

Testing Tomorrow's Technology

**Application
For**

**Title 47 USC, Part 2, Subpart J, Paragraph 2.902, Equipment Authorization of
Verification for an Unintentional Radiator per Part 15, Subpart B, Paragraphs
15.107 and 15.109**

And

**Part 2, Subpart J, Paragraph 2.907 Equipment Authorization of Certification for an
Intentional Radiator per Part 15, Subpart C, paragraphs 15.207, 15.209 and 15.247**

For the

**Acuity Brands Technology Services, Inc.
ROAM
Model Number: ROAMMK3MOD1**

**FCC ID: UJX-ROAMMK3MOD1
IC: 6715A-ROAMMK3MOD1**

**UST Project: 14-0060
Issue Date: April 7, 2014**

Total Pages: 64

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



Testing Tomorrow's Technology

I certify that I am authorized to sign for the Test Agency 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: Alan Ghasiani

Name: Alan Ghasiani

Title: Compliance Engineer – President

Date April 7, 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

US Tech Test Report: FCC Part 15 Certification/ RSS 210
FCC ID: UJX- ROAMMK3MOD1
IC: 6715A-ROAMMK3MOD1
Test Report Number: 14-0060
Issue Date: April 7, 2014
Customer: Acuity Brands Technology Services, Inc.
Model: ROAMMK3MOD1

MEASUREMENT TECHNICAL REPORT

COMPANY NAME: Acuity Brands Technology Services, Inc.

MODEL: ROAMMK3MOD1

FCC ID: UJX- ROAMMK3MOD1

IC ID: 6715A-ROAMMK3MOD1

DATE: April 7, 2014

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

Equipment type: 2.4 GHz Transmitter Module

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

If yes, defer until: N/A
date

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

US Tech Test Report:	FCC Part 15 Certification/ RSS 210
FCC ID:	UJX- ROAMMK3MOD1
IC:	6715A-ROAMMK3MOD1
Test Report Number:	14-0060
Issue Date:	April 7, 2014
Customer:	Acuity Brands Technology Services, Inc.
Model:	ROAMMK3MOD1

Table of Contents

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
1	General Information.....	7
1.1	Purpose of this Report.....	7
1.2	Characterization of Test Sample	7
1.3	Product Description	7
1.4	Configuration of Tested System	8
1.5	Test Facility	8
1.6	Related Submittal(s)/Grant(s)	8
2	Tests and Measurements.....	10
2.1	Test Equipment	10
2.2	Modifications to EUT Hardware.....	11
2.3	Number of Measurements for Intentional Radiators (15.31(m))	12
2.4	Frequency Range of Radiated Measurements (Part 15.33)	12
2.4.1	Intentional Radiator.....	12
2.4.2	Unintentional Radiator	12
2.5	Measurement Detector Function and Bandwidth (CFR 15.35)	13
2.5.1	Detector Function and Associated Bandwidth	13
2.5.2	Corresponding Peak and Average Requirements.....	13
2.5.3	Pulsed Transmitter Averaging.....	13
2.6	EUT Antenna Requirements (CFR 15.203)	14
2.7	Restricted Bands of Operation (Part 15.205).....	16
2.8	Transmitter Duty Cycle (CFR 35 (c))	16
2.9	Intentional Radiator, Power Lines Conducted Emissions (CFR 15.207)	18
2.10	Intentional Radiator, Radiated Emissions (Antenna Conducted) (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a)).....	20
2.11	Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a))	36
2.12	Band Edge Measurements – (CFR 15.247 (d))	41
2.13	Six (6) dB Bandwidth per CFR 15.247(a)(2), (IC RSS 210, A8.2(a))	45
2.14	Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))	49
2.15	Power Spectral Density (CFR 15.247(e)) (IC RSS 210 A8.5).....	53
2.16	99% Occupied Bandwidth (IC RSS 210, A8.1)	57
2.17	Unintentional Radiator Power Lines Conducted Emissions (CFR 15.107) ...	61
2.18	Unintentional Radiator and Intentional Radiator, Radiated Emissions (CFR 15.109 and 15.209)	63

US Tech Test Report: FCC Part 15 Certification/ RSS 210
FCC ID: UJX- ROAMMK3MOD1
IC: 6715A-ROAMMK3MOD1
Test Report Number: 14-0060
Issue Date: April 7, 2014
Customer: Acuity Brands Technology Services, Inc.
Model: ROAMMK3MOD1

List of Figures

<u>Figures</u>	<u>Title</u>	<u>Page</u>
Figure 1. Test Configuration		15
Figure 3. Antenna Conducted Spurious Emissions – Low Channel, Part 1		21
Figure 4. Antenna Conducted Spurious Emissions – Low Channel, Part 2		22
Figure 5. Antenna Conducted Spurious Emissions – Low Channel, Part 3		23
Figure 6. Antenna Conducted Spurious Emissions – Low Channel, Part 4		24
Figure 7. Antenna Conducted Spurious Emissions – Low Channel, Part 5		25
Figure 8. Antenna Conducted Spurious Emissions – Mid Channel, Part 1		26
Figure 9. Antenna Conducted Spurious Emissions – Mid Channel, Part 2		27
Figure 10. Antenna Conducted Spurious Emissions – Mid Channel, Part 3		28
Figure 11. Antenna Conducted Spurious Emissions – Mid Channel, Part 4		29
Figure 12. Antenna Conducted Spurious Emissions – Mid Channel, Part 5		30
Figure 13. Antenna Conducted Spurious Emissions – High Channel, Part 1.....		31
Figure 14. Antenna Conducted Spurious Emissions – High Channel, Part 2.....		32
Figure 15. Antenna Conducted Spurious Emissions – High Channel, Part 3.....		33
Figure 16. Antenna Conducted Spurious Emissions – High Channel, Part 4.....		34
Figure 17. Antenna Conducted Spurious Emissions – High Channel, Part 5.....		35
Figure 18. Band Edge Compliance – Low Channel Delta - Peak.....		42
Figure 19. Figure 20. Band Edge Compliance – High Channel Delta - Peak.....		43
Figure 20. Six dB Bandwidth - 15.247 (a) (2) - Low Channel.....		46
Figure 21. Six dB Bandwidth - 15.247 (a) (2) - Mid Channel.....		47
Figure 22. Six dB Bandwidth - 15.247 (a) (2) - High Channel		48
Figure 23. Peak Antenna Conducted Output Power, Low Channel		50
Figure 24. Peak Antenna Conducted Output Power, Mid Channel		51
Figure 25. Peak Antenna Conducted Output Power, High Channel		52
Figure 26. Peak Power Spectral Density - Part 15.247 (e) - Low Channel		54
Figure 27. Power Spectral Density - Part 15.247 (e) - Mid Channel		55
Figure 28. Peak Power Spectral Density - Part 15.247 (e) - High Channel.....		56
Figure 29. Low Channel 99% Bandwidth		58
Figure 30. Mid Channel 99% Bandwidth.....		59
Figure 31. High Channel 99% Bandwidth		60

US Tech Test Report:	FCC Part 15 Certification/ RSS 210
FCC ID:	UJX- ROAMMK3MOD1
IC:	6715A-ROAMMK3MOD1
Test Report Number:	14-0060
Issue Date:	April 7, 2014
Customer:	Acuity Brands Technology Services, Inc.
Model:	ROAMMK3MOD1

List of Tables

<u>Table</u>	<u>Title</u>	<u>Page</u>
Table 1.	EUT and Peripherals.....	9
Table 2.	Test Instruments	10
Table 3.	Number of Test Frequencies for Intentional Radiators.....	12
Table 4.	Allowed Antenna(s)	14
Table 5.	Transmitter Power Line Conducted Emissions Test Data, Part 15.207	19
Table 6.	Antenna 1- Peak Radiated Fundamental & Harmonic Emissions	37
Table 7.	Antenna 1- Average Radiated Fundamental & Harmonic Emissions	38
Table 8.	Antenna 2- Peak Radiated Fundamental & Harmonic Emissions	39
Table 9.	Antenna 2- Average Radiated Fundamental & Harmonic Emissions	40
Table 10.	Six (6) dB Bandwidth.....	45
Table 11.	Peak Antenna Conducted Output Power per Part 15.247 (b) (3)	49
Table 12.	Power Spectral Density for Low, Mid and High Bands	53
Table 13.	99% Occupied Bandwidth	57
Table 14.	Power Line Conducted Emissions Data, Class A Part 15.107, Peak Measurement vs. Avg. Limits	62
Table 15.	Unintentional Radiator, Radiated Emissions	64

List of Attachments

- Agency Agreement
- Application Forms
- Letter of Confidentiality
- Equipment Label(s)
- Block Diagram(s)
- Schematic(s)
- Test Configuration Photographs
- Internal Photographs
- Theory of Operation
- RF Exposure
- User's Manual

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 247.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on April 7, 2014 in good operating condition.

1.3 Product Description

The Equipment under Test (EUT) is the Acuity Brands Technology Services, Inc. radio module, model ROAMMK3MOD1, which is a 2.4 GHZ transmitter module. The ROAMMK3MOD1 comes in two styles. One style uses a trace antenna with an internal power setting of 0xFF. The second style uses an external antenna and has an internal power setting of 0XD0. The EUT employs 802.15.4 radio technology. Primary use for this radio, after installation in a street light, is to provide control and communication with ground personnel or central offices. The radio will typically be installed on top of 30' street lighting utility poles to send and receive data.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

1.4 Configuration of Tested System

The Test Sample was tested per *ANSI C63.4:2003, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* (2003) for FCC subpart B Digital equipment Verification requirements and per FCC KDB Publication number 558074 for Digital Transmission Systems Operating Under section 15.247. Also, FCC, KDB Publication No. 558074 was used as a test procedure guide.

Digital RF conducted and radiated verification emissions data (FCC 15.107 and 109) below 1 GHz were taken with the measuring receiver (or spectrum analyzer's) resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements performed above 1.0 GHz were made with a RBW of 1 MHz. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process.

A list of EUT and Peripherals is found in Table 1 below. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are provided in separate Appendices.

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is 186022. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

1.6 Related Submittal(s)/Grant(s)

The EUT will be used to wirelessly send/receive data. The transceiver presented in this report will be used with other like transceivers:

The EUT is subject to the following FCC Equipment Authorizations:

- a) Certification of the transmitter (with modular approval), see test data presented herein.
- b) Verification as a class A digital device.

The manufacturer desires to seek a limited modular approval for this device.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER.	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
2.4 GHz radio Acuity Brands (EUT)	ROAMMK3 MOD1	Engineering Sample	Pending: UJX- ROAMMK3MOD1	1.5 m U Power cable
Antenna See antenna details	--	--	--	--
RF Sniffer Acuity Brands	ROAM	00350D9	Various	3m U Data cable
Laptop Various	Various	Various	Various	1.5m U Power cable

US Tech Test Report:	FCC Part 15 Certification/ RSS 210
FCC ID:	UJX- ROAMMK3MOD1
IC:	6715A-ROAMMK3MOD1
Test Report Number:	14-0060
Issue Date:	April 7, 2014
Customer:	Acuity Brands Technology Services, Inc.
Model:	ROAMMK3MOD1

2 Tests and Measurements

2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are included herein.

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	E4407B	AGILENT	US41442935	11/8/2013
SPECTRUM ANALYZER	8566B	HEWLETT-PACKARD	2410A00109	2/03/2014
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	2944A06291	2/06/2014
LOOP ANTENNA	SAS-200/562	A. H. Systems	142	9/12/2013 2 yr cycle
BICONICAL ANTENNA	3110B	EMCO	9306-1708	7/02/2012 2 yr cycle
LOG PERIODIC ANTENNA	3146	EMCO	3110-3236	6/05/12 2 yr cycle
HORN ANTENNA	SAS-571	A. H. Systems	605	7/23/2013 2 yr cycle
HORN ANTENNA	EMCO	3116	9505-2255	8/09/12 2 yr cycle
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00480	2/06/14
LISN	8028-50-TS24-BNC	Solar Electronics	910495 & 910496	3/19/2014
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

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

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model: ROAMMK3MOD1

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

During intentional radiation testing, the software setting for the output power was changed to bring the EUT into compliance with Part 15.247 limits. For the trace antenna version of the EUT, the power setting was set to the maximum output level, 0xFF. For the external dipole antenna version of the EUT, the power setting was set to 0xD0 (reduced level).

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 as follows:

Table 3. Number of Test Frequencies for Intentional Radiators

Frequency Range over which the device operates	Number of Frequencies	Location in the Range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near the top 1 near the bottom
Greater than 10 MHz	3	1 near top 1 near middle 1 near bottom

Because the EUT operates over 2.4 GHz to 2.4835 GHz, 3 test frequencies will be used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

2.4.1 Intentional Radiator

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10th harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range shall be 30 MHz to 1000 MHz, or to the range specified in 2.4.1 above, whichever is the higher range of investigation.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the following:

2.5.1 Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the Quasi-peak device are used.

2.5.2 Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

2.5.3 Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may also be expressed logarithmically in dB. Please section 2.8 herein for details.

US Tech Test Report:	FCC Part 15 Certification/ RSS 210
FCC ID:	UJX- ROAMMK3MOD1
IC:	6715A-ROAMMK3MOD1
Test Report Number:	14-0060
Issue Date:	April 7, 2014
Customer:	Acuity Brands Technology Services, Inc.
Model:	<u>ROAMMK3MOD1</u>

2.6 EUT Antenna Requirements (CFR 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. Only the antenna(s) listed in Table 4 will be used with this module.

Table 4. Allowed Antenna(s)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB _i	TYPE OF CONNECTOR
Antenna 1	Kenbotong Communications Ltd.	Dipole	TQJ-2400D	5.0	N-Type
Antenna 2	Acuity	Trace	PIFA	2.0	NA

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

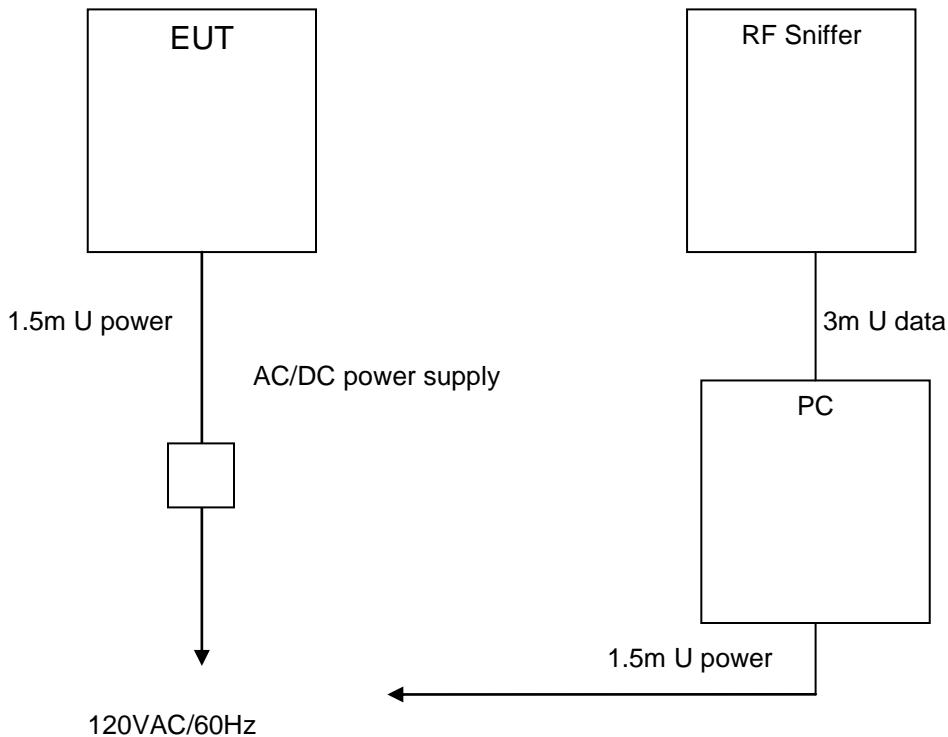


Figure 1. Test Configuration

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 UJX- ROAMMK3MOD1
 6715A-ROAMMK3MOD1
 14-0060
 April 7, 2014
 Acuity Brands Technology Services, Inc.
 ROAMMK3MOD1

2.7 Restricted Bands of Operation (Part 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious cannot exceed the limits of 15.209. Radiated harmonics and other Spurious are examined for this requirement see paragraph 2.10.

2.8 Transmitter Duty Cycle (CFR 35 (c))

The transmitter is capable of sending three types of transmissions. They are listed below, along with their pulse-width duration:

	Phy. overhead	Data length	TX len	Tx duration (μs)	Warm up (μs)	Sw delay (μs)	Total TX (μs)
Nack	8	15	23	736	144	20	900
ACK	8	24	32	1024	144	20	1188
Msg	8	125	133	4256	144	20	4420

The duty cycle de-rating factor used in the calculation of average radiated limits (per CFR 15.209 and 15.35(c)) is described below. This factor was calculated by first determining the worst case scenario for system operation.

The worst-case scenario in any 125 ms timeslot, along with all transmission lengths, will be as follows:

Transmitter Activity	Duration (μs)
Rcv message	
Send nack	736
Rcv message	
Send nack	736
Rcv message	
Send nack	736
Rcv message	
Send nack	736
Rcv message	
Send nack	736
Send message	4256
Rcv ACK	
Total:	7936

The duty cycle is computed as follows (in any 100 ms period):

$$\text{Duty Cycle} = (7936/100000) = 0.07936 \approx 0.08 = 8\%$$

$$\text{Correction Factor} = 20\log_{10}(0.08) = -21.9 \text{ dB}$$

-21.9 dB

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

For the purposes of this report and accompanying submittal package a -20dB factor will be used for all average measurements.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.9 Intentional Radiator, Power Lines Conducted Emissions (CFR 15.207)

The power line conducted voltage emission measurements have been carried out in accordance with CFR 15.207, per ANSI C63.4:2003, Paragraph 7, with a spectrum analyzer connected to an LISN and the EUT placed into a continuous mode of transmission.

The worst-case results for conducted emissions were determined to be produced when the EUT was operating under continuous transmission. The worst case measurement occurred on the Phase line at 0.9965 MHz. The emission level was 8.8 dB from the applicable limit. All other emissions were at least 9.0 dB from the limit. Those results are given in the table below.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 UJX- ROAMMK3MOD1
 6715A-ROAMMK3MOD1
 14-0060
 April 7, 2014
 Acuity Brands Technology Services, Inc.
 ROAMMK3MOD1

Table 5. Transmitter Power Line Conducted Emissions Test Data, Part 15.207

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: GY	Specification Requirement: FCC Part 15.207 Class A		Project No.: 14-0060	Manufacturer: Acuity Brands Model: ROAMMK3MOD1		
Frequency (MHz)	Test Data (dBuV)	LISN+CL-PA (dB)	Corrected Results (dBuV)	Avg Limits (dBuV)	Margin (dB)	Detector
120 VAC, 60 Hz, Phase Line						
0.1997	53.00	1.13	54.13	66.0	11.9	PK
0.9965	50.80	0.38	51.18	60.0	8.8	QP
1.0040	50.60	0.38	50.98	60.0	9.0	QP
6.4350	40.90	0.42	41.32	60.0	18.7	PK
12.7000	32.70	0.50	33.20	60.0	26.8	PK
21.1800	25.10	0.63	25.73	60.0	34.3	PK
120 VAC, 60 Hz, Neutral Line						
0.1987	53.70	1.10	54.80	66.0	11.2	PK
0.9840	47.90	0.37	48.27	60.0	11.7	QP
1.0000	47.70	0.37	48.07	60.0	11.9	QP
6.6050	40.50	0.42	40.92	60.0	19.1	PK
13.4100	34.60	0.51	35.11	60.0	24.9	PK
20.5500	24.70	0.62	25.32	60.0	34.7	PK

(*)= Quasi-Peak limit used

SAMPLE CALCULATION At 0.9965 MHz:

Magnitude of Measured Frequency	50.80	dBuV
+ Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	0.038	dB
Corrected Result	51.18	dBuV

Test Date: April 2, 2014

Tested By
Signature:



Name: George Yang

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.10 Intentional Radiator, Radiated Emissions (Antenna Conducted) (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a))

The EUT was put into a continuous-transmit mode of operation and tested per FCC KDB Publication 558074 for conducted out of band emissions emanating from the antenna port over the frequency range of 30 MHz to 25 GHz. A conducted scan was performed on the EUT to identify and record spurious signals that were related to the transmitter. Antenna Conducted Emissions of a significant magnitude that fell within restricted bands were then measured as radiated emissions on the OATS. The conducted emissions graphs are found in Figures 3 through 8 below. The limit for antenna conducted power is 1 Watt (30 dBm) per 15.247 (b)(3).

For radiated measurements, the EUT was set into a continuous transmission mode. Below 1 GHz, the RBW of the measuring instrument was set equal to 120 kHz. Peak measurements above 1 GHz were measured using a RBW = 1 MHz, with a VBW \geq RBW. The results of peak radiated spurious emissions falling within restricted bands are given in Table 6 below.

For Average Voltage measurements above 1 GHz, the emissions were measured using RBW = 1 MHz and VBW = 10 Hz. For a pulse-modulated transmitter, the EUT's average emissions are further modified by adding to them the worst-case duty cycle, determined by adding the EUT's total pulse widths (on time) over a 100 ms period and dividing by 100 ms.

Note: The following measurements were made with the radio set to its maximum power level of 0XFF. This is deemed to be the worst case setting.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

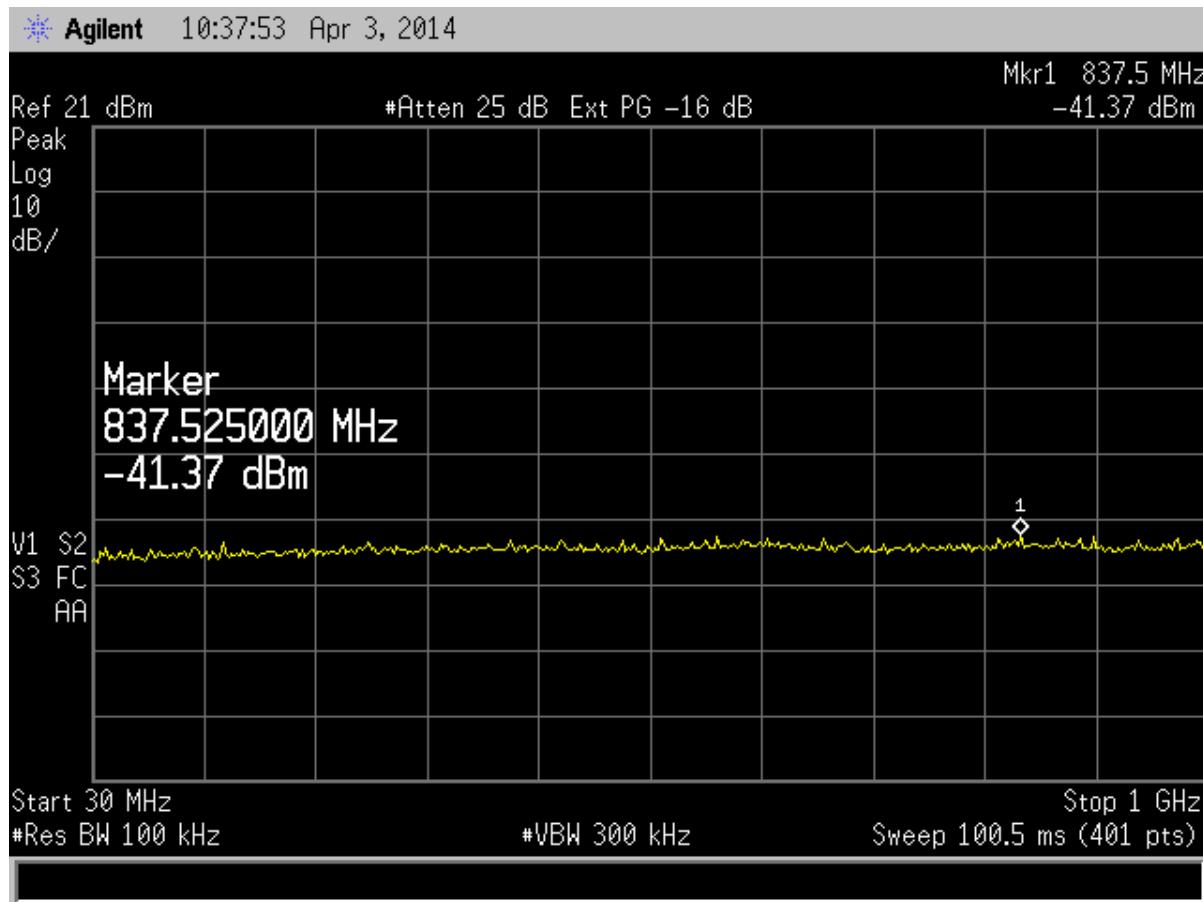


Figure 2. Antenna Conducted Spurious Emissions – Low Channel, Part 1

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

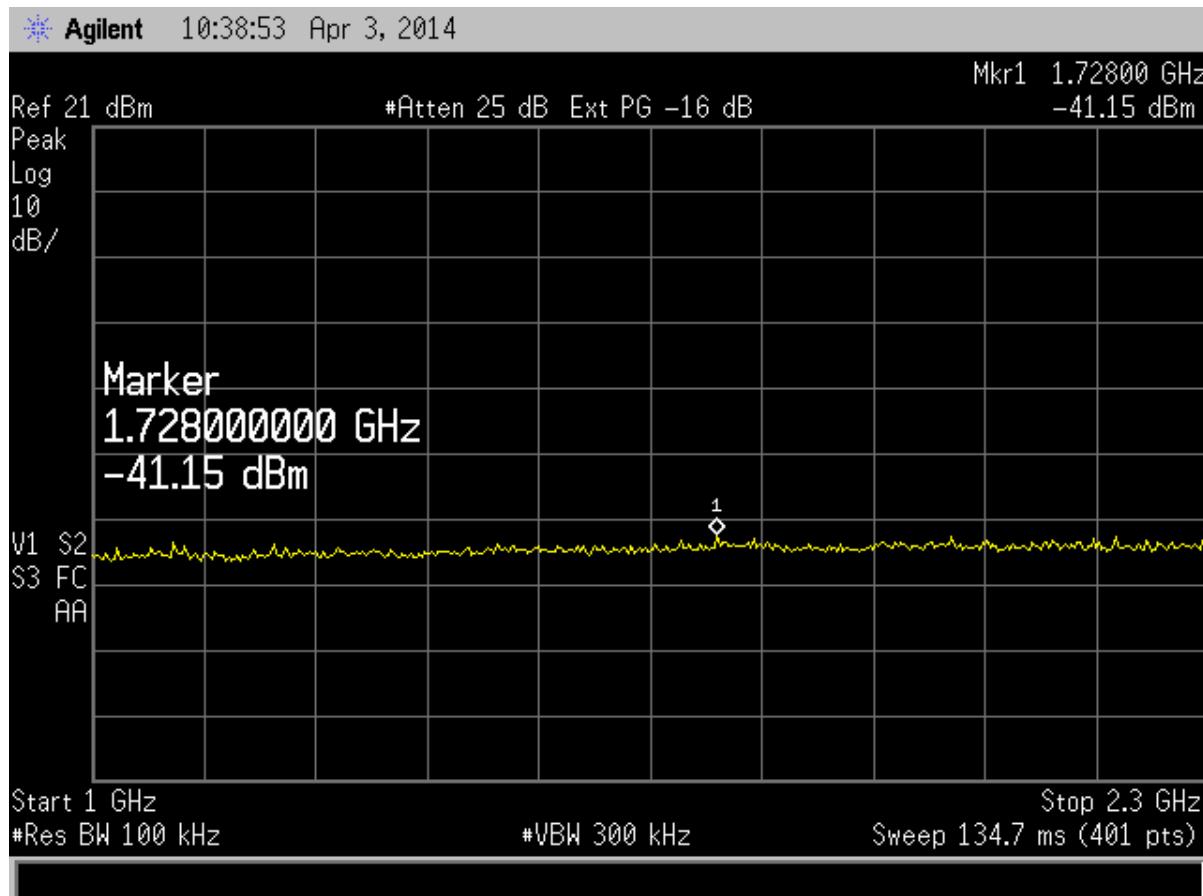


Figure 3. Antenna Conducted Spurious Emissions – Low Channel, Part 2

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

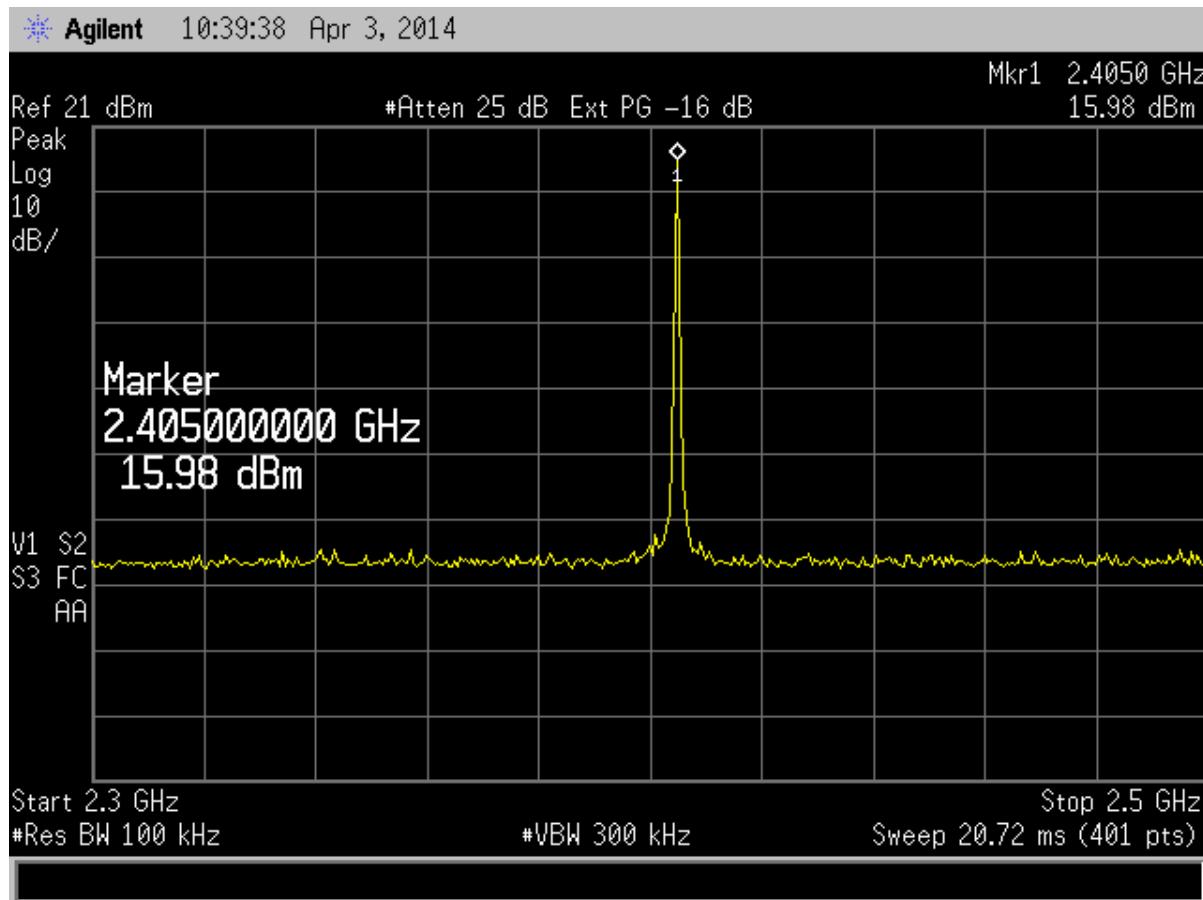


Figure 4. Antenna Conducted Spurious Emissions – Low Channel, Part 3
Note: Large Signal shown is Fundamental Frequency

Magnitude of Fundamental Frequency is less than 30dBm.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

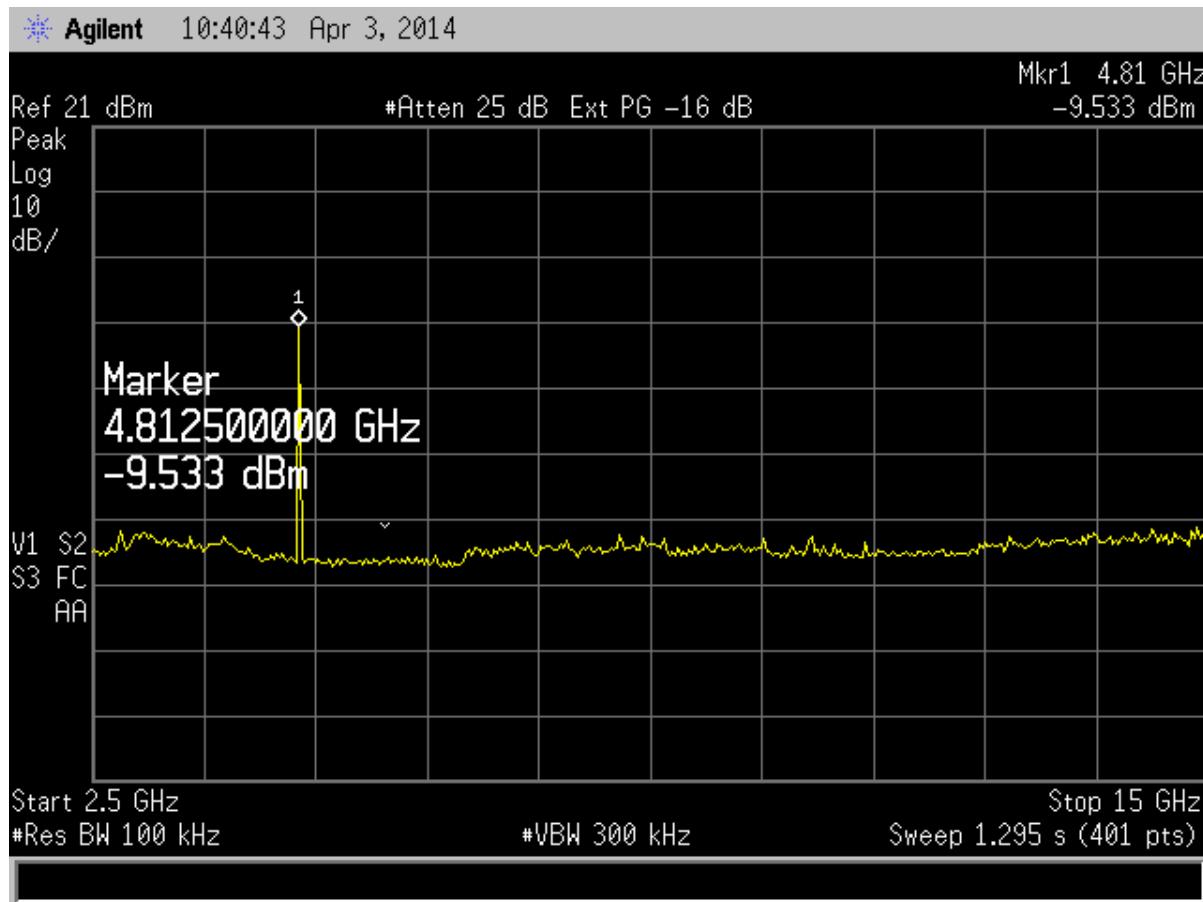


Figure 5. Antenna Conducted Spurious Emissions – Low Channel, Part 4

Note: Large Signal shown is harmonic of fundamental frequency

Magnitude of Fundamental Frequency	15.98 dBm
<u>Magnitude of Harmonic</u>	<u>-(-9.53 dBm)</u>
Difference	25.51 dB

Difference must be at least 20 dB.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

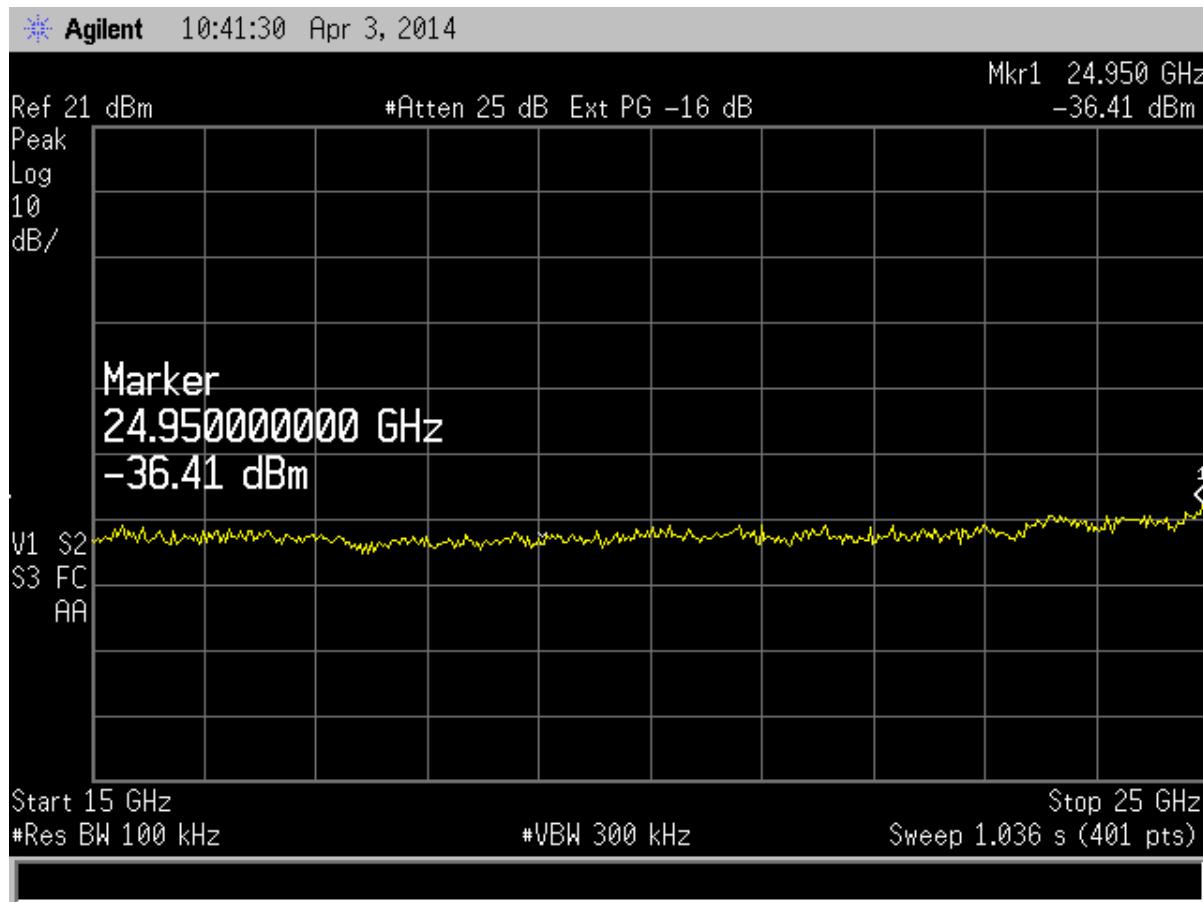


Figure 6. Antenna Conducted Spurious Emissions – Low Channel, Part 5

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

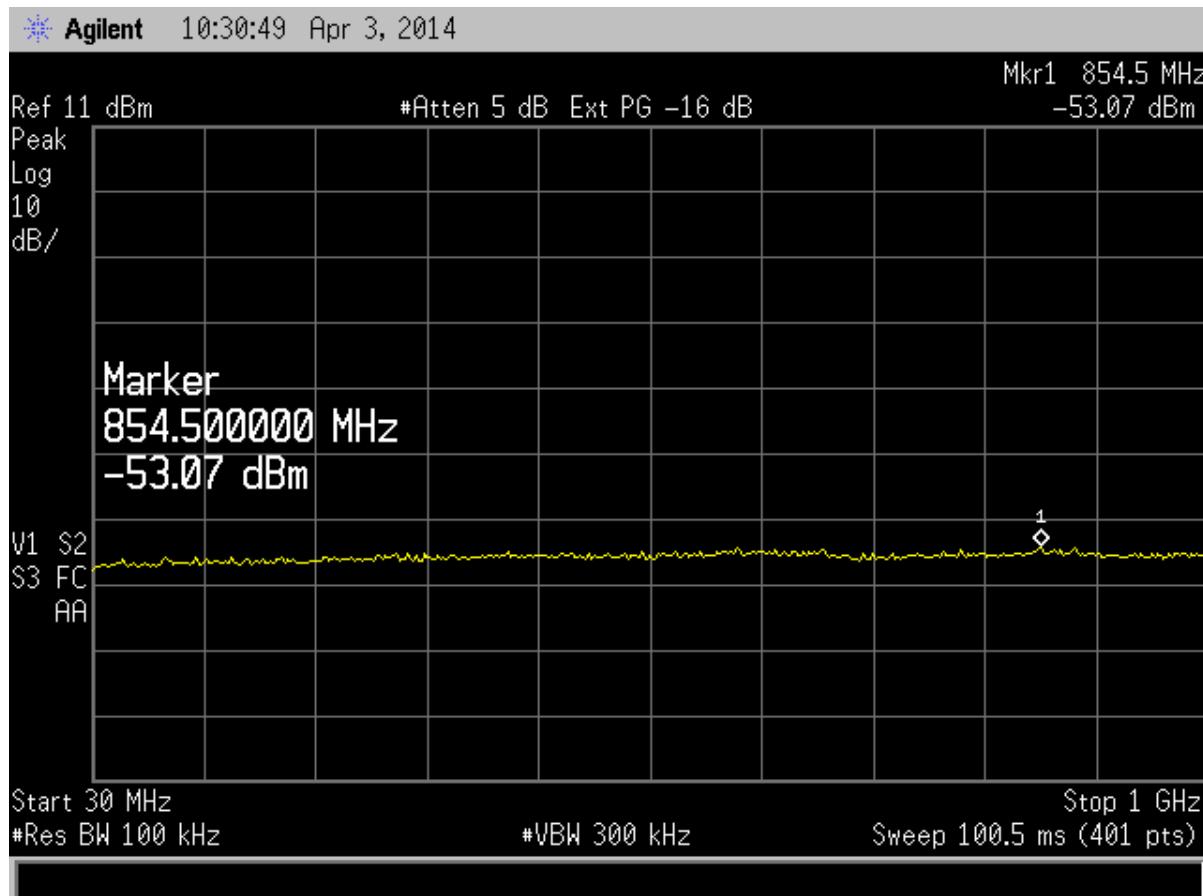


Figure 7. Antenna Conducted Spurious Emissions – Mid Channel, Part 1

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

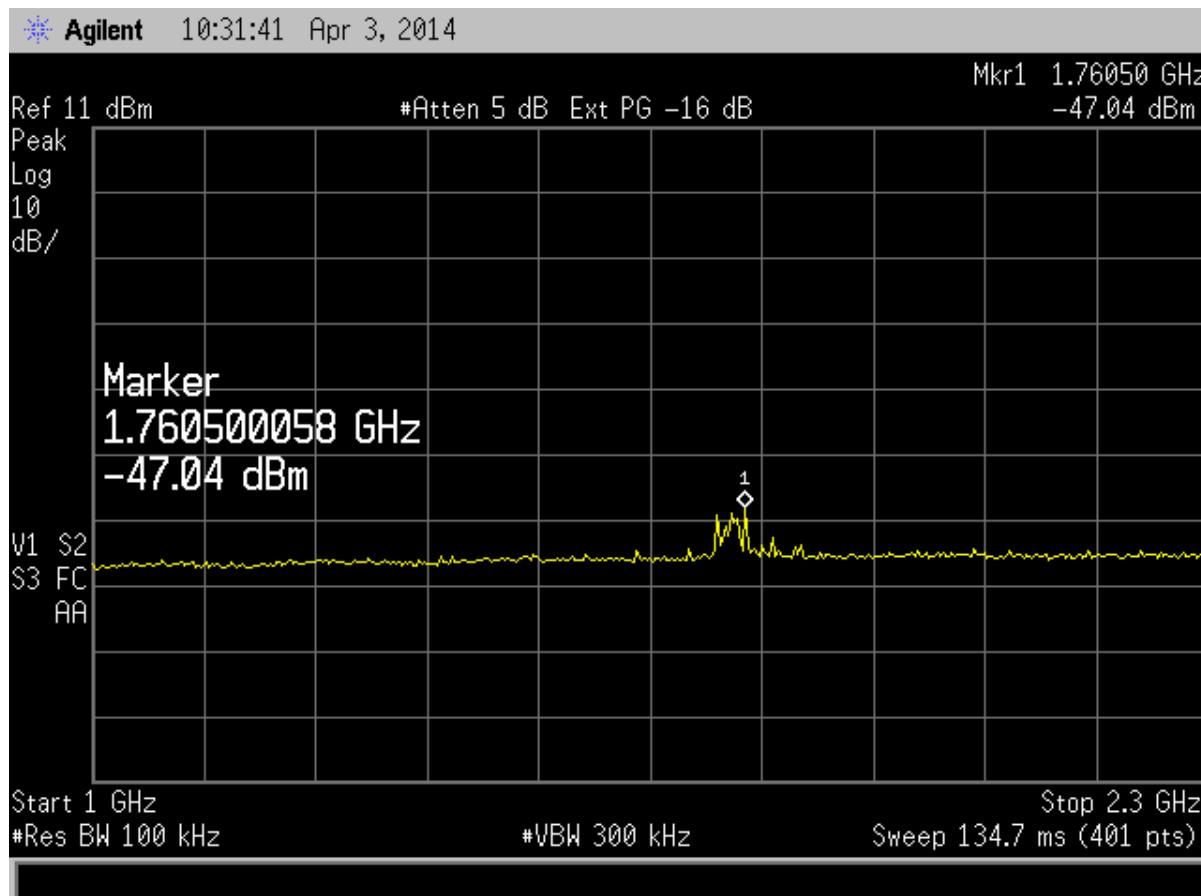


Figure 8. Antenna Conducted Spurious Emissions – Mid Channel, Part 2

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

Note: Signal shown represents Fundamental Frequency

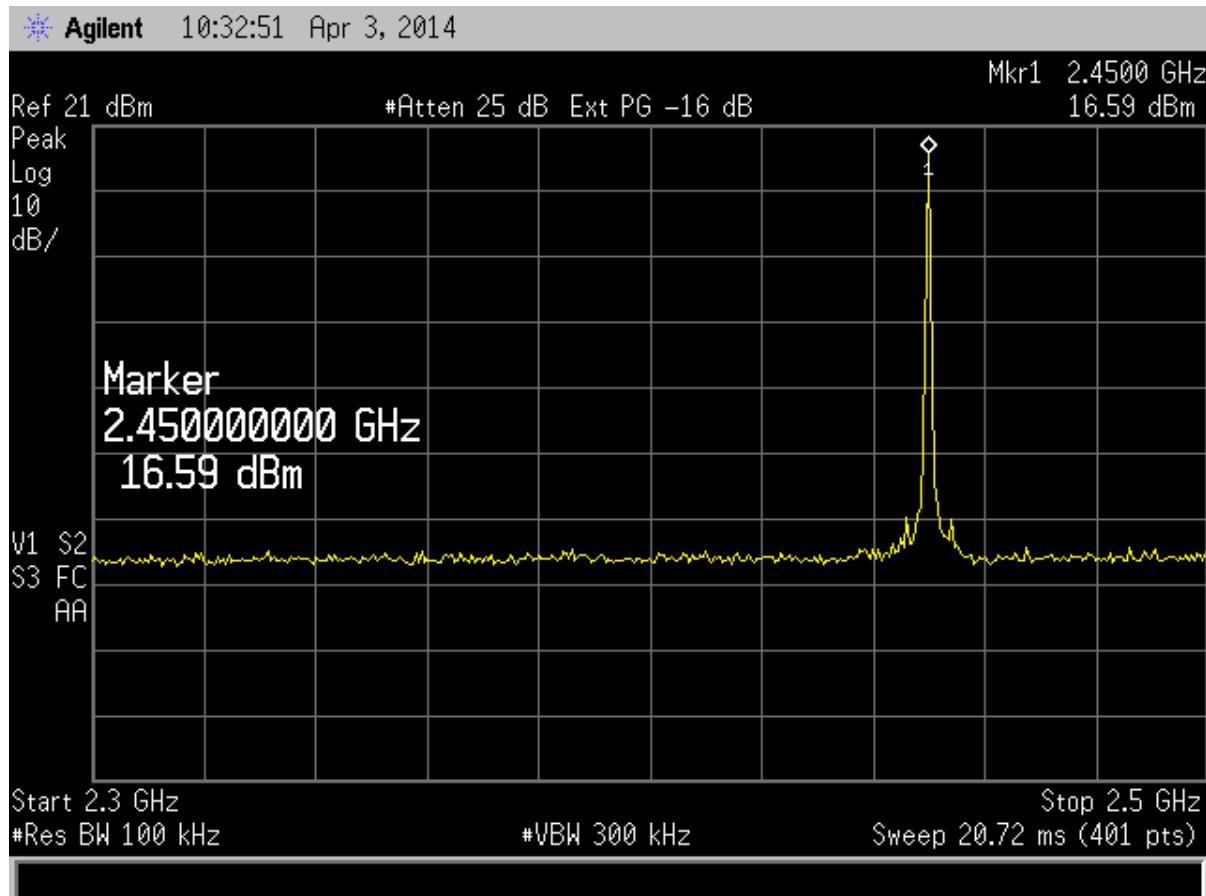


Figure 9. Antenna Conducted Spurious Emissions – Mid Channel, Part 3

Note: Large Signal shown is Fundamental Frequency

Magnitude of Fundamental Frequency is less than 30 dBm.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

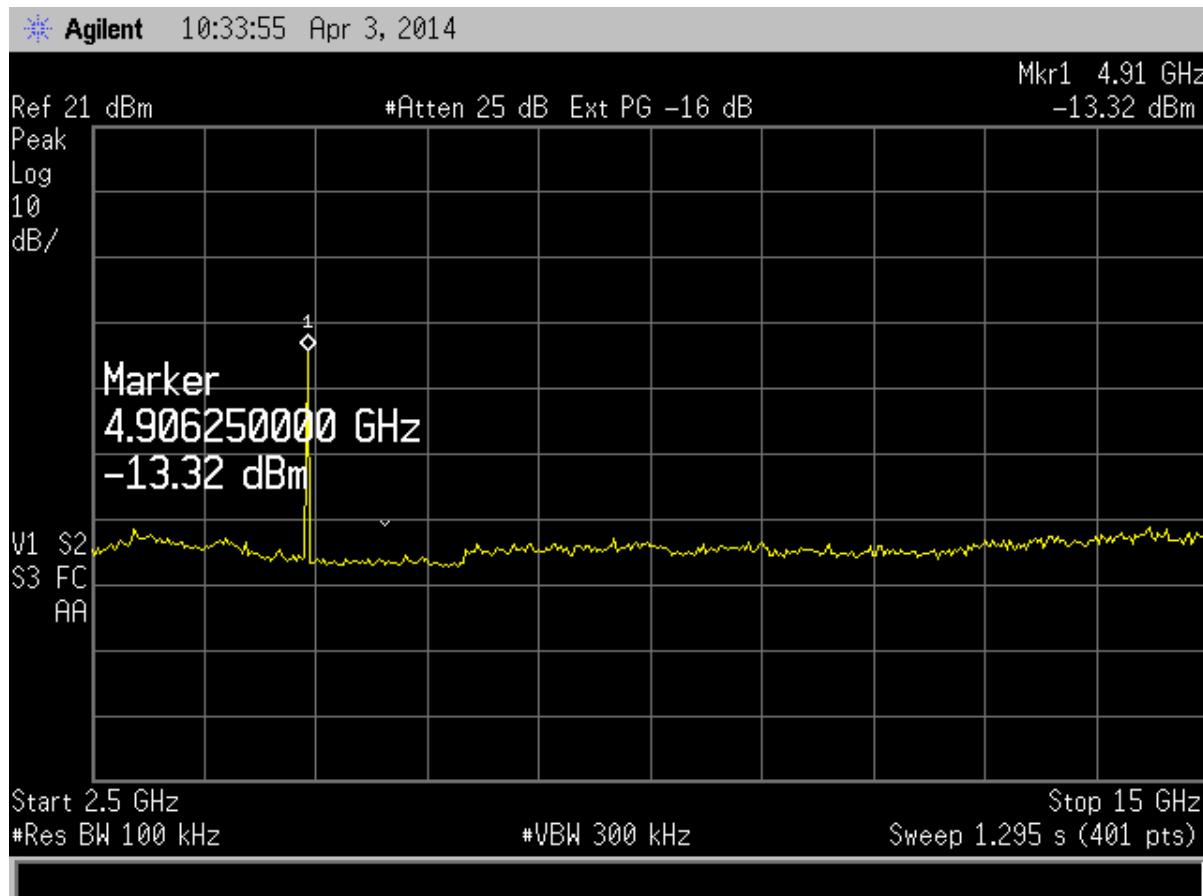


Figure 10. Antenna Conducted Spurious Emissions – Mid Channel, Part 4

Note: Large Signal shown is harmonic of fundamental frequency

Magnitude of Fundamental Frequency	16.59 dBm
Magnitude of Harmonic	-(-13.32 dBm)
Difference	29.91 dB

Difference must be at least 20 dB.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

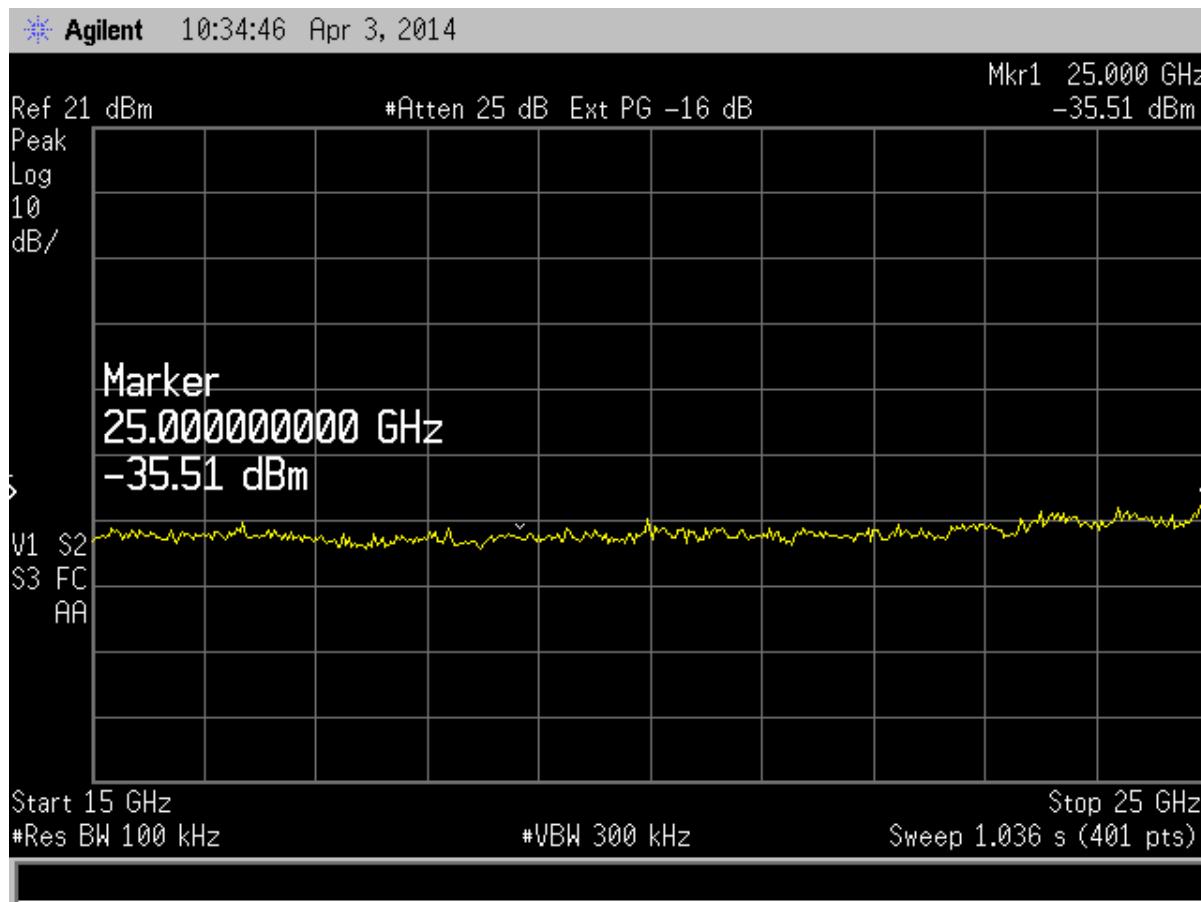


Figure 11. Antenna Conducted Spurious Emissions – Mid Channel, Part 5

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

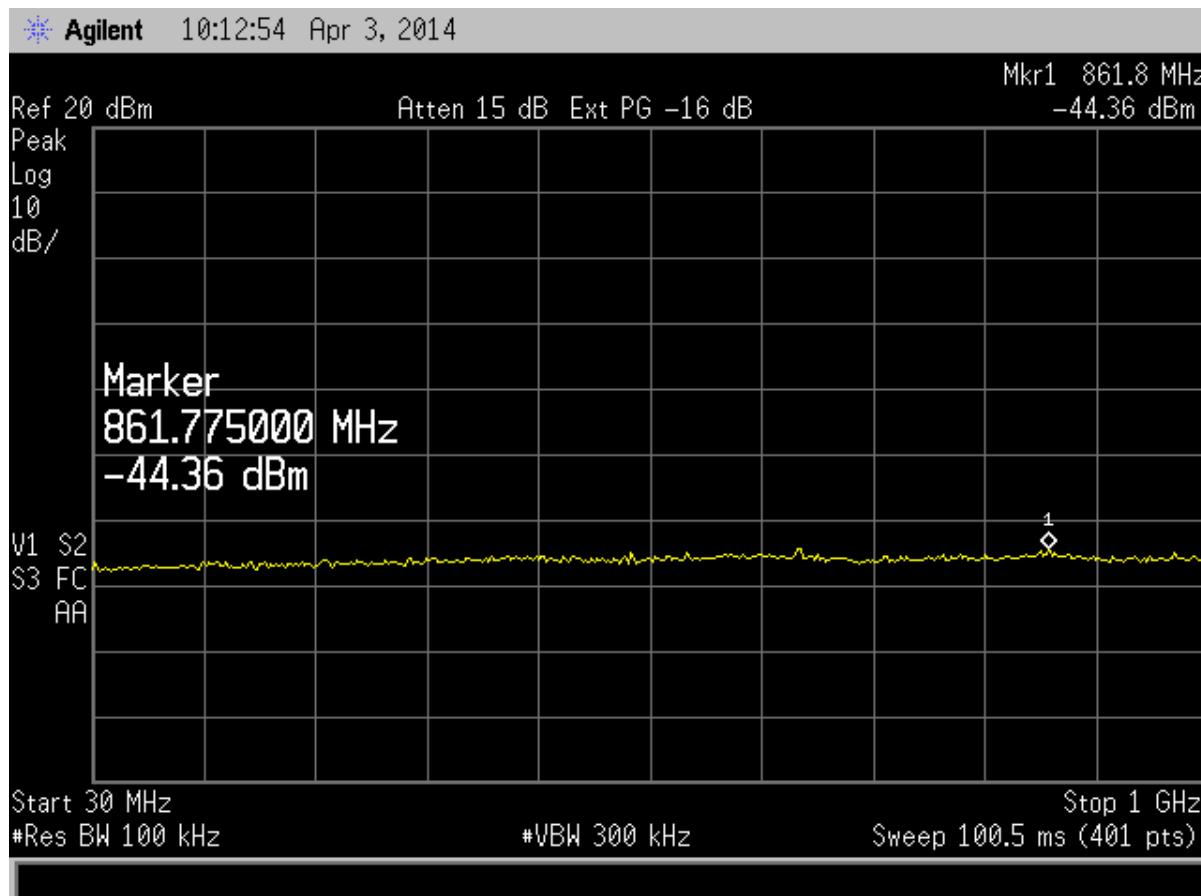


Figure 12. Antenna Conducted Spurious Emissions – High Channel, Part 1

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

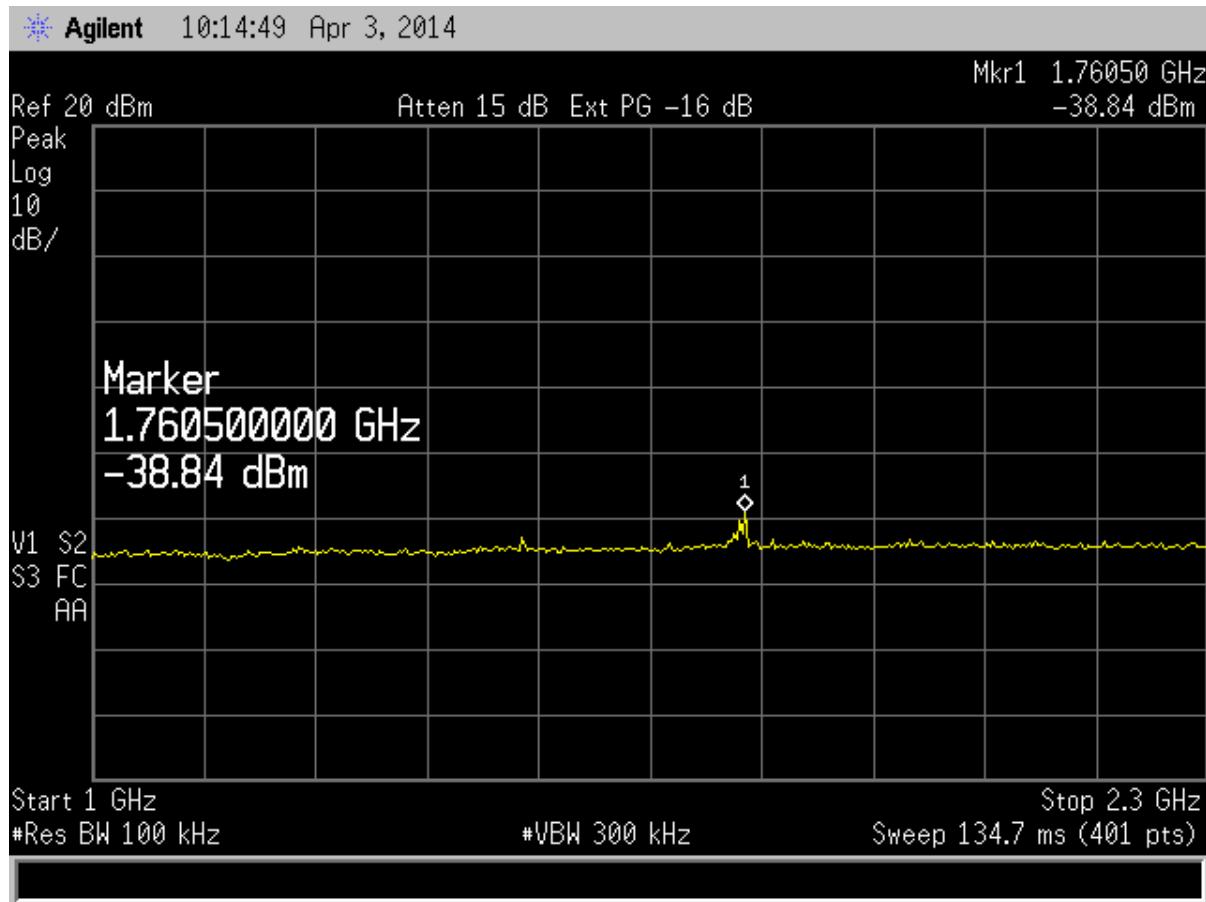


Figure 13. Antenna Conducted Spurious Emissions – High Channel, Part 2

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

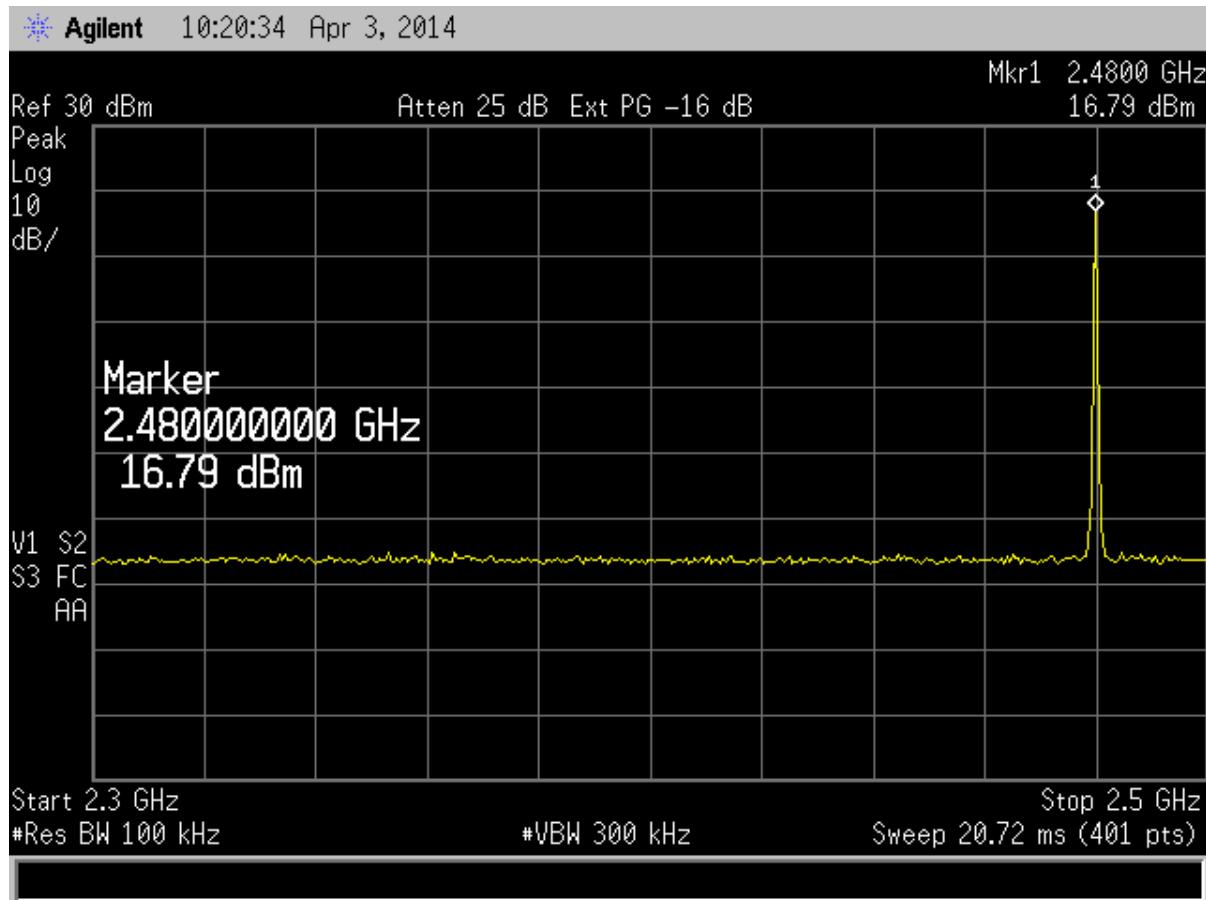


Figure 14. Antenna Conducted Spurious Emissions – High Channel, Part 3

Note: Large Signal shown is Fundamental Frequency

Magnitude of Fundamental Frequency is less than 30 dBm.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

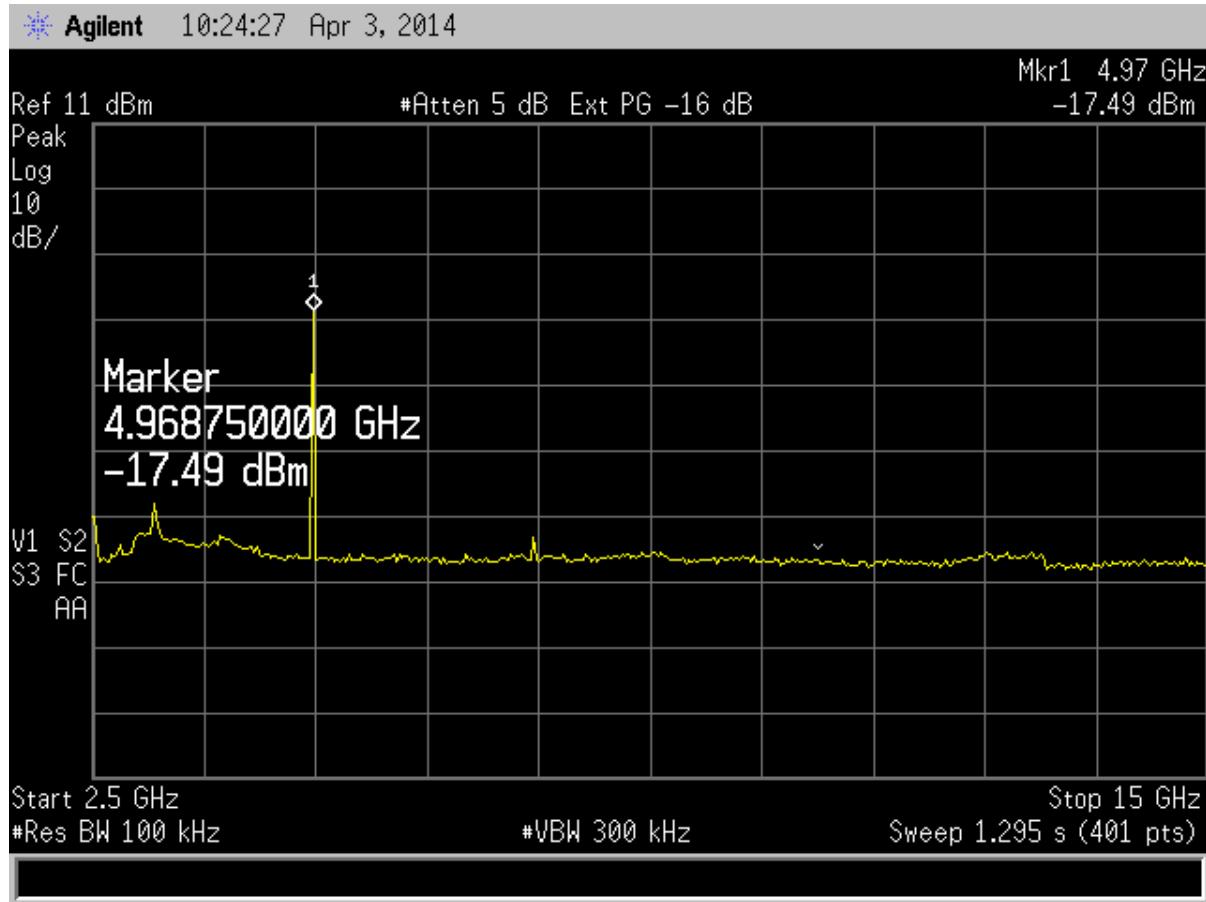


Figure 15. Antenna Conducted Spurious Emissions – High Channel, Part 4

Note: Large Signal shown is harmonic of fundamental frequency

Magnitude of Fundamental Frequency	16.79 dBm
Magnitude of Harmonic	-(-17.49 dBm)
Difference	24.28 dB

Difference must be at least 20 dB.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

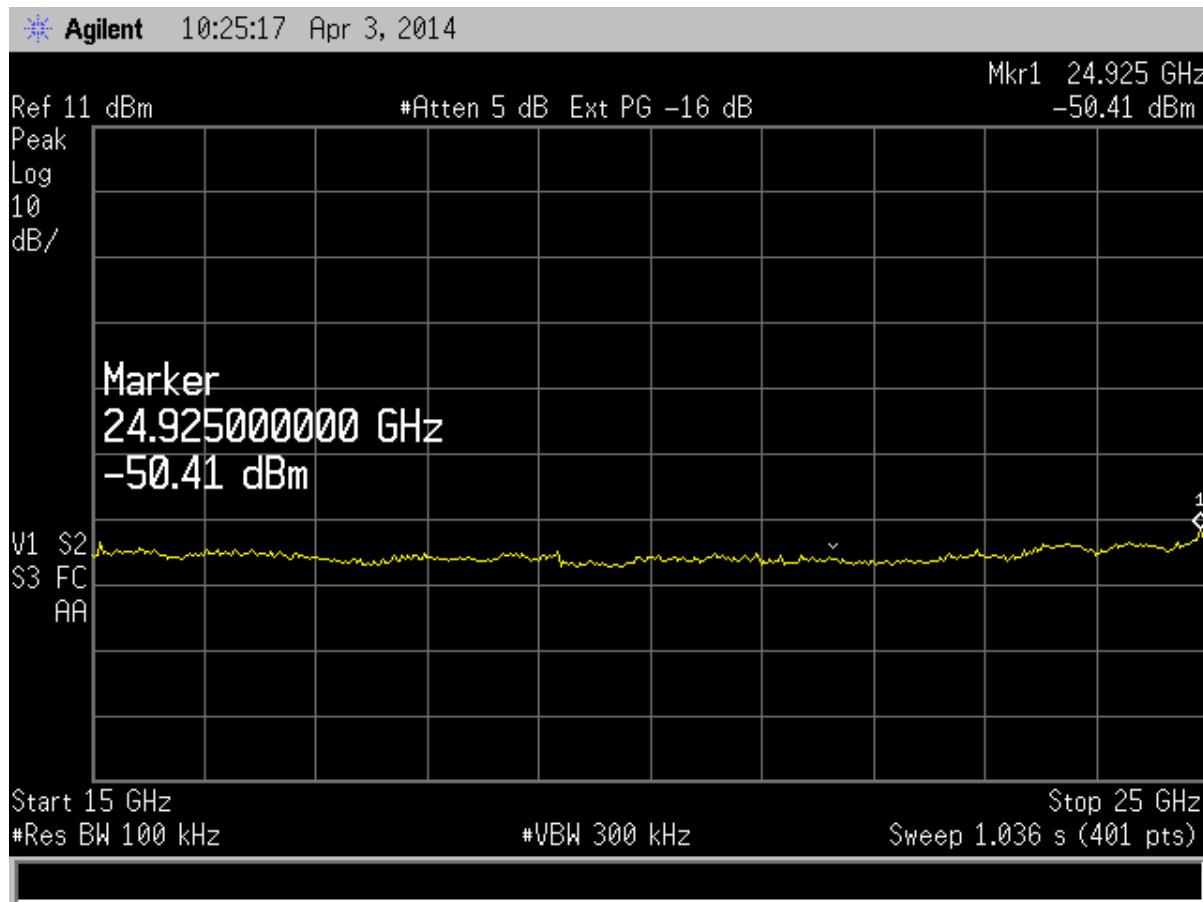


Figure 16. Antenna Conducted Spurious Emissions – High Channel, Part 5

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.11 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.247(d)) (IC RSS 210, A2.9 (a))

On the OATS, the EUT was mounted on top of a non-conductive table, 80 cm above the floor, by placing it in the X-Z plane along the Z axis with its bottom cover in parallel with the ground. The front of the EUT faced the measurement antenna located 3 meters away. Each signal measured was maximized by raising and lowering the receive antenna between 1 and 4 meters in height while monitoring the ever changing spectrum analyzer display (with channel A in the Clear-Write mode and channel B in the Max-Hold mode) for the largest signal visible. That exact antenna height where the signal was maximized was recorded for reproducibility purposes. Also, the EUT was rotated about its Y-axis while monitoring the Spectrum Analyzer display for maximum. The EUT azimuth was recorded for reproducibility purposes. The EUT was measured when both maxima were simultaneously satisfied.

The test data is detailed below for this section. Several radiated emissions above 1 GHz were measured at a distance of 1 meter. The measured value at 1 meter was then extrapolated to the resultant at 3 meters using an inverse distance extrapolation factor of -20 dB/decade. There were no test failures.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 UJX- ROAMMK3MOD1
 6715A-ROAMMK3MOD1
 14-0060
 April 7, 2014
 Acuity Brands Technology Services, Inc.
 ROAMMK3MOD1

Table 6. Antenna 1- Peak Radiated Fundamental & Harmonic Emissions

Tested By: JW	Test: FCC Part 15, Para 15.247(d) Project: 14-0060			Client: Acuity Brands Model: ROAMMK3MOD1		
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)
Low Channel - PEAK						
2404.96	80.90	31.88	112.78		3M/Hor.	
4809.95	67.44	4.15	*71.59	74.0	3M/Hor.	2.4
7214.57	48.30	11.70	~50.50	92.8	1M/Hor.	42.3
Mid Channel - PEAK						
2449.93	81.54	31.98	113.52		3M/Hor.	
4899.83	55.25	4.29	*59.54	74.0	3M/Hor.	14.5
High Channel – PEAK						
2479.90	82.10	31.83	113.93		3M/Hor.	
4959.72	52.36	3.60	*55.96	74.0	3M/Hor.	18.0

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic (25GHz using EMCO 3116 Horn Antenna)
3. (~)Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).
4. Sample Calculation at 7214.57MHz:

Magnitude of Measured Frequency	48.30	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	11.70	dB/m
1 meter to 3 meter extrapolation	-9.50	dB
Corrected Result	50.50	dBuV/m

Test Date: April 1, 2014

Tested By

Signature: John C Wynn

Name: John Wynn

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 UJX- ROAMMK3MOD1
 6715A-ROAMMK3MOD1
 14-0060
 April 7, 2014
 Acuity Brands Technology Services, Inc.
 ROAMMK3MOD1

Table 7. Antenna 1- Average Radiated Fundamental & Harmonic Emissions

Tested By: JW	Test: FCC Part 15, Para 15.247(d) Project: 14-0060			Client: Acuity Brands Model: ROAMMK3MOD1		
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)
Low Channel - Average						
2404.96	80.90	11.88	92.78		3M/Hor.	
4809.95	67.44	-15.85	51.59	54.0	3M/Hor.	2.4
7214.57	37.59	-8.30	**19.79	72.8	1M/Hor.	53.0
Mid Channel - Average						
2449.93	81.63	11.98	93.61		3M/Hor.	
4899.83	50.27	-15.71	34.56	54.0	3M/Hor.	19.4
High Channel - Average						
2479.90	81.91	11.83	93.74		3M/Hor.	
4959.72	47.58	-16.40	31.18	54.0	3M/Hor.	22.8

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for **peak** measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic (25GHz using EMCO 3116 Horn Antenna)
3. (~)Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).
4. All measurements are corrected with a -20dB duty. See section 2.8
5. Sample Calculation at 7214.57MHz:

Magnitude of Measured Frequency	37.59	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	-8.30	dB/m
<u>1 meter to 3 meter extrapolation</u>	-9.50	dB
Corrected Result	19.79	dBuV/m

Test Date: April 1, 2014

Tested By

Signature: John C Wynn

Name: John Wynn

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 UJX- ROAMMK3MOD1
 6715A-ROAMMK3MOD1
 14-0060
 April 7, 2014
 Acuity Brands Technology Services, Inc.
 ROAMMK3MOD1

Table 8. Antenna 2- Peak Radiated Fundamental & Harmonic Emissions

Tested By: JW	Test: FCC Part 15, Para 15.247(d) Project: 14-0060			Client: Acuity Brands Model: ROAMMK3MOD1		
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)
Low Channel - Peak						
2404.96	70.12	31.88	102.00		3M/Hor.	
4809.95	65.02	4.15	*69.17	74.0	3M/Hor.	4.8
7214.87	56.47	11.10	67.57	82.0	3M/Hor.	14.4
9619.75	51.88	15.69	~58.07	82.0	1M/Hor.	23.9
12024.60	52.27	19.13	~*61.90	74.0	1M/Hor.	12.1
16834.45	45.42	23.81	~59.73	82.0	1M/Hor.	22.3
Mid Channel - Peak						
2449.95	69.32	31.98	101.30		3M/Hor.	
4899.90	63.37	4.29	*67.66	74.0	3M/Hor.	6.3
7349.79	54.70	12.68	*67.38	74.0	3M/Hor.	6.6
9799.58	42.90	14.84	48.24	81.3	1M/Hor.	33.1
12249.78	52.02	20.90	~*63.42	74.0	1M/Hor.	10.6
17149.50	49.79	27.71	~68.00	81.3	1M/Hor.	13.3
High Channel - Peak						
2479.90	69.28	31.83	101.11		3M/Hor.	
4959.72	63.25	3.60	*66.85	74.0	3M/Hor.	7.2
7422.37	52.91	12.19	65.10	80.1	3M/Hor.	15.0
9919.65	50.44	14.40	~55.34	80.1	1M/Hor.	24.8
12399.60	54.29	20.50	~*65.29	74.0	1M/Hor.	8.7
17349.55	50.86	28.28	~69.64	80.1	1M/Hor.	10.5

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic (25GHz using EMCO 3116 Horn Antenna)
3. (~)Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).
4. Sample Calculation at 9799.58MHz:

Magnitude of Measured Frequency	42.90	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	14.48	dB/m
1 meter to 3 meter extrapolation	-9.50	dB
Corrected Result	48.24	dBuV/m

Test Date: April 1, 2014

Tested By 
 Signature: _____

Name: John Wynn

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 UJX- ROAMMK3MOD1
 6715A-ROAMMK3MOD1
 14-0060
 April 7, 2014
 Acuity Brands Technology Services, Inc.
 ROAMMK3MOD1

Table 9. Antenna 2- Average Radiated Fundamental & Harmonic Emissions

Tested By: JW	Test: FCC Part 15, Para 15.247(d) Project: 14-0060			Client: Acuity Brands Model: ROAMMK3MOD1		
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB/m)	Corrected Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)
Low Channel - Average						
2404.96	70.08	11.78	81.86		3M/Hor.	
4809.95	63.90	-15.94	47.96	54.0	3M/Hor.	6.0
7214.57	54.22	-8.88	45.34	61.9	3M/Hor.	16.5
9619.75	47.92	-4.31	~34.11	61.9	1M/Hor.	27.8
12024.60	49.19	-0.87	~38.82	54.0	1M/Hor.	15.2
16834.45	51.62	3.67	~45.79	61.9	1M/Hor.	16.1
Mid Channel - Average						
2449.95	68.32	11.98	80.30		3M/Hor.	
4899.90	60.79	-15.71	45.08	54.0	3M/Hor.	8.9
7349.79	51.82	-7.32	44.50	54.0	3M/Hor.	9.5
9799.58	40.53	-5.16	~25.87	60.3	1M/Hor.	34.4
12249.78	48.05	0.90	~39.45	54.0	1M/Hor.	14.5
17149.50	44.64	22.47	~57.61	60.3	1M/Hor.	2.7
High Channel - Average						
2479.90	68.76	11.73	80.49		3M/Hor.	
4959.72	61.65	-16.42	45.23	54.0	3M/Hor.	8.8
7422.37	49.41	-7.87	41.54	60.5	3M/Hor.	18.9
9919.65	43.95	-5.64	~28.81	60.5	1M/Hor.	31.7
12399.60	49.62	0.69	~40.81	54.0	1M/Hor.	13.2
17349.55	50.86	8.24	~49.60	60.5	1M/Hor.	10.9

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic (25GHz using EMCO 3116 Horn Antenna)
3. (~)Measurements taken at 1 meter were extrapolated to 3 meter using a factor of (-9.5 dB).
4. All measurements are corrected with a -20dB duty. See section 2.8
5. Sample Calculation at 9799.58MHz:

Magnitude of Measured Frequency	40.53	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	-5.16	dB
<u>1 meter to 3 meter extrapolation</u>	-9.50	dB
Corrected Result	25.87	dBuV/m

Test Date: April 1, 2014

Tested By: John C Wynn
 Signature: John C Wynn

Name: John Wynn

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.12 Band Edge Measurements – (CFR 15.247 (d))

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Antenna port conducted measurements are performed to demonstrate compliance with the requirement of 15.247(d) that all emissions outside of the band edges be attenuated by at least 20 dB when compared to its highest in-band value (contained in a 100 kHz band). Because these frequencies occur above 1000 MHz they have both a peak and average requirement.

To capture the band edge set the Spectrum Analyzer frequency span large enough (usually around 10 MHz) to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. Conducted measurements are performed with RBW $\geq 1\%$ of the frequency span. In all cases, the VBW is set \geq RBW. See figure 24 and 25 below.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

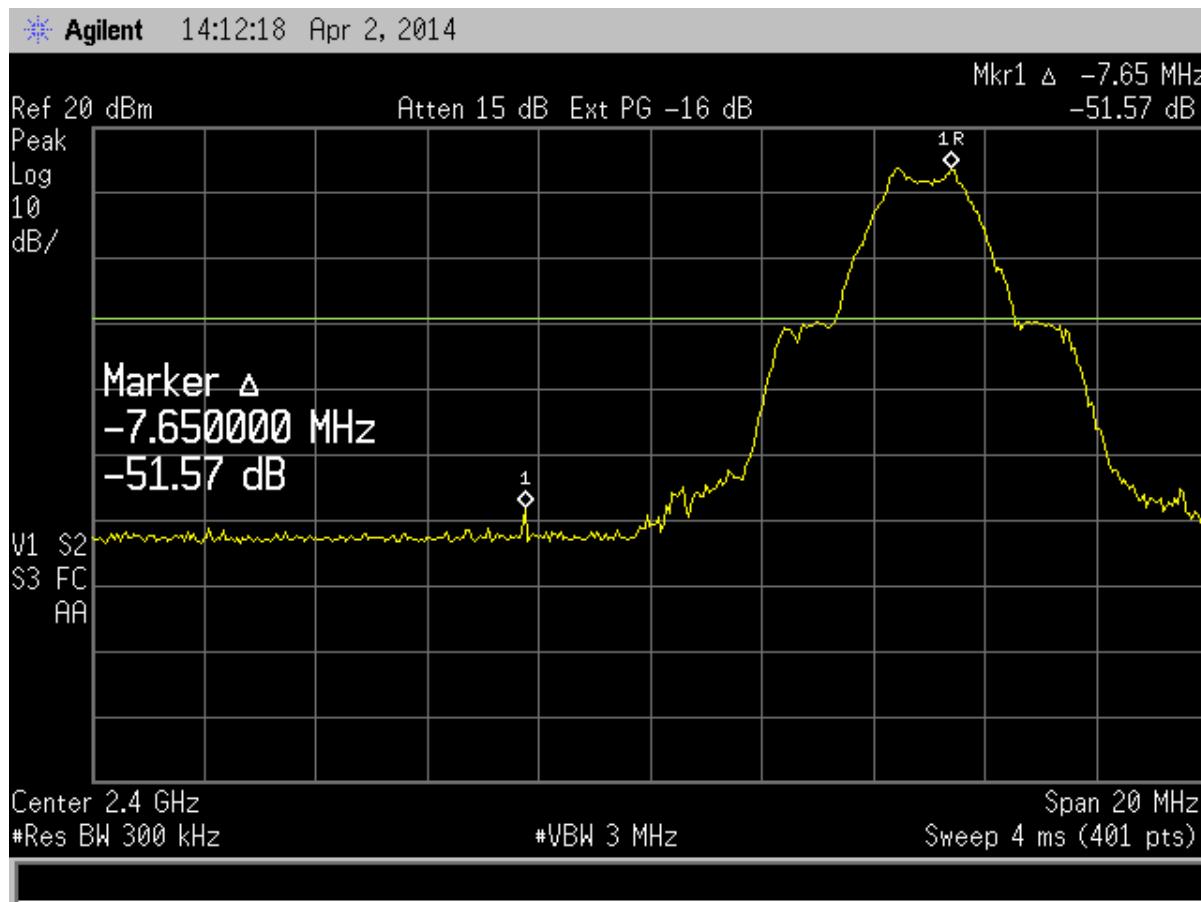


Figure 17. Band Edge Compliance – Low Channel Delta - Peak

Lower band edge must be greater than 20 dB.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

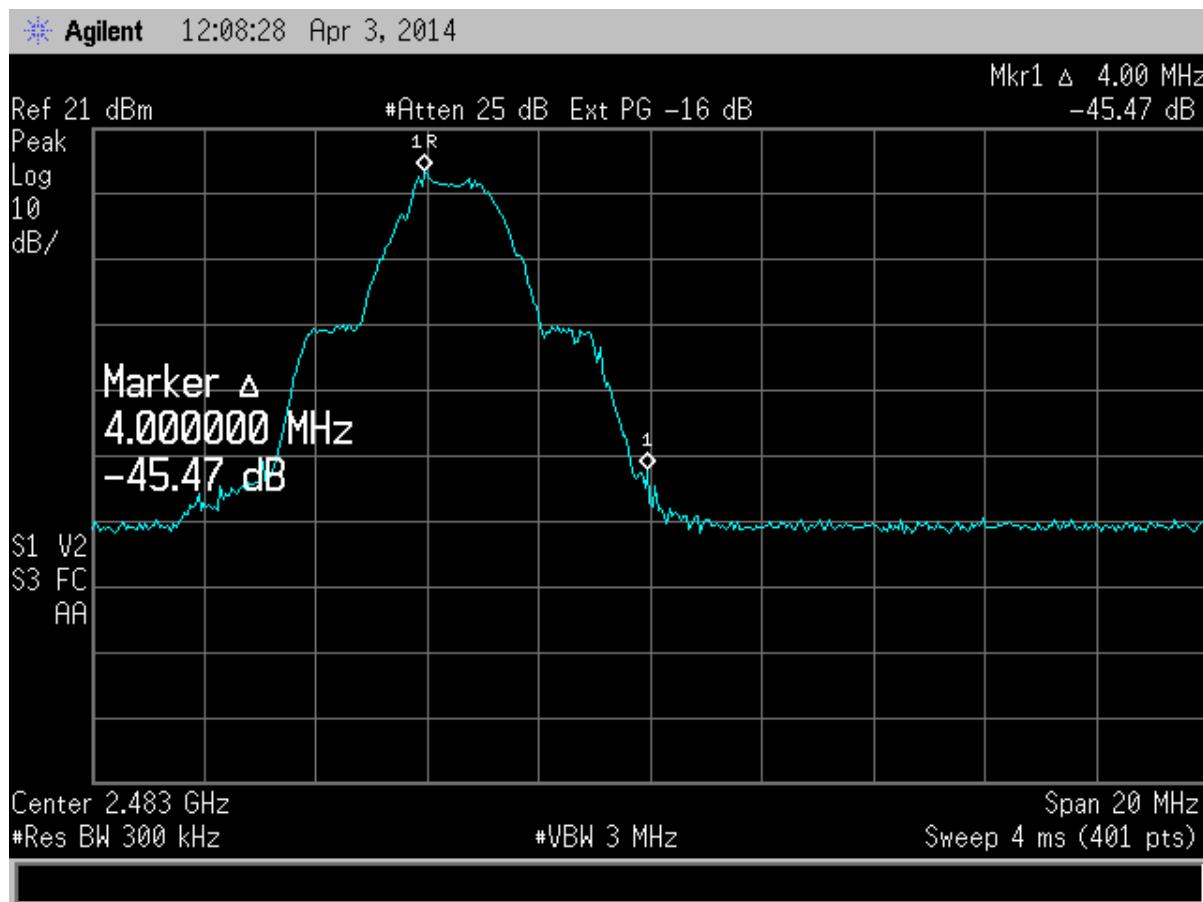


Figure 18. Figure 20. Band Edge Compliance – High Channel Delta - Peak

The limit for the average value of radiated emissions in a Restricted Band is 54 dBuV/m. To compute the average values of the band edge emissions, the duty cycle correction factor of -20.0 dB is applied to the values in the Corrected Results column. After this correction the EUT is found to have met the restrictions placed on average radiated emissions in Restricted Bands. The worst-case measurement is computed below.

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

Calculation of worst case PEAK upper band edge measurement:

High Channel Corrected Measured Value from Table 6	113.93	dBuV
<u>High Channel Band Edge Delta from Figure 28</u>	<u>-45.47</u>	<u>dB</u>
Calculated Result	68.46	dBuV/m
Average Limit + 20dB Relaxation for PEAK	74.00	dBuV/m
<u>Calculated Result</u>	<u>-68.46</u>	<u>dBuV/m</u>
Band Edge Margin	5.54	dBuV/m

Calculation of worst case AVERAGE upper band edge measurement:

High Channel Corrected Measured Value from Table 7	93.74	dBuV
<u>High Channel Band Edge Delta from Figure 28</u>	<u>-45.47</u>	<u>dB</u>
Calculated Result	48.27	dBuV/m
Peak Limit	54.00	dBuV/m
<u>Calculated Result</u>	<u>-48.27</u>	<u>dBuV/m</u>
Band Edge Margin	5.73	dBuV/m

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.13 Six (6) dB Bandwidth per CFR 15.247(a)(2), (IC RSS 210, A8.2(a))

The EUT antenna port was connected to a spectrum analyzer having a $50\ \Omega$ input impedance. Measurements were performed similar to the method of FCC, KDB Publication No. 558074 for a bandwidth of 6 dB. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW \geq RBW. The results of this test are given in the table below and Figures below.

Table 10. Six (6) dB Bandwidth

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum FCC Bandwidth (MHz)
2405	1.64	0.5
2450	1.58	0.5
2480	1.58	0.5

Test Date: April 2, 2014

Tested By

Signature: John C Wynn

Name: John Wynn

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1



Figure 19. Six dB Bandwidth - 15.247 (a) (2) - Low Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

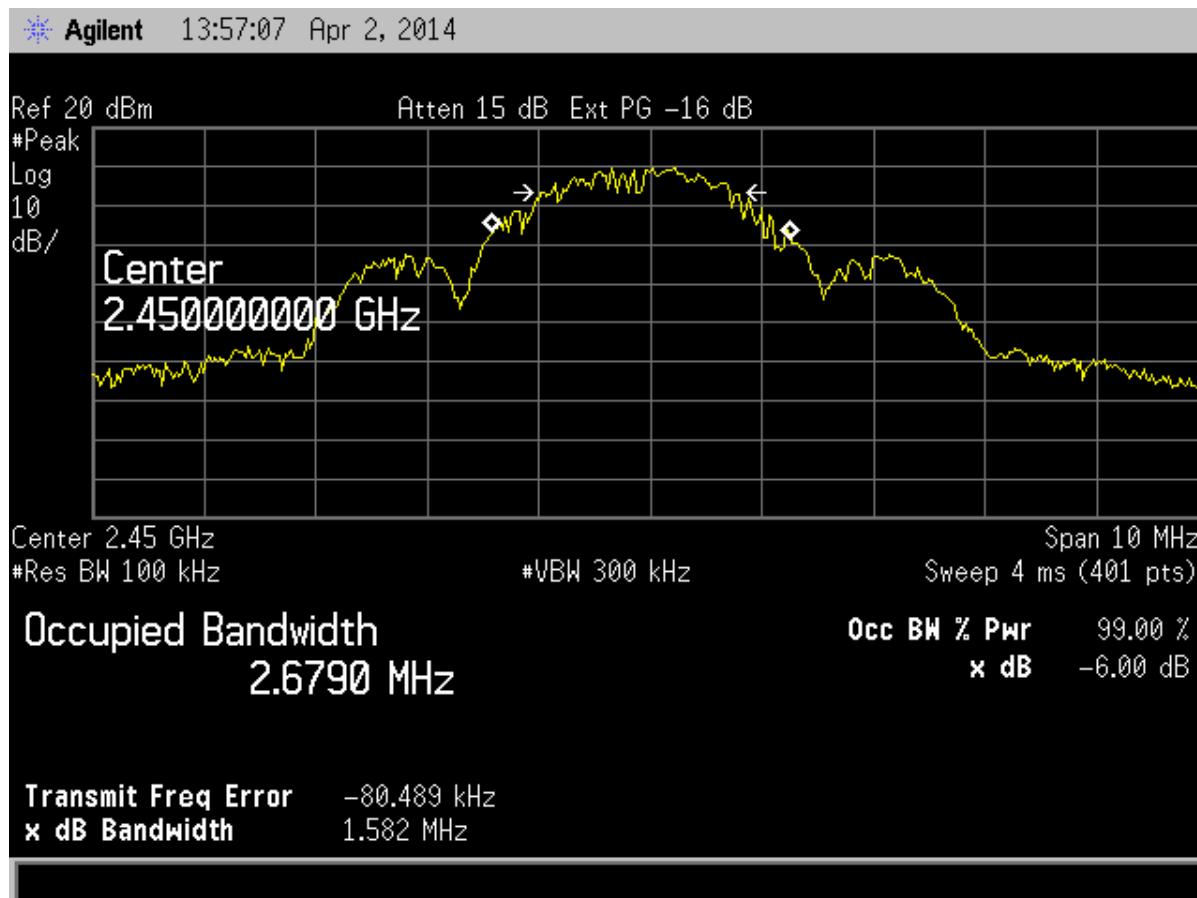


Figure 20. Six dB Bandwidth - 15.247 (a) (2) - Mid Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

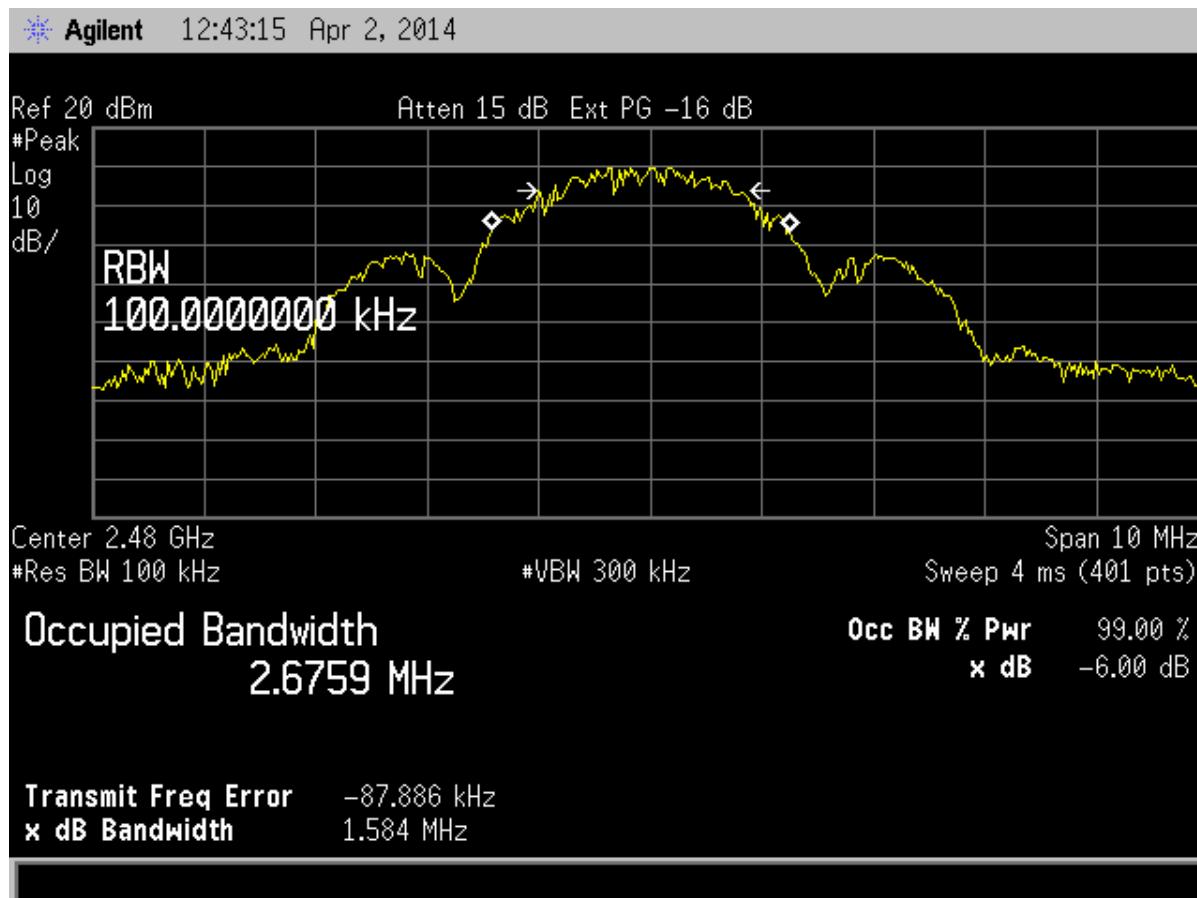


Figure 21. Six dB Bandwidth - 15.247 (a) (2) - High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.14 Maximum Peak Conducted Output Power (CFR 15.247 (b) (3))

For the ROAMMK3MOD1 module, the transmitter was programmed to operate at a maximum output power across the bandwidth. For this test the output power of the radio was set to the highest level, 0XFF.

Peak power within the band 2400 MHz to 2483.5 MHz was measured per FCC KDB Publication 558074 as an Antenna Conducted test with a spectrum analyzer by connecting the spectrum analyzer directly, via a short RF cable, and attenuators to the antenna output terminals on the EUT. The spectrum analyzer was set for an impedance of 50Ω with the RBW set greater than the 6 dB bandwidth of the EUT, and the $VBW \geq RBW$. Peak antenna conducted output power is tabulated in the table below.

Table 11. Peak Antenna Conducted Output Power per Part 15.247 (b) (3)

Frequency of Fundamental (MHz)	Raw Test Data dBm	Converted Data (mW)	FCC Limit (mW Maximum)
2405.35	14.32	27.04	1000
2450.25	14.79	30.13	1000
2480.40	15.14	32.66	1000

Test Date: April 2, 2014

Tested By

Signature:

Name: John Wynn

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1



Figure 22. Peak Antenna Conducted Output Power, Low Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

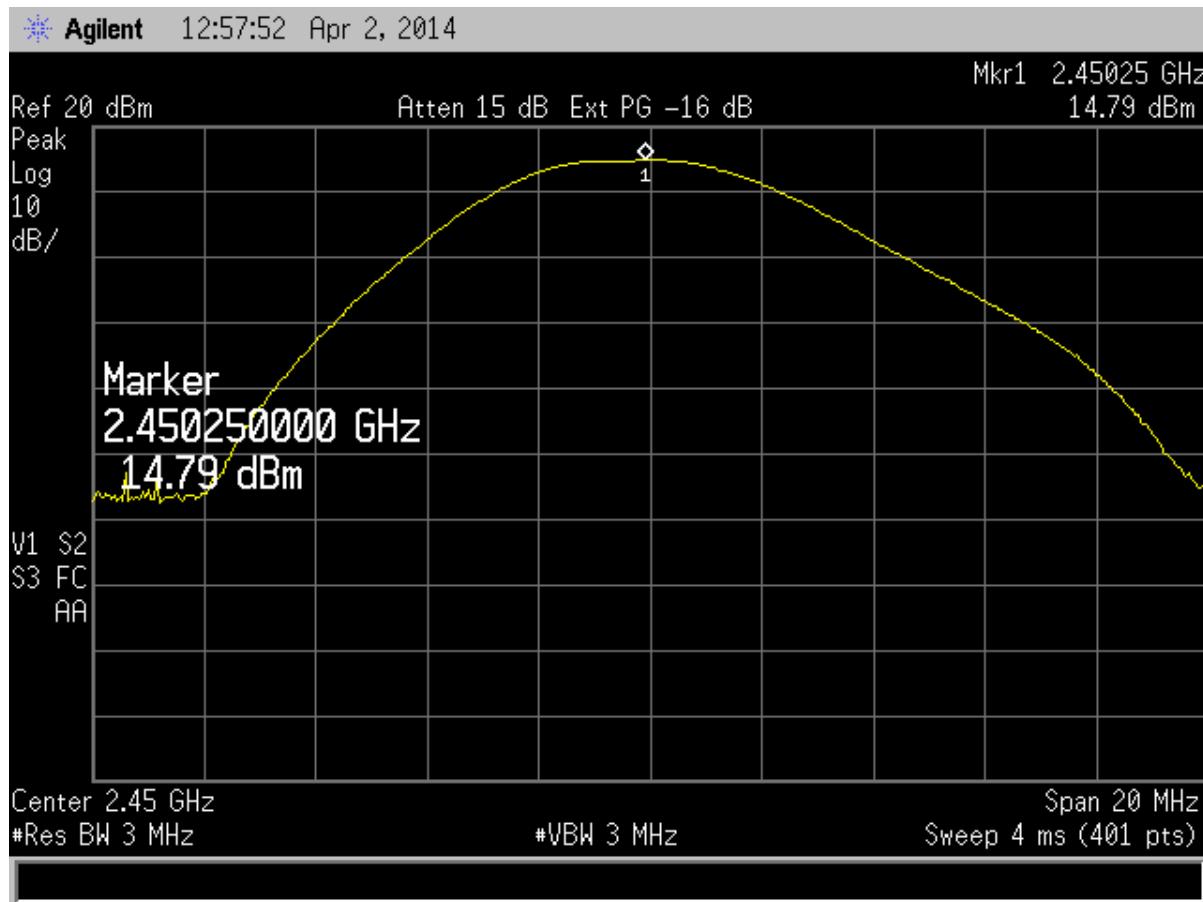


Figure 23. Peak Antenna Conducted Output Power, Mid Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

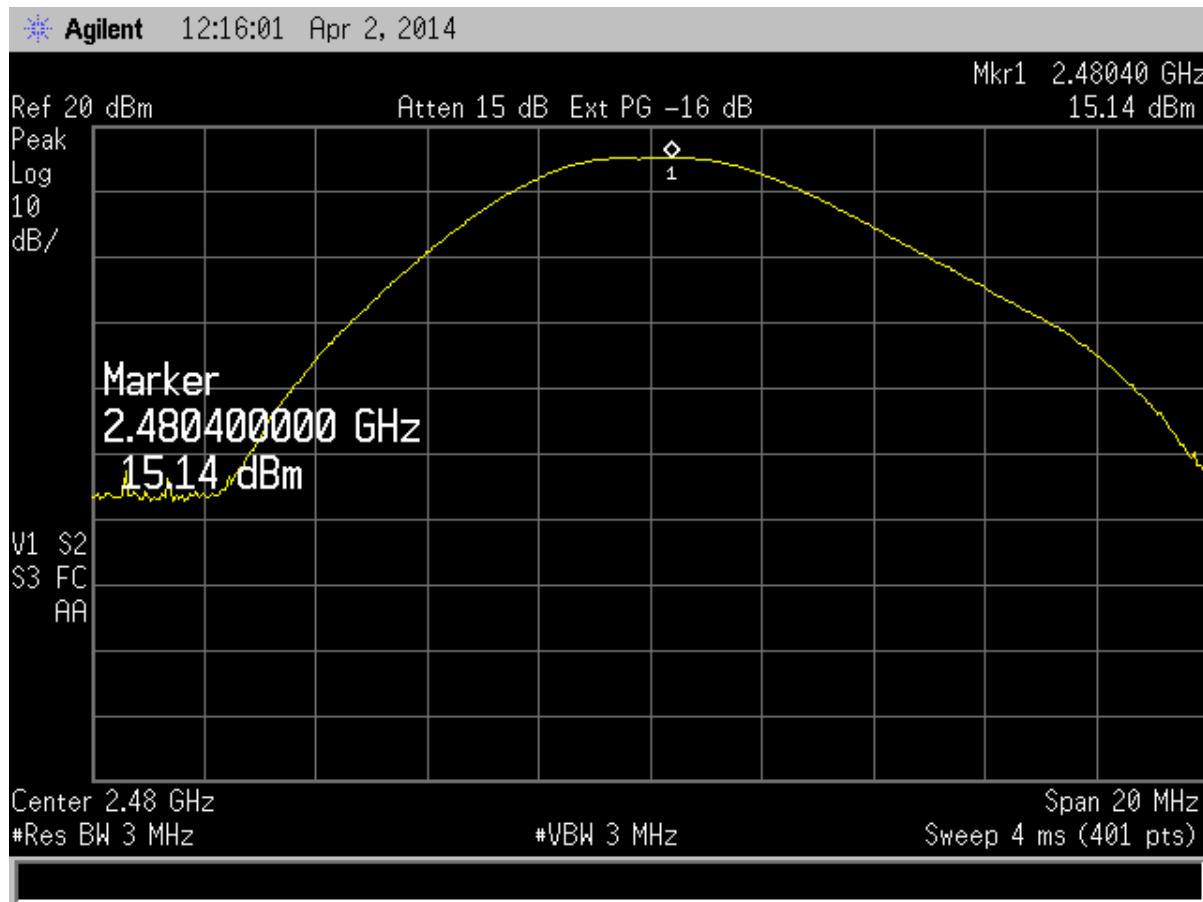


Figure 24. Peak Antenna Conducted Output Power, High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.15 Power Spectral Density (CFR 15.247(e)) (IC RSS 210 A8.5)

The transmitter was placed into a continuous mode of operation at all applicable frequencies. The measurements were performed per the procedures of FCC KDB Procedure 558074. The RBW was set to 3 kHz and the Video Bandwidth was set to \geq RBW. The trace capture time was set to (Span/3 kHz).

In accordance with 15.247 (e), the power spectral density shall be no greater than +8 dBm per any 3 kHz band.

Results are shown in the table below and Figures 23 through 25 below. All are less than +8 dBm per 3 kHz band.

Table 12. Power Spectral Density for Low, Mid and High Bands

Frequency (MHz)	Test Data (dBm/3 kHz)	Results (dBm/3 kHz)	FCC Limit (dBm/3 kHz)
Low-2405	1.704	1.704	+8.0
Mid-2450	2.131	2.131	+8.0
High-2475	2.196	2.196	+8.0

Test Date: April 2, 2014

Tested By

Signature: John C Wynn

Name: John Wynn

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

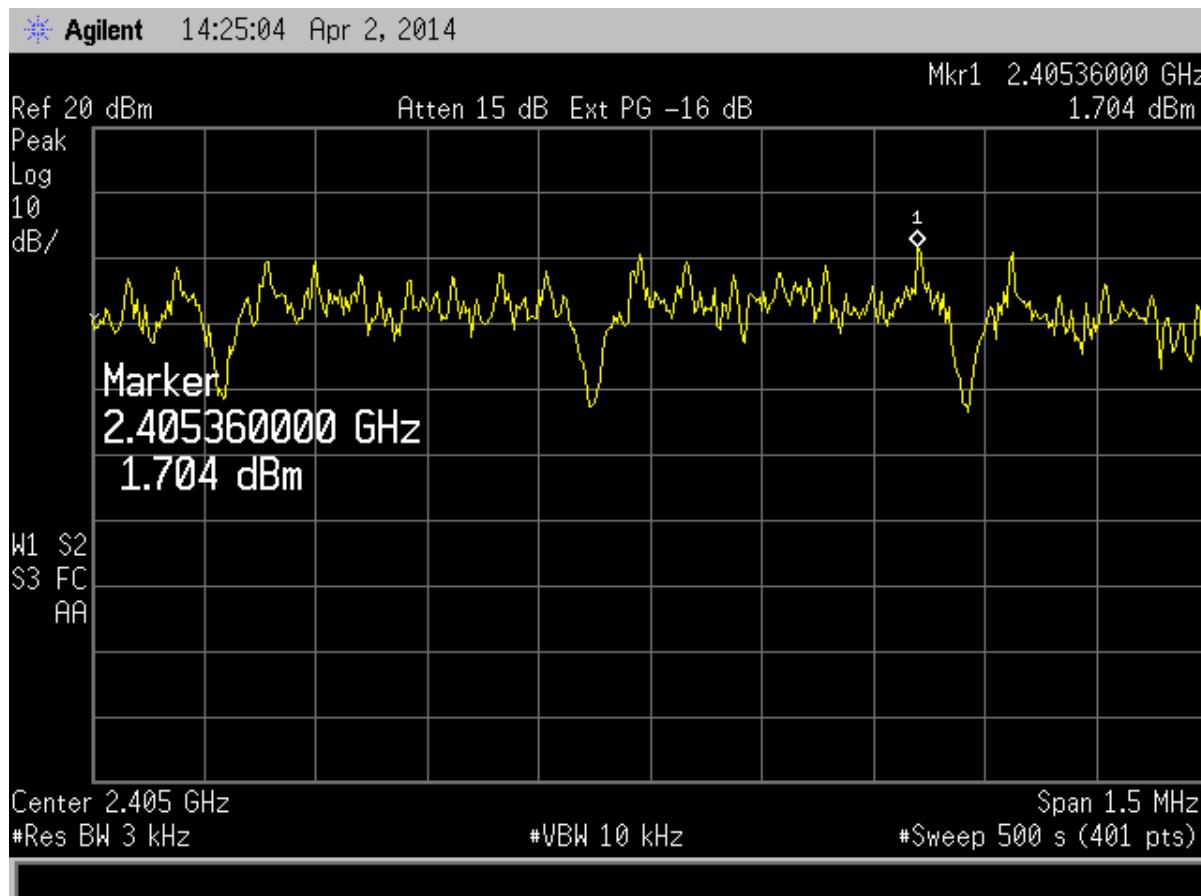


Figure 25. Peak Power Spectral Density - Part 15.247 (e) - Low Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

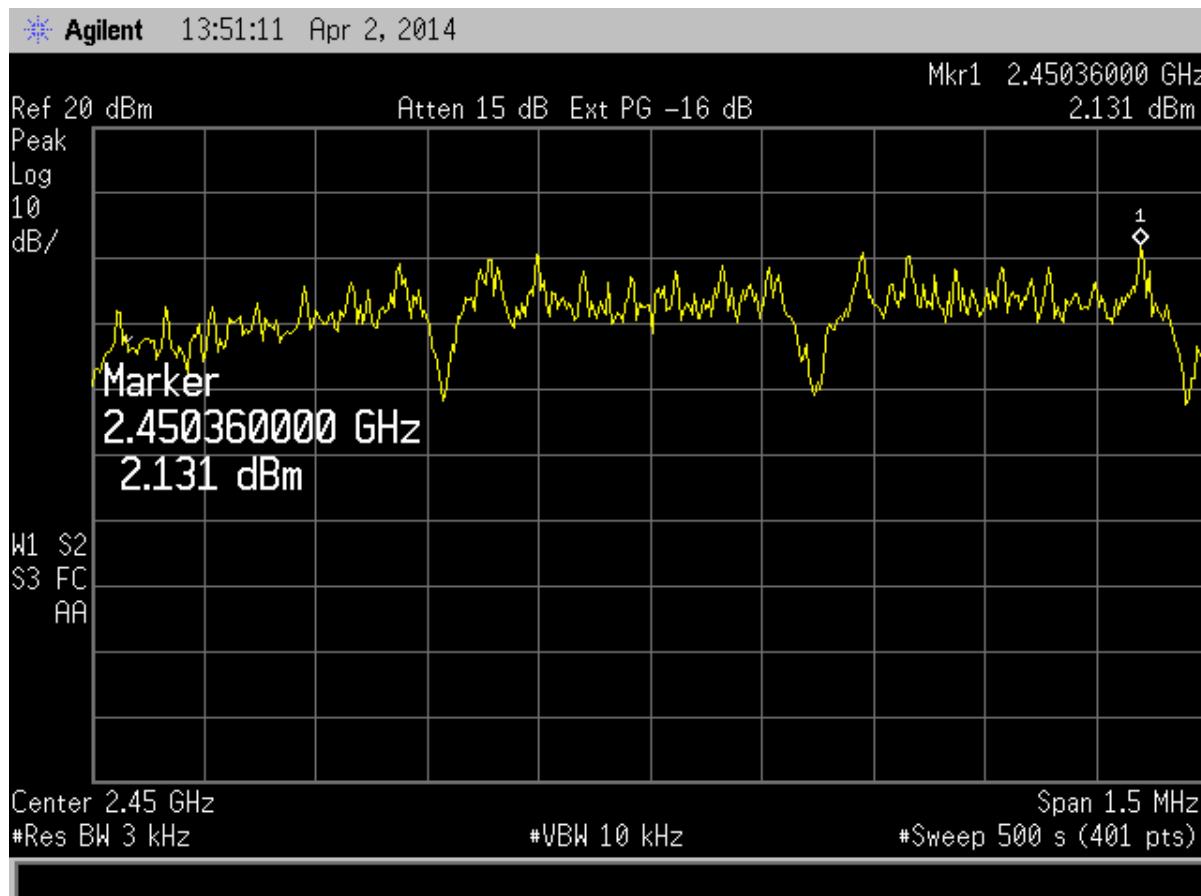


Figure 26. Power Spectral Density - Part 15.247 (e) - Mid Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

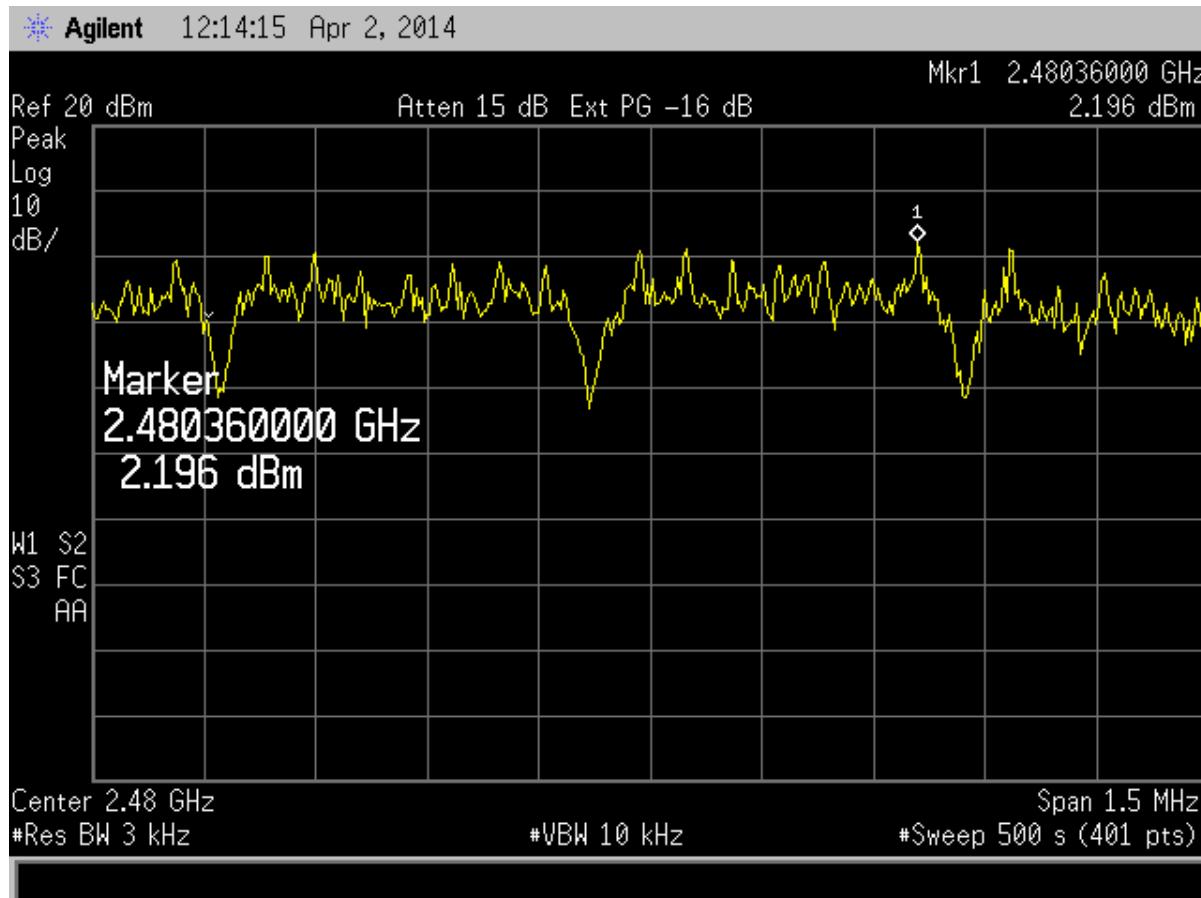


Figure 27. Peak Power Spectral Density - Part 15.247 (e) - High Channel

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model: ROAMMK3MOD1

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.16 99% Occupied Bandwidth (IC RSS 210, A8.1)

The EUT antenna port was connected to a spectrum analyzer having a $50\ \Omega$ input impedance. Measurements were performed similar to the method of FCC, KDB Publication No. 558074 for a bandwidth of 20 dB. The RBW was set to approximately 1/100 of the manufacturers claimed RBW and with the VBW \geq RBW. The results of this test are given in Table 15 and Figures 29 through 31.

Table 13. 99% Occupied Bandwidth

Frequency (MHz)	99% Occupied Bandwidth (MHz)
2405.0	2.69
2450.0	2.68
2480.0	2.68

Test Date: April 2, 2014

Tested By

Signature: John C Wynn

Name: John Wynn

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1



Figure 28. Low Channel 99% Bandwidth

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

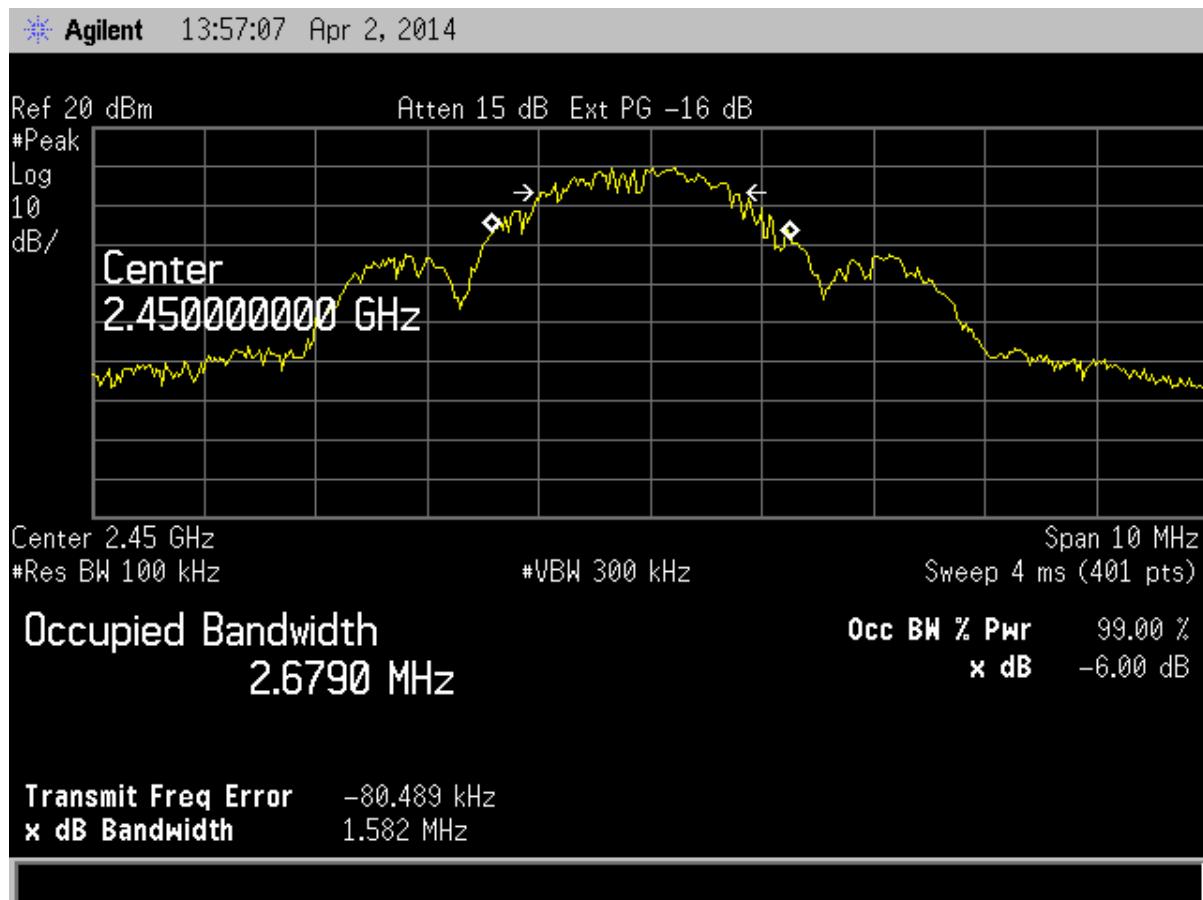


Figure 29. Mid Channel 99% Bandwidth

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1



Figure 30. High Channel 99% Bandwidth

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.17 Unintentional Radiator Power Lines Conducted Emissions (CFR 15.107)

The test data provided in this section is to support the Verification requirement for the digital apparatus. The power line conducted voltage measurements for Receiver and Digital Devices have been carried out in accordance with CFR 15.107 and ANSI C63.4:2003, Paragraph 7, with a spectrum analyzer connected to an LISN and the EUT placed into an idle condition or a continuous mode of receive (non-transmitting). Please refer to the results as shown in Table 16 below.

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

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 UJX- ROAMMK3MOD1
 6715A-ROAMMK3MOD1
 14-0060
 April 7, 2014
 Acuity Brands Technology Services, Inc.
 ROAMMK3MOD1

Table 14. Power Line Conducted Emissions Data, Class A Part 15.107, Peak Measurement vs. Avg. Limits

CONDUCTED EMISSIONS 150 kHz to 30 MHz						
Tested By: GY	Specification Requirement: FCC Part 15.207 Class A		Project No.: 14-0060	Manufacturer: Acuity Brands Model: ROAMMK3MOD1		
Frequency (MHz)	Test Data (dBuV)	LISN+CL-PA (dB)	Corrected Results (dBuV)	Avg Limits (dBuV)	Margin (dB)	Detector
120 VAC, 60 Hz, Phase Line						
0.1997	53.00	1.13	54.13	66.0	11.9	PK
0.9965	50.80	0.38	51.18	60.0	8.8	QP
1.0040	50.60	0.38	50.98	60.0	9.0	QP
6.4350	40.90	0.42	41.32	60.0	18.7	PK
12.7000	32.70	0.50	33.20	60.0	26.8	PK
21.1800	25.10	0.63	25.73	60.0	34.3	PK
120 VAC, 60 Hz, Neutral Line						
0.1987	53.70	1.10	54.80	66.0	11.2	PK
0.9840	47.90	0.37	48.27	60.0	11.7	QP
1.0000	47.70	0.37	48.07	60.0	11.9	QP
6.6050	40.50	0.42	40.92	60.0	19.1	PK
13.4100	34.60	0.51	35.11	60.0	24.9	PK
20.5500	24.70	0.62	25.32	60.0	34.7	PK

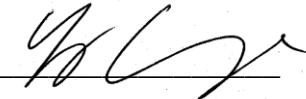
(*)= Quasi-Peak limit used

SAMPLE CALCULATION At 0.9965 MHz:

Magnitude of Measured Frequency	50.80	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain – Duty Cycle	0.38	dB
Corrected Result	51.13	dBuV/m

Test Date: April 2, 2014

Tested By
 Signature:



Name: George Yang

US Tech Test Report:
FCC ID:
IC:
Test Report Number:
Issue Date:
Customer:
Model:

FCC Part 15 Certification/ RSS 210
UJX- ROAMMK3MOD1
6715A-ROAMMK3MOD1
14-0060
April 7, 2014
Acuity Brands Technology Services, Inc.
ROAMMK3MOD1

2.18 Unintentional Radiator and Intentional Radiator, Radiated Emissions (CFR 15.109 and 15.209)

The test data provided herein is to support the verification requirement for digital devices. Radiated emissions coming from the EUT in a non-transmit state per 15.109 were evaluated from 30 MHz to 12.5 GHz as well as radiated emission coming for the EUT in a transmitting state per 15.209 and were investigated from 9kHz or the lowest operating clock frequency to 25 GHz and tested as detailed in ANSI C63.4:2003, Paragraph 8. The worst case is presented in Table 15 below.

Radiated emissions within the band of 9 kHz to 30 MHz were investigated using a calibrated Loop Antenna and per the requirements of ANSI C63.4:2003.

Measurements were made with the analyzer's resolution bandwidth set to 120 kHz for measurements made below 1 GHz and 1 MHz for measurements made above 1 GHz. The video bandwidth was set to three times the resolution bandwidth; 1 MHz RBW and 3 MHz VBW. The test data were maximized for magnitude by rotating the turn-table through 360 degrees and raising and lowering the receiving antenna between 1 to 4 meters in height as a part of the measurement procedure.

All measured signals were at least 1.8 dB below the specification limit. The results are shown in Table 15 below. These results are meant to show that this EUT's digital device portion has met the verification requirements for an unintentional radiator under CFR Part 15.109 as well as the intentional transmitter requirements of CFR Part 15.209.

US Tech Test Report:
 FCC ID:
 IC:
 Test Report Number:
 Issue Date:
 Customer:
 Model:

FCC Part 15 Certification/ RSS 210
 UJX- ROAMMK3MOD1
 6715A-ROAMMK3MOD1
 14-0060
 April 7, 2014
 Acuity Brands Technology Services, Inc.
 ROAMMK3MOD1

Table 15. Unintentional Radiator, Radiated Emissions

Test By: JW	Test: FCC Part 15.109/15.209 Project: 14-0060 Class A		Client: Acuity Brands Model: ROAMMK3MOD1				
Frequency (MHz)	Test Data (dBuV)	AF+CL-PA (dB)	Results (dBuV/m)	Limits (dBuV/m)	Distance / Polarization	Margin (dB)	DETECTOR PK / QP
Tested from 9 kHz to 25 GHz							
61.90	51.84	-28.72	23.12	40.0	3m/vert.	16.9	PK
83.70	47.30	-27.94	19.36	40.0	3m/vert.	20.6	PK
149.47	50.44	-23.94	26.50	43.5	3m/vert.	17.0	PK
61.96	46.18	-28.02	18.16	40.0	3m/Hor.	21.8	PK
83.68	44.52	-28.24	16.28	40.0	3m/Hor.	23.7	PK
158.11	44.85	-24.40	20.45	43.5	3m/Hor.	23.1	PK

No other emissions detected.

AF is antenna factor. CL is cable loss. PA is preamplifier gain

SAMPLE CALCULATION at 61.9 MHz:

Magnitude of Measured Frequency	51.84	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain and 10.5 dB		
Correction factor for 3 to 10 meter extrapolation:	-28.72	dB
Corrected Result	23.12	dBuV/m

Test Date: March 31, 2014

Tested By Signature: John C Wynn

Name: John Wynn