

Zodiac Pool Systems, Inc

Application
For
Certification

FCC ID: RIR400121

J-BOX

Model: 400121

Transceiver

Report No.: 150616009SZN-002

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-14]

Prepared and Checked by:

Approved by:

Sign on file



Digitally signed
by Andy Yan
Location: Intertek
Testing Services

Jenner Liu
Engineer

Andy Yan
Senior Project Engineer
Date: November 30, 2015

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.
- This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results referenced from this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
- For Terms And Conditions of the services, it can be provided upon request.
- The evaluation data of the report will be kept for 3 years from the date of issuance.

TRF no.: FCC 15C_Tx_b

Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch

6F, D Block, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China
Tel: (86 755) 8601 6288 Fax: (86 755) 8601 6751 Website: www.china.intertek-etlsemko.com

LIST OF EXHIBITS

INTRODUCTION

<i>EXHIBIT 1:</i>	Summary of Tests
<i>EXHIBIT 2:</i>	General Description
<i>EXHIBIT 3:</i>	System Test Configuration
<i>EXHIBIT 4:</i>	Measurement Results
<i>EXHIBIT 5:</i>	Equipment Photographs
<i>EXHIBIT 6:</i>	Product Labeling
<i>EXHIBIT 7:</i>	Technical Specifications
<i>EXHIBIT 8:</i>	Instruction Manual
<i>EXHIBIT 9:</i>	Confidentiality Request
<i>EXHIBIT 10:</i>	Miscellaneous Information
<i>EXHIBIT 11:</i>	Test Equipment List

INTERTEK TESTING SERVICES

MEASUREMENT/TECHNICAL REPORT

J-BOX

Model: 400121

FCC ID: RIR400121

This report concerns (check one) Original Grant ☒ Class II Change ☐

Equipment Type: DTS - Digital Transmission System

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes ☐ No ☒

If yes, defer until :
date

Company Name agrees to notify the Commission by:
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes ☐ No ☒

If no, assumed Part 15, Subpart C for intentional radiator - the new 47 CFR [10-01-14] Edition] provision.

Report prepared by:

Jenner Liu
Intertek Testing Services Shenzhen Ltd.
Kejiyuan Branch
6F, Block D, Huahan Building, Langshan Road,
Nanshan District, Shenzhen, P. R. China
Phone: (86 755) 8614 0639
Fax: (86 755) 8614 6751

INTERTEK TESTING SERVICES

Table of Contents

1.0	<u>Summary of Test results</u>	2
2.0	<u>General Description</u>	4
2.1	Product Description	4
2.2	Related Submittal(s) Grants	5
2.3	Test Methodology	5
2.4	Test Facility	5
3.0	<u>System Test Configuration</u>	7
3.1	Justification	7
3.2	EUT Exercising Software	7
3.3	Special Accessories	7
3.4	Measurement Uncertainty	8
3.5	Equipment Modification	8
3.6	Support Equipment List and Description	8
4.0	<u>Measurement Results</u>	10
4.1	Maximum Conducted Output Power at Antenna Terminals	10
4.2	Minimum 6 dB RF Bandwidth	11
4.3	Maximum Power Density Reading	14
4.4	Out of Band Conducted Emissions	17
4.5	Out of Band Radiated Emissions	23
4.6	Transmitter Radiated Emissions in Restricted Bands	24
4.7	Field Strength Calculation	25
4.8	Radiated Spurious Emission	26
4.9	Conducted Emission	31
4.10	Radiated Emissions from Digital Section of Transceiver	34
4.11	Transmitter Duty Cycle Calculation and Measurements	35
5.0	<u>Equipment Photographs</u>	37
6.0	<u>Product Labelling</u>	39
7.0	<u>Technical Specifications</u>	41
8.0	<u>Instruction Manual</u>	43
9.0	<u>Confidentiality Request</u>	45
10.0	<u>Discussion of Pulse Desensitization</u>	47
11.0	<u>Test Equipment List</u>	49

INTERTEK TESTING SERVICES

List of attached file

Exhibit type	File Description	Filename
Test Report	Test Report	report.pdf
Test Setup Photo	Radiated Emission	radiated photos.pdf
Test Setup Photo	Conducted Emission	conducted photos.pdf
External Photo	External Photo	external photos.pdf
Internal Photo	Internal Photo	internal photos.pdf
Block Diagram	Block Diagram	block.pdf
Schematics	Circuit Diagram	circuit.pdf
Operation Description	Technical Description	descri.pdf
ID Label/Location	Label Artwork and Location	label.pdf
User Manual	User Manual	manual.pdf
Cover Letter	Confidentiality Letter	request.pdf
Cover Letter	Certification of Agreement	agreement.pdf
Cover Letter	Letter of Agency	agency.pdf

INTERTEK TESTING SERVICES

EXHIBIT 1

SUMMARY OF TEST RESULTS

INTERTEK TESTING SERVICES

1.0 Summary of Test results

J-BOX

Model: 400121

FCC ID: RIR400121

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)(3)	Pass
6 dB Bandwidth	15.247(a)(2)	Pass
Max. Power Density	15.247(e)	Pass
Out of Band Antenna Conducted Emission	15.247(d)	Pass
Radiated Emission in Restricted Bands	15.247(d)	Pass
AC Conducted Emission	15.207	Pass
Antenna Requirement	15.203	Pass (See Notes)

Notes: The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

EXHIBIT 2

GENERAL DESCRIPTION

INTERTEK TESTING SERVICES

2.0 **General Description**

2.1 Product Description

The Equipment Under Test (EUT) is a J-BOX, it is able to transmit and receive data with other transceivers through 915.95-927.00MHz. The EUT was powered by AC 120V, 60Hz. For more detailed features description, please refer to the user's manual.

Type of Modulation: FSK.

Antenna Type: Integral Antenna.

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

INTERTEK TESTING SERVICES

2.2 Related Submittal(s) Grants

This is an application for certification of:

DTS- Part 15 Digital Transmission System (902-928MHz Digital Modulation Transceiver), and there is a corresponding unit for certification with FCC ID: RIR400120 and will be submitted at the same time.

2.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10: 2013 and KDB 558074 v03r03. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the “**Justification Section**” of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The Semi-Anechoic chamber and shield room used to collect the radiated data and conducted data are **Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch** and located at 6F, Block D, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: 242492).

EXHIBIT 3

SYSTEM TEST CONFIGURATION

INTERTEK TESTING SERVICES

3.0 System Test Configuration

3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables were manipulated to produce worst case emissions. The EUT was powered by AC 120V, 60Hz, the worst case data was reported.

For maximizing emissions, the EUT was rotated through 360°, the EUT was placed on the styrene turntable with 0.8m up to 1GHz and 1.5 m above 1GHz. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

The rear of unit was flushed with the rear of the table when it was powered by adapter up to 1GHz and placed in the centre of turntable above 1GHz.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

3.2 EUT Exercising Software

The EUT exercise program (provided by client) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The worst case configuration is used in all specified testing.

The parameters of test software setting:

During the test, Channel and power controlling software provided by the applicant was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the application and is going to be fixed on the firmware of the end product.

3.3 Special Accessories

N/A.

INTERTEK TESTING SERVICES

3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance – Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

3.5 Equipment Modification

Any modifications installed previous to testing by Zodiac Pool Systems, Inc will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch.

3.6 Support Equipment List and Description

This product was tested in the following configuration:

Refer List:

Description	Manufacturer	Model No.
PDA	Zodiac Pool Systems, Inc	400120
Power board	Zodiac Pool Systems, Inc	N/A

INTERTEK TESTING SERVICES

EXHIBIT 4

MEASUREMENT RESULTS

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc

Date of Test: November 26, 2015

Model: 400121

4.0 **Measurement Results**

4.1 Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b)(3):

The antenna power of the EUT was connected to the input of a broadband peak RF power meter. The power meter have a video bandwidth that is greater than DTS bandwidth and utilize a fast-responding diode detector. Power was read directly at the EUT antenna terminals with cable loss added.

For antennas with gains of 6 dBi or less, maximum allowed Transmitter output is 1 watt (+30 dBm).

Transmitting (Antenna Gain = 2.0dBi)		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 915.95	7.76	5.97
Middle Channel: 921.80	7.80	6.03
High Channel: 927.00	7.82	6.05

Cable loss: 1.0 dB External Attenuation: 0 dB

Cable loss, external attenuation has been included in OFFSET function

EUT max. output level = 7.82dBm

For RF Exposure, the information is saved with filename: RF exposure.pdf.

TRF no.: FCC 15C_TX_b

FCC ID: RIR400121

Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc

Date of Test: November 26, 2015

Model: 400121

4.2 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a)(2):

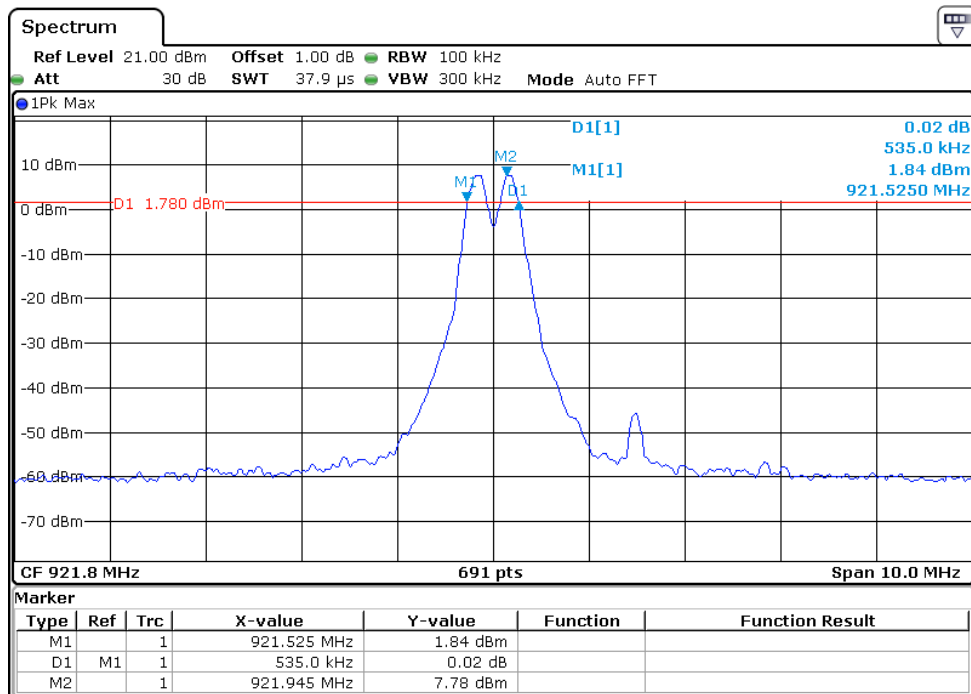
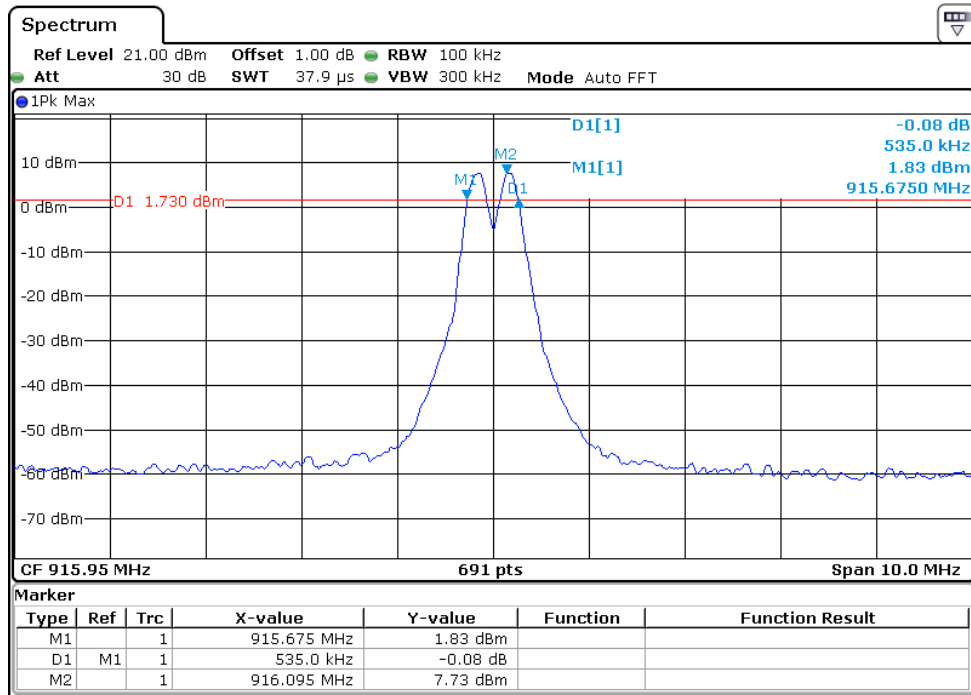
The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 KHz according to FCC KDB 558074. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

Limit: The 6 dB Bandwidth is at least 500 kHz.

Transmitting	
Frequency (MHz)	6 dB Bandwidth (MHz)
915.95	0.535
921.80	0.535
927.00	0.521

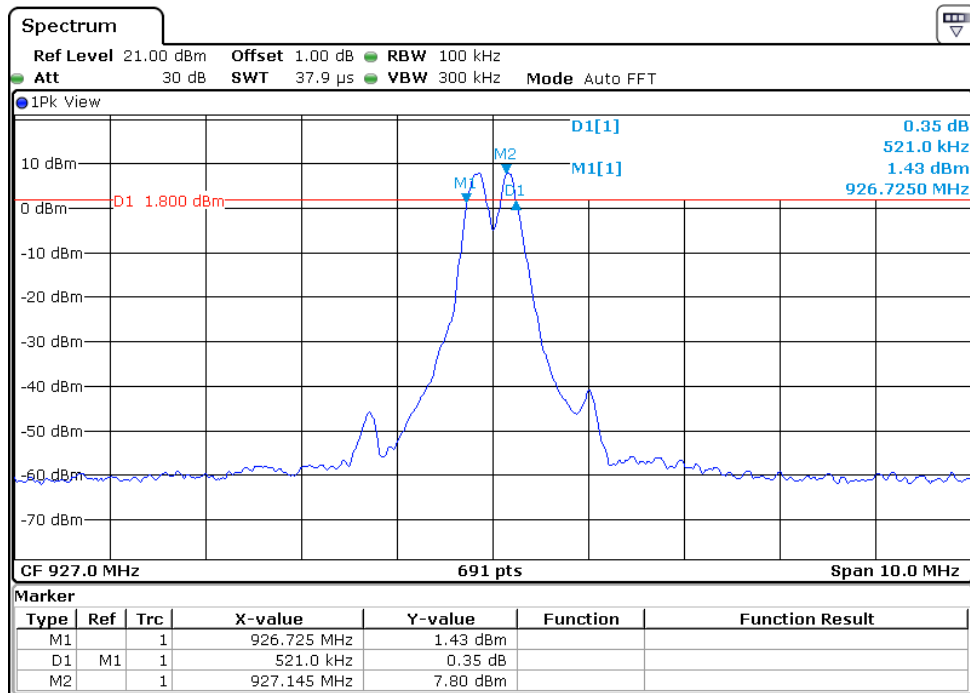
The test plots are attached as below.

INTERTEK TESTING SERVICES



TRF no.: FCC 15C_TX_b
 FCC ID: RIR400121
 Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES



INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
Date of Test: November 26, 2015
Model: 400121

4.3 Maximum Power Density Reading, FCC Rule 15.247(e):

The Measurement Procedure PKPSD was set according to the FCC KDB 558074.

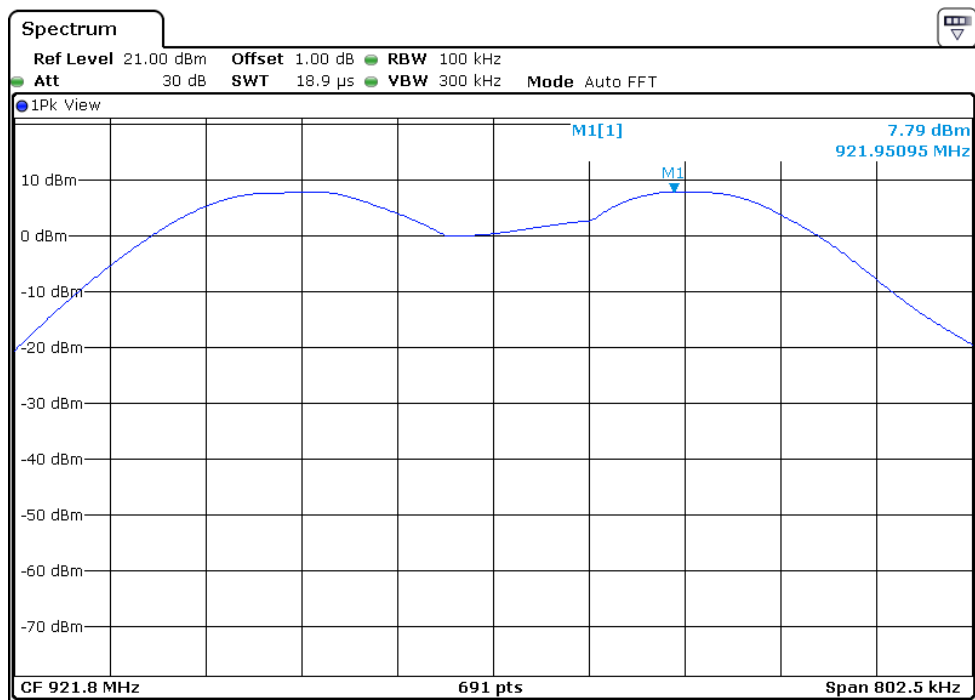
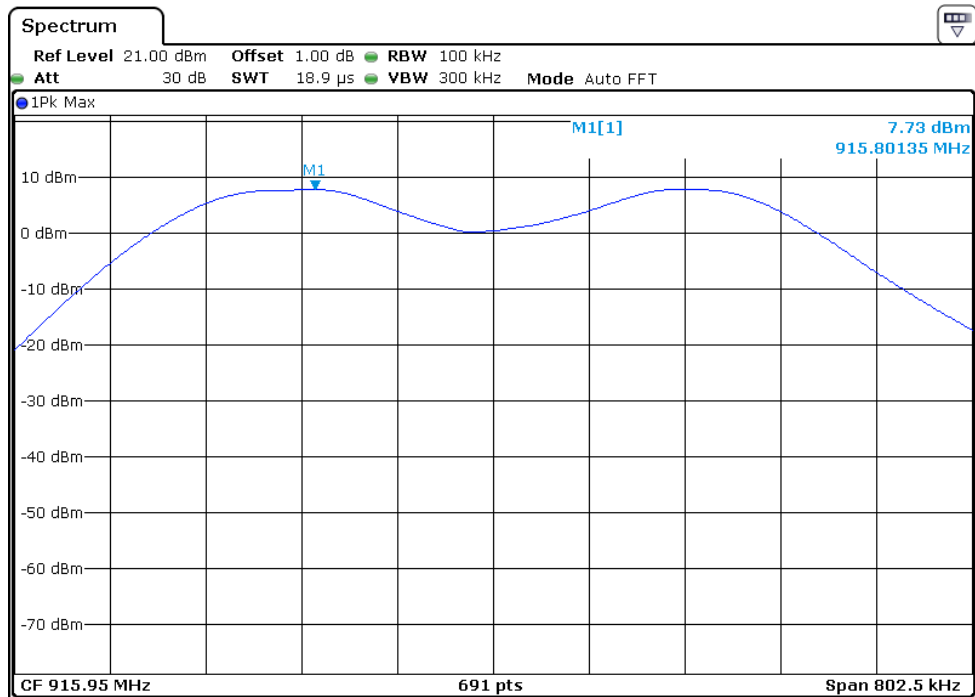
Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

Limit: The Power Density does not exceed 8dBm/3 kHz.

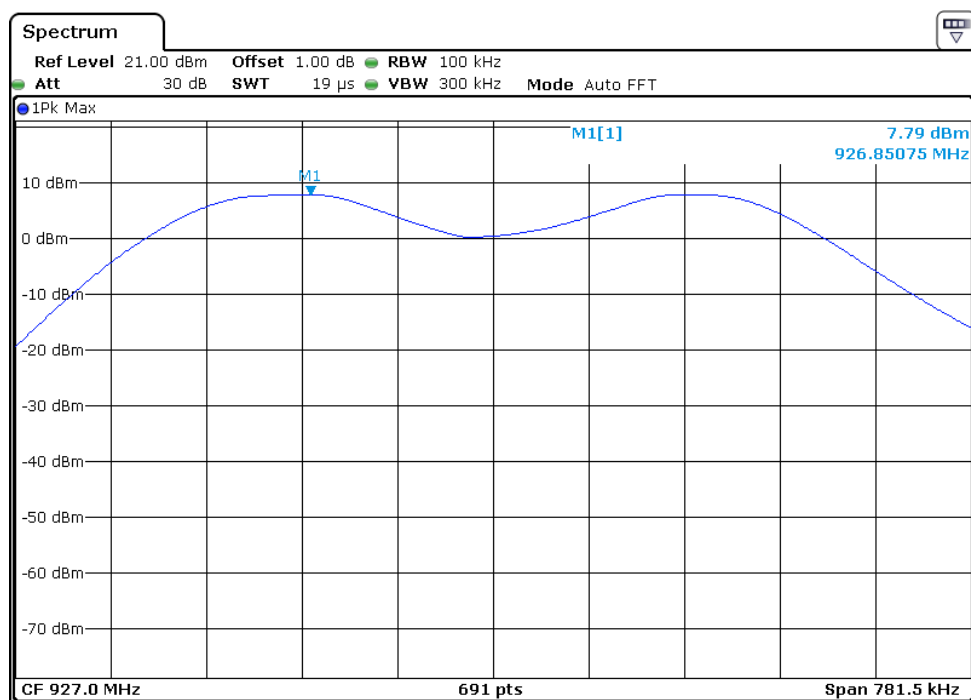
Transmitting	
Frequency (MHz)	Power Density with RBW 100KHz
915.95	7.73
921.80	7.79
927.00	7.79

The test plots are attached as below.

INTERTEK TESTING SERVICES



INTERTEK TESTING SERVICES



TRF no.: FCC 15C_TX_b
FCC ID: RIR400121
Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
Date of Test: November 26, 2015
Model: 400121

4.4 Out of Band Conducted Emissions, FCC Rule 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. The Measurement Procedure was set according to the FCC KDB 558074.

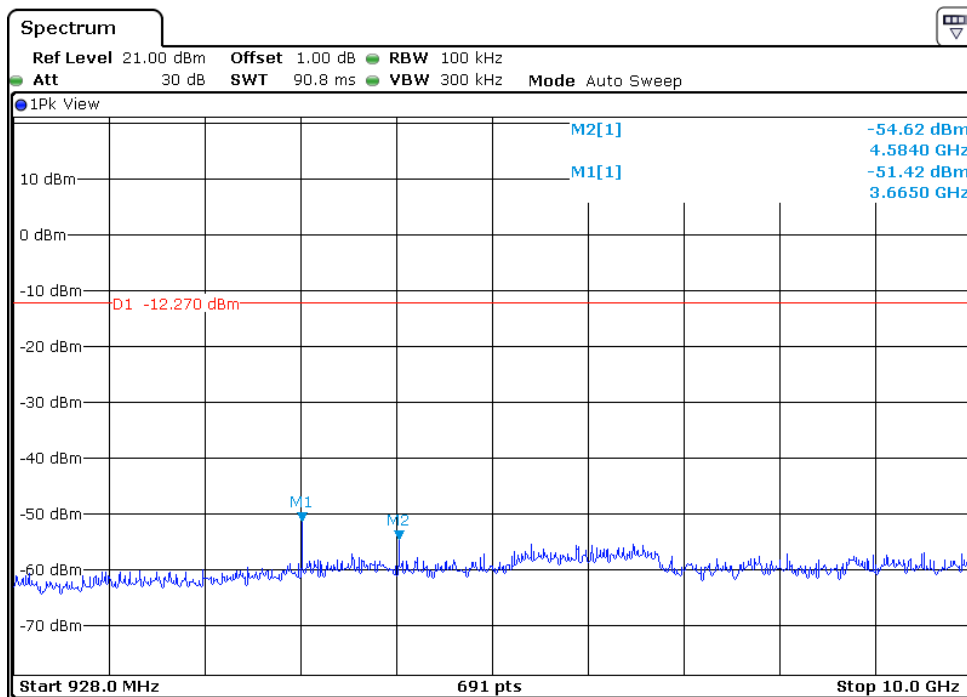
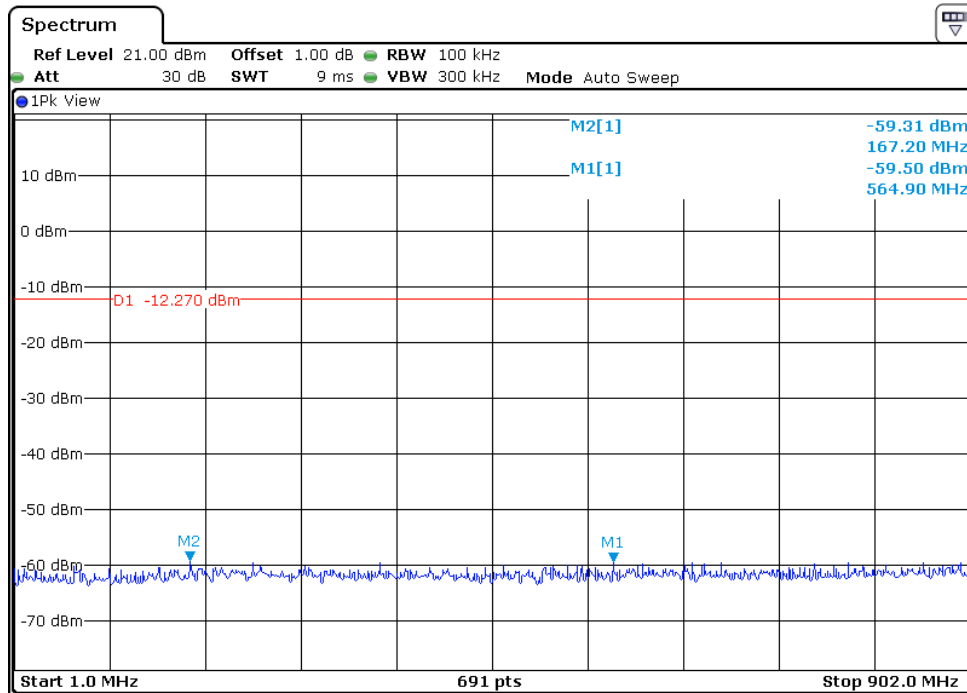
All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

The test plots showed all spurious emission up to the tenth harmonic were measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

The test plots are attached as below.

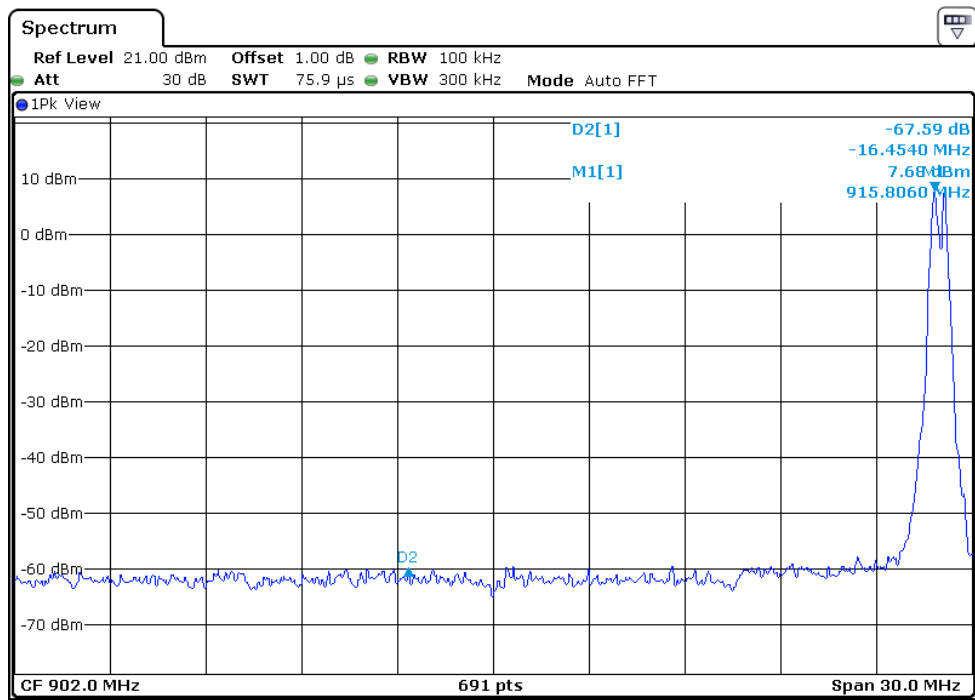
INTERTEK TESTING SERVICES

Channel 01 (915.95MHz) Reference Level: 7.73dBm



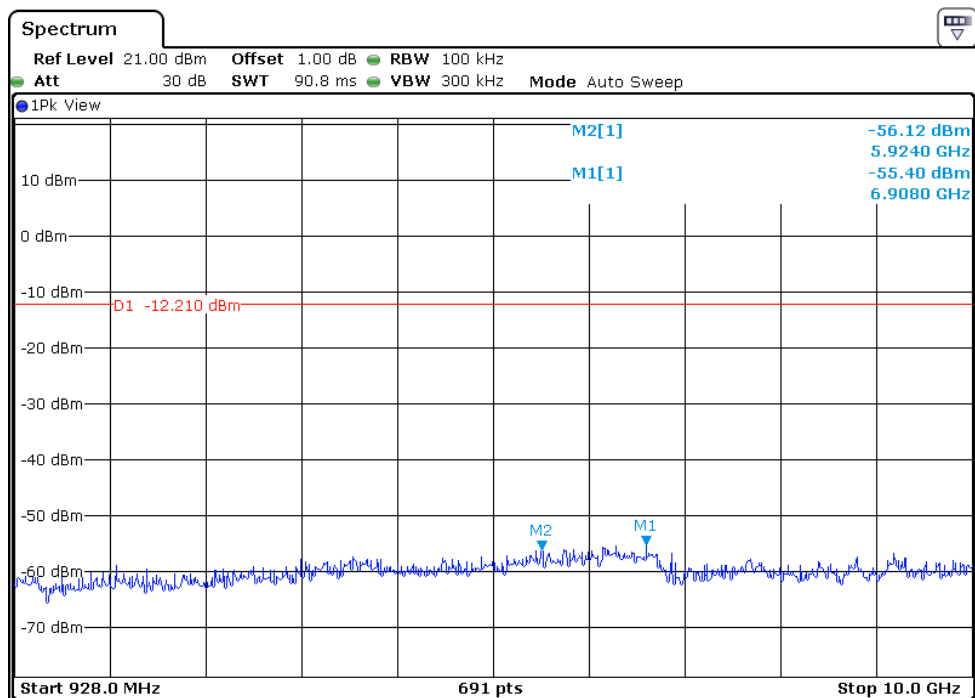
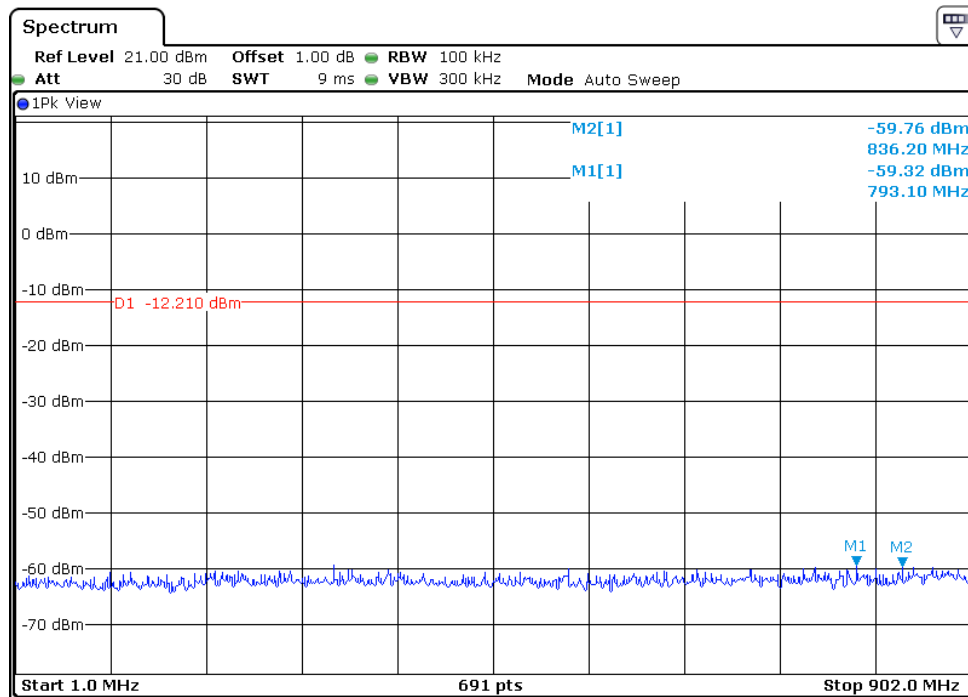
TRF no.: FCC 15C_TX_b
FCC ID: RIR400121
Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES



INTERTEK TESTING SERVICES

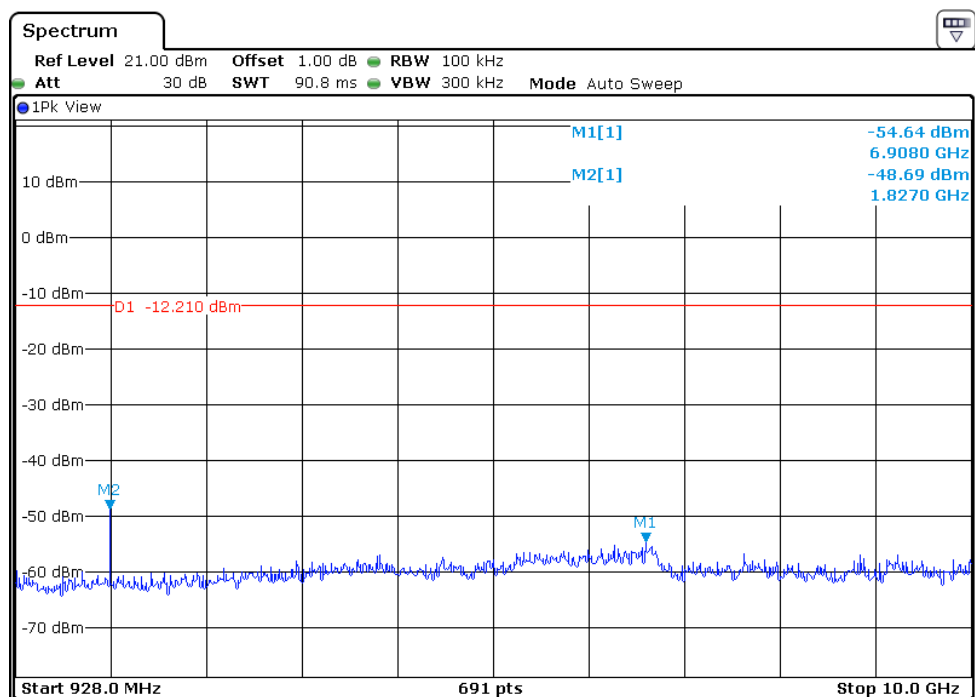
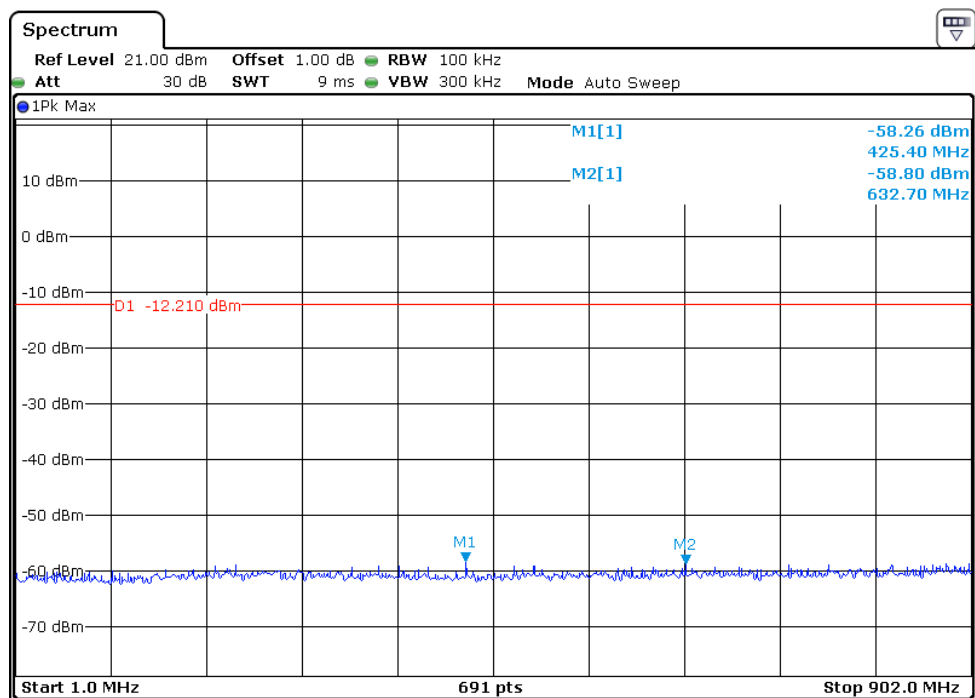
Channel 10 (921.80MHz) Reference Level: 7.79dBm



TRF no.: FCC 15C_TX_b
FCC ID: RIR400121
Report No.: 150616009SZN-002

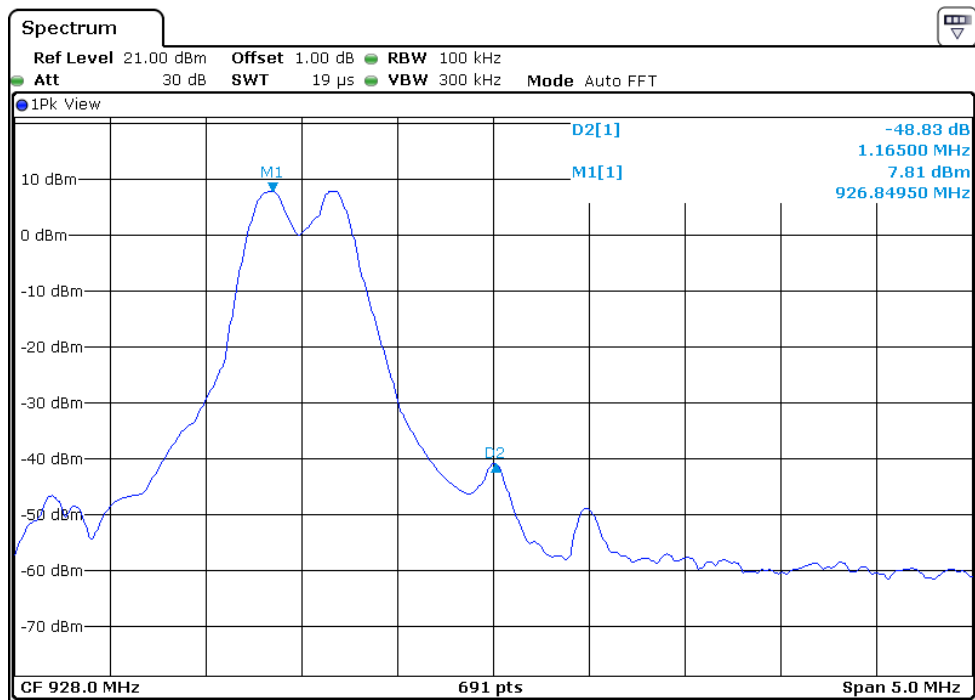
INTERTEK TESTING SERVICES

Channel 18 (927.00MHz) Reference Level: 7.79dBm



TRF no.: FCC 15C_TX_b
FCC ID: RIR400121
Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES



INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
Date of Test: November 26, 2015
Model: 400121

4.5 Out of Band Radiated Emissions (for emissions in 4.4 above that are less than 20dB below carrier), FCC Rule 15.247(d):

For out of band emissions that are close to or that exceed the 20dB attenuation requirement described in the specification, radiated measurements were performed at a 3m separation distance to determine whether these emissions complied with the general radiated emission requirement.

- ☒ Not required, since all emissions are more than 20dB below fundamental
☐ See attached data sheet

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
Date of Test: November 26, 2015
Model: 400121

4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection unless otherwise specified.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc

Date of Test: November 26, 2015

Model: 400121

4.7 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$FS = RA + AF + CF - AG + PD$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB
- PD = Pulse Desensitization in dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD$$

Example

Assume a receiver reading of 62.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB. The net field strength for comparison to the appropriate emission limit is 42 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$PD = 0 \text{ dB}$$

$$FS = 62 + 7.4 + 1.6 - 29 + 0 = 42 \text{ dB}\mu\text{V/m}$$

$$\text{Level in mV/m} = \text{Common Antilogarithm} [(42 \text{ dB}\mu\text{V/m})/20] = 125.9 \mu\text{V/m}$$

TRF no.: FCC 15C_TX_b

FCC ID: RIR400121

Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
Date of Test: November 26, 2015
Model: 400121

4.8 Radiated Spurious Emission

Worst Case Radiated Spurious Emission at 31.455MHz is passed by 15.9dB margin.

For the electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc

Date of Test: November 26, 2015

Model: 400121

Worst Case Operating Mode: TX-Channel 01

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	82.380	27.0	20.0	8.7	15.7	40.0	-24.3
Horizontal	100.325	34.4	20.0	10.1	24.5	43.5	-19.0
Horizontal	359.800	27.7	20.0	17.5	25.2	46.0	-20.8
Horizontal	610.930	26.9	20.0	23.1	30.0	46.0	-16.0
Vertical	31.455	25.8	20.0	18.3	24.1	40.0	-15.9
Vertical	79.955	31.2	20.0	8.4	19.6	40.0	-20.4
Vertical	101.295	35.4	20.0	10.0	25.4	43.5	-18.1

NOTES: 1. Quasi-Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. All emissions are below the QP limit.

TRF no.: FCC 15C_TX_b

FCC ID: RIR400121

Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc

Date of Test: November 26, 2015

Model: 400121

Mode: TX-Channel 01 (915.95MHz)

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*2747.850	57.5	36.8	29.6	50.3	74.0	-23.7
Horizontal	*3663.800	55.9	36.2	32.1	51.8	74.0	-22.2

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*2747.850	57.5	36.8	29.6	18.0	32.3	54.0	-21.7
Horizontal	*3663.800	55.9	36.2	32.1	18.0	33.8	54.0	-20.2

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna used for the emission over 1000MHz.

* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

TRF no.: FCC 15C_TX_b

FCC ID: RIR400121

Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
 Date of Test: November 26, 2015
 Model: 400121
 Mode: TX-Channel 10 (921.80MHz)

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*2765.400	58.0	35.6	29.7	52.1	74.0	-21.9
Horizontal	*3687.200	55.4	36.3	32.1	51.2	74.0	-22.8

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*2765.400	58.0	35.6	29.7	18.0	34.1	54.0	-19.9
Horizontal	*3687.200	55.4	36.3	32.1	18.0	33.2	54.0	-20.8

- NOTES: 1. Peak detector is used except for others stated.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.
- * Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
 Date of Test: November 26, 2015
 Model: 400121
 Mode: TX-Channel 18 (927.00MHz)

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*2781.000	56.5	35.6	29.8	50.7	74.0	-23.3
Horizontal	*3708.000	55.1	36.3	32.1	50.9	74.0	-23.1

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	*2781.000	56.5	35.6	29.8	18.0	32.7	54.0	-21.3
Horizontal	*3708.000	55.1	36.3	32.1	18.0	32.9	54.0	-21.1

- NOTES: 1. Peak detector is used except for others stated.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.
- * Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

INTERTEK TESTING SERVICES

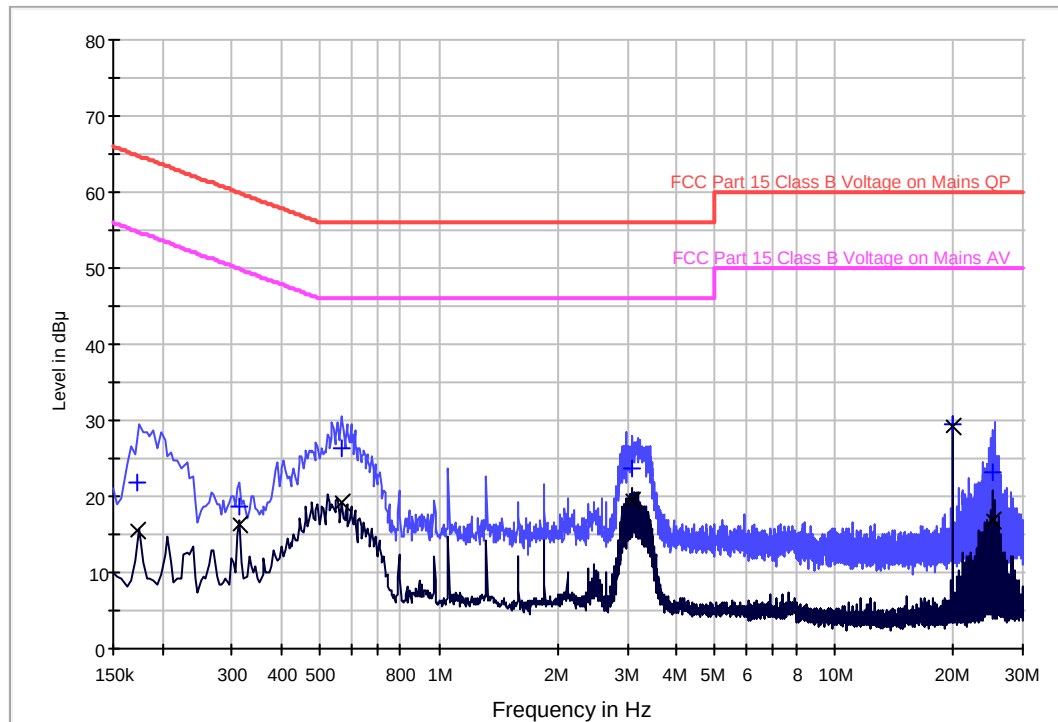
4.9 Conducted Emission

Worst Case Conducted emission at 20.002MHz is Passed by 20.3dB margin

For electronic filing, the worst case conducted emission configuration photograph is saved with filename: conducted photos.pdf.

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
Date of Test: November 26, 2015
Model: 400121
Worst Case Operating Mode: TX-Channel 01
Line: Live
Conducted Emission Test - FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.173	21.9	L1	9.8	42.9	64.8
0.314	18.6	L1	9.9	41.3	59.9
0.566	26.4	L1	9.9	29.6	56.0
3.078	23.6	L1	10.0	32.4	56.0
20.002	29.5	L1	10.2	30.5	60.0
25.094	23.3	L1	10.3	36.7	60.0

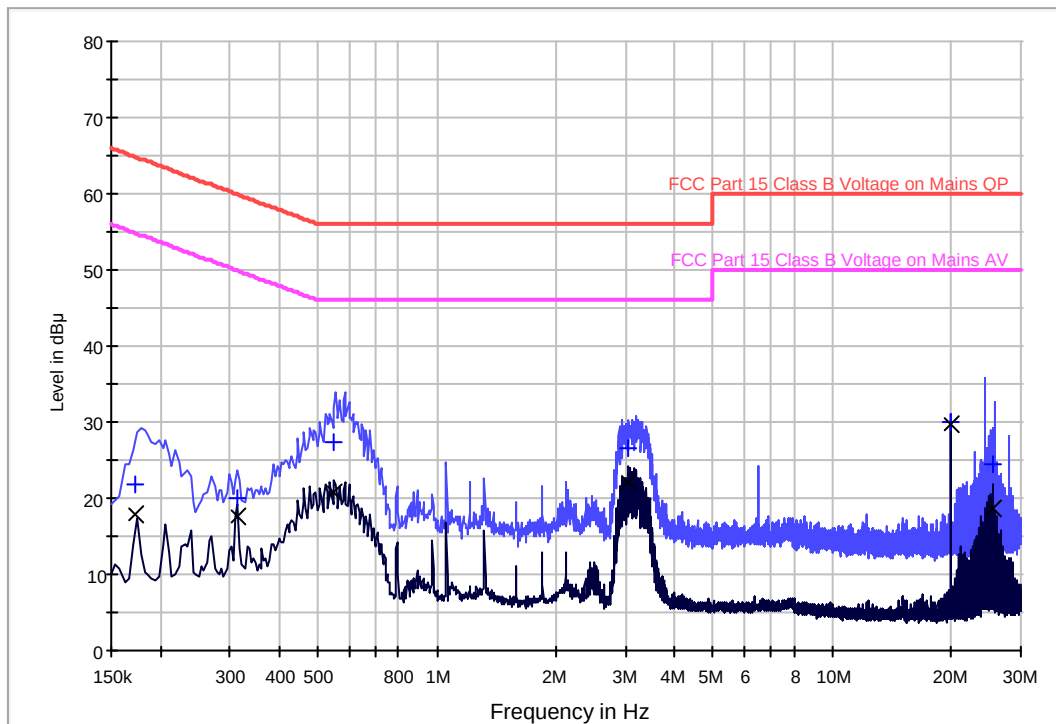
Result Table AV

Frequency (MHz)	Average (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.173	15.6	L1	9.8	39.2	54.8
0.314	16.3	L1	9.9	33.6	49.9
0.566	19.2	L1	9.9	26.8	46.0
3.078	19.5	L1	10.0	26.5	46.0
20.002	29.3	L1	10.2	20.7	50.0
25.094	16.9	L1	10.3	33.1	50.0

TRF no.: FCC 15C_TX_b
FCC ID: RIR400121
Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc
 Date of Test: November 26, 2015
 Model: 400121
 Worst Case Operating Mode: TX-Channel 01
 Line: Neutral
Conducted Emission Test – FCC



Result Table QP

Frequency (MHz)	QuasiPeak (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.173	22.0	N	10.2	42.8	64.8
0.314	20.1	N	10.2	39.8	59.9
0.550	27.3	N	10.3	28.7	56.0
3.062	26.5	N	10.3	29.5	56.0
20.002	29.9	N	10.4	30.1	60.0
25.346	24.5	N	10.4	35.5	60.0

Result Table AV

Frequency (MHz)	Average (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.173	17.9	N	10.2	36.9	54.8
0.314	17.7	N	10.2	32.2	49.9
0.550	20.9	N	10.3	25.1	46.0
3.062	22.0	N	10.3	24.0	46.0
20.002	29.7	N	10.4	20.3	50.0
25.346	18.7	N	10.4	31.3	50.0

TRF no.: FCC 15C_TX_b
 FCC ID: RIR400121
 Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc

Date of Test: November 26, 2015

Model: 400121

4.10 Radiated Emissions from Digital Section of Transceiver, FCC Ref: 15.109

☒ Not required - No digital part

☐ Test results are attached

☐ Included in the separated report.

TRF no.: FCC 15C_TX_b

FCC ID: RIR400121

Report No.: 150616009SZN-002

INTERTEK TESTING SERVICES

Applicant: Zodiac Pool Systems, Inc

Date of Test: November 26, 2015

Model: 400121

4.11 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

Averaging factor in dB = $20 \log (\text{duty cycle})$

The specification for output field strengths in accordance with the FCC rules specifies measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

A plot of the worst-case duty cycle as detected in this manner are saved with filename: af.pdf

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 598.7ms

Effective period of the cycle = 75.362ms

DC = $75.362\text{ms} / 598.7\text{ms} = 0.1259$ or 12.59%

Therefore, the averaging factor is found by $20 \log_{10} 0.1259 = -18.0 \text{ dB}$

EXHIBIT 5
EQUIPMENT PHOTOGRAPHS

INTERTEK TESTING SERVICES

5.0 Equipment Photographs

For electronic filing, the photographs are saved with filename: external photos.pdf & internal photos.pdf.

EXHIBIT 6

PRODUCT LABELLING

INTERTEK TESTING SERVICES

6.0 **Product Labeling**

For electronic filing, the FCC ID label artwork and location is saved with filename: label.pdf.

EXHIBIT 7

TECHNICAL SPECIFICATIONS

INTERTEK TESTING SERVICES

7.0 Technical Specifications

For electronic filing, the block diagram and circuit diagram are saved with filename: block.pdf and circuit.pdf respectively.

EXHIBIT 8

INSTRUCTION MANUAL

INTERTEK TESTING SERVICES

8.0 **Instruction Manual**

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

EXHIBIT 9

CONFIDENTIALITY REQUEST

INTERTEK TESTING SERVICES

9.0 **Confidentiality Request**

For electronic filing, the confidentiality request of the tested EUT is saved with filename: request.pdf.

INTERTEK TESTING SERVICES

EXHIBIT 10

MISCELLANEOUS INFORMATION

INTERTEK TESTING SERVICES

10.0 **Discussion of Pulse Desensitization**

The determination of pulse desensitization was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF*.

Pulse desensitization is not applicable for this device..

EXHIBIT 11

TEST EQUIPMENT LIST

INTERTEK TESTING SERVICES

11.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	20-May-2015	20-May-2016
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	20-May-2015	20-May-2016
SZ061-04	BiConiLog Antenna	ETS	3142C	00066460	17-Oct-2015	17-Oct-2016
SZ185-01	EMI Receiver	R&S	ESCI	100547	07-Feb-2015	07-Feb-2016
SZ061-08	Horn Antenna	ETS	3115	00092346	17-Oct-2015	17-Oct-2016
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	03-Sep-2015	03-Sep-2016
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	29-Apr-2015	29-Apr-2016
SZ056-06	Signal Analyzer	R&S	FSV40	101101	08-Jul-2015	08-Jul-2016
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	07-Feb-2015	07-Feb-2016
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	19-Apr-2014	19-Apr-2016
SZ062-02	RF Cable	RADIALL	RG 213U	--	27-Jun-2015	27-Dec-2015
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	08-Oct-2015	08-Apr-2016
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	08-Oct-2015	08-Apr-2016
SZ067-04	Notch Filter	Micro-Tronics	BRM5070 2-02	--	20-May-2015	20-May-2016
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	03-Nov-2015	03-Nov-2016
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	03-Nov-2015	03-Nov-2016
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	24-Jun-2015	24-Jun-2016
SZ188-03	Shielding Room	ETS	RFD-100	4100	23-Aug-2014	23-Aug-2016