SmartLabs, Inc.

TEST REPORT FOR

INSTEON Hub, 2242-222

Tested To The Following Standards:

FCC Part 15 Subpart C Sections 15.207, 15.209, 15.249
and
RSS 210 Issue 8

Report No.: 93104-14

Date of issue: August 7, 2012

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

SmartLabs, Inc.
16542 Millikan Ave
Orvine, CA 92606

Representative: Matthew Carter
Customer Reference Number: 12-3MC0426-02

REPORT PREPARED BY:

Dianne Dudley
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 93104

DATE OF EQUIPMENT RECEIPT: July 6, 2012
DATE(S) OF TESTING: July 6-25, 2012

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Site Registration & Accreditation Information

Location	CB #	Taiwan	Canada	FCC	Japan
Brea A	US0060	SL2-IN-E-1146R	3082D-1	90473	R-2945 C-3248 T-1572

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart C

Description	Test Procedure/Method	Results
Voltage Variation	FCC Part 15 Subpart C Section 15.31(e)	Pass
Conducted Emissions	FCC Part 15 Subpart C Section 15.207 / ANSI C63.4 (2003)	Pass
RF Power Output	FCC Part 15 Subpart C Section 15.249	Pass
-20dBc & 99% Occupied Bandwidth	FCC Part 15 Subpart C Section 15.249 / RSS 210 Issue 8	Pass
Bandedge	FCC Part 15 Subpart C	Pass
Field Strength of Spurious Emissions	FCC Part 15 Subpart C Section 15.249(d)	Pass

Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

Summary of Conditions
Modifications during testing: Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V. Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral. Take center tap of caps above as ground and connect to Ethernet card's ground. Add EMI filters to the four power and signal lines between Ethernet and power supply boards. Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components. Ground Ethernet jack case. Use shielded Ethernet cable. Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield. Added ferrite PN0446164151 with one loop to Ethernet cable.

EQUIPMENT UNDER TEST (EUT)

EQUIPMENT UNDER TEST

INSTEON Hub
Manuf: SmartLabs, Inc.
Model: 2242-222
Serial: NA

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

Laptop
Manuf: Toshiba
Model: A105-S4004
Serial: NA

Dual Speed Hub
Manuf: Netgear
Model: DS309
Serial: NA

FCC PART 15 SUBPART C

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) 47 CFR 15C requirements for Unlicensed Radio Frequency Devices, Subpart C - Intentional Radiators.

15.31(e) Voltage Variations

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **15.31e**
Work Order #: **93104** Date: 7/25/2012
Test Type: **Maximized Emissions** Time: 11:33:00
Equipment: **INSTEON Hub** Sequence#: 41
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00309	Preamp	8447D	3/29/2012	3/29/2014
T2	AN01995	Biconilog Antenna	CBL6111C	5/16/2012	5/16/2014
T3	ANP05050	Cable	RG223/U	3/21/2011	3/21/2013
T4	ANP05198	Cable	8268	12/21/2010	12/21/2012
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

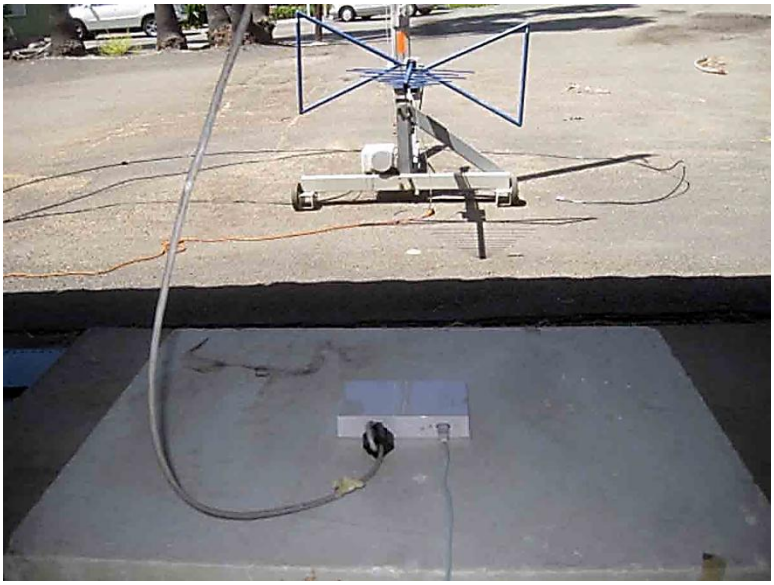
Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	A105-S4004	NA

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in constant transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = fundamental
RBW=VBW=120kHz.
Test environment conditions: 22°C, 42% relative humidity, 100kPa
15.31(e) compliance: the supply voltage was varied between 85% and 115% of the nominal rated supply voltage (100vac and 240 VAC); no change in the fundamental signal level was observed.
Modification: Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V. Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral. Take center tap of caps above as ground and connect to Ethernet card's ground. Add EMI filters to the four power and signal lines between Ethernet and power supply boards. Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

Test Setup Photos



15.207 AC Conducted Emissions

Test Data Sheets

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **93104** Date: 7/6/2012
Test Type: **Conducted Emissions** Time: 15:31:18
Equipment: **INSTEON Hub** Sequence#: 28
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222 120V 60Hz
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02610	High Pass Filter	HE9615-150K-50-720B	11/21/2011	11/21/2013
T2	ANP04358	Cable	RG142	4/10/2012	4/10/2014
T3	ANP06084	Attenuator	SA18N10W-06	12/8/2010	12/8/2012
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
T4	AN00847.1	50uH LISN-Line 1 (dB)	3816/2NM	12/21/2010	12/21/2012
	AN00847.1	50uH LISN-Line 2 (dB)	3816/2NM	12/21/2010	12/21/2012
	AN00848.1	50uH LISN-Line 1 (dB)	3816/2nm	3/22/2011	3/22/2013
	AN00848.1	50uH LISN-Line 2 (dB)	3816/2nm	3/22/2011	3/22/2013

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	A105-S4004	NA

Test Conditions / Notes:

The EUT is placed on the wooden table. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = 150kHz-30MHz
RBW=VBW=9kHz.
Test environment conditions: 19° C, 51% relative humidity, 100kPa
Modification:
Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V.
Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral.
Take center tap of caps above as ground and connect to Ethernet card's ground.
Add EMI filters to the four power and signal lines between Ethernet and power supply boards.
Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

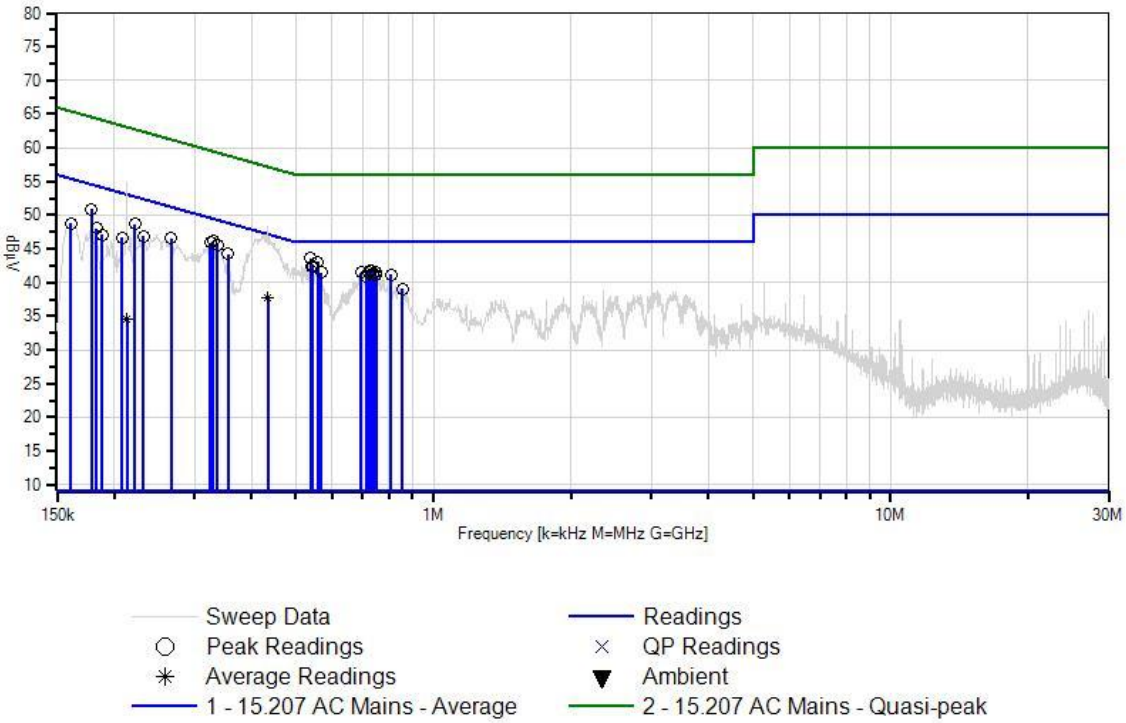
Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Lead: L1 (Live)

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	537.601k	37.6	+0.2	+0.0	+5.8	+0.0	+0.0	43.6	46.0	-2.4	L1 (L
2	558.690k	37.1	+0.2	+0.0	+5.8	+0.0	+0.0	43.1	46.0	-2.9	L1 (L
3	329.620k	40.1	+0.2	+0.1	+5.7	+0.0	+0.0	46.1	49.5	-3.4	L1 (L
4	544.146k	36.4	+0.2	+0.0	+5.8	+0.0	+0.0	42.4	46.0	-3.6	L1 (L
5	178.361k	44.8	+0.3	+0.0	+5.8	+0.0	+0.0	50.9	54.6	-3.7	L1 (L
6	325.257k	39.9	+0.2	+0.1	+5.7	+0.0	+0.0	45.9	49.6	-3.7	L1 (L
7	541.237k	36.3	+0.2	+0.0	+5.8	+0.0	+0.0	42.3	46.0	-3.7	L1 (L
8	336.165k	39.5	+0.2	+0.1	+5.7	+0.0	+0.0	45.5	49.3	-3.8	L1 (L
9	221.993k	42.7	+0.2	+0.0	+5.8	+0.0	+0.0	48.7	52.7	-4.0	L1 (L
10	733.946k	35.8	+0.2	+0.0	+5.8	+0.0	+0.0	41.8	46.0	-4.2	L1 (L
11	728.129k	35.7	+0.2	+0.0	+5.8	+0.0	+0.0	41.7	46.0	-4.3	L1 (L
12	693.950k	35.5	+0.2	+0.0	+5.8	+0.0	+0.0	41.5	46.0	-4.5	L1 (L
13	722.311k	35.5	+0.2	+0.0	+5.8	+0.0	+0.0	41.5	46.0	-4.5	L1 (L
14	745.582k	35.5	+0.2	+0.0	+5.8	+0.0	+0.0	41.5	46.0	-4.5	L1 (L

15	567.416k	35.5	+0.2	+0.0	+5.8	+0.0	+0.0	41.5	46.0	-4.5	L1 (L
16	266.353k	40.6	+0.2	+0.0	+5.8	+0.0	+0.0	46.6	51.2	-4.6	L1 (L
17	355.072k	38.2	+0.2	+0.1	+5.7	+0.0	+0.0	44.2	48.8	-4.6	L1 (L
18	739.037k	35.3	+0.2	+0.0	+5.8	+0.0	+0.0	41.3	46.0	-4.7	L1 (L
19	806.667k	35.2	+0.2	+0.0	+5.8	+0.0	+0.0	41.2	46.0	-4.8	L1 (L
20	749.218k	35.1	+0.2	+0.0	+5.8	+0.0	+0.0	41.1	46.0	-4.9	L1 (L
21	712.857k	35.0	+0.2	+0.0	+5.8	+0.0	+0.0	41.0	46.0	-5.0	L1 (L
22	232.174k	40.9	+0.2	+0.0	+5.8	+0.0	+0.0	46.9	52.4	-5.5	L1 (L
23	182.724k	41.9	+0.3	+0.0	+5.8	+0.0	+0.0	48.0	54.4	-6.4	L1 (L
24	160.908k	42.5	+0.5	+0.0	+5.8	+0.0	+0.0	48.8	55.4	-6.6	L1 (L
25	208.176k	40.7	+0.2	+0.0	+5.8	+0.0	+0.0	46.7	53.3	-6.6	L1 (L
26	853.935k	33.0	+0.2	+0.1	+5.8	+0.0	+0.0	39.1	46.0	-6.9	L1 (L
27	188.542k	41.1	+0.2	+0.0	+5.8	+0.0	+0.0	47.1	54.1	-7.0	L1 (L
28 Ave	433.610k	31.7	+0.2	+0.1	+5.7	+0.0	+0.0	37.7	47.2	-9.5	L1 (L
^	433.610k	42.4	+0.2	+0.1	+5.7	+0.0	+0.0	48.4	47.2	+1.2	L1 (L
30 Ave	213.267k	28.6	+0.2	+0.0	+5.8	+0.0	+0.0	34.6	53.1	-18.5	L1 (L
^	213.267k	48.9	+0.2	+0.0	+5.8	+0.0	+0.0	54.9	53.1	+1.8	L1 (L
^	216.903k	40.9	+0.2	+0.0	+5.8	+0.0	+0.0	46.9	52.9	-6.0	L1 (L

CKC Laboratories, Inc. Date: 7/6/2012 Time: 15:31:18 SmartLabs, Inc. WO#: 93104
15.207 AC Mains - Average Test Lead: L1 (Live) 120V 60Hz Sequence#: 28 Ext ATTN: 0 dB



Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **93104** Date: 7/6/2012
Test Type: **Conducted Emissions** Time: 15:26:03
Equipment: **INSTEON Hub** Sequence#: 27
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222 120V 60Hz
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02610	High Pass Filter	HE9615-150K-50-720B	11/21/2011	11/21/2013
T2	ANP04358	Cable	RG142	4/10/2012	4/10/2014
T3	ANP06084	Attenuator	SA18N10W-06	12/8/2010	12/8/2012
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
	AN00847.1	50uH LISN-Line 1 (dB)	3816/2NM	12/21/2010	12/21/2012
T4	AN00847.1	50uH LISN-Line 2 (dB)	3816/2NM	12/21/2010	12/21/2012
	AN00848.1	50uH LISN-Line 1 (dB)	3816/2nm	3/22/2011	3/22/2013
	AN00848.1	50uH LISN-Line 2 (dB)	3816/2nm	3/22/2011	3/22/2013

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	A105-S4004	NA

Test Conditions / Notes:

The EUT is placed on the wooden table. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = 150kHz-30MHz
RBW=VBW=9kHz.
Test environment conditions: 19° C, 51% relative humidity, 100kPa
Modification:
Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V.
Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral.
Take center tap of caps above as ground and connect to Ethernet card's ground.
Add EMI filters to the four power and signal lines between Ethernet and power supply boards.
Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

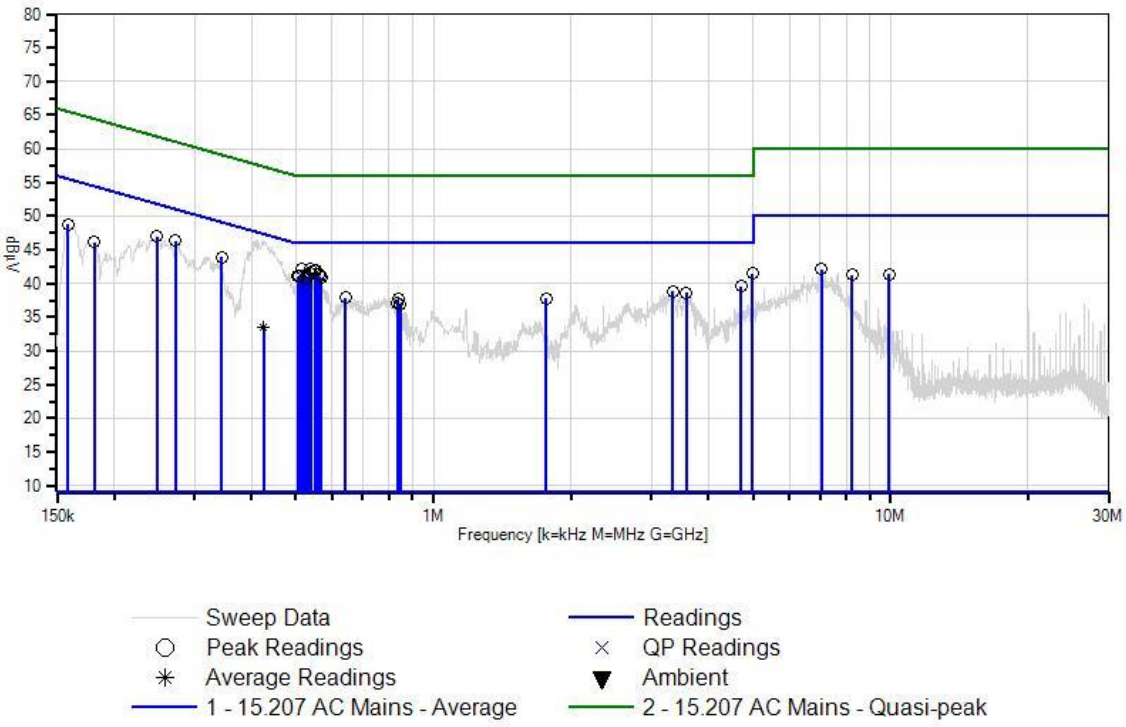
Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Lead: L2 (Neutral)

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	516.512k	36.1	+0.2	+0.1	+5.7	+0.0	+0.0	42.1	46.0	-3.9	L2 (N
2	536.146k	36.1	+0.2	+0.0	+5.8	+0.0	+0.0	42.1	46.0	-3.9	L2 (N
3	549.963k	36.0	+0.2	+0.0	+5.8	+0.0	+0.0	42.0	46.0	-4.0	L2 (N
4	552.872k	36.0	+0.2	+0.0	+5.8	+0.0	+0.0	42.0	46.0	-4.0	L2 (N
5	539.055k	35.5	+0.2	+0.0	+5.8	+0.0	+0.0	41.5	46.0	-4.5	L2 (N
6	4.981M	35.2	+0.1	+0.2	+5.8	+0.2	+0.0	41.5	46.0	-4.5	L2 (N
7	272.898k	40.3	+0.2	+0.0	+5.8	+0.0	+0.0	46.3	51.0	-4.7	L2 (N
8	560.871k	35.3	+0.2	+0.0	+5.8	+0.0	+0.0	41.3	46.0	-4.7	L2 (N
9	248.173k	41.0	+0.2	+0.0	+5.8	+0.0	+0.0	47.0	51.8	-4.8	L2 (N
10	507.785k	35.2	+0.2	+0.1	+5.7	+0.0	+0.0	41.2	46.0	-4.8	L2 (N
11	505.604k	35.1	+0.2	+0.1	+5.7	+0.0	+0.0	41.1	46.0	-4.9	L2 (N
12	563.780k	35.1	+0.2	+0.0	+5.8	+0.0	+0.0	41.1	46.0	-4.9	L2 (N
13	528.147k	34.9	+0.2	+0.1	+5.7	+0.0	+0.0	40.9	46.0	-5.1	L2 (N
14	568.871k	34.9	+0.2	+0.0	+5.8	+0.0	+0.0	40.9	46.0	-5.1	L2 (N
15	520.875k	34.8	+0.2	+0.1	+5.7	+0.0	+0.0	40.8	46.0	-5.2	L2 (N
16	343.437k	37.9	+0.2	+0.1	+5.7	+0.0	+0.0	43.9	49.1	-5.2	L2 (N
17	4.713M	33.3	+0.1	+0.2	+5.8	+0.2	+0.0	39.6	46.0	-6.4	L2 (N
18	158.726k	42.3	+0.7	+0.0	+5.8	+0.0	+0.0	48.8	55.5	-6.7	L2 (N
19	3.340M	32.7	+0.1	+0.2	+5.8	+0.1	+0.0	38.9	46.0	-7.1	L2 (N
20	3.578M	32.4	+0.1	+0.2	+5.8	+0.1	+0.0	38.6	46.0	-7.4	L2 (N
21	7.067M	35.7	+0.1	+0.2	+5.8	+0.3	+0.0	42.1	50.0	-7.9	L2 (N
22	640.864k	31.9	+0.2	+0.0	+5.8	+0.0	+0.0	37.9	46.0	-8.1	L2 (N
23	1.766M	31.6	+0.2	+0.1	+5.8	+0.1	+0.0	37.8	46.0	-8.2	L2 (N

24	181.270k	40.0	+0.3	+0.0	+5.8	+0.0	+0.0	46.1	54.4	-8.3	L2 (N
25	837.210k	31.6	+0.2	+0.1	+5.8	+0.0	+0.0	37.7	46.0	-8.3	L2 (N
26	9.914M	34.6	+0.2	+0.2	+5.8	+0.6	+0.0	41.4	50.0	-8.6	L2 (N
27	8.238M	34.7	+0.2	+0.2	+5.8	+0.4	+0.0	41.3	50.0	-8.7	L2 (N
28	835.028k	31.0	+0.2	+0.0	+5.8	+0.0	+0.0	37.0	46.0	-9.0	L2 (N
29	845.209k	30.8	+0.2	+0.1	+5.8	+0.0	+0.0	36.9	46.0	-9.1	L2 (N
30	424.884k Ave	27.5	+0.2	+0.1	+5.7	+0.0	+0.0	33.5	47.4	-13.9	L2 (N
^	424.884k	40.4	+0.2	+0.1	+5.7	+0.0	+0.0	46.4	47.4	-1.0	L2 (N

CKC Laboratories, Inc. Date: 7/6/2012 Time: 15:26:03 SmartLabs, Inc. WO#: 93104
15.207 AC Mains - Average Test Lead: L2 (Neutral) 120V 60Hz Sequence#: 27 Ext ATTN: 0 dB



Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **93104** Date: 7/6/2012
Test Type: **Conducted Emissions** Time: 15:13:19
Equipment: **INSTEON Hub** Sequence#: 25
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222 230V 50Hz
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02610	High Pass Filter	HE9615-150K-50-720B	11/21/2011	11/21/2013
T2	ANP04358	Cable	RG142	4/10/2012	4/10/2014
T3	ANP06084	Attenuator	SA18N10W-06	12/8/2010	12/8/2012
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
T4	AN00847.1	50uH LISN-Line 1 (dB)	3816/2NM	12/21/2010	12/21/2012
	AN00847.1	50uH LISN-Line 2 (dB)	3816/2NM	12/21/2010	12/21/2012
	AN00848.1	50uH LISN-Line 1 (dB)	3816/2nm	3/22/2011	3/22/2013
	AN00848.1	50uH LISN-Line 2 (dB)	3816/2nm	3/22/2011	3/22/2013

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	A105-S4004	NA

Test Conditions / Notes:

The EUT is placed on the wooden table. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = 150kHz-30MHz
RBW=VBW=9kHz.
Test environment conditions: 19° C, 51% relative humidity, 100kPa
Modification: Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V. Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral.
Take center tap of caps above as ground and connect to Ethernet card's ground.
Add EMI filters to the four power and signal lines between Ethernet and power supply boards.
Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

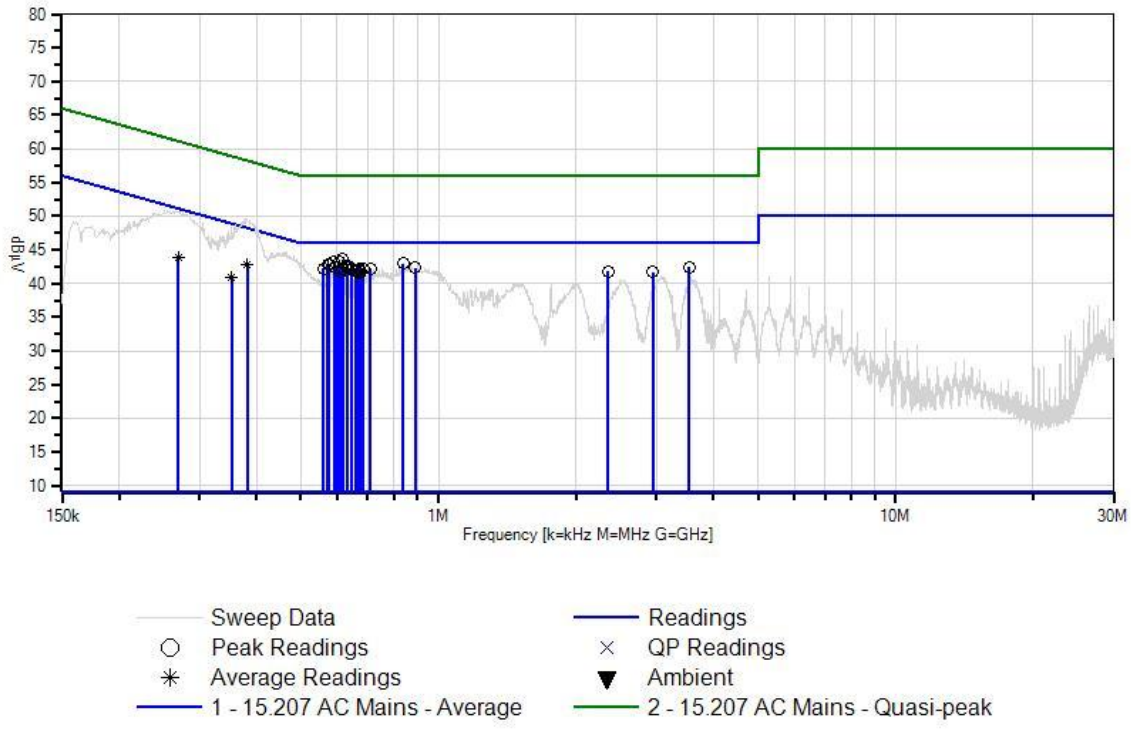
Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Lead: L1 (Live)

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	616.866k	37.6	+0.2	+0.0	+5.8	+0.0	+0.0	43.6	46.0	-2.4	L1 (L
2	589.960k	37.2	+0.2	+0.0	+5.8	+0.0	+0.0	43.2	46.0	-2.8	L1 (L
3	605.958k	37.2	+0.2	+0.0	+5.8	+0.0	+0.0	43.2	46.0	-2.8	L1 (L
4	836.482k	37.0	+0.2	+0.0	+5.8	+0.0	+0.0	43.0	46.0	-3.0	L1 (L
5	571.779k	36.8	+0.2	+0.0	+5.8	+0.0	+0.0	42.8	46.0	-3.2	L1 (L
6	576.870k	36.8	+0.2	+0.0	+5.8	+0.0	+0.0	42.8	46.0	-3.2	L1 (L
7	632.865k	36.6	+0.2	+0.0	+5.8	+0.0	+0.0	42.6	46.0	-3.4	L1 (L
8	629.956k	36.5	+0.2	+0.0	+5.8	+0.0	+0.0	42.5	46.0	-3.5	L1 (L
9	594.323k	36.4	+0.2	+0.0	+5.8	+0.0	+0.0	42.4	46.0	-3.6	L1 (L
10	631.410k	36.4	+0.2	+0.0	+5.8	+0.0	+0.0	42.4	46.0	-3.6	L1 (L
11	3.531M	36.2	+0.1	+0.2	+5.8	+0.1	+0.0	42.4	46.0	-3.6	L1 (L
12	889.963k	36.2	+0.2	+0.1	+5.8	+0.0	+0.0	42.3	46.0	-3.7	L1 (L
13	708.494k	36.2	+0.2	+0.0	+5.8	+0.0	+0.0	42.2	46.0	-3.8	L1 (L
14	673.588k	36.2	+0.2	+0.0	+5.8	+0.0	+0.0	42.2	46.0	-3.8	L1 (L
15	615.412k	36.2	+0.2	+0.0	+5.8	+0.0	+0.0	42.2	46.0	-3.8	L1 (L
16	559.417k	36.2	+0.2	+0.0	+5.8	+0.0	+0.0	42.2	46.0	-3.8	L1 (L
17	647.409k	36.2	+0.2	+0.0	+5.8	+0.0	+0.0	42.2	46.0	-3.8	L1 (L
18	644.500k	36.2	+0.2	+0.0	+5.8	+0.0	+0.0	42.2	46.0	-3.8	L1 (L
19	684.496k	36.1	+0.2	+0.0	+5.8	+0.0	+0.0	42.1	46.0	-3.9	L1 (L
20	661.953k	36.0	+0.2	+0.0	+5.8	+0.0	+0.0	42.0	46.0	-4.0	L1 (L
21	659.044k	35.9	+0.2	+0.0	+5.8	+0.0	+0.0	41.9	46.0	-4.1	L1 (L
22	612.503k	35.8	+0.2	+0.0	+5.8	+0.0	+0.0	41.8	46.0	-4.2	L1 (L
23	660.499k	35.8	+0.2	+0.0	+5.8	+0.0	+0.0	41.8	46.0	-4.2	L1 (L
24	2.353M	35.6	+0.2	+0.2	+5.8	+0.0	+0.0	41.8	46.0	-4.2	L1 (L

25	676.497k	35.7	+0.2	+0.0	+5.8	+0.0	+0.0	41.7	46.0	-4.3	L1 (L
26	2.940M	35.4	+0.2	+0.2	+5.8	+0.1	+0.0	41.7	46.0	-4.3	L1 (L
27	669.952k	35.6	+0.2	+0.0	+5.8	+0.0	+0.0	41.6	46.0	-4.4	L1 (L
28	381.252k Ave	36.8	+0.2	+0.1	+5.7	+0.0	+0.0	42.8	48.3	-5.5	L1 (L
^	381.252k	43.7	+0.2	+0.1	+5.7	+0.0	+0.0	49.7	48.3	+1.4	L1 (L
30	269.989k Ave	37.9	+0.2	+0.0	+5.8	+0.0	+0.0	43.9	51.1	-7.2	L1 (L
^	269.989k	44.7	+0.2	+0.0	+5.8	+0.0	+0.0	50.7	51.1	-0.4	L1 (L
32	352.163k Ave	35.0	+0.2	+0.1	+5.7	+0.0	+0.0	41.0	48.9	-7.9	L1 (L
^	352.163k	42.4	+0.2	+0.1	+5.7	+0.0	+0.0	48.4	48.9	-0.5	L1 (L

CKC Laboratories, Inc. Date: 7/6/2012 Time: 15:13:19 SmartLabs, Inc. WO#: 93104
15.207 AC Mains - Average Test Lead: L1 (Live) 230V 50Hz Sequence#: 25 Ext ATTN: 0 dB



Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **15.207 AC Mains - Average**
Work Order #: **93104** Date: 7/6/2012
Test Type: **Conducted Emissions** Time: 15:19:29
Equipment: **INSTEON Hub** Sequence#: 26
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222 230V 50Hz
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02610	High Pass Filter	HE9615-150K-50-720B	11/21/2011	11/21/2013
T2	ANP04358	Cable	RG142	4/10/2012	4/10/2014
T3	ANP06084	Attenuator	SA18N10W-06	12/8/2010	12/8/2012
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
	AN00847.1	50uH LISN-Line 1 (dB)	3816/2NM	12/21/2010	12/21/2012
T4	AN00847.1	50uH LISN-Line 2 (dB)	3816/2NM	12/21/2010	12/21/2012
	AN00848.1	50uH LISN-Line 1 (dB)	3816/2nm	3/22/2011	3/22/2013
	AN00848.1	50uH LISN-Line 2 (dB)	3816/2nm	3/22/2011	3/22/2013

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Dual Speed Hub	Netgear	DS309	NA

Test Conditions / Notes:

The EUT is placed on the wooden table. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = 150kHz-30MHz
RBW=VBW=9kHz.
Test environment conditions: 19°C, 51% relative humidity, 100kPa
Modification:
Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V.
Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral. Take center tap of caps above as ground and connect to Ethernet card's ground. Add EMI filters to the four power and signal lines between Ethernet and power supply boards. Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

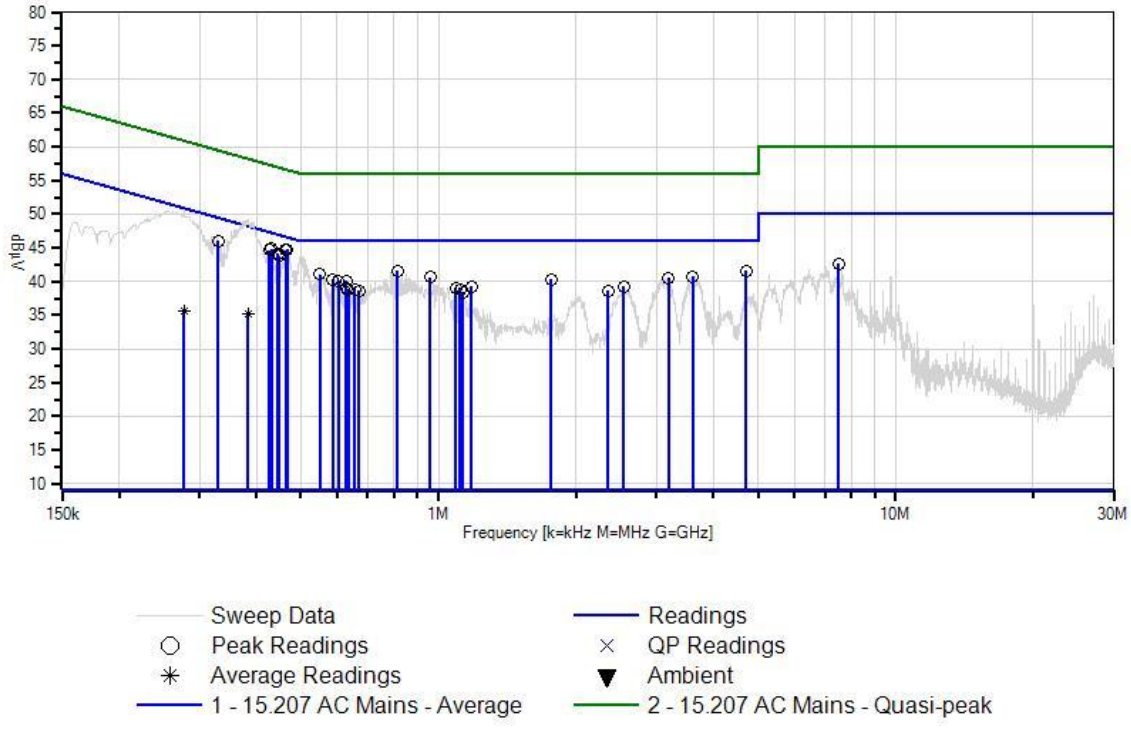
Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Lead: L2 (Neutral)

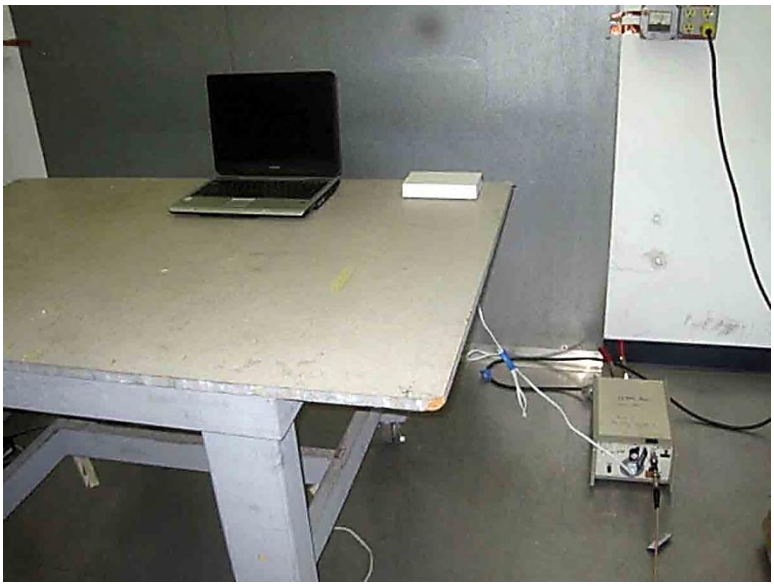
#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	466.334k	38.8	+0.2	+0.1	+5.7	+0.0	+0.0	44.8	46.6	-1.8	L2 (N
2	462.698k	38.7	+0.2	+0.1	+5.7	+0.0	+0.0	44.7	46.6	-1.9	L2 (N
3	431.428k	38.9	+0.2	+0.1	+5.7	+0.0	+0.0	44.9	47.2	-2.3	L2 (N
4	427.064k	38.7	+0.2	+0.1	+5.7	+0.0	+0.0	44.7	47.3	-2.6	L2 (N
5	445.972k	38.1	+0.2	+0.1	+5.7	+0.0	+0.0	44.1	46.9	-2.8	L2 (N
6	448.881k	37.8	+0.2	+0.1	+5.7	+0.0	+0.0	43.8	46.9	-3.1	L2 (N
7	329.619k	40.0	+0.2	+0.1	+5.7	+0.0	+0.0	46.0	49.5	-3.5	L2 (N
8	811.756k	35.6	+0.2	+0.0	+5.8	+0.0	+0.0	41.6	46.0	-4.4	L2 (N
9	4.705M	35.3	+0.1	+0.2	+5.8	+0.2	+0.0	41.6	46.0	-4.4	L2 (N
10	549.235k	35.1	+0.2	+0.0	+5.8	+0.0	+0.0	41.1	46.0	-4.9	L2 (N
11	3.603M	34.6	+0.1	+0.2	+5.8	+0.1	+0.0	40.8	46.0	-5.2	L2 (N
12	958.007k	34.5	+0.2	+0.1	+5.8	+0.0	+0.0	40.6	46.0	-5.4	L2 (N
13	3.182M	34.3	+0.1	+0.2	+5.8	+0.1	+0.0	40.5	46.0	-5.5	L2 (N
14	1.766M	34.1	+0.2	+0.1	+5.8	+0.1	+0.0	40.3	46.0	-5.7	L2 (N
15	586.323k	34.3	+0.2	+0.0	+5.8	+0.0	+0.0	40.3	46.0	-5.7	L2 (N
16	604.503k	34.1	+0.2	+0.0	+5.8	+0.0	+0.0	40.1	46.0	-5.9	L2 (N
17	628.501k	34.1	+0.2	+0.0	+5.8	+0.0	+0.0	40.1	46.0	-5.9	L2 (N
18	1.179M	33.2	+0.2	+0.1	+5.8	+0.0	+0.0	39.3	46.0	-6.7	L2 (N
19	2.540M	33.0	+0.2	+0.2	+5.8	+0.1	+0.0	39.3	46.0	-6.7	L2 (N
20	1.090M	33.0	+0.2	+0.1	+5.8	+0.0	+0.0	39.1	46.0	-6.9	L2 (N
21	631.409k	33.0	+0.2	+0.0	+5.8	+0.0	+0.0	39.0	46.0	-7.0	L2 (N
22	654.680k	32.9	+0.2	+0.0	+5.8	+0.0	+0.0	38.9	46.0	-7.1	L2 (N
23	1.115M	32.7	+0.2	+0.1	+5.8	+0.0	+0.0	38.8	46.0	-7.2	L2 (N

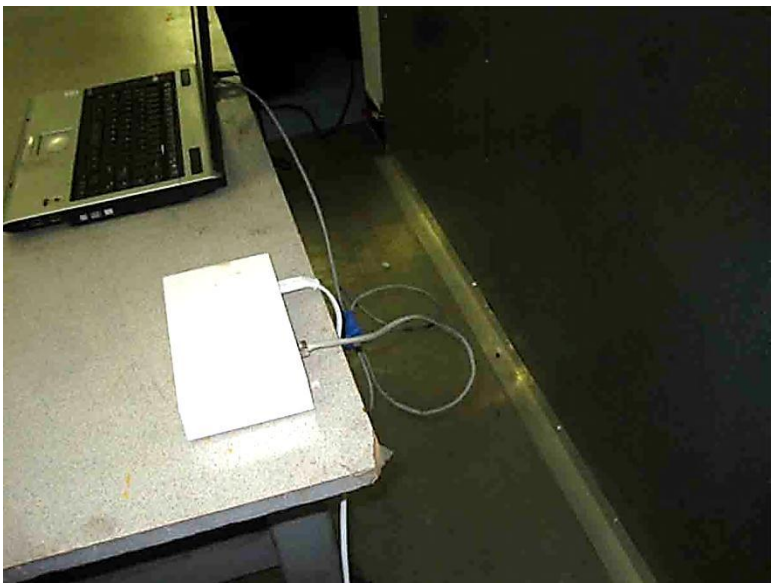
24	634.318k	32.7	+0.2	+0.0	+5.8	+0.0	+0.0	38.7	46.0	-7.3	L2 (N
25	7.508M	36.2	+0.2	+0.2	+5.8	+0.3	+0.0	42.7	50.0	-7.3	L2 (N
26	669.951k	32.6	+0.2	+0.0	+5.8	+0.0	+0.0	38.6	46.0	-7.4	L2 (N
27	2.353M	32.3	+0.2	+0.2	+5.8	+0.1	+0.0	38.6	46.0	-7.4	L2 (N
28	1.132M	32.3	+0.2	+0.1	+5.8	+0.0	+0.0	38.4	46.0	-7.6	L2 (N
29 Ave	382.705k	29.1	+0.2	+0.1	+5.7	+0.0	+0.0	35.1	48.2	-13.1	L2 (N
^	382.705k	43.3	+0.2	+0.1	+5.7	+0.0	+0.0	49.3	48.2	+1.1	L2 (N
31 Ave	277.260k	29.7	+0.2	+0.0	+5.8	+0.0	+0.0	35.7	50.9	-15.2	L2 (N
^	277.260k	44.6	+0.2	+0.0	+5.8	+0.0	+0.0	50.6	50.9	-0.3	L2 (N

CKC Laboratories, Inc. Date: 7/6/2012 Time: 15:19:29 SmartLabs, Inc. WO#: 93104
15.207 AC Mains - Average Test Lead: L2 (Neutral) 230V 50Hz Sequence#: 26 Ext ATTN: 0 dB



Test Setup Photos





15.249 RF Power Output

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
Work Order #: **93104** Date: 7/25/2012
Test Type: **Maximized Emissions** Time: 11:33:00
Equipment: **INSTEON Hub** Sequence#: 41
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00309	Preamp	8447D	3/29/2012	3/29/2014
T2	AN01995	Biconilog Antenna	CBL6111C	5/16/2012	5/16/2014
T3	ANP05050	Cable	RG223/U	3/21/2011	3/21/2013
T4	ANP05198	Cable	8268	12/21/2010	12/21/2012
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	A105-S4004	NA

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in constant transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = fundamental
RBW=VBW=120kHz.
Test environment conditions: 22°C, 42% relative humidity, 100kPa
Modification:
Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V.
Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral.
Take center tap of caps above as ground and connect to Ethernet card's ground.
Add EMI filters to the four power and signal lines between Ethernet and power supply boards.
Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	915.010M	75.3	-27.2	+23.3	+0.5	+5.8	+0.0	77.7	94.0	-16.3	Horiz
2	914.890M	75.3	-27.2	+23.3	+0.5	+5.8	+0.0	77.7	94.0	-16.3	Horiz
3	914.890M	74.4	-27.2	+23.3	+0.5	+5.8	+0.0	76.8	94.0	-17.2	Vert
4	915.010M	74.3	-27.2	+23.3	+0.5	+5.8	+0.0	76.7	94.0	-17.3	Vert

Test Setup Photos

-20dBc Occupied Bandwidth / 99% Bandwidth RSS 210 Issue 8

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **Occupied bandwidth**
Work Order #: **93104** Date: 7/25/2012
Test Type: **Maximized Emissions** Time: 11:33:00
Equipment: **INSTEON Hub** Sequence#: 41
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00309	Preamp	8447D	3/29/2012	3/29/2014
T2	AN01995	Biconilog Antenna	CBL6111C	5/16/2012	5/16/2014
T3	ANP05050	Cable	RG223/U	3/21/2011	3/21/2013
T4	ANP05198	Cable	8268	12/21/2010	12/21/2012
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

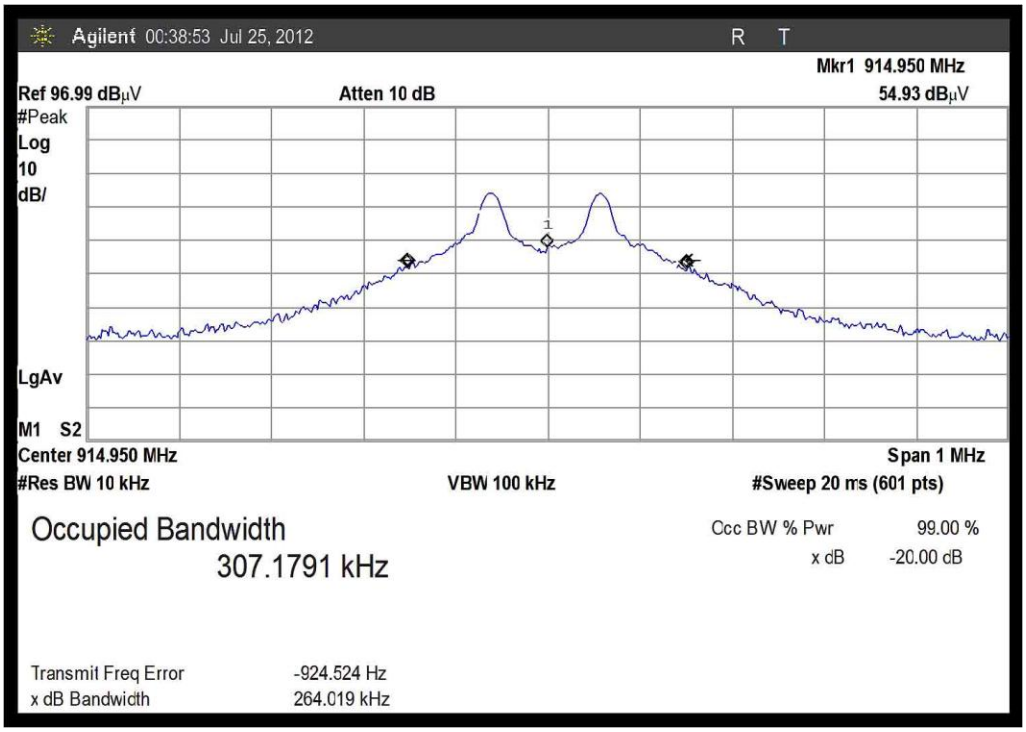
Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	A105-S4004	NA

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in constant transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = fundamental
RBW=VBW=120kHz.
Test environment conditions: 22°C, 42% relative humidity, 100kPa
Modification:
Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V.
Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral. Take center tap of caps above as ground and connect to Ethernet card's ground. Add EMI filters to the four power and signal lines between Ethernet and power supply boards. Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

Test Plots



Test Setup Photos

Bandedge

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **Bandedge**
Work Order #: **93104** Date: 7/25/2012
Test Type: **Maximized Emissions** Time: 11:33:00
Equipment: **INSTEON Hub** Sequence#: 41
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00309	Preamp	8447D	3/29/2012	3/29/2014
T2	AN01995	Biconilog Antenna	CBL6111C	5/16/2012	5/16/2014
T3	ANP05050	Cable	RG223/U	3/21/2011	3/21/2013
T4	ANP05198	Cable	8268	12/21/2010	12/21/2012
	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

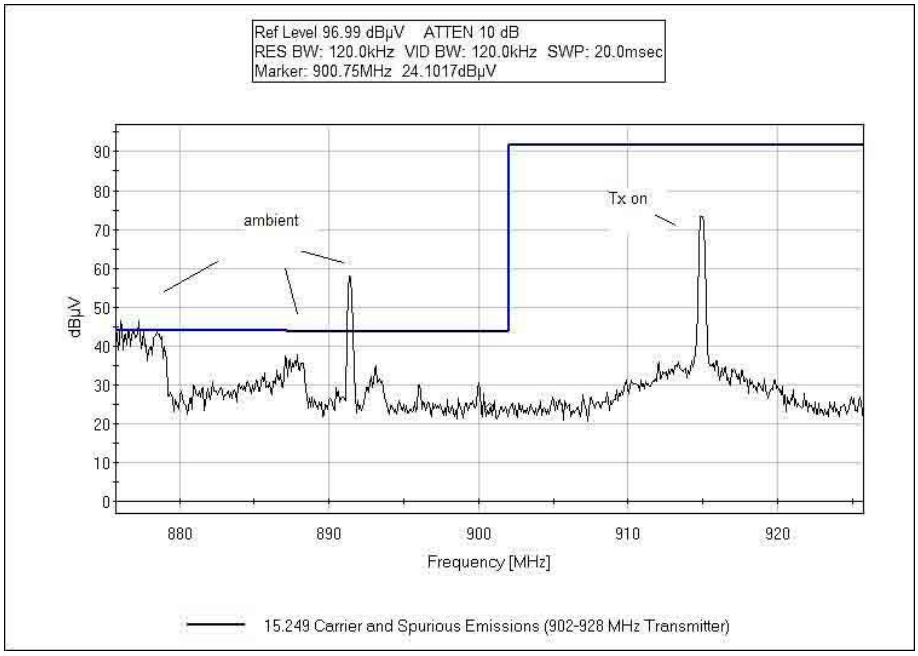
Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	A105-S4004	NA

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in constant transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = fundamental
RBW=VBW=120kHz.
Test environment conditions: 22° C, 42% relative humidity, 100kPa
Modification: Upgrade to 4 layer board, install thicker wires from wireless board to main board, increase voltage to 5.2V. Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral. Take center tap of caps above as ground and connect to Ethernet card's ground. Add EMI filters to the four power and signal lines between Ethernet and power supply boards.
Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

Test Data



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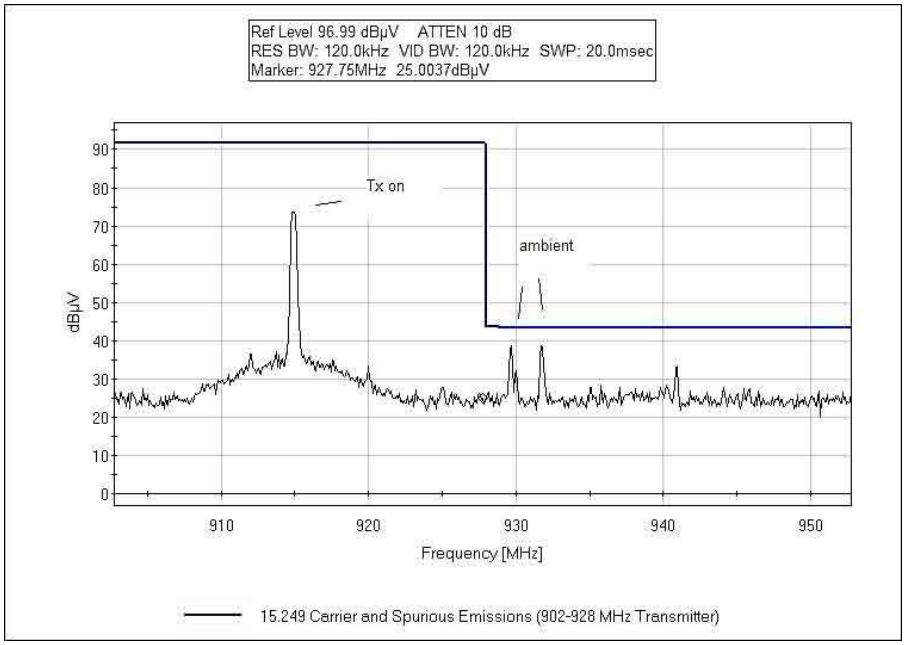

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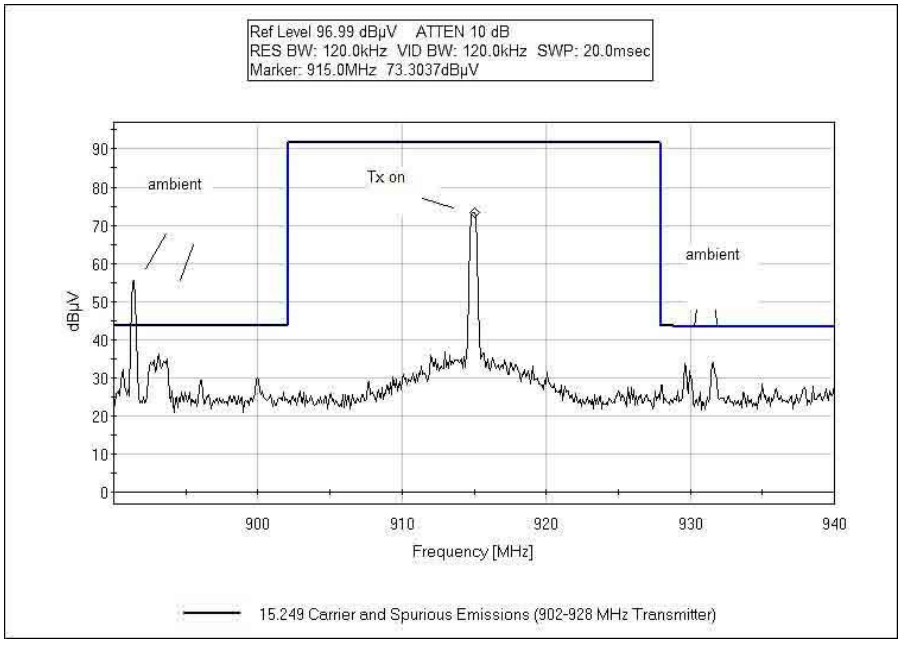
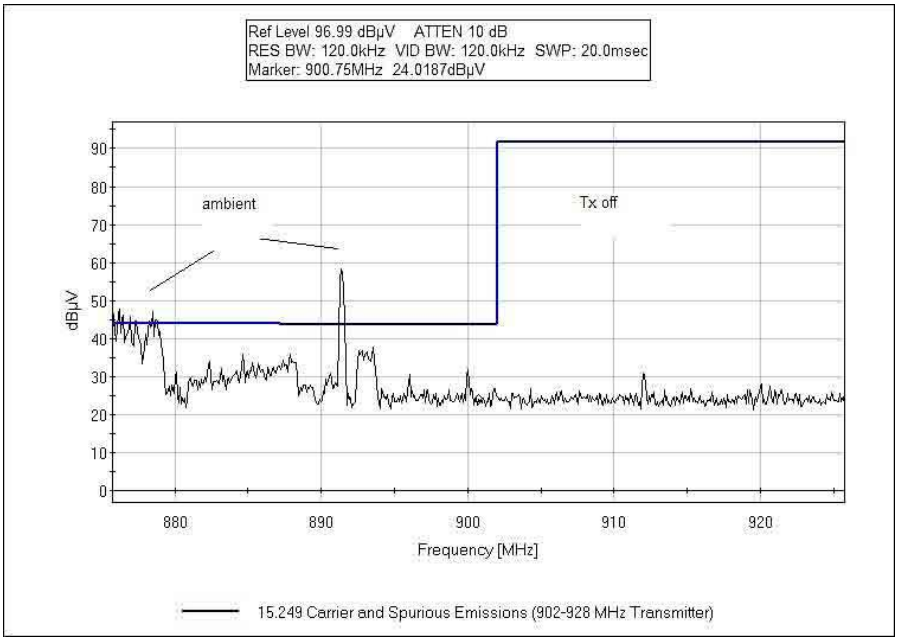


CENTER, Tx ON



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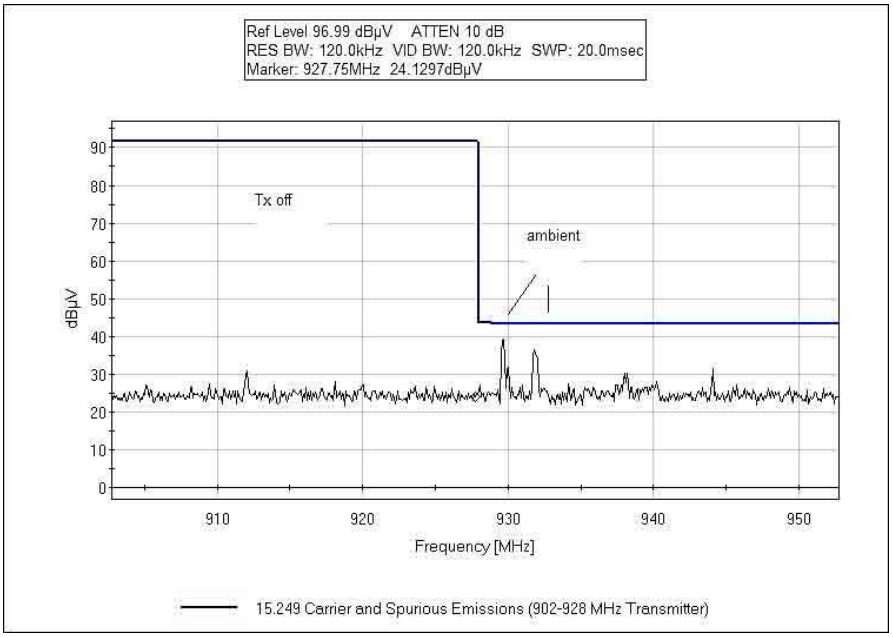
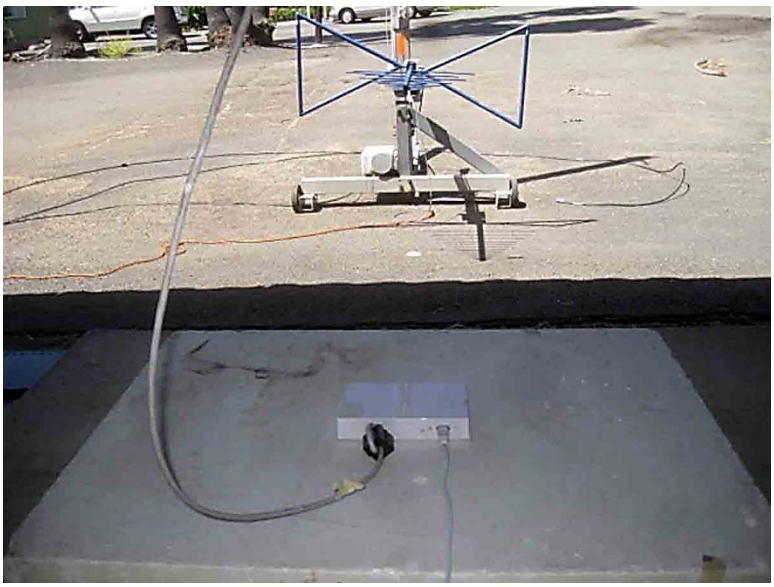

Ref Level 96.99 dBµV ATTEN 10 dB
RES BW: 120.0kHz VID BW: 120.0kHz SWP: 20.0msec
Marker: 927.75MHz 24.1297dBµV
Tx off
ambient
dBµV
90
80
70
60
50
40
30
20
10
0
910
920
930
940
950
Frequency [MHz]
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)

RIGHT, Tx OFF

Test Setup Photos



15.249(d) Radiated Spurious Emissions

Test Data Sheet

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • (714) 993-6112

Customer: **SmartLabs, Inc.**
Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
Work Order #: **93104** Date: 7/25/2012
Test Type: **Maximized Emissions** Time: 14:15:03
Equipment: **INSTEON Hub** Sequence#: 42
Manufacturer: SmartLabs, Inc. Tested By: Don Nguyen
Model: 2242-222
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00309	Preamp	8447D	3/29/2012	3/29/2014
T2	AN01995	Biconilog Antenna	CBL6111C	5/16/2012	5/16/2014
T3	ANP05050	Cable	RG223/U	3/21/2011	3/21/2013
T4	ANP05198	Cable	8268	12/21/2010	12/21/2012
T5	AN02672	Spectrum Analyzer	E4446A	8/9/2010	8/9/2012
T6	AN00786	Preamp	83017A	8/5/2010	8/5/2012
T7	AN03239	Cable	32022-2-29094K-24TC	8/30/2011	8/30/2013
T8	ANP05421	Cable	Sucoflex 104A	2/8/2012	2/8/2014
T9	ANP06081	Cable	L1-PNMNM-48	4/28/2011	4/28/2013
T10	AN03169	High Pass Filter	HM1155-11SS	9/22/2011	9/22/2013
T11	AN02113	Horn Antenna-ANSI C63.5	3115	1/17/2011	1/17/2013
	AN00314	Loop Antenna	6502	6/29/2012	6/29/2014

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
INSTEON Hub*	SmartLabs, Inc.	2242-222	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Toshiba	A105-S4004	NA

Test Conditions / Notes:

The EUT is placed on the wooden table lined with Styrofoam of 10 cm thickness. EUT is installed in fixed position. EUT is connected to remotely located support laptop via shielded crossover Ethernet cable. Ethernet port is pinged every second.
The EUT is set in constant transmit mode.
TX freq = 914.5-915.5MHz
Frequency range of measurement = 9kHz-10GHz
9 kHz -150 kHz; RBW=200 Hz, VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz, VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz, VBW=120 kHz,
1000 MHz-10000 MHz; RBW=1 MHz, VBW=1 MHz.
Test environment conditions: 22°C, 42% relative humidity, 100kPa

Modification: Upgrade to 4 layer board, install thicker wires from wireless board to main board, increased voltage to 5.2V. Add 1842 notch filter at antenna using a 1.8nH inductor in series with 1.8pF. L6=L7=3.9nH, remove shunt tuning capacitor. Bend antenna into U shape. Add two caps in series across hot and neutral. Take center tap of caps above as ground and connect to Ethernet card's ground. Add EMI filters to the four power and signal lines between Ethernet and power supply boards. Each line on the EMI filter has two EMI filters in series. There are a total of 8 EMI filter components.
Ground Ethernet jack case.
Use shielded Ethernet cable.
Wrap grounded shield around Ethernet board and solder to the Ethernet connector shield.
Added ferrite PN0446164151 with one loop to Ethernet cable.

Ext Attn: 0 dB

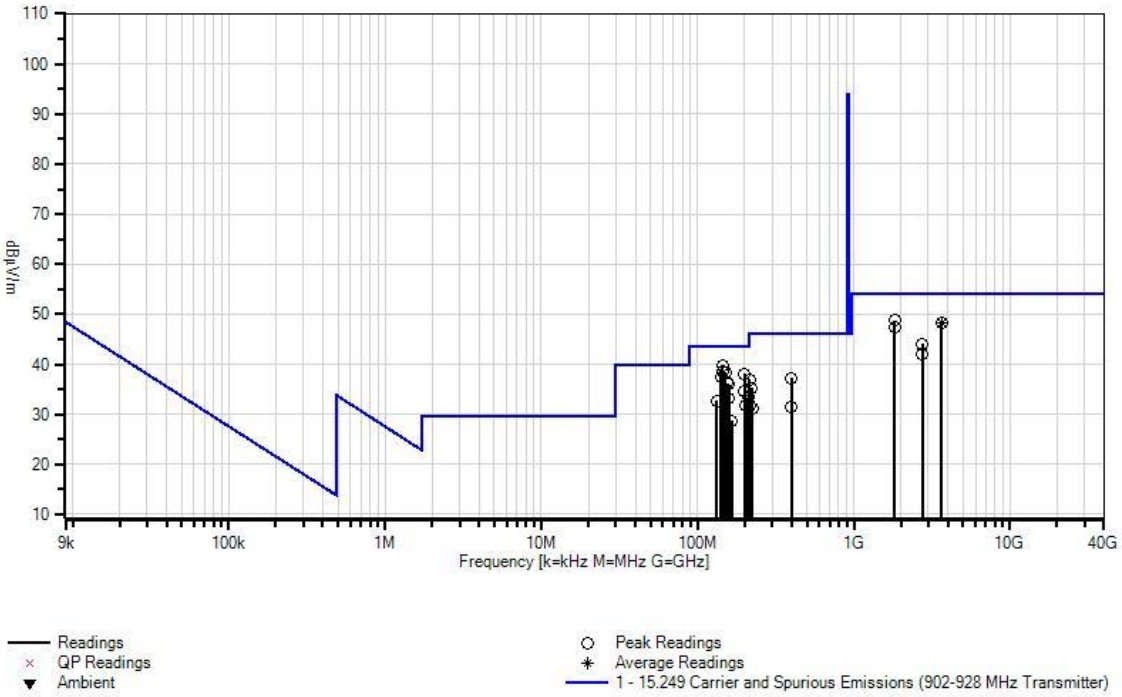
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	143.840M	54.1	-27.9 +0.0 +0.0	+11.2 +0.0 +0.0	+0.1 +0.0 +0.0	+2.1 +0.0	+0.0	39.6	43.5	-3.9	Horiz
2	144.820M	53.1	-27.9 +0.0 +0.0	+11.2 +0.0 +0.0	+0.1 +0.0 +0.0	+2.1 +0.0	+0.0	38.6	43.5	-4.9	Vert
3	145.840M	53.1	-27.9 +0.0 +0.0	+11.1 +0.0 +0.0	+0.1 +0.0 +0.0	+2.1 +0.0	+0.0	38.5	43.5	-5.0	Horiz
4	1829.850M	56.7	+0.0 +0.0 +2.8	+0.0 -38.2 +0.4	+0.0 +0.3 +25.7	+0.0 +1.1	+0.0	48.8	54.0	-5.2	Horiz
5	150.010M	53.0	-27.9 +0.0 +0.0	+10.9 +0.0 +0.0	+0.1 +0.0 +0.0	+2.1 +0.0	+0.0	38.2	43.5	-5.3	Vert
6	200.000M	54.2	-27.9 +0.0 +0.0	+9.1 +0.0 +0.0	+0.2 +0.0 +0.0	+2.5 +0.0	+0.0	38.1	43.5	-5.4	Horiz
7	3659.750M Ave	46.4	+0.0 +0.0 +4.2	+0.0 -37.4 +0.3	+0.0 +0.4 +32.8	+0.0 +1.6	+0.0	48.3	54.0	-5.7	Horiz

^	3659.750M	51.0	+0.0 +0.0 +4.2	+0.0 -37.4 +0.3	+0.0 +0.4 +32.8	+0.0 +1.6	+0.0	52.9	54.0	-1.1	Horiz
9	3659.750M	46.3	+0.0 +0.0 +4.2	+0.0 -37.4 +0.3	+0.0 +0.4 +32.8	+0.0 +1.6	+0.0	48.2	54.0	-5.8	Vert
10	140.990M	52.0	-27.9 +0.0 +0.0	+11.3 +0.0 +0.0	+0.1 +0.0 +0.0	+2.0 +0.0	+0.0	37.5	43.5	-6.0	Vert
11	213.800M	51.8	-27.8 +0.0 +0.0	+10.1 +0.0 +0.0	+0.2 +0.0 +0.0	+2.6 +0.0	+0.0	36.9	43.5	-6.6	Horiz
12	1829.900M	55.2	+0.0 +0.0 +2.8	+0.0 -38.2 +0.4	+0.0 +0.3 +25.7	+0.0 +1.1	+0.0	47.3	54.0	-6.7	Vert
13	155.340M	51.2	-27.9 +0.0 +0.0	+10.7 +0.0 +0.0	+0.1 +0.0 +0.0	+2.1 +0.0	+0.0	36.2	43.5	-7.3	Horiz
14	159.340M	51.1	-27.9 +0.0 +0.0	+10.5 +0.0 +0.0	+0.1 +0.0 +0.0	+2.2 +0.0	+0.0	36.0	43.5	-7.5	Horiz
15	399.990M	45.3	-27.9 +0.0 +0.0	+16.0 +0.0 +0.0	+0.3 +0.0 +0.0	+3.6 +0.0	+0.0	37.3	46.0	-8.7	Horiz
16	200.000M	50.8	-27.9 +0.0 +0.0	+9.1 +0.0 +0.0	+0.2 +0.0 +0.0	+2.5 +0.0	+0.0	34.7	43.5	-8.8	Vert
17	2744.850M	47.4	+0.0 +0.0 +3.4	+0.0 -37.8 +0.3	+0.0 +0.4 +29.0	+0.0 +1.4	+0.0	44.1	54.0	-9.9	Horiz
18	209.500M	48.8	-27.9 +0.0 +0.0	+9.8 +0.0 +0.0	+0.2 +0.0 +0.0	+2.5 +0.0	+0.0	33.4	43.5	-10.1	Vert
19	156.570M	48.1	-27.9 +0.0 +0.0	+10.6 +0.0 +0.0	+0.1 +0.0 +0.0	+2.2 +0.0	+0.0	33.1	43.5	-10.4	Vert
20	222.800M	49.6	-27.8 +0.0 +0.0	+10.7 +0.0 +0.0	+0.2 +0.0 +0.0	+2.6 +0.0	+0.0	35.3	46.0	-10.7	Horiz
21	132.340M	47.0	-28.0 +0.0 +0.0	+11.5 +0.0 +0.0	+0.2 +0.0 +0.0	+2.0 +0.0	+0.0	32.7	43.5	-10.8	Horiz
22	214.500M	46.8	-27.8 +0.0 +0.0	+10.1 +0.0 +0.0	+0.2 +0.0 +0.0	+2.6 +0.0	+0.0	31.9	43.5	-11.6	Vert
23	201.500M	47.8	-27.9 +0.0 +0.0	+9.2 +0.0 +0.0	+0.2 +0.0 +0.0	+2.5 +0.0	+0.0	31.8	43.5	-11.7	Vert
24	2744.900M	45.2	+0.0 +0.0 +3.4	+0.0 -37.8 +0.3	+0.0 +0.4 +29.0	+0.0 +1.4	+0.0	41.9	54.0	-12.1	Vert

25	399.990M	39.4	-27.9 +0.0 +0.0	+16.0 +0.0 +0.0	+0.3 +0.0 +0.0	+3.6 +0.0	+0.0	31.4	46.0	-14.6	Vert
26	166.140M	44.2	-27.9 +0.0 +0.0	+10.0 +0.0 +0.0	+0.2 +0.0 +0.0	+2.2 +0.0	+0.0	28.7	43.5	-14.8	Vert
27	223.000M	45.4	-27.8 +0.0 +0.0	+10.7 +0.0 +0.0	+0.2 +0.0 +0.0	+2.6 +0.0	+0.0	31.1	46.0	-14.9	Vert

CKC Laboratories, Inc. Date: 7/25/2012 Time: 14:15:03 SmartLabs, Inc. WO#: 93104
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Sequence#: 42 Ext
ATTN: 0 dB



Test Setup Photos

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or carrot ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.