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 Power Sensor	Rohde & Schwarz	NRP8S	105196-AU 108195-JG	7/13/22	7/13/23

Dates of Testing: 8/18

Signature: _____

Name & Title: Yenpao Albert Lu , Principal Engineer

Date of Signature 1/26/2023

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.

Identification	
FCC ID:	2ADCB-DELC
Brief Description	2.4 GHz Wireless lighting control
Type of Modular	N/A
Model(s) #	LC

Technical Characteristics	
Technology	Light Switch
Frequency Range	2.402~2.480 GHz
RF O/P Power (Max.)	9.86 dBm
Modulation	GFSK
Bandwidth & Emission Class	1 Mbps
Number of Channels	40
Duty Cycle	33%
Antenna Connector	None
Voltage Rating (AC or Batt.)	5V DC Nominal

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 maybe photographs, length of wire antenna etc.

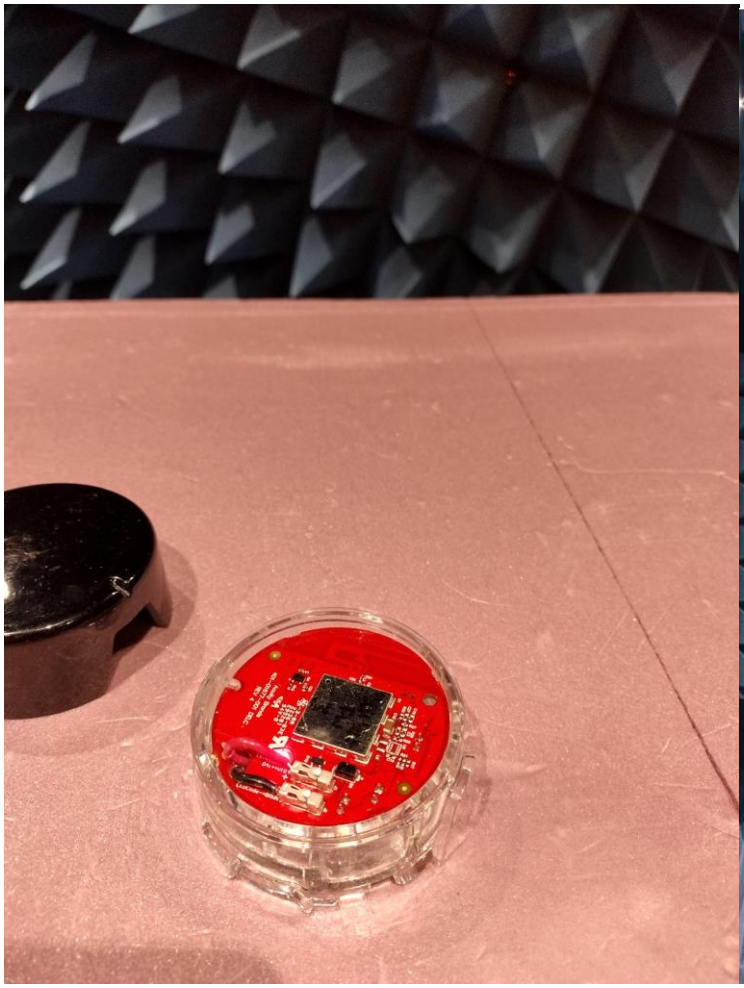
1. Part 15 applications with equipment classes DSC, DXX, DCD, 8CC, etc. which do not have an EIRP limit.
   We need at least the following antenna info: Antenna photos/or drawings, including antenna dimensions.
   - This info cannot be held short term confidential. If necessary, we will have to request 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)

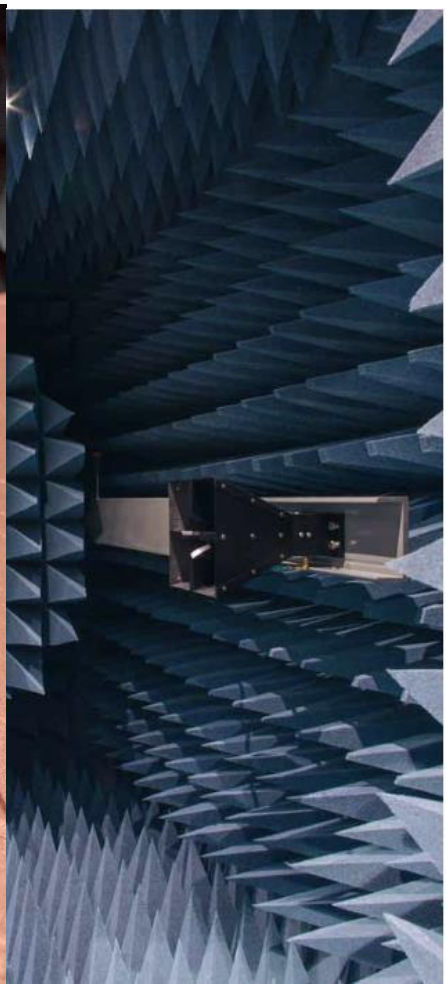
2. Part 15 applications with equipment classes DTS, DSS, NII, 6ID, etc. which use the antenna gain for compliance with EIRP limits:
   We need the manufacturer antenna data sheet or an antenna gain measurement report
   - The report must be a complete report, with a measurement procedure, test equipment, 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 2432 MHz with a FW power setting of 100 using a 5V DC supply. The DUT is placed at the center of the calibrated anechoic chamber.





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 2432 MHz

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

Path Loss HPOL Cal Factor = 47.60 dB

Path Loss VPOL Cal Factor = 46.67 dB

Calculated TRP = 9.86 dBm

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

THETA (deg)	PHI (deg)	H-Pol (dbm)	V-Pol (dBm)
0	0	-36.331	-44.008
0	15	-36.193	-45.205
0	30	-36.597	-42.608
0	45	-37.573	-39.752
0	60	-39.228	-37.72
0	75	-41.708	-36.389
0	90	-44.914	-35.636
0	105	-46.524	-35.388
0	120	-43.727	-35.701
0	135	-40.694	-36.636
0	150	-38.603	-38.267
0	165	-37.321	-40.77
0	180	-36.652	-44.076
0	195	-36.497	-45.563
0	210	-36.832	-42.888
0	225	-37.727	-39.879
0	240	-39.35	-37.675
0	255	-41.879	-36.283
0	270	-45.186	-35.509
0	285	-46.438	-35.294
0	300	-43.466	-35.652

0	315	-40.417	-36.625
0	330	-38.324	-38.296
0	345	-37.008	-40.837
15	0	-37.93	-45.152

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 = 105
-32.382 dBm (V-Pol) + 46.67 dB – 9.86 dBm = 1.52 dBi

The peak gain is -32.94 dBm (V-Pol) + 47.6 dB – 9.86 dBm = 4.8 dBi at Theta = 165, phi = 270.

9. RF Exposure Results

Below are the 2D radiation pattern where Theta 0, and 165 degrees. These two slices were chosen to show the highest gain. Theta is 0 at zenith, 90 at the horizon. Phi is Azimuth that starts from 0 to 360.