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FCC Part 90.217 Test Report

On

Oil eSensor Transmitter
Part Number: 0005618
Serial Number: 0003872-0000C969
FCC ID: X94-0005618REVB00

Customer Name:	EnerTrac, Inc.
Customer P.O:	357
Date of Report:	December 4, 2013
Test Report No:	R-5727N
Test Start Date:	June 8, 2013
Test Finish Date:	November 26, 2013
Test Technician:	M. Seamans
Lead Technician:	T. Hannemann
Approved By:	S. Wentworth
Report Prepared By:	J. Ramsey

Certification and Signatures

We certify that this report is a true report of the results obtained from the tests of the equipment stated and relates only to the equipment tested. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.

Scott Wentworth
Branch Manager
NVLAP Approved Signatory

Todd Hannemann
Laboratory Supervisor
iNARTE Certified ATL-0255-T

Non-Warranty Provision
The testing services have been performed, findings obtained, and reports prepared in accordance with generally accepted testing laboratory principles and practices. This warranty is in lieu of all other warranties, either express or implied.

Non-Endorsement
This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation, endorsement, or certification of the product or material tested. This report must not be used by the client to claim product endorsement by NVLAP, NIST or any agency of the U.S. Government.

Test Program Summary

Applicant/Manufacturer:	EnerTrac, Inc. 94 River Road, Suite 101 Hudson, NH 03051
Equipment under Test (EUT):	The EUT is a transmitter operating in the Part 90 Industrial/Business Radio Pool and will be mounted to oil tanks. It will be used to wirelessly send tank level status information to a remote receiver.
Model:	Oil eSensor
Part Number:	0005618
FCC ID Number:	X94-0005618REVB00
Applicable Test Standards:	FCC Parts 2 & 90.217
90.217 Exemption from	The EUT will have an output power less than 120 mW and operate at frequencies listed in Part 90, Subpart C. The EUT is thereby subject only to the technical requirements of 90.217.
Technical Standards Measurement Procedure:	ANSI/TIA-603-C-2004
EUT Frequency Range Band:	450 MHz – 470 MHz
EUT Channels:	464.725 MHz, 464.700 MHz, 464.650 MHz, 464.625 MHz, 464.600 MHz
Power Output Rating:	74.75 mW (ERP)
Modulation Type:	AM
Antenna Type:	Integral Omni Directional (No Antenna Port)
Input Power:	3.6 VDC via one (1) internal lithium thionyl chloride battery
RF Exposure:	The EUT will operate at a frequency less than 1.5 GHz with an ERP of less than 1.5 W and is therefore exempt from routine evaluation
Temporary Hardware Modification:	In order to enable continuous transmission during testing, a temporary hardware modification was required. A larger capacitor was installed then is typically used in production units.
Support Equipment:	No support equipment was utilized

Test Program Summary (continued)

Measurements Required:

- RF Power Output (2.1046/90.217)
- Occupied Bandwidth (2.1049/90.217 (b)
- Effective Radiated Power of Spurious Radiation (2.1053/90.217)
- Frequency Stability (2.1055/90.217)

RF Output Power (ERP)

Measurement Procedure:

In order to be considered exempt from the other technical requirements of Part 90 and subject only to the technical requirements of 90.217 the output power of the EUT must be less than 120 mW. The test sample was placed on an 80 cm high wooden test stand which was located 3 meters from the test antenna on an FCC listed test site. The effective radiated power of the fundamental frequency was measured using the substitution method specified in ANSI/TIA-603-C-2004. The maximum ERP of the fundamental frequency was measured to be 74.75 mW. See the attached test data.

Effective Radiated Power of Spurious Radiation

Measurement Procedure:

The test sample was placed on an 80cm high wooden test stand which was located 3 meters from the test antenna on an FCC listed test site. The effective radiated power of each spurious emission was measured using the substitution method specified in ANSI/TIA-603-C-2004. The frequency range of the test was 30 MHz – 5 GHz. The limit for out of band spurious emissions is -30 dBc as specified in Part 90.217. No emissions were observed within 20 dB of the specified limit. See the attached test data.

Test Program Summary (continued)

Frequency Stability/Occupied Bandwidth

Measurement Procedure:

Per 90.217(b), for equipment designed to operate with a 12.5 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 25 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier. The test sample was placed into a temperature chamber with a variable DC power source supplying power to the EUT. With the test sample operating at maximum output power the test sample's fundamental output frequency was measured and recorded at 10 degree increments from -30 degrees C to +50 degrees C. At each 10 degree increment, frequency measurements were taken with the DC input voltage set to 3.6 VDC (nominal internal battery voltage) and 1.6 VDC (lowest voltage at which the EUT will transmit).

At each 10 degree increment and DC input voltage referenced above, frequency measurements were also made at the upper and lower -30 dBc points in order to determine the maximum occupied bandwidth of the signal. The maximum occupied bandwidth at -30dBc was determined to be 0.488 kHz. See the attached test data.

Equipment Lists

Fundamental ERP

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
4029	RETLIF	OPEN AREA TEST SITE	3 / 10 Meters	RNH	7/24/2012	7/24/2015
8165	EMCO	BICONILOG	26 - 2000 MHz	3142	5/20/2013	11/30/2014
R450	AGILENT / HP	Analyzer, Spectrum	100 Hz - 26.5 GHz	E7405A;A	8/7/2013	8/31/2014
5107	AGILENT / HP	SIGNAL GENERATOR	100 kHz - 20 GHz	N5183A	5/29/2013	5/31/2014

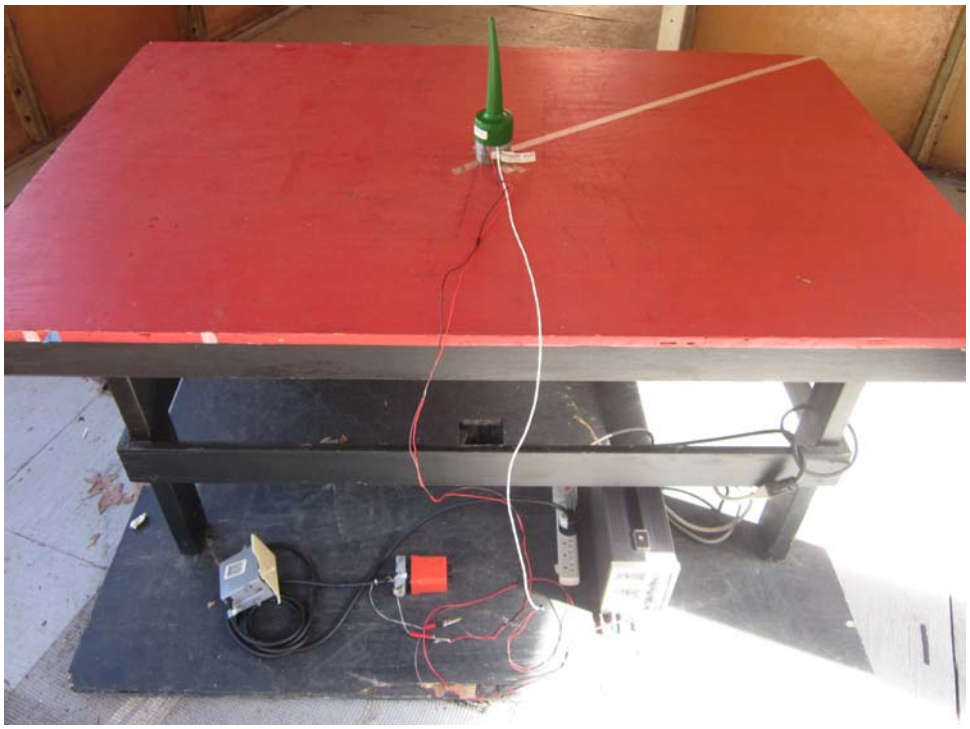
Spurious ERP

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1232	AGILENT / HP	PRE-AMPLIFIER	1 - 26.5GHz	8449B	5/30/2012	6/30/2013
3258	EMCO	DOUBLE RIDGED GUIDE ANTENNA	1 GHZ - 18GHZ	3115	2/24/2012	8/31/2013
4029	RETLIF	OPEN AREA TEST SITE	3 / 10 Meters	RNH	7/24/2012	7/24/2015
5070	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 40 GHz	ESIB40	11/6/2012	11/30/2013
8165	EMCO	BICONILOG	26 - 2000 MHz	3142	5/20/2013	11/30/2014

Occupied Bandwidth/Frequency Stability

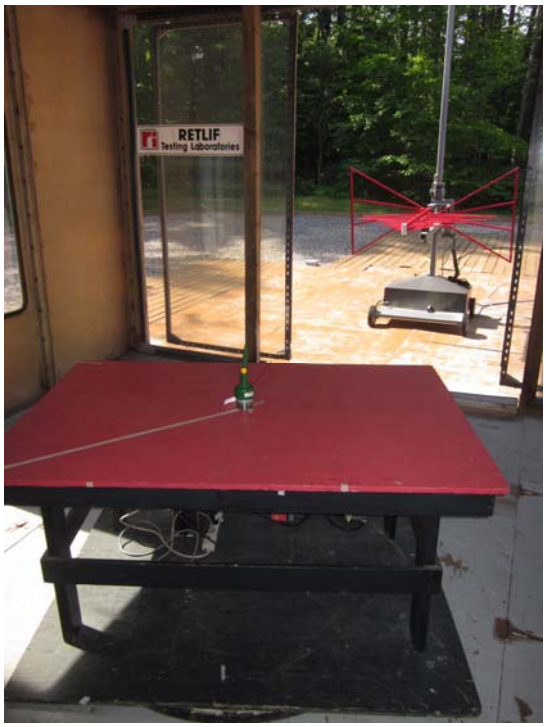
EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
4997	OMEGA	DIGITAL THERMOMETER	-200 DEG C - +1372 DEG C	HH22	8/16/2012	8/31/2013
5049B	FLUKE	DIGITAL MULTIMETER	True RMS Multimeter	111	8/16/2012	8/31/2013
5077	ASSOCIATED ENVIRONME	TEMPERATURE CHAMBER	-50 to 150 C	ZFD-531	8/15/2012	8/31/2013
5110	BK PRECISION	DC POWER SUPPLY	30V / 3A	1630	Calibrate Before Use	
5133	NARDA	10DB ATTENUATOR	DC - 12.4 GHz	757C-10	10/16/2012	10/31/2013
R444	AGILENT / HP	SPECTRUM ANALYZER	100 Hz - 26.5 GHz	E7405A;A	7/6/2012	7/6/2013

Setup Photographs
Fundamental & Spurious ERP

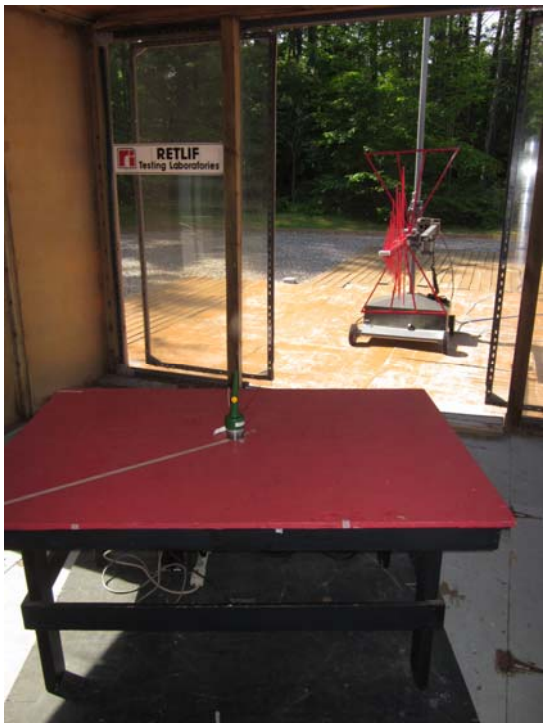


Test Configuration

Setup Photographs
Fundamental & Spurious ERP

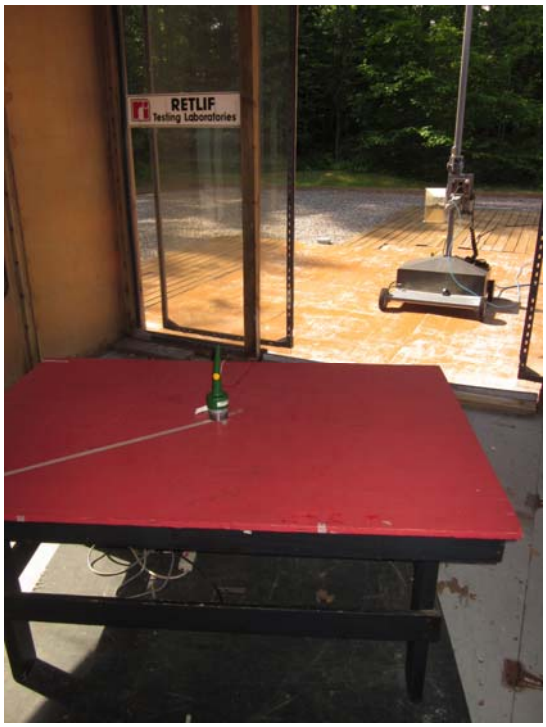


Test Setup, Horizontal Polarization, 30 to 1000 MHz

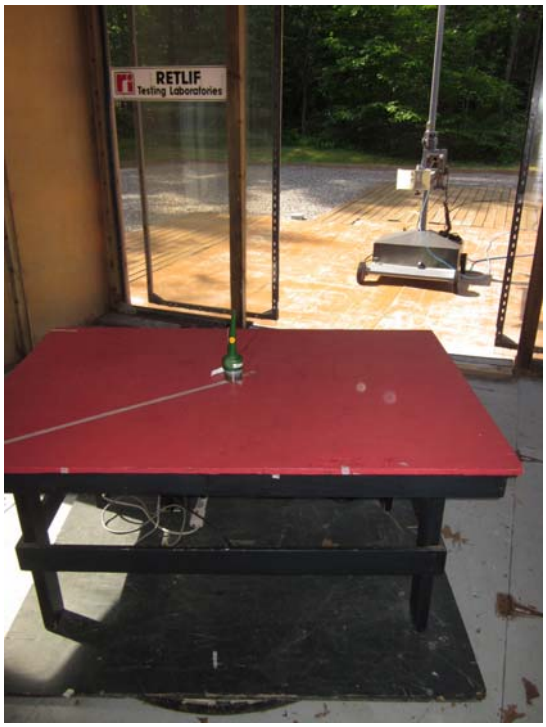


Test Setup, Vertical, 30 to 1000 MHz

Setup Photographs
Fundamental & Spurious ERP



Test Setup, Horizontal Polarization, 1 to 5 GHz



Test Setup, Vertical Polarization, 1 to 5 GHz

Setup Photographs
Occupied Bandwidth/Frequency Stability

Test Setup

Test Data

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET		
Test Method	**RF Power Output (ERP)**	
Customer	EnerTrac	
Job Number	R-5727N	
Test Sample	Oil eSensor Transmitter	
Part Number	0005618	
Serial Number	0003872-0000C969	
Test Specification	FCC Part 2 and 90	Paragraphs: 2.1049 and 2.1046/90.217
Operating Mode	Transmitting at 464.7 MHz	
Technician	M. Seamans	
Date	Nov. 26th, 2013	
Notes: Antenna test distance, 3 meters.		

TEST PARAMETERS

Transmitter Frequency	Antenna	Antenna Ref Level	Signal Gen Level	Ref. Antenna Gain	Corrected Reading	Converted Reading (ERP)	ERP Limit
MHz	**Polarization**	**dBuV**	**dBm**	**dBd**	**dBm**	**mW**	**mW**
464.700	H	78.33	3.535	0.00	3.535	3.535	120.00
464.700	V	93.73	18.735	0.00	18.735	74.745	120.00

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET		
Test Method	**Spurious Emissions (ERP), 30 MHz to 5 GHz**	
Customer	EnerTrac	
Job Number	R-5727N	
Test Sample	Oil eSensor Transmitter	
Part Number	0005618	
Serial Number	N/A	
Test Specification	FCC Part 2 and 90	Paragraphs: 2.1049 and 2.1053/90.217
Operating Mode	Transmitting at 464.7 MHz	
Technician	M. Seamans	
Date	June 6th, 2013	

Notes: Antenna test distance, 3 meters.

TEST PARAMETERS

Transmitter Frequency	Antenna/EUT Position	Antenna Ref Level	Signal Gen Level	Ref. Antenna Gain	Corrected Reading	Converted Reading (ERP)	ERP Limit
MHz	Polarization	dBuV	dBm	dBd	dBm	mW	
30.00	-	-	-	-	-	-	-30dBc
|	-	-	-	-	-	-	|
929.40	-	-	-	-	-	-	|
1394.09	-	-	-	-	-	-	|
1853.59	-	-	-	-	-	-	|
2323.41	-	-	-	-	-	-	|
2787.96	-	-	-	-	-	-	|
3253.05	-	-	-	-	-	-	|
3717.40	-	-	-	-	-	-	|
4181.85	-	-	-	-	-	-	|
4646.65	-	-	-	-	-	-	|
|	-	-	-	-	-	-	|
5000.00	-	-	-	-	-	-	-30dBc

No Spurious or harmonic emissions were observed from the EUT within 20dB of the specified limit.

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET		
Test Method	**Frequency Stability and Occupied Bandwidth**	
Customer	EnerTrac	
Job Number	R-5727N	
Test Sample	Oil eSensor Transmitter	
Part Number	0005618	
Serial Number	N/A	
Test Specification	FCC Part 2 and 90	Paragraphs: 2.1049 and 2.1055/90.217
Operating Mode	Transmitting at 464.7 MHz	
Technician	M. Seamans	
Date	June 5th, 2013	

Notes: Fundamental peak frequency and bandwidth (measured at -30 dBc) recorded at extreme temperature and voltage.

TEST PARAMETERS

Temp.	Voltage	-30 dBc Lower Frequency		Peak Frequency		-30 dBc Upper Frequency		Occupied Bandwidth
C	Vdc	**MHz**		**MHz**		**dB**		**kHz**
-30.00	3.6	464.704234		464.704386		464.704550		0.317
-30.00	1.6	464.700142		464.700285		464.700450		0.308
-20.00	3.6	464.703375		464.703639		464.703792		0.416
-20.00	1.6	464.703381		464.703554		464.703871		0.488
-10.00	3.6	464.703716		464.704036		464.704176		0.459
-10.00	1.6	464.704713		464.704870		464.705008		0.259
0.00	3.6	464.704652		464.704802		464.704957		0.304
0.00	1.6	464.704044		464.704195		464.704353		0.309
10.00	3.6	464.704379		464.704588		464.704724		0.345
10.00	1.6	464.703372		464.703549		464.703683		0.311
20.00	3.6	464.703662		464.703806		464.704043		0.381
20.00	1.6	464.702579		464.702744		464.702876		0.297
30.00	3.6	464.702761		464.702933		464.703669		0.307
30.00	1.6	464.703352		464.703495		464.703634		0.283
40.00	3.6	464.702456		464.702611		464.702816		0.359
40.00	1.6	464.701407		464.701575		464.701758		0.350
50.00	3.6	464.701748		464.701902		464.702893		0.345
50.00	1.6	464.711126		464.711278		464.711513		0.386

1.6 VDC is the lowest voltage at which the EUT transmits.
Frequency Stability: **7.472 kHz** Maximum Occupied Bandwidth: **0.488 kHz**