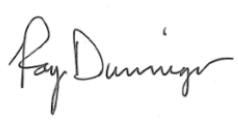
Copeland, New York 13045
Telephone: 607 - 753 - 6711
Facsimile: 607 - 758 - 3683
www.intertek.com

Total Quality. Assured.

Report No.: 101818837CRT-001B 11.21.14

Completed by:	Ray Dunnigan
Title:	Project Engineer
Signature:	

Completed by:	Alex Porter
Title:	Project Reviewer
Signature:	

Performance Test Reports & Findings For:
An Energy Efficiency Comparison Multiple Thermostats

THERMOSTAT ENERGY EFFICIENCY COMPARISON

INDEX

Objective:

To determine through data collected and calculated in a controlled but “real world” test environment if **THERMOSTAT Sample A** saves energy while still maintaining the desired temperature set point as well as maintain indoor relative humidity at an acceptable level in direct comparison to **THERMOSTAT Sample B.**

Parameters

The following parameters are controlled:

VALUE	DESCRIPTION	UNITS	METHOD	MU
Temperature	Air Temperature	Deg F	Thermostat	+/- 0.8 C (approx. 95%, k=2) %
Power	Voltage & Amps	Watts	Power Meter	+/- 0.2 (approx. 95%, k=2) %
Frequency	Frequency	Hz	Household Outlet	+/- 0.24Hz (approx. 95 %, k=2)
Humidity	R/H	%	Thermostat	+/- 5.0 RH% (approx. 95 %, k=2)

Parameters

The following parameters are monitored:

VALUE	DESCRIPTION	UNITS	METHOD	MU
Temperature	Air Temperature	Deg F	Sensor	+/- 0.8 C (approx. 95%, k=2) %
Power	Voltage & Amps	Watts	Data logger	+/- 0.2 (approx. 95%, k=2) %
Frequency	Frequency	Hz	Household Outlet	+/- 0.24Hz (approx. 95 %, k=2)
Humidity	R/H	%	Sensor	+/- 5.0 RH% (approx. 95 %, k=2)

Sample Acquisition

Samples observed at test site:

Sample #	Description	Control #	Witness Location	Date	Condition
Client provided	Programmable thermostat, data logger and environment sensors	See Model and serial numbers in equipment list	SFH in Altamonte Springs, Florida	09.28.14	Good

Testable Hypothesis

The hypothesis as provided by our client:

"*While operating the same HVAC system, the total energy (kWh) consumed by our thermostat will be significantly less than that of the energy consumed by the same HVAC system when controlled by the competing thermostat. Furthermore, our thermostat will provide the energy savings without compromising the desired temperature setting or relative humidity of the environment.*"

TECHNICAL STAFF

TECHNICAL STAFF		
#	**Staff Name**	**Area of Expertise**
1	Ray Dunnigan	Proficient in witnessing test procedures per approved client protocol
2	Elwood Dodge	Proficient in witnessing test procedures per approved client protocol
3	Alex Porter	Qualified to review testing per approved client protocol

**note: Complete training records for staff are available upon request*

CALIBRATED TEST EQUIPMENT

EQUIPMENT LIST

#	Equipment Description	Manufacterer's Name / Model / Serial #	Calibration Date	Calibration due	Range Used
1	Energy Data Logger	eGauge EG3000, S/N 1406270085	09.14.14	09.14.15	0-100A
2	Environment INDOOR Sensor	Thermotron SM-4S-SL, S/N98:8B:AD:00:4D:B2	09.10.14	09.10.15	0-100° F
3	Environment OUTDOOR Sensor	Thermotron SM-4S-SL, S/N 98:8B:AD:00:1E:E7	09.10.14	09.10.15	0-100°F 0-100%rh

EQUIPMENT UNDER TEST

EQUIPMENT LIST

1	Thermostat Sample A	LHTS "REST" v 1.0 7-Day Programmable Thermostat	Thermostats were reviewed and programmed upon test commencement
2	Thermostat Sample B	Honeywell T-8011 7 Day Programmable Thermostat	Thermostats were reviewed and programmed upon test commencement

PROTOCOL & PROCEDURE DESCRIPTION

The test protocols and procedures for this study were client-defined and reviewed and approved for use in the tests by Intertek engineers

Comparison Testing of Thermostats for Energy Efficient Control of a HVAC System

All testing was performed in a fully furnished unoccupied single family home in Altamonte Springs, Florida. During the course of the recorded & documented testing the house was secured from access with all doors and windows closed. The interior environment was maintained by a single HVAC system with two separate thermostats (Sample #A and Sample #B). Both were hard wired through a transfer/relay switch that maintained control of the HVAC system by only one of the thermostats at a time allowing no current to the idle thermostat.

Test Protocol #1
Test #1 was the "steady state" test in which each thermostat controlled and ran the system non-stop for a 48 hour period.
Each 48-hour test period was run at a set point of 65°F for each thermostat respectively.
Sample #A thermostat was in operation for the first 48-hour test period, immediately followed by Sample #B for the nest 48 hours.

Test Protocol #2
Test #2 was the 96 hour "programmed" test.
This test was implemented to simulate the real world of daily cycling on & off the system via the homeowner's preferred temperature setting at different times of day.

The programmed test times & set points:

WAKE: 7:00am to 8:00am @ 70°F set point
LEAVE: 8:00am to 4:00pm @ 72°F set point
RETURN: 4:00pm to 11:00pm @ 70°F set point
SLEEP: 11:00pm to 7:00am @ 72°F set point

TESTS COMMENCED: 09.28.14
TESTS CONCLUDED: 10.15.14

*** ALL aspects of the test site were inspected, audited, and documented personally on-site by the authors of this report prior to the beginning of the study (see tech staff #1)

*** BOTH testing, setup and all thermostat "switch-overs" were overseen, audited and documented by an ETL engineer / field inspector (see tech stuff #2)

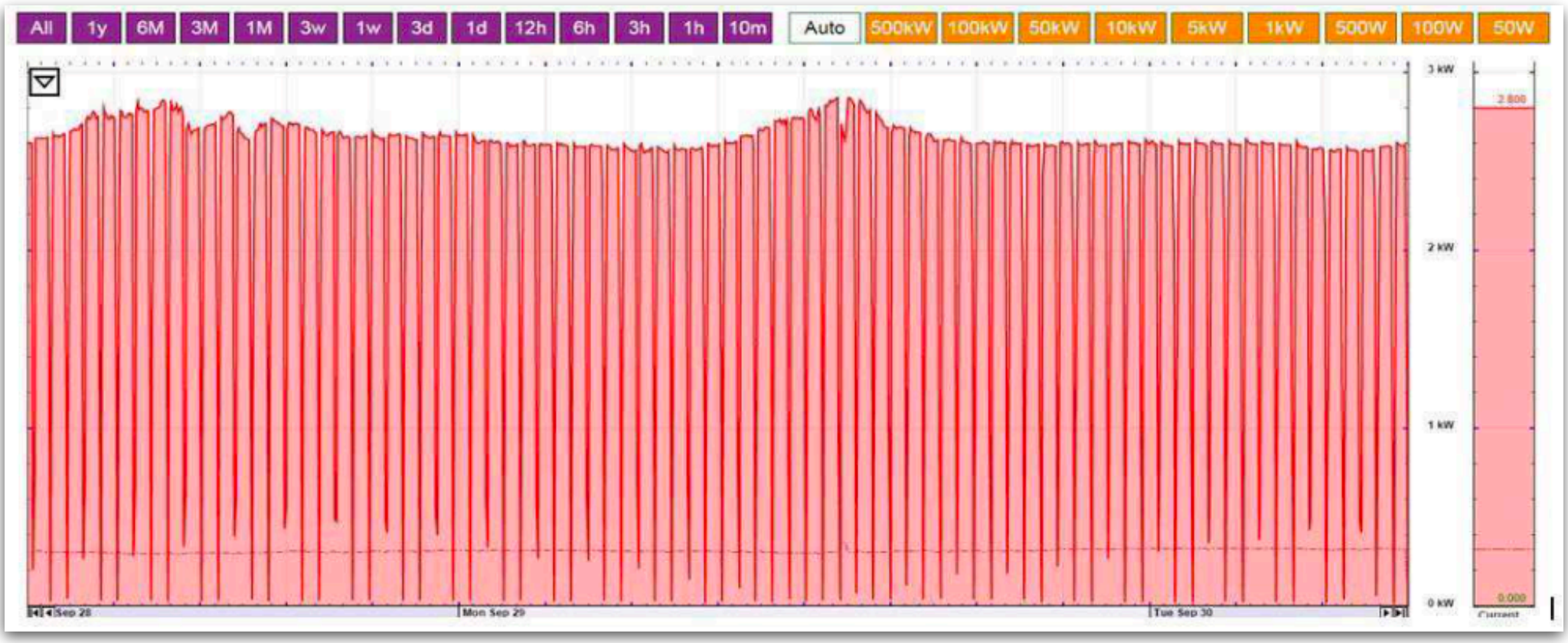
*** The entire operation and test performance was monitored 24/7 by remote, secure internet access by ETL.

48-HOUR TEST DATA FOR SAMPLE A:

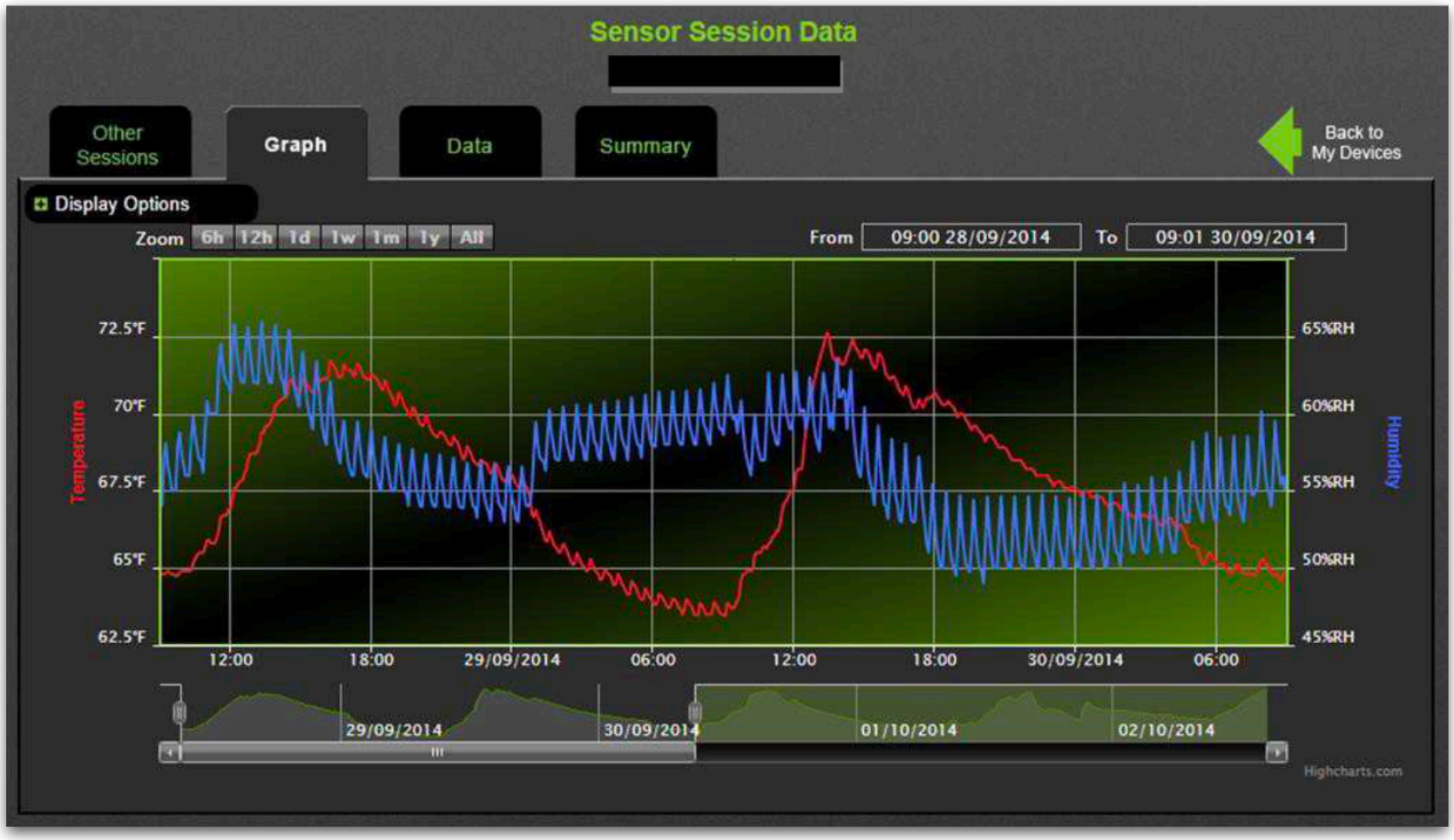
eGauge

Summary for time-period shown in graph

Energy Used	109 kWh	(approx. $13.06 used)
Energy Generated	0.00 kWh	(approx. $0.00 saved)
Net	109 kWh bought	(approx. $13.06 spent)

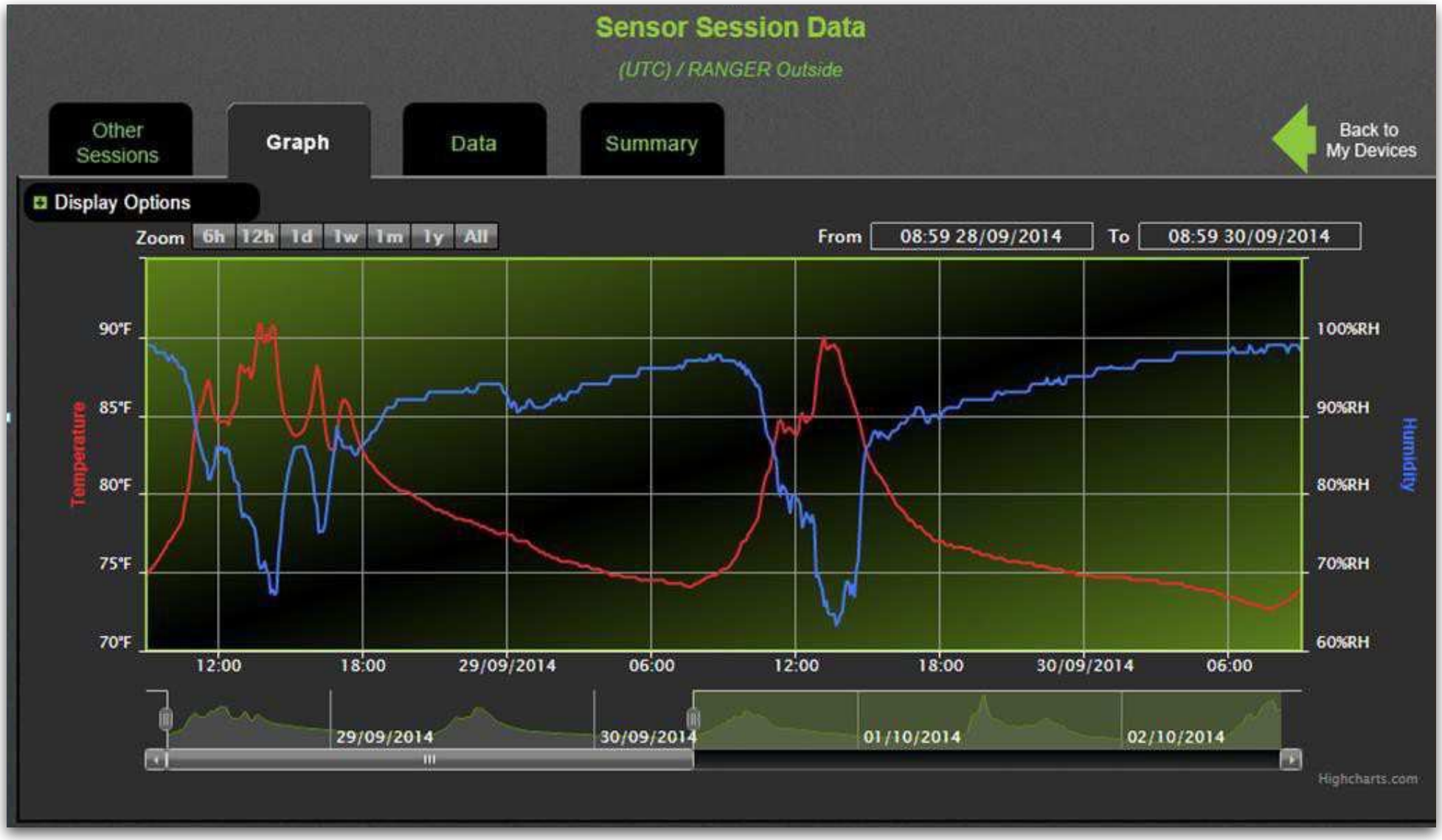


Power Usage for Sample “A” test for 48 Hours at 65°F set point



Indoor Temperature and Humidity Data Log for Sample “A” Test During 48 hours at 65°F set point

48-HOUR TEST DATA FOR SAMPLE A: (continued)



Outdoor Temperature and Humidity Data Log for Sample “A Test During 48 Hours at 65°F set point

Thermostat Sample “A”
48-Hour Test Findings:

Total kWh utilized = 109 kWh

Average Indoor Temperature = 68°F

Average Indoor Relative Humidity = 57%

Average Outdoor Temperature = 78°F

Average outdoor Relative Humidity = 91%

48-HOUR TEST DATA FOR SAMPLE B:

eGauge

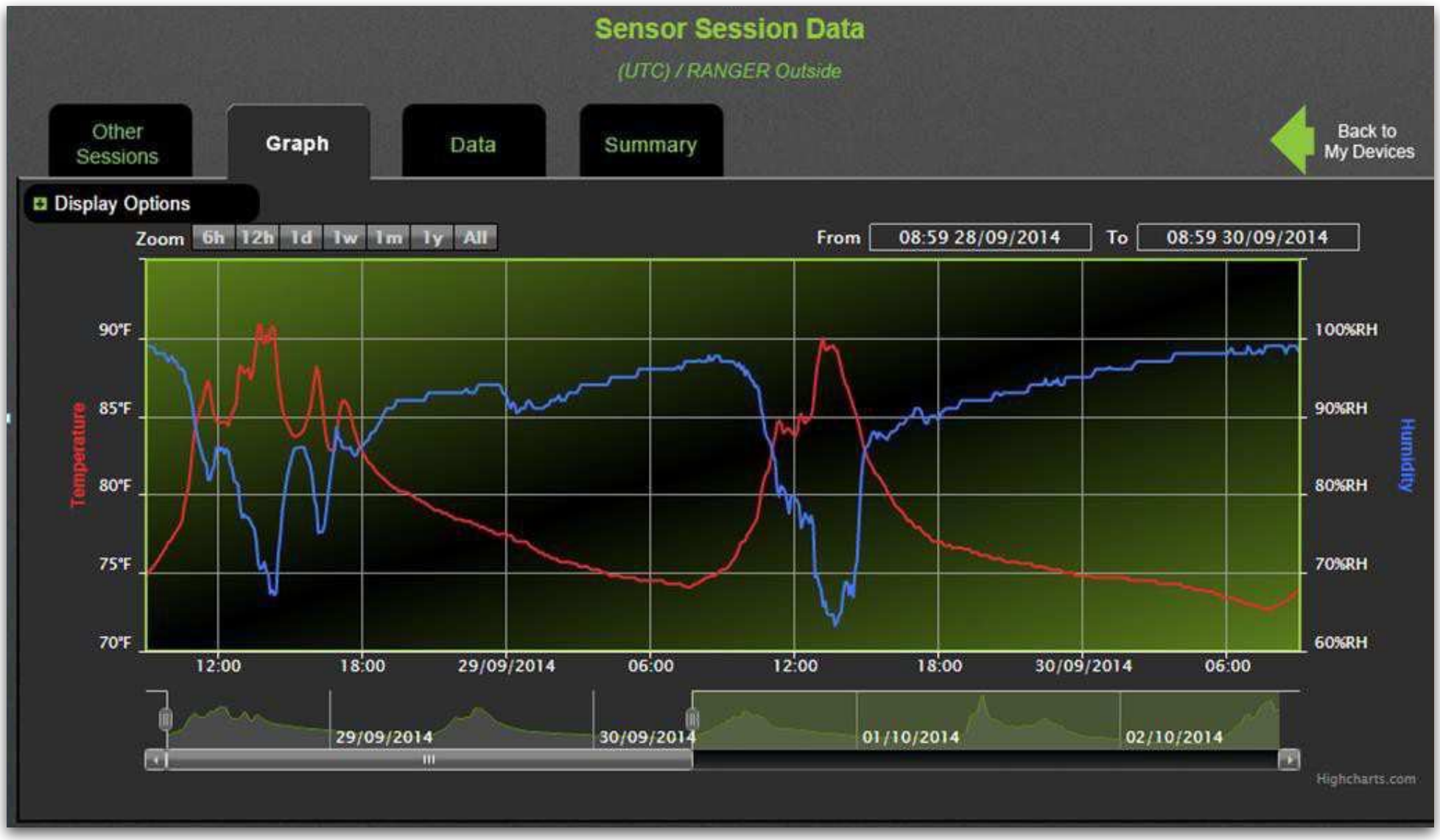
Summary for time-period shown in graph

Energy Used	128 kWh	(approx. $15.37 used)
Energy Generated	0.00kWh	(approx. $0.00 saved)
Net	128 kWh bought	(approx. $15.37 spent)

Power Usage for Sample “B” test for 48 Hours at 65°F set point

Indoor Temperature and Humidity Data Log for Sample “B” Test During 48 hours at 65°F set point

48-HOUR TEST DATA FOR SAMPLE B: (continued)



Outdoor Temperature and Humidity Data Log for Sample “B” Test During 48 Hours at 65°F set point

Thermostat Sample “B”
48-Hour Test Findings:

Total kWh utilized = 128 kWh

Average Indoor Temperature = 68°F

Average Indoor Relative Humidity = 54%

Average Outdoor Temperature = 77°F

Average outdoor Relative Humidity = 93%

48-HOUR STEADY STATE TEST CONCLUSION

After an audit of the data gathered from the 48-hour steady state tests, the following calculations were found to be accurate

Energy Efficiency:

For the duration of the 48-hour test, Sample A operated the HVAC system at a reduced energy burden of **-15%** over Sample B.

INDOOR Temperature & RH:

Sample #A indoor temperature average **-0.147 cooler** than Sample #B

Sample #A relative humidity average **+2.98% higher** than Sample #B

OUTDOOR Temperature & RH:

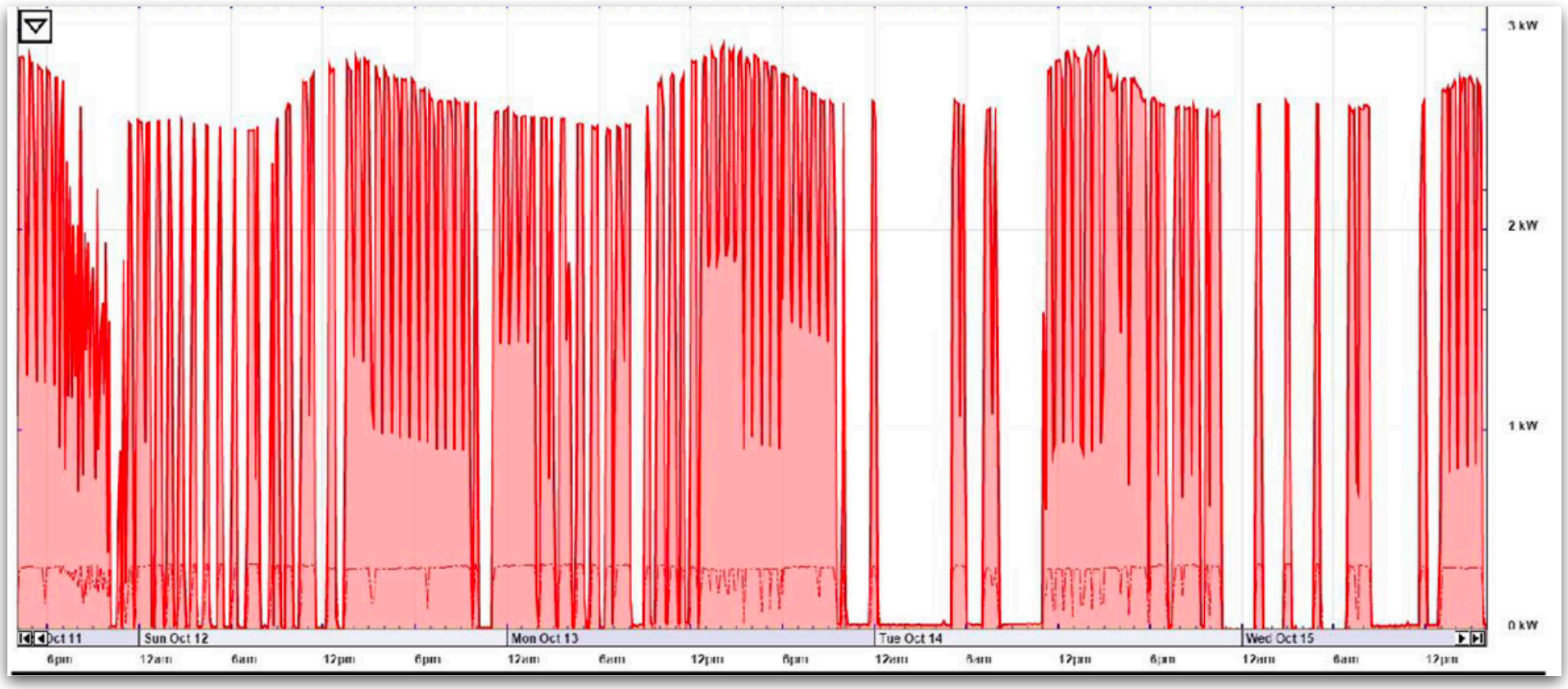
Sample #A outdoor temperature average **+1.91° warmer** than Sample #B

Sample# A outdoor relative humidity average **-2.65% less** than Sample #B

CONCLUSION

Sample A thermostat provided a significant reduction in overall energy burden with little to no adverse effect on the indoor environment regarding temperature and relative humidity.

96-HOUR PROGRAMMED TEST DATA FOR SAMPLE A



THERMOSTAT SAMPLE A
96-HOUR PROGRAMMED TEST FINDINGS:

Total kWh utilized = 152 kWh

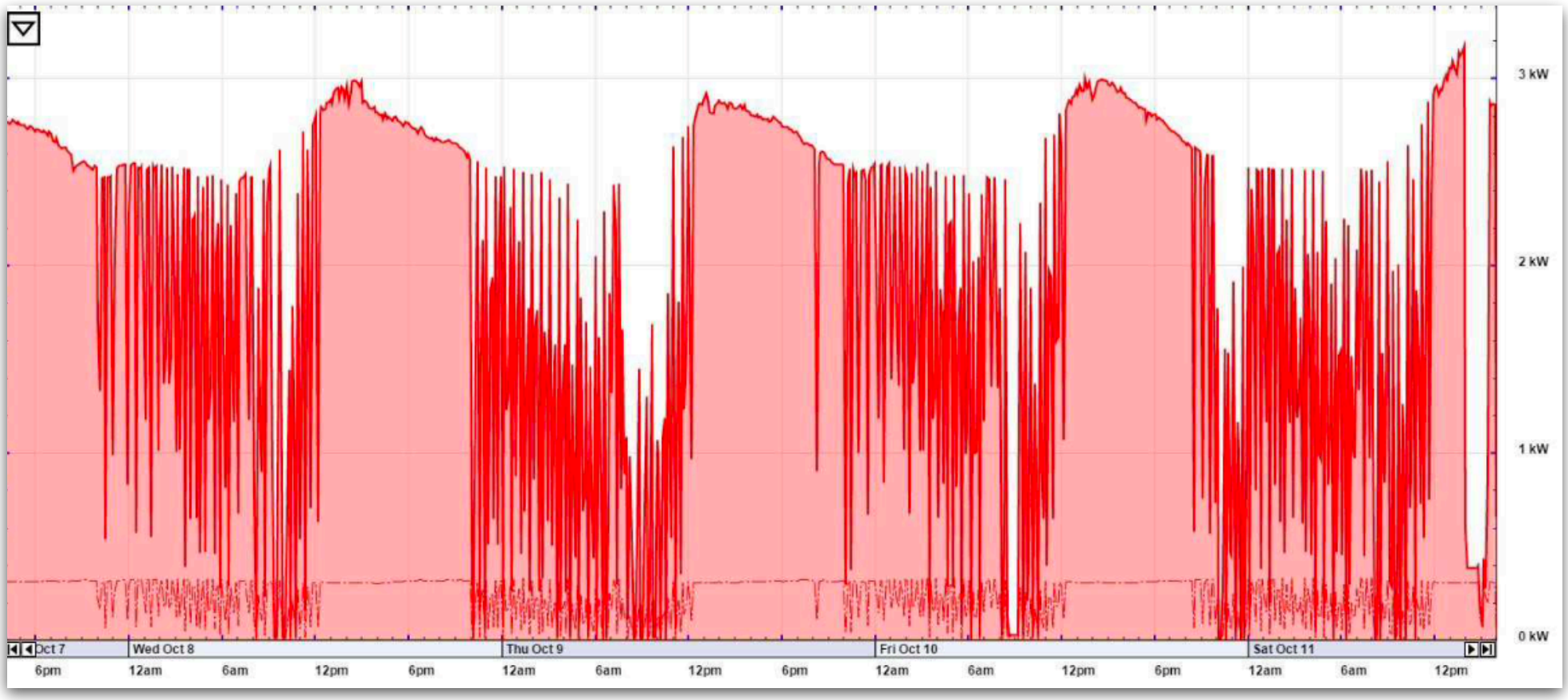
Average Indoor Temperature = 72°F

Average Indoor Relative Humidity = 54% RH

Average Outdoor Temperature = 78°F

Average outdoor Relative Humidity = 79% RH

96-HOUR PROGRAMMED TEST DATA FOR SAMPLE B



THERMOSTAT SAMPLE B
96-HOUR PROGRAMMED TEST FINDINGS:

Total kWh utilized = 208 kWh

Average Indoor Temperature = 71°F

Average Indoor Relative Humidity = 51% RH

Average Outdoor Temperature = 77°F

Average outdoor Relative Humidity = 74% RH

96-HOUR PROGRAMMED TEST CONCLUSION

After an audit of the data gathered from the 96-hour programmed tests, the following calculations were found to be accurate

Energy Burden:

For the duration of the 96-hour programmed test, Sample A operated the HVAC system at a reduced energy burden of **-27%** over Sample B.

INDOOR Temperature & RH:

Sample #A indoor temperature average **+1.38 warmer** than Sample #B

Sample #A relative humidity average **+2.67% higher** than Sample #B

OUTDOOR Temperature & RH:

Sample #A outdoor temperature average **-0.13° cooler** than Sample #B

Sample# A outdoor relative humidity average **+5% less** than Sample #B

CONCLUSION

Sample A thermostat provided a significant reduction in overall energy burden with little to no adverse effect on the indoor environment regarding temperature and relative humidity.

SUMMARY

Based on the data collected, the client's hypothesis is accepted.

The test data collect, review and calculated during this study clearly identifies that thermostat SAMPLE A provide a significant reduction in overall energy burden when compared to the same data collected for thermostat SAMPLE B.

-15% kWh for the Steady State Test

-27% kWh for the Programmed Test

For an average of -21% reduced kWh burden for both protocols

Furthermore, the savings provided above caused little to no adverse effect on the indoor climate focusing mainly on relative humidity which recorded an average increase of less than 3% for both tests conducted while the HVAC system was controlled by thermostat SAMPLE A.

CALCULATION OF MU

Given the test equipment utilized, the "real world" condition of the test environment, as well as other contributing factors, InterTek has assigned an MU of +- 5.2% @ **95% confidence to our findings for this study.**

These results were based upon calculated utilizing ***The NIST Reference on Constants, Units and Uncertainty.***

Based on the data collected, the client's hypothesis is accepted.

Review of the hypothesis as provided by our client:

"*While operating the same HVAC system, the total energy (kWh) consumed by our thermostat will be significantly less than that of the energy consumed by the same HVAC system when controlled by the competing thermostat. Furthermore, our thermostat will provide the energy savings without compromising the desired temperature setting or relative humidity of the environment.*"