



Certification Test Report

**FCC ID: 2ADCB-RMODIT
IC: 6715C-RMODIT**

**FCC Rule Part: 15.247
ISED Canada Radio Standards Specification: RSS-247**

Report Number: AT72160386-1P0

**Manufacturer: Acuity Brands Lighting, Inc.
Model: RMODIT**

**Test Begin Date: June 15, 2020
Test End Date: September 15, 2020**

Report Issue Date: September 30, 2020



FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: 2955.09

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

Prepared By:

**Ryan McGann
Senior Wireless Engineer
TÜV SÜD America Inc.**

Reviewed by:

**Ferdinand Custodio
Senior Wireless Engineer
TÜV SÜD America Inc.**

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This report contains 20 pages

TABLE OF CONTENTS

1	GENERAL	3
1.1	PURPOSE	3
1.2	APPLICANT INFORMATION	3
1.3	PRODUCT DESCRIPTION	3
1.4	TEST METHODOLOGY AND CONSIDERATIONS	4
2	TEST FACILITIES	5
2.1	LOCATION	5
2.2	LABORATORY ACCREDITATIONS/RECOGNITIONS/CERTIFICATIONS	5
2.3	RADIATED EMISSIONS TEST SITE DESCRIPTION	6
2.3.1	<i>Semi-Anechoic Chamber Test Site – Chamber A</i>	<i>6</i>
2.3.2	<i>Semi-Anechoic Chamber Test Site – Chamber B</i>	<i>7</i>
2.4	CONDUCTED EMISSIONS TEST SITE DESCRIPTION	8
2.4.1	<i>Conducted Emissions Test Site</i>	<i>8</i>
3	APPLICABLE STANDARD REFERENCES	9
4	LIST OF TEST EQUIPMENT	9
5	SUPPORT EQUIPMENT.....	10
6	EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM.....	10
7	SUMMARY OF TESTS.....	11
7.1	ANTENNA REQUIREMENT – FCC: 15.203.....	11
7.2	POWER LINE CONDUCTED EMISSIONS – FCC: 15.207, ISED CANADA: RSS-GEN 8.8	11
7.2.1	<i>Measurement Procedure</i>	<i>11</i>
7.2.2	<i>Measurement Results</i>	<i>11</i>
7.3	FUNDAMENTAL EMISSION OUTPUT POWER – FCC: SECTION 15.247(B)(3); ISED CANADA: RSS-247 5.4(D).....	12
7.3.1	<i>Measurement Procedure</i>	<i>12</i>
7.3.2	<i>Measurement Results</i>	<i>12</i>
7.4	EMISSIONS INTO RESTRICTED FREQUENCY BANDS – FCC: 15.205, 15.209; ISED CANADA: RSS-GEN 8.9 / 8.10	13
8	ESTIMATION OF MEASUREMENT UNCERTAINTY	15
9	CONCLUSION.....	15
	APPENDIX A: PLOTS	16

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein for a Class II Permissive Change.

The purpose of this Permissive Change is to add a new host and antenna combination.

1.2 Applicant Information

Acuity Brands Lighting, Inc.
One Lithonia Way
Conyers, GA 30012

1.3 Product Description

The RMODIT RF Module is a device designed to solder directly to another PCB using castellated edges. The product is intended to allow a variety of Acuity Brands devices to communicate in a wireless network. This can either be done by using an external host processor, or by using the processor on the module.

There are two radios on the module. One radio is a 2.4GHz Bluetooth Low Energy radio. The other radio is a proprietary 904-926MHz (915MHz) Implementation. The 904MHz-926MHz radio is 100kbps O-QPSK DSSS 8 symbols/bit. These radios can transmit and receive at the same time.

The host device is a battery powered occupancy sensor and fully independent of a lighting fixture. See Section 5 and Section 6 of this test report for more information.

This report documents the 2.4GHz Bluetooth Low Energy transmitter only. The 904 – 926MHz transmitter evaluation is documented in a separate report.

Technical Details:

Detail	Description
Frequency Range (MHz)	2402 – 2480
Number of Channels	40
Channel Spacing	2 MHz
Modulation Format	GFSK
Data Rates	1Mbps
Operating Voltage	4.5Vdc Batteries (Host)
Antenna Type(s) / Gain(s)	Surface Mount Chip / 3dBi (Molex, P/N: 0479480001)

Test Sample Serial Number: Sample PDT1 #2

Test Sample Condition: The equipment was provided in good condition without any physical damage.

1.4 Test Methodology and Considerations

All modes of operation, including all data rates, were evaluated and the data presented in this report represents the worst case where applicable.

For radiated emissions, the EUT was evaluated in three orthogonal orientations. The worst-case orientation was the Y-orientation. The EUT was programmed to generate a continuously modulated signal on each channel evaluated. See test setup photos for more information.

Power line conducted emissions was not applicable as the device is battery-powered with no facility to connect to the AC mains.

This device contains two independent radios which can transmit simultaneously. Radiated inter-modulation testing was performed for the combination of simultaneous transmissions and found to comply.

Power setting during test: 100

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following addresses:

TÜV SÜD America, Inc.
5945 Cabot Pkwy, Suite 100
Alpharetta, GA 30005
Phone: (678) 341-5900

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation/A2LA accreditation program and has been issued certificate number 2955.09 in recognition of this accreditation.

Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scopes of accreditation.

The Semi-Anechoic Chamber Test Sites and Conducted Emissions Sites have been fully described, submitted to, and accepted by the FCC, ISED Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Designation Accreditation Number:	US1233
FCC Test Site Registration Number:	967699
ISED Canada Lab Code:	23932
VCCI Member Number:	1831
• VCCI Registration Number	A-0295

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site – Chamber A

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 5' in diameter and is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted EMCO Model 1060 installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chase from the turntable to the pit that allows for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

The chamber rear wall is covered with a mixture of Siepel pyramidal absorber. The side walls of the chamber are partially covered with Siepel pyramidal absorber.

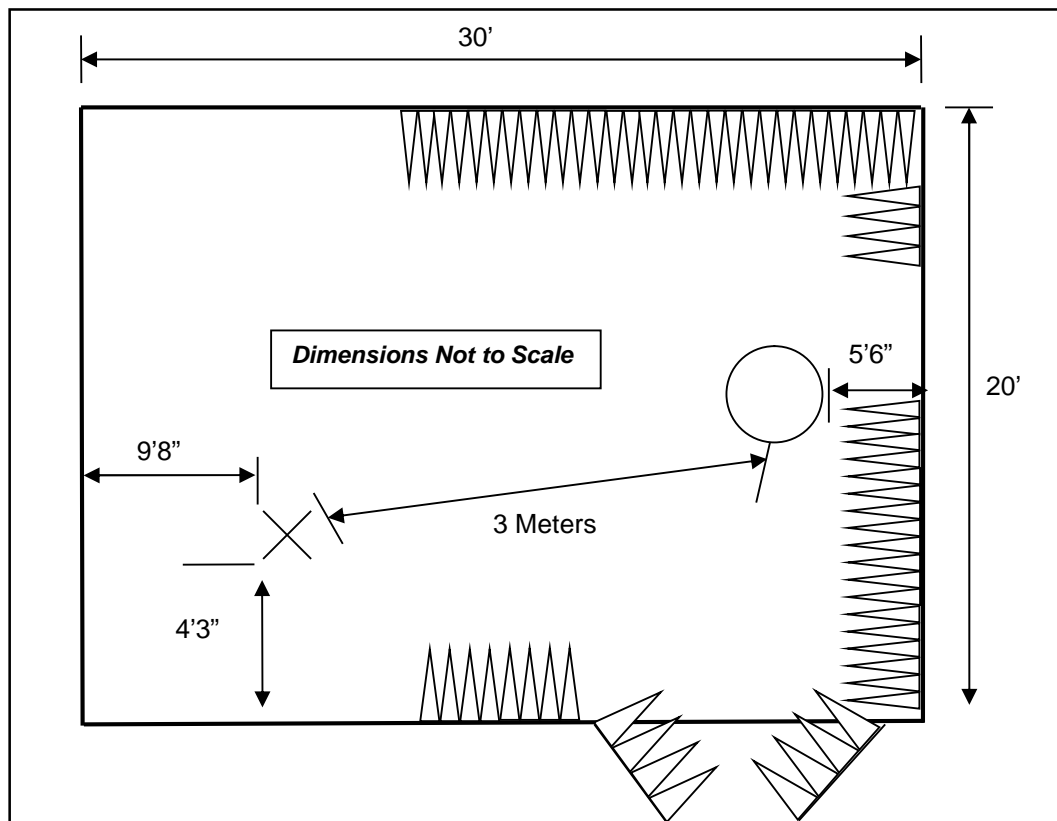


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site – Chamber A

2.3.2 Semi-Anechoic Chamber Test Site – Chamber B

The Semi-Anechoic Chamber Test Site consists of a 20'W x 30'L x 20'H shielded enclosure. The chamber is lined with ETS-Lindgren Ferrite Absorber, model number FT-1500. The ferrite tile 600 mm x 600 mm (2.62 in x 23.62 in) panels and are mounted directly on the inner walls of the chamber shield.

The specular regions of the chamber are lined with additional ETS-Lindgren PS-600 hybrid absorber to extend its frequency range up to 18GHz and beyond.

The turntable is a 2m ETS-Lindgren Model 2170 and installed off the center axis is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the shield using #8 solid copper wire.

The antenna mast is an EMCO 1060 and is remotely controlled from the control room for both antenna height and polarization.

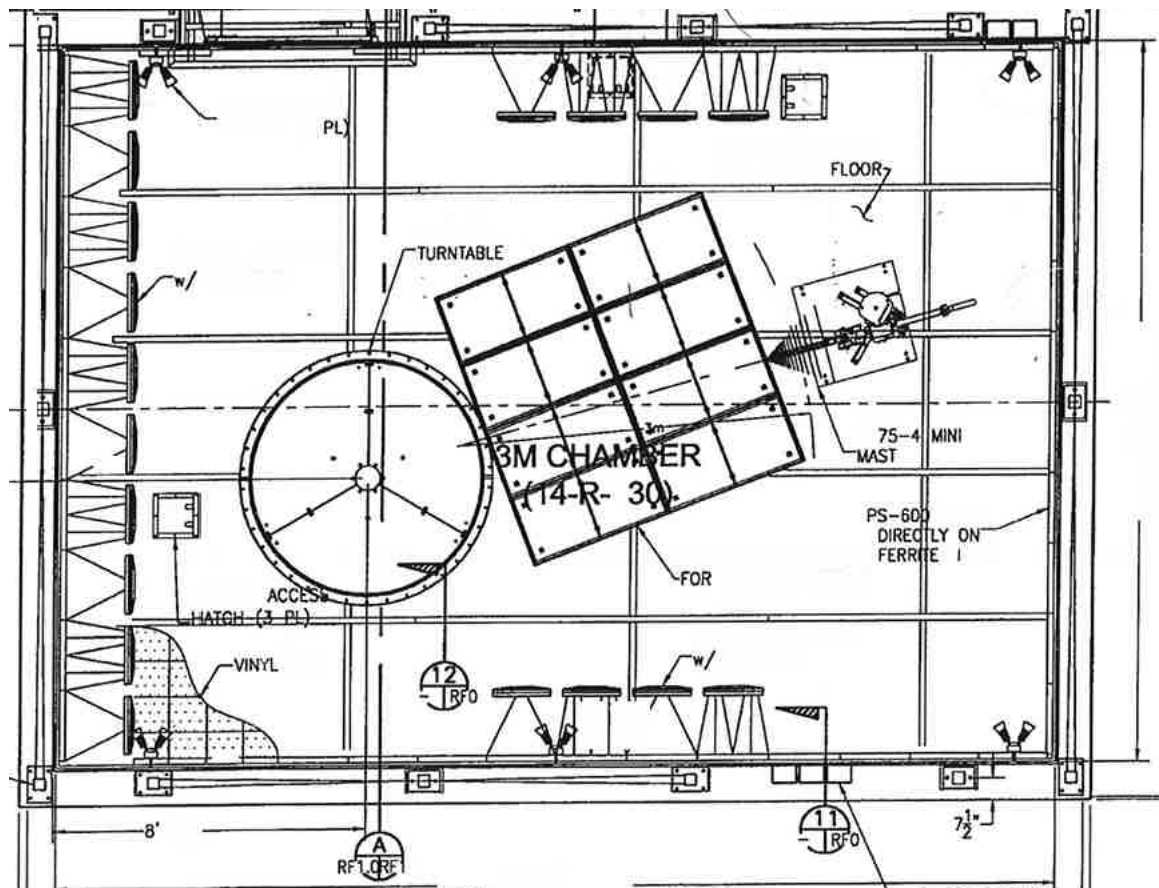


Figure 2.3.2-1: Semi-Anechoic Chamber Test Site – Chamber B

2.4 Conducted Emissions Test Site Description

2.4.1 Conducted Emissions Test Site

The AC mains conducted EMI site is located in the main EMC lab. It consists of a 12' x 10' horizontal coupling plane (HCP) as well as a 12'x8' vertical coupling plane (VCP). The HGP is constructed of 4' x 10' sheets of particle board sandwiched by galvanized steel sheets. These panels are bonded using 11AWG 1/8" x 2" by 10' galvanized sheet steel secured to the panels via by screws. The VCP is constructed of three 4'x8' sheets of 11AWG solid aluminum.

The HCP and VCP are electrically bonded together using 1"x1" angled aluminum secured with screws.

The site is of sufficient size to test tabletop and floor standing equipment in accordance with section 6.1.4 of ANSI C63.10.

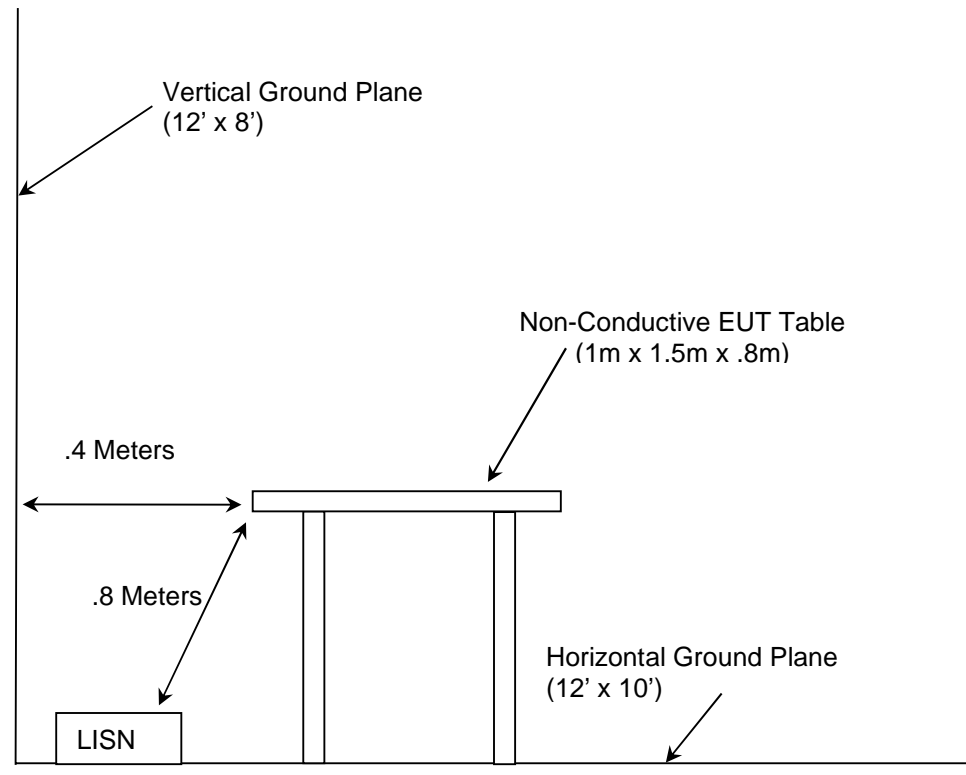


Figure 2.4.1-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2020
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2020
- ❖ FCC KDB 558074 D01 DTS Meas Guidance v05r02 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, April 2, 2019
- ❖ ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- ❖ ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, April 2018 + Amendment 1, March 2019

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
22	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A00526	07/11/2018	07/11/2020
30	Spectrum Technologies	DRH-0118	1-18GHz Horn Antenna	970102	05/29/2019	05/29/2021
321	Hewlett Packard	HPC 8447D	Low Freq. Pre-Amp	1937A02809	09/12/2019	09/12/2020
334	Rohde & Schwarz	3160-09	HF 18 - 26.5GHz	49404	NCR	NCR
335	Suhner	SF-102A	Cable (40GHz)	882/2A	07/08/2019	07/08/2020
345	Suhner Sucoflex	102A	Cable 42(GHz)	1077/2A	07/09/2019	07/09/2020
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	02/11/2019	11/02/2021
651	Rohde & Schwarz	TS-PR26	18GHz to 26.5GHz Pre-Amplifier	100023	07/10/2019	07/10/2020
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	4/2/2020	4/2/2021
851	TUV ATLANTA	FMC0101951-100CM	ASAC Cable Set Consisting of 566, 619, and 564	N/A	10/01/2019	10/01/2020
852	Teseq	CBL 6112D	Bilog Antenna; Attenuator	51617	10/15/2018	10/15/2020

NCR = No Calibration Required

NOTE: All test equipment was used only during active calibration cycles as reported above.

5 SUPPORT EQUIPMENT

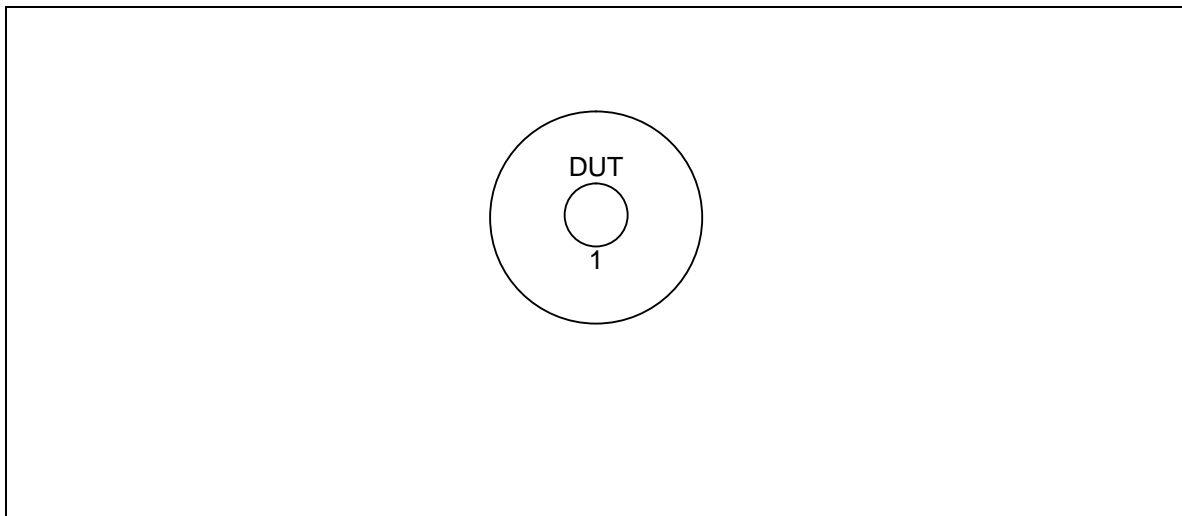
Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Sensor	Acuity Brands Lighting	RMODIT	Sample PDT1 #2

Table 5-2: Cable Description

Item	Cable Type	Length	Shield	Termination
The device was battery-powered with no interface cabling				

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

**Figure 6-1: Test Setup Block Diagram**

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: 15.203

The EUT utilizes an SMT Chip Antenna which is permanently affixed to the module, therefore satisfying the requirements of 15.203. The gain of the SMT Chip Antenna is 3dBi.

7.2 Power Line Conducted Emissions – FCC: 15.207, ISED Canada: RSS-Gen 8.8

7.2.1 Measurement Procedure

Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss

Margin = Corrected Reading - Applicable Limit

7.2.2 Measurement Results

AC power line conducted emissions testing was not required as the host is battery-powered with no facility for connection to the AC mains.

7.3 Fundamental Emission Output Power – FCC: Section 15.247(b)(3); ISED Canada: RSS-247 5.4(d)**7.3.1 Measurement Procedure**

The maximum conducted output power was measured in accordance with FCC KDB 558074 D01 DTS Meas Guidance utilizing the PKPM1 procedure. The RF output of the equipment under test was directly connected to the input of the power meter applying suitable attenuation.

7.3.2 Measurement Results

Performed by: Ryan McGann

Table 7.3.2-1: Maximum Conducted Peak Output Power

Frequency (MHz)	Level (dBm)
2402	9.11
2440	8.89
2480	8.69

7.4 Emissions into Restricted Frequency Bands – FCC: 15.205, 15.209; ISCED Canada: RSS-Gen 8.9 / 8.10

7.4.1.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency.

Prescan plots were collected at a horizontal measurement distance of 1 meter. Final measurements were performed at a horizontal measurement distance of 3 meters and tabular data recorded below. See Appendix A for the prescan plots.

The EUT was rotated through 360° and the receive antenna height was varied from 1 meter to 4 meters so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively.

Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

7.4.1.2 Measurement Results

Performed by: Jeremy Pickens

Table 7.3.1.2-1: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Channel 0 (2402MHz)										
2390	42.90	28.90	H	1.73	44.63	30.63	74.0	54.0	29.4	23.4
2390	42.90	29.40	V	1.73	44.63	31.13	74.0	54.0	29.4	22.9
4804	44.50	32.50	H	9.89	54.39	42.39	74.0	54.0	19.6	11.6
4804	45.20	34.90	V	9.89	55.09	44.79	74.0	54.0	18.9	9.2
Channel 19 (2440MHz)										
4880	44.60	34.10	H	10.00	54.60	44.10	74.0	54.0	19.4	9.9
4880	44.90	34.90	V	10.00	54.90	44.90	74.0	54.0	19.1	9.1
Channel 39 (2480MHz)										
2483.5	54.9	40.8	H	2.23	57.13	43.03	74.0	54.0	16.9	11.0
2483.5	55.7	42.2	V	2.23	57.93	44.43	74.0	54.0	16.1	9.6
4960	42.7	28.9	H	10.12	52.82	39.02	74.0	54.0	21.2	15.0
4960	44.3	32.4	V	10.12	54.42	42.52	74.0	54.0	19.6	11.5

7.4.1.3 Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $44.90 + 10.00 = 54.90\text{dBuV/m}$

Margin: $74\text{dBuV/m} - 54.90\text{dBuV/m} = 19.1\text{dB}$

Example Calculation: Average

Corrected Level: $34.90 + 10.00 - 0 = 44.90\text{dBuV}$

Margin: $54\text{dBuV} - 44.90\text{dBuV} = 9.1\text{dB}$

8 ESTIMATION OF MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) $k = 1.96$ which provide confidence levels of 95%.

Table 8-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	$\pm 0.009 \%$
RF Conducted Output Power	$\pm 0.349 \text{ dB}$
Power Spectral Density	$\pm 0.372 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 1.264 \text{ dB}$
Radiated Emissions $\leq 1 \text{ GHz}$	$\pm 5.814 \text{ dB}$
Radiated Emissions $> 1 \text{ GHz}$	$\pm 4.318 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	$\pm 3.360 \text{ dB}$

9 CONCLUSION

In the opinion of TUV SUD the RMODIT, manufactured by Acuity Brands Lighting, Inc. meets the requirements of FCC Part 15 subpart C and ISED Canada's Radio Standards Specification RSS-247 for the tests documented herein.

Appendix A: Plots

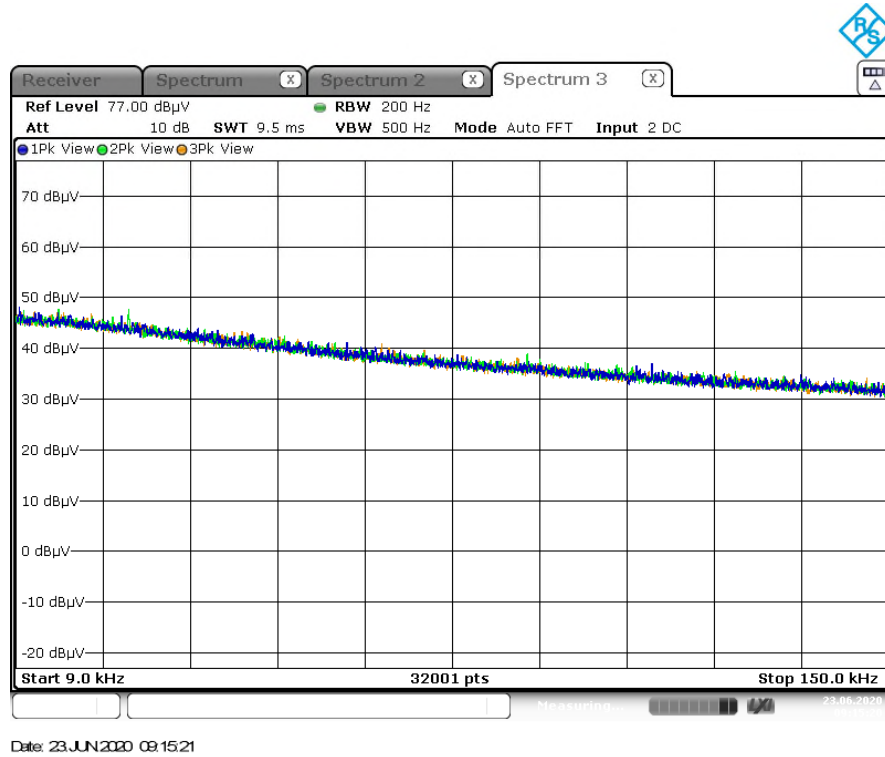


Figure A-1: 9kHz-150kHz

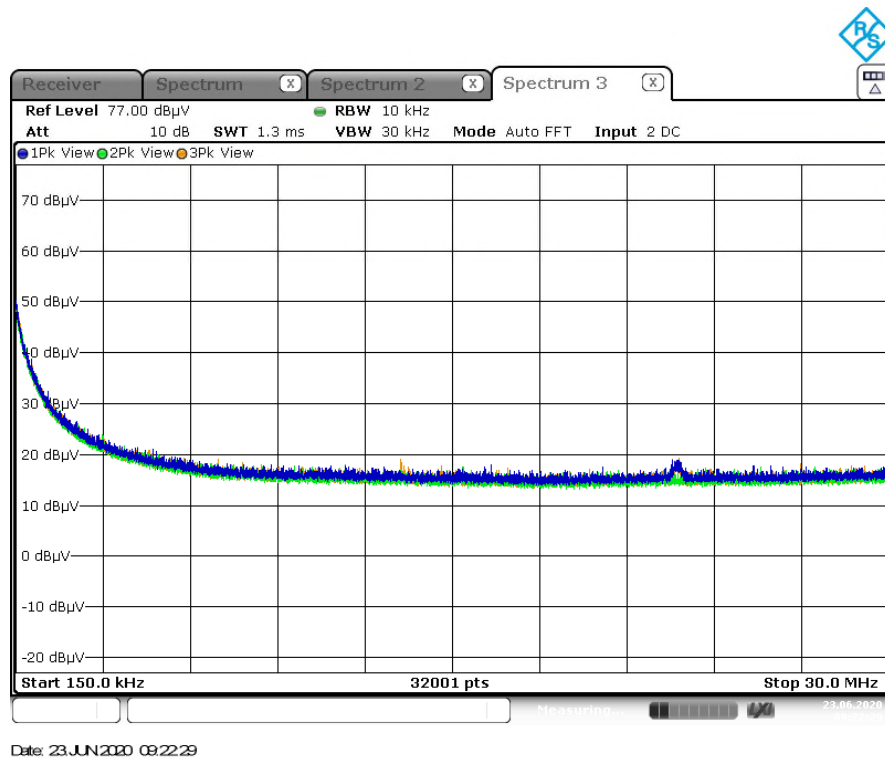


Figure A-2: 150kHz-30MHz

Full Spectrum

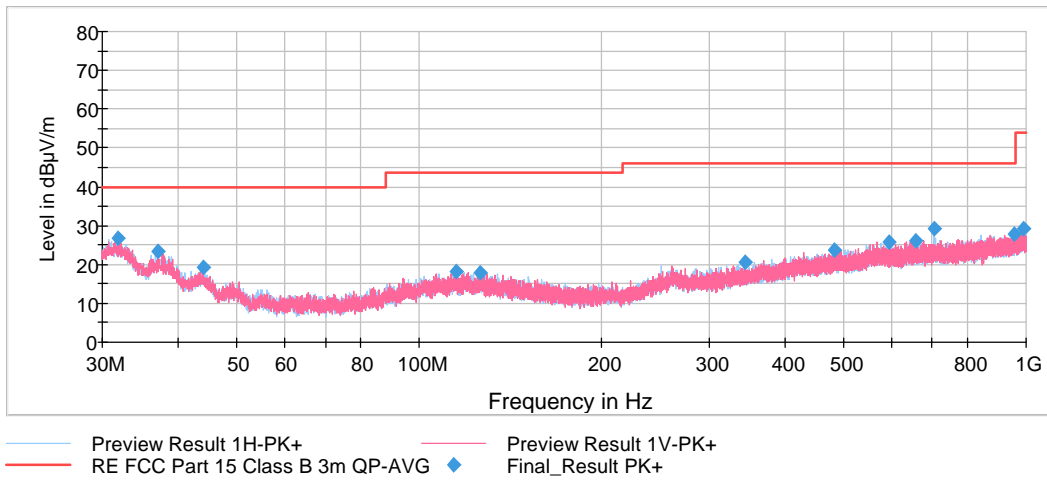
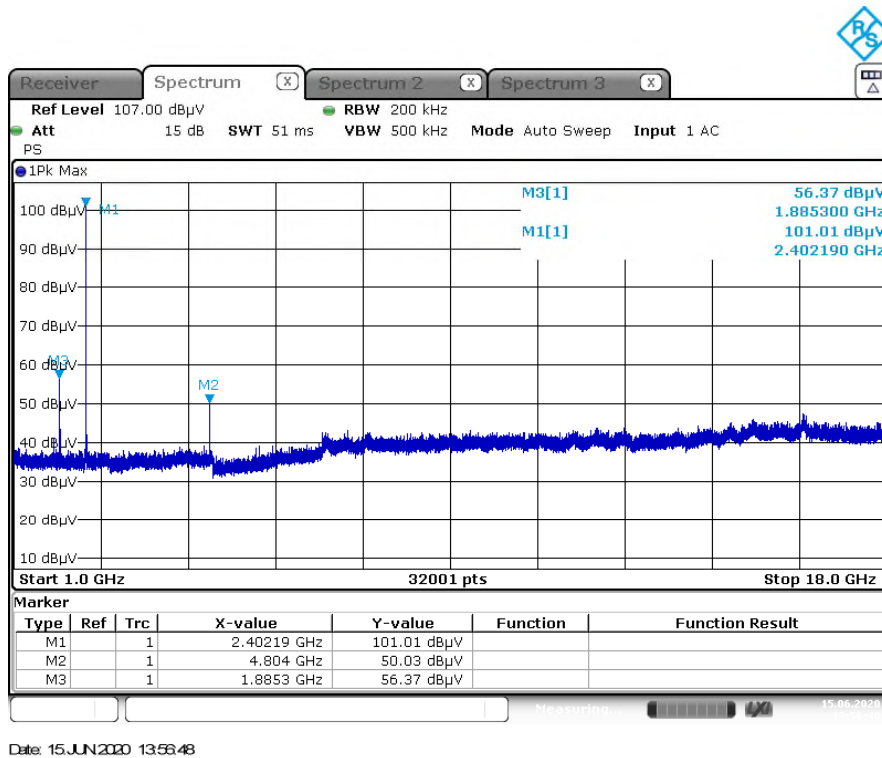


Figure A-3: 30MHz-1GHz



Note: Emission at 1885MHz was ambient cellular interference

Figure A-4: 1GHz-18GHz

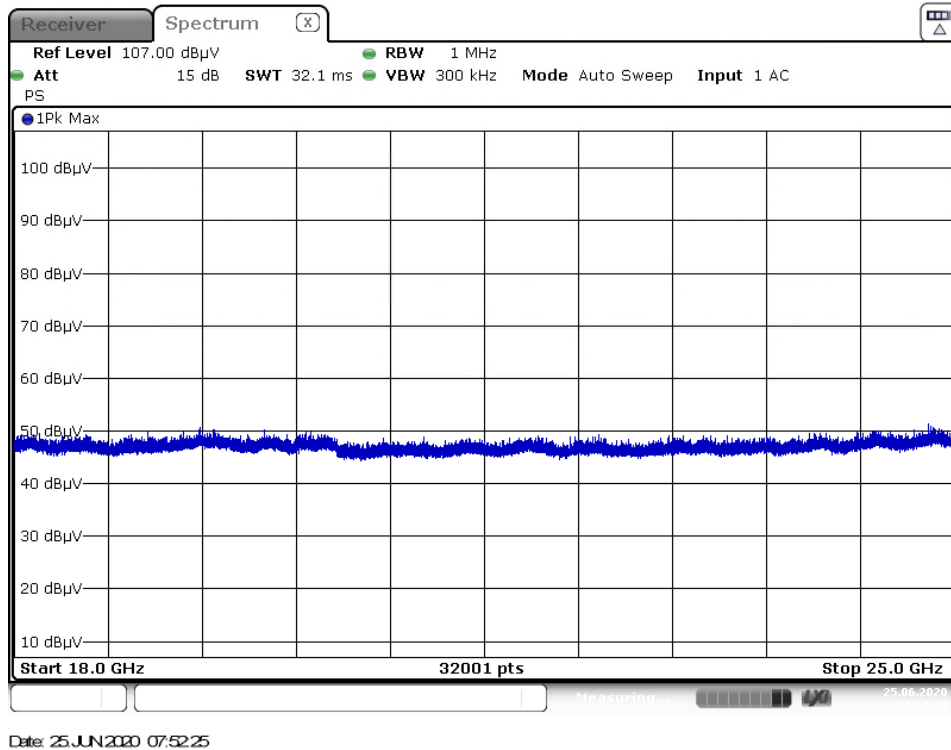


Figure A-5: 18GHz-25GHz

END REPORT