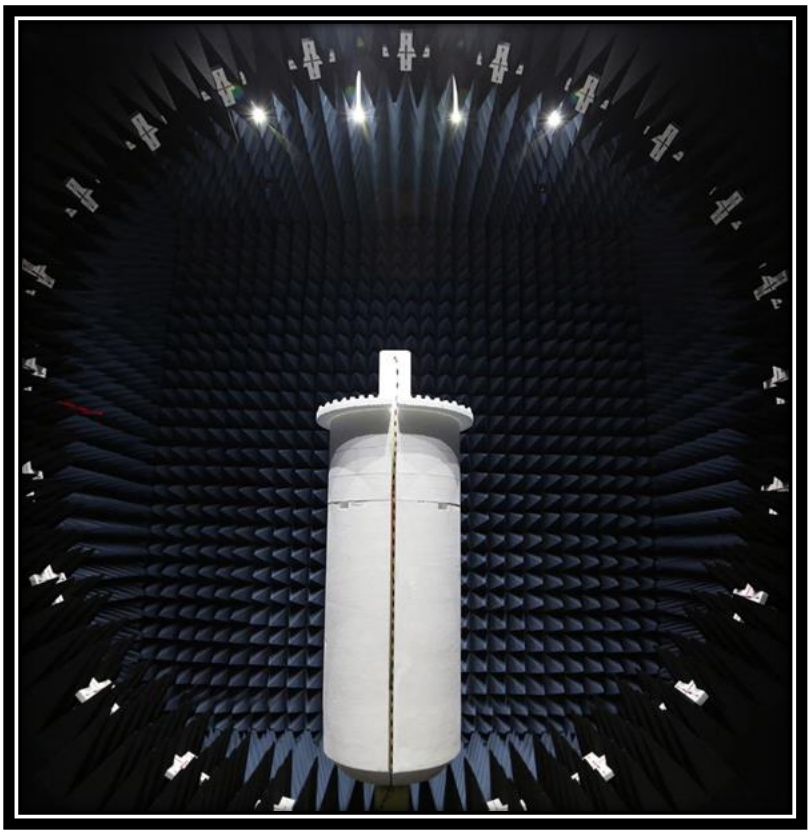
IrriGreen, Inc.

Sprinkler 3 (Model No. 400304)

OTA Report

Report: IRRI0027.1 Rev. 0, Issue Date: May 23, 2025



Approved by:

Chuck Heller, Operations Manager

TABLE OF CONTENTS

element
2023.04.17

Section	Page Number

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

element
2025.02.07

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 - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

FDA - Recognized by the FDA as an Accreditation Scheme for Conformity Assessment (ASCA)-accredited testing laboratory for basic safety and essential performance.

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

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

Korea

MSIT / 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.

SCOPE

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

California Minnesota Oregon Washington

FACILITIES

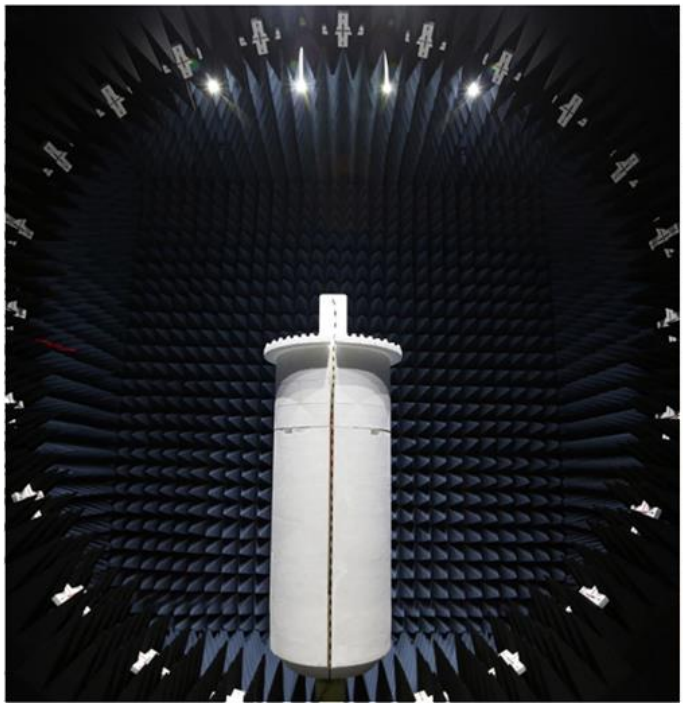
element
2025.01.03

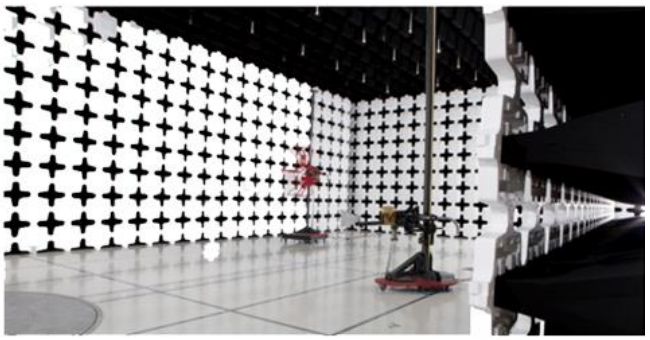
Testing was performed at the following location(s)

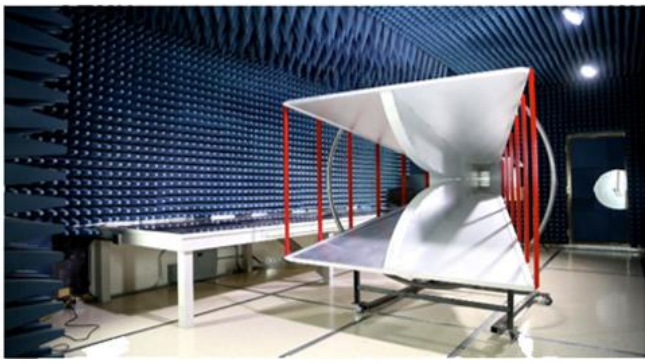
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☒	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☐	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

(1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
(2) A2LA Certificate No.
(3) ISED Company No.
(4) BSMI No.
(5) VCCI Site Filing No.
(6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MOC, NCC, OFCA
(7) FDA ASCA No.







PRODUCT DESCRIPTION

Client and Equipment under Test (EUT) Information

Company Name:	IrriGreen, Inc.
Address:	5250 West 73rd Street
City, State, Zip:	Edina, MN 55439
Test Requested By:	Gary Klinefelter
EUT:	Sprinkler 3 (Model No. 400304)
First Date of Test:	April 7, 2025
Last Date of Test:	April 7, 2025
Receipt Date of Samples:	April 7, 2025
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

Landscape irrigation system consisting of an Irrigreen Controller 3 and an Irrigreen Sprinkler 3 (Model No. 400304)

Testing Objective:

To obtain 3D antenna pattern measurements and calculated antenna performance values (gain, efficiency, TRP, etc)

EUT Photo:

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2025-04-07	Passive 3D Antenna Pattern Measurements	Tested as delivered to test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

OTA TEST DESCRIPTION

OTA 2018.01.04

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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Network Analyzer	Agilent	E5071C	R365	9/25/2022	36 mo
Antenna - Dipole	ETS Lindgren	3126-2450	OTF2	4/18/2024	36 mo
Chamber - OTA	ETS Lindgren	AMS-8923-195	OTA	10/8/2024	36 mo

TEST DESCRIPTION

Using the modes of operation and configurations noted within this report, a radiated pattern measurement test was performed. The frequency ranges investigated (scanned), are also noted in this report.

The EUT was placed on a low dielectric constant support structure (Phi Axis Positioner) in the 3D center of the measurement zone using a laser alignment system. The antenna port of the EUT is connected to an RF feed cable which is connected to a Vector Network Analyzer (VNA) at its opposite end.

The test begins with a measurement path configured (via ETS-Lindgren EMQuest Data Acquisition and Analysis Software) such that an electrical path is present from the Theta polarization element of the -165° detector antenna, to port 2 of the VNA. The VNA drives the EUT through the desired frequency range at the desired IFBW and an insertion loss measurement is obtained. The measurement path is then reconfigured (again via EMQuest) such that an electrical path is present from the Phi polarization element of the -165° detector antenna, to port 2 of the VNA. The VNA drives the EUT through the desired frequency range at the desired IFBW and an insertion loss measurement is obtained. This process is repeated at each of the 23 detector antennas in turn. This process is repeated for every rotation of the Phi Axis Positioner up to 180° - Phi Axis Resolution. When this process is complete, EMQuest applies factors from a Range Calibration and Normalization to produce a final data set with 1D/2D/3D patterns and tabular values such as antenna efficiency, Equivalent Isotropic Radiated Power (EIRP), Total Radiated Power (TRP), etc.

A measurement uncertainty estimation has been performed for this testing. 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. The expanded measurement uncertainty, 95% confidence level (K=2), for Maximum Gain / Efficiency for 2400-2483.5 MHz on active measurements is +/-1.08 dB. The expanded measurement uncertainty, 95% confidence level (K=2), for Maximum Gain / Efficiency for 2400-2483.5 MHz on passive measurements is +/-1.29. The calculations for estimating measurement uncertainty are available upon request.

Procedures for the Range Calibration and Normalization can be found in Element Materials Technology document: WP Antenna Pattern Measurements (3D)

PASSIVE 3D ANTENNA PATTERN MEASUREMENTS

OTA 2018.01.04

EUT:	Sprinkler 3 (Model No. 400304)
Serial Number:	250300190
Customer:	IrriGreen, Inc.
Attendees:	None
Customer Project:	None
Tested By:	Christopher Heintzelman
Test Run Description:	Passive_Run3

Work Order:	IRRI0027
Date:	2/25/2025
Temperature:	22.5 °C
Relative Humidity:	30.4% RH
Bar. Pressure:	993 mbar
Job Site:	MN10

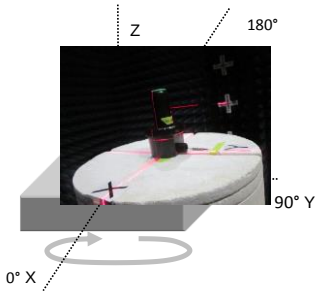
COMMENTS

The highest gain measured is -4.31 dBi at 2472 MHz.

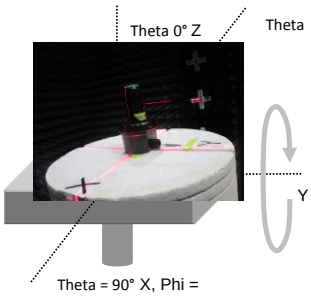
3D PATTERN DATA

Frequency (MHz)	2400	2402	2404	2406	2408	2410	2412	2414	2416	2418	2420
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	-9.87	-9.85	-9.83	-9.81	-9.80	-9.80	-9.75	-9.70	-9.70	-9.68	-9.62
Peak EIRP (dBm)	-5.11	-5.06	-4.96	-5.11	-4.92	-4.93	-4.85	-4.84	-4.76	-4.73	-4.71
Directivity (dBi)	4.76	4.79	4.87	4.70	4.88	4.87	4.90	4.86	4.94	4.95	4.91
Efficiency (dB)	-9.87	-9.85	-9.83	-9.81	-9.80	-9.80	-9.75	-9.70	-9.70	-9.68	-9.62
Efficiency (%)	10.30	10.35	10.40	10.45	10.47	10.48	10.59	10.70	10.72	10.77	10.92
Gain (dBi)	-5.11	-5.06	-4.96	-5.11	-4.92	-4.93	-4.85	-4.84	-4.76	-4.73	-4.71
Average Gain (dB)	-9.87	-9.85	-9.83	-9.81	-9.80	-9.80	-9.75	-9.70	-9.70	-9.68	-9.62
E-Plane 3 dB BW (°)	114.00	114.00	112.00	115.00	111.00	113.00	112.00	114.00	112.00	113.00	112.00
Frequency (MHz)	2422	2424	2426	2428	2430	2432	2434	2436	2438	2440	2442
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	-9.57	-9.58	-9.58	-9.59	-9.55	-9.57	-9.57	-9.56	-9.53	-9.51	-9.52
Peak EIRP (dBm)	-4.70	-4.62	-4.66	-4.68	-4.54	-4.57	-4.58	-4.53	-4.49	-4.52	-4.41
Directivity (dBi)	4.87	4.96	4.92	4.91	5.01	5.00	4.99	5.03	5.04	4.99	5.11
Efficiency (dB)	-9.57	-9.58	-9.58	-9.59	-9.55	-9.57	-9.57	-9.56	-9.53	-9.51	-9.52
Efficiency (%)	11.04	11.02	11.01	11.00	11.08	11.03	11.03	11.07	11.16	11.19	11.16
Gain (dBi)	-4.70	-4.62	-4.66	-4.68	-4.54	-4.57	-4.58	-4.53	-4.49	-4.52	-4.41
Average Gain (dB)	-9.57	-9.58	-9.58	-9.59	-9.55	-9.57	-9.57	-9.56	-9.53	-9.51	-9.52
E-Plane 3 dB BW (°)	113.00	111.00	112.00	112.00	110.00	111.00	110.00	110.00	110.00	110.00	30.00
Frequency (MHz)	2444	2446	2448	2450	2452	2454	2456	2458	2460	2462	2464
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tot. Rad. Pwr. (dBm)	-9.54	-9.50	-9.47	-9.48	-9.50	-9.47	-9.46	-9.46	-9.48	-9.46	-9.49
Peak EIRP (dBm)	-4.50	-4.49	-4.46	-4.51	-4.52	-4.45	-4.42	-4.43	-4.42	-4.43	-4.49
Directivity (dBi)	5.04	5.01	5.01	4.97	4.98	5.03	5.04	5.02	5.06	5.03	5.00
Efficiency (dB)	-9.54	-9.50	-9.47	-9.48	-9.50	-9.47	-9.46	-9.46	-9.48	-9.46	-9.49
Efficiency (%)	11.12	11.21	11.29	11.28	11.23	11.29	11.32	11.34	11.27	11.32	11.26
Gain (dBi)	-4.50	-4.49	-4.46	-4.51	-4.52	-4.45	-4.42	-4.43	-4.42	-4.43	-4.49
Average Gain (dB)	-9.54	-9.50	-9.47	-9.48	-9.50	-9.47	-9.46	-9.46	-9.48	-9.46	-9.49
E-Plane 3 dB BW (°)	110.00	110.00	31.00	32.00	32.00	32.00	32.00	91.00	92.00	92.00	92.00
Frequency (MHz)	2466	2468	2470	2472	2474	2476	2478	2480			
Ant. Port Input Pwr. (dBm)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Tot. Rad. Pwr. (dBm)	-9.51	-9.53	-9.54	-9.55	-9.62	-9.66	-9.69	-9.69			
Peak EIRP (dBm)	-4.40	-4.38	-4.36	-4.31	-4.40	-4.41	-4.45	-4.36			
Directivity (dBi)	5.11	5.15	5.18	5.24	5.22	5.25	5.24	5.33			
Efficiency (dB)	-9.51	-9.53	-9.54	-9.55	-9.62	-9.66	-9.69	-9.69			
Efficiency (%)	11.19	11.15	11.13	11.10	10.93	10.81	10.74	10.74			
Gain (dBi)	-4.40	-4.38	-4.36	-4.31	-4.40	-4.41	-4.45	-4.36			
Average Gain (dB)	-9.51	-9.53	-9.54	-9.55	-9.62	-9.66	-9.69	-9.69			
E-Plane 3 dB BW (°)	91.00	91.00	91.00	90.00	90.00	89.00	90.00	90.00			

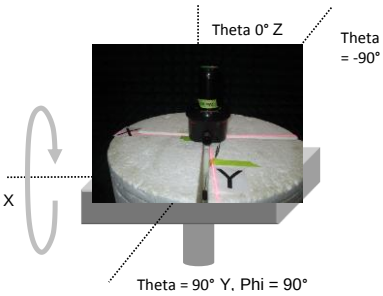
Azimuth Cut (Theta Axis = 90°)



Elevation Cut (Phi Axis = 0°)

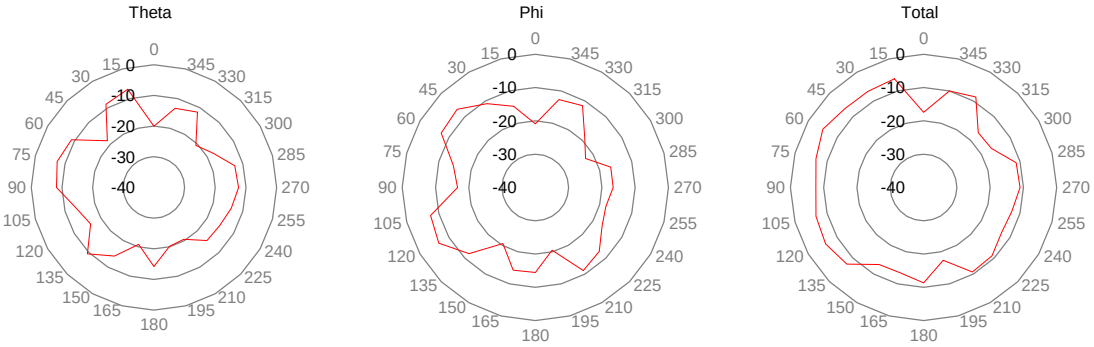


Elevation Cut (Phi Axis = 90°)

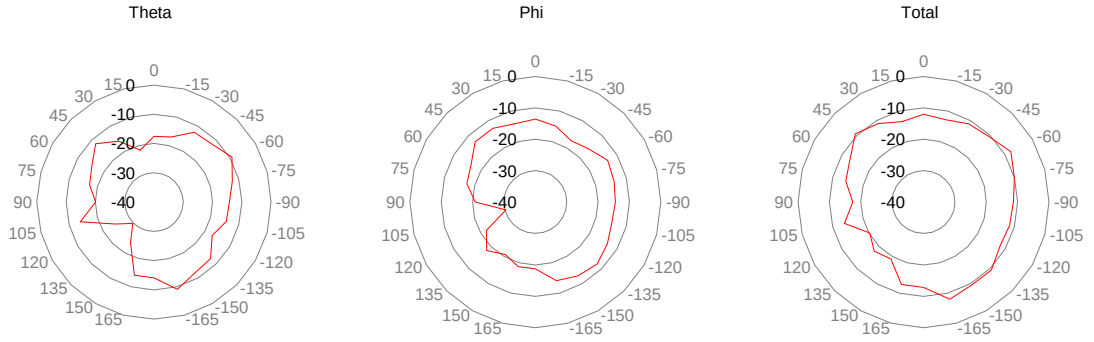


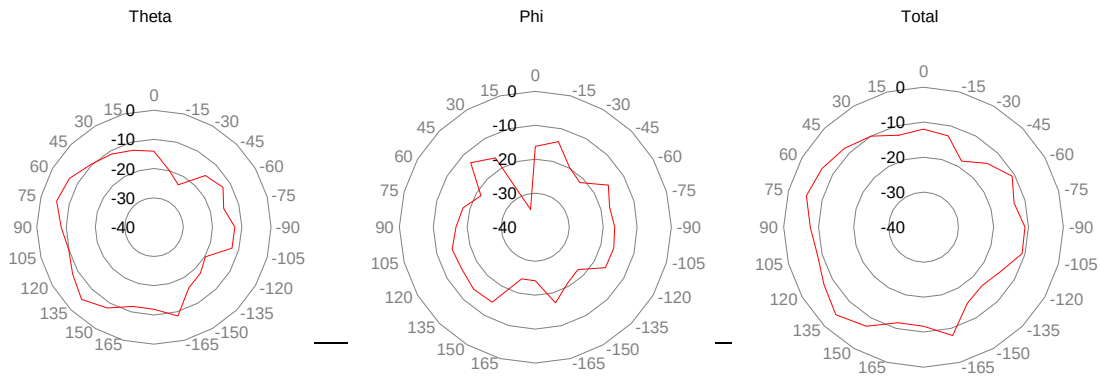
POLAR PLOTS **Frequency (MHz):** 2472

Power (dBm) — Azimuth Cut (Theta Axis = 90°)



Power (dBm) — Elevation Cut (Phi Axis = 0°)





End of Test Report