F2 Labs
16740 Peters Road
Middlefield, Ohio 44062
United States of America
www.f2labs.com

CERTIFICATION TEST REPORT

Manufacturer:	**Cal-Comp Indiana** **1 Technology Way** **Logansport, Indiana 46947** **United States of America**
Applicant:	**The L.D. Kichler Co.** **7711 East Pleasant Valley Road** **Cleveland, Ohio 44131**
Product:	**Design Pro LED Controller**
Models:	**15DC100, 15DC200, 15DC300***
	**Denotes actual model tested as worst case of product family.*
FCC ID:	**YNE-CP300334**
Testing Commenced:	**Mar. 20, 2014**
Testing Ended:	**July 8, 2014**
Summary of Test Results:	**Page 5**

Standards:

- **FCC Part 15 Subpart C, Section 15.249**
- **FCC Part 15 Subpart C, Section 15.215(c) – Additional provisions to the general radiated emission limitations**
- **FCC15.207 - Conducted Limits**
- **FCC Part 15 Subpart A, Section 15.31(e) – Measurement Standards**

Evaluation Conducted by: _____

Michael Toth, Senior EMC Eng.

_____

Ken Littell, EMC Tech. Mgr.

Report Reviewed by: _____

Wendy Fuster, President

F2 Labs
26501 Ridge Road
Damascus, MD 20872
Ph 301.253.4500
Fax 301.253.5179

F2 Labs
16740 Peters Road
Middlefield, OH 44062
Ph 440.632.5541
Fax 440.632.5542

TABLE OF CONTENTS

1 ADMINISTRATIVE INFORMATION

1.1 Measurement Location:

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD**.**

1.2 Measurement Procedure:

All measurements were performed according to the 2009 version of ANSI C63.4 and recommended FCC procedure of measurement of DTS operating under Section 15.249. A list of the measurement equipment can be found in Section 6.

1.3 Uncertainty Budget:

Radiated Emission

- Combined Uncertainty (+ or -) 2.67 dB
- Expanded Uncertainty (+ or -) 5.35 dB

Conducted Emissions

- Combined Uncertainty (+ or -) 1.88 dB
- Expanded Uncertainty (+ or -) 3.75 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.4 Document History:

Document Number	Description	Issue Date	Approved By
F2LQ5984A-01E	First Issue	July 21, 2014	W. Fuster

2 SUMMARY OF TEST RESULTS

Test Name	Standard(s)	Results
-20dB Occupied Bandwidth	CFR 47 Part 15.215(c)	Complies
Field Strength of Emissions	CFR 47 Part 15.249(a)(d)	Complies
Conducted Emissions	CFR 47 Part 15.207(a)	Complies
Voltage Variation	CFR 47 Part 15.31(3)(e)	Complies

Note: Voltage Variation testing in 15.31(3)(e) was performed at the nominal voltage, and then the 85% and 115% of that voltage was tested also. The output power at the frequency was measured to verify how much the power and frequency was affected by the variation of the input power. No shift in frequency or power was measured at either of the varied voltages on any of the channels.

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test	Unloaded 908.4MHz	Loaded 908.4MHz
Field Strength of Fundamental	80.5dBµV/m	75.5dBµV/m
Limit for Fundamental	50 millivolts/meter (93.98 dBµV/m)	50 millivolts/meter (93.98 dBµV/m)
-20dB Occupied Bandwidth	58.2979kHz	59.6145kHz

The 20 dB bandwidth of the emission shall be contained within the frequency band designated in the rule section under which the equipment is operated.

4 ENGINEERING STATEMENT

This report has been prepared on behalf of The L.D. Kichler Company to provide documentation for the testing described herein. This equipment has been tested and found to comply with part 15.249 of the FCC Rules using ANSI C63.4 2009 standard. The test results found in this test report relate only to the items tested.

5 EUT INFORMATION AND DATA

5.1 Equipment Under Test:

Product: Design Pro LED Controller
Model: 15DC300
Serial No.: None Spec.
FCC ID: YNE-CP300334

5.2 Trade Name:

The L.D. Kichler Co.

5.3 Power Supply:

120 Volts AC

5.4 Applicable Rules:

CFR 47, Part 15.249

5.5 Equipment Category:

Radio Transmitter-DTS

5.6 Antenna:

0dBi Gain Integral Antenna

5.7 Accessories:

N/A

5.8 Test Item Condition:

The equipment to be tested was received in good condition.

5.9 Testing Algorithm:

The EUT was set up in a normal operating mode supplying voltage to landscaping lights. The EUT was also outfitted with a Z-Wave wireless module which enables the user to send and received basic ON/OFF commands, synchronize date/time/location, and other useful information with other devices containing a Z-Wave wireless module.

6 LIST OF MEASUREMENT INSTRUMENTATION

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shield Room	0175	Ray Proof	N/A	11645	Aug. 7, 2014
Temp./Humidity Recorder	CL119	Extech	RH520	H005869	Jan. 8, 2015
OATS-3m	CL017	Compliance Labs	N/A	001	Dec. 13, 2014
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	Oct. 29, 2014
Receiver	CL151	Rohde & Schwarz	ESU40	100319	Oct. 30, 2014
Antenna 1-Chamber	0142	ETS/EMCO	3142B	9811-1330	Verified
Antenna 2-OATS	0105	Sunol Sciences	JB1	A101101	May 7, 2015
Horn Antenna	CL098	Emco	3115	9809-5580	Dec. 3, 2015
Pre-Amplifier	CL045	Hewlett-Packard	8447D	2944A08445	Nov. 15, 2015
Pre-Amplifier	CL153	Agilent	83006-69007	MY39500900	Jan. 9, 2015
Software:	Tile Version 1.0		Software Verified: May 5, 2014		
Software:	EMC 32, Version 5.20.2		Software Verified: May 5, 2014		
Amp. w/18” Loop	CL163	A.H. Systems, Inc.	EHA-52B	100	Apr. 24, 2015
LISN 2	0147	Solar	8028-50-TS-24-BNC	1128	Jan. 16, 2017
LISN 4	0146	Solar	8028-50-TS-24-BNC	1127	Jan. 16, 2017
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	Feb. 11, 2015

7 FCC PART 15.215(e) – OCCUPIED BANDWIDTH

7.1 Requirements:

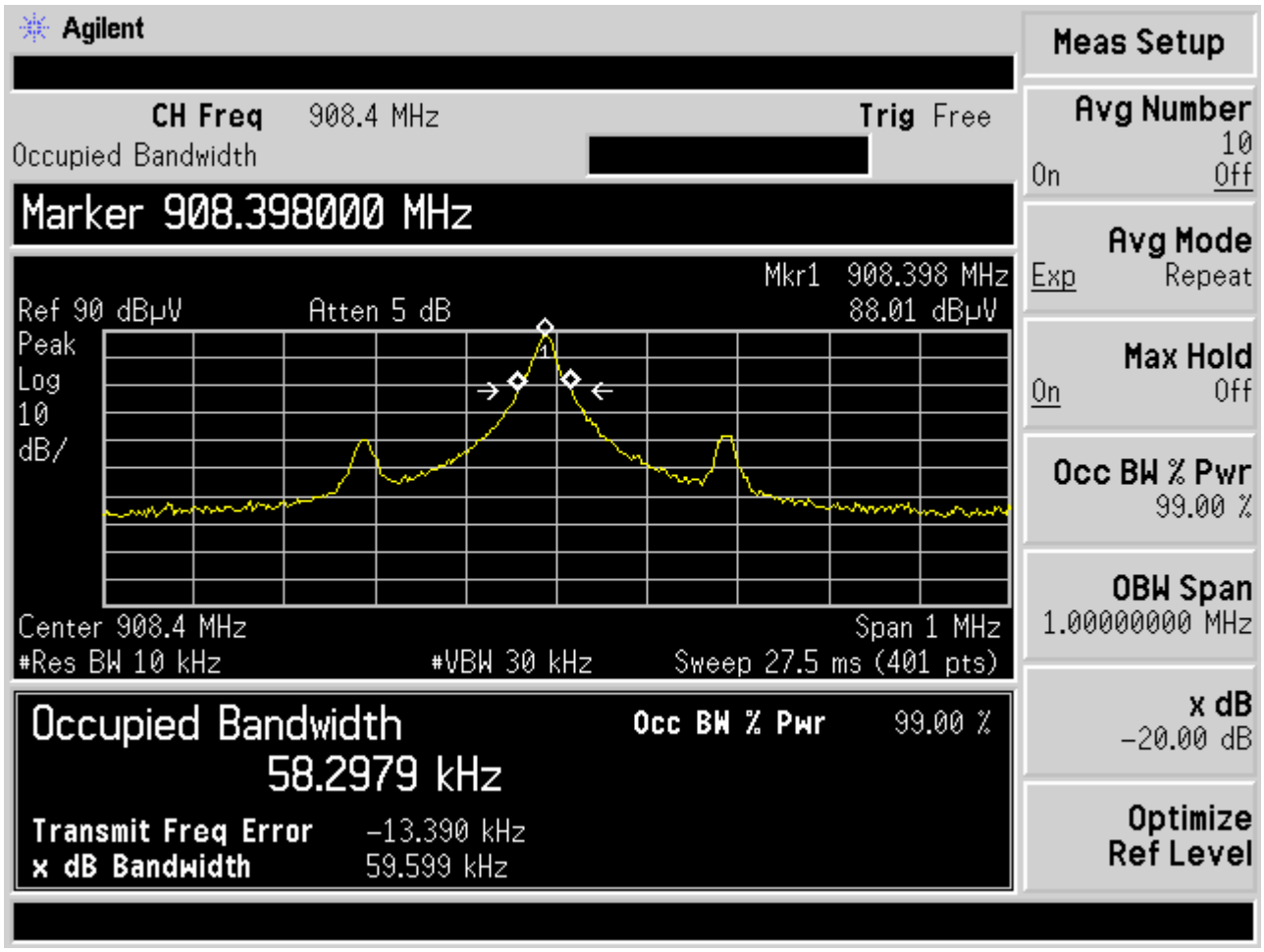
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Bandwidth measurements were made using the analyzer's marker function.

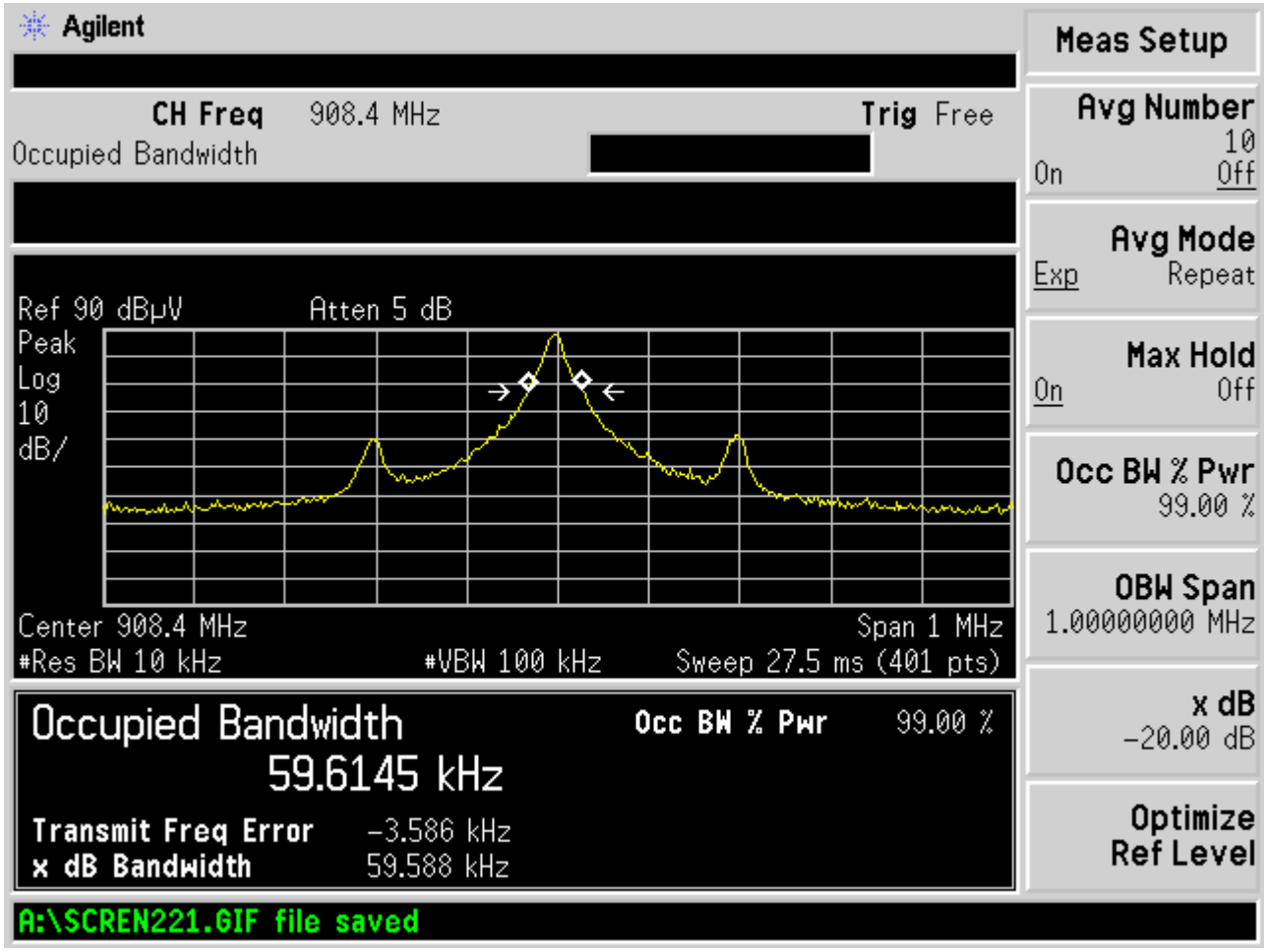
7.2 Occupied Bandwidth Test Data

Test Date:	July 8, 2014	**Test Engineer(s):**	M. Toth
Standards:	CFR 47 Part 15.215(c)	**Air Temperature:**	21.6ºC
		Relative Humidity:	54%

Unloaded



Loaded


Agilent
CH Freq 908.4 MHz
Trig Free
Occupied Bandwidth
Ref 90 dBµV
Atten 5 dB
Peak
Log
10
dB/
Center 908.4 MHz
Span 1 MHz
#Res BW 10 kHz
#VBW 100 kHz
Sweep 27.5 ms (401 pts)
Occupied Bandwidth
59.6145 kHz
Occ BW % Pwr 99.00 %
Transmit Freq Error -3.586 kHz
x dB Bandwidth 59.588 kHz
A:\SCREN221.GIF file saved
Meas Setup
Avg Number
10
On Off
Avg Mode
Exp Repeat
Max Hold
On Off
Occ BW % Pwr
99.00 %
OBW Span
1.00000000 MHz
x dB
-20.00 dB
Optimize
Ref Level

8 FCC PART 15.249(a)(d) – FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

NOTE: During the pre-scan evaluation, the EUT was manually rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. The following tables list the fundamental frequency measured as well as frequencies near the fundamental.

8.1 Test Data - Field Strength of Emissions from Intentional Radiators

Test Date:	June 4, 2014	**Test Engineer(s):**	M. Toth
Standards:	CFR 47 Part 15.249(a)	**Air Temperature:**	26.9ºC
		Relative Humidity:	55%

Unloaded Fundamental

Frequency (MHz)	Polarity	Corr. (dB)	QuasiPeak (dBµV/m)	QuasiPeak (dBµV/m) Limit	QuasiPeak Margin	Bandwidth (kHz)
908.090000	V	28.9	37.6	46.0	-8.4	120.000
908.170000	V	28.9	44.2	46.0	-1.8	120.000
908.180000	H	28.3	41.1	46.0	-4.9	120.000
908.210000	H	28.3	41.4	46.0	-4.6	120.000
908.220000	V	28.9	44.8	46.0	-1.2	120.000
908.240000	H	28.3	40.2	46.0	-5.8	120.000
908.390000	V	28.9	80.5	93.97	-13.5	120.000
908.390000	H	28.3	74.6	93.97	-19.4	120.000
908.570000	H	28.3	40.8	46.0	-5.2	120.000
908.570000	V	28.9	44.7	46.0	-1.3	120.000
908.630000	V	28.9	43.9	46.0	-2.1	120.000
908.640000	H	28.3	39.6	46.0	-6.4	120.000
908.680000	H	28.2	36.9	46.0	-9.1	120.000
908.740000	V	28.9	37.5	46.0	-8.5	120.000

Loaded Fundamental

Frequency (MHz)	Polarity	Corr. (dB)	QuasiPeak (dBµV/m)	QuasiPeak (dBµV/m) Limit	QuasiPeak Margin	Bandwidth (kHz)
908.040000	H	28.3	37.6	46.0	-8.4	120.000
908.040000	V	28.3	36.9	46.0	-9.1	120.000
908.130000	H	28.3	38.3	46.0	-7.7	120.000
908.130000	V	28.9	40.4	46.0	-5.6	120.000
908.200000	H	28.3	42.2	46.0	-3.8	120.000
908.240000	V	28.9	43.8	46.0	-2.2	120.000
908.390000	H	28.3	73.9	93.97	-20.1	120.000
908.390000	V	28.9	75.5	93.97	-18.5	120.000
908.570000	V	28.9	44.1	46.0	-1.9	120.000
908.600000	H	28.3	42.3	46.0	-3.7	120.000
908.680000	V	28.9	39.3	46.0	-6.7	120.000
908.680000	H	28.2	37.8	46.0	-8.2	120.000
908.730000	V	28.9	37.6	46.0	-8.4	120.000
908.750000	H	28.2	37.2	46.0	-8.8	120.000

8.2 Test Data – Spurious Emissions

Notes: Plots are peak, max hold pre-scan data included only to determine what frequencies to investigate and measure. During the pre-scan evaluation, the EUT was rotated in all possible directions to find the maximum emissions. The orthogonal position that showed the highest emissions was used. At some frequencies, no emissions from the EUT were measurable over the ambient noise floor. The readings did not change with EUT on and EUT off.

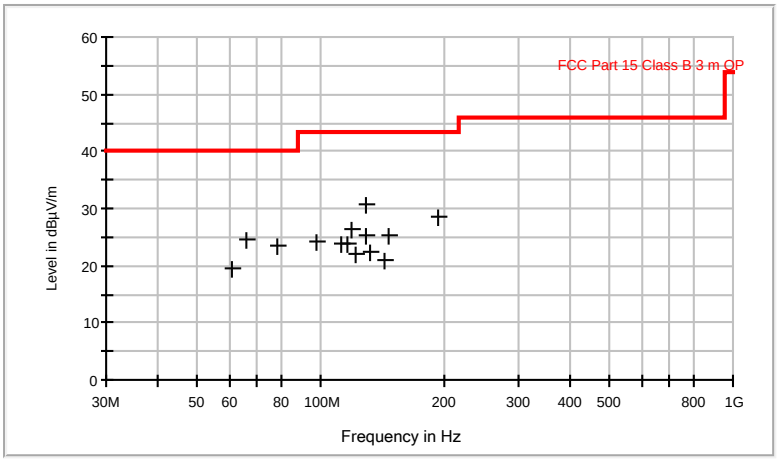
At least 6 of the highest frequencies were measured per ANSI 63.4 on the Open Area Test Site. Frequencies below 1GHz were measured using a quasi-peak detector. The antenna was raised between 1 and 4 meters and the EUT turntable was rotated 360 degrees to maximize the emissions. Some of the frequencies did not change with the EUT on or off. At those frequencies, the test distance was shortened to 1 meter and still no emissions from the EUT were visible or over the ambient or limit.

In the following plots, the black line indicates ambient noise and the red line indicates the measurement with the EUT on. Emissions to be found by the EUT were measured and listed in tables below.

Test Dates:	May 22, 2014; July 8, 2014	**Test Engineer(s):**	M. Toth
Standards:	CFR 47 Part 15.249(d) / Part 15.209	**Air Temperature:**	26.9ºC
		Relative Humidity:	55%

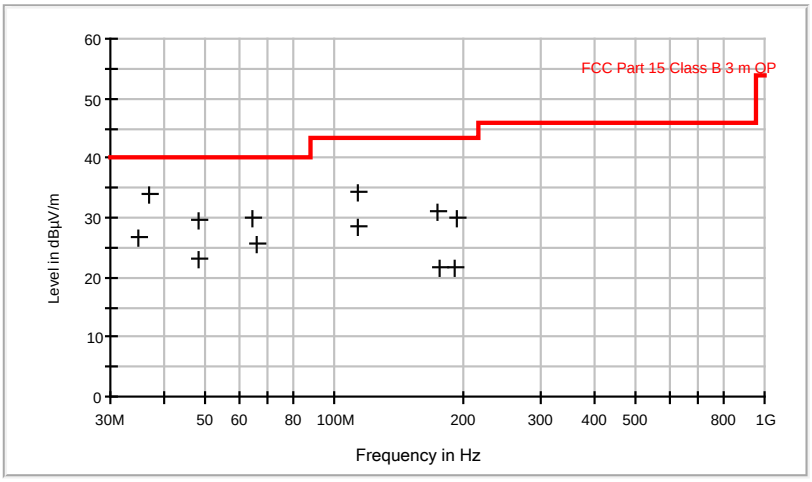
Unloaded Spurious

Frequency (MHz)	Polarity	Corr. (dB)	QuasiPeak (dBµV/m)	QuasiPeak (dBµV/m) Limit	QuasiPeak Margin	Bandwidth (kHz)
60.960000	H	8.8	19.6	40.0	-20.4	120.000
65.640000	V	9.1	24.7	40.0	-15.3	120.000
78.120000	H	9.7	23.6	40.0	-16.4	120.000
97.800000	V	11.2	24.1	43.5	-19.4	120.000
111.600000	V	15.1	23.7	43.5	-19.8	120.000
115.560000	V	15.3	23.9	43.5	-19.6	120.000
118.440000	V	15.1	26.2	43.5	-17.3	120.000
120.720000	H	15.2	22	43.5	-21.5	120.000
128.040000	V	14.7	30.6	43.5	-12.9	120.000
128.040000	H	14.7	25.2	43.5	-18.3	120.000
132.000000	H	14.6	22.4	43.5	-21.1	120.000
142.680000	H	13.6	21.1	43.5	-22.4	120.000
146.400000	V	13.3	25.3	43.5	-18.2	120.000
192.240000	H	13.2	28.7	43.5	-14.8	120.000

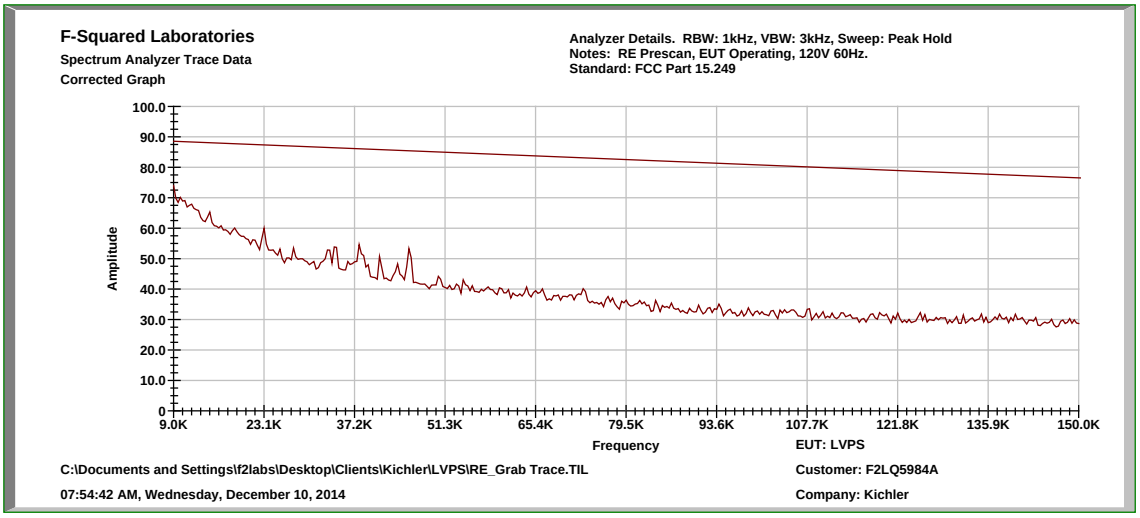


Loaded Spurious

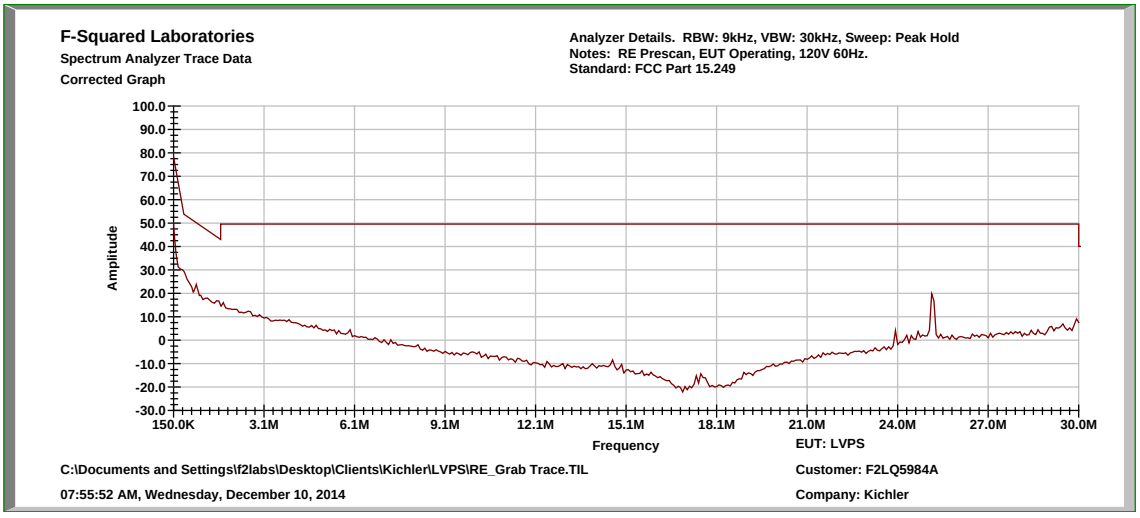
Frequency (MHz)	Polarity	Corr. (dB)	QuasiPeak (dBµV/m)	QuasiPeak (dBµV/m) Limit	QuasiPeak Margin	Bandwidth (kHz)
34.800000	H	18.1	26.9	40.0	-13.1	120.000
36.960000	V	15.1	34.1	40.0	-5.9	120.000
48.000000	H	9.3	23	40.0	-17.0	120.000
48.000000	V	8.9	29.7	40.0	-10.3	120.000
63.960000	V	9.0	29.8	40.0	-10.2	120.000
65.640000	H	9.3	25.6	40.0	-14.4	120.000
112.680000	H	14.6	34.5	43.5	-9.0	120.000
112.680000	V	15.1	28.7	43.5	-14.8	120.000
172.800000	V	13.0	31.2	43.5	-12.3	120.000
174.360000	H	13.0	21.5	43.5	-22.0	120.000
190.680000	H	12.8	21.6	43.5	-21.9	120.000
192.720000	V	13.6	30.1	43.5	-13.4	120.000



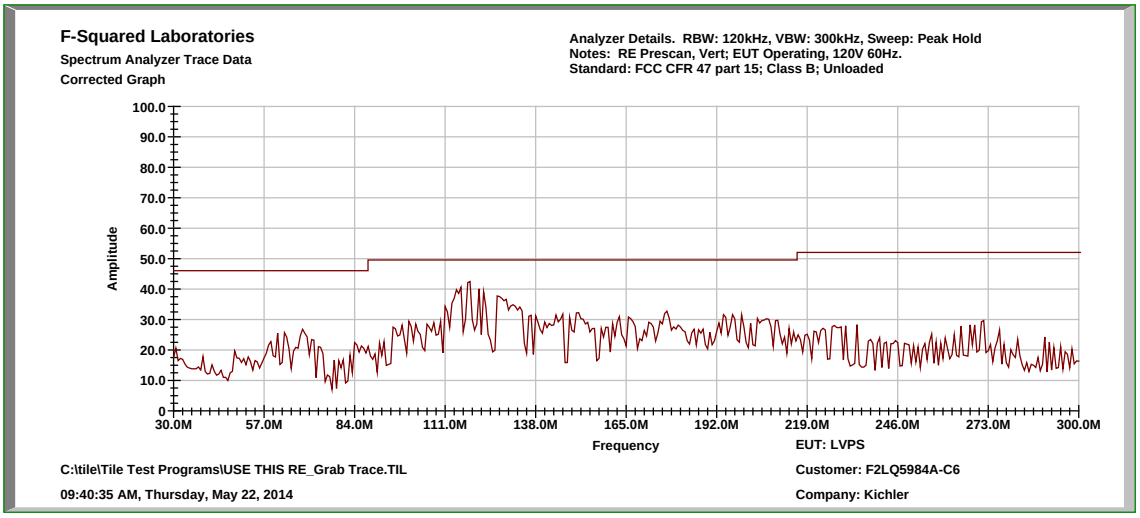
Unloaded, 0.009 MHz to 30 MHz, Vertical



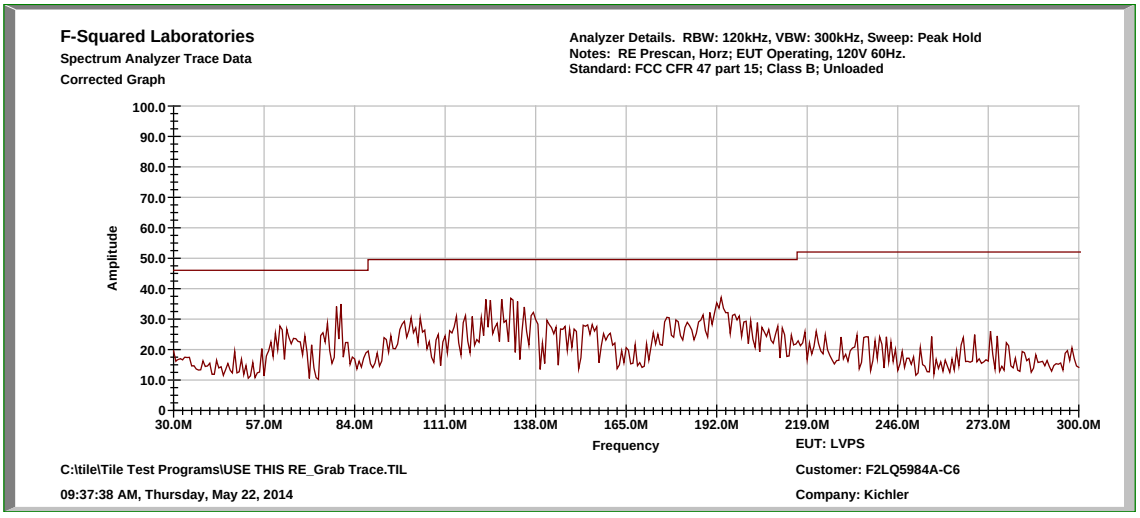
Unloaded, 0.15 MHz to 30 MHz, Horizontal



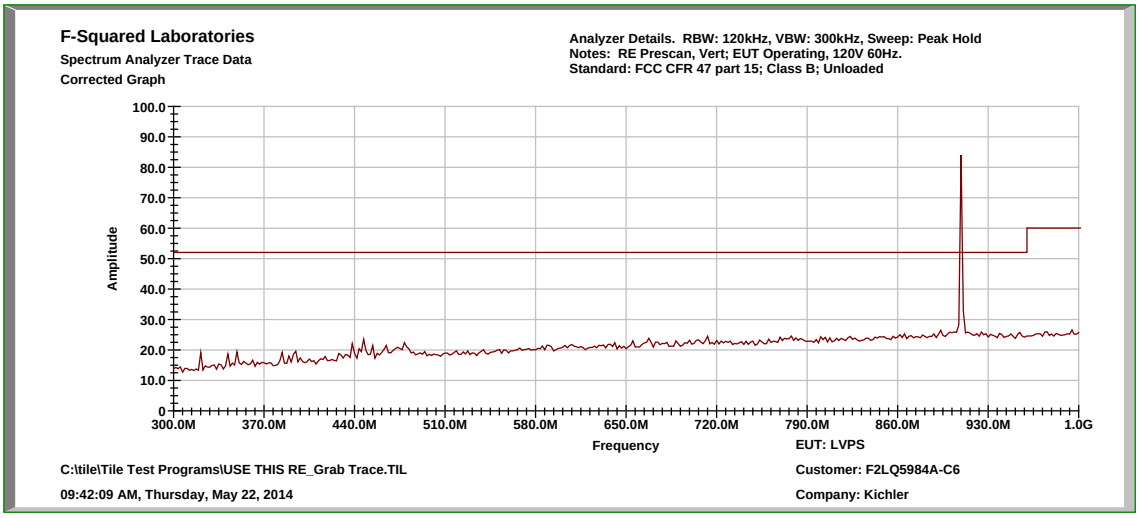
Unloaded, 30 MHz to 300 MHz, Vertical



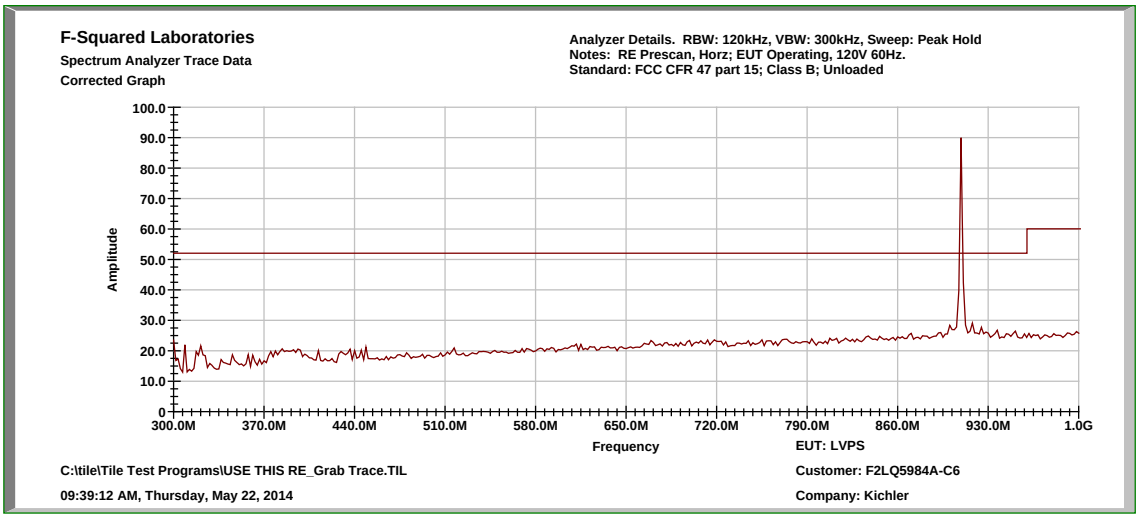
Unloaded, 30 MHz to 300 MHz, Horizontal



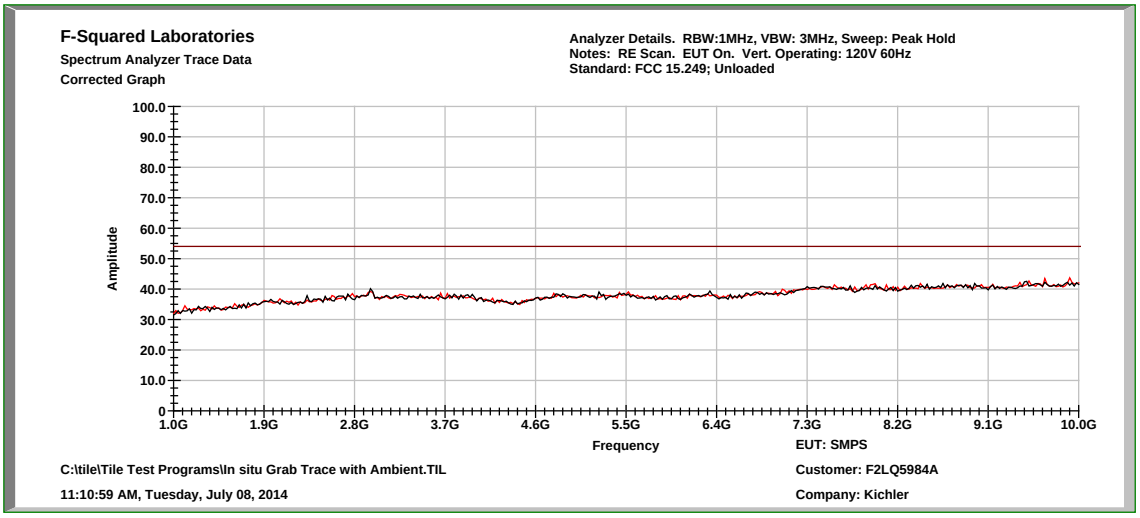
Unloaded, 300 MHz to 1000 MHz, Vertical



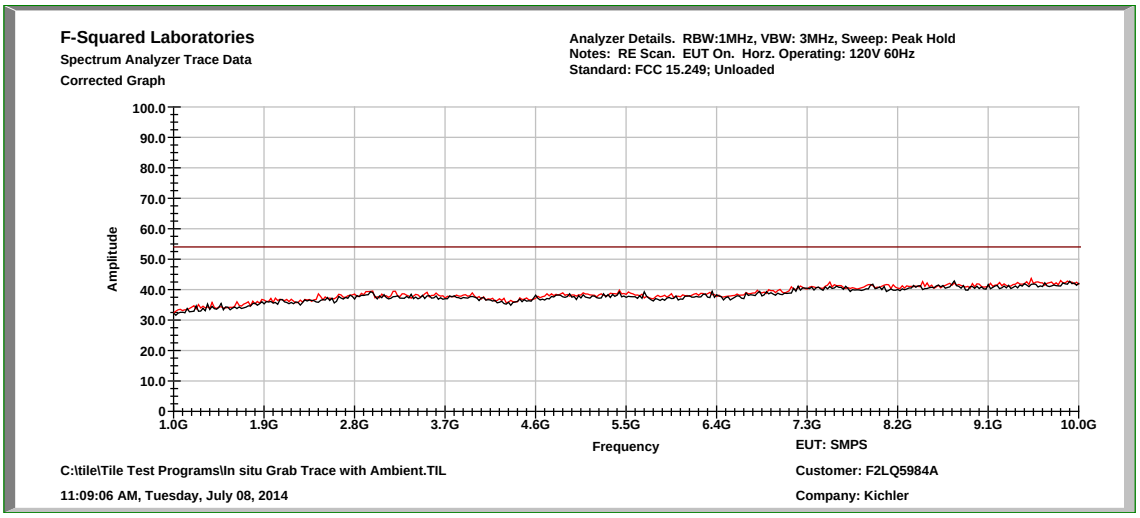
Unloaded, 300 MHz to 1000 MHz, Horizontal



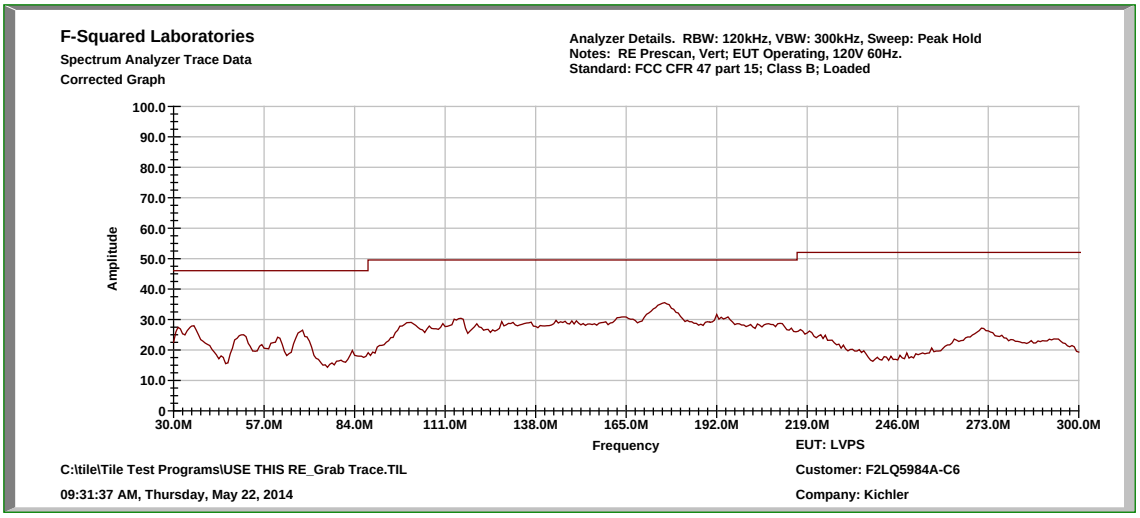
Unloaded, 1 GHz to 10 GHz, Vertical



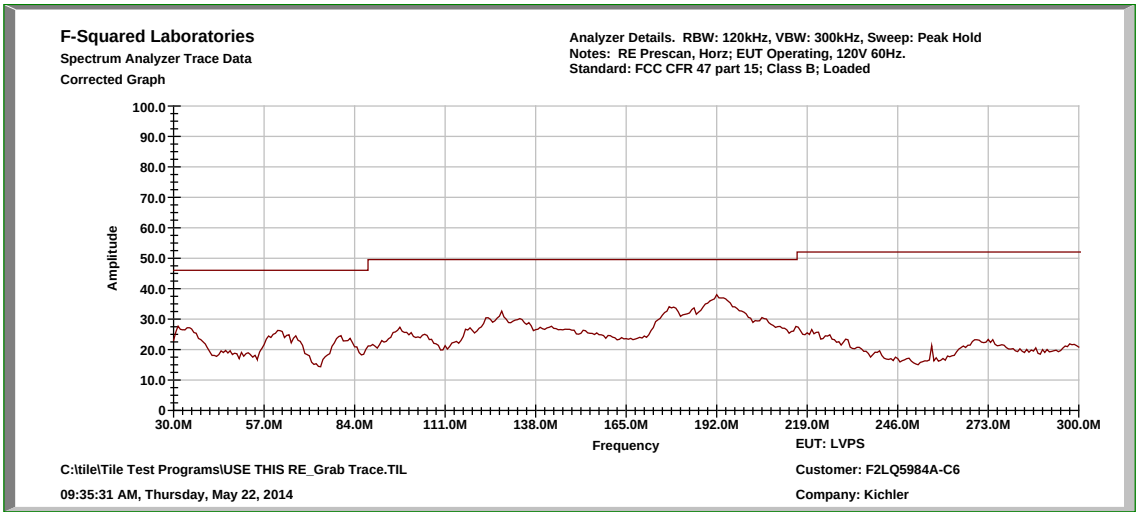
Unloaded, 1 GHz to 10 GHz, Horizontal



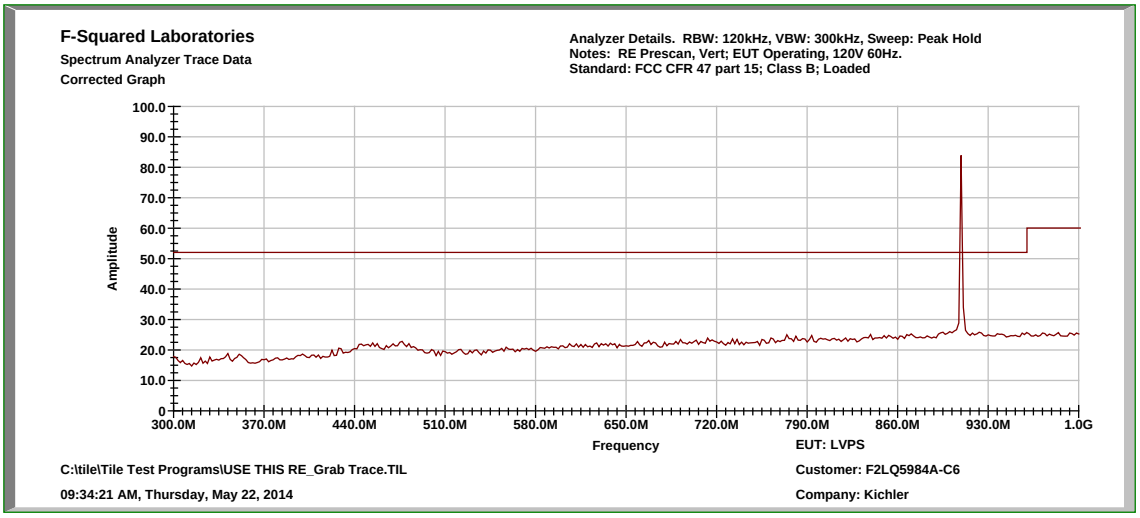
Loaded, 30 MHz to 300 MHz, Vertical



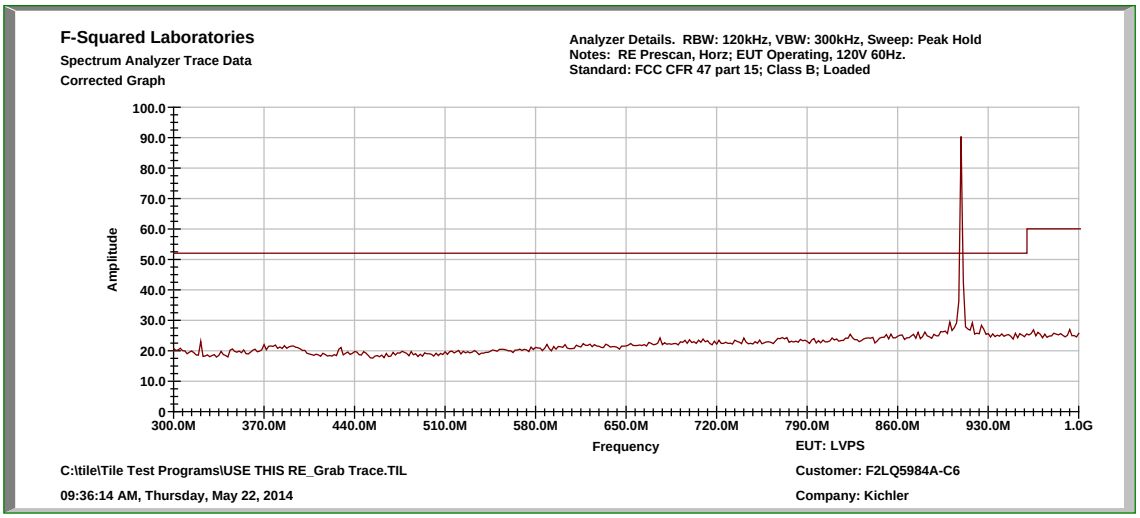
Loaded, 30 MHz to 300 MHz, Horizontal



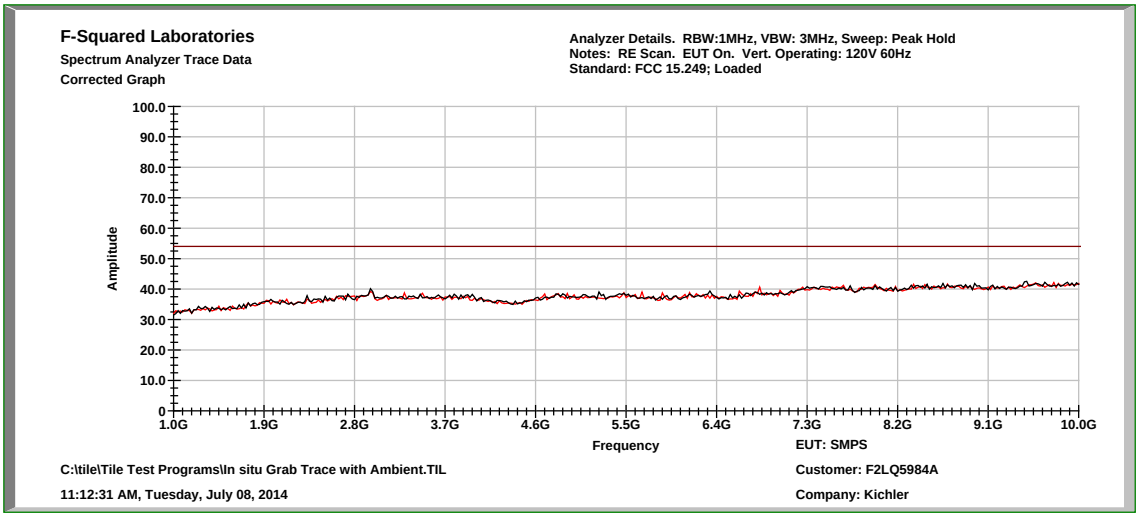
Loaded, 300 MHz to 1000 MHz, Vertical



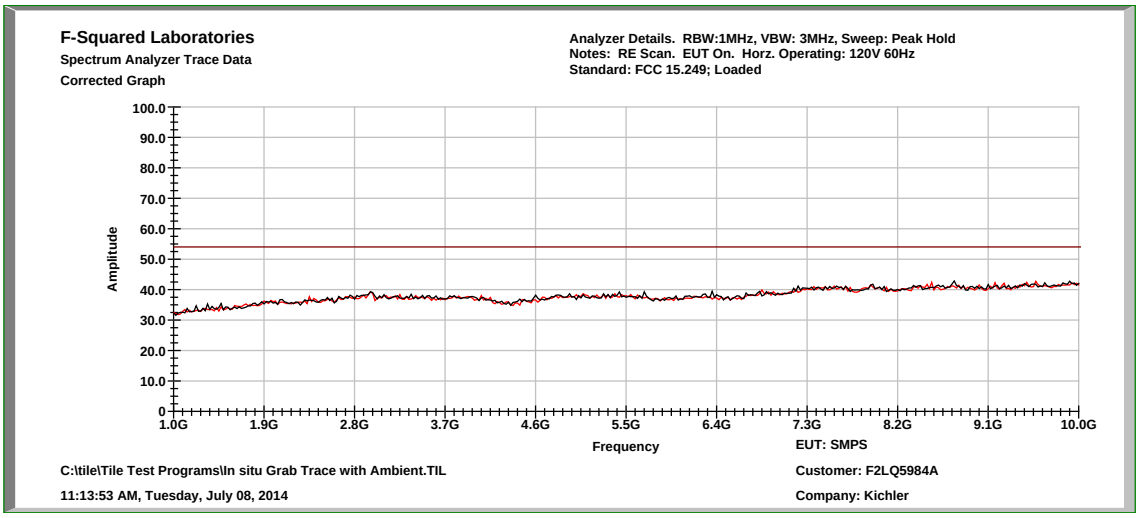
Loaded, 300 MHz to 1000 MHz, Horizontal



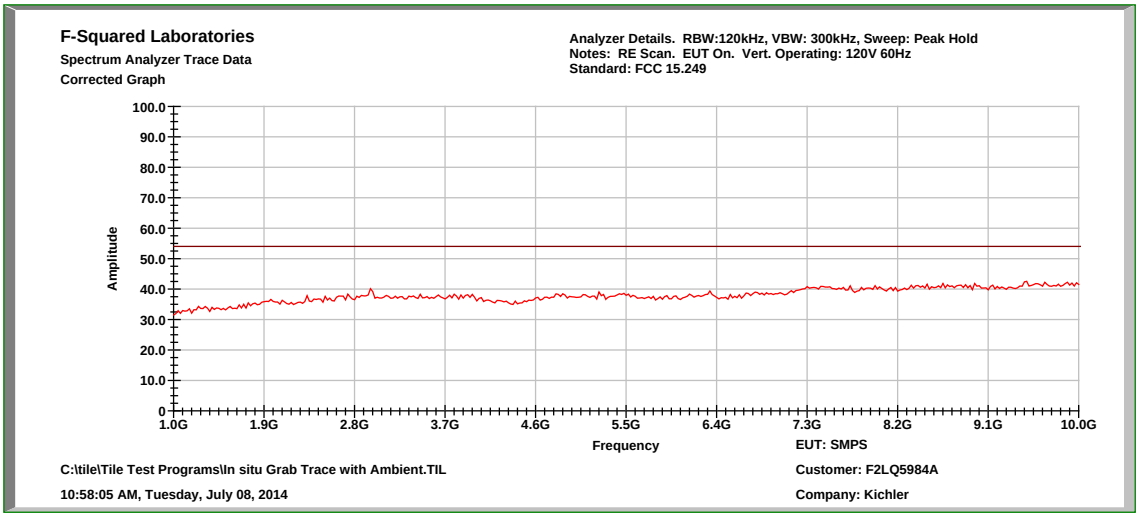
Loaded, 1 GHz to 10 GHz, Vertical



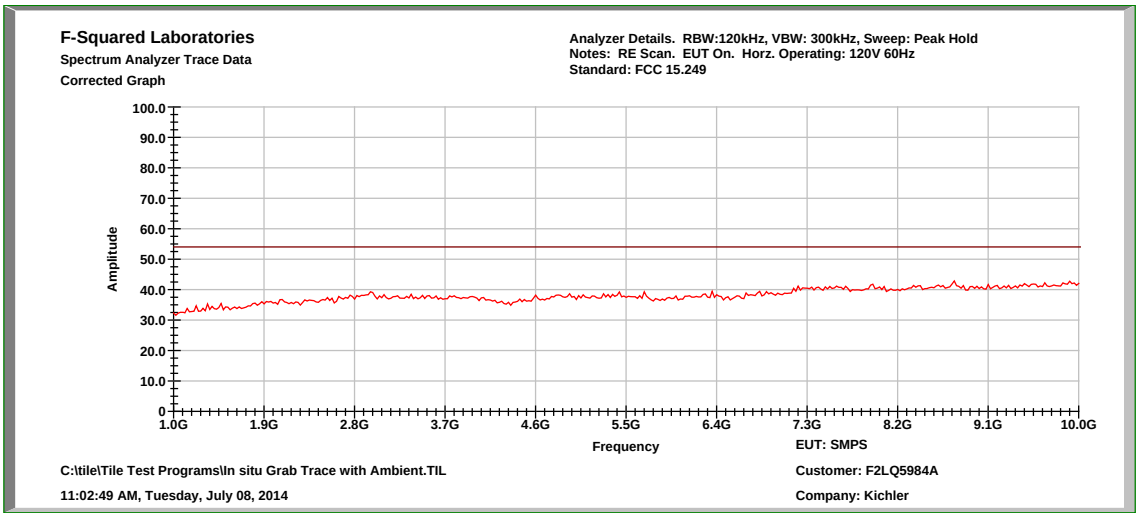
Loaded, 1 GHz to 10 GHz, Horizontal



1 GHz to 10 GHz, Vertical



1 GHz to 10 GHz, Horizontal



9 CONDUCTED EMISSIONS

9.1 Requirements

In accordance with FCC CFR 47 Part 15.207(a), “Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

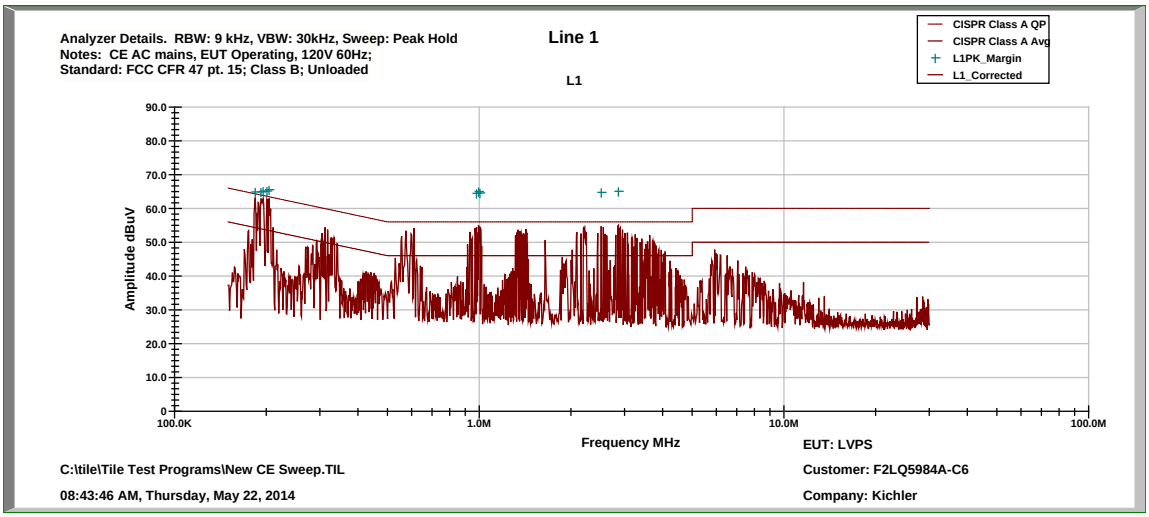
9.2 Procedure

The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power source. The output of the LISN was connected to the input of the receiver via a transient limiter, and emissions in the range 150 kHz to 30 MHz were measured. The measurements were recorded using the quasi-peak and average detectors as directed by the standard, and the resolution bandwidth during testing was 9 kHz. The raw measurements were corrected to allow for attenuation from the LISN, transient limiter and cables.

9.3 Conducted Emissions Test Data

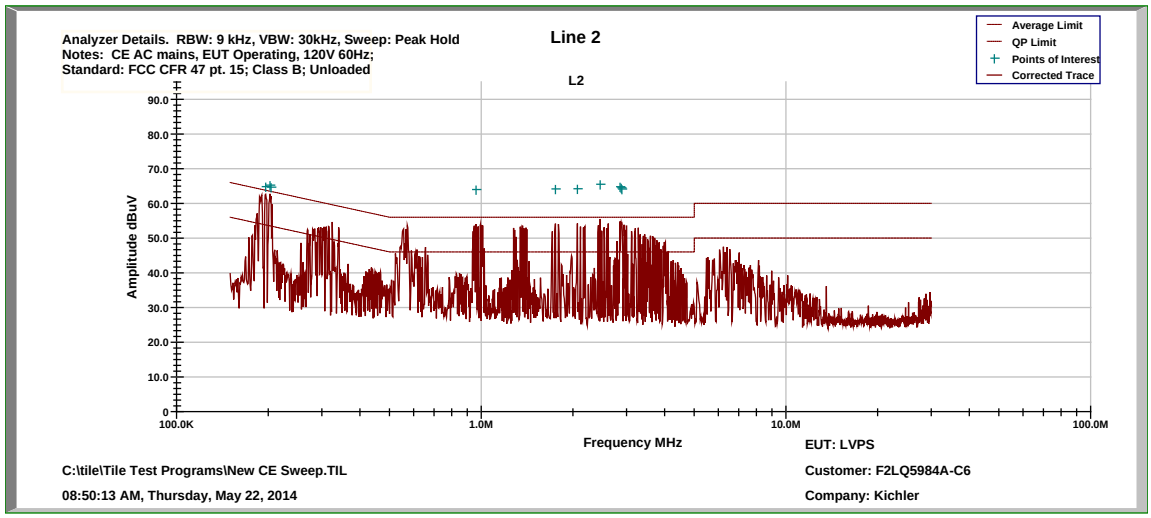
Test Date:	May 22, 2014	**Test Engineer:**	M. Toth
Rule:	15.207	**Air Temperature:**	21.0º C
Test Results:	Pass	**Relative Humidity:**	46%

Unloaded, Conducted Test – Line 1: 0.15 MHz to 30.0 MHz



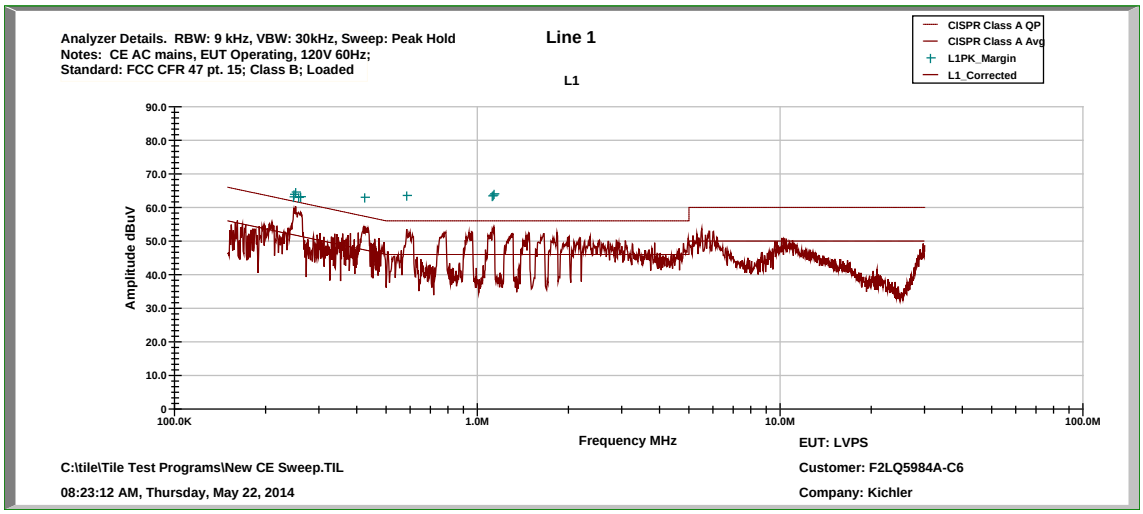
Frequency (MHz)	Corr. (dB)	QuasiPeak (dBµV/m)	QuasiPeak (dBµV/m) Limit	QuasiPeak Margin	Average (dBµV/m)	Average (dBµV/m) Limit	Average Margin
0.184056	11.192	46.657	64.301	-6.5	15.652	54.301	-27.5
0.192164	11.133	49.009	63.943	-3.8	9.955	53.943	-32.9
0.195408	11.107	48.585	63.804	-4.1	25.421	53.804	-17.3
0.201084	11.065	47.414	63.567	-5.1	8.246	53.567	-34.3
0.204327	11.048	44.976	63.434	-7.4	11.06	53.434	-31.3
0.979478	10.416	36.573	56	-9.0	7.843	46	-27.7
0.994863	10.419	36.077	56	-9.5	8.654	46	-26.9
1.005120	10.419	35.573	56	-10.0	9.939	46	-25.6
2.513570	10.36	34.15	56	-11.5	6.284	46	-29.4
2.862240	10.36	34.315	56	-11.3	6.876	46	-28.8

Unloaded, Conducted Test – Line 2: 0.15 MHz to 30.0 MHz



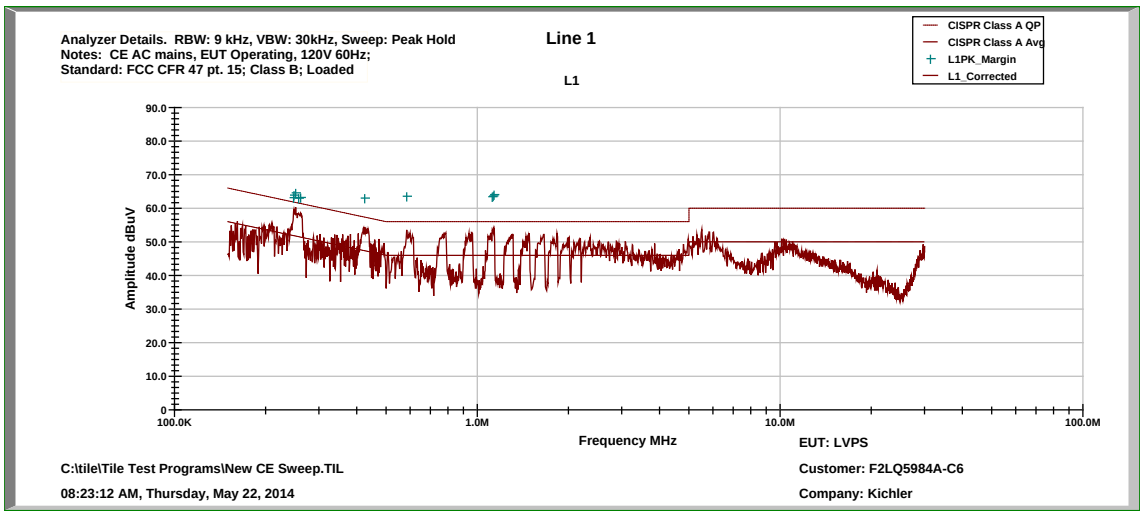
Frequency (MHz)	Corr. (dB)	QuasiPeak (dBµV/m)	QuasiPeak (dBµV/m) Limit	QuasiPeak Margin	Average (dBµV/m)	Average (dBµV/m) Limit	Average Margin
0.196219	11.100	47.895	63.77	-4.8	22.211	53.77	-20.5
0.202706	11.056	44.001	63.5	-8.4	17.285	53.5	-25.2
0.204327	11.048	41.708	63.434	-10.7	12.232	53.434	-30.2
0.961529	10.412	36.449	56	-9.1	8.221	46	-27.4
1.751360	10.380	34.529	56	-11.1	6.493	46	-29.1
2.067600	10.377	34.803	56	-10.8	6.339	46	-29.3
2.456810	10.361	35.384	56	-10.3	7.136	46	-28.5
2.854130	10.360	34.309	56	-11.3	5.63	46	-30.0
2.878450	10.36	33.912	56	-11.7	8.356	46	-27.3
2.894670	10.36	33.661	56	-12.0	9.63	46	-26.0

Loaded, Conducted Test – Line 1: 0.15 MHz to 30.0 MHz



Frequency (MHz)	Corr. (dB)	QuasiPeak (dBµV/m)	QuasiPeak (dBµV/m) Limit	QuasiPeak Margin	Average (dBµV/m)	Average (dBµV/m) Limit	Average Margin
0.247303	10.833	44.546	61.848	-6.5	35.346	51.848	-5.7
0.248113	10.829	45.265	61.82	-5.7	35.433	51.82	-5.6
0.251357	10.818	45.837	61.712	-5.1	38.753	51.712	-2.1
0.257033	10.807	45.733	61.528	-5.0	39.37	51.528	-1.4
0.261087	10.800	45.912	61.397	-4.7	36.59	51.397	-4.0
0.424880	10.550	40.327	57.352	-6.5	33.511	47.352	-3.3
0.584600	10.487	39.389	56	-6.1	29.046	46	-6.5
1.120510	10.400	40.575	56	-5.0	27.073	46	-8.5
1.128200	10.40	41.115	56	-4.5	27.985	46	-7.6
1.135890	10.40	41.915	56	-3.7	24.85	46	-10.8

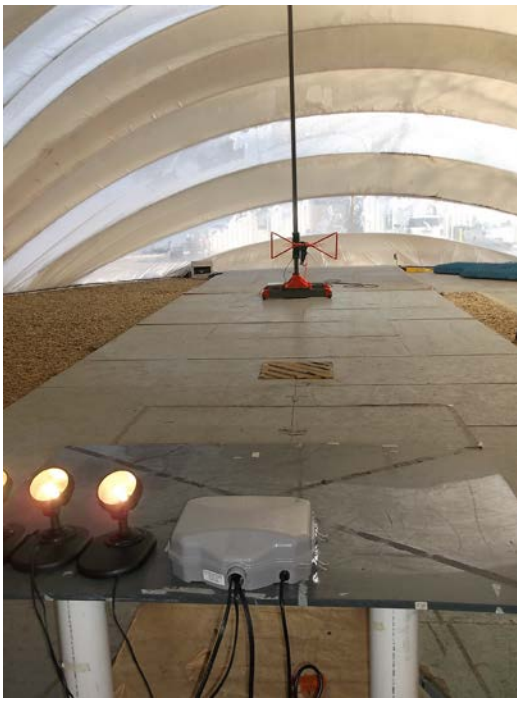
Loaded, Conducted Test – Line 2: 0.15 MHz to 30.0 MHz



Frequency (MHz)	Corr. (dB)	QuasiPeak (dBµV/m)	QuasiPeak (dBµV/m) Limit	QuasiPeak Margin	Average (dBµV/m)	Average (dBµV/m) Limit	Average Margin
0.192164	11.132	43.101	63.943	-9.71	24.37	53.943	-18.441
0.209192	11.024	45.835	63.237	-6.378	32.322	53.237	-9.891
0.212436	11.008	45.703	63.11	-6.399	33.943	53.11	-8.159
0.248924	10.825	46.689	61.793	-4.279	38.54	51.793	-2.428
0.251357	10.817	46.459	61.712	-4.436	39.997	51.712	-0.898
0.252978	10.814	46.309	61.659	-4.536	39.773	51.659	-1.072
0.254600	10.811	46.107	61.606	-4.688	39.96	51.606	-0.835
0.257033	10.807	46.323	61.528	-4.398	40.265	51.528	-0.456
0.260276	10.80	46.64	61.423	-3.982	38.248	51.423	-2.374
0.584600	10.49	38.985	56	-6.528	32.196	46	-3.317

10 PHOTOGRAPHS/EXHIBITS – PRODUCT PHOTOS, TEST SETUPS

Spurious Emissions, Loaded



Spurious Emissions, Unloaded

Field Strength of Emissions, Occupied Bandwidth

Conducted Emissions