

NORTHWEST EMC

IrriGreen, Inc
433.92 MHz Transmitter and Wi-Fi radio
FCC 2.1091:2015

Report # IRRI0006.2



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. This Report may only be duplicated in its entirety

CERTIFICATE OF EVALUATION

Last Date of Evaluation: July 13, 2015
IrriGreen, Inc
Model: 433.92 MHz Transmitter and Wi-Fi radio

Radio Equipment Evaluation

Standards

| Specification | Method |
|-----------------|--|
| FCC 2.1091:2015 | KDB 447498 D01 General RF Exposure Guidance v05r02 |

Results

| Method Clause | Test Description | Applied | Results | Comments |
|---------------|------------------------------|---------|---------|----------|
| 7.1 | Maximum Permissible Exposure | Yes | Pass | |

Deviations From Standards

None

Approved By:



Don Facteau, IT Manager

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. 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. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

| Revision Number | Description | Date | Page Number |
|-----------------|-------------|------|-------------|
| 00 | None | | |

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 17065 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

MSIP / 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.

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

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

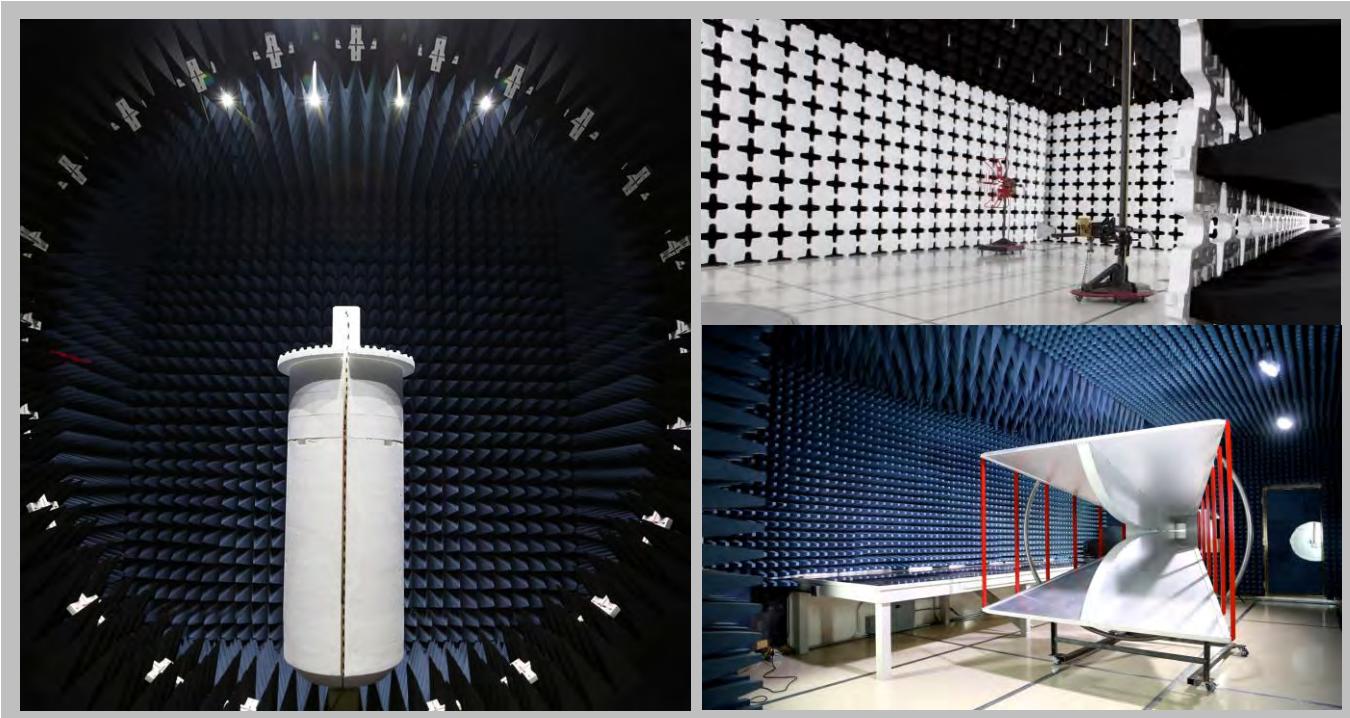
<http://www.nwemc.com/accreditations/>

<http://gsi.nist.gov/global/docs/cabs/designations.html>

FACILITIES



| California | Minnesota | New York | Oregon | Texas | Washington |
|---|---|---|--|--|---|
| Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918 | Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136 | Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214 | Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066 | Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255 | Labs NC01-05 19201 120 th Ave NE Bothell, WA 9801 (425)984-6600 |
| NVLAP | | | | | |
| NVLAP Lab Code: 200676-0 | NVLAP Lab Code: 200881-0 | NVLAP Lab Code: 200761-0 | NVLAP Lab Code: 200630-0 | NVLAP Lab Code: 201049-0 | NVLAP Lab Code: 200629-0 |
| Industry Canada | | | | | |
| 2834B-1, 2834B-3 | 2834E-1 | N/A | 2834D-1, 2834D-2 | 2834G-1 | 2834F-1 |
| BSMI | | | | | |
| SL2-IN-E-1154R | SL2-IN-E-1152R | N/A | SL2-IN-E-1017 | SL2-IN-E-1158R | SL2-IN-E-1153R |
| VCCI | | | | | |
| A-0029 | A-0109 | N/A | A-0108 | A-0201 | A-0110 |
| Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA | | | | | |
| US0158 | US0175 | N/A | US0017 | US0191 | US0157 |



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

| | |
|---------------------------|---------------------------------------|
| Company Name: | IrriGreen, Inc |
| Address: | 5250 West 73rd Street, Suite I |
| City, State, Zip: | Edina, MN 55439 |
| Test Requested By: | Gary Klinefelter |
| Model: | 433.92 MHz Transmitter and Wifi radio |
| Evaluation Date: | July 13, 2015 |

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

IrriGreen has developed a new box to add to their irrigation system. This box has a 433MHz radio that talks to their IrriGreen Server and also a TI CC3100 WiFi module to talk to a phone. It also has a connection for a flow sensor and a 24 VAC transformer.

The antennas are used greater than 20 cm away from the user, and the radios cannot transmit simultaneously. Therefore a standalone MPE evaluation is applicable.

Evaluation Objective:

To demonstrate compliance with FCC requirements for RF exposure for 2.1091 mobile devices.

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

OVERVIEW

Human exposure to RF emissions from mobile devices (47 CFR §2.1091) may be evaluated based on the MPE limits adopted by the FCC for electric and magnetic field strength and/or power density, as appropriate, since exposures are assumed to occur at distances of 20 cm or more from persons. ANSI C95.1:2005 + Amd 1:2010 specifies a minimum separation distance of 20 cm for performing reliable field measurements to determine adherence to MPE limits. If the minimum separation distance between a transmitter and nearby persons is more than 20 cm under normal operating conditions, compliance with MPE limits may be determined at such distance from the transmitter. When applicable, operation instructions and prominent warning labels may be used to alert the exposed persons to maintain a specified distance from the transmitter or to limit their exposure durations and usage conditions to ensure compliance. If the use of warning labels on a transmitter is not effective or desirable, the alternative of performing SAR evaluation with the device at its closest range to persons under normal operating conditions may be used. The field strength and power density limits adopted by the FCC are based on whole-body averaged exposure and the assumption of RF field levels relate most accurately to estimating whole-body averaged SAR. This means some local values of exposures exceeding the stated field strength and power density limits may not necessarily imply non-compliance if the spatial average of spatially averaged RF fields over the exposed portions of a person's body does not exceed the limits.

COMPLIANCE WITH 2.1091

“Mobile devices that operate in the Cellular Radiotelephone Service, the Personal Communications Services, the Satellite Communications Services, the General Wireless Communications Service, the Wireless Communications Service, the Maritime Services and the Specialized Mobile Radio Service authorized under subpart H of part 22 of this chapter, parts 24, 25, 26 and 27 of this chapter, part 80 of this chapter (ship earth stations devices only) and part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more. Unlicensed personal communications service devices, unlicensed millimeter wave devices and unlicensed NII devices authorized under §§15.253, 15.255, and 15.257, and subparts D and E of part 15 of this chapter are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if their ERP is 3 watts or more or if they meet the definition of a portable device as specified in §2.1093(b) requiring evaluation under the provisions of that section. All other mobile and unlicensed transmitting devices are categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, except as specified in §§1.1307(c) and 1.1307(d) of this chapter. Applications for equipment authorization of mobile and unlicensed transmitting devices subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in paragraph (d) of this section as part of their application.”

The EUT will only be used with a separation distance of 20 centimeters or greater between the antenna and the body of the user or nearby persons and can therefore be considered a mobile transmitter per 47 CFR 2.1091(b). Per 47 CFR 1.1310, the EUT meets the General Population / Uncontrolled exposure limits listed in Table 1.

COMPLIANCE WITH FCC KDB 447498 D01 General RF Exposure Guidance v05r02

"KDB 447498 D01 General RF Exposure Guidance v05r02" provides the procedures, requirements, and authorization policies for mobile and portable devices. Section 7.1 best fits the exposure condition described in this report. Since these mobile devices are categorically excluded from routine evaluation; simple calculations may be used to estimate the power density to demonstrate compliance with 47 CFR 1.1310 requirements. The attached estimate shows MPE limits are met at a 20 cm boundary.

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

FCC LIMITS FOR MPE

Limits for General Population /Uncontrolled Exposure: 47 CFR 1.1310

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm ²) | Averaging Time (minutes) |
|-----------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| 0.3 - 1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34 - 30 | 824/f | 2.19/f | *(180/f ²) | 30 |
| 30 - 300 | 27.5 | 0.073 | 0.2 | 30 |
| 300 - 1500 | | | f/1500 | 30 |
| 1500 - 100000 | | | 1 | 30 |

f = frequency in MHz

* = Plane-wave equivalent power density

METHOD OF EVALUATION

Per the professional installation instructions, the exposure level for the radio is evaluated at a 20 cm distance from the radio's transmitting antenna using the general equation:

$$S = \frac{P * G}{4 * \pi * R^2}$$

Where: S = power density (mW/cm²)

P = power input to the antenna (mW)

G = numeric power gain relative to an isotropic radiator

R = distance to the center of the radiation of the antenna ((20 cm = limit for MPE estimates)

P*G = EIRP

Solving for S, the maximum power density 20 cm from the transmitting antenna is determined. This level is then compared to the applicable limit for the transmit frequency.

The standalone MPE is summarized in the following table:

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| | | | | | |
|-------------------|--|--|-----------|--------------------|-----------|
| EUT: | 433.92 MHz Transmitter and Wi-Fi radio | | | Work Order: | IRRI0006 |
| Serial Number: | None | | | Date: | 7/13/2015 |
| Customer: | IrriGreen, Inc. | | | Temperature (°C): | N/A |
| Attendees: | None | | | Rel. Humidity (%): | N/A |
| Customer Project: | None | | | Bar. Pres. (mb): | N/A |
| | Power: N/A | | Job Site: | N/A | |

TEST SPECIFICATIONS

| | |
|-----------------|--|
| Specification: | Method: |
| FCC 2.1091:2015 | KDB 447498 D01 General RF Exposure Guidance v05r02 |

COMMENTS

433.92 MHz transmitter and Wi-Fi radios do not transmit simultaneously

DEVIATIONS FROM TEST STANDARD

None

MPE Estimates for Individual Devices

| Radio | Antenna Type | Antenna Manufacturer | Antenna Model | Transmit Frequency (MHz) | Max Output Power (mW) | Duty Cycle | Duty Cycle Corrected Output Power (mW) | Antenna Gain (dBi) | Minimum Antenna Cable Loss (dB) | Power Density @ 20 cm (mW/cm ²) | General Population Exposure Limit from 1.1310 (mW/cm ²) |
|-----------|--------------|----------------------|-----------------|-----------------------------|--------------------------|------------|---|-----------------------|------------------------------------|--|--|
| 433 MHz | 1/4-wave | Linx | ANT-433-HETH | 433.92 | 0.017 | 1 | 0.017 | n/a ¹ | n/a ¹ | 0.0000034 | 0.3 |
| 802.11bgn | 1/2-wave | Linx | ANT-2.4-WRT-UFL | 2412 | 51.02 | 1 | 51.02 | 3.5 | 0 | 0.023 | 1.0 |

Note 1: Radiated output power calculated as follows: 77.6 dBuV/m @ 3m = 0.017 mW EIRP