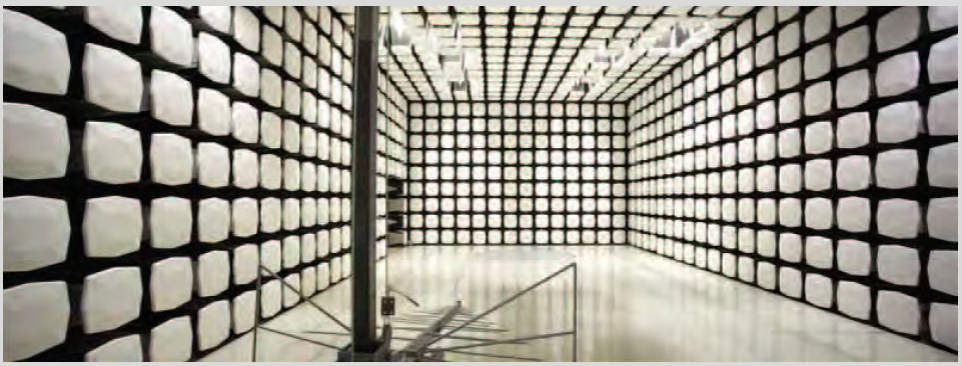
IrriGreen, Inc.

IrriGreen Genius Irrigation System

FCC 15.207:2014

FCC 15.231:2014

Report #: IRRI0001 Rev.1



Report Prepared By Northwest EMC Inc.

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

California – Minnesota – Oregon – New York – Washington

NORTHWEST EMC

WTD 12.5.23

CERTIFICATE OF TEST

Last Date of Test: May 20, 2014
IrriGreen, Inc.
Model: IrriGreen Genius Irrigation System

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 of Strength Fundamental	FCC 15.231:2014	ANSI C63.10:2009	Pass
Spurious Radiated Emissions	FCC 15.231:2014	ANSI C63.10:2009	Pass
Powerline Conducted Emissions	FCC 15.207:2014	ANSI C63.10:2009	Pass

Deviations From Test Standards

None

Approved By:

Tim O'Shea, Operations Manager

NVLAP

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.

NORTHWEST EMC
REV 2012.08.02

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		
01	Updated last date	5/27/2014	2, 7, 9
01	Updated functional description	5/27/2014	7
01	Added High Channel Data	5/27/2014	13-15, 19-21, 24-25, 29-30, 31-41

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

REV 2012.05.24

ACCREDITATIONS AND AUTHORIZATIONS

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

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.

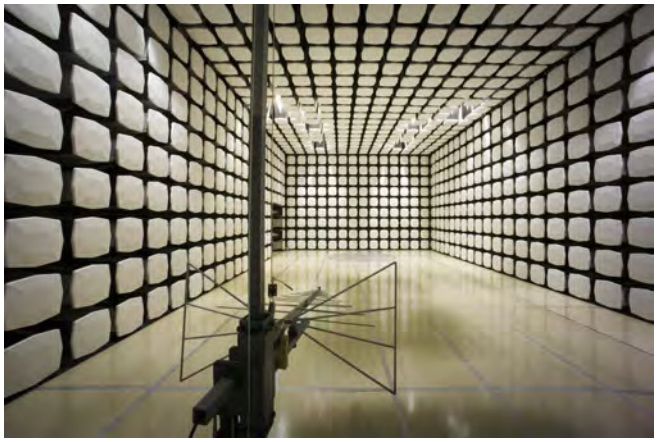
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.12	-0.01
Amplitude Accuracy (dB)	0.49	-0.49
Conducted Power (dB)	0.41	-0.41
Radiated Power via Substitution (dB)	0.69	-0.68
Temperature (degrees C)	0.81	-0.81
Humidity (% RH)	2.89	-2.89
Field Strength (dB)	3.80	-3.80
AC Powerline Conducted Emissions (dB)	2.94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

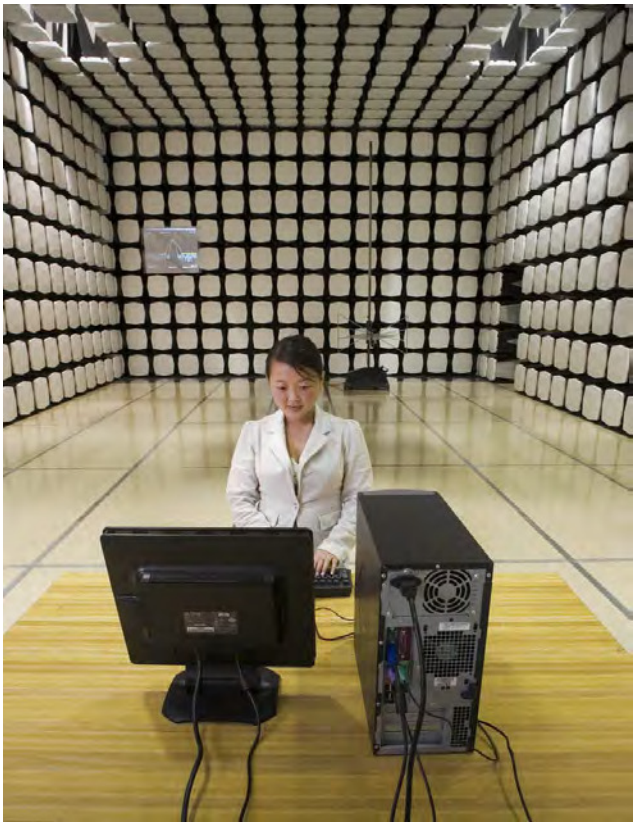
NORTHWEST EMC

REV 2013.06.28

FACILITIES

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 120th 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	2834C-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





PRODUCT DESCRIPTION

WTD 12.5.23

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 Irrigation System
First Date of Test:	January 14, 2014
Last Date of Test:	May 20, 2014
Receipt Date of Samples:	January 14, 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.

CONFIGURATIONS

Configuration IRRI0001- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Genius Server	IrriGreen, Inc.	500101	2456532-0035

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Genius Sprinkler	IrriGreen, Inc.	400101	2456532
Irrigation Controller	Hunter	PC-3001	None
AC Adapter	Hunter	WT57-2401000AU	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Irrigation	No	3.2m	No	Genius Sprinkler	Genius Server
Irrigation	No	0.5m	No	Genius Server	Irrigation Controller
DC Power	No	1.6m	No	Irrigation Controller	AC Adapter
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

MODIFICATIONS

WTD 12.5.23

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	1/14/2014	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.
2	5/19/2014	Field Strength of Fundamental	Modified from delivered configuration.	Lowered Power and raised Baud rate. Modification authorized by Gary.	EUT remained at Northwest EMC following the test.
3	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.
4	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.
5	5/20/2014	Powerline Conducted 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
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	5/20/2013	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 +….

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:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.183 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [((1)(8.183))/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.

DUTY CYCLE

EUT:	IrriGreen Genius Irrigation System			**Work Order:**	IRRI0001
Serial Number:	2456532-0035			**Date:**	01/14/14
Customer:	IrriGreen, Inc			**Temperature:**	23°C
Attendees:	Gary Klinefelter			**Humidity:**	16%
Project:	None			**Barometric Pres.:**	1016.5
Tested by:	Trevor Buls	**Power:**	110VAC/60Hz	**Job Site:**	MN05

TEST SPECIFICATIONS	Test Method
FCC 15.231:2014	ANSI C63.10:2009

COMMENTS

A Operating at low channel 433.92 MHz.

DEVIATIONS FROM TEST STANDARD

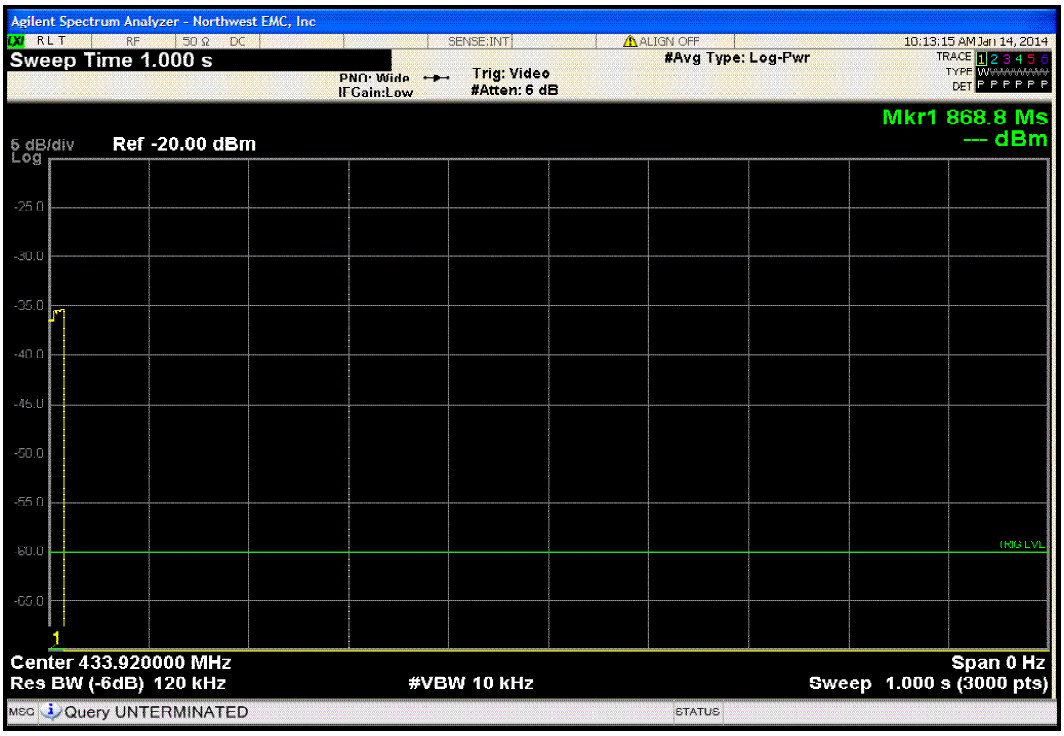
None

Configuration #	1	Signature	Trevor Buls

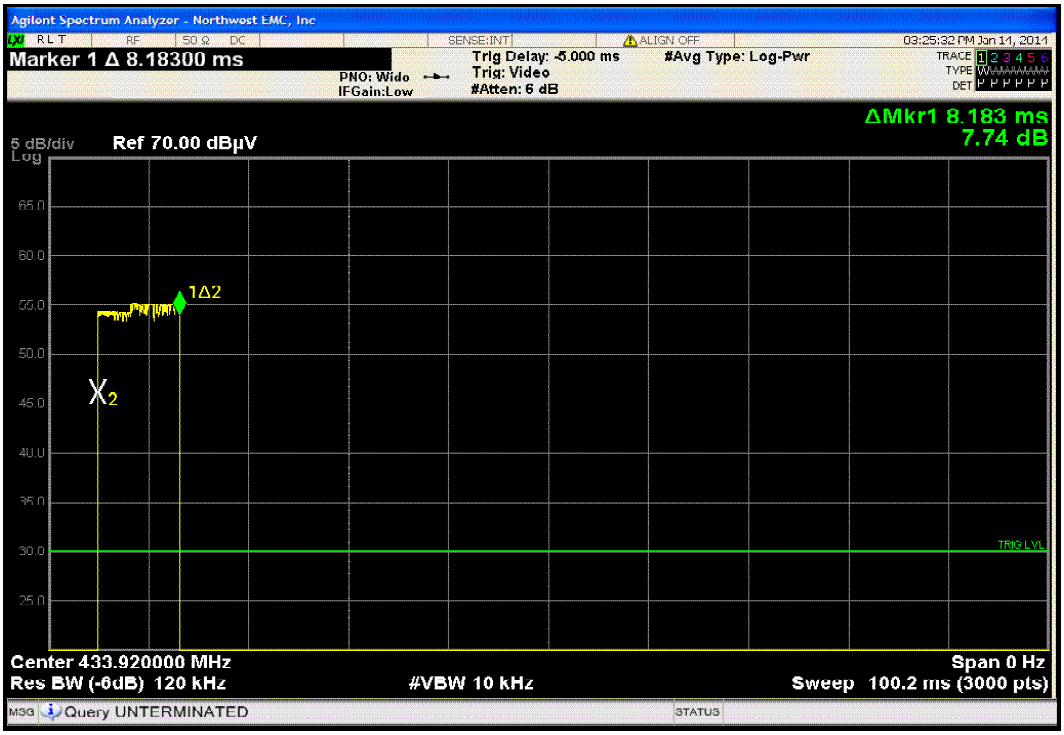
	Value	Limit	Result
1 Second Window	N/A	N/A	N/A
100 mS Window	8.183 mS	N/A	N/A

DUTY CYCLE

1 Second Window							
					Value	Limit	Result
					N/A	N/A	N/A



100 mS Window							
					Value	Limit	Result
					8.183 mS	N/A	N/A



DUTY CYCLE

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TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	5/20/2013	12
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24

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 +….

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.

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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

EUT:	IrriGreen Genius Irrigation System			**Work Order:**	IRRI0005
Serial Number:	2456532-0035			**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:**	110VAC/60Hz	**Job Site:**	MN05

TEST SPECIFICATIONS	Test Method
FCC 15.231:2014	ANSI C63.10:2009

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

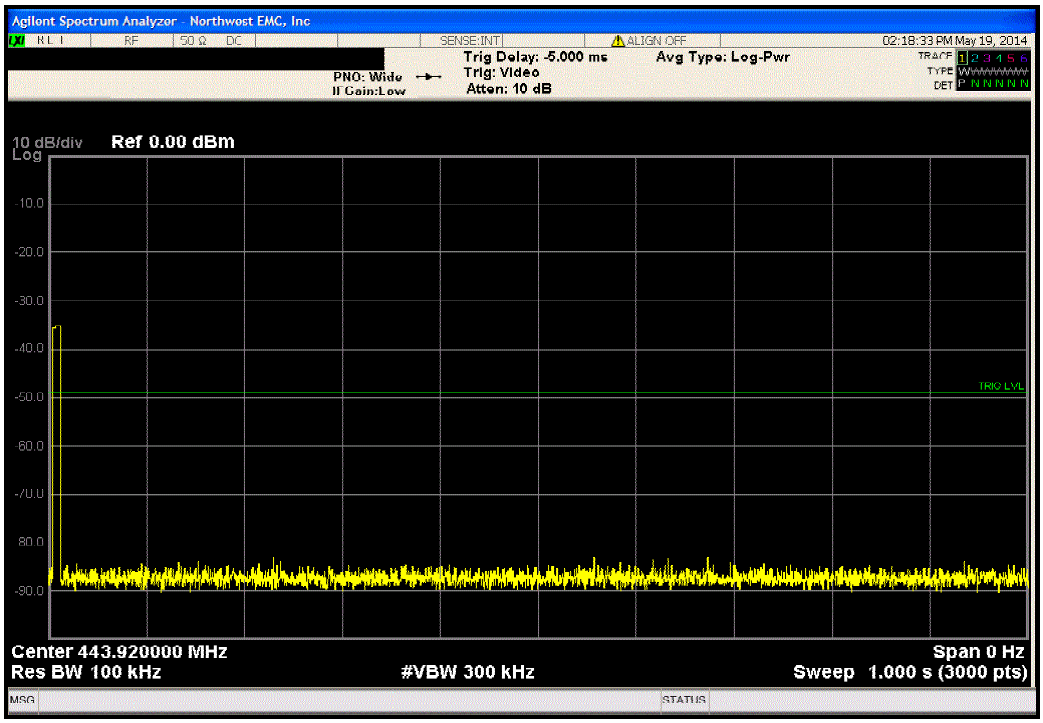
None

Configuration #	IRRI0001 - 1	Signature	Trevor Buls

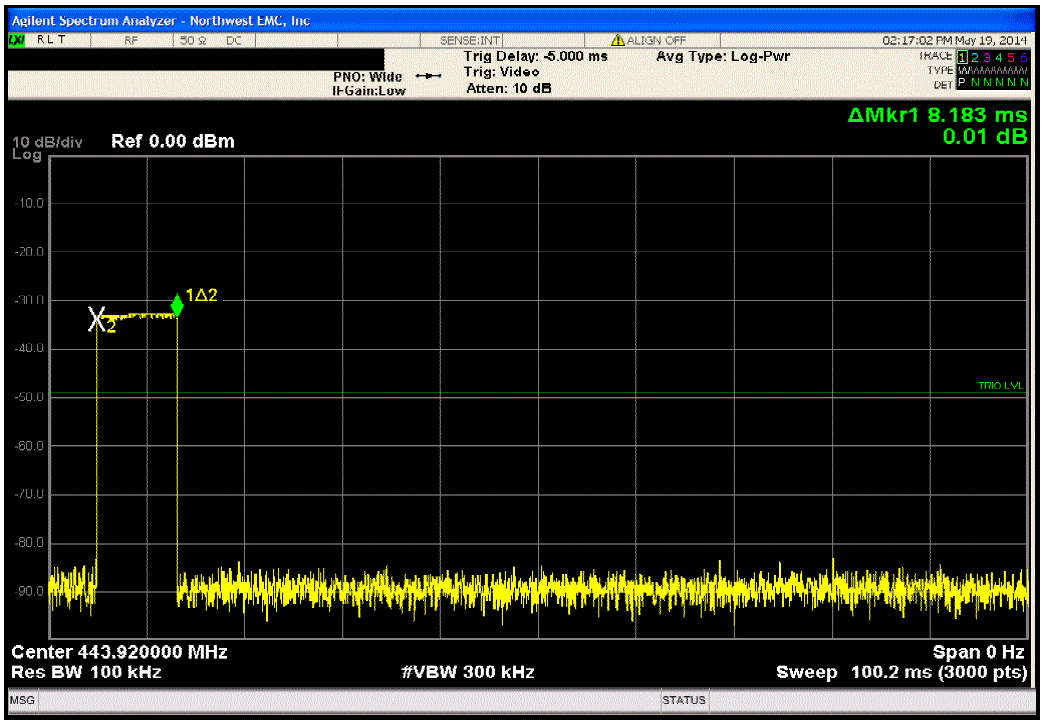
	Value	Limit	Result
1 Second Window	N/A	N/A	N/A
100 mS Window	8.183 mS	N/A	N/A

DUTY CYCLE

1 Second Window							
					Value	Limit	Result
					N/A	N/A	N/A



100 mS Window							
					Value	Limit	Result
					8.183 mS	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
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	5/20/2013	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 was measured with the EUT configured for continuous modulated operation at its single transmit frequency. The spectrum analyzer's resolution bandwidth was >= 1% of the 20dB bandwidth and the video bandwidth was greater than or equal to the resolution bandwidth.

The 20 dB bandwidth of the transmit frequency is less than 0.25% of the center frequency.

OCCUPIED BANDWIDTH

EUT:	IrriGreen Genius Irrigation System			**Work Order:**	IRRI0001
Serial Number:	2456532-0035			**Date:**	01/14/14
Customer:	IrriGreen, Inc			**Temperature:**	23°C
Attendees:	Gary Klinefelter			**Humidity:**	16%
Project:	None			**Barometric Pres.:**	1016.5
Tested by:	Trevor Buls	**Power:**	110VAC/60Hz	**Job Site:**	MN05

TEST SPECIFICATIONS	Test Method
FCC 15.231:2014	ANSI C63.10:2009

COMMENTS

Operating at low channel 433.92 MHz.

DEVIATIONS FROM TEST STANDARD

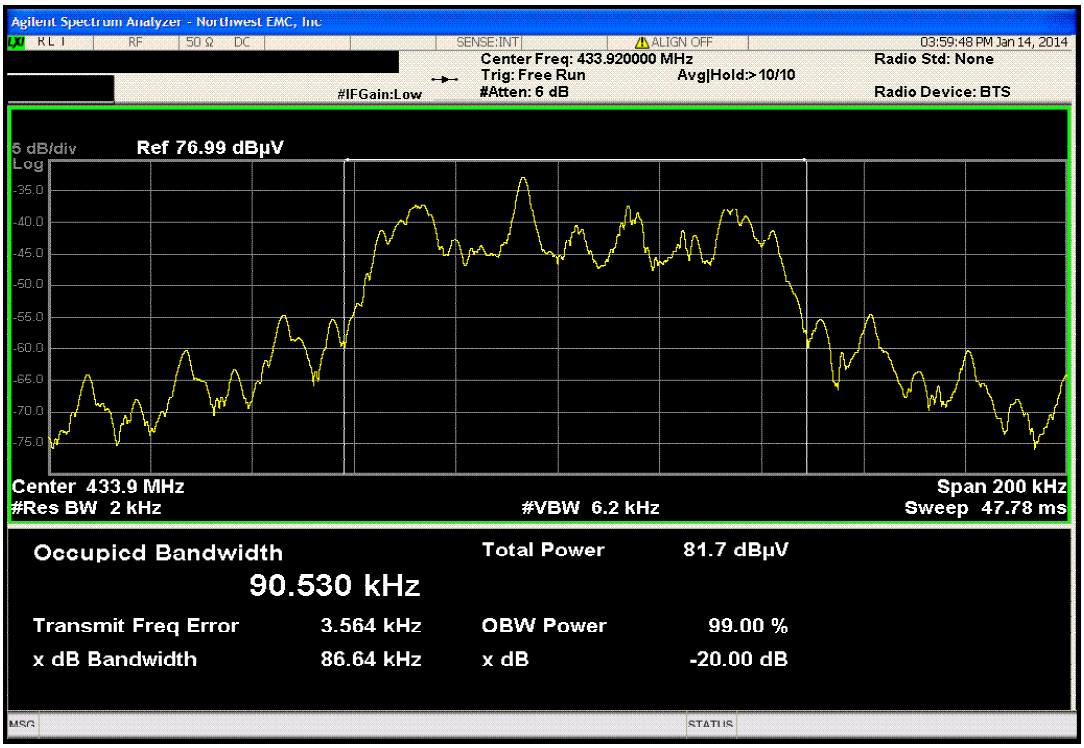
None

Configuration #	1	Signature	Trevor Buls

	Value (kHz)	Limit (kHz)	Result
Low Channel	86.64	1084.8	Pass

OCCUPIED BANDWIDTH

Mid Channel						
				Value (kHz)	Limit (kHz)	Result
				86.64	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	5/20/2013	12
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12
Spectrum Analyzer	Agilent	N9010A	AFI	1/27/2013	24

TEST DESCRIPTION

The occupied bandwidth was measured with the EUT configured for continuous modulated operation at its single transmit frequency. The spectrum analyzer's resolution bandwidth was >= 1% of the 20dB bandwidth and the video bandwidth was greater than or equal to the resolution bandwidth.

The 20 dB bandwidth of the transmit frequency is less than 0.25% of the center frequency.

OCCUPIED BANDWIDTH

EUT:	IrriGreen Genius Irrigation System			**Work Order:**	IRRI0005
Serial Number:	2456532-0035			**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:**	110VAC/60Hz	**Job Site:**	MN05

TEST SPECIFICATIONS	Test Method
FCC 15.231:2014	ANSI C63.10:2009

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

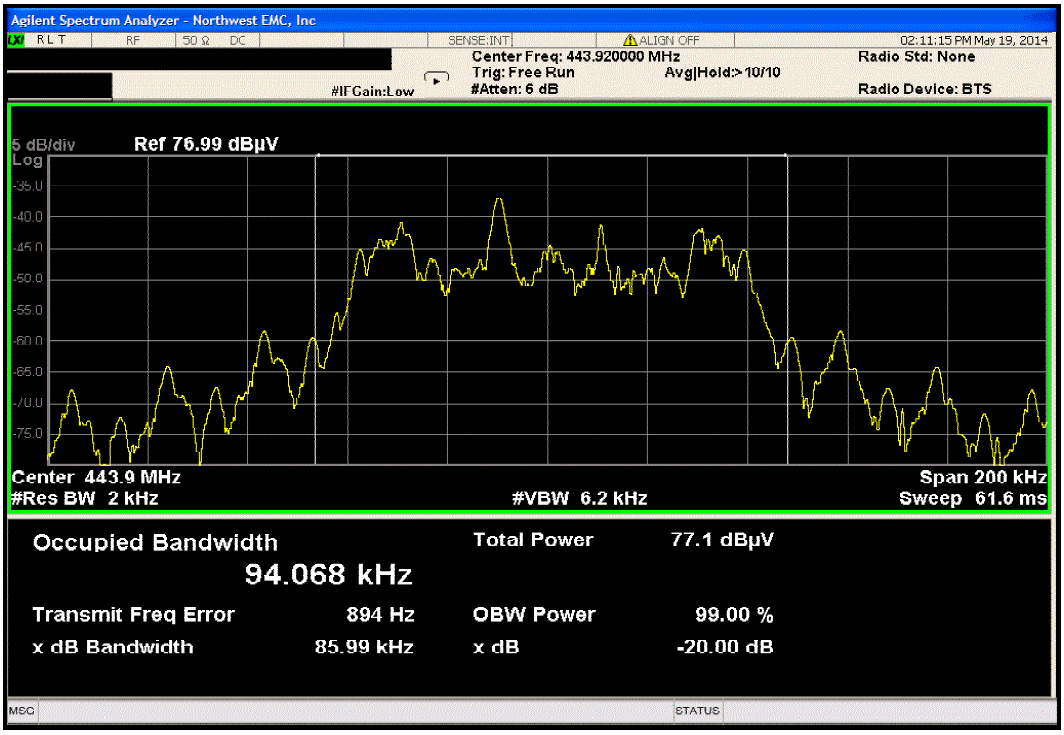
None

Configuration #	IRRI0001 - 1	Signature	Trevor Buls

	Value (kHz)	Limit (kHz)	Result
High Channel	85.99	1109.8	Pass

OCCUPIED BANDWIDTH

Mid Channel						
				Value (kHz)	Limit (kHz)	Result
				85.99	1109.8	Pass



FIELD STRENGTH OF FUNDAMENTAL

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 433.92 MHz, modulated.

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

IRRI0001 - 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
Attenuator, 20 dB, 'SMA'	SM Electronics	SA6-20	REO	5/20/2013	12 mo
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	5/20/2013	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

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

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:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.183 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [((1)(8.183))/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.

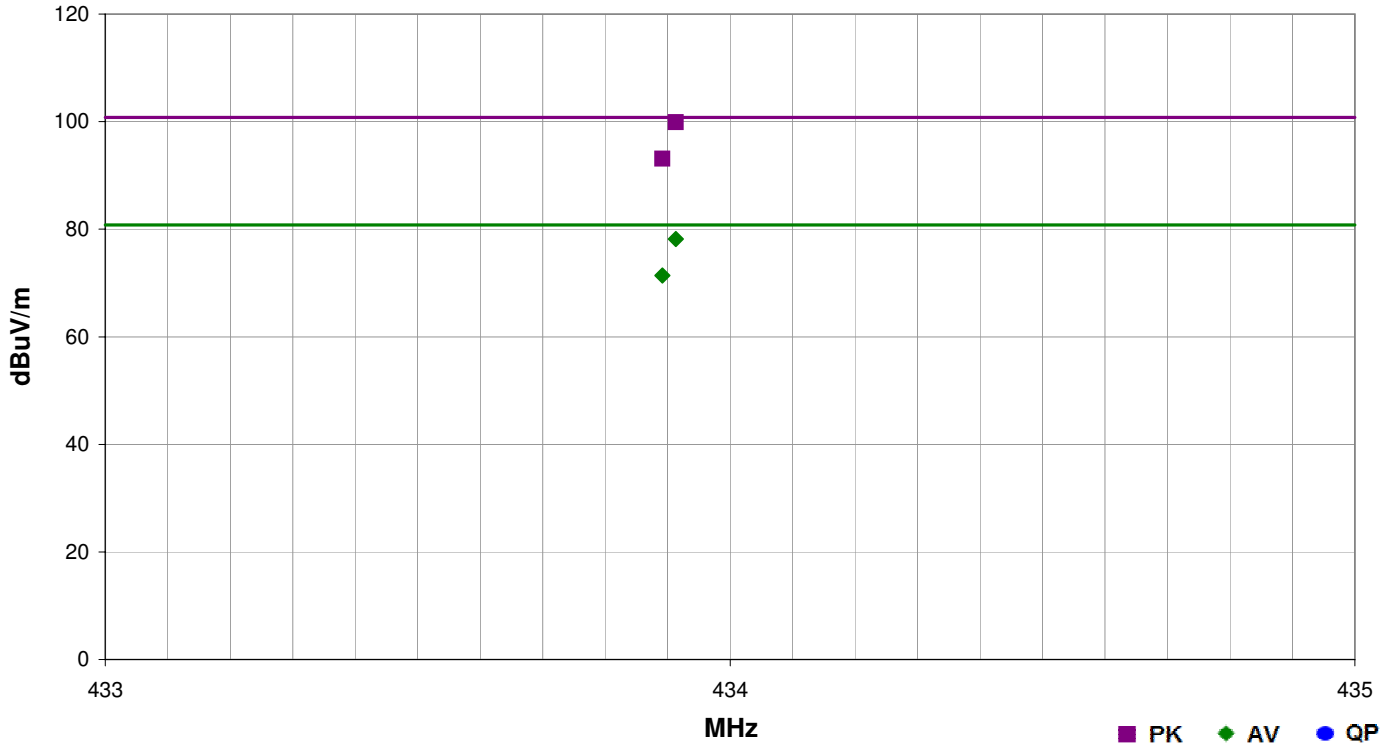
The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(b). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

FIELD STRENGTH OF FUNDAMENTAL

Work Order:	IRRI0001	**Date:**	01/14/14	Trevor Buls	
Project:	None	**Temperature:**	23.6 °C		
Job Site:	MN05	**Humidity:**	17.2% RH		
Serial Number:	2456532-0035	**Barometric Pres.:**	1004.1 mbar	**Tested by:**	Trevor Buls
EUT:	IrriGreen Genius Irrigation System				
Configuration:	1				
Customer:	IrriGreen, Inc				
Attendees:	Gary Klinefelter				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting semi-continuously at 433.92 MHz, modulated.				
Deviations:	None				
Comments:	Operating at low channel 433.92 MHz. Normal installation is in the upright position (EUT Vertical), so that was the only position tested.				

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

Run #	11	**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)
433.913	57.4	22.5	1.0	97.0		20.0	Vert	PK	0.0	99.9	100.8	-0.9
433.913	57.4	22.5	1.0	97.0	-21.7	20.0	Vert	AV	0.0	78.2	80.8	-2.6
433.892	50.6	22.5	1.0	122.0		20.0	Horz	PK	0.0	93.1	100.8	-7.7
433.892	50.6	22.5	1.0	122.0	-21.7	20.0	Horz	AV	0.0	71.4	80.8	-9.4

FIELD STRENGTH OF FUNDAMENTAL

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

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

IRRI0001 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	443 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
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

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:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.183 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [((1)(8.183))/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.

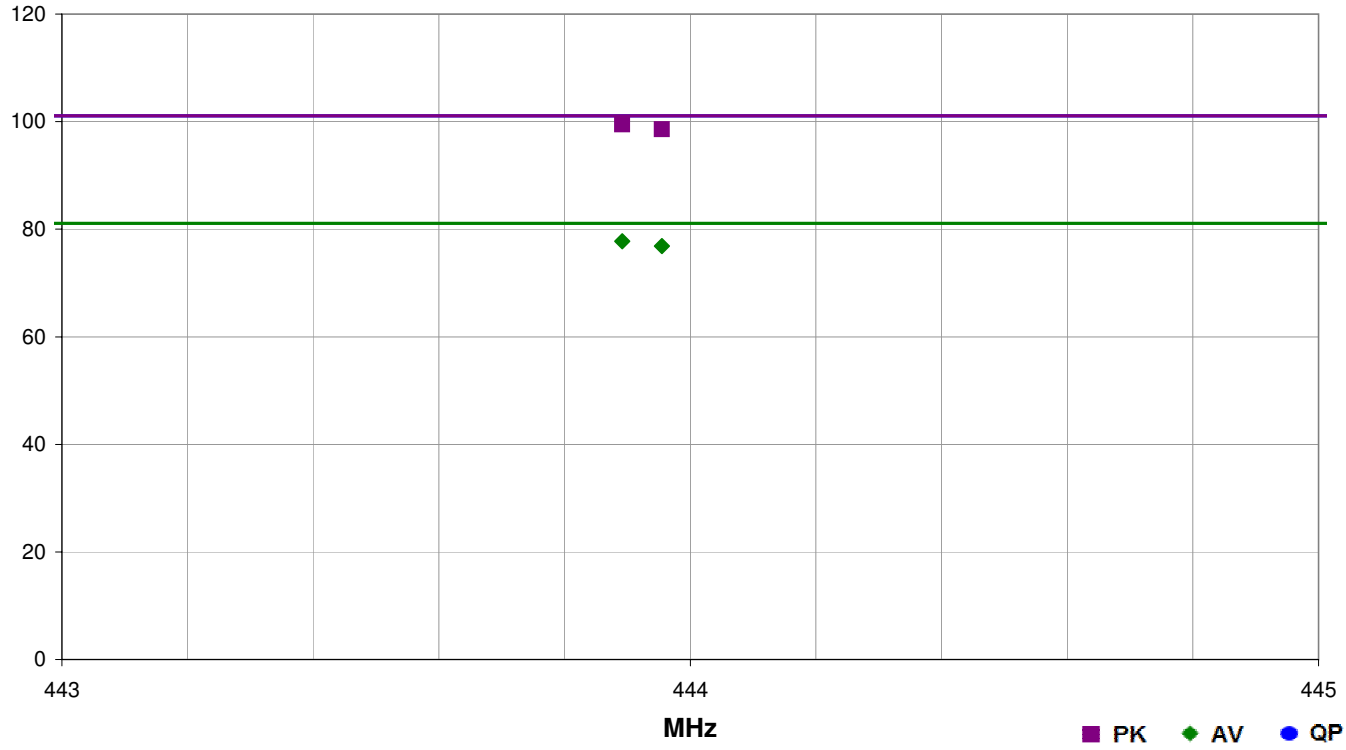
The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(b). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

FIELD STRENGTH OF FUNDAMENTAL

Work Order:	IRRI0005	**Date:**	05/19/14	Trevor Buls	
Project:	None	**Temperature:**	23.3 °C		
Job Site:	MN05	**Humidity:**	33.1% RH		
Serial Number:	2456532-0035	**Barometric Pres.:**	1016.2 mbar	**Tested by:**	Trevor Buls
EUT:	IrriGreen Genius Irrigation System				
Configuration:	IRRI0001 - 1				
Customer:	IrriGreen, Inc				
Attendees:	Gary Klinefelter				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting semi-continuously at 443.92 MHz, modulated.				
Deviations:	None				
Comments:	Normal installation is in the upright position (EUT Vertical), so that was the only position tested.				

Test Specifications	**Test Method**
FCC 15.231:2014	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)
443.892	76.5	23.0	1.0	322.0		0.0	Vert	PK	0.0	99.5	101.1	-1.6
443.955	75.6	23.0	1.0	201.0		0.0	Horz	PK	0.0	98.6	101.1	-2.5
443.892	76.5	23.0	1.0	322.0	-21.7	0.0	Vert	AV	0.0	77.8	81.1	-3.3
443.955	75.6	23.0	1.0	201.0	-21.7	0.0	Horz	AV	0.0	76.9	81.1	-4.2

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 433.92 MHz, modulated.

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

IRRI0001 - 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	5/20/2013	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	5/20/2013	12 mo
MN05 Cables	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	8/12/2013	12 mo
Antenna, Horn (DRG)	ETS Lindgren	3115	AIP	6/29/2011	36 mo
Pre-Amplifier	Miteq	AM-1616-1000	PAD	5/20/2013	12 mo
Antenna, Bilog	Teseq	CBL 6141B	AYD	12/17/2013	12 mo
MN05 Cables	ESM Cable Corp.	Bilog Cables	MNH	5/20/2013	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:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.183 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [((1)(8.183))/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.

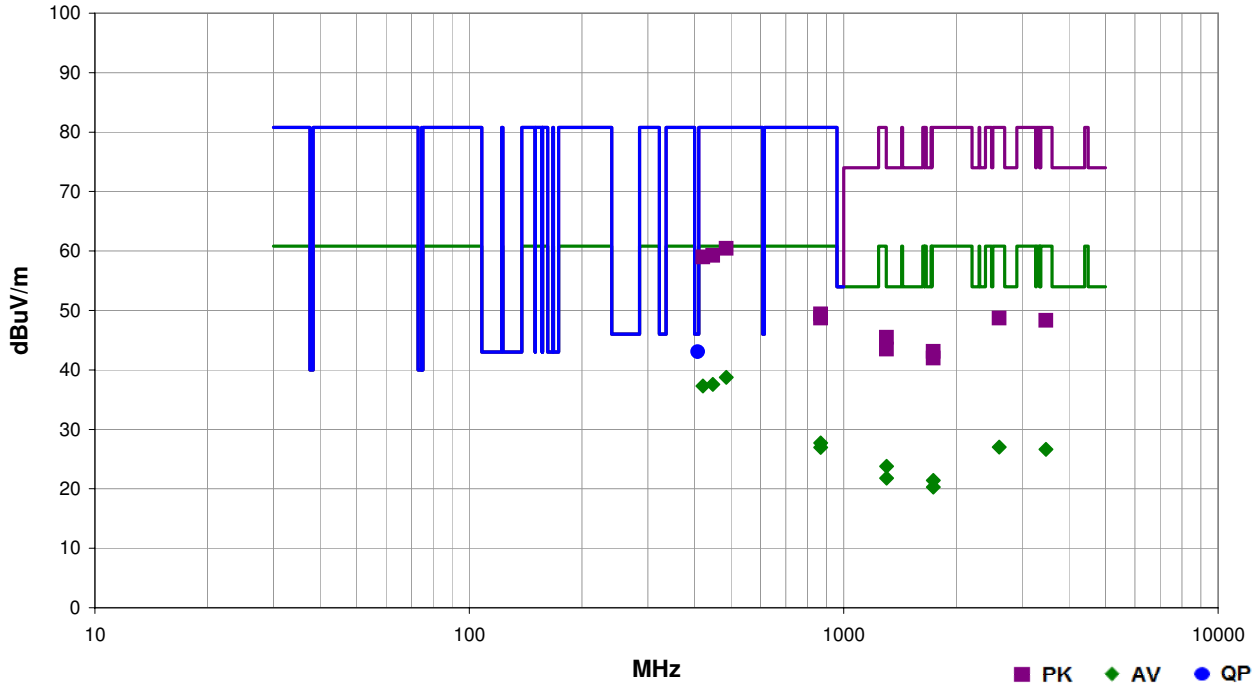
The field strength of the spurious emissions meet the limits as defined in 47 CFR 15.231(b). The spurious emissions also meet the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions. Further, spurious emissions meet the provisions of 15.205 using the measurement instrumentation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

SPURIOUS RADIATED EMISSIONS

Work Order:	IRRI0001	**Date:**	01/14/14	Trevor Buls	
Project:	None	**Temperature:**	23.6 °C		
Job Site:	MN05	**Humidity:**	17.2% RH		
Serial Number:	2456532-0035	**Barometric Pres.:**	1004.1 mbar	**Tested by:**	Trevor Buls
EUT:	IrriGreen Genius Irrigation System				
Configuration:	1				
Customer:	IrriGreen, Inc				
Attendees:	Gary Klinefelter				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting semi-continuously at 433.92 MHz, modulated.				
Deviations:	None				
Comments:	Operating at low channel 433.92 MHz. Normal installation is in the upright position (EUT Vertical), so that was the only position tested.				

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
407.959	32.6	0.5	1.0	241.0		10.0	Vert	QP	0.0	43.1	46.0	-2.9	Normal operation
485.909	48.8	1.7	1.0	241.0		10.0	Vert	PK	0.0	60.5	80.8	-20.3	
446.933	48.1	1.1	1.0	89.0		10.0	Vert	PK	0.0	59.2	80.8	-21.6	
420.941	48.2	0.8	1.0	248.0		10.0	Vert	PK	0.0	59.0	80.8	-21.8	
485.909	48.8	1.7	1.0	241.0	-21.7	10.0	Vert	AV	0.0	38.8	60.8	-22.0	
446.933	48.1	1.1	1.0	89.0	-21.7	10.0	Vert	AV	0.0	37.5	60.8	-23.3	
420.941	48.2	0.8	1.0	248.0	-21.7	10.0	Vert	AV	0.0	37.3	60.8	-23.5	
1301.750	51.4	-5.9	1.8	233.0		0.0	Vert	PK	0.0	45.5	74.0	-28.5	
1301.750	51.4	-5.9	1.8	233.0	-21.7	0.0	Vert	AV	0.0	23.8	54.0	-30.2	
1301.842	49.4	-5.9	1.0	329.0		0.0	Horz	PK	0.0	43.5	74.0	-30.5	
867.910	30.3	9.1	1.0	224.0		10.0	Vert	PK	0.0	49.4	80.8	-31.4	
2603.465	50.8	-2.1	1.0	191.0		0.0	Horz	PK	0.0	48.7	80.8	-32.1	
867.780	29.6	9.1	1.0	10.0		10.0	Horz	PK	0.0	48.7	80.8	-32.1	
1301.842	49.4	-5.9	1.0	329.0	-21.7	0.0	Horz	AV	0.0	21.8	54.0	-32.2	
3471.600	47.7	0.6	1.2	0.0		0.0	Horz	PK	0.0	48.3	80.8	-32.5	

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
867.910	30.3	9.1	1.0	224.0	-21.7	10.0	Vert	AV	0.0	27.7	60.8	-33.1	
2603.465	50.8	-2.1	1.0	191.0	-21.7	0.0	Horz	AV	0.0	27.0	60.8	-33.8	
867.780	29.6	9.1	1.0	10.0	-21.7	10.0	Horz	AV	0.0	27.0	60.8	-33.8	
3471.600	47.7	0.6	1.2	0.0	-21.7	0.0	Horz	AV	0.0	26.6	60.8	-34.2	
1735.883	47.9	-4.8	1.0	0.0		0.0	Horz	PK	0.0	43.1	80.8	-37.7	
1735.675	46.8	-4.8	3.3	256.0		0.0	Vert	PK	0.0	42.0	80.8	-38.8	
1735.883	47.9	-4.8	1.0	0.0	-21.7	0.0	Horz	AV	0.0	21.4	60.8	-39.4	
1735.675	46.8	-4.8	3.3	256.0	-21.7	0.0	Vert	AV	0.0	20.3	60.8	-40.5	

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

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

IRRI0001 - 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
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
Attenuator, 10db, 'SMA'	S.M. Electronics	SA18H-10	REN	5/15/2014	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:

Period = 100 mSec
Pulsewidth of Type 1 Pulse = 8.183 mSec
Number of Type 1 Pulses = 1

Duty Cycle = 20 log [((1)(8.183))/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.

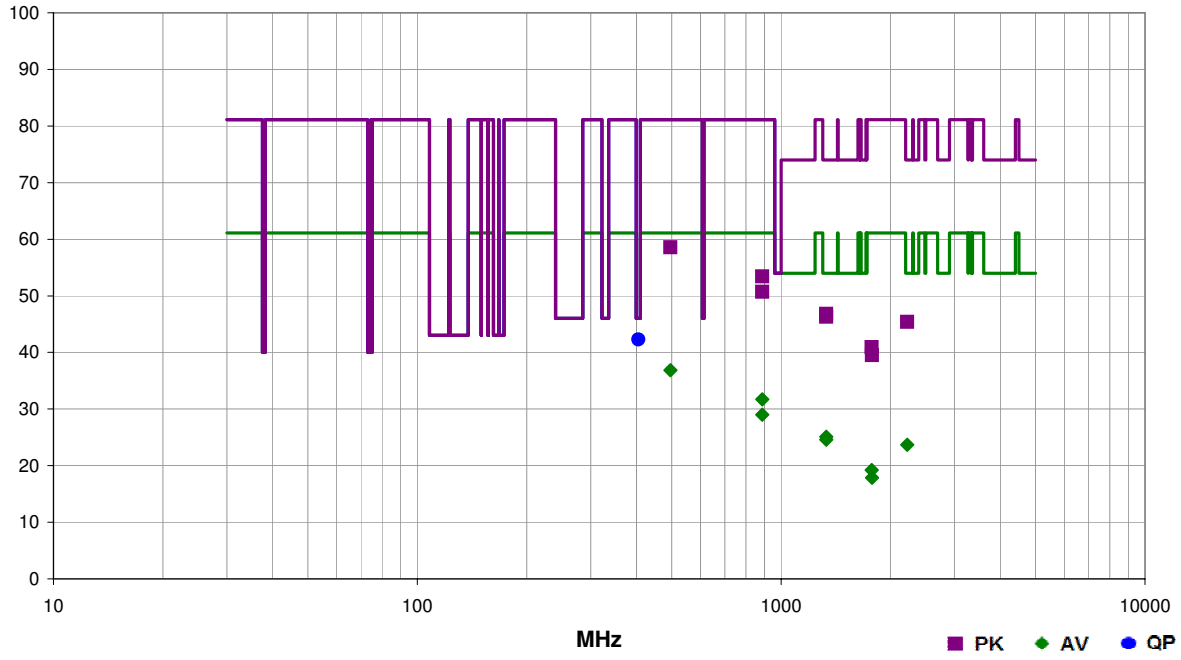
The field strength of the spurious emissions meet the limits as defined in 47 CFR 15.231(b). The spurious emissions also meet the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions. Further, spurious emissions meet the provisions of 15.205 using the measurement instrumentation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

SPURIOUS RADIATED EMISSIONS

Work Order:	IRRI0005	**Date:**	05/19/14	Trevor Buls	
Project:	None	**Temperature:**	23.3 °C		
Job Site:	MN05	**Humidity:**	33.1% RH		
Serial Number:	2456532-0035	**Barometric Pres.:**	1016.2 mbar	**Tested by:**	Trevor Buls
EUT:	IrriGreen Genius Irrigation System				
Configuration:	IRRI0001 - 1				
Customer:	IrriGreen, Inc				
Attendees:	Gary Klinefelter				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting semi-continuously at 443.92 MHz, modulated.				
Deviations:	None				
Comments:	Normal installation is in the upright position (EUT Vertical), so that was the only position tested.				

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

Run #	5	**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)
404.952	31.4	0.8	1.0	5.0		10.0	Vert	QP	0.0	42.3	46.0	-3.7
495.910	46.2	2.3	1.0	359.0		10.0	Vert	PK	0.0	58.5	81.1	-22.6
495.910	46.2	2.3	1.0	359.0	-21.7	10.0	Vert	AV	0.0	36.8	61.1	-24.3
1331.792	52.3	-5.5	1.0	111.0		0.0	Horz	PK	0.0	46.8	74.0	-27.2
887.910	33.6	9.8	1.0	27.0		10.0	Horz	PK	0.0	53.4	81.1	-27.7
1331.733	51.8	-5.5	1.1	51.0		0.0	Vert	PK	0.0	46.3	74.0	-27.7
2219.615	47.3	-1.9	1.0	116.0		0.0	Vert	PK	0.0	45.4	74.0	-28.6
1331.792	52.3	-5.5	1.0	111.0	-21.7	0.0	Horz	AV	0.0	25.1	54.0	-28.9
887.910	33.6	9.8	1.0	27.0	-21.7	10.0	Horz	AV	0.0	31.7	61.1	-29.4
1331.733	51.8	-5.5	1.1	51.0	-21.7	0.0	Vert	AV	0.0	24.6	54.0	-29.4
2219.615	47.3	-1.9	1.0	116.0	-21.7	0.0	Vert	AV	0.0	23.7	54.0	-30.3
887.780	30.9	9.8	1.0	160.0		10.0	Vert	PK	0.0	50.7	81.1	-30.4
887.780	30.9	9.8	1.0	160.0	-21.7	10.0	Vert	AV	0.0	29.0	61.1	-32.1
1775.517	45.8	-4.9	1.0	186.0		0.0	Horz	PK	0.0	40.9	81.1	-40.2
1775.683	44.4	-4.9	1.0	116.0		0.0	Vert	PK	0.0	39.5	81.1	-41.6
1775.517	45.8	-4.9	1.0	186.0	-21.7	0.0	Horz	AV	0.0	19.2	61.1	-41.9
1775.683	44.4	-4.9	1.0	116.0	-21.7	0.0	Vert	AV	0.0	17.8	61.1	-43.3

POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

The EUT will be powered either directly or indirectly from the AC power line. Therefore, conducted emissions measurements were made on the AC input of the EUT, or on the AC input of the device used to power the EUT. The AC power line conducted emissions were measured with the EUT operating at the lowest, the highest, and a middle channel in the operational band. The EUT was transmitting at its maximum data rate. For each mode, the spectrum was scanned from 150 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.10-2009.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Receiver	Rohde & Schwarz	ESCI	ARG	04/01/2013	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HGN	05/31/2012	24 mo
Attenuator 20dB, BNC	Fairview Microwave	SA01B-20	AQP	08/09/2013	12 mo
MN03 Cables	ESM Cable Corp.	Conducted Cables	MNC	12/05/2013	12 mo
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	05/24/2013	12 mo

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.94 dB	-2.94 dB

CONFIGURATIONS INVESTIGATED

IRRI0001-1

MODES INVESTIGATED

Transmitting Semi-Continuously, modulated at 433.92 MHz.

NORTHWEST EMC
WTD.2013.07.23, PSA-ESCI 2012.12.14, EmiR5 2014.01.02

POWERLINE CONDUCTED EMISSIONS

EUT:	IrriGreen Genius Irrigation System	Work Order:	IRRI0001
Serial Number:	2456532-0035	Date:	01/15/2014
Customer:	IrriGreen, Inc	Temperature:	22.9°C
Attendees:	Gary Klinefelter	Relative Humidity:	12.4%
Customer Project:	None	Bar. Pressure:	1021.5 mb
Tested By:	Trevor Buls	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	IRRI0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

Run #:	4	Line:	Neutral	Ext. Attenuation (dB):	20

COMMENTS

None

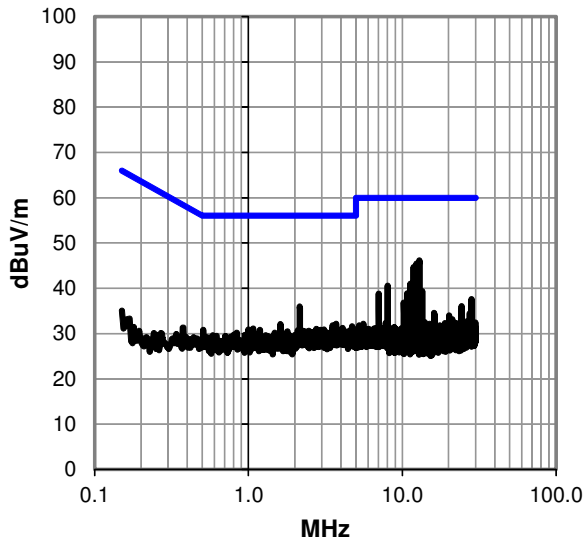
EUT OPERATING MODES

Transmitting Semi-Continuously, modulated at 433.92 MHz.

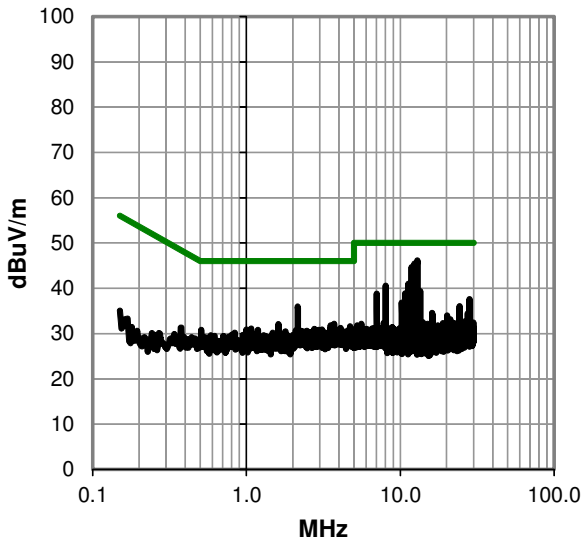
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



NORTHWEST EMC

WTD.2013.07.23, PSA-ESCI 2012.12.14, EmiR5 2014.01.02

POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #4

Peak Data - vs - Quasi Peak Limit

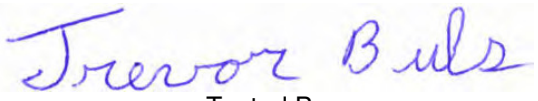
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Margin (dB)
12.928	25.3	20.9	46.2	60.0	-13.8
12.394	24.6	20.8	45.4	60.0	-14.6
11.857	23.9	20.8	44.7	60.0	-15.3
12.133	22.1	20.8	42.9	60.0	-17.1
12.096	21.6	20.8	42.4	60.0	-17.6
11.320	20.2	20.8	41.0	60.0	-19.0
12.171	19.9	20.8	40.7	60.0	-19.3
8.041	20.0	20.6	40.6	60.0	-19.4
2.153	15.7	20.3	36.0	56.0	-20.0
13.476	18.5	20.9	39.4	60.0	-20.6
10.775	18.1	20.7	38.8	60.0	-21.2
7.037	18.3	20.5	38.8	60.0	-21.2
12.062	18.0	20.8	38.8	60.0	-21.2
28.224	15.5	22.1	37.6	60.0	-22.4
28.314	15.1	22.1	37.2	60.0	-22.8
10.234	16.1	20.7	36.8	60.0	-23.2
3.717	11.8	20.4	32.2	56.0	-23.8
1.616	11.8	20.3	32.1	56.0	-23.9
24.270	14.4	21.7	36.1	60.0	-23.9
3.530	11.5	20.4	31.9	56.0	-24.1
4.713	11.2	20.4	31.6	56.0	-24.4
3.694	11.2	20.4	31.6	56.0	-24.4
3.627	11.0	20.4	31.4	56.0	-24.6
4.086	10.9	20.4	31.3	56.0	-24.7
24.191	13.5	21.7	35.2	60.0	-24.8
1.075	10.8	20.3	31.1	56.0	-24.9

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Margin (dB)
12.928	25.3	20.9	46.2	50.0	-3.8
12.394	24.6	20.8	45.4	50.0	-4.6
11.857	23.9	20.8	44.7	50.0	-5.3
12.133	22.1	20.8	42.9	50.0	-7.1
12.096	21.6	20.8	42.4	50.0	-7.6
11.320	20.2	20.8	41.0	50.0	-9.0
12.171	19.9	20.8	40.7	50.0	-9.3
8.041	20.0	20.6	40.6	50.0	-9.4
2.153	15.7	20.3	36.0	46.0	-10.0
13.476	18.5	20.9	39.4	50.0	-10.6
10.775	18.1	20.7	38.8	50.0	-11.2
7.037	18.3	20.5	38.8	50.0	-11.2
12.062	18.0	20.8	38.8	50.0	-11.2
28.224	15.5	22.1	37.6	50.0	-12.4
28.314	15.1	22.1	37.2	50.0	-12.8
10.234	16.1	20.7	36.8	50.0	-13.2
3.717	11.8	20.4	32.2	46.0	-13.8
1.616	11.8	20.3	32.1	46.0	-13.9
24.270	14.4	21.7	36.1	50.0	-13.9
3.530	11.5	20.4	31.9	46.0	-14.1
4.713	11.2	20.4	31.6	46.0	-14.4
3.694	11.2	20.4	31.6	46.0	-14.4
3.627	11.0	20.4	31.4	46.0	-14.6
4.086	10.9	20.4	31.3	46.0	-14.7
24.191	13.5	21.7	35.2	50.0	-14.8
1.075	10.8	20.3	31.1	46.0	-14.9

CONCLUSION

Pass



Tested By

NORTHWEST EMC

WTD.2013.07.23, PSA-ESCI 2012.12.14, EmiR5 2014.01.02

POWERLINE CONDUCTED EMISSIONS

EUT:	IrriGreen Genius Irrigation System	Work Order:	IRRI0001
Serial Number:	2456532-0035	Date:	01/15/2014
Customer:	IrriGreen, Inc	Temperature:	22.9°C
Attendees:	Gary Klinefelter	Relative Humidity:	12.4%
Customer Project:	None	Bar. Pressure:	1021.5 mb
Tested By:	Trevor Buls	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	IRRI0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

Run #:	6	Line:	High Line	Ext. Attenuation (dB):	20

COMMENTS

None

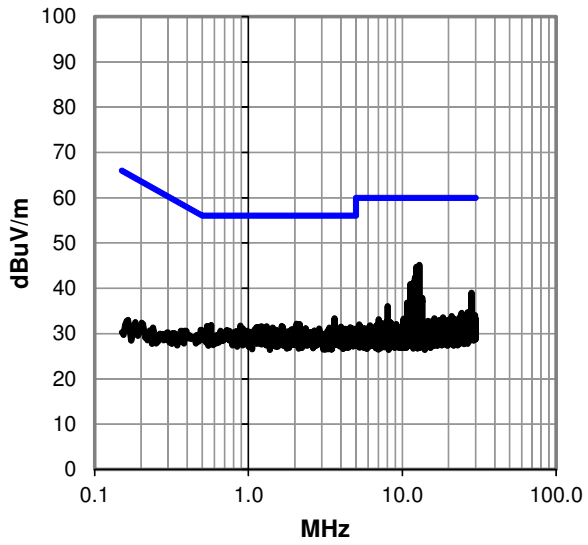
EUT OPERATING MODES

Transmitting Semi-Continuously, modulated at 433.92 MHz.

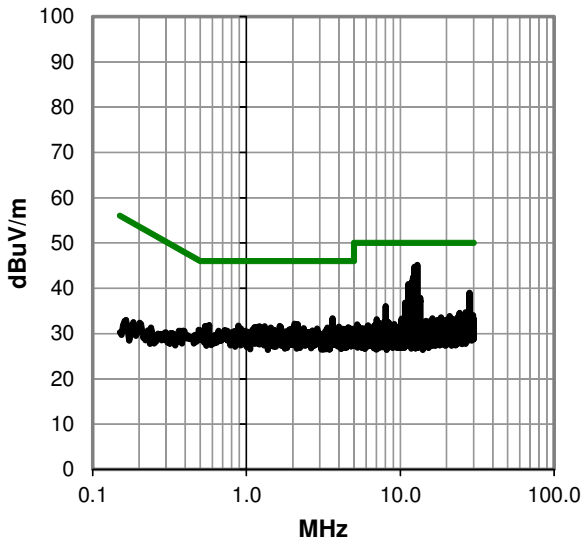
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



NORTHWEST EMC

WTD.2013.07.23, PSA-ESCI 2012.12.14, EmiR5 2014.01.02

POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #6

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Margin (dB)
12.935	24.3	20.9	45.2	60.0	-14.8
12.391	23.9	20.8	44.7	60.0	-15.3
12.133	21.7	20.8	42.5	60.0	-17.5
12.096	21.4	20.8	42.2	60.0	-17.8
11.861	20.5	20.8	41.3	60.0	-18.7
11.316	20.1	20.8	40.9	60.0	-19.1
12.171	19.5	20.8	40.3	60.0	-19.7
28.220	16.9	22.1	39.0	60.0	-21.0
28.310	16.1	22.1	38.2	60.0	-21.8
12.062	17.4	20.8	38.2	60.0	-21.8
13.476	17.0	20.9	37.9	60.0	-22.1
3.631	13.0	20.4	33.4	56.0	-22.6
10.775	16.1	20.7	36.8	60.0	-23.2
28.399	14.7	22.1	36.8	60.0	-23.2
2.053	11.9	20.3	32.2	56.0	-23.8
2.153	11.8	20.3	32.1	56.0	-23.9
8.044	15.5	20.6	36.1	60.0	-23.9
0.572	11.7	20.2	31.9	56.0	-24.1
0.885	11.5	20.3	31.8	56.0	-24.2
0.538	11.5	20.2	31.7	56.0	-24.3
1.646	11.4	20.3	31.7	56.0	-24.3
1.213	11.3	20.3	31.6	56.0	-24.4
1.310	11.3	20.3	31.6	56.0	-24.4
3.989	11.2	20.4	31.6	56.0	-24.4
1.176	11.2	20.3	31.5	56.0	-24.5
1.668	11.2	20.3	31.5	56.0	-24.5

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Margin (dB)
12.935	24.3	20.9	45.2	50.0	-4.8
12.391	23.9	20.8	44.7	50.0	-5.3
12.133	21.7	20.8	42.5	50.0	-7.5
12.096	21.4	20.8	42.2	50.0	-7.8
11.861	20.5	20.8	41.3	50.0	-8.7
11.316	20.1	20.8	40.9	50.0	-9.1
12.171	19.5	20.8	40.3	50.0	-9.7
28.220	16.9	22.1	39.0	50.0	-11.0
28.310	16.1	22.1	38.2	50.0	-11.8
12.062	17.4	20.8	38.2	50.0	-11.8
13.476	17.0	20.9	37.9	50.0	-12.1
3.631	13.0	20.4	33.4	46.0	-12.6
10.775	16.1	20.7	36.8	50.0	-13.2
28.399	14.7	22.1	36.8	50.0	-13.2
2.053	11.9	20.3	32.2	46.0	-13.8
2.153	11.8	20.3	32.1	46.0	-13.9
8.044	15.5	20.6	36.1	50.0	-13.9
0.572	11.7	20.2	31.9	46.0	-14.1
0.885	11.5	20.3	31.8	46.0	-14.2
0.538	11.5	20.2	31.7	46.0	-14.3
1.646	11.4	20.3	31.7	46.0	-14.3
1.213	11.3	20.3	31.6	46.0	-14.4
1.310	11.3	20.3	31.6	46.0	-14.4
3.989	11.2	20.4	31.6	46.0	-14.4
1.176	11.2	20.3	31.5	46.0	-14.5
1.668	11.2	20.3	31.5	46.0	-14.5

CONCLUSION

Pass

Trevor Buls

Tested By

POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

The EUT will be powered either directly or indirectly from the AC power line. Therefore, conducted emissions measurements were made on the AC input of the EUT, or on the AC input of the device used to power the EUT. The AC power line conducted emissions were measured with the EUT operating at the lowest, the highest, and a middle channel in the operational band. The EUT was transmitting at its maximum data rate. For each mode, the spectrum was scanned from 150 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.10-2009.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Receiver	Rohde & Schwarz	ESR7	ARI	05/06/2014	12 mo
MN03 Cables	ESM Cable Corp.	Conducted Cables	MNC	12/05/2013	12 mo
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	05/15/2014	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HGN	05/31/2012	24 mo
Attenuator 20dB, BNC	Fairview Microwave	SA01B-20	AQP	08/09/2013	12 mo

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.94 dB	-2.94 dB

CONFIGURATIONS INVESTIGATED

IRRI0001-1

MODES INVESTIGATED

Transmitting modulated at 443.92 MHz

POWERLINE CONDUCTED EMISSIONS

EUT:	IrriGreen Genius Irrigation System	Work Order:	IRRI0005
Serial Number:	2456532-0035	Date:	05/20/2014
Customer:	IrriGreen, Inc.	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	42.5%
Customer Project:	None	Bar. Pressure:	1014.2 mb
Tested By:	Trevor Buls	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	IRRI0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

Run #:	3	Line:	Neutral	Ext. Attenuation (dB):	20

COMMENTS

None

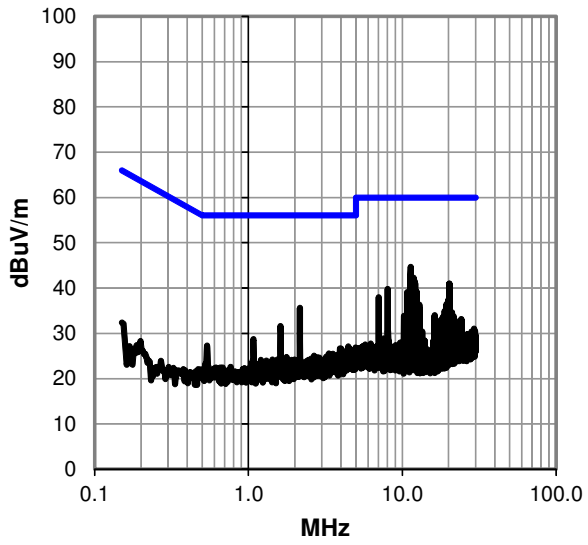
EUT OPERATING MODES

Transmitting modulated at 443.92 MHz

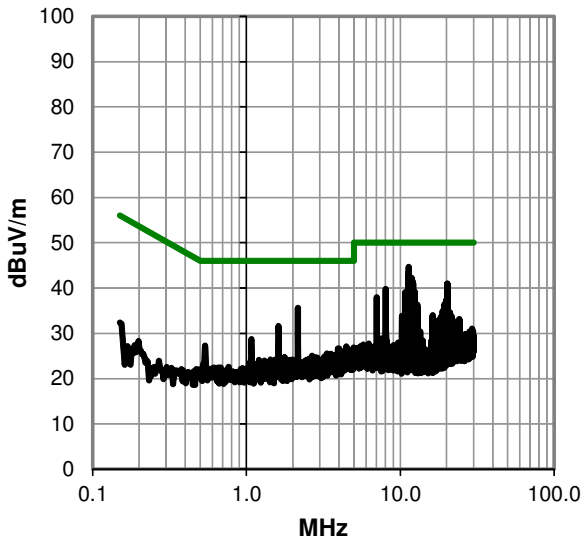
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #3

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Margin (dB)
11.327	23.9	20.8	44.7	60.0	-15.3
11.868	21.5	20.8	42.3	60.0	-17.7
12.100	20.6	20.8	41.4	60.0	-18.6
12.144	20.2	20.8	41.0	60.0	-19.0
20.240	19.5	21.5	41.0	60.0	-19.0
20.166	19.5	21.5	41.0	60.0	-19.0
8.037	19.2	20.6	39.8	60.0	-20.2
2.157	15.3	20.3	35.6	56.0	-20.4
12.409	18.3	20.8	39.1	60.0	-20.9
10.786	18.3	20.8	39.1	60.0	-20.9
20.304	17.5	21.5	39.0	60.0	-21.0
12.182	17.9	20.8	38.7	60.0	-21.3
7.033	17.4	20.5	37.9	60.0	-22.1
19.964	16.0	21.4	37.4	60.0	-22.6
12.059	16.1	20.8	36.9	60.0	-23.1
19.420	15.1	21.4	36.5	60.0	-23.5
12.943	15.5	20.9	36.4	60.0	-23.6
1.616	11.3	20.3	31.6	56.0	-24.4
20.501	13.5	21.5	35.0	60.0	-25.0
18.871	13.6	21.3	34.9	60.0	-25.1
21.039	13.1	21.5	34.6	60.0	-25.4
16.245	12.9	21.1	34.0	60.0	-26.0
10.246	13.1	20.8	33.9	60.0	-26.1
21.583	12.2	21.6	33.8	60.0	-26.2
16.189	12.5	21.1	33.6	60.0	-26.4
18.338	12.3	21.3	33.6	60.0	-26.4

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Margin (dB)
11.327	23.9	20.8	44.7	50.0	-5.3
11.868	21.5	20.8	42.3	50.0	-7.7
12.100	20.6	20.8	41.4	50.0	-8.6
12.144	20.2	20.8	41.0	50.0	-9.0
20.240	19.5	21.5	41.0	50.0	-9.0
20.166	19.5	21.5	41.0	50.0	-9.0
8.037	19.2	20.6	39.8	50.0	-10.2
2.157	15.3	20.3	35.6	46.0	-10.4
12.409	18.3	20.8	39.1	50.0	-10.9
10.786	18.3	20.8	39.1	50.0	-10.9
20.304	17.5	21.5	39.0	50.0	-11.0
12.182	17.9	20.8	38.7	50.0	-11.3
7.033	17.4	20.5	37.9	50.0	-12.1
19.964	16.0	21.4	37.4	50.0	-12.6
12.059	16.1	20.8	36.9	50.0	-13.1
19.420	15.1	21.4	36.5	50.0	-13.5
12.943	15.5	20.9	36.4	50.0	-13.6
1.616	11.3	20.3	31.6	46.0	-14.4
20.501	13.5	21.5	35.0	50.0	-15.0
18.871	13.6	21.3	34.9	50.0	-15.1
21.039	13.1	21.5	34.6	50.0	-15.4
16.245	12.9	21.1	34.0	50.0	-16.0
10.246	13.1	20.8	33.9	50.0	-16.1
21.583	12.2	21.6	33.8	50.0	-16.2
16.189	12.5	21.1	33.6	50.0	-16.4
18.338	12.3	21.3	33.6	50.0	-16.4

CONCLUSION

Pass

Trevor Buls

Tested By

NORTHWEST EMC

WTD.2013.07.23, PSA-ESCI 2014.02.19, EmiR5 2014.05.14

POWERLINE CONDUCTED EMISSIONS

EUT:	IrriGreen Genius Irrigation System	Work Order:	IRRI0005
Serial Number:	2456532-0035	Date:	05/20/2014
Customer:	IrriGreen, Inc.	Temperature:	23.8°C
Attendees:	None	Relative Humidity:	42.5%
Customer Project:	None	Bar. Pressure:	1014.2 mb
Tested By:	Trevor Buls	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	IRRI0001-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2014	ANSI C63.10:2009

TEST PARAMETERS

Run #:	4	Line:	High Line	Ext. Attenuation (dB):	20

COMMENTS

None

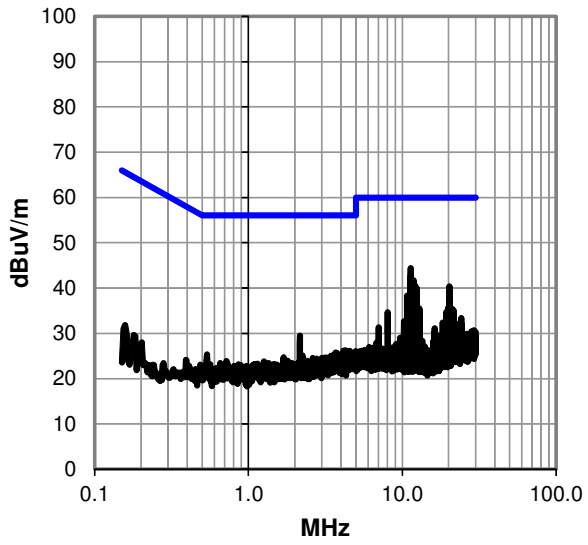
EUT OPERATING MODES

Transmitting modulated at 443.92 MHz

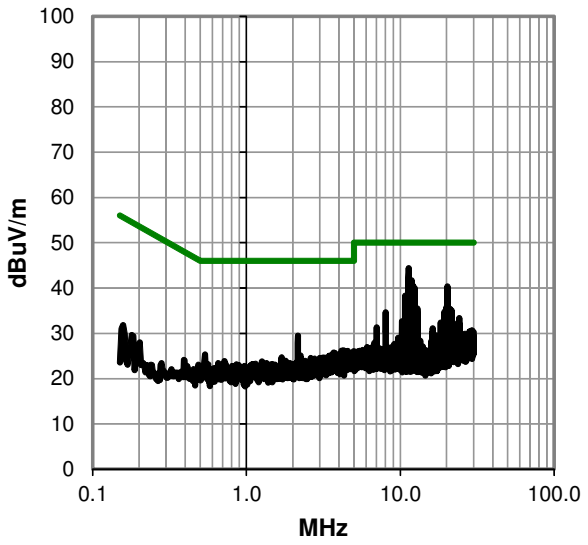
DEVIATIONS FROM TEST STANDARD

None

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



NORTHWEST EMC

WTD.2013.07.23, PSA-ESCI 2014.02.19, EmiR5 2014.05.14

POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #4

Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Margin (dB)
11.327	23.6	20.8	44.4	60.0	-15.6
11.868	20.9	20.8	41.7	60.0	-18.3
12.100	19.7	20.8	40.5	60.0	-19.5
12.144	19.6	20.8	40.4	60.0	-19.6
20.240	18.9	21.5	40.4	60.0	-19.6
12.186	19.3	20.8	40.1	60.0	-19.9
12.409	19.1	20.8	39.9	60.0	-20.1
20.166	18.2	21.5	39.7	60.0	-20.3
20.304	17.5	21.5	39.0	60.0	-21.0
10.783	17.5	20.8	38.3	60.0	-21.7
12.059	15.7	20.8	36.5	60.0	-23.5
19.964	14.3	21.4	35.7	60.0	-24.3
12.947	14.6	20.9	35.5	60.0	-24.5
21.054	13.9	21.5	35.4	60.0	-24.6
21.580	13.5	21.6	35.1	60.0	-24.9
20.501	13.5	21.5	35.0	60.0	-25.0
19.427	13.4	21.4	34.8	60.0	-25.2
8.037	14.0	20.6	34.6	60.0	-25.4
21.035	12.2	21.5	33.7	60.0	-26.3
2.157	9.2	20.3	29.5	56.0	-26.5
24.199	11.6	21.8	33.4	60.0	-26.6
10.246	11.9	20.8	32.7	60.0	-27.3
18.341	11.1	21.3	32.4	60.0	-27.6
22.113	10.7	21.6	32.3	60.0	-27.7
18.882	10.8	21.4	32.2	60.0	-27.8
24.292	10.3	21.8	32.1	60.0	-27.9

Peak Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Margin (dB)
11.327	23.6	20.8	44.4	50.0	-5.6
11.868	20.9	20.8	41.7	50.0	-8.3
12.100	19.7	20.8	40.5	50.0	-9.5
12.144	19.6	20.8	40.4	50.0	-9.6
20.240	18.9	21.5	40.4	50.0	-9.6
12.186	19.3	20.8	40.1	50.0	-9.9
12.409	19.1	20.8	39.9	50.0	-10.1
20.166	18.2	21.5	39.7	50.0	-10.3
20.304	17.5	21.5	39.0	50.0	-11.0
10.783	17.5	20.8	38.3	50.0	-11.7
12.059	15.7	20.8	36.5	50.0	-13.5
19.964	14.3	21.4	35.7	50.0	-14.3
12.947	14.6	20.9	35.5	50.0	-14.5
21.054	13.9	21.5	35.4	50.0	-14.6
21.580	13.5	21.6	35.1	50.0	-14.9
20.501	13.5	21.5	35.0	50.0	-15.0
19.427	13.4	21.4	34.8	50.0	-15.2
8.037	14.0	20.6	34.6	50.0	-15.4
21.035	12.2	21.5	33.7	50.0	-16.3
2.157	9.2	20.3	29.5	46.0	-16.5
24.199	11.6	21.8	33.4	50.0	-16.6
10.246	11.9	20.8	32.7	50.0	-17.3
18.341	11.1	21.3	32.4	50.0	-17.6
22.113	10.7	21.6	32.3	50.0	-17.7
18.882	10.8	21.4	32.2	50.0	-17.8
24.292	10.3	21.8	32.1	50.0	-17.9

CONCLUSION

Pass

Trevor Buls

Tested By