TEST REPORT

Report Number: 3166778ATL-003

July 30, 2009

Product Designation: Energy Management System

Standard: 47 CFR Part 15, Subpart C (15.231 - Periodic operation in the band 40.66-40.70 MHz and above 70 MHz)

Tested by:
Intertek Testing Services NA Inc.
1950 Evergreen Blvd., Suite 100
Duluth, GA 30096

Client:
Sequentric Energy Systems LLC
2840 South College Road
Suite 210
Wilmington, NC 28412
Contact: Daniel Flohr
Phone: 910.233.8690

Tests performed by:

Richard C. Bianco
EMC Project Engineer

Report reviewed by:

Jeremy O. Pickens
EMC Department Manager

1.0 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatum text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2.0 Test Summary

Section	Test Full Name	Test Date	Result
4.0	Overview of EUT (Low Power Transmitters) (FCC 15C - EUT Overview)		
5.0	Restrictions (FCC 15C - 15.231(a))	05/25/2009	
6.0	Duty Cycle Determination (FCC 15A - 15.35(c))	04/29/2009	PASS
7.0	Radiated Emissions - SHC-HVAC (FCC 15C - 15.231(b))	05/24/2009	PASS
8.0	Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))	05/24/2009	PASS
9.0	Radiated Emissions - SHC-CT4 (FCC 15C - 15.231(b))	05/25/2009	PASS
10.0	Conducted emissions on AC power lines - SHC-HVAC (Conducted Emissions)	07/29/2009	PASS
11.0	Conducted emissions on AC power lines - SHC-LCM (Conducted Emissions)	05/12/2009	PASS
12.0	Conducted emissions on AC power lines - SHC-CT4 (Conducted Emissions)	05/12/2009	PASS
13.0	Bandwidth Requirements (FCC 15C - 15.231(c))	07/29/2009	PASS
14.0	Revision History (Revision History)		

3.0 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Load Control Module (LCM)	Sequentric Energy Systems, LLC	SHC-LCM	256-68128
Load Demand Monitor (LDM)	Sequentric Energy Systems, LLC	SHC-CT4	261-68690
HVAC Control unit (HVAC)	Sequentric Energy Systems, LLC	SHC-HVAC	NA

EUT receive date:	04/27/2009
EUT receive condition:	Good

Description of EUT provided by Client:
Sequentric RF System comprising of:
• Gateway Control Unit (Gateway)
• 6 VAC Input
• Load Control Module (LCM)
• 120-240 VAC Input
• Load Demand Monitor (LDM)
• 120-240 VAC Input
• HVAC Control unit (HVAC)
• 24 VAC input

Description of EUT exercising:
The EUT was placed in a continuous transmit state with normal modulation.

4.0 Overview of EUT (Low Power Transmitters) (FCC 15C - EUT Overview)

Method:

Complete the overview spreadsheet.

Related Submittal(s) Grants: This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application.

Data:

Applicant	Sequentric Energy Systems LLC
	2840 South College Road
	Wilmington NC 28412
Trade Name & Model No.	SQR Energy Management System (SHC-HVAC, SHC-CT4, SHC-LCM)
FCC Identifier	WPV-SEQR09001 (The RF circuit is identical for all 4 models. Only layout and antennas are different).
Frequency Range (MHz)	434
Antenna Type (15.203)	Integral Antenna (3 models)
Manufacturer name & address	Sequentrics Energy Systems LLC
	2840 South College Road
	Wilmington NC 28412

Related Submittals and Grants:	This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application.
Additions, deviations and exclusions from standards	None

5.0 Restrictions (FCC 15C - 15.231(a))

Method:

15.231(a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

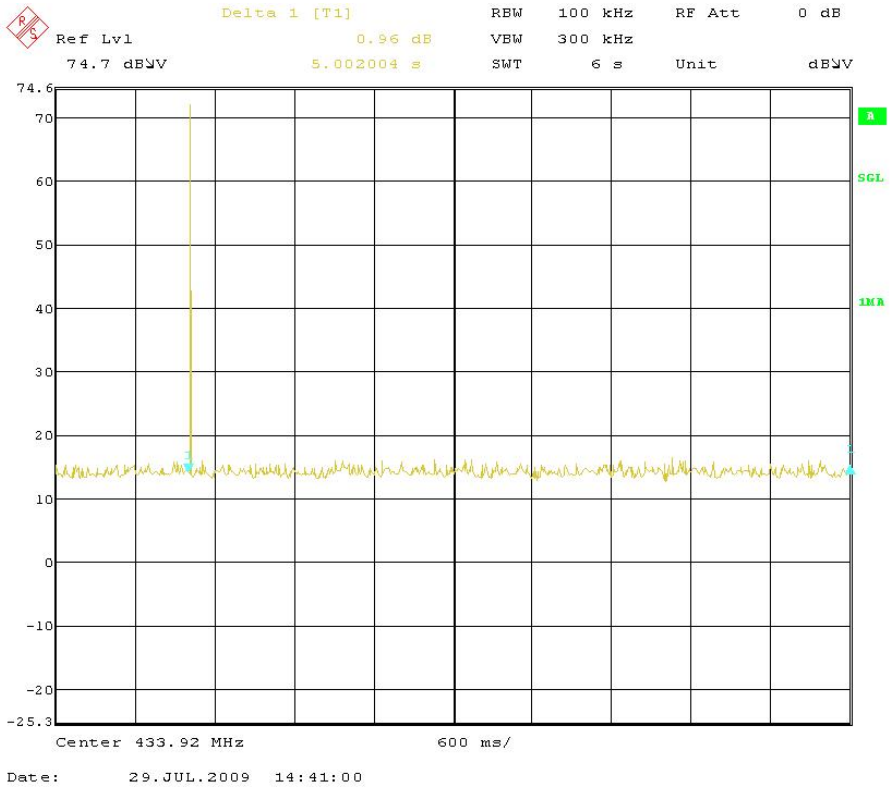
(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

Plot:



5 second plot

5.0 Restrictions (FCC 15C - 15.231(a))

Data:

15.231(a)	Response	Requirement
Frequency Range (Mhz, max)	434	40.66-40.70 MHz and > 70MHz
Frequency Range (MHz, min)	434	40.66-40.70 MHz and > 70MHz
Transmit only control signal?	Yes	Only control signal allowed
Continuous transmission?	No	No
Voice transmission?	No	No
Video transmission?	No	No
Radio control of toy?	No	No

15.231(a)(1)		
Manually operated?	No	
Deactivates within 5 seconds?	N/A	Yes
Show plot (10 second sweep)	N/A	

15.231(a)(2)		
Automatically operated?	Yes	
Deactivates within 5 seconds?	Yes	Yes
Show plot (10 second sweep)	Yes	

15.231(a)(3)		
Periodically transmits at predetermined intervals?	No	No
Polling signals?	No	Allowed, with restrictions
Polling rate and timing	No	< 2 seconds per hour

15.231(a)(4)		
For Emergency Use?	No	Allowed

15.231(a)(5)		
Exceed 15.231(a)(1) or (a)(2) requirements?	No	Allowed for professional install

6.0 Duty Cycle Determination (FCC 15A - 15.35(c))

Method:

(c) Unless otherwise specified, e.g. §15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

Determine the period of the pulse train, T, in mSec and record the results. T is defined as the time from the beginning of one pulse train to the beginning of the next pulse train.

Count the number of different types of pulses, N and record the results.

For each of the different types of pulses, count the number of occurrences within one pulse train.

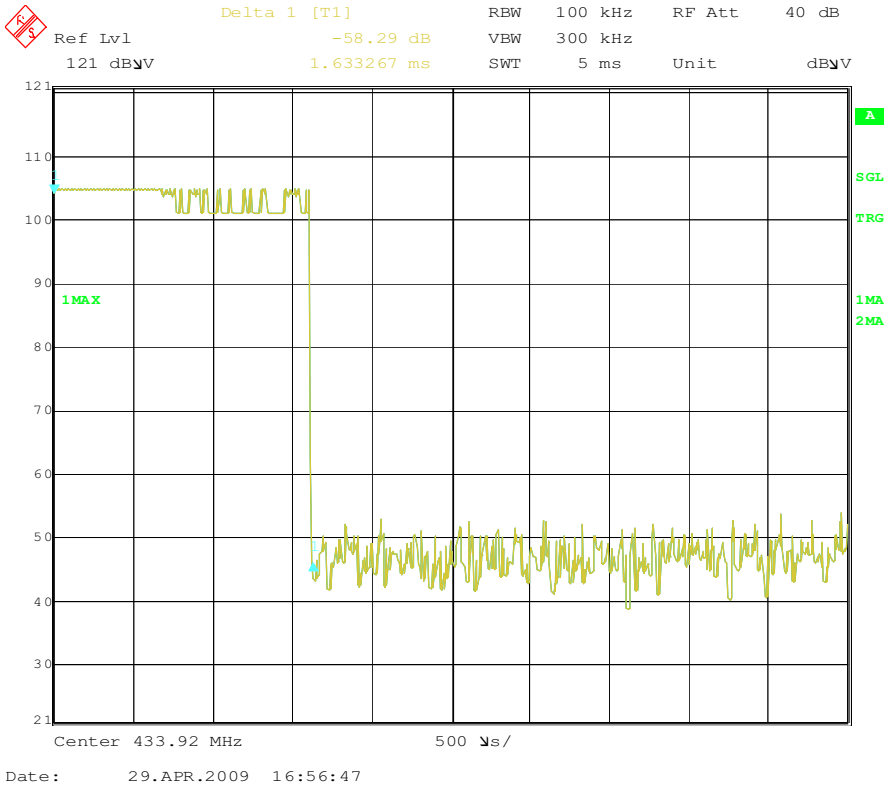
Use the Duty Cycle Correction Factor, DCCF, from the results table and use it to adjust the field strength measurements recorded for radiated emissions.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/10/2008	10/10/2009

Results: The sample tested was found to Comply.

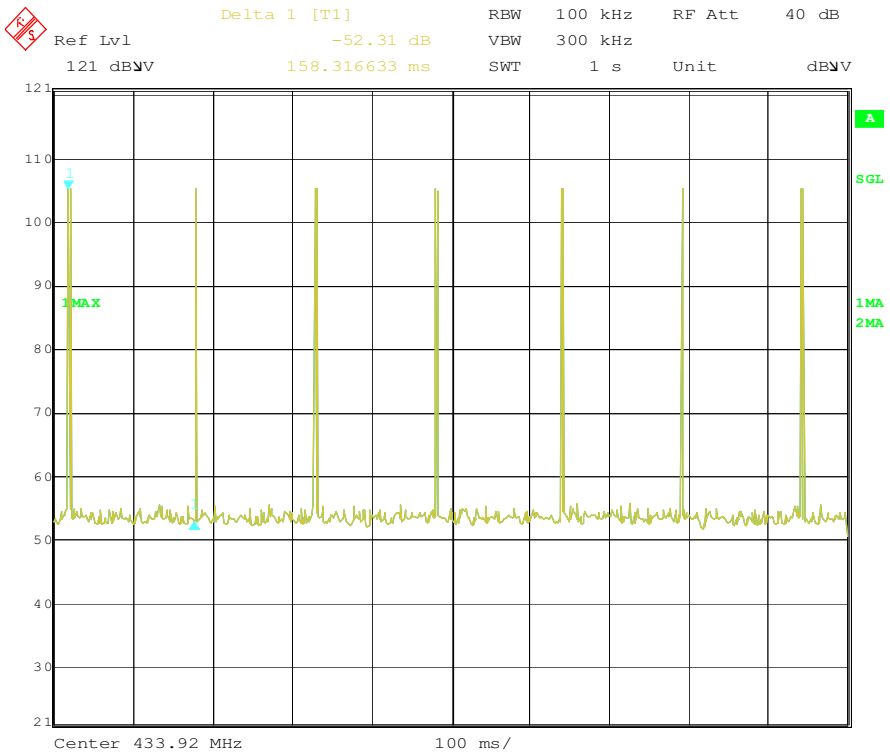
Plot:



Single Pulse Train

6.0 Duty Cycle Determination (FCC 15A - 15.35(c))

Plot:



Complete Pulse Train

6.0 Duty Cycle Determination (FCC 15A - 15.35(c))

Data:

Duration of Pulse Train, T (mSec):	158.317
Averaging Interval, A_I (mSec):	100
Number of different Pulses, N:	1

	Number ($\#P_x$)	Pulse Width, mSec (PW_x)	Product ($\#P_x$)*(PW_x)
Pulse Width 1	1	1.633	1.633
Pulse Width 2			
Pulse Width 3			
Pulse Width 4			
Pulse Width 5			
Pulse Width 6			
Pulse Width 7			
Pulse Width 8			
Pulse Width 9			
Pulse Width 10			

Duty Cycle:	0.01633
Duty Cycle Correction Factor, dB:	-35.7

$$T_{on} = (PW_1 * \#P)_1 + (PW_{2*} * \#P_2) + \cdots + (PW_n * \#P_n)$$

$$DutyCycle = T_{on} \div A_I$$

$$DCCF = 20 * Log_{10}(DutyCycle)$$

7.0 Radiated Emissions - SHC-HVAC (FCC 15C - 15.231(b))

Method:

Equipment setup for radiated disturbance tests shall follow the guidelines of ANSI C63.4:2003.

(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the limits specified in FCC Part 15.231(b).

Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

For radiated emission measurements, the EUT is attached to a styro-foam block and placed on a non-conductive table whose top is 80cm above the ground plane. If the EUT is handheld, the signal shall be aximized through rotation and placement in the three orthogonal axes.

During the test the EUT is rotated and 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 3 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. All readings are extrapolated back to the equivalent 3-meter reading using inverse scaling with distance.

Radiated emission measurements were performed from 30 MHz to 10 times the highest frequency generated in the EUT.

Analyzer resolution is:
100 kHz or greater for frequencies 1000 MHz and below,
1 MHz for frequencies above 1000 MHz.

The Peak value of the Field Strength was measured. The Average value was obtained from the Peak by subtracting the Duty Cycle Correction Factor.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	211386	09/26/2008	09/26/2009
Antenna, Horn, <18 GHz	EMCO	3115	BOX-HORN1	08/08/2008	08/08/2009
Cable E201, 18 GHz, N, 3m	Megaphase	TM18 NKNK 118	E201	01/29/2009	01/29/2010
Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/04/2009	05/04/2010
Cable ST1, 7m, N-N, 18 GHz	Storm Products Co.	PR90-206-7MTR	ST1	01/23/2009	01/23/2010
EMI Receiver	Hewlett Packard	8546A	213109	09/29/2008	09/29/2009
EMI Receiver, Preselector section	Hewlett Packard	85460A	213108	09/29/2008	09/29/2009
Excel spreadsheet for radiated emissions	Software	Excel - RE Worksh	SW004	12/08/2008	12/08/2009
Preamplifier, 10 MHz to 2000 MHz, 27 dB gain	Mini-Circuits	ZKL-2	200074	10/20/2008	10/20/2009
Preamplifier, 20 MHz to 18 GHz, 40 dB	A.H. Systems	PAM-0118	200108	04/07/2009	04/07/2010
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/10/2008	10/10/2009
Tile - software profile for radiated and conducted emissions testing.	Software	Tile - Emissions	SW006	12/08/2008	12/08/2009

Results: The sample tested was found to Comply.

7.0 Radiated Emissions - SHC-HVAC (FCC 15C - 15.231(b))

Photo:

Test Setup - Front View

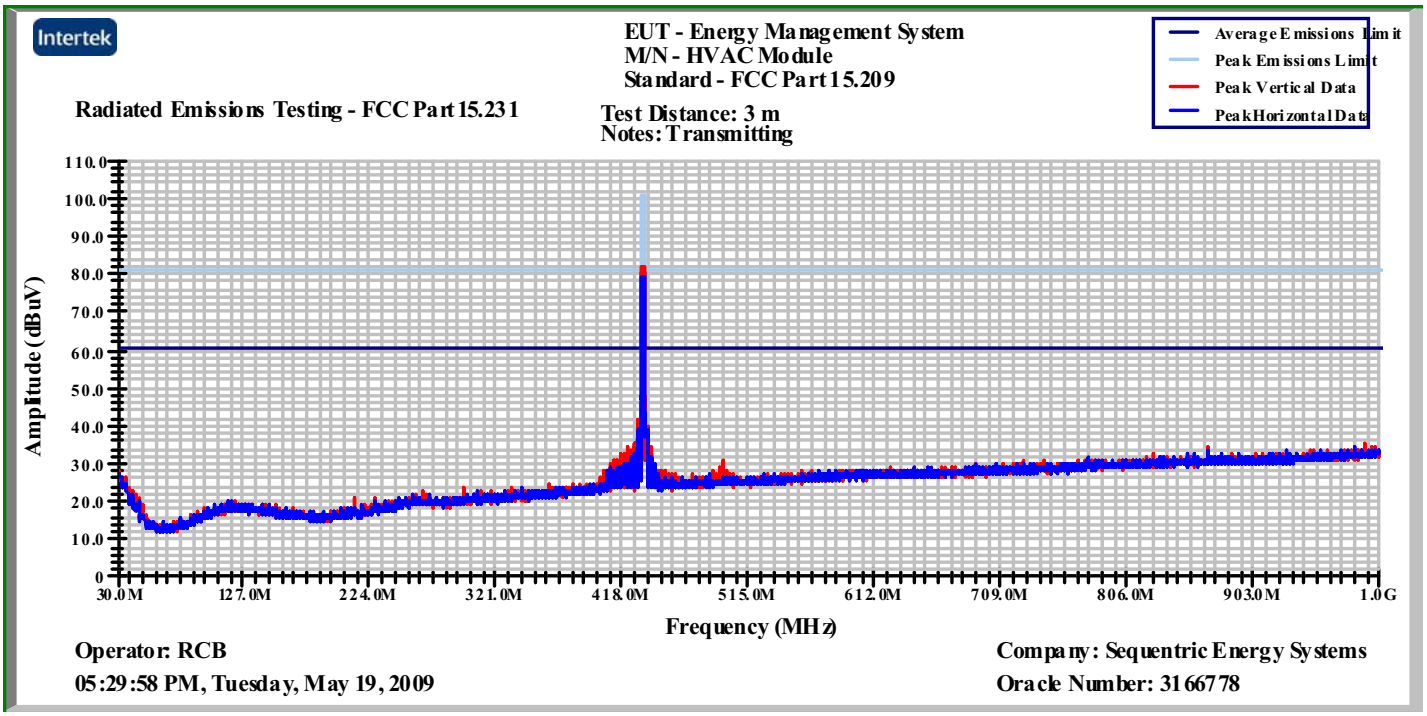
7.0 Radiated Emissions - SHC-HVAC (FCC 15C - 15.231(b))

Photo:

Test Setup - Rear View

7.0 Radiated Emissions - SHC-HVAC (FCC 15C - 15.231(b))

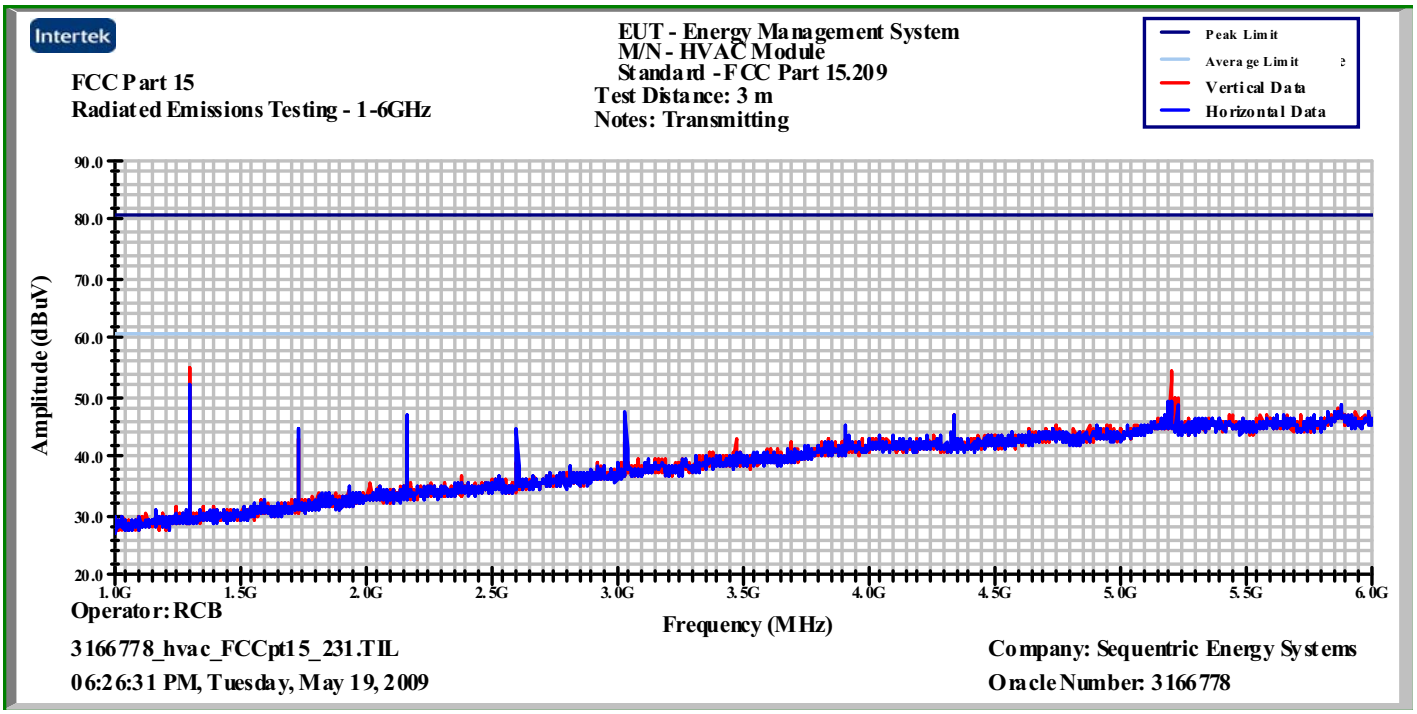
Plot:



Peak Plot

7.0 Radiated Emissions - SHC-HVAC (FCC 15C - 15.231(b))

Plot:



Peak Plot

7.0 Radiated Emissions - SHC-HVAC (FCC 15C - 15.231(b))

Data:

Frequency Range (MHz): 30 to 1000 **Test Distance (m):** 3

Input power: 24VAC **Modifications for compliance (y/n):** n

Notes:

A	B	C	D	E	F	G	H	I	J	K
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Duty Cycle Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Axis / Detector**
H	433.875	87.4	17.4	4.3	27.9	0.0	81.3	100.8	-19.5	XP
H	433.875	87.4	17.4	4.3	27.9	35.7	45.6	80.8	-35.2	XA
V	433.867	87.4	18.3	4.3	27.9	0.0	82.1	100.8	-18.7	XP
V	433.867	87.4	18.3	4.3	27.9	35.7	46.4	80.8	-34.4	XA
H	433.866	93.2	17.4	4.3	27.9	0.0	87.1	100.8	-13.7	YP
H	433.866	93.2	17.4	4.3	27.9	35.7	51.4	80.8	-29.4	YA
V	433.878	90.7	18.3	4.3	27.9	0.0	85.4	100.8	-15.4	YP
V	433.878	90.7	18.3	4.3	27.9	35.7	49.7	80.8	-31.1	YA
H	433.868	94.2	17.4	4.3	27.9	0.0	88.1	100.8	-12.7	ZP
H	433.868	94.2	17.4	4.3	27.9	35.7	52.4	80.8	-28.4	ZA
V	433.868	91.9	18.3	4.3	27.9	0.0	86.6	100.8	-14.2	ZP
V	433.868	91.9	18.3	4.3	27.9	35.7	50.9	80.8	-29.9	ZA
Calculations		G=C+D+E-F		I=G-H						

Tabular Data

7.0 Radiated Emissions - SHC-HVAC (FCC 15C - 15.231(b))

Data:

Frequency Range (MHz): 30 to 1000 **Test Distance (m):** 3

Input power: 24VAC **Modifications for compliance (y/n):** n

Notes:

A	B	C	D	E	F	G	H	I	J	K
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Duty Cycle Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Axis / Detector**
V	1301.568	65.9	23.9	0.5	40.4	0.0	49.9	60.8	-10.9	XP
V	5189.994	57.5	33.3	0.5	41.0	0.0	50.3	60.8	-10.5	XP
V	1301.543	61.8	23.9	0.5	40.4	0.0	45.8	60.8	-15.0	YP
V	5190.163	47.4	33.3	0.5	41.0	0.0	40.2	60.8	-20.6	YP
V	1301.493	64.4	23.9	0.5	40.4	0.0	48.4	60.8	-12.4	ZP
V	5190.245	46.2	33.3	0.5	41.0	0.0	39.1	60.8	-21.7	ZP
Calculations		G=C+D+E-F		I=G-H						

Tabular Data

8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

Method:

Radiated emissions testing was performed using the methods described in the previous section.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	211386	09/26/2008	09/26/2009
Antenna, Horn, <18 GHz	EMCO	3115	BOX-HORN1	08/08/2008	08/08/2009
Cable E201, 18 GHz, N, 3m	Megaphase	TM18 NKNK 118	E201	01/29/2009	01/29/2010
Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/04/2009	05/04/2010
Cable ST1, 7m, N-N, 18 GHz	Storm Products Co.	PR90-206-7MTR	ST1	01/23/2009	01/23/2010
EMI Receiver	Hewlett Packard	8546A	213109	09/29/2008	09/29/2009
EMI Receiver, Preselector section	Hewlett Packard	85460A	213108	09/29/2008	09/29/2009
Excel spreadsheet for radiated emissions	Software	Excel - RE Worksh	SW004	12/08/2008	12/08/2009
Preamplifier, 10 MHz to 2000 MHz, 27 dB gain	Mini-Circuits	ZKL-2	200074	10/20/2008	10/20/2009
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/10/2008	10/10/2009
Tile - software profile for radiated and conducted emissions testing.	Software	Tile - Emissions	SW006	12/08/2008	12/08/2009

Results: The sample tested was found to Comply.

8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

Photo:

Test Setup - Front View

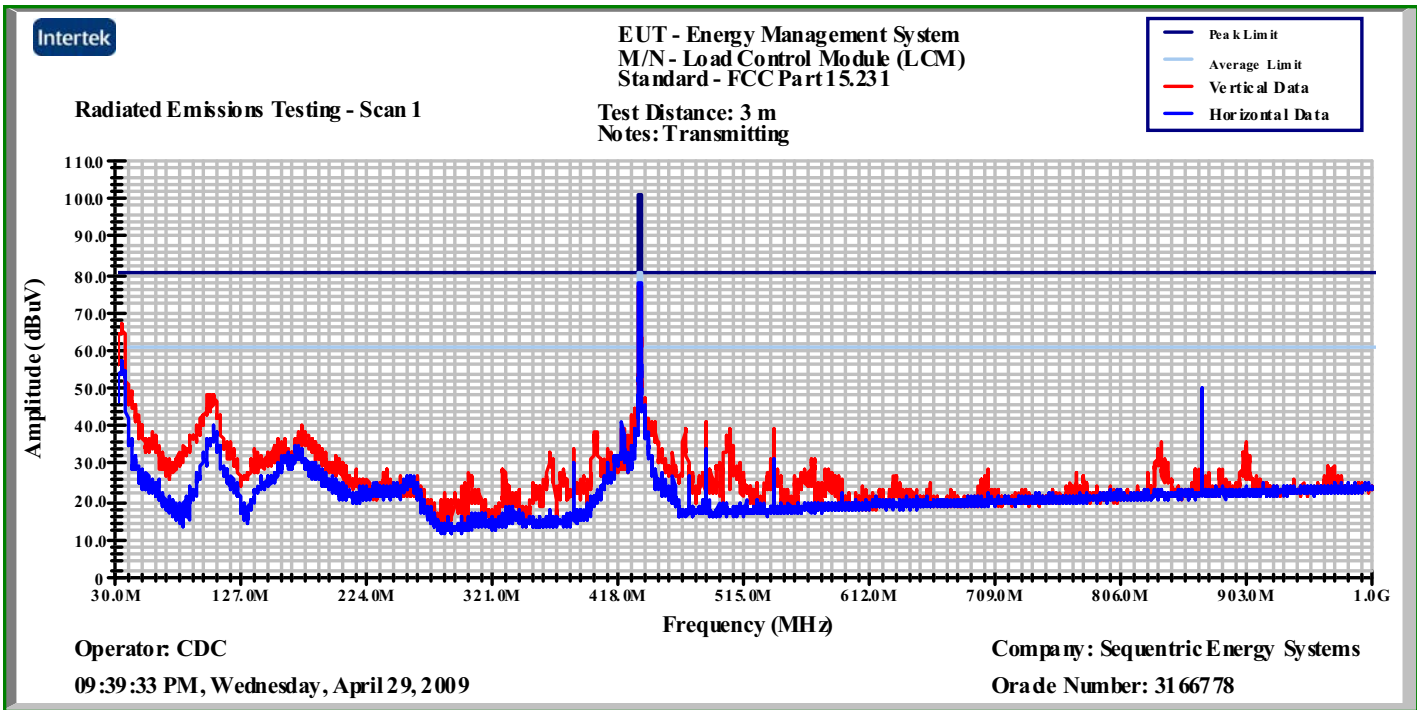
8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

Photo:

Test Setup - Rear View

8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

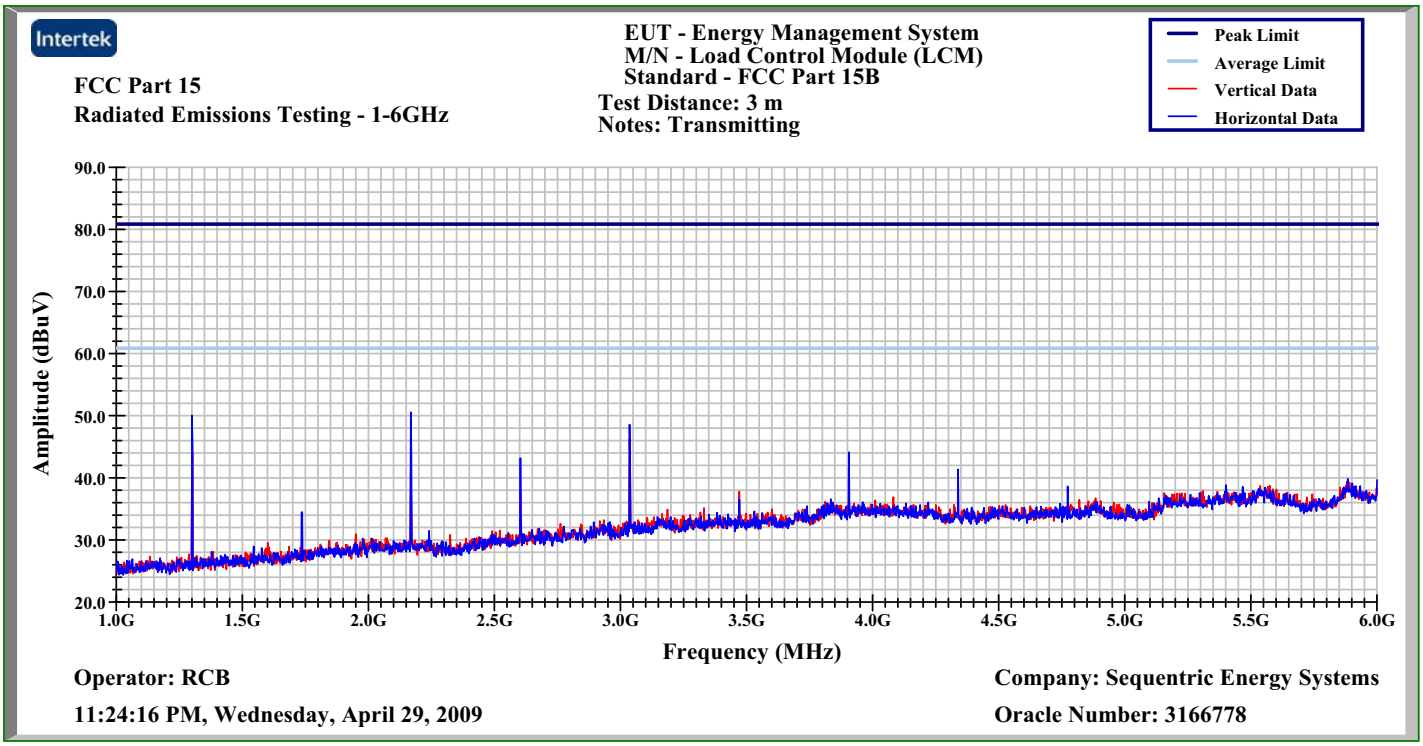
Plot:



Peak Plot

8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

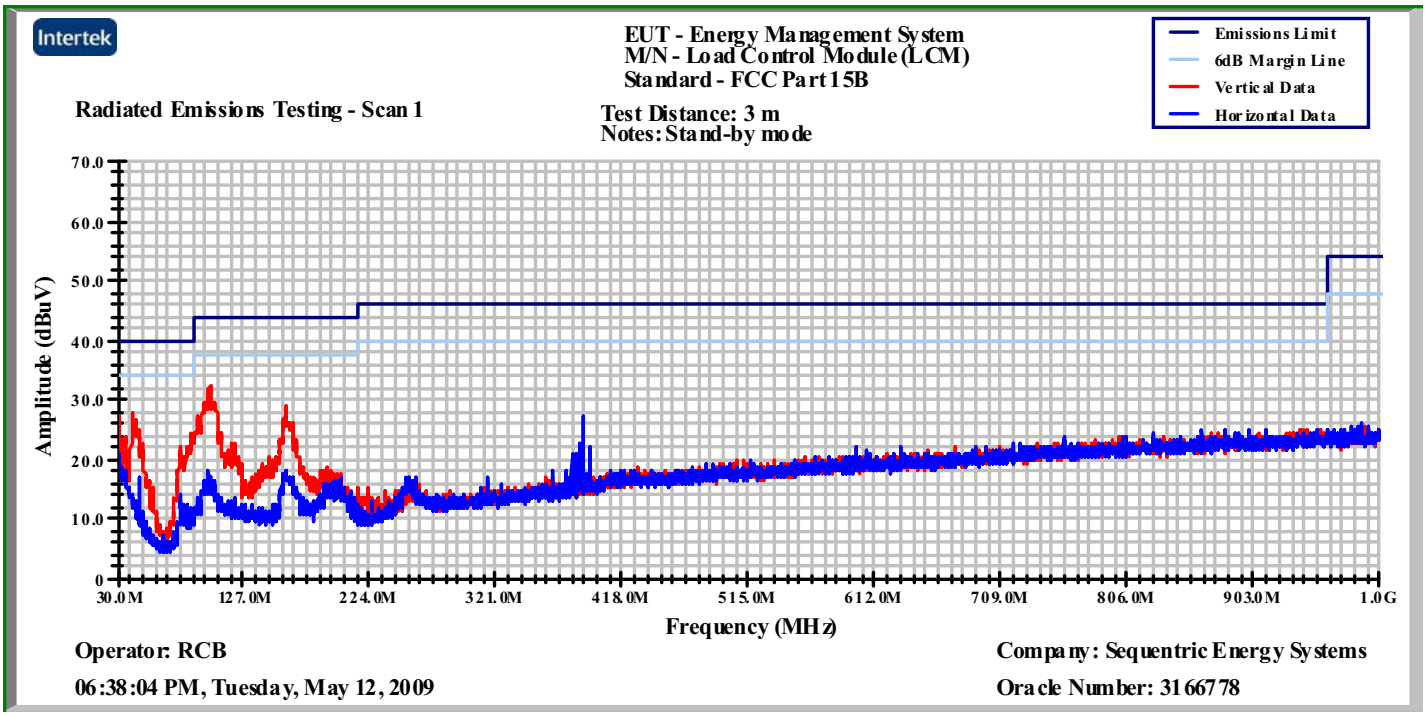
Plot:



Peak Plot

8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

Plot:



Peak Data - Standby

8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

Data:

Frequency Range (MHz): 30 to 1000 **Test Distance (m):** 3

Input power: 120 Vac/ 60 Hz **Modifications for compliance (y/n):** N

Notes: Continuously Transmitting

A	B	C	D	E	F	G	H	I	J	K
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Duty Cycle Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Axis / Detector**
V	34.870	92.5	16.0	1.0	39.7	0.0	69.8	80.8	-11.0	XP
V	34.870	92.5	16.0	1.0	39.7	35.7	34.1	60.8	-26.7	XP
V	41.145	73.0	13.8	1.1	40.3	0.0	47.6	80.8	-33.3	XP
V	41.145	73.0	13.8	1.1	40.3	35.7	11.9	60.8	-48.9	XP
V	101.062	90.9	13.4	1.9	40.9	0.0	65.3	80.8	-15.6	XP
V	101.062	90.9	13.4	1.9	40.9	35.7	29.6	60.8	-31.2	XP
V	105.570	89.3	13.1	1.9	40.9	0.0	63.4	80.8	-17.4	XP
V	105.570	89.3	13.1	1.9	40.9	35.7	27.7	60.8	-33.1	XP
V	420.936	63.1	17.7	3.8	40.8	0.0	43.8	80.8	-37.0	XP
V	420.936	63.1	17.7	3.8	40.8	35.7	8.1	60.8	-52.7	XP
V	432.184	76.7	18.3	3.8	40.8	0.0	58.0	80.8	-22.9	XP
V	432.184	76.7	18.3	3.8	40.8	35.7	22.3	60.8	-38.5	XP
V	433.870	110.2	18.3	3.8	40.8	0.0	91.4	100.8	-9.4	XP
V	433.870	110.2	18.3	3.8	40.8	35.7	55.7	80.8	-25.1	XP
V	485.890	60.1	18.1	3.8	40.9	0.0	41.1	80.8	-39.7	XP
V	485.890	60.1	18.1	3.8	40.9	35.7	5.4	60.8	-55.4	XP
V	867.730	71.8	21.8	5.5	40.7	0.0	58.4	80.8	-22.5	XP
V	867.730	71.8	21.8	5.5	40.7	35.7	22.7	60.8	-38.1	XP
Calculations		G=C+D+E-F		I=G-H						

Tabular Data - Transmitting

8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

Data:

Input power: 120 Vac/ 60 Hz **Limit:** FCC15 Class B-3m

Modifications for compliance (y/n): N

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Detectors / Bandwidths Det/RBW/VBW**
V	1302.000	47.8	24.6	7.1	40.6	39.0	54.0	-15.0	A/1M/3M
V	2169.500	44.8	27.6	8.8	40.7	40.4	54.0	-13.6	A/1M/3M
V	2603.500	54.7	28.5	9.6	40.9	51.7	54.0	-2.3	P/1M/3M
V	3031.075	41.9	30.0	10.3	40.9	41.3	54.0	-12.7	A/1M/3M
V	3904.750	34.1	32.2	12.0	41.0	37.3	54.0	-16.7	A/1M/3M
V	4338.680	48.4	32.3	12.8	41.2	52.3	54.0	-1.7	P/1M/3M
Calculations		G=C+D+E-F		I=G-H					

Tabular Data - Transmitting

8.0 Radiated Emissions - SHC-LCM (FCC 15C - 15.231(b))

Data:

Date: 05/12/2009 **Test Distance (m):** 3
Frequency Range (MHz): 30 to 1000 **Limit:** FCC15 Class B-3m
Input power: 120 Vac/ 60 Hz **Modifications for compliance (y/n):** n

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Detectors / Bandwidths Det/RBW/VBW**
Standby Mode									
V	31.943	48.2	18.9	0.9	39.3	28.8	40.0	-11.2	Pk/120k/300k
V	42.246	54.3	13.1	1.1	39.9	28.6	40.0	-11.4	Pk/120k/300k
V	100.951	60.4	11.2	1.8	40.6	32.7	43.5	-10.8	Pk/120k/300k
V	104.839	57.0	11.8	1.8	40.6	30.0	43.5	-13.5	Pk/120k/300k
V	159.657	56.3	10.7	2.3	40.6	28.8	43.5	-14.7	Pk/120k/300k
H	388.064	50.3	17.2	3.6	40.5	30.6	46.0	-15.4	Pk/120k/300k
Calculations		G=C+D+E-F		I=G-H					

Tabular Data - Standby

9.0 Radiated Emissions - SHC-CT4 (FCC 15C - 15.231(b))

Method:

Radiated emissions testing was performed using the methods described in the previous section.

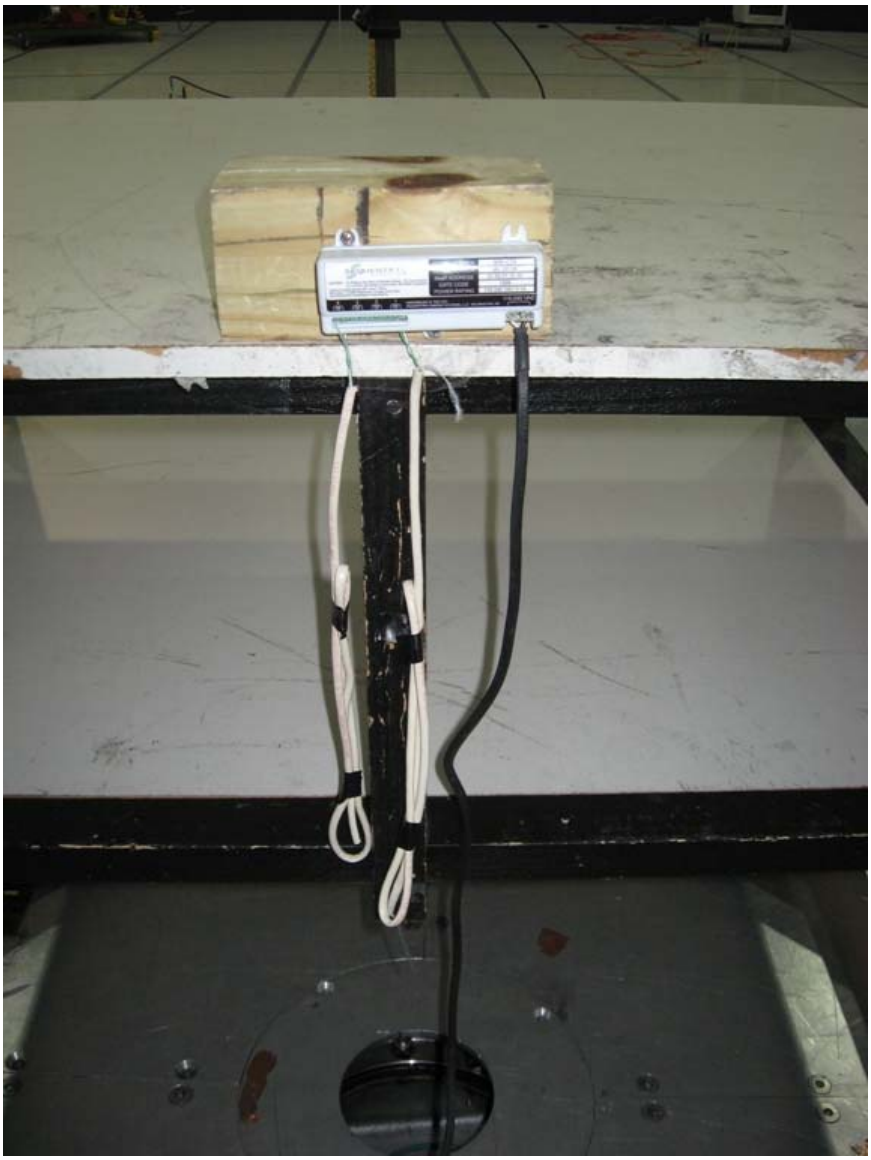
Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	211386	09/26/2008	09/26/2009
Antenna, Horn, <18 GHz	EMCO	3115	BOX-HORN1	08/08/2008	08/08/2009
Cable E201, 18 GHz, N, 3m	Megaphase	TM18 NKNK 118	E201	01/29/2009	01/29/2010
Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/04/2009	05/04/2010
Cable TT1, 6ft, N(Male) to N(Male)	Mini-Circuits	CBL-6FT-NMNM	TT1	05/04/2009	05/04/2010
EMI Receiver	Hewlett Packard	8546A	213109	09/29/2008	09/29/2009
EMI Receiver, Preselector section	Hewlett Packard	85460A	213108	09/29/2008	09/29/2009
Excel spreadsheet for radiated emissions	Software	Excel - RE Worksh	SW004	12/08/2008	12/08/2009
Preamplifier, 10 MHz to 2000 MHz, 27 dB gain	Mini-Circuits	ZKL-2	200074	10/20/2008	10/20/2009
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/10/2008	10/10/2009
Tile - software profile for radiated and conducted emissions testing.	Software	Tile - Emissions	SW006	12/08/2008	12/08/2009

Results: The sample tested was found to Comply.

9.0 Radiated Emissions - SHC-CT4 (FCC 15C - 15.231(b))

Photo:



Test Setup - Front View

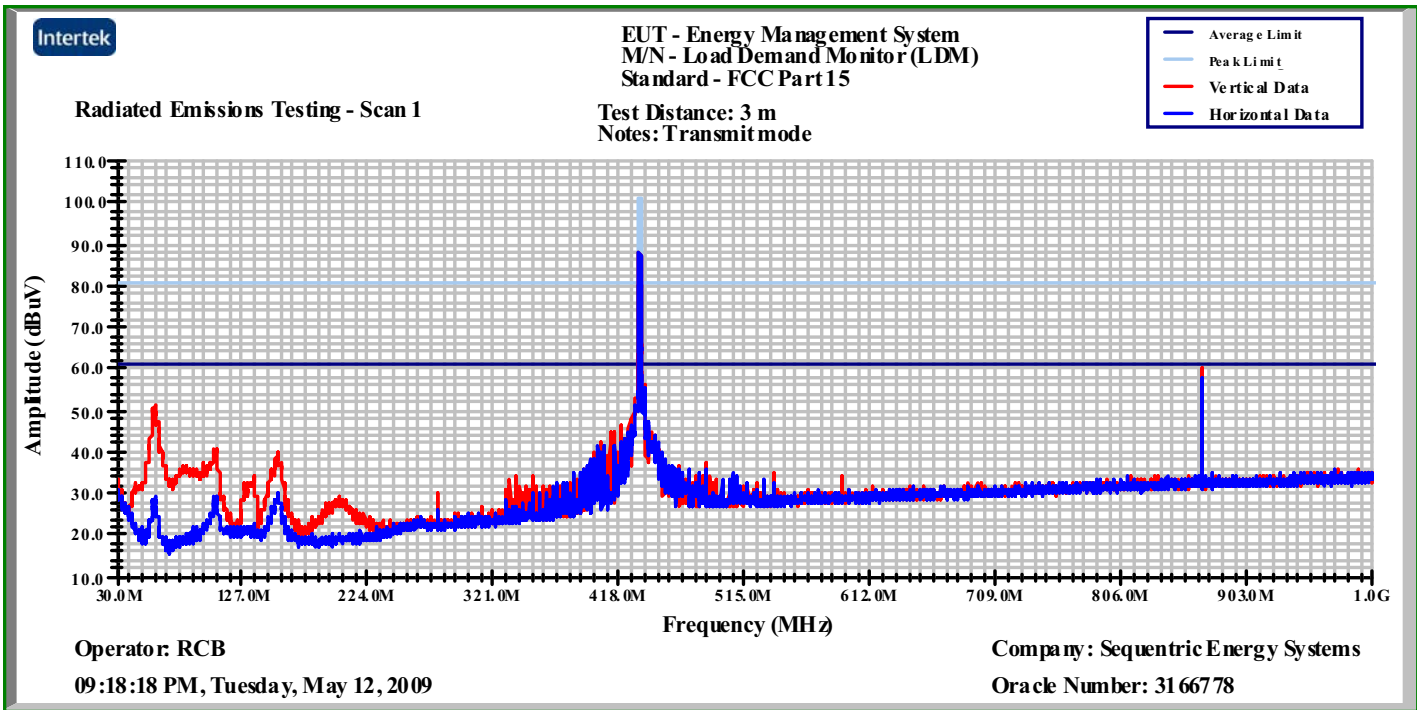
9.0 Radiated Emissions - SHC-CT4 (FCC 15C - 15.231(b))

Photo:

Test Setup - Rear View

9.0 Radiated Emissions - SHC-CT4 (FCC 15C - 15.231(b))

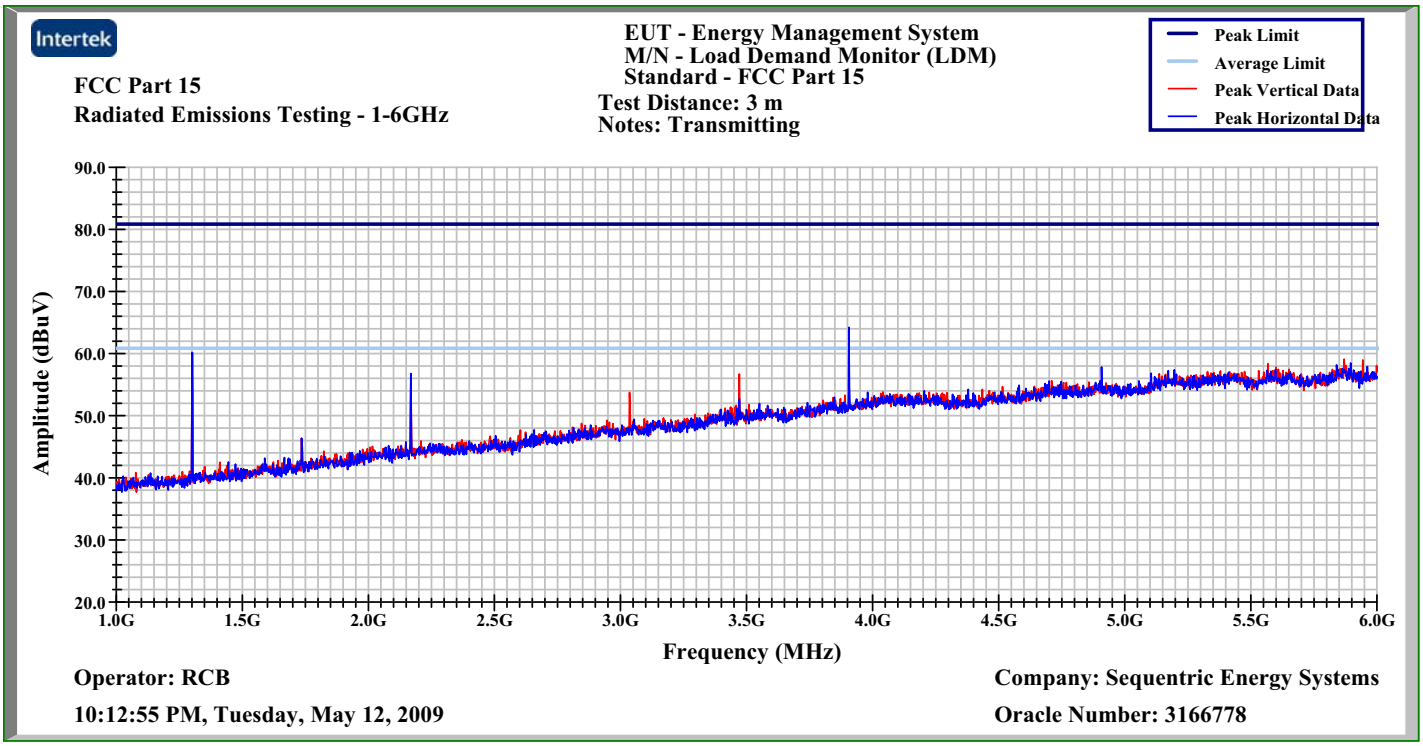
Plot:



Peak Plot

9.0 Radiated Emissions - SHC-CT4 (FCC 15C - 15.231(b))

Plot:



Peak Plot

9.0 Radiated Emissions - SHC-CT4 (FCC 15C - 15.231(b))

Data:

Frequency Range (MHz): 30 to 1000 **Test Distance (m):** 3

Input power: 120 Vac/ 60 Hz **Modifications for compliance (y/n):** n

Notes:

A	B	C	D	E	F	G	H	I	J	K
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Duty Cycle Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Axis / Detector**
H	433.954	76.9	17.4	3.8	0.0	0.0	98.1	100.8	-2.7	XP
H	433.954	76.9	17.4	3.8	0.0	35.7	62.4	80.8	-18.4	XA
V	433.863	76.7	18.3	3.8	0.0	0.0	98.8	100.8	-2.0	YP
V	433.863	76.7	18.3	3.8	0.0	35.7	63.1	80.8	-17.8	YA
H	867.905	64.4	20.6	5.4	40.4	0.0	50.0	80.8	-30.8	ZP
H	867.905	64.4	20.6	5.4	40.4	35.7	14.3	60.8	-46.5	ZA
V	867.721	69.3	21.8	5.4	40.4	0.0	56.1	80.8	-24.7	XP
V	867.721	69.3	21.8	5.4	40.4	35.7	20.4	60.8	-40.4	XA
Calculations		G=C+D+E-F		I=G-H						

Radiated Emissions from 30-1000MHz

9.0 Radiated Emissions - SHC-CT4 (FCC 15C - 15.231(b))

Data:

Frequency Range (MHz): 1000-6000 **Test Distance (m):** 3

Input power: 120 Vac/ 60 Hz **Modifications for compliance (y/n):** n

Notes:

A	B	C	D	E	F	G	H	I	J	K
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Duty Cycle Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Axis / Detector**
H	1301.605	62.6	23.9	15.9	40.4	0.0	62.0	80.8	-18.8	XP
H	1301.605	62.6	23.9	15.9	40.4	35.7	26.3	60.8	-34.5	XA
H	3904.797	56.2	31.1	20.1	40.9	0.0	66.5	80.8	-14.3	YP
H	3904.797	56.2	31.1	20.1	40.9	35.7	30.8	60.8	-30.1	YA
Calculations		G=C+D+E-F		I=G-H						

Radiated Emissions from 1000-6000MHz

10.0 Conducted emissions on AC power lines - SHC-HVAC (Conducted Emissions)

Method:

Equipment setup for conducted disturbance tests shall follow the guidelines of ANSI C63.4:2003.

Measurements in the frequency range of 150kHz to 30 MHz shall be performed with a quasi-peak or average detector instrument that meets the requirements of Section One of CISPR 16. An AMN shall be used to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN defined in CISPR 16 shall be used.

In the frequency range of 150 kHz to 30 MHz, a resolution/video bandwidth of 9kHz/30kHz or greater shall be used.

The EUT shall be located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

If a flexible mains cord is provided by the manufacturer that is in excess of 1m, the excess cable shall be folded back and forth as far as possible to form a bundle not exceeding 0.4m in length.

The EUT shall be arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance shall be measured between each current carrying conductor and the reference ground. Each measured values shall be reported.

If EUT is intended for tabletop use, the EUT shall be placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is be placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table shall be constructed of non-conductive materials. Its dimensions are at least 1m by 1.5m, but may be extended for larger EUT.

If EUT is floor standing, the floor standing EUT shall be placed on a horizontal metal ground plane and isolated from the ground plane by up to 12 mm of insulating material. The metal ground plane shall extend at least 0.5m beyond the boundaries of the EUT and had minimum dimensions of 2m by 2m.

TEST SITE
The test site for conducted emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. The VCCI Registration Number for this site is C-2818.

MEASUREMENT UNCERTAINTY
Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes. The values given are the measurement uncertainty values with an expanded uncertainty of k=2.
150 kHz to 30 MHz: +/- 2.8 dB

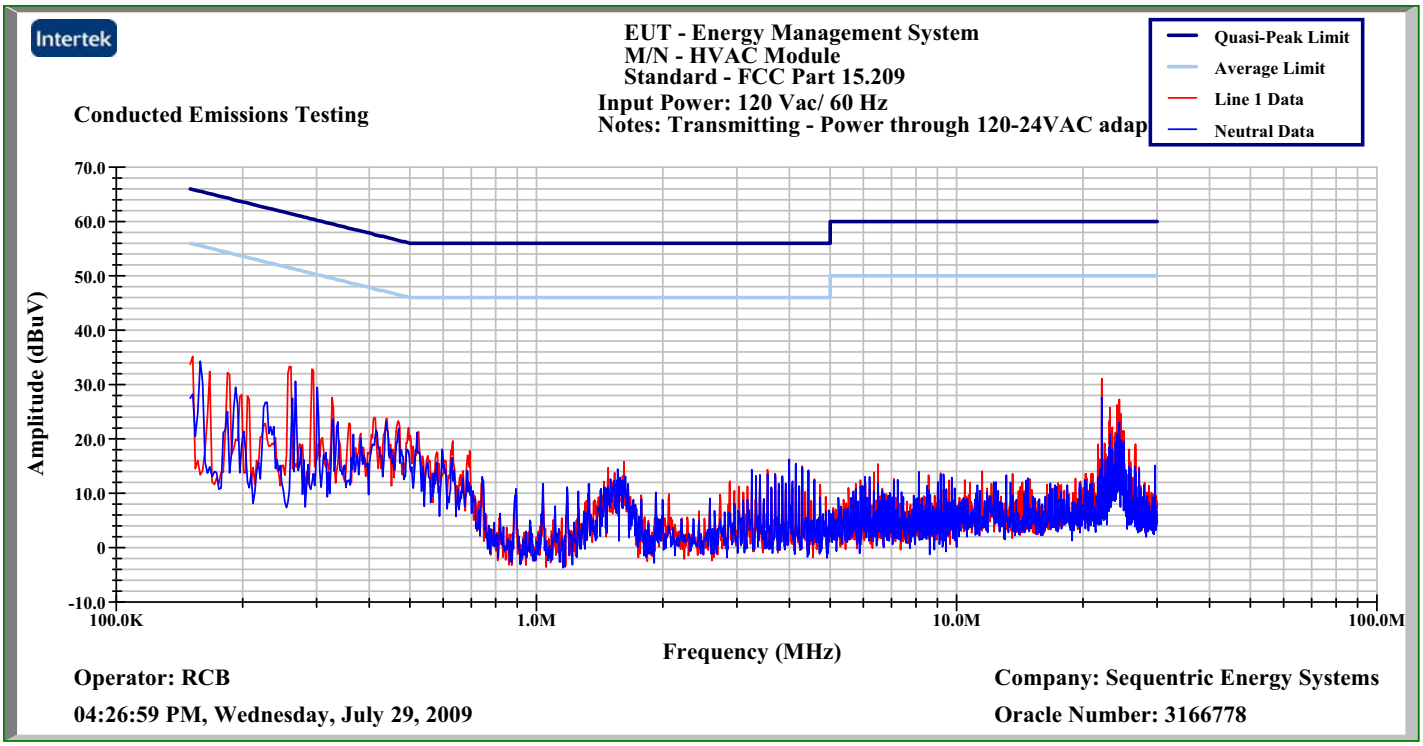
Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Cable E13, 7m Ferrite (Formerly N8)	Belden	RG-58	E13	02/19/2009	02/19/2010
Cable TT1, 6ft, N(Male) to N(Male)	Mini-Circuits	CBL-6FT-NMNM	TT1	05/05/2008	05/05/2009
EMI Receiver	Hewlett Packard	8546A	213109	09/29/2008	09/29/2009
EMI Receiver, Preselector section	Hewlett Packard	85460A	213108	09/29/2008	09/29/2009
Excel spreadsheet for conducted emissions tests	Software	Excel - CE Worksh	SW002	12/08/2008	12/08/2009
LISN	Solar Electronics	8012-50-R-24-BNC	213006	03/09/2009	03/09/2010
Tile - software profile for radiated and conducted emissions testing.	Software	Tile - Emissions	SW006	12/08/2008	12/08/2009

Results: The sample tested was found to Comply.

10.0 Conducted emissions on AC power lines - SHC-HVAC (Conducted Emissions)

Plot:



Peak Plot

10.0 Conducted emissions on AC power lines - SHC-HVAC (Conducted Emissions)

Data:

Peak data was more than 15dB below the average limits. Refer to plot for data.

11.0 Conducted emissions on AC power lines - SHC-LCM (Conducted Emissions)

Method:

Equipment setup for conducted disturbance tests shall follow the guidelines of ANSI C63.4:2003.

Measurements in the frequency range of 150kHz to 30 MHz shall be performed with a quasi-peak or average detector instrument that meets the requirements of Section One of CISPR 16. An AMN shall be used to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN defined in CISPR 16 shall be used.

In the frequency range of 150 kHz to 30 MHz, a resolution/video bandwidth of 9kHz/30kHz or greater shall be used.

The EUT shall be located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

If a flexible mains cord is provided by the manufacturer that is in excess of 1m, the excess cable shall be folded back and forth as far as possible to form a bundle not exceeding 0.4m in length.

The EUT shall be arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance shall be measured between each current carrying conductor and the reference ground. Each measured values shall be reported.

If EUT is intended for tabletop use, the EUT shall be placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is be placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table shall be constructed of non-conductive materials. Its dimensions are at least 1m by 1.5m, but may be extended for larger EUT.

If EUT is floor standing, the floor standing EUT shall be placed on a horizontal metal ground plane and isolated from the ground plane by up to 12 mm of insulating material. The metal ground plane shall extend at least 0.5m beyond the boundaries of the EUT and had minimum dimensions of 2m by 2m.

TEST SITE
The test site for conducted emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. The VCCI Registration Number for this site is C-2818.

MEASUREMENT UNCERTAINTY
Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes. The values given are the measurement uncertainty values with an expanded uncertainty of k=2.
150 kHz to 30 MHz: +/- 2.8 dB

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Cable TT1, 6ft, N(Male) to N(Male)	Mini-Circuits	CBL-6FT-NMNM	TT1	05/04/2009	05/04/2010
Cable TT5	Andrews	Cable TT5	TT5 211405	05/04/2009	05/04/2010
EMI Receiver	Hewlett Packard	8546A	213109	09/29/2008	09/29/2009
EMI Receiver, Preselector section	Hewlett Packard	85460A	213108	09/29/2008	09/29/2009
Excel spreadsheet for conducted emissions tests	Software	Excel - CE Worksh	SW002	12/08/2008	12/08/2009
LISN (TT5)	Fischer Custom Comm	FCC-LISN-50-50-M	211407	08/25/2008	08/25/2009
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/10/2008	10/10/2009
Tile - software profile for radiated and conducted emissions testing.	Software	Tile - Emissions	SW006	12/08/2008	12/08/2009
Transient Limiter	Hewlett Packard	11947A	213100	08/05/2008	08/05/2009

Results: The sample tested was found to Comply.

11.0 Conducted emissions on AC power lines - SHC-LCM (Conducted Emissions)

Photo:

Test Setup - Front View

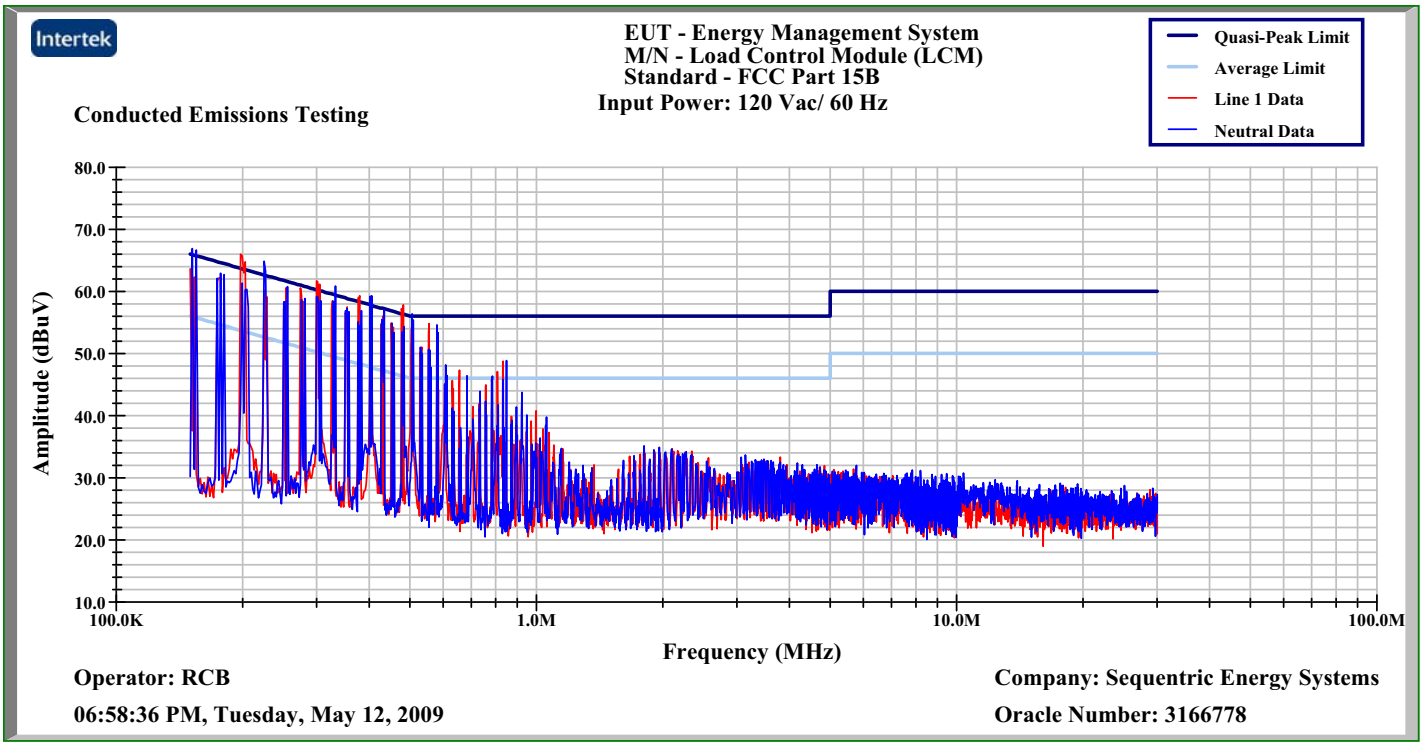
11.0 Conducted emissions on AC power lines - SHC-LCM (Conducted Emissions)

Photo:

Test Setup - Rear View

11.0 Conducted emissions on AC power lines - SHC-LCM (Conducted Emissions)

Plot:



Peak Plot

11.0 Conducted emissions on AC power lines - SHC-LCM (Conducted Emissions)

Data:

Frequency Range (MHz): .15-30

Input power: 120 Vac/ 60 Hz **Limit:** CISPR Class B

Modifications for compliance (y/n): n

A	B	C	D	E	F	G	H	I
LISN Number 1,2	**Detector (P,QP, A)**	**Frequency MHz**	**Reading dBuV**	**Cable Loss dB**	**LISN Ins. Loss dB**	**Net dBuV**	**Limit dBuV**	**Margin dB**
1	QP	0.158	46.9	0.0	6.2	53.1	65.7	-12.6
1	A	0.158	16.6	0.0	6.2	22.8	55.7	-32.9
1	QP	0.197	44.6	0.0	6.2	50.8	63.8	-13.0
1	A	0.197	18.6	0.0	6.2	24.9	53.8	-28.9
1	QP	0.294	40.7	0.0	6.2	46.9	60.5	-13.6
1	A	0.294	17.5	0.0	6.2	23.7	50.5	-26.8
1	QP	0.403	38.0	0.0	6.2	44.2	57.9	-13.7
1	A	0.403	18.6	0.0	6.2	24.8	47.9	-23.1
1	QP	0.590	38.6	0.0	6.2	44.8	56.0	-11.2
1	A	0.590	17.9	0.0	6.2	24.1	46.0	-21.9
1	QP	0.838	29.6	0.0	6.2	35.8	56.0	-20.2
1	A	0.838	18.0	0.0	6.2	24.2	46.0	-21.8
2	QP	0.151	45.3	0.0	6.0	51.3	66.0	-14.7
2	A	0.151	8.7	0.0	6.0	14.7	56.0	-41.3
2	QP	0.201	43.6	0.0	6.0	49.6	63.6	-14.0
2	A	0.201	18.2	0.0	6.0	24.2	53.6	-29.4
2	QP	0.305	40.4	0.0	6.0	46.4	60.1	-13.7
2	A	0.305	18.7	0.0	6.0	24.7	50.1	-25.4
2	QP	0.403	37.9	0.0	6.0	43.9	57.9	-14.0
2	A	0.403	19.8	0.0	6.0	25.8	47.9	-22.1
2	QP	0.591	38.3	0.0	6.0	44.3	56.0	-11.7
2	A	0.591	17.7	0.0	6.0	23.7	46.0	-22.3
2	QP	0.798	28.9	0.0	6.0	34.9	56.0	-21.1
2	A	0.798	17.0	0.0	6.0	23.0	46.0	-23.0
Calculations		G=D+E+F		I=G-H				

Tabular Data

12.0 Conducted emissions on AC power lines - SHC-CT4 (Conducted Emissions)

Method:

Conducted emissions testing was performed using the methods described in the previous section.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Cable TT1, 6ft, N(Male) to N(Male)	Mini-Circuits	CBL-6FT-NMNM	TT1	05/04/2009	05/04/2010
Cable TT5	Andrews	Cable TT5	TT5 211405	05/04/2009	05/04/2010
EMI Receiver	Hewlett Packard	8546A	213109	09/29/2008	09/29/2009
EMI Receiver, Preselector section	Hewlett Packard	85460A	213108	09/29/2008	09/29/2009
Excel spreadsheet for conducted emissions tests	Software	Excel - CE Worksh	SW002	12/08/2008	12/08/2009
LISN (TT5)	Fischer Custom Comm	FCC-LISN-50-50-M	211407	08/25/2008	08/25/2009
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/10/2008	10/10/2009
Tile - software profile for radiated and conducted emissions testing.	Software	Tile - Emissions	SW006	12/08/2008	12/08/2009
Transient Limiter	Hewlett Packard	11947A	213100	08/05/2008	08/05/2009

Results: The sample tested was found to Comply.

12.0 Conducted emissions on AC power lines - SHC-CT4 (Conducted Emissions)

Photo:

Test Setup - Front View

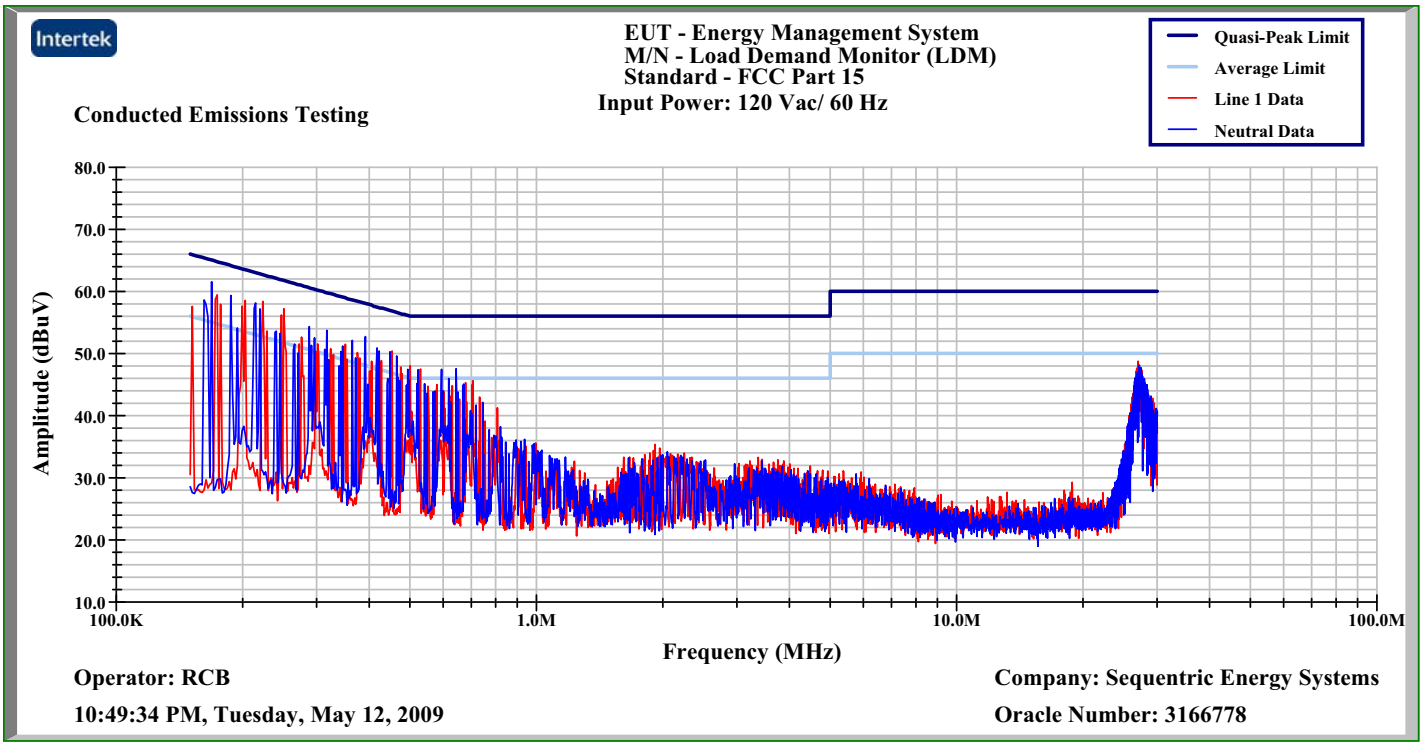
12.0 Conducted emissions on AC power lines - SHC-CT4 (Conducted Emissions)

Photo:

Test Setup - Rear View

12.0 Conducted emissions on AC power lines - SHC-CT4 (Conducted Emissions)

Plot:



Peak Plot

12.0 Conducted emissions on AC power lines - SHC-CT4 (Conducted Emissions)

Data:

Frequency Range (MHz): .15-30

Input power: 120 Vac/ 60 Hz **Limit:** CISPR Class B

Modifications for compliance (y/n): n

A	B	C	D	E	F	G	H	I
LISN Number 1,2	**Detector (P,QP, A)**	**Frequency MHz**	**Reading dBuV**	**Cable Loss dB**	**LISN Ins. Loss dB**	**Net dBuV**	**Limit dBuV**	**Margin dB**
1	QP	0.151	40.5	0.0	6.2	46.7	66.0	-19.3
1	A	0.151	11.3	0.0	6.2	17.5	56.0	-38.5
1	QP	0.205	39.1	0.0	6.2	45.3	63.4	-18.1
1	A	0.205	16.8	0.0	6.2	23.0	53.4	-30.4
1	QP	0.303	34.2	0.0	6.2	40.4	60.2	-19.8
1	A	0.303	21.2	0.0	6.2	27.4	50.2	-22.8
1	QP	0.404	31.3	0.0	6.2	37.5	57.9	-20.4
1	A	0.404	18.7	0.0	6.2	24.9	47.9	-23.0
1	QP	0.504	30.6	0.0	6.2	36.8	56.0	-19.2
1	A	0.504	19.0	0.0	6.2	25.2	46.0	-20.8
1	QP	29.995	26.0	0.3	7.2	33.5	60.0	-26.5
1	A	29.995	17.6	0.3	7.2	25.1	50.0	-24.9
2	QP	0.151	40.3	0.0	6.0	46.3	66.0	-19.7
2	A	0.151	12.6	0.0	6.0	18.6	56.0	-37.4
2	QP	0.206	38.4	0.0	6.0	44.4	63.4	-19.0
2	A	0.206	16.7	0.0	6.0	22.7	53.4	-30.7
2	QP	0.301	33.9	0.0	6.0	39.9	60.2	-20.3
2	A	0.301	21.3	0.0	6.0	27.3	50.2	-22.9
2	QP	0.405	31.4	0.0	6.0	37.4	57.8	-20.4
2	A	0.405	19.3	0.0	6.0	25.3	47.8	-22.5
2	QP	0.502	30.2	0.0	6.0	36.2	56.0	-19.8
2	A	0.502	18.9	0.0	6.0	24.9	46.0	-21.1
2	QP	29.995	27.3	0.3	6.7	34.3	60.0	-25.7
2	A	29.995	16.9	0.3	6.7	23.9	50.0	-26.1
Calculations		G=D+E+F		I=G-H				

Tabular Data

13.0 Bandwidth Requirements (FCC 15C - 15.231(c))

Method:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

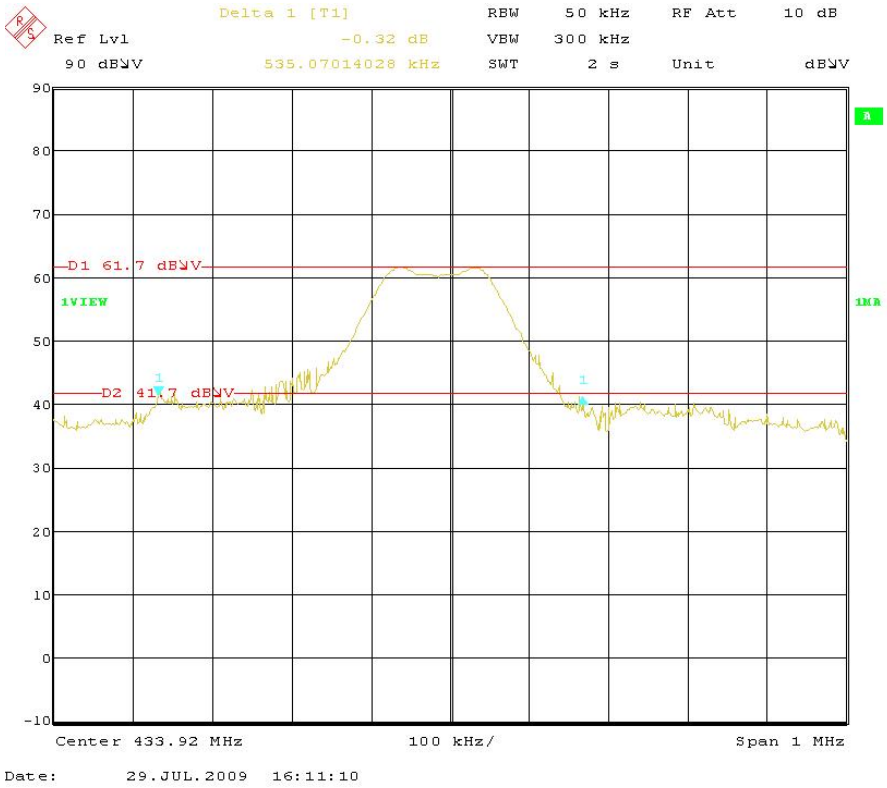
- Center Frequency is set to the fundamental of transmitter.
- Resolution Bandwidth is set to approximately 1% of the emission bandwidth.
- Video Bandwidth is set greater than or equal to the Resolution Bandwidth.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Spectrum Analyzer, 20Hz-40GHz	Rohde & Schwarz	FSEK30	200062	10/10/2008	10/10/2009

Results: The sample tested was found to Comply.

Plot:



Bandwidth Plot

13.0 Bandwidth Requirements (FCC 15C - 15.231(c))

Data:

Fundamental Frequency MHz	Measured Bandwidth MHz	Bandwidth Limit MHz
433.9	0.535	1.08475

Suggested Instrument Settings	
RBW (kHz):	54
VBW (kHz):	163
Span (MHz):	1.085
Sweep time (s):	>1

14.0 Revision History (Revision History)

Method:

Document the history of the report.

Data:

Revision Level	Date	Report Number	Notes
Original issue	May 29, 2009	3166778ATL-003	--
1	June 9, 2009	3166778ATL-003	Corrected antenna information and polling information
2	July 23, 2009	3166778ATL-003	- Removed Gateway (SHC-G) from test report - will be filed separately. - Corrected limit line labeling in plots
3	July 28, 2009	3166778ATL-003	- Corrected company designation in Section 5.0.
4	July 29, 2009	3166778ATL-003	- Corrected bandwidth plot - Added conducted emissions data for HVAC unit - Updated LCM radiated emissions data to clarify test results.