



## Antenna Gain Test Report

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## 1. Customer Information

Applicant: Acuity Brands Lighting, Inc  
Address: One Lithonia Way  
Conyers, GA 30012  
Tel: 770-922-9000

## 2. Location of Testing


Test Laboratory

Testing was performed at Acuity Brands Lighting, Inc. permanent laboratory located at Conyers, GA

List of Test Equipment

| Test Equipment     |                             |                 |       |                        |             |         |
|--------------------|-----------------------------|-----------------|-------|------------------------|-------------|---------|
| Type               | Device                      | Manufacturer    | Model | SN#                    | Current Cal | Cal Due |
| Antenna            | Dual polarized horn antenna | Howland Company | QR-4  | 1069                   | 7/13/22     | 7/13/23 |
| CHAMBER            | CHAMBER                     | Howland Company | 3500D | N/A                    | 7/13/22     | 7/13/23 |
| Power Meter        | dual channel power meter    | Rohde & Schwarz | NRX   | 101261-JA              | 7/13/22     | 7/13/23 |
| Power Meter Sensor | 2x <u>Power Sensor</u>      | Rohde & Schwarz | NRP8S | 105196-AU<br>108195-JG | 7/13/22     | 7/13/23 |

Dates of Testing: 8/18

Signature:   
Name & Title: Yenpao Albert Lu , Principal Engineer  
Date of Signature: 9/15/2022

### 3. Test Sample(s) (EUT/DUT)

The test sample was received: 4/18/2022

#### Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

#### 900MHz Sample

| Identification    |  |
|-------------------|--|
| FCC ID:           | 2ADCB-RPODU  |
| Brief Description | Light Switch with 900 MHz TX   |
| Type of Modular   | N/A  |
| Model(s) #        | RPODU  |
| Firmware version  | N/A  |
| Software version  | N/A  |
| Serial Number     | Old Filter Firmware-501-01661-001<br>New Filter Firmware-501-01661-007 |

| Technical Characteristics    |                    |
|------------------------------|--------------------|
| Technology                   | Light Switch       |
| Frequency Range              | 902-928 MHz        |
| RF O/P Power (Max.)          | 15.37 dBm/ 0.034 W |
| Modulation                   | N/A                |
| Bandwidth & Emission Class   | N/A                |
| Number of Channels           | N/A                |
| Duty Cycle                   | 33%                |
| Antenna Connector            | SMA                |
| Voltage Rating (AC or Batt.) | 3.7 V              |

| Identification    |                              |
|-------------------|------------------------------|
| FCC ID:           | 2ADCB-RPODU                  |
| Brief Description | Light Switch with 2.4 GHz BT |
| Type of Modular   | N/A                          |
| Model(s) #        | RPODU                        |
| Firmware version  | N/A                          |
| Software version  | N/A                          |
| Serial Number     | 501-01661-001                |

| Technical Characteristics    |                                |
|------------------------------|--------------------------------|
| Technology                   | Bluetooth                      |
| Frequency Range              | 2400-2480.5 MHz                |
| RF O/P Power (Max.)          | 6.94 dBm/ 4.943 mW – 0.00494 W |
| Modulation                   | N/A                            |
| Bandwidth & Emission Class   | N/A                            |
| Number of Channels           | N/A                            |
| Duty Cycle                   | 33%                            |
| Antenna Connector            | SMA                            |
| Voltage Rating (AC or Batt.) | 3.7 V                          |

#### 4. Test methods & Applicable Regulatory Limits

##### Test methods/Standards/Guidance:

Test procedures and guidance for measuring transmitters are provided in ANSI C63.10-2013.

- 1) ANSI C63.10-2013
- 2) 353028 D01 Antennas Part 15 Transmitters v01r01

##### 5. Applied Limits and Regulatory Limits:

- 3) FCC CFR 47 Part 15.203

##### 6. FCC Notice:

All part 15 applications will need to show how the antenna gain was derived either from a manufacturer data sheet or a measurement. Where the gain of the antenna is inherently accounted for as a result of the measurement, such as field strength measurements on a part 15.249 or 15.231 device, so the gain does not necessarily need to be verified. However, enough information regarding the construction of the antenna shall be provided. Such information may be photographs, length of wire antenna etc.

1. Part 15 applications with equipment classes **DSC, DXX, DCD, 8CC**, etc. which do not have an EIRP limit.  
We need at least the following antenna info: **Antenna photos/or drawings, including antenna dimensions.**
  - This info cannot be held short term confidential. If necessary, we will have to request the customer to provide a separate exhibit for that antenna photo/or drawing, if the internal photos are being held short term confidential. Alternatively, antenna info can be placed in the test report. That would make things easier to review and process.  
(We plan on providing guidance to customers in our newsletter to identify the antenna info vs. internal photo.).
  - Any antenna technical specifications, which are deemed confidential by customer/applicant should be removed from the antenna exhibit or test report.
  - However, antenna specifications such antenna gain, antenna patterns, etc. are not considered confidential information.
  - Antenna gain reports are **NOT** required for these equipment classes because the antenna gain is already accounted for in the field strength measurement of the fundamental emission. (see attached FCC minutes)
2. Part 15 applications with equipment classes **DTS, DSS, NII, 6ID**, etc. which use the antenna gain for compliance with EIRP limits:  
We need the manufacturer antenna data sheet or an antenna gain measurement report
  - The report must be a complete report, with a measurement procedure, test equipment, test setup, signatures, facility/test site descriptions, etc.
  - There is not requirement for the RF lab to be accredited.
  - The FCC has not specified or endorsed any measurement procedures. However, the FCC indicated at the TCBC conf call on June 14...
    - test labs should use good judgement when reviewing antenna datasheets with gain measured in free space because that the gain might change significantly when attached to the device... FCC wants test labs and manufacturers to be aware of it and take this into account. FCC does not necessarily need to see what was done, but needs to know whether gain has changed.

- Confidential information about the antenna can be made confidential but photos/drawings, gain, antenna patterns, test setups are not considered confidential.

## 7. Measurement/Calculation Procedure

The DUT was set to transmit continuous sine wave at 914 MHz with a FW power setting of 200 using a lithium coin cell. The DUT is placed at the center of the calibrated anechoic chamber. The same procedure applies for 2.4 GHz.



The first channel of the power sensor measures the vertical polarization of the dual polarized ridge horn, while the second channel measures the horizontal polarization.



The raw data from the power meter received from Dual ridge horn contains both vertical and horizontal polarized power. Below is the sample data from RPODU at 914 MHz

+++++++ Test Data Summary +++++++

Path Loss HPOL Cal Factor = 38.68 dB

Path Loss VPOL Cal Factor = 37.87 dB

Calculated TRP = 13.56 dBm

\*\*\*\*\* Test Data Results \*\*\*\*\*

| THETA<br>(deg) | PHI<br>(deg) | H-Pol<br>(dbm) | V-Pol<br>(dBm) |
|----------------|--------------|----------------|----------------|
| 0.00           | 0.00         | -23.930        | -34.396        |
| 0.00           | 15.00        | -24.026        | -43.313        |
| 0.00           | 30.00        | -24.747        | -33.388        |
| 0.00           | 45.00        | -26.203        | -28.277        |
| 0.00           | 60.00        | -28.680        | -25.457        |
| 0.00           | 75.00        | -33.075        | -23.791        |
| 0.00           | 90.00        | -44.064        | -22.912        |
| 0.00           | 105.00       | -39.158        | -22.668        |
| 0.00           | 120.00       | -31.449        | -23.028        |
| 0.00           | 135.00       | -27.792        | -24.038        |
| 0.00           | 150.00       | -25.671        | -25.871        |
| 0.00           | 165.00       | -24.473        | -28.971        |
| 0.00           | 180.00       | -23.961        | -34.731        |
| 0.00           | 195.00       | -24.055        | -44.220        |
| 0.00           | 210.00       | -24.761        | -33.494        |
| 0.00           | 225.00       | -26.197        | -28.362        |
| 0.00           | 240.00       | -28.675        | -25.513        |
| 0.00           | 255.00       | -33.110        | -23.816        |
| 0.00           | 270.00       | -44.387        | -22.901        |
| 0.00           | 285.00       | -38.880        | -22.629        |
| 0.00           | 300.00       | -31.311        | -22.964        |
| 0.00           | 315.00       | -27.715        | -23.951        |
| 0.00           | 330.00       | -25.634        | -25.752        |
| 0.00           | 345.00       | -24.452        | -28.798        |



## 8. Equations

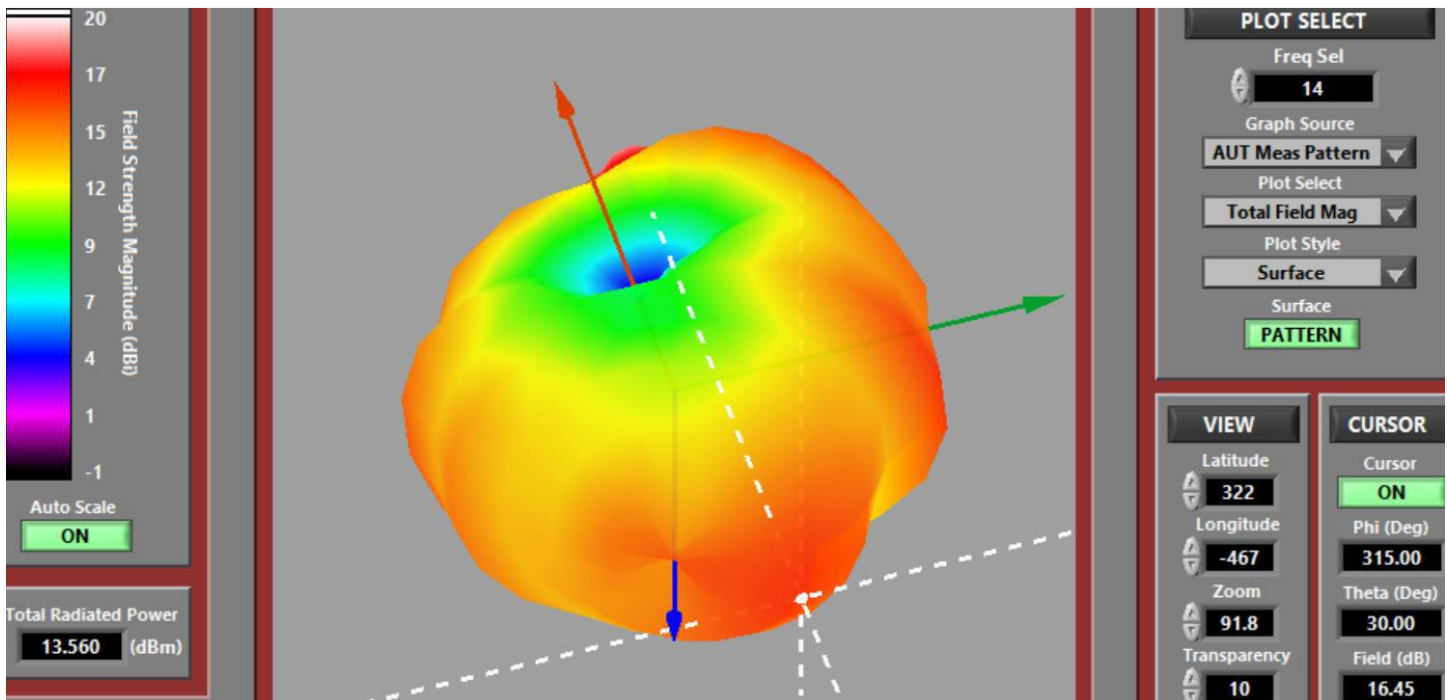
The following equation is used to determine the realized gain.

Realized gain = Raw measured value + Path loss Cal Factor – Total radiated power

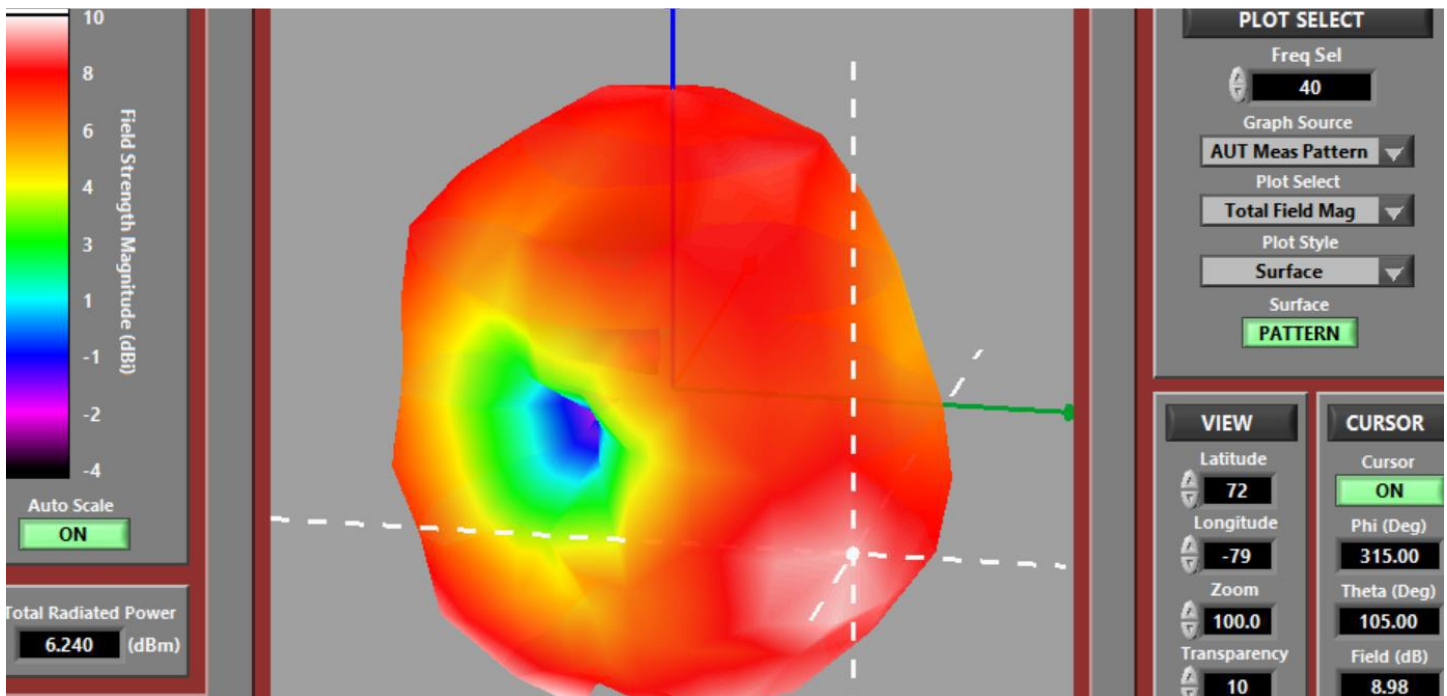
Example calculation at theta = 0, phi = 270.

-22.9 dBm (V-Pol) + 37.87 dB – 13.56 dBm = 1.41 dBi

## 9. RF Exposure Results



Radiation pattern for 914 MHz meandered dipole. The peak gain at the cursor is  $16.45 - 13.56 = 2.89$  dBi



Radiation pattern for 2442 MHz IFA antenna. The peak gain at the cursor is  $8.98 - 6.24 = 2.74$  dBi