Testing Tomorrow's Technology

Application for

US Code Title 47, Part 2, Subpart J, Section 2.947, Certification
Per
Part 15, Subpart C, for Intentional Radiators, Section 15.249, Intentional Radiator Operating within the Band 2400 MHz to 2483.5 MHz

And

US Code Title 47, Part 2, Subpart J, Section 2.902, Verification
Per
Part 15, Subpart B, for Unintentional Radiators, section 15.101, 15.107 and 15.109

For the

Acuity Brands Lighting

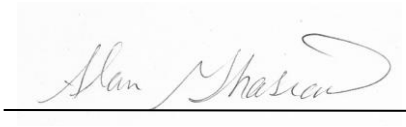
Model: FCS 7TSN

UST Project: 14-0201
Test Date(s): July 30, 2014 and September 2-10, 2014
Issue Date: September 23, 2014

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com

I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: 

Name: Alan Ghasiani

Title: Consulting Engineer - President

Date: September 23, 2014

This report shall not be reproduced except in full. This report may be copied in part only with the prior written approval of US Tech. The results contained in this report are subject to the adequacy and representative character of the sample provided.

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: Acuity Brands Lighting

MODEL(S): FCS 7TSN
FCC ID: 2ADCB-FCS7TSN
IC: 6715C-FCS7TSN

DATE: September 23, 2014

This report concerns (check one): Original grant X
Class II change_____

Equipment type: Intentional Radiator Operating within the bands 2400-2483.5 MHz

Deferred grant requested per 47 CFR 0.457(d) (1) (ii)? yes_____ No X

If yes, defer until:_____
date

N.A. agrees to notify the Commission by N.A.
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

SUMMARY OF TEST REQUIREMENTS

FCC Requirement	Title	Disposition
15.205	Restricted Bands	Pass
15.207	Intentional Radiator Power Line Conducted Emissions	Pass
15.209	Intentional Radiator Radiated Emissions	Pass
15.249(a)	Fundamental Field Strength	Pass
15.107	Unintentional Radiator Power Line Conducted Emissions	Pass
15.109	Unintentional Radiator Radiated Emissions	Pass

N/A = Not applicable for this unit.

Table of Contents

List of Tables

List of Figures

List of Appendices

Appendix	Title
A	Agency Agreement
B	Application Forms
C	Letter of Confidentiality
D	Equipment Label
E	Block Diagram(s)
F	Schematic(s)
G	Test Configuration Photographs
H	External Photographs
I	Internal Photographs
J	Theory of Operation
K	User's Manual

1 General Information

1.1 Purpose of this Report

This report is prepared as a means of presenting test data to be used by a Telecom Certification Body in determination of whether this product is permitted for unlicensed dissemination to the general public according to the FCC Rules and Regulations for RF Devices Intentional Radiators.

1.2 Product Description

The Equipment Under Test (EUT) is the Acuity Brands Lighting Model FCS 7TSN. The EUT incorporates an ISM band transceiver operating in the 2400-2483.5 MHz frequency band. Per 47 CFR Part 15.31(m) the EUT was evaluated at the low, middle and high channels for operation in this band. Test data for these channels is provided herein.

The EUT is a touch screen lighting control. Each EUT provides direct control and programming for up to 36 zones and up to 8 EUTs can be networked together. The EUT can control digital LED and traditional line voltage luminaries via DMX, 0-10VDC, DALI, nLight, phase-control dimming and switching.

The EUT is powered through a 24 VDC Class 2 power supply that can be fed 120 -277 V and draws 40 W, and has the following Bluetooth Radio Features:

Modulation: FHSS/GFSK and DPSK (EUT tested in GFSK mode)
Data Packet: DH1, DH3, and DH5
Bluetooth rated maximum output power: +4 dBm
Frequency band of operation: 2400 MHz to 2483.5 MHz

1.3 Related Submittal(s)/Grant(s)

1.3.1 The EUT is subject to the following FCC authorizations:

a) Certification under section 15.249 as a transmitter.
b) Verification under 15.101 as a digital device and receiver.

1.3.2 Certification of the Transmitter

The EUT employs FHSS modulation, but is not being certified under CFR 15.247 because the field strength of the fundamental and its harmonics are within the limits specified in 47 CFR 15.249. Therefore the EUT is instead being presented under the requirements of CFR 15.249. The EUT will operate within the frequency band of 2400 MHz to 2483.5 MHz.

1.3.3 Verification of the Digital apparatus

The Verification requirement shares many common report elements with the Certification report. Therefore, though this report is mostly intended to provide data for the Certification process, the Verification authorization report (part 15.107 and 15.109) for the EUT is included herein.

2 Tests and Measurements

2.1 Configuration of Tested System

The sample was set up and tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Frequency Range of 9 kHz to 40 GHz (2003). Conducted and radiated emissions data were taken with the EMC test receiver (or spectrum analyzer's) resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. A Block diagram of the tested system is shown in Figure 1. A listing of the EUT and its test peripherals is found in Table 1 below. Test configuration photographs for spurious and fundamental emissions measurements are in the attached appendices.

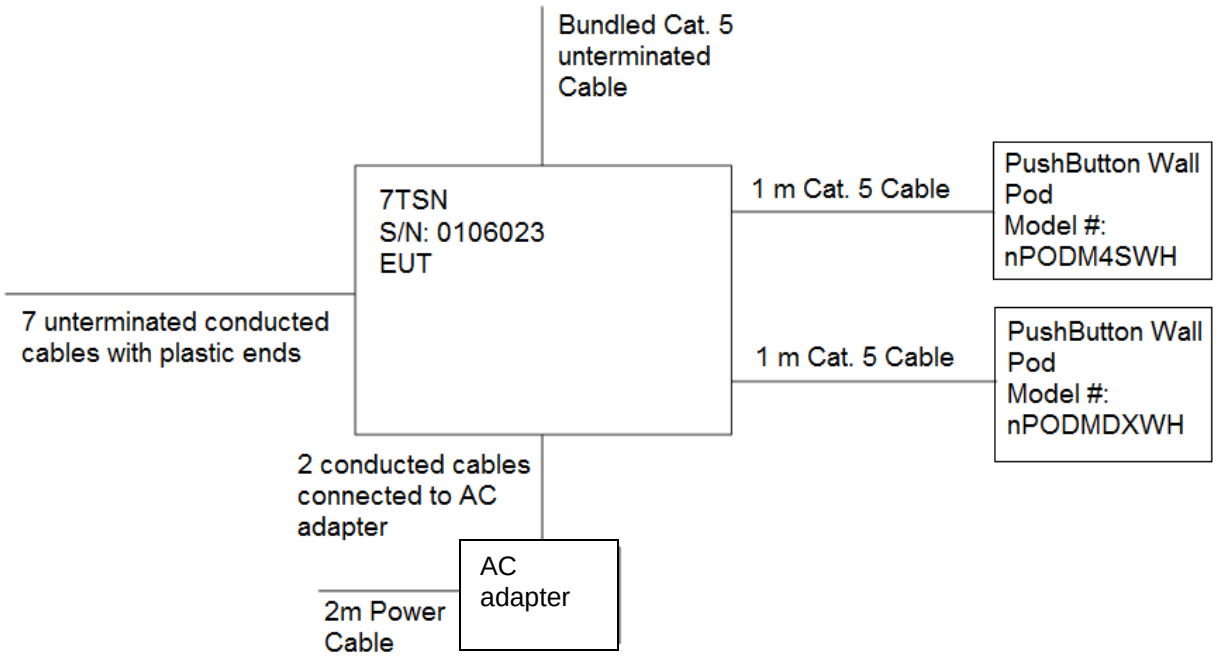


Figure 1. Test Configuration

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID/IC Number	CABLES P/D
(EUT) Acuity Brands Lighting	FCS 7TSN	01060023	Pending: FCC ID: 2ADCB-FCS7TSN IC: 6715C-FCS7TSN	1m UD (x3) 2m UD (x7) 2m UP (x2)
AC adapter Acuity Brands Lighting	FCS PS10	Engineering Sample	N/A	2.0 m UP
mLight	nPODM4SWH	007E2000	N/A	1m UD
mLight	nPODMDXWH	005B68E1	N/A	1m UD
High Perfection Tech.	LP1-4--24	1312621211	N/A	0.5 m UP 2m UP
Apple	iPad	N/A	N/A	None

S = Shielded P = Power
U = Unshielded D = Data

Table 2. Details of I/O Cables Attached to EUT

DESCRIPTION OF CABLE	DETAILS OF CABLE			CABLE LENGTH
Power Cord	**Manufacturer and Part Number**			2 meters
	Acuity Brands Lighting			
	Shield Type	**Shield Termination**	**Type of Backshell**	
	N/A	N/A	N/A	
Cat. 5 (X2)	**Manufacturer and Part Number**			1 meter and 2 meter
	CND			
	Shield Type	**Shield Termination**	**Type of Back Shell**	
	N/A	N/A	N/A	
Conducted Cables with Plastic ends (X7)	**Manufacturer and Part Number**			2 meter and 0.5 meter
	CND			
	Shield Type	**Shield Termination**	**Type of Backshell**	
	N/A	N/A	N/A	

Shield Type
N/A = None
F = Foil
B = Braided
2B = Double Braided
CND = Could Not Determine

Shield Termination
N/A = None
360 = 360 Degrees
P = Pigtail/Drain Wire
CND = Could Not Determine
MU = Metal Unshielded

Type of Backshell
N/A = Not Applicable
PS = Plastic Shielded
PU = Plastic Unshielded
MS = Metal Shielded

2.2 EUT Characterization

The sample used for testing was received by US Tech on September 2, 2014 in good operating condition.

2.3 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC under designation number 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1.

2.4 Test Equipment

Table 2 describes test equipment used to evaluate this product.

Table 3 . Test Instruments used for Evaluation

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8566B	HEWLETT-PACKARD	2410A00109	2/3/2014
QUASI_PEAK ADAPTER	85650A	HEWLETT-PACKARD	2430A00523	2/3/2014
SPECTRUM ANALYZER	E4407B	Agilent	US41442935	11/8/2013
PREAMP	8447D	HEWLETT-PACKARD	2944A07436	2/6/2014
PREAMP	8449B	HEWLETT-PACKARD	3008A00480	2/6/2014
BICONICAL ANTENNA	3110B	EMCO	9306-1708	7/2/2012 2 yr Extend 90 days
LOG PERIODIC ANTENNA	3146	EMCO	9110-3236	6/5/2012 2 yr Extend 90 days
BICONICAL ANTENNA	3110B	EMCO	9307-1431	2/13/13 2 yr
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	7/01/14 2 yr
HORN ANTENNA	SAS-571	A.H. SYSTEMS	605	7/23/2013 2 yrs
LOOP ANTENNA	SAS-200/562	A. H. Systems	142	9/12/2013 2 yr cycle
LISN (X2)	9247-50-TS-50-N	Solar Electronics	955824 & 955826	3/20/2014

Note: The calibration interval of the above test instruments is 12 months unless stated otherwise, and all calibrations are traceable to NIST/USA.

2.5 Modifications to EUT

No modifications were made by US Tech to bring the EUT into compliance with FCC Part 15, Subpart B, Class A Limits for the receiver and digital portion of the EUT or the Subpart C, Transmitter requirements.

2.6 Measurement Standards (CFR 15.31)

Intentional and unintentional radiators are to use the methods of ANSI C63.4:2003. Measurements were made on an Open Area Test Site (OATS) wherever possible. For battery powered equipment, new (or fully charged) batteries are used. Section 15.31(m) indicates that if the EUT System operates over the 2400 MHz to 2483.5 MHz ISM band, measurements must be made near the bottom of the band (around 2400 MHz for example) and in the middle of the band (2440 MHz) as well as near the top of the band (2483.5 MHz).

2.7 Frequency Range of Radiated Measurements (CFR 15.33)

The frequency range is detailed below for intentional and unintentional radiators.

2.7.1 Frequency Range for Intentional Radiators

The spectrum was investigated from the lowest RF signal generated without going below 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency.

2.7.2 Frequency Range for Unintentional Radiators

The spectrum was investigated from the lowest RF signal generated without going below the lowest frequency for which an emissions limit is specified (30 MHz) to the 5th harmonic of the highest fundamental frequency of the digital device (12.5 GHz maximum).

2.7.3 Measurement Detector Function and Bandwidth (CFR 15.35)

On any frequency below 1000 MHz, the limits shown are based upon measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths. On frequencies above 1000 MHz, the radiation limits are based upon the use of measuring instrumentation employing an average detector function.

When average detector measurements are specified for use, including emission measurements below 1000 MHz, there is also a corresponding limit for Peak detector measurements having a limit of 20 dB above the corresponding average limit unless a different peak emission limit is specified. Measurements above 1000 MHz utilize a minimum resolution bandwidth of 1 MHz.

When radiated emissions limits are expressed in terms of the average value of the emission and pulsed operation is employed, the measurement field strength is determined by averaging over one complete pulse train (Duty Cycle) including blanking intervals for pulse trains up to 0.1 second in duration. The exact method of calculating the average field strength is included in paragraph 2.11 of this report. Refer to Figures 2 and 3 for duty cycle measurement data.

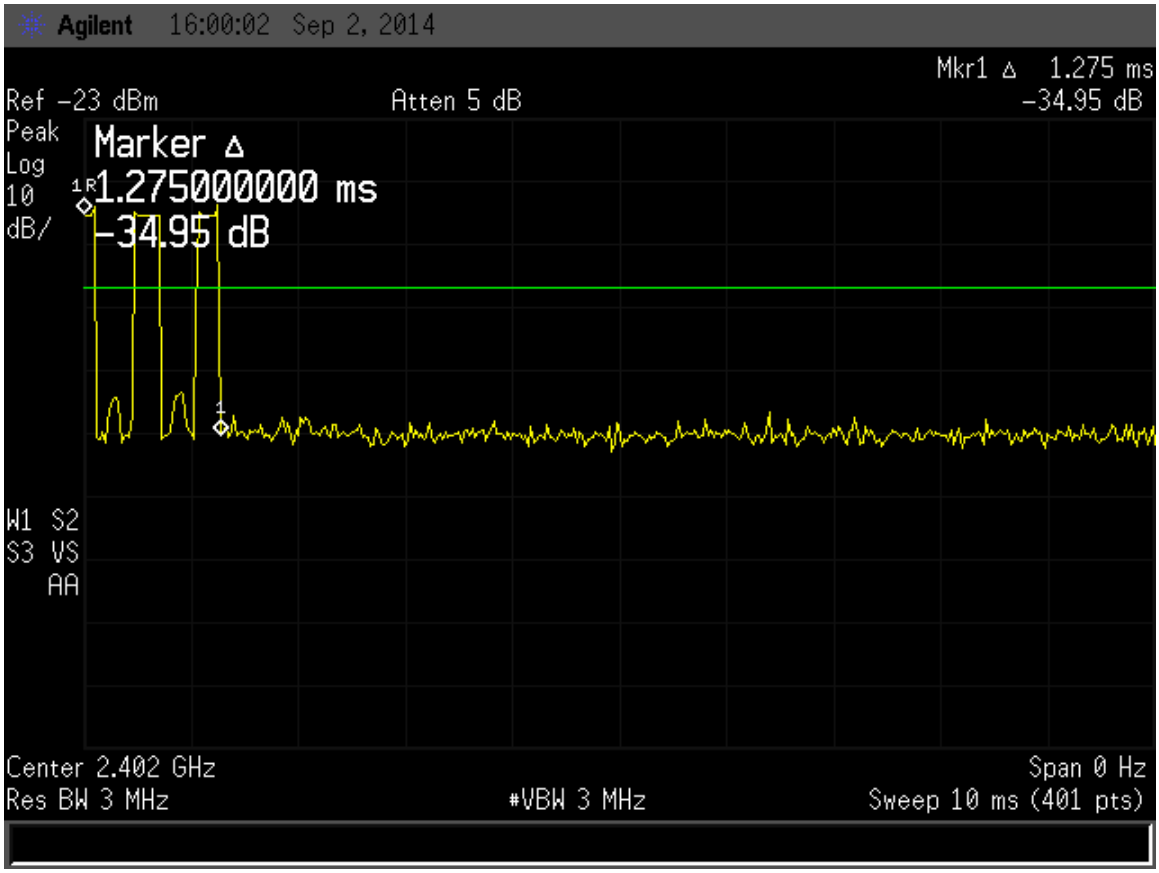


Figure 2. Transmitter Pulse Width

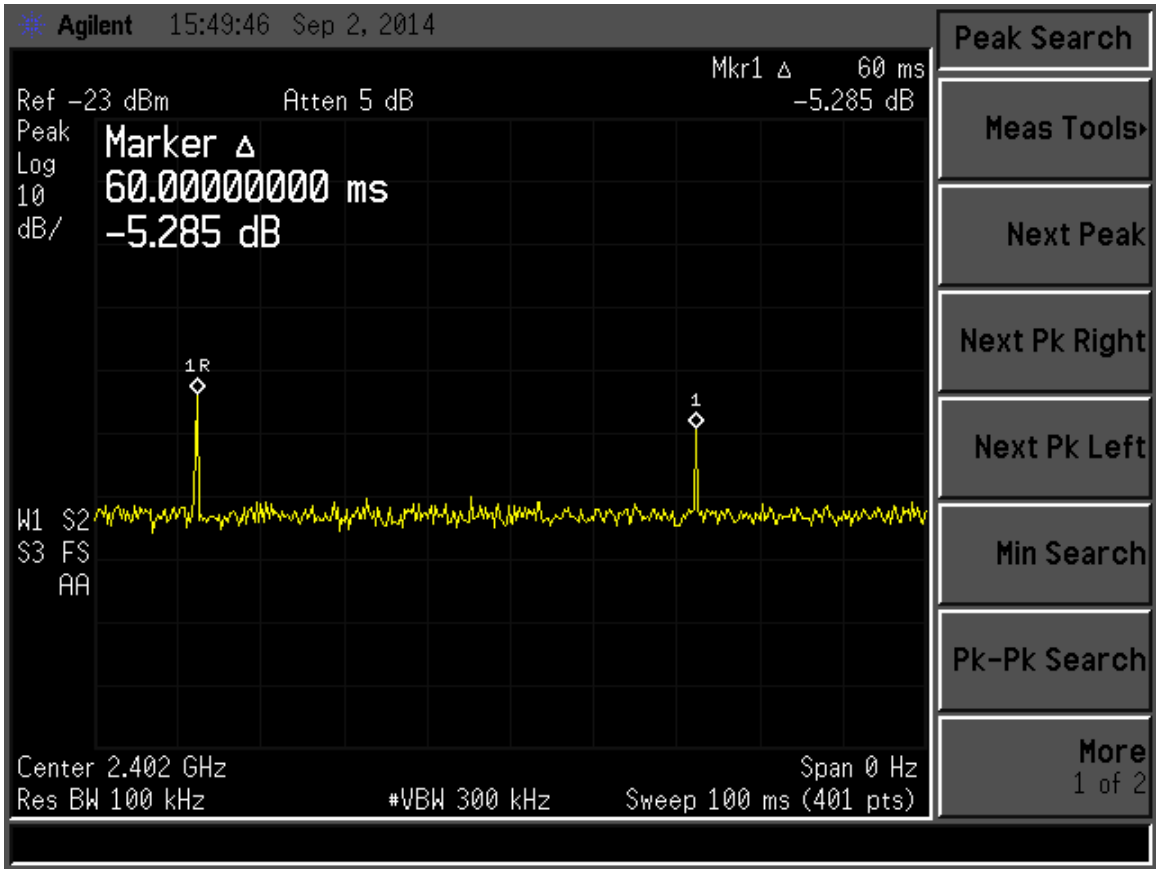


Figure 3. Transmitter Pulse Train within 100 mS

(1.275 ms)/60 ms = 0.021 = 2.1% percent

Duty Cycle = 20 Log (0.021) = -33 dB

The Duty Cycle factor applied in this test report is -20 dB.

2.8 Antenna Requirement (CFR 15.203)

The EUT has an integrated trace antenna; there are no external antenna ports.

Table 4 . Allowed Antenna(s)

MANUFACTURER	TYPE OF ANTENNA	MODEL	REPORT REFERENCE	GAIN dB_i	TYPE OF CONNECTOR
Molex	PCB Chip Antenna	0479480001	Antenna	3.0	SMD

2.9 Restricted Bands of Operation (CFR 15.205)

Only radiated harmonics and other spurious signals can be permitted to fall into the restricted bands of 15.205. All signals found in paragraph 2.7 above shall be examined for this requirement. Limits are based upon the limits of paragraph 15.209. Above 1 GHz, the limits are for Average value. See tables below for peak and Average measurements. According to CFR 15.35, the peak limits can exceed the average limits by 20 dB.

2.10 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207)

For an intentional radiator that is designed to be connected to the public utility power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz - 30 MHz shall not exceed the limits of the table depicted in 15.207 (a) except as applicable per section 15.207.

The AC power line emissions were evaluated while the radio was installed within the host device and transmitting as it would in normal operation. The worst case emission was 2.9 dB below the limit at 0.5838 MHz on the neutral line of the EUT. All other emissions were at least 3.6 dB above the limits. See Table 9 below tabulated test data.

2.11 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.249 (a), (e))

The EUT was placed into a continuous transmit mode of operation. A preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the product. To obtain the worse case results the EUT was tested in X, Y and Z axes to determine the worst case orientation. Radiated measurements below 30 MHz were tested with a RBW = 9 kHz; emissions below 1 GHz were tested with a RBW = 120 kHz and radiated measurements above 1 GHz were measured using a RBW =1 MHz. All VBW was set to three times the RBW value.

Test data is found in Tables 5-7.

Table 5 . Intentional Radiator, Peak Radiated Emissions (CFR 15.209), 0.009 MHz to 1000MHz

Peak Radiated Emissions, Digital Device and Receiver							
Test By: CF	**Test:** Radiated Emissions- .009 MHz to 30 MHz			**Client:** Acuity Brands Lighting			
	Project: 14-0201	**Requirement** 15.209		**Model:** FCS 7TSN			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Distance / Polarity (meters)**	**Margin (dB)**	**Detector PK / QP**
79.9800	53.50	-16.43	37.07	40.0	3m./HORZ	2.9	**QP**
86.2200	45.40	-16.20	29.20	40.0	3m./HORZ	10.8	**QP**
115.6900	54.90	-14.38	40.52	43.5	3m./HORZ	3.0	**QP**
132.9700	53.50	-13.05	40.45	43.5	3m./HORZ	3.1	**QP**
166.3100	53.50	-11.76	41.74	43.5	3m./HORZ	1.8	**QP**
141.7700	52.70	-12.15	40.55	43.5	3m./VERT	2.9	**QP**
200.0000	48.30	-13.06	35.24	43.5	3m./VERT	8.3	**QP**
222.4100	43.60	-13.15	30.45	46.0	3m./VERT	15.5	**QP**
268.7800	41.00	-11.06	29.94	46.0	3m./VERT	16.1	**QP**
300.0000	53.30	-9.11	44.19	46.0	3m./VERT	1.8	**QP**
440.0000	45.20	-6.94	38.26	46.0	3m./VERT	7.7	**PK**
500.0000	47.40	-4.52	42.88	46.0	3m./VERT	3.1	**QP**
560.0000	43.70	-3.75	39.95	46.0	3m./VERT	6.0	**QP**
600.0000	46.90	-2.94	43.96	46.0	3m./VERT	2.0	**QP**
249.9000	52.30	-12.25	40.05	46.0	3m./HORZ	6.0	**QP**
260.0000	52.10	-11.32	40.78	46.0	3m./HORZ	5.2	**PK**
350.0000	48.20	-8.84	39.36	46.0	3m./HORZ	6.6	**PK**
400.0000	45.30	-7.36	37.94	46.0	3m./HORZ	8.1	**PK**

SAMPLE CALCULATION: at 79.9800 MHz, 53.50dbuV + (-16.43)dB = 37.07 dBuV/m

Test Date: November 26, 2014

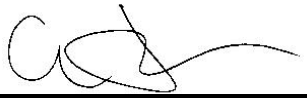
Tested by Signature:  **Name: Carrie Fincannon**

Table 6 . Peak Fundamental and Harmonics, (CFR15.209, 15.249(a)), 1 GHz to 25 GHz

Radiated Fundamental and Harmonics Emissions								
Test By: JW	**Test:** Fundamental and Harmonics CFR 15.209, 15.249 (a)				**Client:** Acuity Brands Lighting			
	Project: 14-0201		**Class: N/A**		**Model:** FCS 7TSN			
Frequency (MHz)	**Test Data (dBuV)**	**DF+FL***	**AF+CL-PA (dB/m)**	**Corrected Results (dBuV/m)**	**Peak Limits (dBuV/m)**	**Distance / Polarity (Meters)**	**Margin (dB)**	**Det PK / AVG**
2401.0	66.45	0	31.93	98.38	114.0	3.0 m / HORZ	15.6	**PK**
4802.1	53.77	0	1.68	55.45	74.0	3.0 m /HORZ	18.6	**PK**
7205.0	51.41	0	3.96	55.37	74.0	3.0 m /HORZ	18.6	**PK**
2437.0	64.53	0	31.93	96.46	114.0	3.0 m /HORZ	17.5	**PK**
4880.0	56.85	0	1.58	58.43	74.0	3.0 m / HORZ	15.6	**PK**
7320.0	51.19	0	4.20	55.39	74.0	3.0 m /HORZ	18.6	**PK**
2479.6	60.35	0	30.06	90.41	114.0	3.0 m /HORZ	23.6	**PK**
4959.4	52.82	0	0.93	53.75	74.0	3.0 m /HORZ	20.2	**PK**
7439.0	52.82	0	4.33	57.15	74.0	3.0 m /HORZ	16.9	**PK**

All other emissions were at least 20 dB below the applicable limit.
*measurements at 1 meter were extrapolated to 3 meters using a factor of -9.5 dB.

SAMPLE CALCULATION: at 2401.0 MHz, = 66.45 dBuV + (0) + (31.93) dB/m = 98.38 dBuV/m @ 3m

Test Date: September 2, 2014

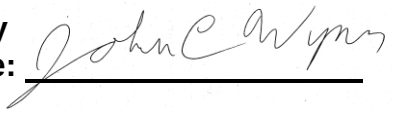
Tested by Signature:  **Name: John Wynn**

Table 7 . AVERAGE Fundamental and Harmonics, (CFR15.209, 15.249(a)), 1 GHz to 25 GHz

Radiated Fundamental and Harmonics Emissions								
Test By: JW	**Test:** Fundamental and Harmonics CFR 15.249 (a)				**Client:** Acuity Brands Lighting			
	Project: 14-0201		**Class: N/A**		**Model:** FCS 7TSN			
Frequency (MHz)	**Test Data (dBuV)**	**DF+FL**	**AF+CL-PA+DC (dB/m)**	**Corrected Results (dBuV/m)**	**Limits (dBuV/m)**	**Distance / Polarity (Meters)**	**Margin (dB)**	**Det PK / AVG**
2401.0	42.45	0	31.93	74.38	94.0	3.0 m /HORZ	19.6	**AVG**
4802.1	37.92	0	1.68	39.60	54.0	3.0 m /HORZ	14.4	**AVG**
7205.0	35.62	0	3.96	39.58	54.0	3.0 m /HORZ	14.4	**AVG**
2437.0	28.41	0	31.93	60.34	94.0	3.0 m /HORZ	33.7	**AVG**
4880.0	38.54	0	1.58	40.12	54.0	3.0 m /HORZ	13.9	**AVG**
7320.0	35.50	0	4.20	39.70	54.0	3.0 m /HORZ	14.3	**AVG**
2479.6	28.92	0	30.06	58.98	94.0	3.0 m /HORZ	35.0	**AVG**
4959.4	37.47	0	0.93	38.40	54.0	3.0 m /HORZ	15.6	**AVG**
7439.0	36.52	0	4.33	40.85	54.0	3.0 m /HORZ	13.2	**AVG**

All other emissions were at least 20 dB below the applicable limit.
*measurements at 1 meter were extrapolated to 3 meters using a factor of -9.5 dB.
*duty cycle factor = -20 dB

SAMPLE CALCULATION: at 2401.0 MHz, = 42.45 dBuV + (0) + (31.93) dB/m = 74.38 dBuV/m @ 3m

Test Date: September 2, 2014

Tested by
Signature:  **Name: John Wynn**

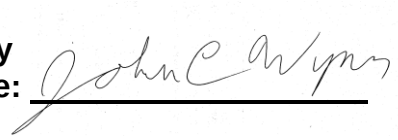
2.12 20 dB Bandwidth Measurement per CFR 15.249, 99% Occupied Bandwidth (IC RSS 210, A8.1)

These measurements were performed while the EUT was in a constant transmit mode. A method similar to the marker delta method was used to capture the points. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW ≥ RBW.

Table 8 . 20 dB Bandwidth and 99% Occupied Bandwidth

Frequency (MHz)	20 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2402.00	1.24	1.24
2426.00	1.24	1.24
2480.00	1.28	1.28

Test Date: September 2, 2014

Tested by
Signature:  **Name: John Wynn**

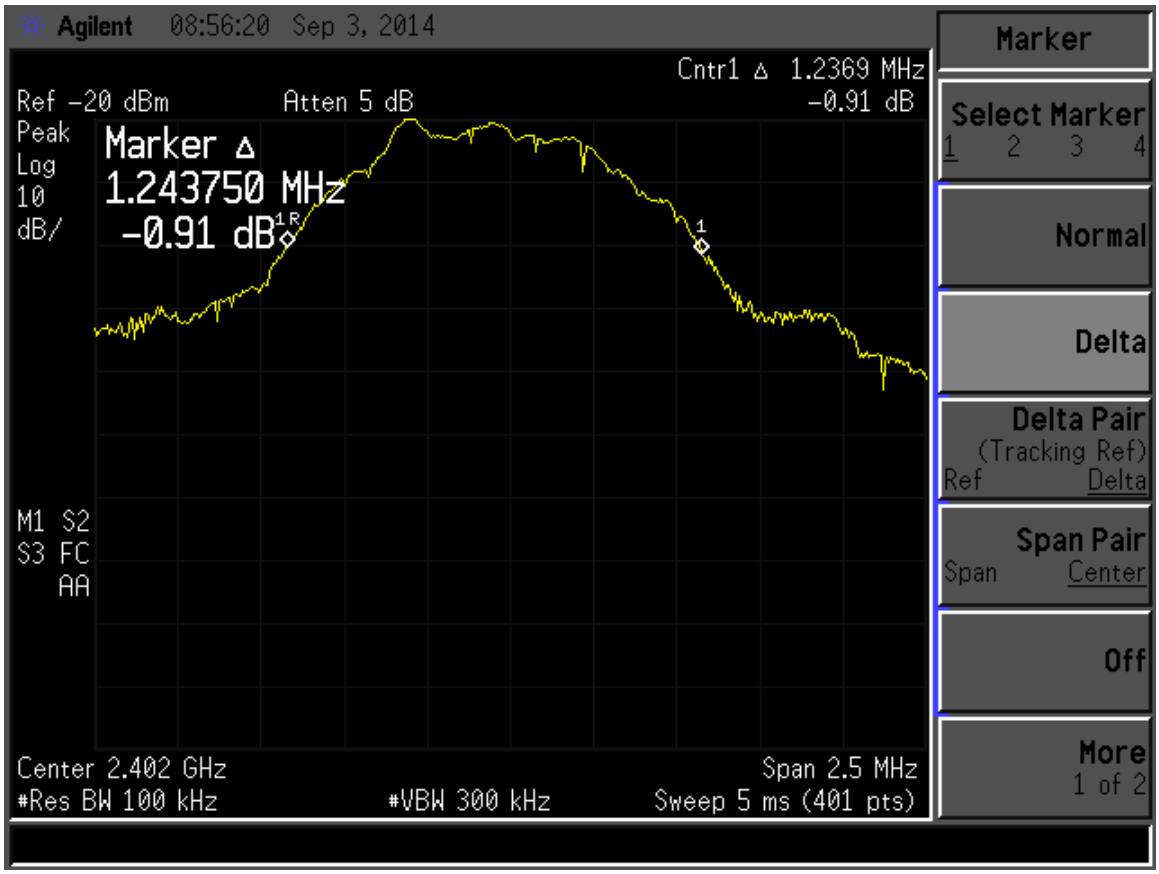


Figure 4. Low Channel Bandwidth

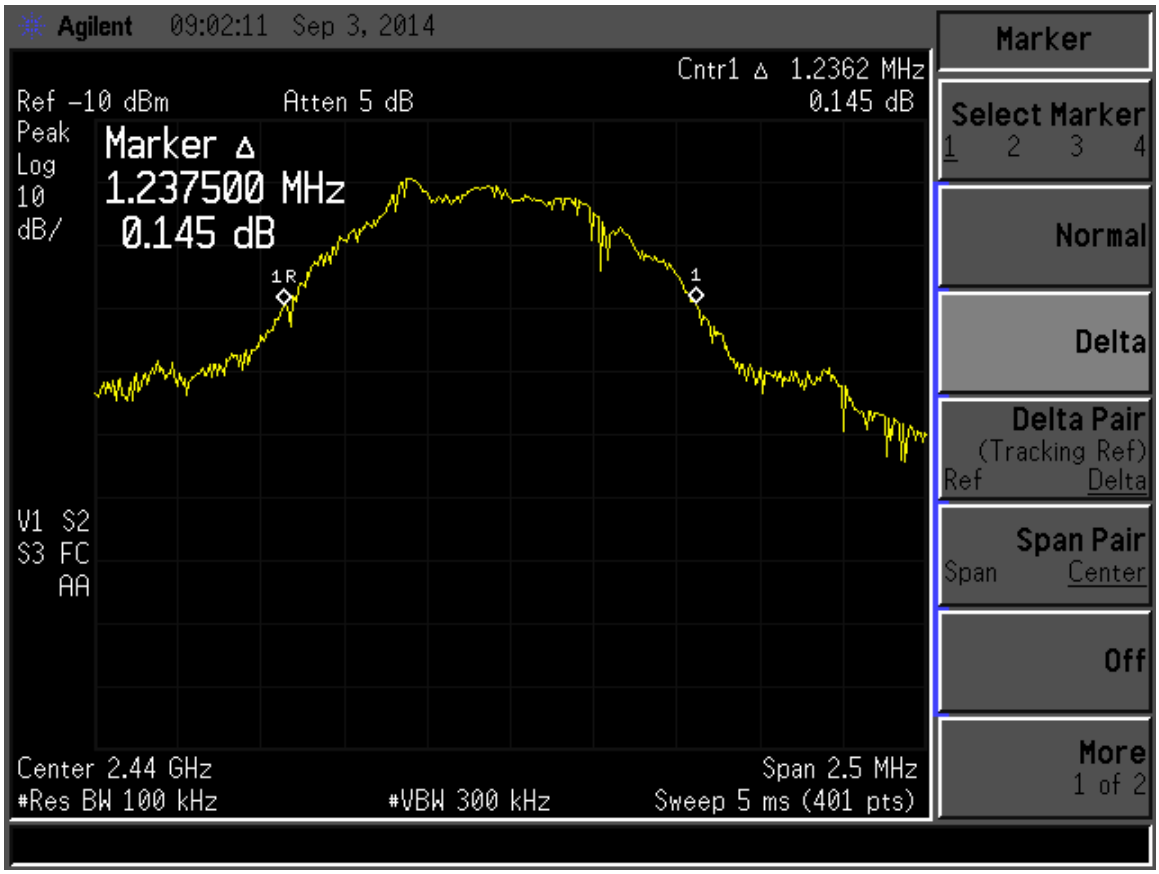


Figure 5. Mid Channel Bandwidth

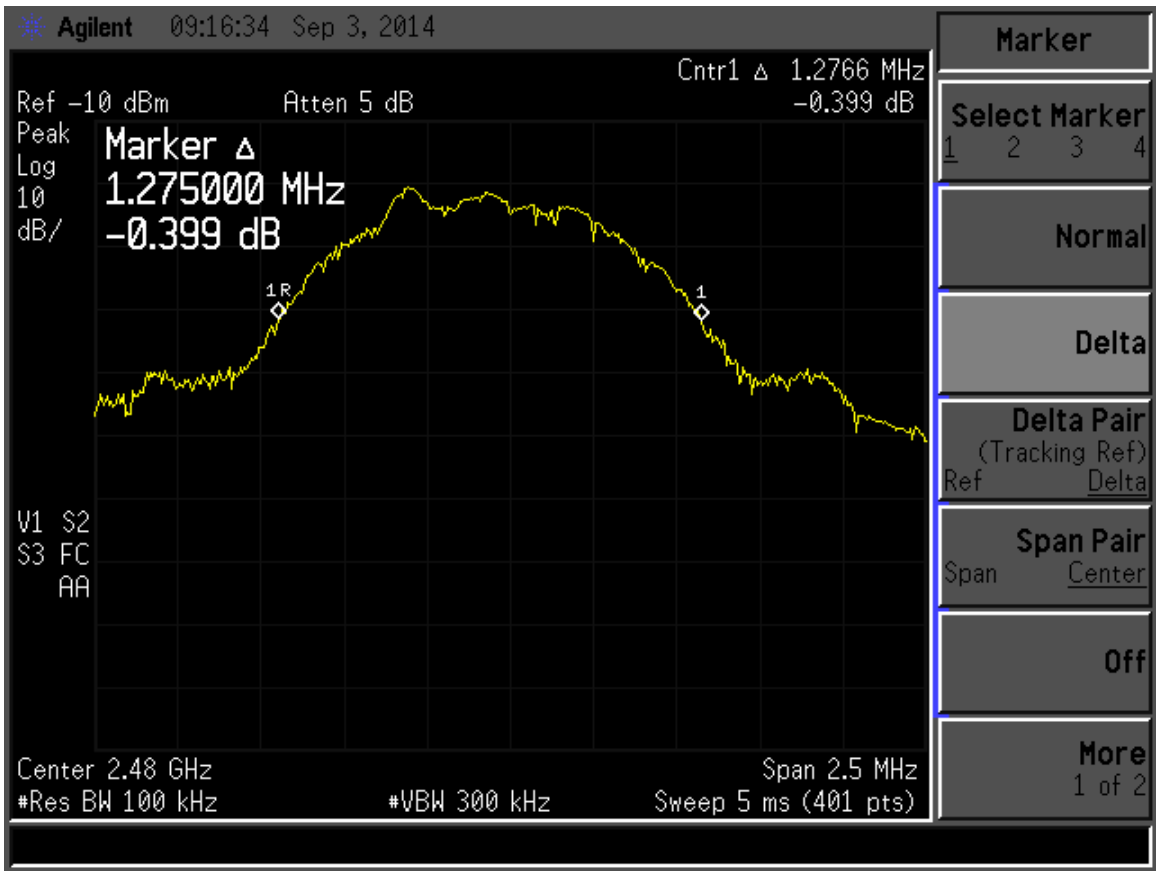


Figure 6. High Channel Bandwidth

2.13 Band Edge Measurements (CFR15.249(d))

Band Edge measurements were made using the marker delta procedure is cited in ANSI C63.10:2009 section 6.9.3. Per the procedure the low and high channels were evaluated to show compliance to the band edge requires of this subpart. The peak at the highest EUT related emission outside the upper and lower occupied bandwidth was compared to the restricted band limits. A measurement was made of the fundamental and the emission was measured using a spectrum analyzer in peak detection mode. A Resolution Bandwidth of 1% to 5% of the total span was used. This procedure was repeated for both channels. The limits were derived as described in the following sections.

2.13.1 High Band Edge

Above 2483.5 MHz the limit per section 15.249(d) is 50 dB below the fundamental or the value expressed by CFR 15.209 (54 dBuV/m) whichever is the lesser attenuation.

The PEAK High Channel fundamental recorded in Table 5 is 90.41 dBuV/m
90.41– 41.85 = 48.85 dB. Passing Margin: 74 - 48.56 = 25.44 dB.

The AVG High Channel fundamental recorded in Table 6 is 58.98 dBuV/m; however using the PEAK fundamental results and applying the duty factor, the AVG band edge limits are met: 54- (48.56-20.0)= 25.44 dB

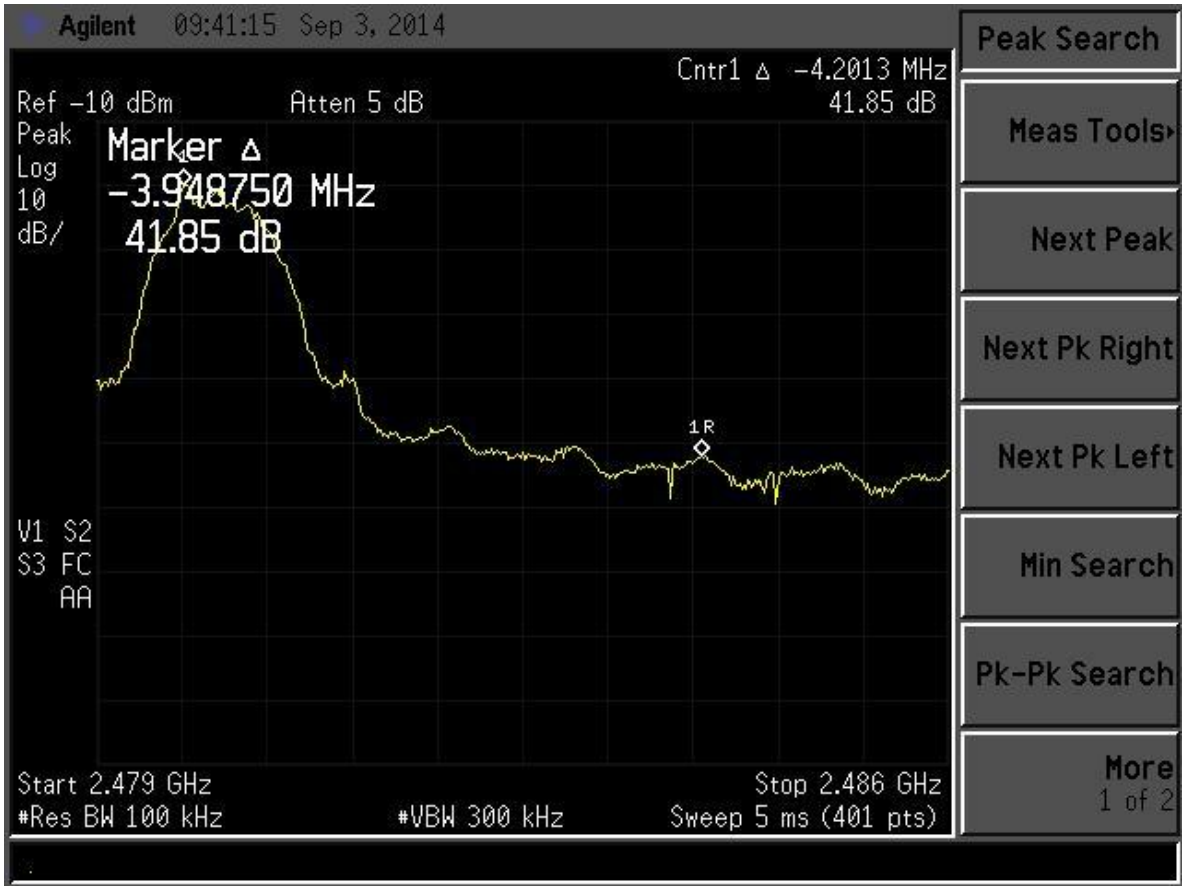


Figure 7. Radiated Band Edge – High Channel Delta

2.13.2 Low Band Edge

The PEAK low channel fundamental recorded in Table 5 is 98.38 dBuV/m: 98.38-40.44 = 57.94 dB. Passing Margin = 74 – 57.94 = 16.06 dB

The AVG low channel fundamental recorded in Table 6 is 74.38 dBuV/m; however using the PEAK fundamental results and applying the duty factor, the AVG band edge limits are met: 54- (57.94-20.0)= 16.06 dB

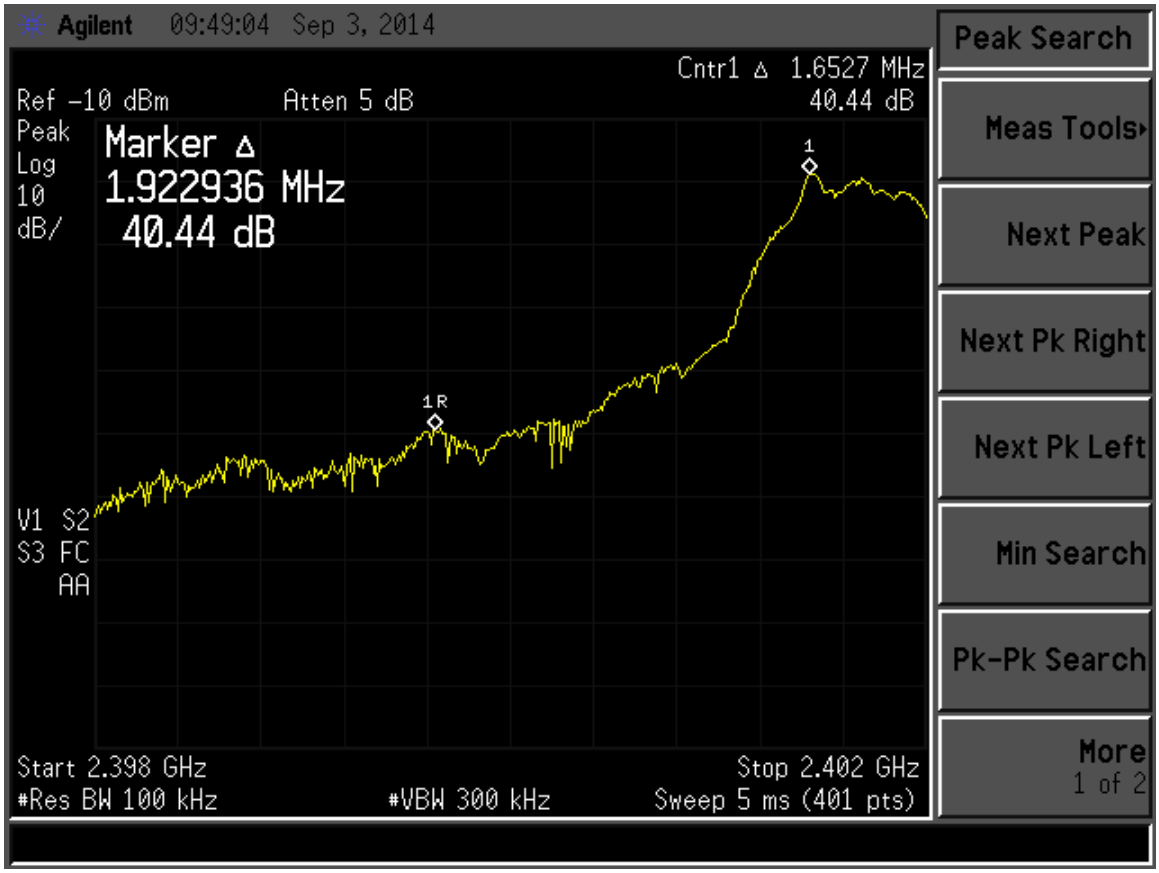


Figure 8. Radiated Band Edge – Low Channel Delta

2.13.3 Restricted Band Evaluation

The following restricted bands were evaluated to ensure no other emissions besides those reported in sections 2.13.1 and 2.13.2 above were present.

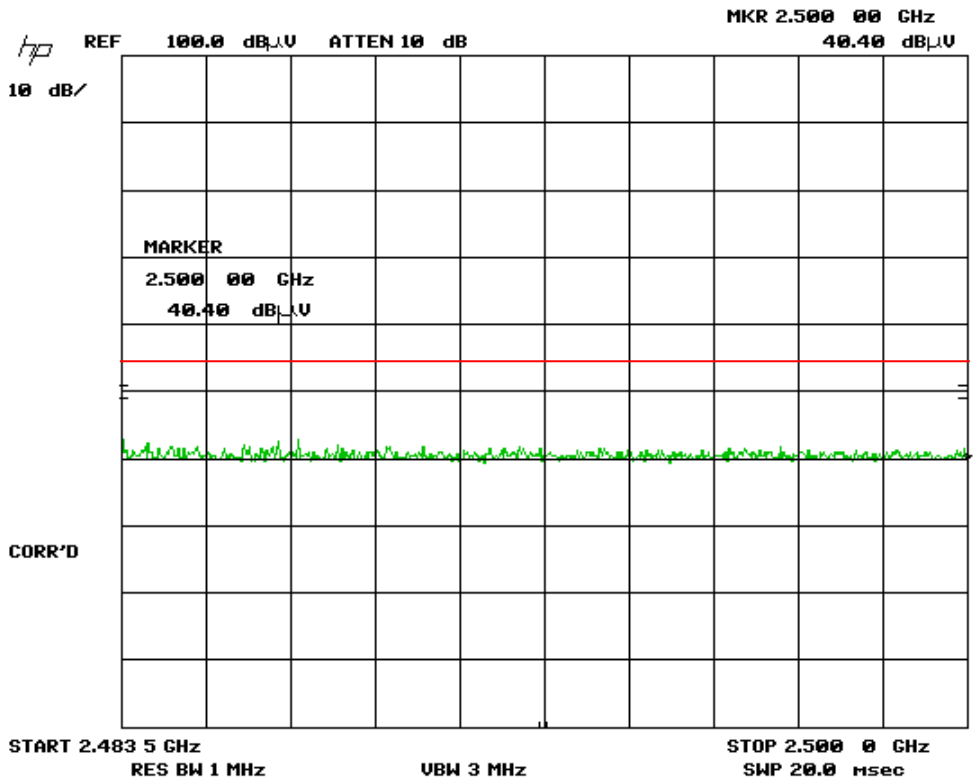


Figure 9. Restricted Band 2.4835 GHz to 2.5 GHz

All emissions within this range were below the AVG limit of 54 dBuV.

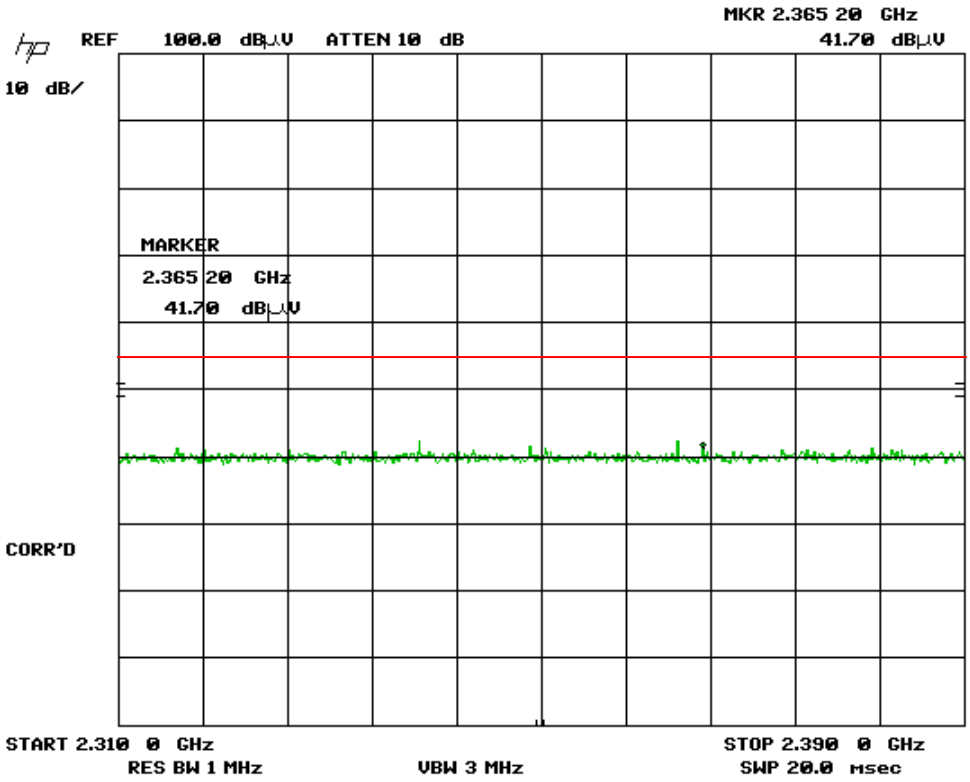


Figure 10. Restricted Band 2.310 GHz to 2.390 GHz

All emissions within this range were below the AVG limit of 54 dBuV.

2.14 Unintentional Radiator, Power Conducted Emissions (CFR 15.107)

The unit was set up and measured for conducted power line emissions. The measurement setup and test procedures were in accordance with ANSI C63.4:2003, paragraph 7. The EUT is connected to the power lines through the ac adaptor. This configuration is used to test and show compliance to CFR 15.107 for powerline conducted emissions.

The AC power line emissions were evaluated while the radio was installed within the host device and transmitting as it would in normal operation. The worst case emission was 2.9 dB below the limit at 0.5838 MHz on the neutral line of the EUT. All other emissions were at least 3.6 dB above the limits.

Measurements were made over the 150 kHz to 30 MHz frequency range for the unit. The measurement receiver was connected to the RF receiver Port on the LISN and each power lead was individually measured. Test results are shown on Table 9 for the unit.

NOTE: The test data provided in this section is to support the Verification requirement for the digital apparatus.

Table 9 . Power line Conducted Emissions Data, Class B (15.107/15.209)

Tested By: JW	**Test:** FCC Power Line Conducted Emissions 150 KHz – 30 MHz , Hot Phase			**Client:** Acuity Brands Lighting		
	Project: 14-0201			**Model:** FCS 7TSN		
Frequency (MHz)	**Test Data (dBuV)**	**LISN+CL-PA (dB)**	**Results (dBuV)**	**Limits (dBuV)**	**Margin (dB)**	**DET PK/QP /AVG**
120 VAC, 60 Hz Phase						
0.1882	47.60	1.00	48.60	54.1	5.5	**PK**
0.5377	42.00	0.38	42.38	46.0	3.6	**QP**
1.4600	37.60	0.32	37.92	46.0	8.1	**PK**
7.8000	30.50	0.43	30.93	50.0	19.1	**PK**
19.4300	38.40	0.57	38.97	50.0	11.0	**PK**
25.7900	36.40	0.65	37.05	50.0	12.9	**QP**
0.1882	47.60	1.00	48.60	54.1	5.5	**PK**
120 VAC, 60 Hz Neutral						
0.1655	43.20	1.25	44.45	55.2	10.7	**PK**
0.5838	42.50	0.55	43.05	46.0	2.9	**QP**
1.0560	39.00	0.63	39.63	46.0	6.4	**PK**
5.2600	30.40	1.23	31.63	50.0	18.4	**PK**
18.4000	32.10	1.42	33.52	50.0	16.5	**PK**
25.9600	37.30	1.48	38.78	50.0	11.2	**QP**

Tested from 150 kHz to 30 MHz.
SAMPLE CALCULATIONS: at 0.1688 MHz Phase, 44.20 (dBuV) + 1.39 (dB) = 45.59 dBuV.

Test Date: November 12, 2014
Tested by
Signature: John C Wynn Name: John C. Wynn

2.15 Unintentional Radiator, Radiated Emissions (CFR 15.109)

Radiated emissions disturbance Measurements were performed with an instrument having both peak and quasi-peak detectors over the frequency range of 30 MHz to 12.5 GHz. Measurements of the radiated emissions were made with the receiver antenna at a distance of 3 m from the boundary of the test unit.

The end product device is a considered a Class A device therefore all measurements performed at a test distance of 3 m such as described above was extrapolated to 10 meters using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements)

For measurements from 30 MHz to 12.5 GHz, the test antenna was varied from 1 m to 4 m in height while watching the analyzers' display for the maximum magnitude of the signal at the test frequency. The antenna polarization (horizontal or vertical) and test sample azimuth were varied during the measurements to find the maximum field strength readings to record.

The worst-case radiated emission in the range of 30 MHz to 1 GHz was 4.7 dB below the limit at 87.06 MHz. This signal is found in Table 9. All other radiated emissions were 5.3 dB or more below the limit.

The worst-case radiated emission above 1 GHz was 3.2 dB below the limit at 12008.MHz. This signal is found in Table 10. All other radiated emissions were 11.4 dB or more below the limit.

NOTE: The test data provided in this section is to support the Verification requirement for the digital apparatus.

Table 10. Unintentional Radiator, Peak Radiated Emissions, 30 MHz – 1000 MHz (CFR 15.109)

Peak Radiated Emissions, Digital Device and Receiver							
Test By: JW	**Test:** Radiated Emissions- 30 MHz to 1GHz			**Client:** Acuity Brands Lighting			
	Project: 14-0201	**Requirement** 15.109, Class: A		**Model:** FCS 7TSN			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Distance / Polarity (meters)**	**Margin (dB)**	**Detector PK / QP**
79.9800	53.50	-26.93	26.57	39.0	3m./HORZ	12.4	**QP**
115.6900	54.90	-24.88	30.02	43.5	3m./HORZ	13.5	**QP**
132.9700	53.50	-23.55	29.95	43.5	3m./HORZ	13.6	**QP**
166.3100	53.50	-22.26	31.24	43.5	3m./HORZ	12.3	**QP**
87.0600	60.50	-26.20	34.30	39.0	3m./VERT	4.7	**QP**
96.7600	64.00	-25.84	38.16	43.5	3m./VERT	5.3	**QP**
112.8630	61.10	-24.56	36.54	43.5	3m./VERT	7.0	**QP**

Note: Measurements at 3 meters were extrapolated to 10 meters using an extrapolation factor of -10.5 dB.

Tested from 30 MHz to 1 GHz

SAMPLE CALCULATION: at 79.9800MHz, 53.50dBuV + (-26.93)dB = 26.57 dBuV/m

Test Date: November 26, 2014

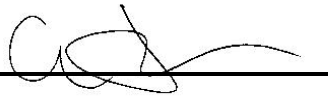
Tested by Signature:  **Name: Carrie Fincannon**

Table 11. Unintentional Radiator, Peak Radiated Emissions, 1 GHz – 12.5 GHz (15.109)

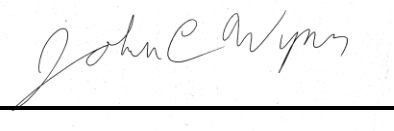
Peak Radiated Emissions, Digital Device and Receiver							
Test By: JW	**Test:** Radiated Emissions- 1 GHz to 12.5 GHz			**Client:** Acuity Brands Lighting			
	Project: 14-0201	**Requirement** 15.109, Class: A		**Model:** FCS 7TSN			
Frequency (MHz)	**Test Data (dBuV)**	**AF+CL-PA (dB)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Distance / Polarity (meters)**	**Margin (dB)**	**Detector PK / QP**
1000.00	61.20	-23.13	38.07	49.5	3.0m. /VERT	11.4	**PK**
1100.00	57.74	-23.04	34.70	49.5	3.0m. /VERT	14.8	**PK**
1199.00	54.37	-22.68	31.69	49.5	3.0m. /VERT	17.8	**PK**
1300.00	52.54	-20.86	31.68	49.5	3.0m /VERT	17.8	**PK**
1099.60	53.13	-22.39	30.74	49.5	3.0m. /HORZ	18.8	**PK**
12008.00	41.57	4.76	46.33	49.5	3.0m. /HORZ	3.2	**PK**

Note: Measurements at 3 meters were extrapolated to 10 meters using an extrapolation factor of -10.5 dB.

Tested from 1 GHz to 12.5 GHz

SAMPLE CALCULATION:
RESULTS at 1000 MHz, 61.20 dBuV + (-23.13) dB = 38.07 dBuV/m

Test Date: September 2, 2014

Tested by Signature:  **Name: John C. Wynn**

2.16 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4. A coverage factor of k=2 was used to give a level of confidence of approximately 95%.

2.16.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ±2.8 dB.

The data listed in this test report does have sufficient margin to negate the effects of uncertainty. Therefore, the EUT unconditionally meets this requirement.

2.16.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ±5.33 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ±5.12 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ±5.15 dB.

The data listed in this test report does not have sufficient margin to negate the effects of uncertainty. Therefore, the EUT conditionally meets this requirement.