



C2PC Test Report

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

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

TÜV SÜD Report Number: RD72151775.200

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

**Test Begin Date: July 25, 2019
Test End Date: August 2, 2019**

Report Issue Date: August 2, 2019



FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 2955.18

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

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This report contains 18 pages

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1 GENERAL

1.1 Purpose

The purpose of this C2PC report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and ISED Canada's Radio Standards Specification RSS-247 Certification due to the addition of a different type and higher gain antenna.

1.2 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 radio. The other radio is a proprietary 904-926MHz (915MHz) Implementation. The 904MHz-926MHz radio is 100kbps OQPSK DSSS 8 symbols/bit. These radios are capable of transmitting and receiving at the same time.

This report documents the 904 - 926MHz transmitter only. The 2.4GHz transmitter evaluation is documented in a separate report.

Technical Information:

Modulation Format: O-QPSK

Data Rate: 100 kbps

Antenna Type / Gain: Inverted F PCB trace antenna / 2.1dBi

Operating Voltage: 3.3Vdc Nominal

Manufacturer Information:

Acuity Brands Lighting, Inc.

1 Lithonia Way

Conyers, GA 30012

EUT Serial Numbers: TÜV SÜD #01

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

The antenna type was changed to an Inverted F PCB trace antenna with a higher gain. Based on the change, a radiated spurious emissions evaluation was performed with the new antenna.

The 900MHz ISM transmitter was evaluated for radiated spurious emissions measurements.

For RSE, the EUT was evaluated in 3 orthogonal planes and the X orientation being the worst case. The worst-case orientation was reported in the report.

The client provided software to exercise the EUT. The power setting in the software was 200.

2 TEST FACILITIES

2.1 Location

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

TÜV SÜD America Inc.
2320 Presidential Drive, Suite 101
Durham, NC 27703
Phone: (919) 381-4235

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America Inc. (Durham) is accredited to ISO/IEC 17025 by A2LA accreditation program, and has been issued certificate number 2955.18 in recognition of this accreditation. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

FCC Registered Test Site Number: 637011
ISED Canada U.S. Identification Number US0217

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 18' x 28' x 18' shielded enclosure. The chamber is lined with Samwha Electronics Co. LTD Ferrite Absorber, model number SFA300 (HSN-1). The ferrite tile is 10cm x 10 cm and weighs approximately 1.4lbs. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber. On top of the ferrite tiles is DMAS HT-45 (Dutch Microwave Absorber Solutions) hybrid absorber on all walls except the wall behind the antenna mast which has a shorter DMAS HT-25 absorber.

The turntable is 1.50m in diameter and is located 150cm 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 short #6 copper wire. The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the turntable. 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.

Behind the turntable is a 2' x 6' x 1.5' deep shielded pit used for support equipment if necessary. The pit is equipped with 2 - 4" PVC chase from the turntable to the pit that allow 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.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

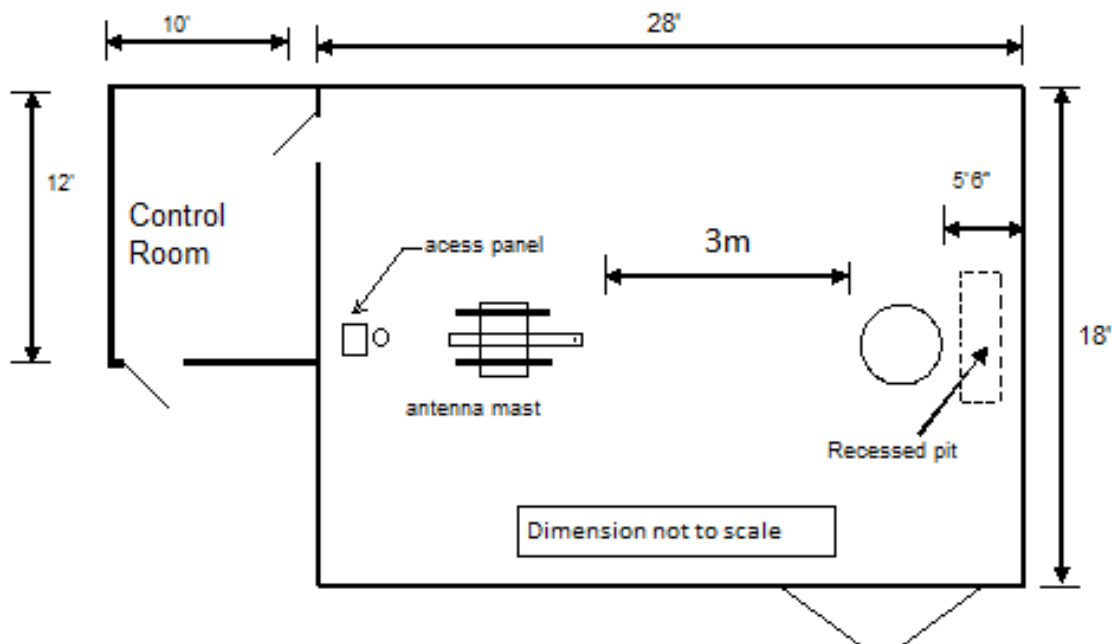


Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 10' sheet galvanized steel horizontal ground reference plane (GRP) bonded every 6" to an 8' X 8' aluminum vertical ground plane.

A diagram of the room is shown below in figure 2.4-1:

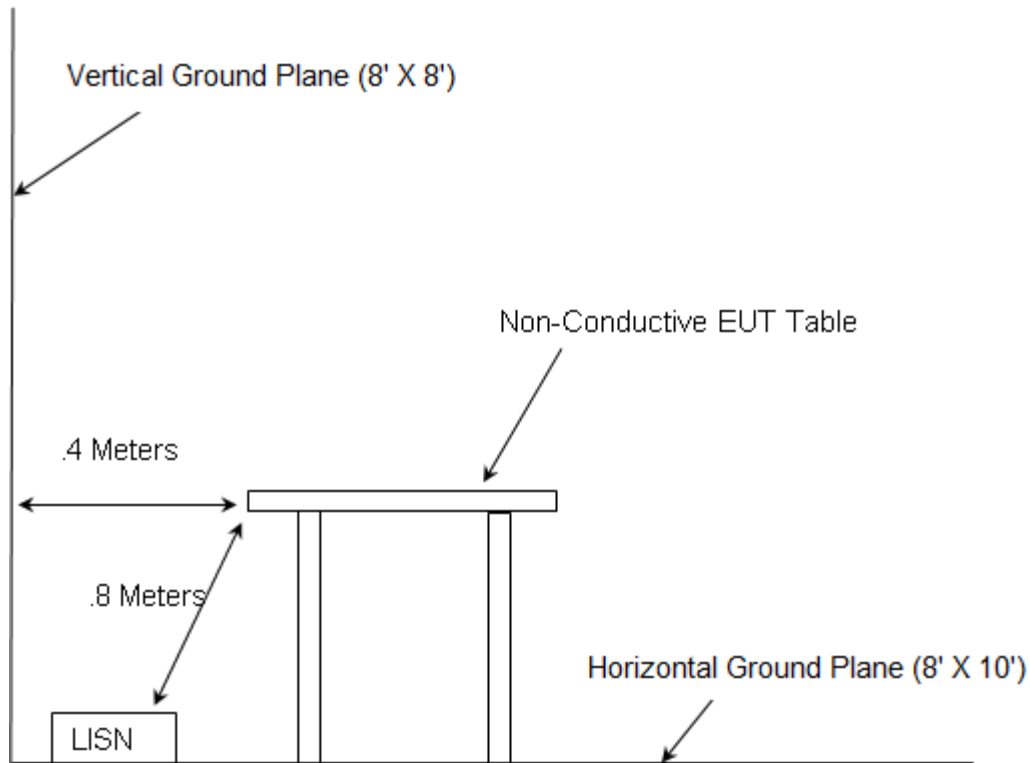


Figure 2.4-1: AC Mains Conducted EMI Site

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, 2019
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2019
- ❖ ISED Canada Radio Standards Specification: RSS-247, Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and License-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 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 #	Last Calibration Date	Calibration Due Date
DEMC3002	Rohde & Schwarz	ESU40	Receiver	100346	10/31/2018	10/31/2019
DEMC3006	Rohde & Schwarz	TS-PR18	Amplifiers	122006	1/22/2019	1/22/2020
DEMC3011	Rohde & Schwarz	ENV216	LISN	3011	1/22/2019	1/22/2020
DEMC3012	Rohde & Schwarz	EMC32-EB	Software	100731	NCR	NCR
DEMC3016	Fei Teng Wireless Technology	HA-07M18G-NF	Antennas	2013120203	2/7/2018	2/7/2020
DEMC3027	Micro-Tronics	BRM50702	Filter	175	1/15/2019	1/15/2020
DEMC3029	Micro-Tronics	HPM50108	Filter	134	1/15/2019	1/15/2020
DEMC3038	Florida RF Labs	NMSE-290AW-60.0-NMSE	Cable Set	1448	1/16/2019	1/16/2020
DEMC3039	Florida RF Labs	NMSE-290AW-396.0-NMSE	Cable Set	1447	1/16/2019	1/16/2020
DEMC3051	Mountain View Cable	BMS-RG400-264.0-BMS	Cables	3051	2/12/2019	2/12/2020
DEMC3055	Rohde & Schwarz	3005	Cables	3055	1/22/2019	1/22/2020
DEMC3149	Rohde & Schwarz	1129.9003.26	Spectrum Analyzer	100042	4/30/2019	4/30/2020
DEMC3161	TESEQ	CBL-6112D	Antennas	51323	1/31/2019	1/31/2020

NCR = No Calibration Required

DMAS MT-25 RF absorber material was used on the floor for all final measurements above 1 GHz.

Asset DEMC3002: Firmware Version: ESU40 is 4.73 SP4

Asset DEMC3012: Software Version: EMC32-B is 10.50.00

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Acuity Brands Lighting, Inc.	RMODIT	TUV SUD #01

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	Power Cable	2.1m	No	1 to AC Power

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

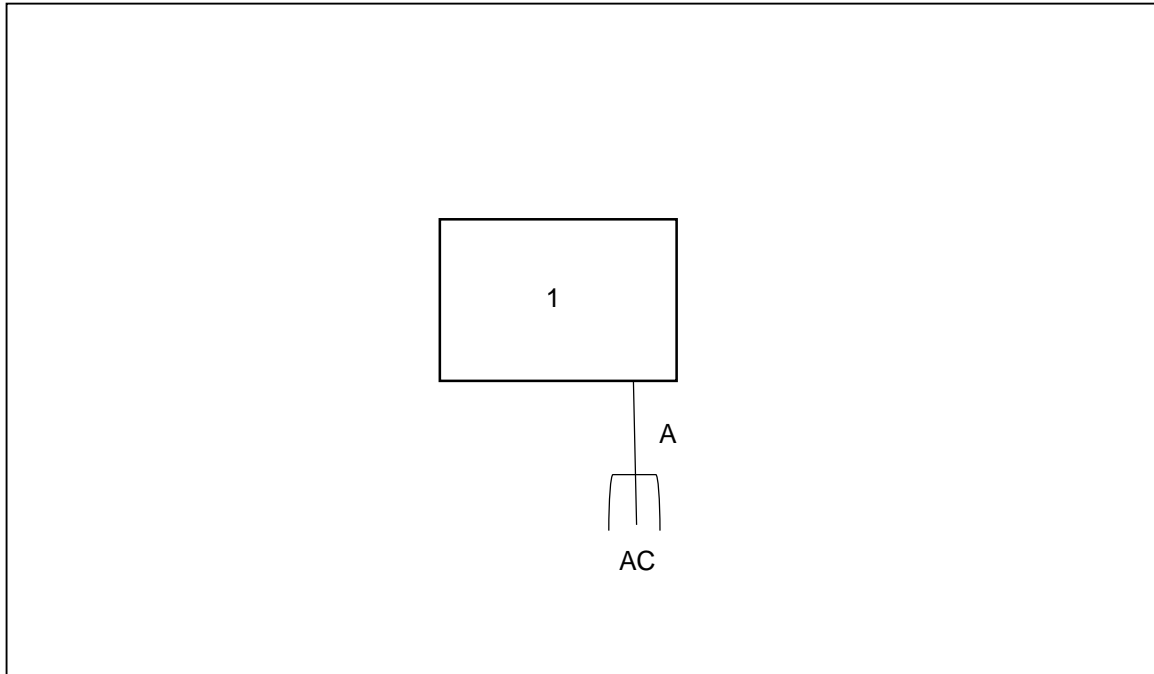


Figure 6-1: Test Setup Block Diagram

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 inverted F PCB antenna is an integral antenna on the PCB and the Taoglas and Nitol antennas connect to the U.FL port. Therefore, the connection type satisfies the requirements of Section 15.203.

7.2 Power Line Conducted Emissions – FCC: 15.207; ISED Canada: RSS-Gen 8.8**7.2.1 Measurement Procedure**

ANSI C63.10-2013 section 6 was the guiding document for this evaluation. 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 = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Performed by: Charlie Callis

Table 7.2.2-1: Conducted EMI Results – Line 1

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
0.295	31.59	16.34	9.62	41.21	25.96	60.38	50.38	19.2	24.4
0.349	32.5	19.9	9.73	42.23	29.63	58.99	48.99	16.8	19.4
0.629	35.94	12.52	9.63	45.57	22.15	56.00	46.00	10.4	23.9
1.012	30.93	12.39	9.63	40.56	22.02	56.00	46.00	15.4	24.0
1.307	30.3	12.28	9.63	39.93	21.91	56.00	46.00	16.1	24.1
5.36	26.77	13.4	9.86	36.63	23.26	60.00	50.00	23.4	26.7

Table 7.2.2-2: Conducted EMI Results – Line 2

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
0.1904	33.47	26.63	9.66	43.13	36.29	64.02	54.02	20.9	17.7
0.365	34.12	23.99	9.76	43.88	33.75	58.61	48.61	14.7	14.9
0.629	33.78	17.94	9.67	43.45	27.61	56.00	46.00	12.5	18.4
3.47	27.72	20.18	9.83	37.55	30.01	56.00	46.00	18.5	16.0
5.6	25.68	16.06	9.96	35.64	26.02	60.00	50.00	24.4	24.0
17.5	17.2	9.61	10.23	27.43	19.84	60.00	50.00	32.6	30.2

7.3 Peak Output Power – FCC: 15.247(b)(2); ISED Canada: RSS-247

See ACS report number 16-3027.W06.2A

7.4 Channel Usage Requirements**7.4.1 Carrier Frequency Separation – FCC: 15.247(a)(1); ISED Canada: RSS-247**

See ACS report number 16-3027.W06.2A

7.4.2 Number of Hopping Channels – FCC: 15.247(a)(1)(i); ISED Canada: RSS-247

See ACS report number 16-3027.W06.2A

7.4.3 Channel Dwell Time – FCC: 15.247(a)(1)(i); ISED Canada: RSS-247

See ACS report number 16-3027.W06.2A

7.4.4 20dB / 99% Bandwidth – FCC: 15.247(a)(1)(i), ISED Canada: RSS-247

See ACS report number 16-3027.W06.2A

7.5 Band-Edge Compliance and Spurious Emissions**7.5.1 Band-Edge Compliance of RF Conducted Emissions – FCC: 15.247(d); ISED Canada RSS-247**

See ACS report number 16-3027.W06.2A

7.5.2 RF Conducted Spurious Emissions – FCC: 15.247(d); ISED Canada RSS-247

See ACS report number 16-3027.W06.2A

7.5.3 Radiated Spurious Emissions – FCC: 15.205, 15.209; ISED Canada RSS-247, RSS-Gen 8.9/8.10**7.5.3.1 Measurement Procedure**

Radiated emissions tests were made over the frequency range of 30MHz to 10GHz, 10 times the highest fundamental frequency.

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

7.5.3.2 Duty Cycle Correction

The Duty Cycle Correction was not required.

7.5.3.3 Measurement Results

Performed by: Chris Gormley

Table 7.5.3.3-1: 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
Low Channel										
2712	42.60	32.10	V	-2.28	40.32	29.82	74.0	54.0	33.68	24.18
2712	44.40	34.80	H	-2.28	42.12	32.52	74.0	54.0	31.88	21.48
3616	56.10	47.90	V	1.04	57.14	48.94	74.0	54.0	16.86	5.06
3616	54.40	46.10	H	1.04	55.44	47.14	74.0	54.0	18.56	6.86
4520	39.30	25.60	V	3.65	42.95	29.25	74.0	54.0	31.05	24.75
4520	39.30	25.40	H	3.65	42.95	29.05	74.0	54.0	31.05	24.95
5424	37.90	24.20	V	4.60	42.50	28.80	74.0	54.0	31.50	25.20
5424	38.30	24.40	H	4.60	42.90	29.00	74.0	54.0	31.10	25.00
Middle Channel										
2742	41.70	31.40	V	-2.19	39.51	29.21	74.0	54.0	34.49	24.79
2742	43.30	34.50	H	-2.19	41.11	32.31	74.0	54.0	32.89	21.69
3656	56.80	48.90	V	1.21	58.01	50.11	74.0	54.0	15.99	3.89
3656	55.00	46.80	H	1.21	56.21	48.01	74.0	54.0	17.79	5.99
4570	39.40	25.20	V	3.63	43.03	28.83	74.0	54.0	30.97	25.17
4570	39.10	25.40	H	3.63	42.73	29.03	74.0	54.0	31.27	24.97
High Channel										
2778	40.90	29.50	V	-2.08	38.82	27.42	74.0	54.0	35.18	26.58
2778	43.00	34.20	H	-2.08	40.92	32.12	74.0	54.0	33.08	21.88
3704	57.00	49.00	V	1.42	58.42	50.42	74.0	54.0	15.58	3.58
3704	55.50	47.30	H	1.42	56.92	48.72	74.0	54.0	17.08	5.28
4630	38.20	24.50	V	3.61	41.81	28.11	74.0	54.0	32.19	25.89
4630	38.70	24.60	H	3.61	42.31	28.21	74.0	54.0	31.69	25.79

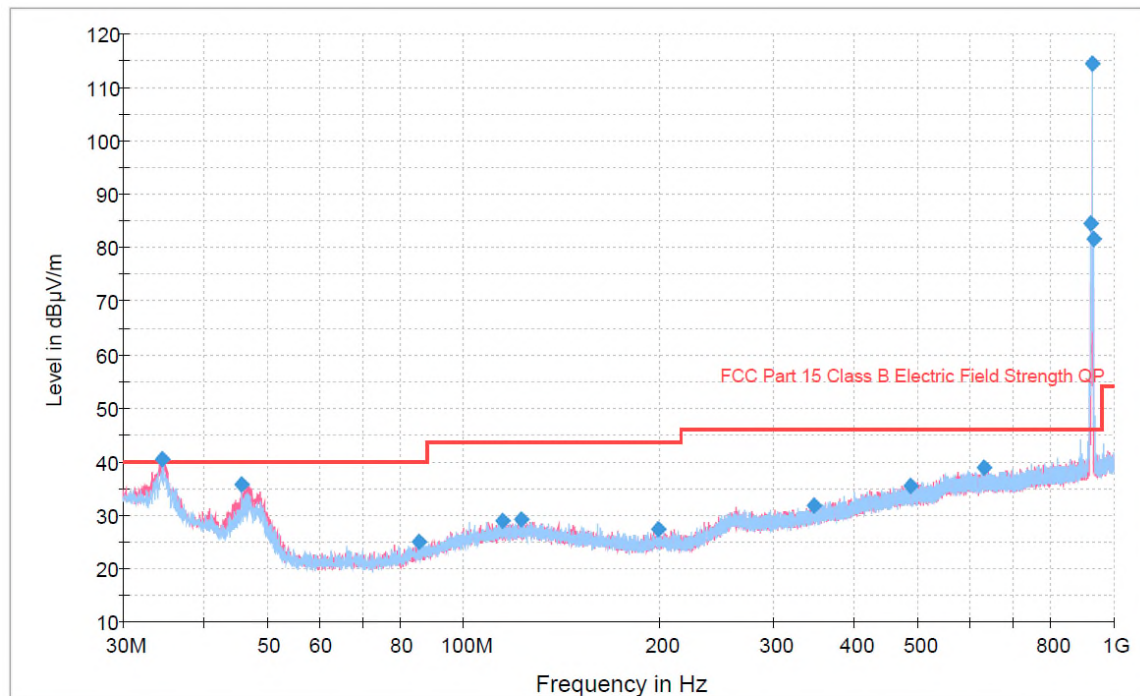


Figure 7.5.3.3-1: High Channel, X Axis, 30MHz – 1GHz

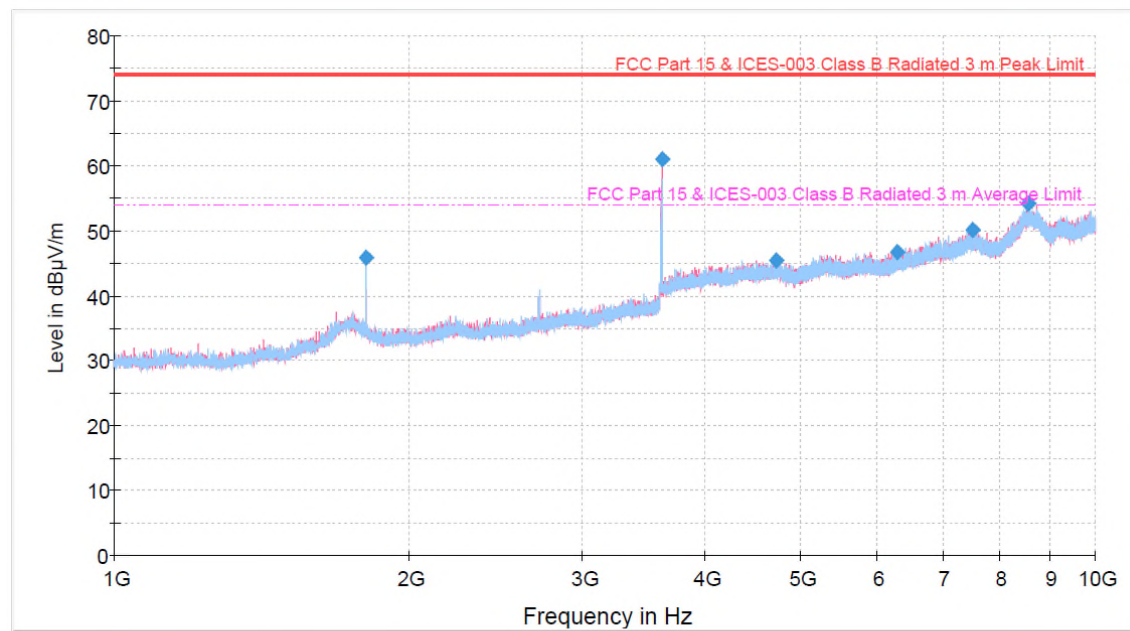


Figure 7.5.3.3-2: Low Channel, X Axis, 1 – 10GHz

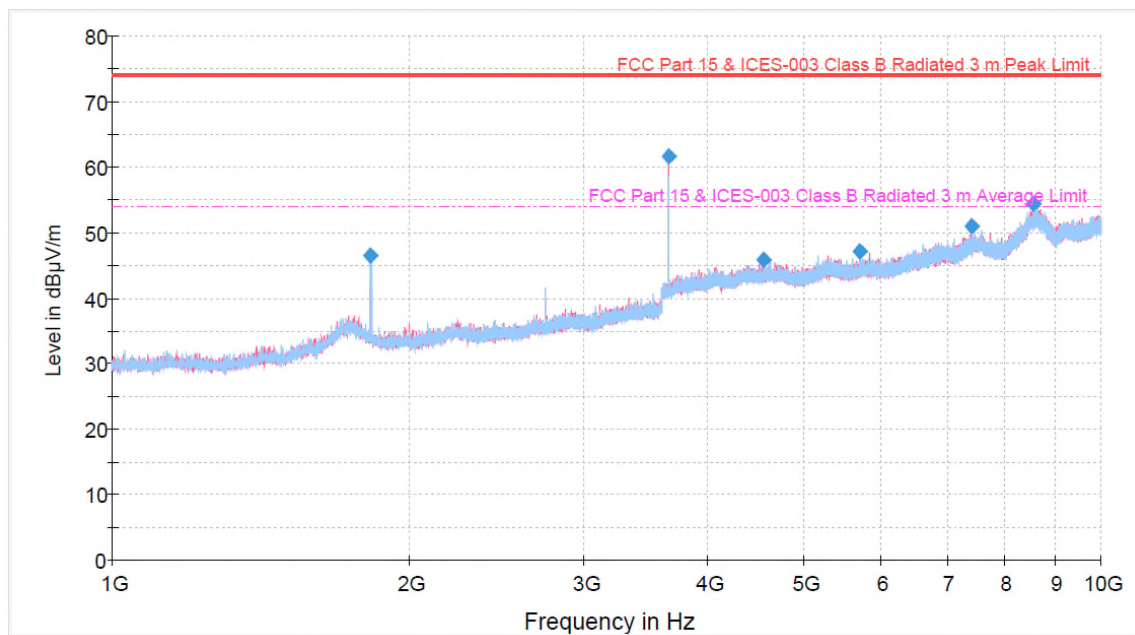


Figure 7.5.3.3-3: Mid Channel, X Axis, 1 – 10GHz

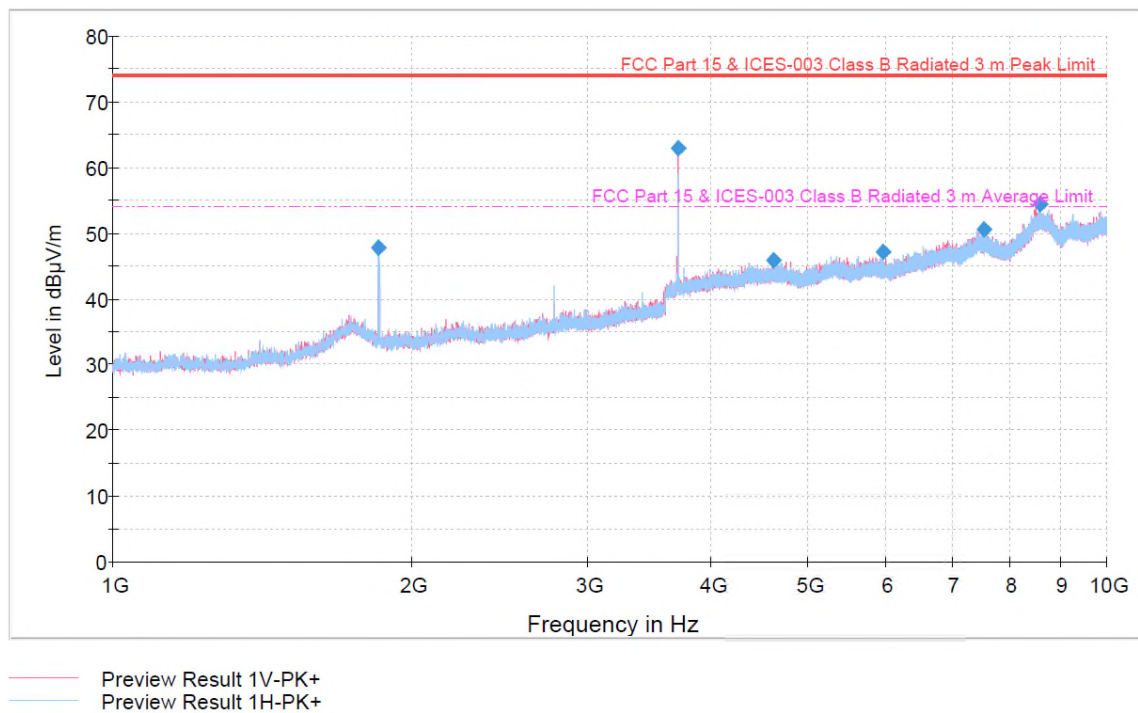


Figure 7.5.3.4: High Channel, X Axis, 1 – 10GHz

7.5.3.4 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: $40.9 - 2.08 = 38.82\text{dBuV/m}$

Margin: $74\text{dBuV/m} - 38.82\text{dBuV/m} = 35.18\text{dB}$

Example Calculation: Average

Corrected Level: $29.5 - 2.08 = 27.42\text{dBuV}$

Margin: $54\text{dBuV} - 27.42\text{dBuV} = 26.58\text{dB}$

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%.

Parameter	U_{lab}
Occupied Channel Bandwidth	$\pm 0.004\%$
RF Conducted Output Power	$\pm 0.689 \text{ dB}$
Power Spectral Density	$\pm 0.5 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 2.717 \text{ dB}$
Radiated Emissions	$\pm 5.877 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	± 2.85

8 CONCLUSION

In the opinion of TÜV SÜD America Inc. 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.

END REPORT