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Test Report

Prepared for: Sentinel Hydrosolutions, LLC

Model: LDS-3

Description: Water Security Product

Serial Number: N/A

FCC ID: 2AMDU-LDS
IC: 23980-LDS

To

FCC Part 15.231

Date of Issue: July 16, 2018

On the behalf of the applicant:	**Sentinel Hydrosolutions, LLC** **1305 Simpson Way, Suite E** **Escondido, CA 92029**
Attention of:	**Pete Lauentzius, Chief Engineer** **Ph: (760)504-1530** **E-mail: plaurentzius@gmail.com**

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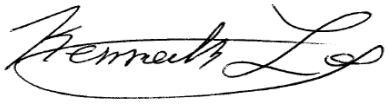
Project No: p1830002



Kenneth Lee
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	7/16/2018	Kenneth Lee	Original document
2.0	6/28/2018	Kenneth Lee	Updated the Occupied Bandwidth section from 99% to -20 dB. Updated detector used in Field Strength Measurements. Updated Duty Cycle Correction and included a plot showing more than 5 seconds sweep time.
3.0	7/16/2018	Kenneth Lee	Updated Fundamental Field Strength and added peak limits to results summary. Updated Duty Cycle correction procedure as well as correction factor. Added companion device to accessory information.

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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

ACCREDITED
TESTING CERT
#2152.01

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The applicant has been cautioned as to the following

15.21: Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator the responsible part may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices
Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2013 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (°C)	**Humidity (%)**	**Pressure (Mbar)**
17-29	26-37	952-979

EUT Description
Model: LDS-3
Description: Water Security Product
Serial Number: N/A
Additional Information: The EUT is a leak detector for water lines. The device can detect water leaks and turn off the water if needed. The EUT transmits control signals to the water valve to close, if a leak is detected. The same radio used in this device is also used in other models. The radios in these models are identical, only the housing changed, so spurious emissions' testing was performed on each housing.

EUT Operation during Tests
The EUT was set to transmit at the maximum available output power.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Valve used as Companion Device	Sentinel Hydrosolutions	VB015	4201

Cables: None

Modifications: None

Test Results Summary

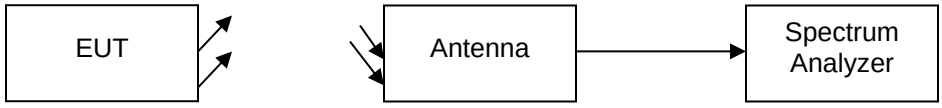
Specification	Test Name	Pass, Fail, N/A	Comments
15.231(a),(e)	Fundamental Field Strength	Pass	
15.231(d)	Out of Band Spurious Emissions	Pass	
15.231(c), RSS-210	-20 dB Occupied Bandwidth	Pass	

Fundamental Field Strength
Engineer: Kenneth Lee
Test Date: 3/20/2018

Test Procedure

The EUT was tested in a semi-anechoic chamber at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Fundamental Field Strength.

Test Setup



Spectrum Analyzer Settings

Detector Settings	RBW	VBW	Span
Peak	120 kHz	300 kHz	As Necessary

Sample Calculations:
Correction Factors include Antenna and cable insertion loss.
Measured Level includes correction factors that were entered into the spectrum analyzer before recording test data.
All following limits were converted to dBuV/m by the calculation stated below:
20*LOG(uV/m)

Fundamental Frequency (MHz)	Field Strength of Fundamental (uV/m)	Field Strength of Spurious Emissions (uV/m)
260 - 470	3750 to 12500	375 to 1250

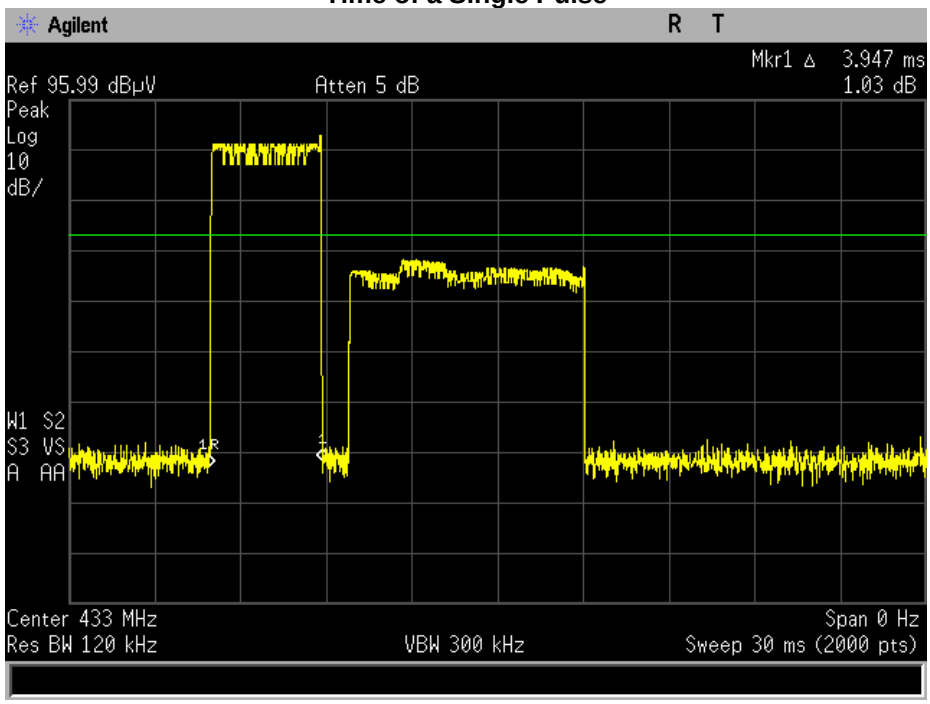
*Linear interpolations

Fundamental Field Strength

Tuned Frequency (MHz)	Peak Measured Level (dBuV/m)	Duty Cycle Correction (dB)	Corrected Reading (dBuV/m)	Avg. Limit (dBuV/m)	Peak Limit (dBuV/m)	Result
433	92.94	-35.599	57.341	80.8	100.8	Pass

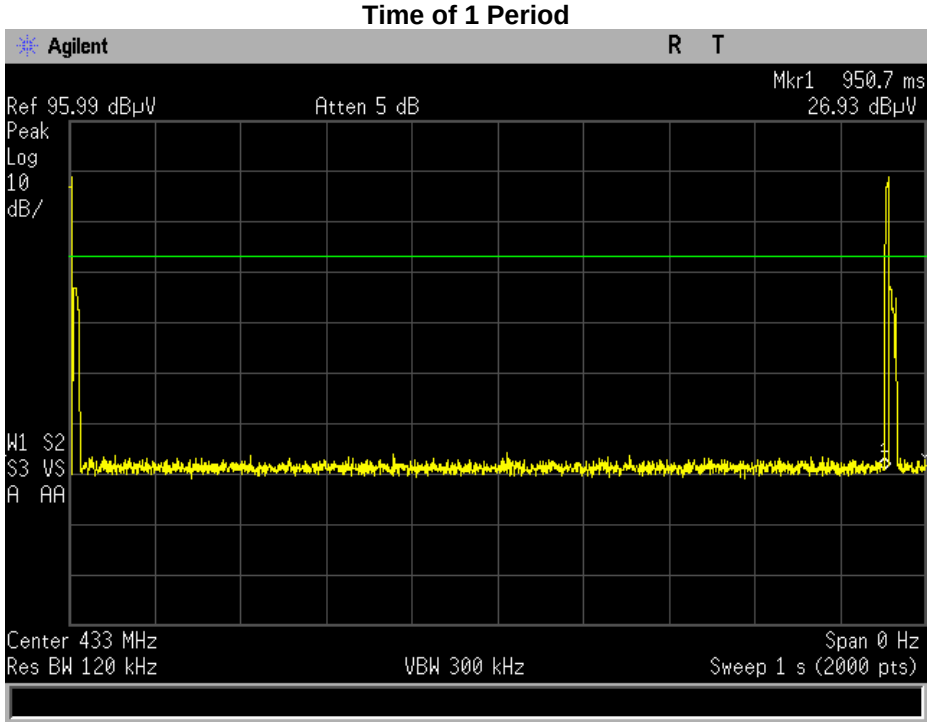
Duty Cycle Correction

Time of a Single Pulse

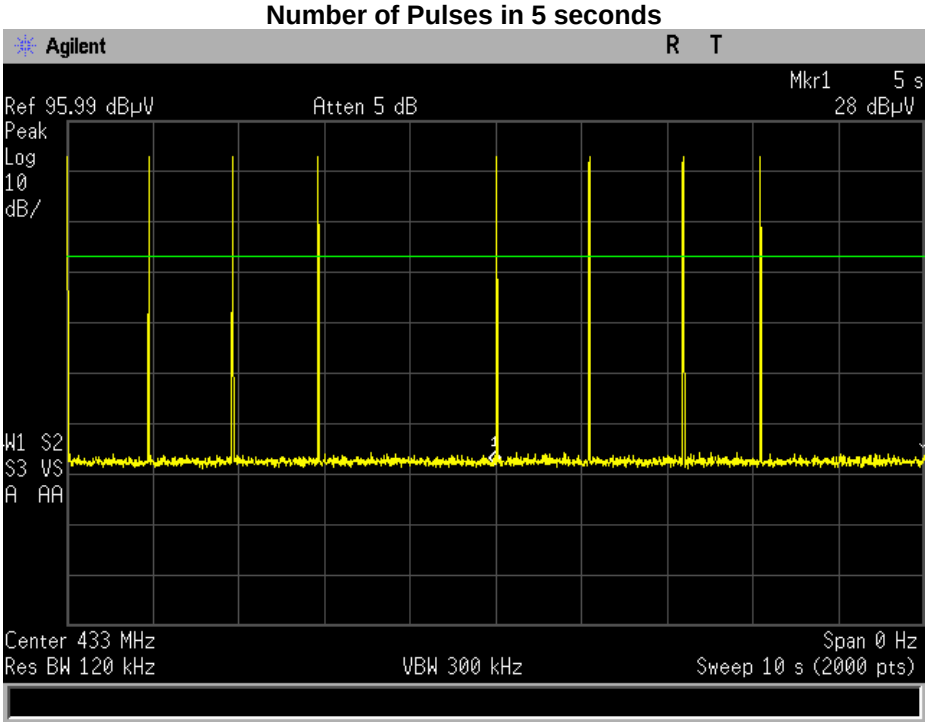


Note: The second, lower amplitude, pulse in the plot is the response from the companion device; therefore it is not included in the calculation

Time of 1 Period



Number of Pulses in 5 seconds



Note: This plot has a sweep time of greater than 5 seconds to show the transmitter stops operation automatically.

Duty Cycle and Correction Calculation

Time of Single Pulse = 3.947 ms
Time of a Single Period = 950.7 ms
Duty Cycle = ON_T / T
Duty Cycle = 15.778 ms / 950.7 ms = 0.016596

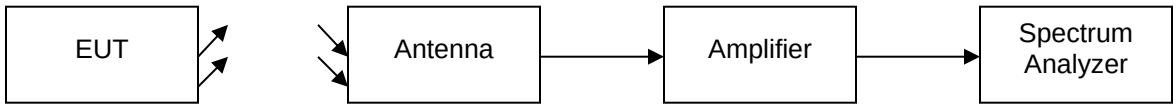
Per ANSI C63.10 Section 7.5 (f)
Duty Cycle Correction = 20 Log (Duty Cycle)
Duty Cycle Correction = 20 Log (0.016596) = -35.599 dB

Radiated Spurious Emissions
Engineer: Kenneth Lee
Test Date: 3/21/2018

Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the limits for Radiated Spurious Emissions. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording data. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup



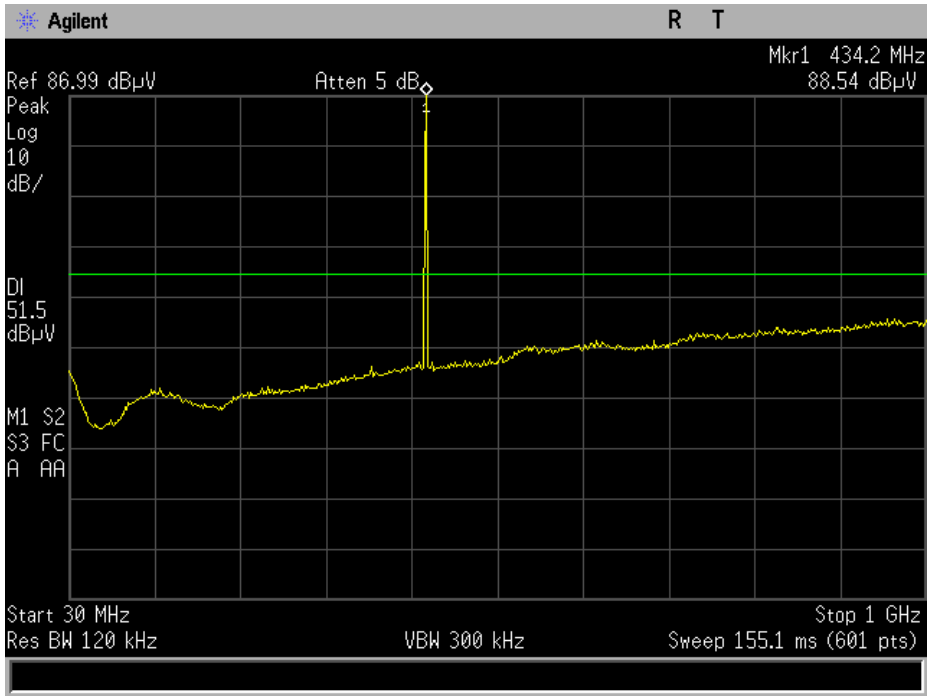
Analyzer Settings

Detector Settings	RBW (MHz)	VBW (MHz)	Span
Peak	1	3	As Necessary
Average	1	3	As Necessary

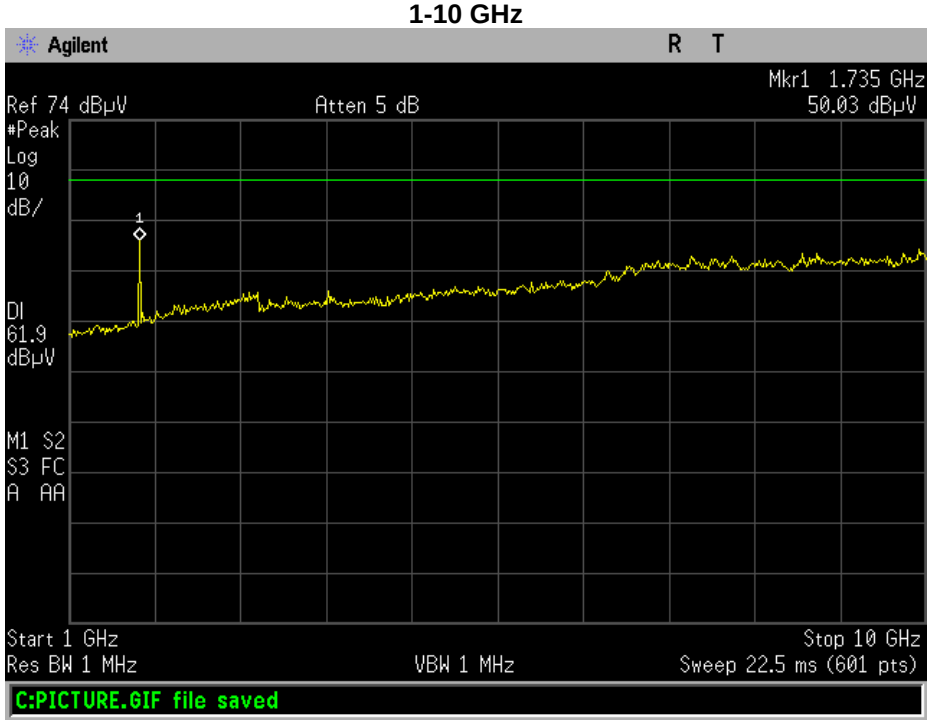
Sample Calculations:
Correction Factors include Antenna and cable insertion loss correction factors.
Measured Level includes correction factors that were input to the spectrum analyzer before recording test data

Radiated Spurious Emissions Plots

30-1000 MHz



1-10 GHz



Occupied Bandwidth

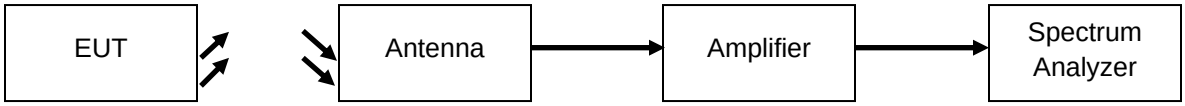
Engineer: Kenneth Lee

Test Date: 3/20/2018

Test Procedure

The EUT was tested in a semi-anechoic chamber at a distance of 3 meter from the receiving antenna. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold while the -20dB bandwidth was measured.

Test Setup



Occupied Bandwidth Summary

Frequency (MHz)	Recorded Measurement (kHz)	Result
433	186.1	Pass

-20dB Bandwidth

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	6/9/17	6/9/18
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
EMI Analyzer	Agilent	E7405A	i00379	2/13/18	2/13/19
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
Preamplifier for 1-18GHz horn antenna	Miteq	AFS44 00101 400 23-10P-44	i00509	N/A	N/A

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT