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FCC PART 15.249 TEST REPORT

UNLICENSED INTENTIONAL RADIATOR

Applicant	VERDANT ENVIRONMENTAL TECHNOLOGIES
Address	5667 ROYALMOUNT AVENUE
	MONTREAL QUEBEC H4P 2P9 CANADA
FCC ID	XEYX9RF
Model Number	X9-RF
Product Description	REMOTE SENSOR
FCC Standard Applied	47 CFR §15.249
Date Sample Received	4/14/2014
Date Tested	4/24/2014
Report Issue Date	5/20/2014
Tested By	CORY LEVERETT
Approved By	CORY LEVERETT
Report Number	593AZUT14TestReport_Rev1.1
Test Results	☒ PASS ☐ FAIL

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.
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APPLICANT: VERDANT ENVIRONMENTAL TECHNOLOGIES

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

The device under test does:

- ☒ fulfill the general approval requirements as identified in this test report
☐ not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025: 2005 requirements.

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Authorized Signatory Name:

Cory Leverett
Engineering Project Manager

Date: **May 20, 2014**



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GENERAL INFORMATION

EUT Specification

The test results relate only to the items tested.			
Applicable Standard	Part 15.249		
EUT Description	REMOTE SENSOR		
FCC ID	KEYX9RF		
Model Number	X9-RF		
Operating Frequency	TX: 902.4-927.6MHz	RX: Same	
No. of Channels	64		
Modulation type	GFSK only		
Programed Output power	-2dBm		
Data Rate	50kbps at input, 100kbps over-the-air Manchester encoded		
EUT Power Source	☐ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☒ Battery Operated Exclusively		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	None, Fixed wire antenna		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.		
Conditions in the Test laboratory	Temperature: 26°C Relative humidity: 50%		
Test Exercise	Two Samples were used, and programmed as follows: Sample 1: Transmits @ max power continuously at fixed frequency selectable between 902.4, 915, and 926.6MHz. Sample 2: Normal operation with a channel Dwell Time of 16.384 seconds.		
Revision History of EUT	The output power level of the device was revised to be in compliance of the FCC rules. The manufacturer has specified this as -2dBm power level setting.		

Related Reports

This EUT has a receiver that was tested for compliance with FCC part 15.109B limits. This receiver was found to be in compliance with the FCC limits following the verification procedure.

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TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Antenna-Active Loop	ETS-Lindgren	6502	00062529	10/09/2013	10/09/2015
Antenna: Biconnical	Eaton	94455-1	1057	06/14/13	06/14/15
Antenna: Log-Periodic	Eaton	96005	1243	05/31/13	05/31/15
Signal Generator	HP	8640B	2308A21464	09/18/13	09/18/15
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
EMI Test *Receiver*	Rhode & Schwarz	ESU 40	100320	03/21/15	03/21/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	10/05/12	10/05/14

*EMI Test Receiver Firmware Version: 4.73 Service Pack 1

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TEST PROCEDURES

Radiation Interference: ANSI C63.4-2003 using a spectrum analyzer, a preselector, a quasi-peak adapter, and an appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz with an appropriate sweep speed and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3 MHz above 1 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worst case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+ CL	= FS
33	20 dBuV	+ 10.36 dB	+ 0.5	= 30.86 dBuV/m @ 3m

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30 MHz.

Occupied Bandwidth: A small sample of the transmitter output was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to -10 dBm per division.

ANSI C63.4-2003 10.1 Measurement Procedures: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation. When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. Emissions attenuated more than 20 dB below the permissible value are not reported.

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RADIATION INTERFERENCE

Rules Part No.: 15.249(d), 15.35(a), 15.209

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 – 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters
Part 15.249	
Fundamental 902 – 928 MHz	94.0 dB μ V/m @ 3 meters
Fundamental 2.4 – 2.4835 GHz	94.0 dB μ V/m @ 3 meters
Harmonics	54.0 dB μ V/m @ 3 meters

Test Data:

Field Strength Table

Sample 1 was used determined to produce the worst case emissions, this sample was in static mode with constant TX. Emissions were checked to the tenth harmonic. The worse case for each tuned frequency is highlighted in yellow. If no emission was measurable the noise floor was reported, this is noted in the table as NE/NF.

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Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Detector Type	Ant. Polarity	Coax Loss dB	Correction Factor dB / m	Duty Cycle Factor	Field Strength dBuV / m	Margin dB
902.4	902.4	53.9	Q Peak	V	2.38	23.3	NA	79.58	14.42
902.4	902.4	58.6	Q Peak	H	2.38	23.3	NA	84.29	9.71
902.4	1,804.00	26.7	M Peak	V	2.74	30.54	20	39.98	14.02
902.4	1,804.00	28.9	M Peak	H	2.74	30.54	20	42.18	11.82
902.4	2,707.00	29.6	M Peak	H	3.39	33.03	20	46.02	7.98
902.4	2,707.00	30.5	M Peak	V	3.39	33.03	20	46.92	7.08
902.4	9,024.00	0.8	Average	V	6.61	36.12	0	43.5	NE/NF
902.4	9,024.00	1	Average	H	6.61	36.12	0	43.71	NE/NF
915	915	54	Q Peak	V	2.4	23.35	NA	79.74	14.26
915	915	56.8	Q Peak	H	2.4	23.35	NA	82.51	11.49
915	1,830.00	25.9	M Peak	H	2.76	30.68	20	39.34	14.66
915	1,830.00	26.4	M Peak	V	2.76	30.68	20	39.84	14.16
915	2,745.00	30.8	M Peak	V	3.42	33.09	20	47.31	6.69
915	2,745.00	30.9	M Peak	H	3.42	33.09	20	47.41	6.59
915	9,150.00	1.3	Average	H	6.65	36.25	0	44.2	NE/NF
927.6	927.6	54.7	Q Peak	V	2.42	23.48	NA	80.64	13.36
927.6	927.6	57	Q Peak	H	2.42	23.48	NA	82.87	11.13
927.6	1,855.00	26.8	M Peak	V	2.78	30.82	20	40.4	13.6
927.6	1,855.00	27.8	M Peak	H	2.78	30.82	20	41.4	12.6
927.6	2,782.00	31.1	M Peak	V	3.45	33.15	20	47.7	6.3
927.6	2,782.00	31.6	M Peak	H	3.45	33.15	20	48.2	5.8
927.6	9,276.00	1.9	Average	H	6.68	36.38	0	45	NE/NF

Result : Pass

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BAND EDGE COMPLIANCE

Rules Part No.: 15.249 (d)

Requirements: 50 dBc or in the case of restricted bands 54 dBuV/m.

Test Result: Pass

Test Data: Worst Case Sample 2 Normal operation with hopping on

Upper Band Edge										
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Detector	Coax Loss dB	Correction Factor dB/m	Fundamental Field Strength	Field Strength dBuV/m	dBc	Margin dB
927.6	932.7	0.4	H	Q Peak	2.43	23.5	82.87	26.33	56.54	6.54
927.6	933.74	-0.3	V	Q Peak	2.43	23.5	82.87	25.68	57.19	7.19
927.6	938.5	-0.7	V	Q Peak	2.44	23.5	82.87	25.25	57.62	7.62
927.6	945.24	1	H	Q Peak	2.45	23.6	82.87	27.03	55.84	5.84
927.6	957.05	0.4	V	Q Peak	2.47	23.77	82.87	26.6	56.27	6.27
927.6	980.90*	0.9	H	Q Peak	2.5	24.11	82.87	27.54	55.33	26.46

Lower Band Edge										
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Detector	Coax Loss dB	Correction Factor dB/m	Fundamental Field Strength	Field Strength dBuV/m	dBc	Margin dB
902.4	880.88	1.2	H	Q Peak	2.28	23.13	84.29	26.57	57.72	7.72
902.4	889.62	0.6	V	Q Peak	2.32	23.39	84.29	26.32	57.97	7.97
902.4	895.58	1.4	V	Q Peak	2.36	23.34	84.29	27.1	57.19	7.19
902.4	896.25	0.1	H	Q Peak	2.36	23.34	84.29	25.78	58.51	8.51
902.4	897.69	0.1	H	Q Peak	2.37	23.32	84.29	25.81	58.48	8.48
902.4	901.11	0	V	Q Peak	2.38	23.3	84.29	25.68	58.61	8.61

***Denotes Restricted band**

Result: Pass

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DUTY CYCLE

Total # of pulses: 1 in 100 ms

Duration of pulse: 6.63ms maximum duration of pulse according to plot captured.

$20 * \log ((6.63)/100) = 20 * \log (.066) = 23.56 \text{ dB}$

Duty Cycle On time Plot in 100ms

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22.Apr 14 15:56

Ref 82 dBμV

*Att 10 dB

RBW 100 kHz

*VBW 100 kHz

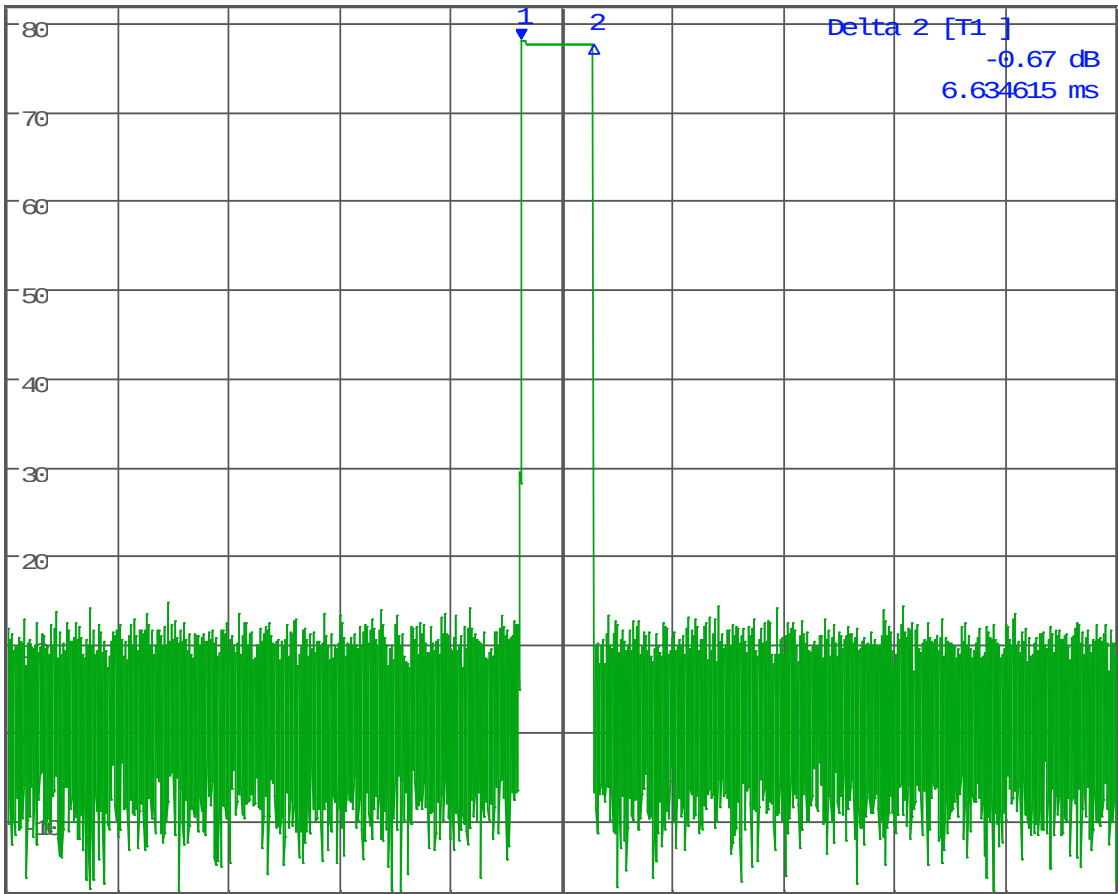
SWT 100 ms

Marker 1 [T1]

78.20 dBμV

46.250000 ms

1 AP
VIEW



Center 902.4 MHz

10 ms/

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OCCUPIED BANDWIDTH

-20dBm Occupied Bandwidth Plot:



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POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: 15.207

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBuV)	Average Limits (dBuV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50

Test Data: The attached graphs represent the emissions read for power line conducted for this device. Both lines were observed.

N/A
Battery or vehicle powered EUT.

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