



FOR THE SCOPE OF ACCREDITATION UNDER NVLAP LAB CODE 500051-0

TEST REPORT #090117A

STANDARD: FCC PART 15

SUBPART C--INTENTIONAL RADIATORS

**SECTION 15. 231 PERIODIC OPERATION IN THE BAND
40.66 – 40.70 MHZ AND ABOVE 70 MHZ**

EQUIPMENT TESTED:

WATERLEAKX SYSTEMS, LLC.

WATER LEAK DETECTION AND INTERCEPTION SYSTEM

FCC ID: 2AHFR-WLXS007

MODEL: WLXS007 (CCU and VCU)

TEST DATE: 09 JANUARY, 2017

1100 Falcon Avenue
Glencoe, MN 55336



CERTIFICATION SERVICES, INC.

Tele: 320-864-4444
Fax: 320-864-6611

Prepared for:

WaterleakX Systems, LLC
143 Oak Street
Excelsior, MN 55331

Test agent:

International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336
Tele: 320-864-4444
Fax: 320-864-6611

Test location:

International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336
Tele: 320-864-4444
Fax: 320-864-6611

Prepared by:

International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336

International Certification Services represents to the client that testing is done in accordance with standard procedures applicable and that reported test results are accurate within generally accepted commercial ranges of accuracy.

This report only applies to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. International Certification Services shall have no liability for any deductions, inferences or generalizations drawn by the client or others from this report.

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1.0 TEST SUMMARY

TEST REPORT: #090117A

COMPANY: WaterleakX Systems, LLC.

AGENT: International Certification Services, Inc.

PHONE: 320-864-4444

TEST DATE: 09 January, 2017

EQUIPMENT UNDER TEST: Wireless controller (WLXS007) to be used in the following models: CCU-001, VCU-002

GENERAL TEST SUMMARY: The testing was performed at International Certification Services, Inc. at 1100 Falcon Ave, Glencoe, MN 55336

VERIFICATION / CERTIFICATION STATUS: The WaterleakX Systems, LLC. Wireless Controller (WLXS007) was found to be in compliance with the FCC Part 15 Subpart C, Section 15.231 requirements.

MODIFICATIONS NECESSARY: None

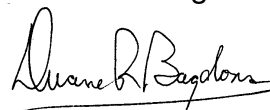
TESTED BY

Steve Wendlandt



WRITTEN BY

Duane R. Bagdons



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Applicable Standards

47 CFR Ch.1

FCC Part 15

Radio Frequency Devices

Subpart C

Intentional Radiators

Section 15.231

Periodic Operation in the band 40.66 – 40.70 Mhz,
and above 70 Mhz.

2.1 Referenced Standards

ANSI C63.10-2013 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 Ghz.

ANSI C63.4 2014 Procedures for Compliance Testing of Unlicensed Wireless Devices

2.2 Equipment Units Tested

The equipment tested was a 418. Mhz Wireless Controller. This Intentional Radiator model: WLXS007 is used in 2 different WaterleakX Systems models, namely: Model: CCU-001, VCU-002. The CCU-001 and VCU-002 use the same PC board and the same external stick antenna (DA-418-02-SMR-WE 158 mm). The transmitter circuit is a LINX OOK transceiver and the Microcontroller used in the system is an ATXMEGA32AU operating at 8 Mhz. The transmitting circuitry is identical on both controller models, This device is automatically triggered and shuts off after a 106 mS time period. The total ON time of the transmitter was measured at 1.75 seconds in a 1 hour time period.

2.3 Equipment and Cable Configuration

See photo of the EUT test configuration setup in Attachment A

2.4 List of Test Equipment

<u>Test Equipment</u>	<u>Model</u>	<u>S/N</u>	<u>Calibration Due Date</u>
Spectrum Analyzer	Hewlett-Packard 8566B	2421A00458	04/07/17
Preamp	P0035	2443A03658	03/26/17
Biconical Antenna	EMCO Model 93110B	105799	04/17/17
Log Periodic Antenna (200-1000 MHz)	EMCO 3146	9111-3280	04/17/17
Horn Antenna (1-18 Ghz)	EMCO 3115	2334	08/17/18
LISN	FCC –LISN-50-25-2	109	08/11/17
Transient Suppressor	EM-7600	290	09/24/17

Measurement cable losses, and antenna correction factors are included in the data sheets. The Resolution BW was set at 1 Mhz and the Video BW was set at 1 Hz with a Span of 0 Hz to perform the correct average detected measurements over 1000 Mhz.

2.5 Units of Measurement.

All measurements were taken in dBuV/m with the antenna located at 3 meters distance from the EUT. Frequency measurements are recorded in Mhz

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2.6 Location of Test Site

The open area test site (OATS) measurement facility used to collect the data was International Certification Services, Inc. at 1100 Falcon Ave in Glencoe, MN 55336. This site has been certified to be in spec of the normalized site attenuation per ANSI C63.4.-2014.

2.7 Measurement Procedures

The antenna was placed at a distance of 3 meters from the EUT. The EUT was set on an insulating table in the OATS site and rotated through 360 degrees to determine the worst case EUT orientation. The antenna was then positioned vertical and horizontal to determine which antenna polarity orientation was worst case. Certification data was recorded at all the transmitter frequencies from the fundamental to the 10th harmonic at an antenna height variation of from 1-4 meters.

2.8 Reporting Measurement Data

See data sheets and plots in Attachment B.

2.9 Radiated Emissions Data

The frequency and amplitude of the tuned frequency of the EUT along with the frequencies and amplitudes of the harmonics up to the 10th harmonic are reported in the data sheets in Attachment B. This information is plotted against the limit of section 15.231 of FCC Part 15 subpart C. Both Horizontal and Vertical antenna polarities as well as antenna heights of 1 to 4 meters were observed.

The Final Level, expressed in dBuV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBuV) and adding the antenna correction factor and cable loss factor (Factor dB) and subtracting the preamp gain. This result then has the FCC limit subtracted from it to provide the margin which gives the tabular data as shown in the data sheets in Attachment B.

Example:

<u>Frequency</u> <u>(MHz)</u>	<u>Level</u> <u>(dBuV)</u>	<u>Factor</u> <u>(dB)</u>	=	<u>Corr Data</u> <u>(dBuV/m)</u>	-	<u>FCC Limit</u> <u>(dBuV/m)</u>	=	<u>Margin</u> <u>(dB)</u>
100.0	20.6	+ 11.0	=	31.6	-	43.5	=	-11.9

2.10 Conducted Emissions Data

The initial step in collecting conducted emission data is the use of a spectrum analyzer to do a peak scan of the EUT. The plot is then used for reference, and a tuned receiver is then used to gather the quasi-peak measurement. The final level, expressed in dBuV, is arrived at by taking the reading from the EMI receiver. The Final Level given is compared directly to the Standard limit. To convert the data measurement between dBuV and uV, the following conversions apply:

$$\begin{aligned} \text{dBuV} &= 20(\log \text{uV}) \\ \text{uV} &= \log^{-1}(\text{dBuV}/20) \end{aligned}$$

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2.11 Operating Frequency Data for Intentional Radiators

All operating frequencies and harmonic frequencies is recorded in the data sheets in Attachment B.

2.12 Occupied Bandwidth Data for Intentional Radiators

The occupied BW data for the EUT is listed in the data sheets in Attachment B.

2.13 Summary of Results

The EUT passed the requirements of FCC Part 15 Subpart C, Section 15.231 with a maximum field strength of 74.1 dBuV/m (Peak detected signal) (CCU and VCU) at the fundamental frequency of 418 Mhz against a limit of 80.28 dBuV/m. No modifications were necessary to accomplish this compliance.

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ATTACHMENT A

RADIATED AND CONDUCTED MEASUREMENT TEST SET UP

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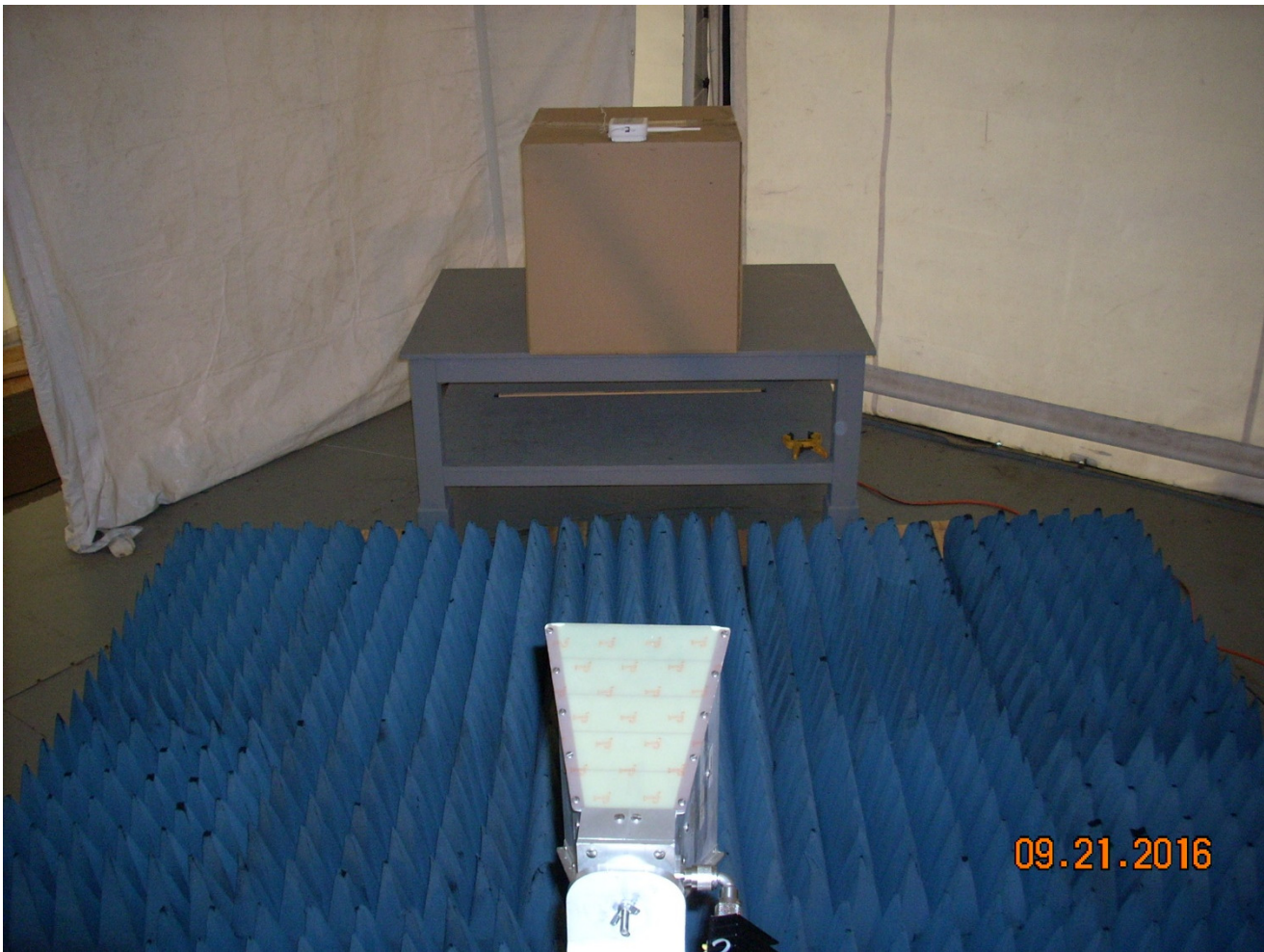
WaterleakX Systems
Wireless Controller Model: WLXS007 (CCU and VCU)
Radiated Emissions Test Configuration



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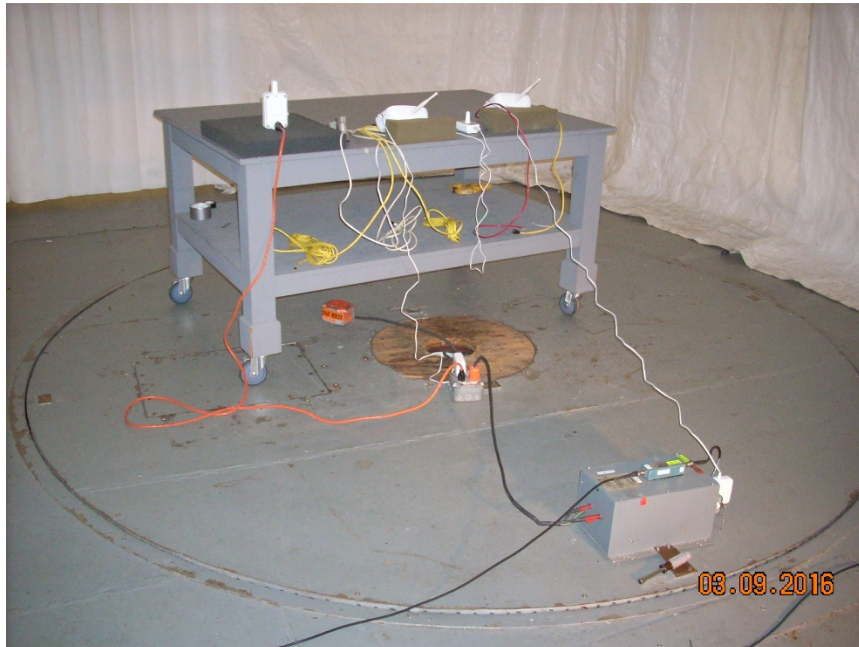


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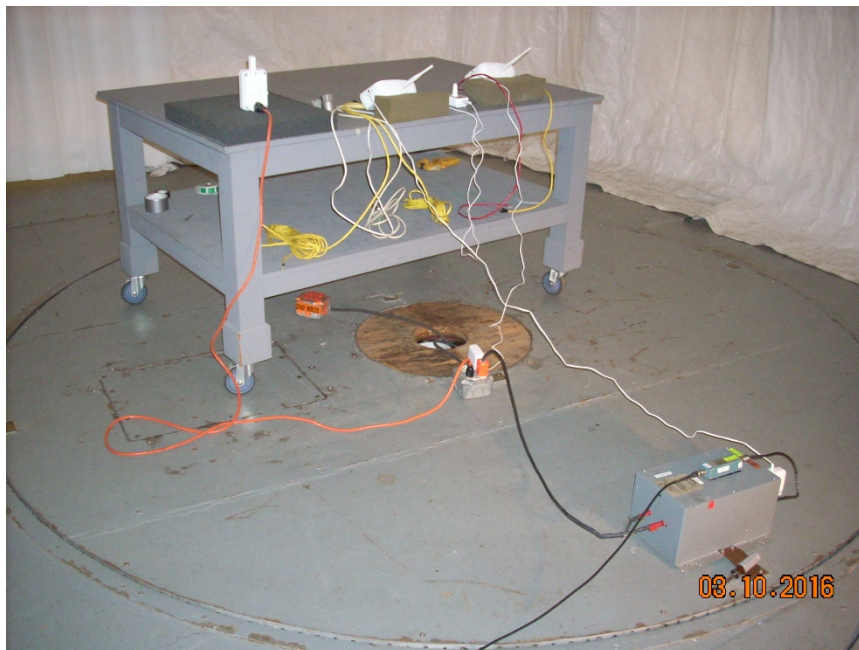


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**WaterleakX Systems
Wireless Controller Model: WLXS007
Conducted Emissions Test Configuration**



CCU



VCU

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ATTACHMENT B

DETAILED TEST DATA SHEETS

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WaterleakX Systems, LLC.
Wireless Controller
Model: WLXS007 (CCU and VCU)

Test Technician: Duane R. Bagdons

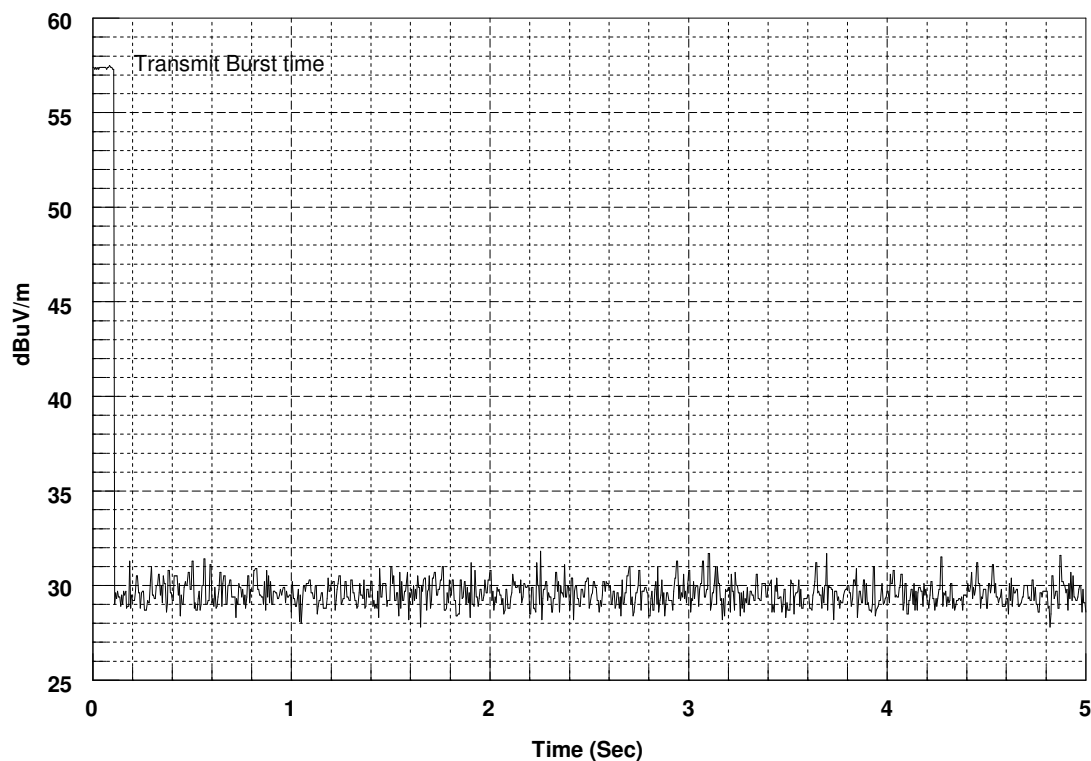
Center Frequency: 418.012 Mhz

Preliminary testing was done to determine what antenna polarity and antenna height generated the highest signal levels. Tests were performed on both models: (CCU-001, VCU-002). Tests were performed at this test configuration and then each frequency was maximized to 0-360 degrees orientation and antenna height of 1-4 meters to determine the worst case output amplitude of each model.

15.231 (a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

15.231 (a) (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Waterleak X Systems, LLC
Wireless Controller Model: WLXS007
Transmit BurstTime



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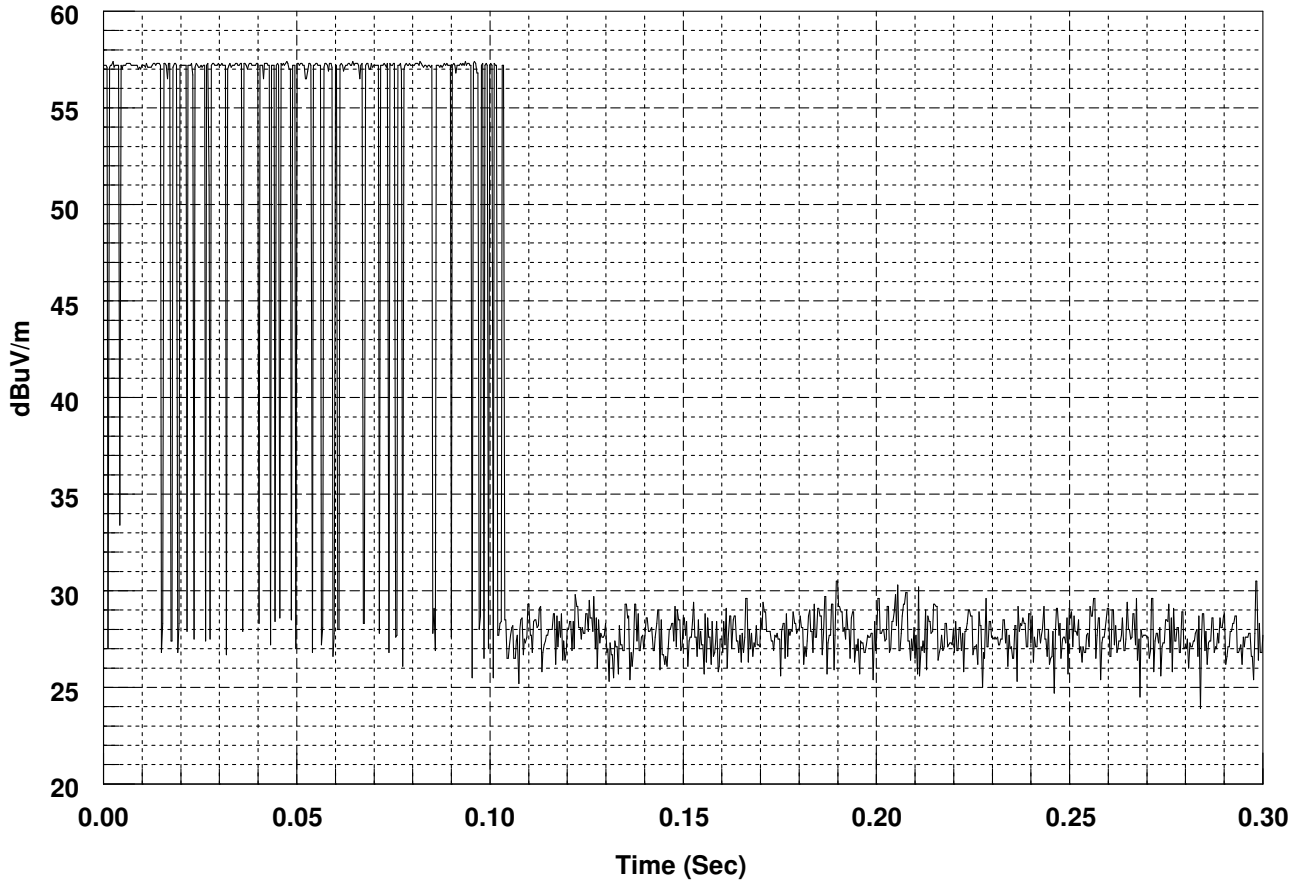
January 09, 2017

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Waterleak X Systems, LLC
Wireless Controller Model: WLXS007
Transmit Burst



International Certification Services, Inc.

January 09, 2017

The EUT passed this requirement.

15.231 (a) (3) Periodic transmissions at regular predetermined intervals are not permitted....There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

The Transmit burst is typically 103.3291 mS long. The actual transmit time in a 1 hour period is 1.756594 seconds.

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SampleNumber	CCU-001 T/R	T/R State Duration (Minutes)	Transmit Time (Milliseconds)
0			
100002	0	0.001	0
223295	1	0.002	103.293
188169926	0	3.132	0
188293222	1	0.002	103.296
416145769	0	3.797	0
416269090	1	0.002	103.321
615948995	0	3.328	0
616072253	1	0.002	103.258
831905304	0	3.597	0
832028688	1	0.002	103.384
1031885725	0	3.331	0
1032009101	1	0.002	103.376
1224093615	0	3.201	0
1224216982	1	0.002	103.367
1455514713	0	3.855	0
1455638022	1	0.002	103.309
1693083075	0	3.957	0
1693206266	1	0.002	103.191
1931403172	0	3.970	0
1931526516	1	0.002	103.344
2114636975	0	3.052	0
2114760316	1	0.002	103.341
2305898195	0	3.185	0
2306021571	1	0.002	103.376
2517887803	0	3.531	0
2518011358	1	0.002	103.555
2730790345	0	3.546	0
2730913718	1	0.002	103.373
2966367685	0	3.924	0
2966491008	1	0.002	103.323
3202023033	0	3.925	0
3202146287	1	0.002	103.254
3413266627	0	3.518	0
3413389860	1	0.002	103.233
3600092221	0	3.111	0
		Total Time = 3600.092 Seconds	Total Transmit Time=1.756594 seconds

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Since the data control is identical on each of the models, this test was only performed on the CCU-001 model. The EUT passed this requirement.

15.231 (a) (4) Intentional Radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

Not Applicable

15.231 (a) (5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(4) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

Not Applicable

15.231 (b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Freq (Mhz)	Field Strength of Fundamental (uV/m)	Field Strength of Spurious Emissions (uV/m)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750	125 to 375
174-260	3750	375
260-470	3750 to 12,500**	375 to 1250**
Above 470	12,500	1250

**Linear interpolations

The maximum permitted fundamental field strengths are as follows:...for the band 260-470 Mhz, uV/m at 3 meters = 41.6667 (F) – 7083.3333. The maximum permitted unwanted emissions level is 20 dB below the maximum permitted fundamental level.

LIMIT:

Fundamental Freq (Mhz)	Field Strength of Fundamental (uV/m)	Field Strength of Fundamental (dBuV/m)	Field Strength of Spurious Emissions (uV/m)	Field Strength of Spurious Emissions (dBuV/m)
418	10,333.35	80.28	1033.335	60.28

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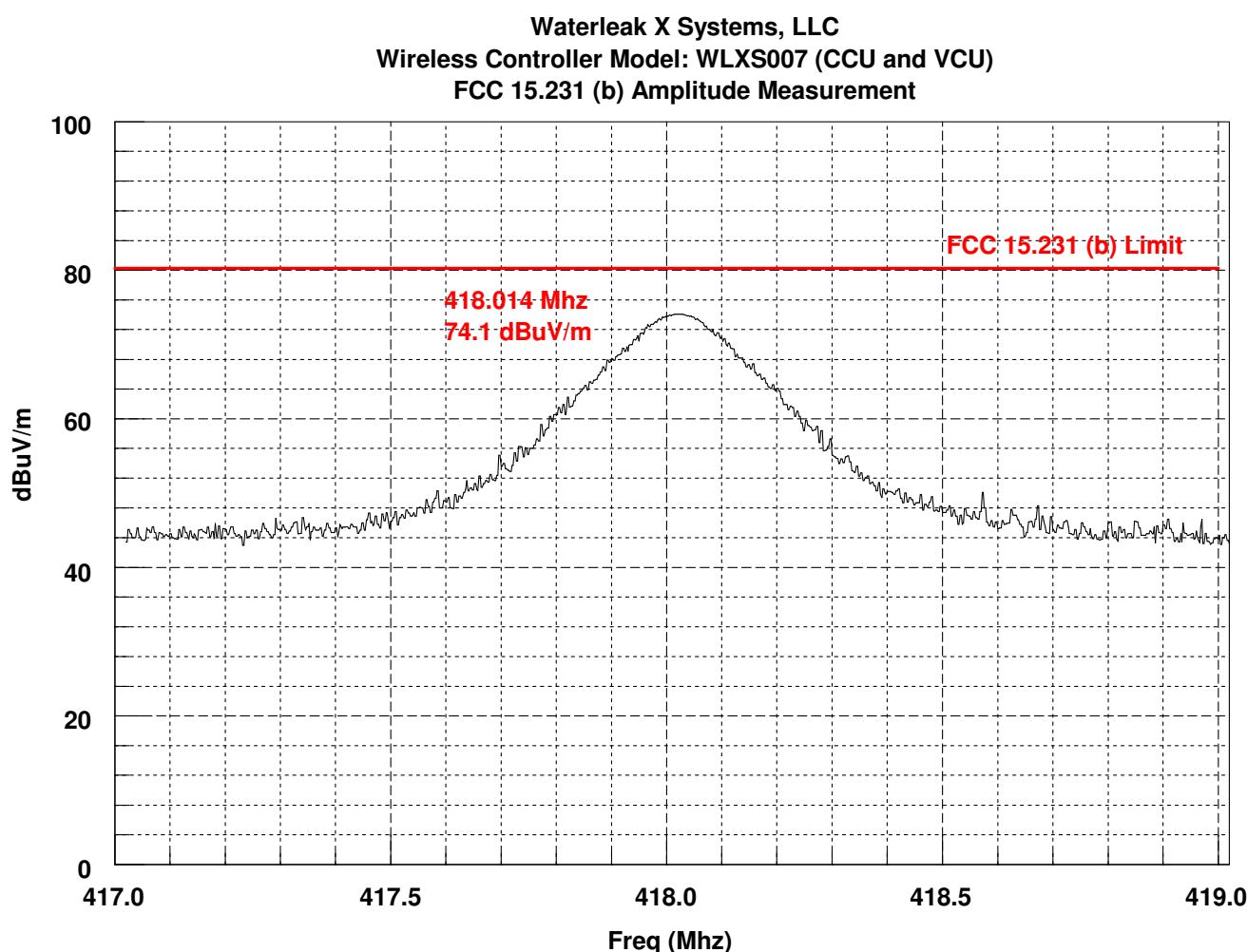


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15.231 (b)(1) The field strength limits are specified at a distance of 3 meters.

15.231 (b)(2) Intentional Radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emissions measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

Model: CCU-001 represents both the CCU-001 and VCU-002 since they both use the same PC board and Electronics AND the same antenna.



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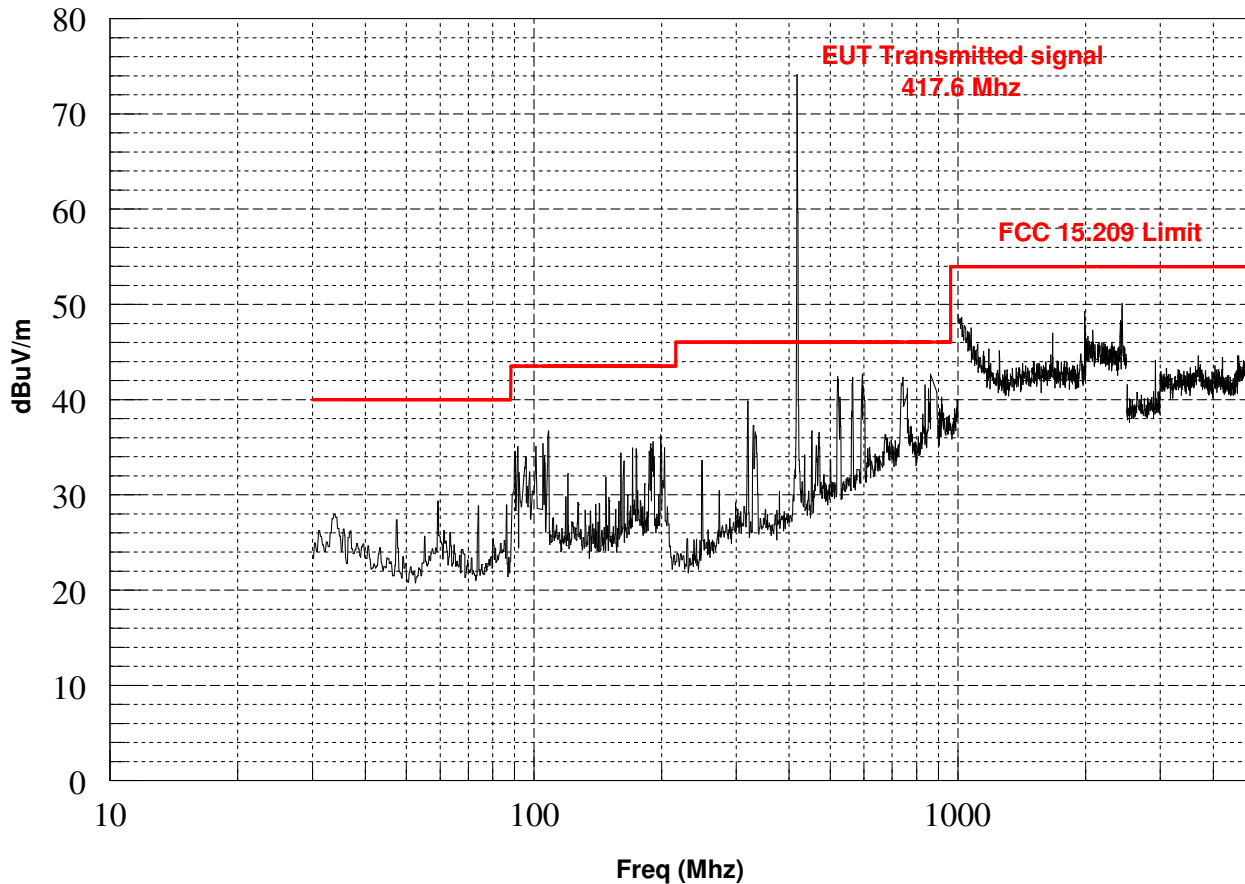
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WaterleakX Systems, LLC
Model: WLXS007 (CCU and VDU)
FCC 15.209 Spurious Emissions



International Certification Services, Inc.

January 09, 2017

NOTE: No signals were observed below 30 Mhz.

15.231 (b)(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

See the graphs in the above section.
The EUT passes this requirement.

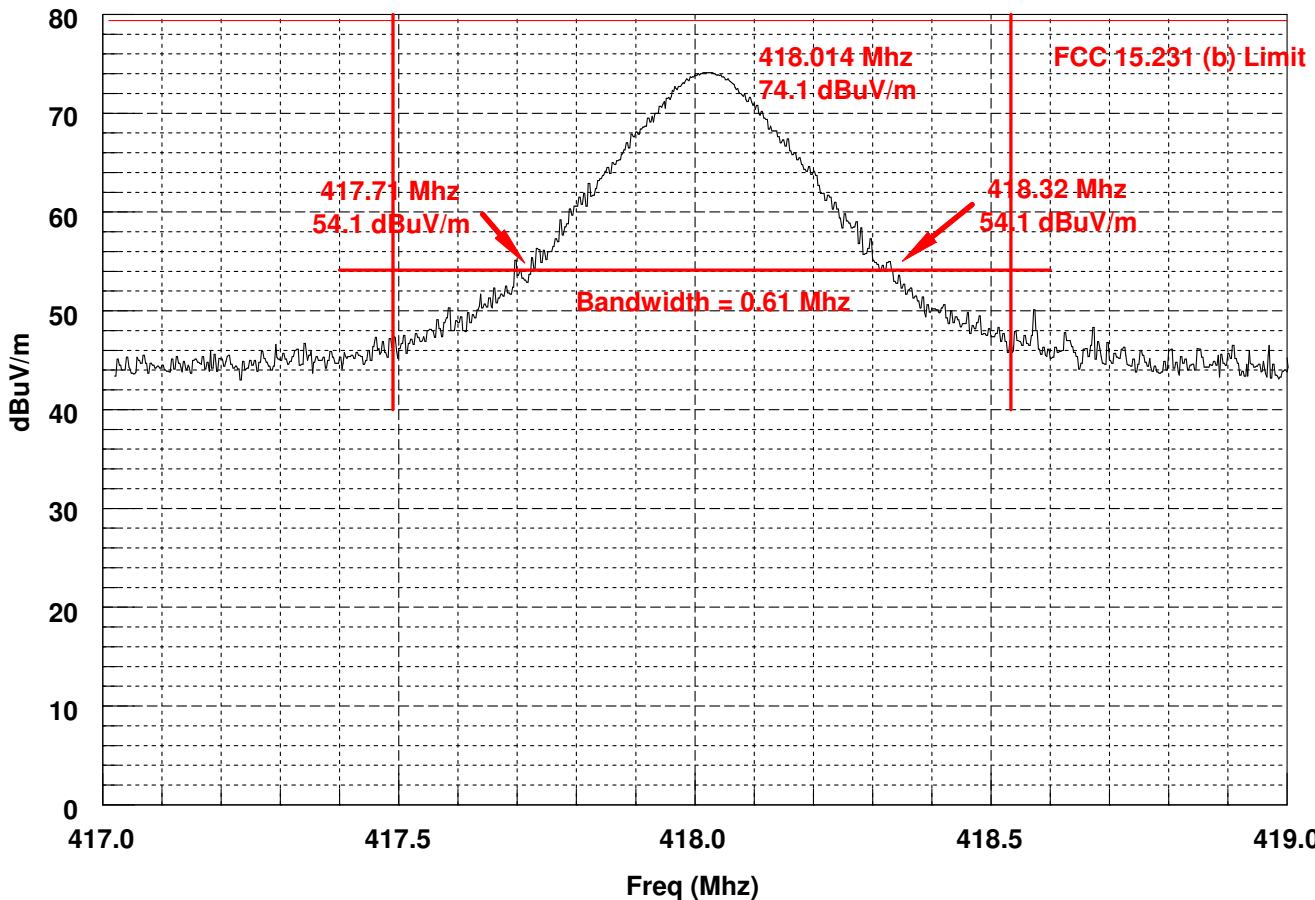
15.231 (c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 Mhz and below 900 Mhz. For devices operating above 900 Mhz, the emissions shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

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Waterleak X Systems, LLC
Wireless Controller Model: WLXS007 (CCU and VDU)
FCC 15.231(c) Bandwidth Measurement



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The specified 20 dB Bandwidth is 0.25% of the Fundamental Frequency which calculates to be 1.05 Mhz. The EUT measured 0.61 Mhz.

The EUT passes this requirement

15.231 (d) For devices operating within the frequency band 40.66 to 40.70 Mhz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be +/- 0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 degrees to +50 Degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Not Applicable

15.231 (e) Intentional Radiators may operate at a periodic rate exceeding that specified in paragraph (a) and may be employed for any type of operation, including operation prohibited in

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paragraph (a), provided the intentional radiator complies with the provision of paragraphs (b) through (d) of this Section, except the field strength table in paragraph (b) is replaced by the following:

Fundamental Frequency (Mhz)	Field Strength of Fundamental (uV/m)	Field Strength of Fundamental (dBuV/m)	Field Strength of Spurious Emission (uV/m)	Field Strength of Spurious Emission (dBuV/m)
40.66-40.70	1000	60	100	40
70-130	500	53.979	50	33.979
130-174	500 to 1500**		50 to 150**	
174-260	1500	63.52	150	43.52
260-470	1500 to 5000**		150 to 500**	
418	4133.347	72.326	413.3329	52.326
Above 470	5000	73.979	500	53.979

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Not Applicable for this EUT

15.207 (c) Conducted Emissions Data

The initial step in collecting conducted emission data is the use of a spectrum analyzer to do a peak scan of the EUT. The plot is then used for reference, and a tuned receiver is then used to gather the quasi-peak measurement. The final level, expressed in dBuV, is arrived at by taking the reading from the EMI receiver. The Final Level given is compared directly to the Standard limit. To convert the data measurement between dBuV and uV, the following conversions apply:

$$\text{dBuV} = 20(\log \text{uV})$$

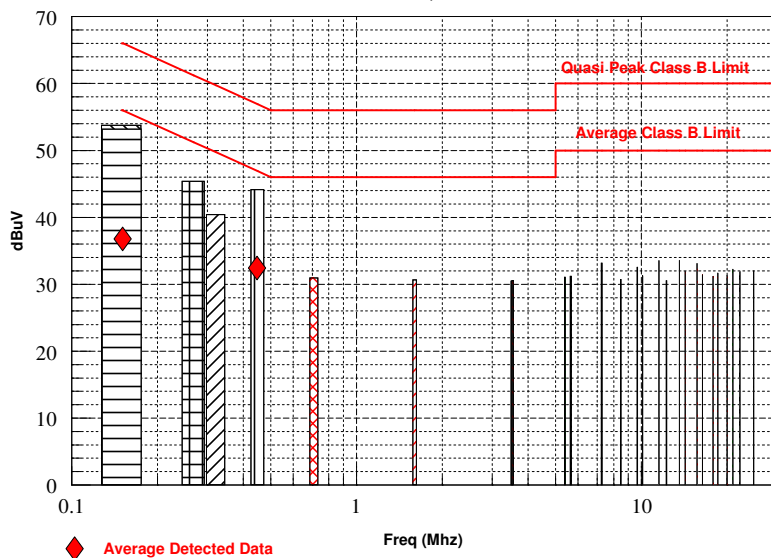
$$\text{uV} = \log^{-1}(\text{dBuV}/20)$$

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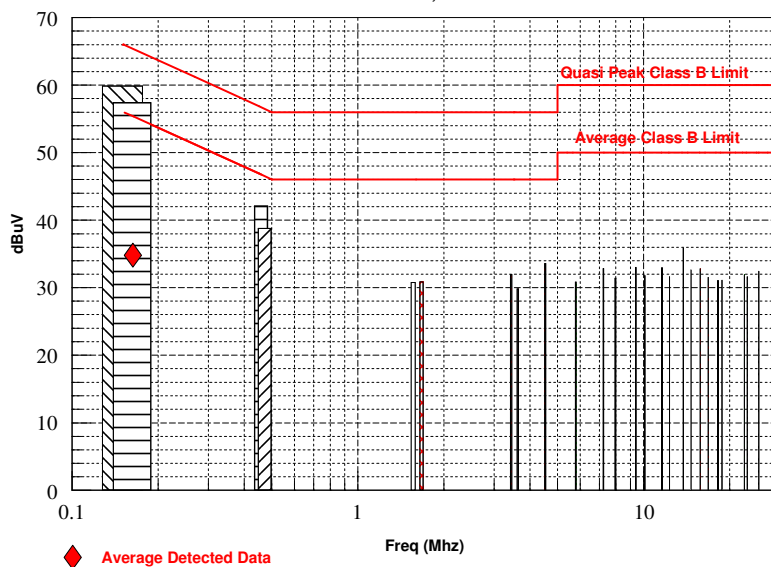
Waterleak X Systems, LLC
 Wireless Controller Model: WLXS007 (CCU)
 FCC 15.207 (c) Conducted Emissions Measurement
 120 VAC, 60 Hz



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January 09, 2017

Waterleak X Systems, LLC
 Wireless Controller Model: WLXS007 (CCU)
 FCC 15.207 (c) Conducted Emissions Measurement
 208 VAC, 60 Hz



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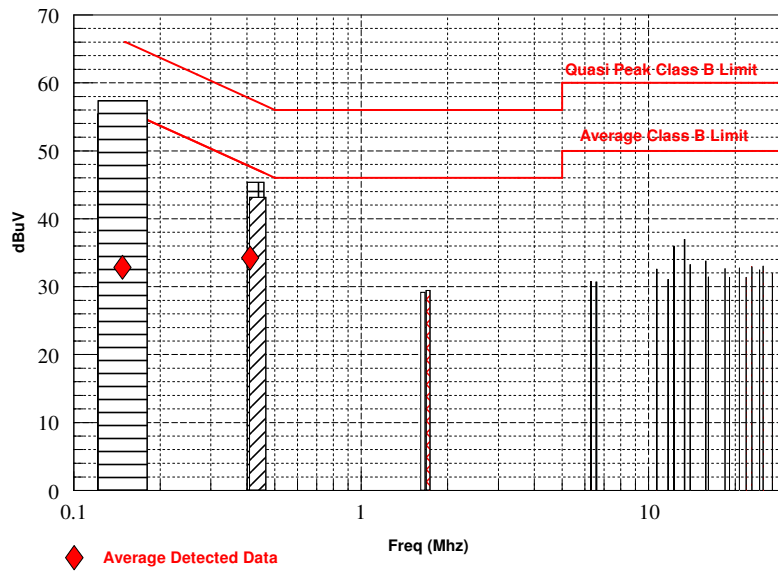
January 09, 2017

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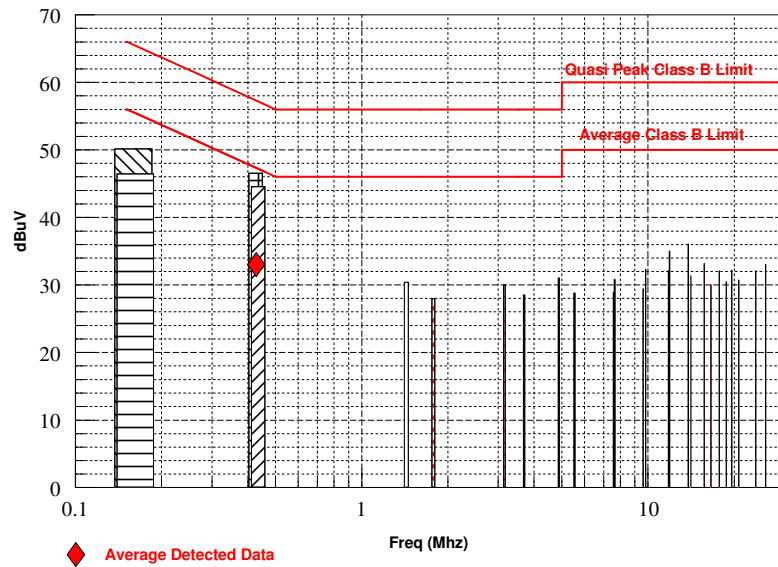
Waterleak X Systems, LLC
 Wireless Controller Model: WLXS007 (VCU)
 FCC 15.207 (c) Conducted Emissions Measurement
 120 VAC, 60 Hz



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January 09, 2017

Waterleak X Systems, LLC
 Wireless Controller Model: WLXS007 (VCU)
 FCC 15.207 (c) Conducted Emissions Measurement
 208 VAC, 60 Hz



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ATTACHMENT C

**PRODUCT DATA SHEET OR PRODUCT INFORMATION FORM AS SUPPLIED
BY THE CUSTOMER**

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CERTIFICATION SERVICES, INC.

COMPANY NAME: WaterleakX Systems, LLC.

CUSTOMER REPRESENTATIVE: International Certification Services, Inc.

EQUIPMENT DESCRIPTION: Wireless Controller

MODEL NUMBER: WLXS007 CCU and VCU

SERIAL NUMBER: N/A

TYPE OF TEST: ☐ Development
☐ Initial Design Verification
☐ Design Change (Please describe exact changes below)
☒ Production Sample (Audit Test)
Changes made: NONE

OSCILLATOR FREQUENCIES:

8 Mhz

PRODUCT SHIELDING PROVISION:

Plastic enclosure

I/O CABLES: NONE

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