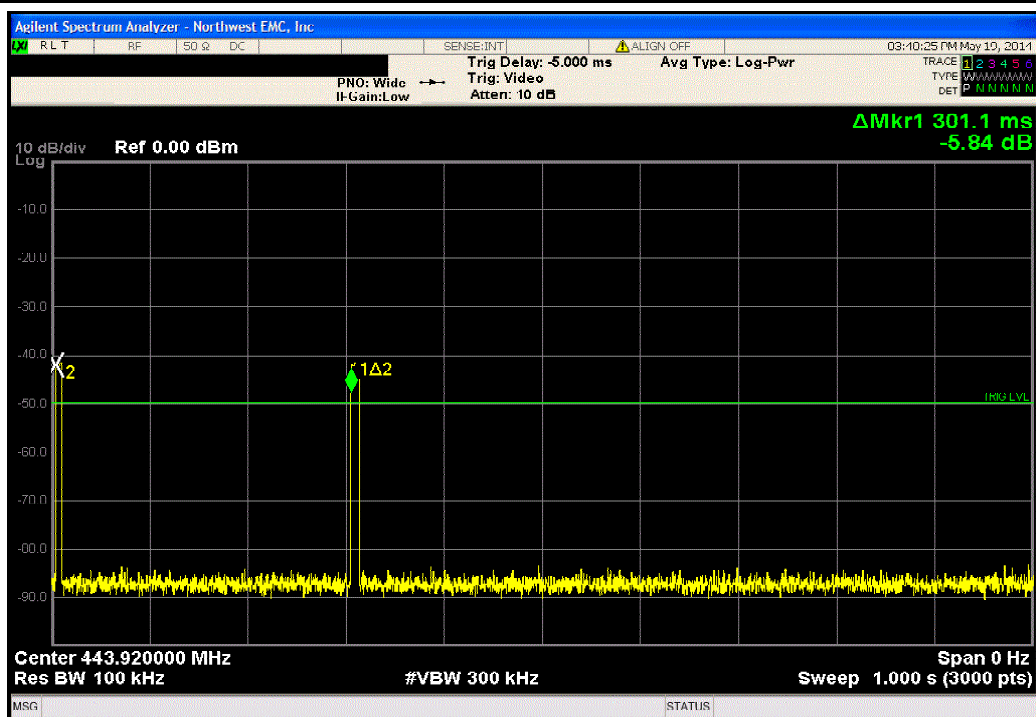
XMit 2013.08.15

EUT: IrriGreen Genius System - Handheld Programmer		Work Order: IRR10005			
Serial Number: None		Date: 05/19/14			
Customer: IrriGreen, Inc		Temperature: 23.3 °C			
Attendees: Gary Klinefelter		Humidity: 33.1% RH			
Project: None		Barometric Pres.: 1016.2 mbar			
Tested by: Trevor Buls		Power: Battery			
Job Site: MN05					
TEST SPECIFICATIONS		Test Method			
FCC 15.231:2014		ANSI C63.10:2009			
COMMENTS					
None					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	IRR10002 - 1	Signature <i>Trevor Buls</i>			
		Pulse Width (mS)	Period (mS)	Limit	Result
100 mS Window		8.216	N/A	N/A	N/A
1 S Window		N/A	301.1	N/A	N/A
10 S Window		N/A	N/A	N/A	N/A

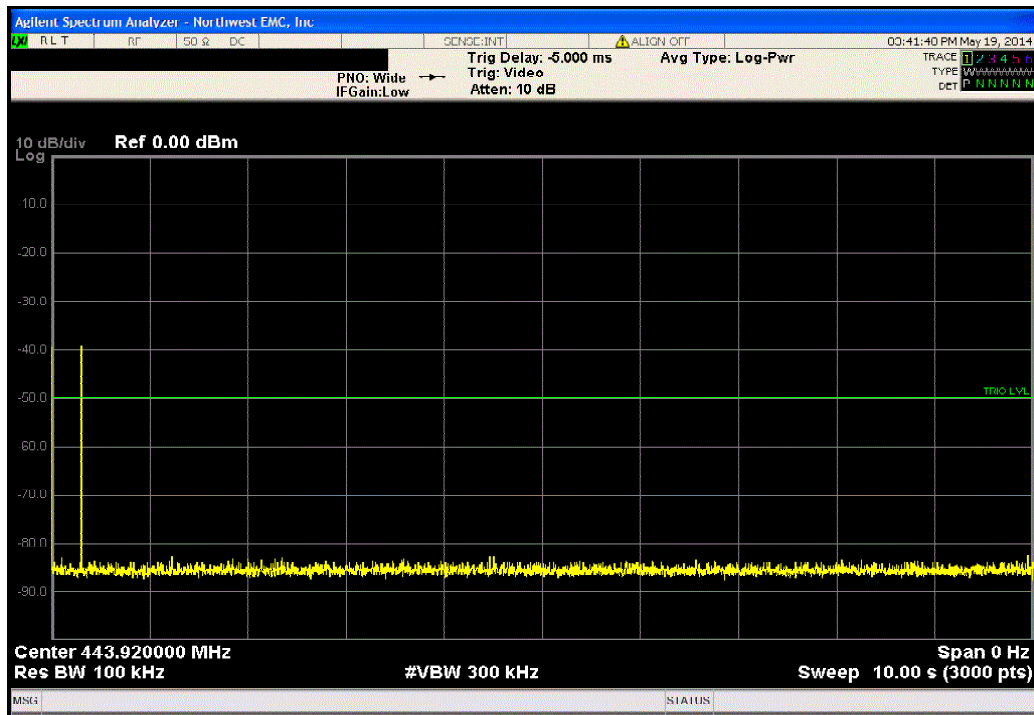
100 mS Window						
Pulse Width (mS)		Period (mS)	Limit	Result		
8.216		N/A	N/A	N/A		



1 S Window						
Pulse Width (mS)		Period (mS)	Limit	Result		
N/A		301.1	N/A	N/A		



10 S Window							
Pulse Width				Period			
(mS)				(mS)			
Limit				Result			
				N/A	N/A	N/A	N/A



OCCUPIED BANDWIDTH

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo.)
Spectrum Analyzer	Agilent	E4443A	AAS	3/27/2014	24
Near Field Probe Set	ETS	7405	IPO	NCR	0

TEST DESCRIPTION

The occupied bandwidth is required to be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

The measurement was made using near field probe near the integral antenna of the EUT to the input of the spectrum analyzer. The EUT was transmitting at its maximum data rate.

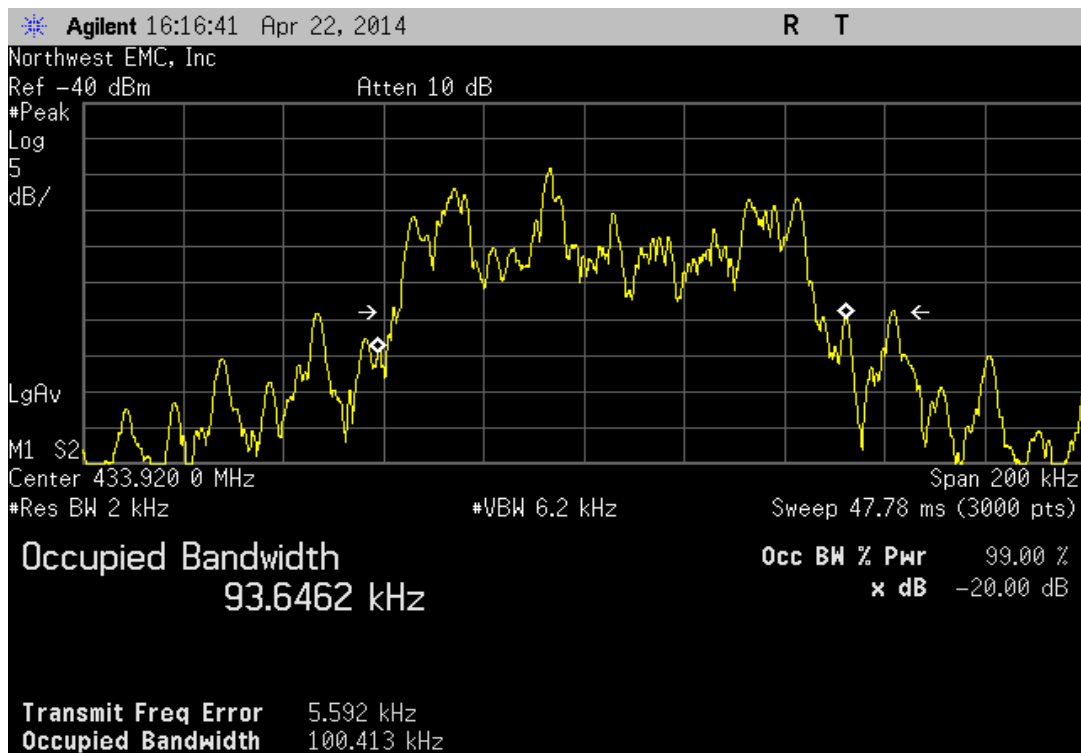


OCCUPIED BANDWIDTH

XMit 2013.08.15

EUT: IrriGreen Genius System - Handheld Programmer		Work Order: IRR10002	
Serial Number: None		Date: 04/22/14	
Customer: IrriGreen, Inc		Temperature: 23.1°C	
Attendees: None		Humidity: 27%	
Project: None		Barometric Pres.: 1022	
Tested by: Trevor Buls		Power: Battery	
		Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
FCC 15.231:2014		ANSI C63.10:2009	
COMMENTS			
Limit is based on center frequency: 433.92 MHz * 0.25% = 1084.4 MHz.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Trevor Buls</i>	
		Value (kHz)	Limit (kHz)
433.92 MHz		100.413	1084.8
			Result
			Pass

433.92 MHz						
				Value (kHz)	Limit (kHz)	Result
				100.413	1084.8	Pass



OCCUPIED BANDWIDTH

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	3/14/2014	12 mo
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo

TEST DESCRIPTION

The occupied bandwidth is required to be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

The measurement was made using a radiated setup connected to the input of the spectrum analyzer. The EUT was transmitting at its maximum data rate.

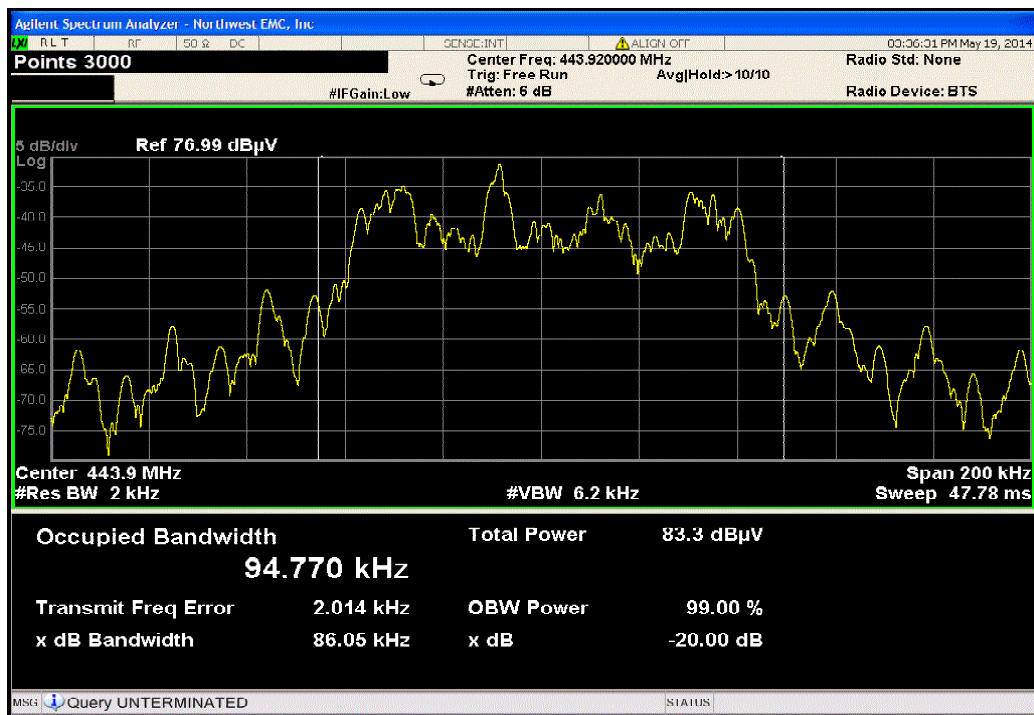


OCCUPIED BANDWIDTH

XMit 2013.08.15

EUT: IrriGreen Genius System - Handheld Programmer		Work Order: IRRI0005	
Serial Number: None		Date: 05/19/14	
Customer: IrriGreen, Inc		Temperature: 23.3 °C	
Attendees: Gary Klinefelter		Humidity: 33.1% RH	
Project: None		Barometric Pres.: 1016.2 mbar	
Tested by: Trevor Buls		Power: Battery	
Job Site: MN05			
TEST SPECIFICATIONS		Test Method	
FCC 15.231:2014		ANSI C63.10:2009	
COMMENTS			
None			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	IRRI0002 - 1	Signature <i>Trevor Buls</i>	
		Value (kHz)	Limit (kHz)
443.92 MHz		86.05	1109.8
			Result
			Pass

433.92 MHz				Value	Limit	Result
				(kHz)	(kHz)	
				86.05	1109.8	Pass



Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 433.92 MHz, Modulated

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

IRRI0002 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 433 MHz Stop Frequency 435 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12 mo
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	3/14/2014	12 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was configured for continuous modulated operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT in 3 orthogonal planes (per ANSI C63.10:2009).

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" = N1L1 + N2L2 +

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 + N2L2 +)/100mS or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT's pulse train are as follows:

Actual Period = 395.2 mSec
Measurement Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.216 mSec
Number of Type 1 Pulses = 1

Duty Cycle = $20 \log [(8.216)(1) / 100] = -21.7 \text{ dB}$

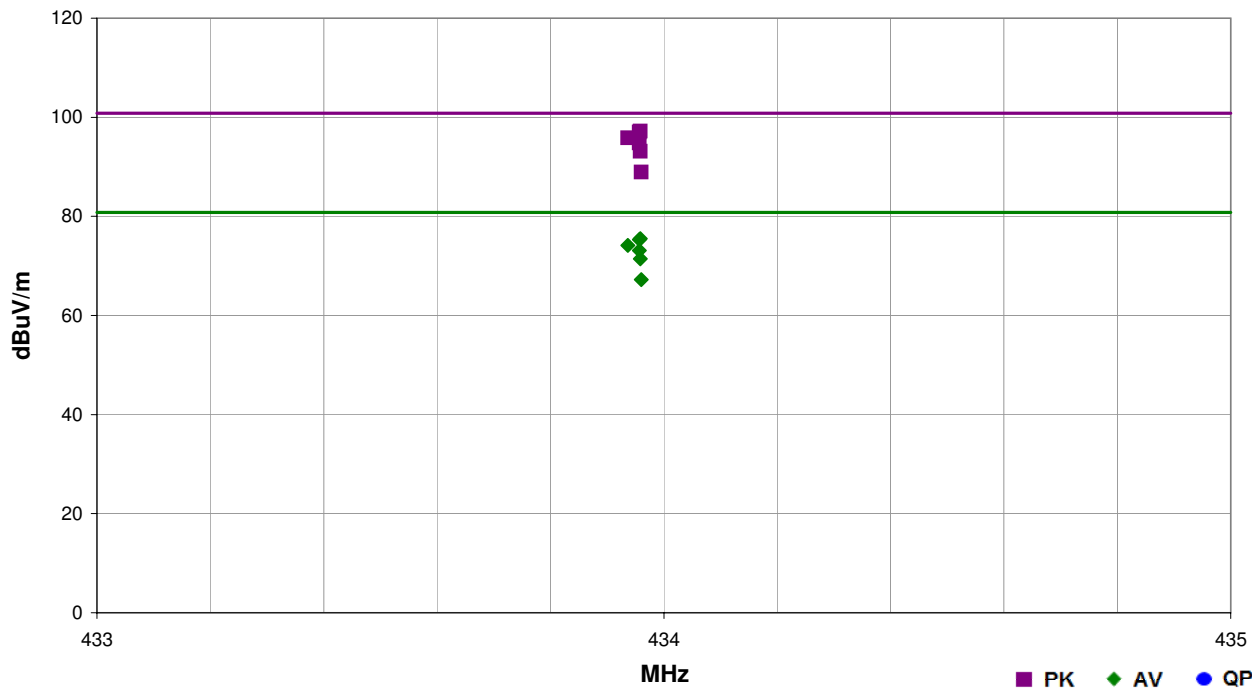
The duty cycle correction factor of -21.7 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(b). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

Work Order:	IRRI0002	Date:	04/22/14	<i>Trevor Buls</i>
Project:	None	Temperature:	23.2 °C	
Job Site:	MN05	Humidity:	26.9% RH	
Serial Number:	None	Barometric Pres.:	1021 mbar	
Tested by: Trevor Buls				
EUT: IriGreen Genius System - Handheld Programmer				
Configuration: 1				
Customer: IriGreen, Inc				
Attendees: None				
EUT Power: Battery				
Operating Mode: Transmitting at 433.92 MHz, Modulated				
Deviations: None				
Comments: None				

Test Specifications	Test Method
FCC 15.231:2014	ANSI C63.10:2009

Run #	1	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
-------	---	-------------------	---	-------------------	------	---------	------



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
433.958	74.4	22.8	1.0	212.0		0.0	Horz	PK	0.0	97.2	100.8	-3.6	EUT on Side
433.957	74.2	22.8	1.1	17.0		0.0	Vert	PK	0.0	97.0	100.8	-3.8	EUT Horizontal
433.937	73.0	22.8	2.1	241.0		0.0	Horz	PK	0.0	95.8	100.8	-5.0	EUT Vertical
433.958	74.4	22.8	1.0	212.0	-21.7	0.0	Horz	AV	0.0	75.5	80.8	-5.3	EUT on Side
433.957	74.2	22.8	1.1	17.0	-21.7	0.0	Vert	AV	0.0	75.3	80.8	-5.5	EUT Horizontal
433.957	72.0	22.8	1.2	203.0		0.0	Vert	PK	0.0	94.8	100.8	-6.0	EUT Vertical
433.937	73.0	22.8	2.1	241.0	-21.7	0.0	Horz	AV	0.0	74.1	80.8	-6.7	EUT Vertical
433.958	70.3	22.8	2.0	74.0		0.0	Horz	PK	0.0	93.1	100.8	-7.7	EUT Horizontal
433.957	72.0	22.8	1.2	203.0	-21.7	0.0	Vert	AV	0.0	73.1	80.8	-7.7	EUT Vertical
433.958	70.3	22.8	2.0	74.0	-21.7	0.0	Horz	AV	0.0	71.4	80.8	-9.4	EUT Horizontal
433.960	66.1	22.8	2.3	128.0		0.0	Vert	PK	0.0	88.9	100.8	-11.9	EUT on Side
433.960	66.1	22.8	2.3	128.0	-21.7	0.0	Vert	AV	0.0	67.2	80.8	-13.6	EUT on Side

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting semi-continuously at 443.92 MHz, modulated.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

IRRI0002 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz Stop Frequency 5 GHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator, 10db, 'SMA'	S.M. Electronics	SA18H-10	REN	5/15/2014	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	3/14/2014	12 mo
MN05 Cables	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	3/14/2014	12 mo
Antenna, Horn (DRG)	ETS Lindgren	3115	AIP	6/29/2011	36 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAD	3/14/2014	12 mo
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12 mo
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	3/14/2014	12 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was configured for continuous modulated operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT in 3 orthogonal planes (per ANSI C63.10:2009).

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" = N1L1 + N2L2 +

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 + N2L2 + ...)/100mS or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT's pulse train are as follows:

Actual Period = 301.1 mSec
Measurement Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.216 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [(8.216)(1) / 100] = -21.7 dB

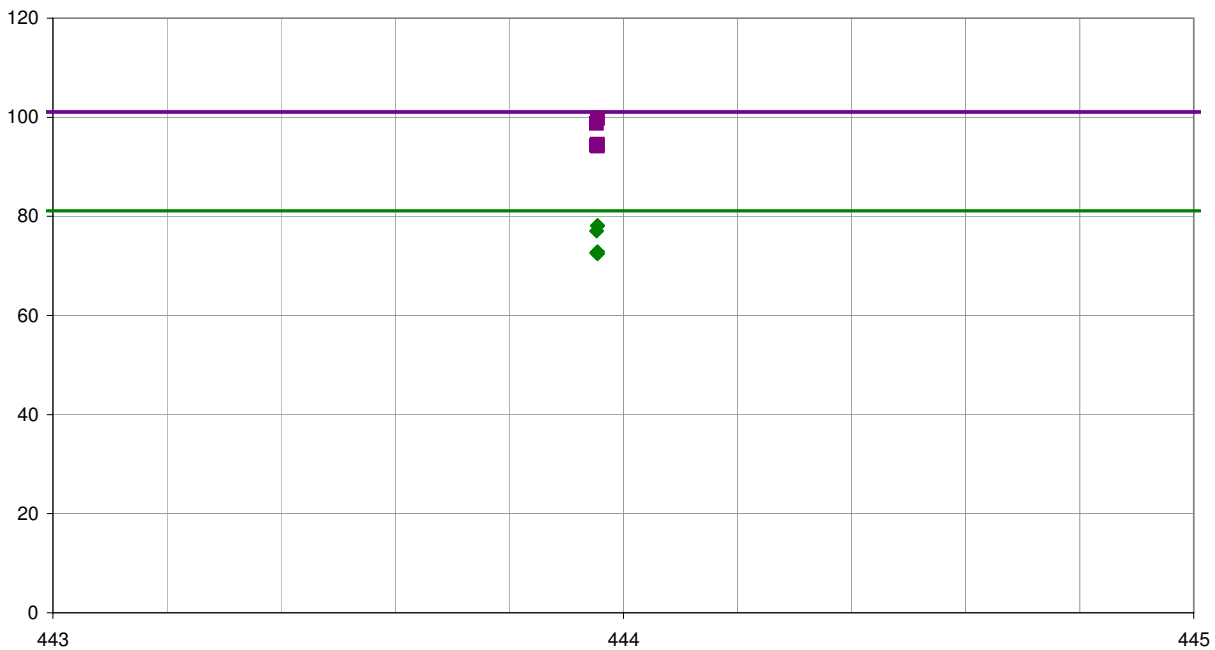
The duty cycle correction factor of -21.7 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(b). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

Work Order:	IRRI0005	Date:	05/19/14	<i>Trevor Buls</i>
Project:	None	Temperature:	23.3 °C	
Job Site:	MN05	Humidity:	33.1% RH	
Serial Number:	None	Barometric Pres.:	1016.2 mbar	
Tested by: Trevor Buls				
EUT:	Irrigreen Genius System - Handheld Programmer			
Configuration:	IRRI0002 - 1			
Customer:	Irrigreen, Inc.			
Attendees:	Gary Klinefelter			
EUT Power:	Battery			
Operating Mode:	Transmitting semi-continuously at 443.92 MHz, modulated.			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
FCC 15.231:2014	ANSI C63.10:2009

Run #	9	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
-------	---	-------------------	---	-------------------	------	---------	------



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
443.955	76.9	23.0	1.1	14.0		0.0	Vert	PK	0.0	99.9	101.1	-1.2	EUT Horizontal
443.955	76.8	23.0	2.2	246.0		0.0	Horz	PK	0.0	99.8	101.1	-1.3	EUT on Side
443.953	75.8	23.0	1.9	252.0		0.0	Horz	PK	0.0	98.8	101.1	-2.3	EUT Vertical
443.955	76.9	23.0	1.1	14.0	-21.7	0.0	Vert	AV	0.0	78.2	81.1	-2.9	EUT Horizontal
443.955	76.8	23.0	2.2	246.0	-21.7	0.0	Horz	AV	0.0	78.1	81.1	-3.0	EUT on Side
443.953	75.8	23.0	1.9	252.0	-21.7	0.0	Horz	AV	0.0	77.1	81.1	-4.0	EUT Vertical
443.955	71.6	23.0	1.0	274.0		0.0	Horz	PK	0.0	94.6	101.1	-6.5	EUT Horizontal
443.953	71.4	23.0	1.0	220.0		0.0	Vert	PK	0.0	94.4	101.1	-6.7	EUT Vertical
443.955	71.2	23.0	2.1	128.0		0.0	Vert	PK	0.0	94.2	101.1	-6.9	EUT on Side
443.955	71.6	23.0	1.0	274.0	-21.7	0.0	Horz	AV	0.0	72.9	81.1	-8.2	EUT Horizontal
443.953	71.4	23.0	1.0	220.0	-21.7	0.0	Vert	AV	0.0	72.7	81.1	-8.4	EUT Vertical
443.955	71.2	23.0	2.1	128.0	-21.7	0.0	Vert	AV	0.0	72.5	81.1	-8.6	EUT on Side

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 433.92 MHz, Modulated

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

IRRI0002 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	5 GHz
-----------------	--------	----------------	-------

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
High Pass Filter	Micro-Tronics	HPM50108	HGP	5/31/2012	24 mo
Attenuator, 10db, 'SMA'	S.M. Electronics	SA18H-10	REN	5/20/2013	12 mo
Attenuator, 20 dB, 'SMA'	SM Electronics	SA6-20	REO	5/20/2013	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	3/14/2014	12 mo
Antenna, Horn (DRG)	ETS Lindgren	3115	AIP	6/29/2011	36 mo
MN05 Cables	ESM Cable Corp.	Public Ridge Guide Horn Cabl	MNI	3/14/2014	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAD	3/14/2014	12 mo
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12 mo
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	3/14/2014	12 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The single, integral antenna to be used with the EUT was tested. The EUT was configured for un-modulated, CW operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT in 3 orthogonal planes (per ANSI C63.10:2009).

A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" = N1L1 +N2L2 +....

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 +N2L2 +...)/100mS or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT's pulse train are as follows:

Actual Period = 395.2 mSec
Measurement Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.216 mSec
Number of Type 1 Pulses = 1

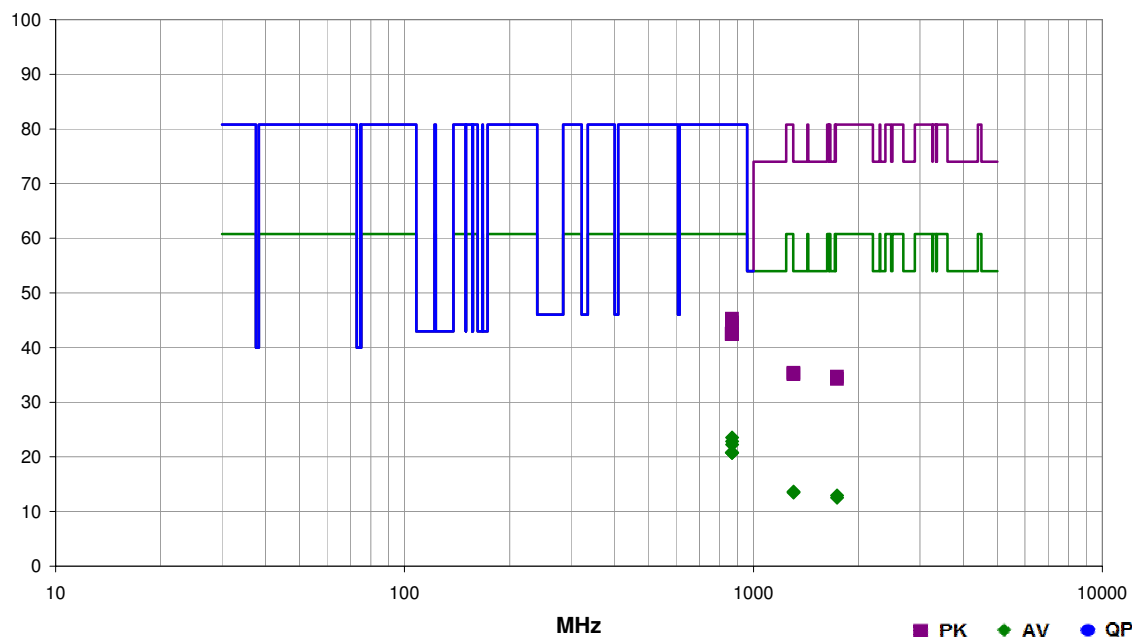
Duty Cycle = 20 log [(8.216)(1) /100] = -21.7 dB

The duty cycle correction factor of -21.7 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz for measurements at or below 1GHz. Above 1GHz, a resolution bandwidth of 1MHz and a video bandwidth of 3MHz was used.

Work Order:	IRRI0002	Date:	04/22/14	<i>Trevor Buls</i>
Project:	None	Temperature:	23.2 °C	
Job Site:	MN05	Humidity:	26.9% RH	
Serial Number:	None	Barometric Pres.:	1021 mbar	
		Tested by:	Trevor Buls	
EUT:	IrriGreen Genius System - Handheld Programmer			
Configuration:	1			
Customer:	IrriGreen, Inc			
Attendees:	None			
EUT Power:	Battery			
Operating Mode:	Transmitting at 433.92 MHz, Modulated			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
FCC 15.231(b):2014	ANSI C63.10:2009

Run #	2	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
-------	---	-------------------	---	-------------------	------	---------	------



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
867.900	25.7	9.5	1.0	193.0		10.0	Vert	PK	0.0	45.2	80.8	-35.6	EUT Horizontal
867.810	25.0	9.5	1.0	227.0		10.0	Horz	PK	0.0	44.5	80.8	-36.3	EUT Vertical
867.800	24.4	9.5	2.7	197.0		10.0	Horz	PK	0.0	43.9	80.8	-36.9	EUT on Side
867.900	25.7	9.5	1.0	193.0	-21.7	10.0	Vert	AV	0.0	23.5	60.8	-37.3	EUT Horizontal
867.810	25.0	9.5	1.0	227.0	-21.7	10.0	Horz	AV	0.0	22.8	60.8	-38.0	EUT Vertical
866.805	23.0	9.5	3.9	343.0		10.0	Horz	PK	0.0	42.5	80.8	-38.3	EUT Horizontal
869.230	22.9	9.6	1.0	176.0		10.0	Vert	PK	0.0	42.5	80.8	-38.3	EUT Vertical
868.800	22.9	9.6	3.9	23.0		10.0	Vert	PK	0.0	42.5	80.8	-38.3	EUT on Side
867.800	24.4	9.5	2.7	197.0	-21.7	10.0	Horz	AV	0.0	22.2	60.8	-38.6	EUT on Side
1301.767	41.0	-5.6	1.0	52.0		0.0	Horz	PK	0.0	35.4	74.0	-38.6	EUT on Side
1301.750	40.8	-5.6	1.9	217.0		0.0	Vert	PK	0.0	35.2	74.0	-38.8	EUT Horizontal
866.805	23.0	9.5	3.9	343.0	-21.7	10.0	Horz	AV	0.0	20.8	60.8	-40.0	EUT Horizontal
869.230	22.9	9.6	1.0	176.0	-21.7	10.0	Vert	AV	0.0	20.8	60.8	-40.0	EUT Vertical
868.800	22.9	9.6	3.9	23.0	-21.7	10.0	Vert	AV	0.0	20.8	60.8	-40.0	EUT on Side
1301.767	41.0	-5.6	1.0	52.0	-21.7	0.0	Horz	AV	0.0	13.7	54.0	-40.3	EUT on Side
1301.750	40.8	-5.6	1.9	217.0	-21.7	0.0	Vert	AV	0.0	13.5	54.0	-40.5	EUT Horizontal
1735.717	39.6	-5.0	1.0	255.0		0.0	Vert	PK	0.0	34.6	80.8	-46.2	EUT Horizontal
1737.042	39.2	-5.0	1.0	56.0		0.0	Horz	PK	0.0	34.2	80.8	-46.6	EUT on Side
1735.717	39.6	-5.0	1.0	255.0	-21.7	0.0	Vert	AV	0.0	12.9	60.8	-47.9	EUT Horizontal
1737.042	39.2	-5.0	1.0	56.0	-21.7	0.0	Horz	AV	0.0	12.5	60.8	-48.3	EUT on Side

SPURIOUS RADIATED EMISSIONS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting semi-continuously at 443.92 MHz, modulated.

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

IRRI0002 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz Stop Frequency 5 GHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator, 10db, 'SMA'	S.M. Electronics	SA18H-10	REN	5/15/2014	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	3/14/2014	12 mo
MN05 Cables	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	3/14/2014	12 mo
Antenna, Horn (DRG)	ETS Lindgren	3115	AIP	6/29/2011	36 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAD	3/14/2014	12 mo
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12 mo
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	3/14/2014	12 mo
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The single, integral antenna to be used with the EUT was tested. The EUT was configured for un-modulated, CW operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT in 3 orthogonal planes (per ANSI C63.10:2009).

A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where "On time" = N1L1 + N2L2 +

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 + N2L2 + ...)/100ms or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT's pulse train are as follows:

Actual Period = 301.1 mSec
Measurement Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.216 mSec
Number of Type 1 Pulses = 1

Duty Cycle = $20 \log \left(\frac{(8.216)(1)}{100} \right) = -21.7 \text{ dB}$

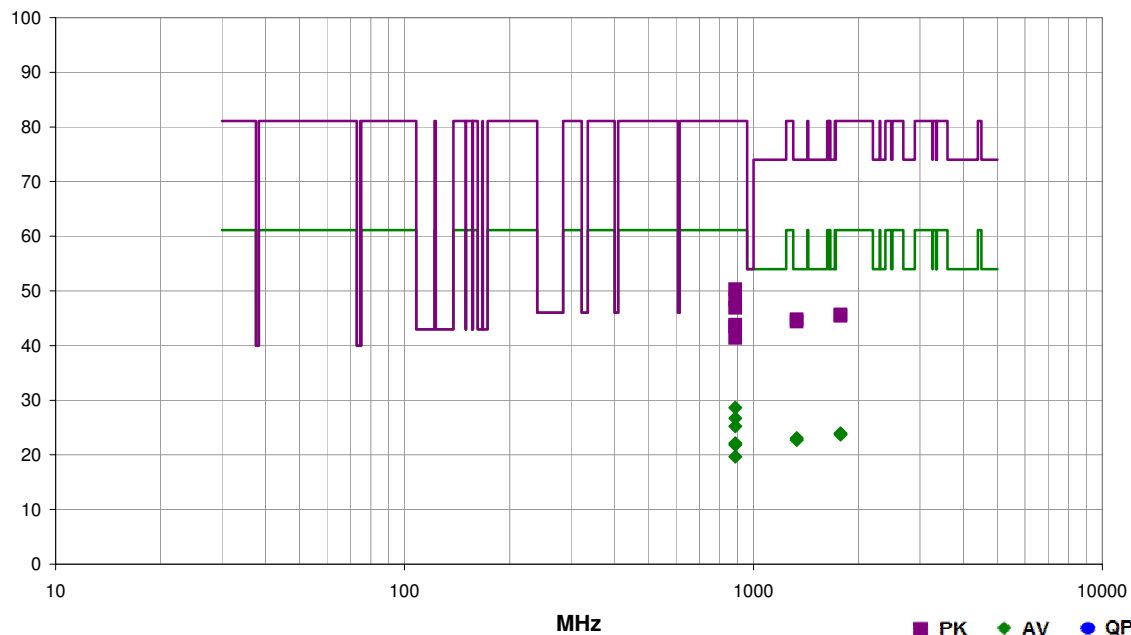
The duty cycle correction factor of -21.7 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz for measurements at or below 1GHz. Above 1GHz, a resolution bandwidth of 1MHz and a video bandwidth of 3MHz was used.

The field strength of the spurious emissions meet the limits as defined in 47 CFR 15.231(b). The spurious emissions also meet the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions. Further, spurious emissions meet the provisions of 15.205 using the measurement instrumentation specified in that section.

Work Order:	IRRI0005	Date:	05/20/14	<i>Trevor Buls</i>
Project:	None	Temperature:	23.5 °C	
Job Site:	MN05	Humidity:	41.7% RH	
Serial Number:	None	Barometric Pres.:	1012.8 mbar	
EUT:	IrriGreen Genius System - Handheld Programmer			
Configuration:	IRRI0002 - 1			
Customer:	IrriGreen, Inc.			
Attendees:	None			
EUT Power:	Battery			
Operating Mode:	Transmitting semi-continuously at 443.92 MHz, modulated.			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
FCC 15.231(b):2014	ANSI C63.10:2009

Run #	13	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass
-------	----	-------------------	---	-------------------	------	---------	------



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
1331.517	40.3	-5.5	1.0	347.0		10.0	Vert	PK	0.0	44.8	74.0	-29.2	EUT Horizontal
1331.292	39.9	-5.5	1.0	151.0		10.0	Horz	PK	0.0	44.4	74.0	-29.6	EUT on Side
887.920	30.5	9.8	2.3	28.0		10.0	Horz	PK	0.0	50.3	81.1	-30.8	EUT on Side
1331.517	40.3	-5.5	1.0	347.0	-21.7	10.0	Vert	AV	0.0	23.1	54.0	-30.9	EUT Horizontal
1331.292	39.9	-5.5	1.0	151.0	-21.7	10.0	Horz	AV	0.0	22.7	54.0	-31.3	EUT on Side
887.920	30.5	9.8	2.3	28.0	-21.7	10.0	Horz	AV	0.0	28.6	61.1	-32.5	EUT on Side
887.835	28.6	9.8	2.2	79.0		10.0	Horz	PK	0.0	48.4	81.1	-32.7	EUT Vertical
887.905	27.1	9.8	1.0	307.0		10.0	Vert	PK	0.0	46.9	81.1	-34.2	EUT Horizontal
887.835	28.6	9.8	2.2	79.0	-21.7	10.0	Horz	AV	0.0	26.7	61.1	-34.4	EUT Vertical
1778.375	40.5	-4.9	1.0	115.0		10.0	Horz	PK	0.0	45.6	81.1	-35.5	EUT on Side
1776.050	40.3	-4.9	1.6	273.0		10.0	Vert	PK	0.0	45.4	81.1	-35.7	EUT Horizontal
887.905	27.1	9.8	1.0	307.0	-21.7	10.0	Vert	AV	0.0	25.2	61.1	-35.9	EUT Horizontal
1778.375	40.5	-4.9	1.0	115.0	-21.7	10.0	Horz	AV	0.0	23.9	61.1	-37.2	EUT on Side
887.800	24.0	9.8	1.1	209.0		10.0	Vert	PK	0.0	43.8	81.1	-37.3	EUT Vertical
1776.050	40.3	-4.9	1.6	273.0	-21.7	10.0	Vert	AV	0.0	23.7	61.1	-37.4	EUT Horizontal
887.890	23.7	9.8	1.0	70.0		10.0	Horz	PK	0.0	43.5	81.1	-37.6	EUT Horizontal
887.800	24.0	9.8	1.1	209.0	-21.7	10.0	Vert	AV	0.0	22.1	61.1	-39.0	EUT Vertical
887.890	23.7	9.8	1.0	70.0	-21.7	10.0	Horz	AV	0.0	21.8	61.1	-39.3	EUT Horizontal
886.625	21.6	9.8	1.0	214.0		10.0	Vert	PK	0.0	41.4	81.1	-39.7	EUT on Side
886.625	21.6	9.8	1.0	214.0	-21.7	10.0	Vert	AV	0.0	19.7	61.1	-41.4	EUT on Side