



FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

58 KHz ELECTRONIC ARTICLE SURVEILLANCE SYSTEM

MODELS: WG WFDG and WG WFFG

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Prepared for

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Revision History

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--	6/26/2014	Initial Issue	M. Mekuria
A	3/17/2015	Update Sections 5.1, 5.5, 7.1 and 7.2 to address TCB's questions	O. Su
B	4/1/2015	Update report to address TCB's question	T. Chu

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. MEASURING INSTRUMENT CALIBRATION	5
4.2. SAMPLE CALCULATION	5
4.3. MEASUREMENT UNCERTAINTY.....	5
5. EQUIPMENT UNDER TEST	6
5.1. DESCRIPTION OF EUT	6
5.2. DESCRIPTION OF MODELS DIFFERENCES.....	6
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	6
5.4. SOFTWARE AND FIRMWARE.....	6
5.5. WORST-CASE CONFIGURATION AND MODE.....	7
5.6. DESCRIPTION OF TEST SETUP.....	8
6. TEST AND MEASUREMENT EQUIPMENT	9
7. EMISSIONS LIMITS AND RESULTS	10
7.1. RADIATED EMISSIONS.....	10
7.2. TX SPURIOUS EMISSIONS 9 KHz TO 30 MHz	11
7.3. RADIATED EMISSIONS 30 to 1000 MHz.....	12
7.4. AC MAINS LINE CONDUCTED EMISSIONS	13
8. SETUP PHOTOS.....	20
8.1. RADIATED EMISSIONS BELOW 30 MHz	20
8.2. RADIATED EMISSIONS ABOVE 30MHz.....	21
8.3. AC MAINS LINE CONDUCTED EMISSIONS	22
9. EUT PHOTOS	23

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: WG SECURITY PRODUCTS, INC.
2105 S. BASCOM AVE. SUITE 316
CAMPBELL, CA 95008, U.S.A.

EUT DESCRIPTION: 58 kHz ELECTRONIC ARTICLE SURVEILLANCE SYSTEM

MODELS: WG WFDG and WG WFFG

SERIAL NUMBER: A0-70-50- 14/04-00001

DATE TESTED: MAY 7, 8 & 12, 2014

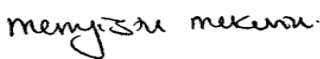
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Pass

* Models differences are explained within the body of this report.

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.


Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:



Mengistu Mekuria
Senior Engineer
UL Verification Services Inc.

Tested By:



Oliver Su
Senior Engineer
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15 and ANSI C63.10-2009.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input checked="" type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 58 kHz an electronic article surveillance system and consists of a Pedestal (i.e. Antenna), Detection tag, WiFi Adapter box, Control box, and external “Smart” power supply module. The principle of operation is as follows: receiver software provides a control signal to the transmitter to send out a 1.6 ms TX burst periodically in a random sequence, and then reads in the received signal, which is, in turn, processed to determine whether it is a tag signal or noise. The receiver software compares the tag signal sequence with the transmitting sequence. If the two sequences match, the software triggers activation of visual and audio alarms. EUT included two versions of the product. One is for floor installations, floorguard model WG WFFG, and other is for door installations, doorguard model WG WFDG.

The EUT is powered by an external “smart” power supply, input rating 100-240 VAC 50-60 Hz, output rating 24 VAC, 1.9 A.

5.2. DESCRIPTION OF MODELS DIFFERENCES

The WG WFFG version is the larger unit of the two models. The manufacturer confirmed that two models have the same internal components, same power supply SPS-24 and differ only in the antenna and enclosure sizes. Each model contains two TX/RX coils - a figure-8 coil set and a loop coil set. The differences in the TX/RX coil parameters are as follows:

Model	Loop coil antenna area m ²		Length, any element m		Number of turns		Length, all turn m	
	Figure-8	Loop	Figure-8	Loop	Figure-8	Loop	Figure-8	Loop
WG WFFG	<0.49	<0.38	4.02	2.915	8	9	32.16	26.235
WG WFDG	<0.21	<0.165	2.9	2.41	10	11	29	26.51

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes an integrated loop antenna.

5.4. SOFTWARE AND FIRMWARE

Not Applicable.

5.5. WORST-CASE CONFIGURATION AND MODE

The following configurations were investigated during testing:

EUT Configuration	Description
Idle (Continuous Transmission)	Antenna assembly and control box were connected to 24 VAC power supply. No tag was placed inside the field of the antenna assembly.
Alarm ON Configuration	Antenna assembly and control box were connected to 24 VAC power supply. Tag was placed inside the field of the antenna assembly in order to trigger an alarm ("beep on").

Base on the investigation at 3 meter distance, model WG WFFG is determined to be the worst case on below and above 30 MHz, TX/RX without tag; therefore, model WG WFFG was used to perform on all final testing.

Models	WG WFFG	WG WFDG
Items		
Fundamental (58 KHz) measured level (dBuv)	91.16	81.8
Tx Ant size Figure-8, Area (m ²)	<0.49	<0.21
Rx Ant size, Loop Area (m ²)	<0.38	<0.165

Notes: The model WG WFFG represented for other model WG WFDG in this test. Because of two models have the same AC power supply and circuitries, except for the antenna size.

5.6. DESCRIPTION OF TEST SETUP

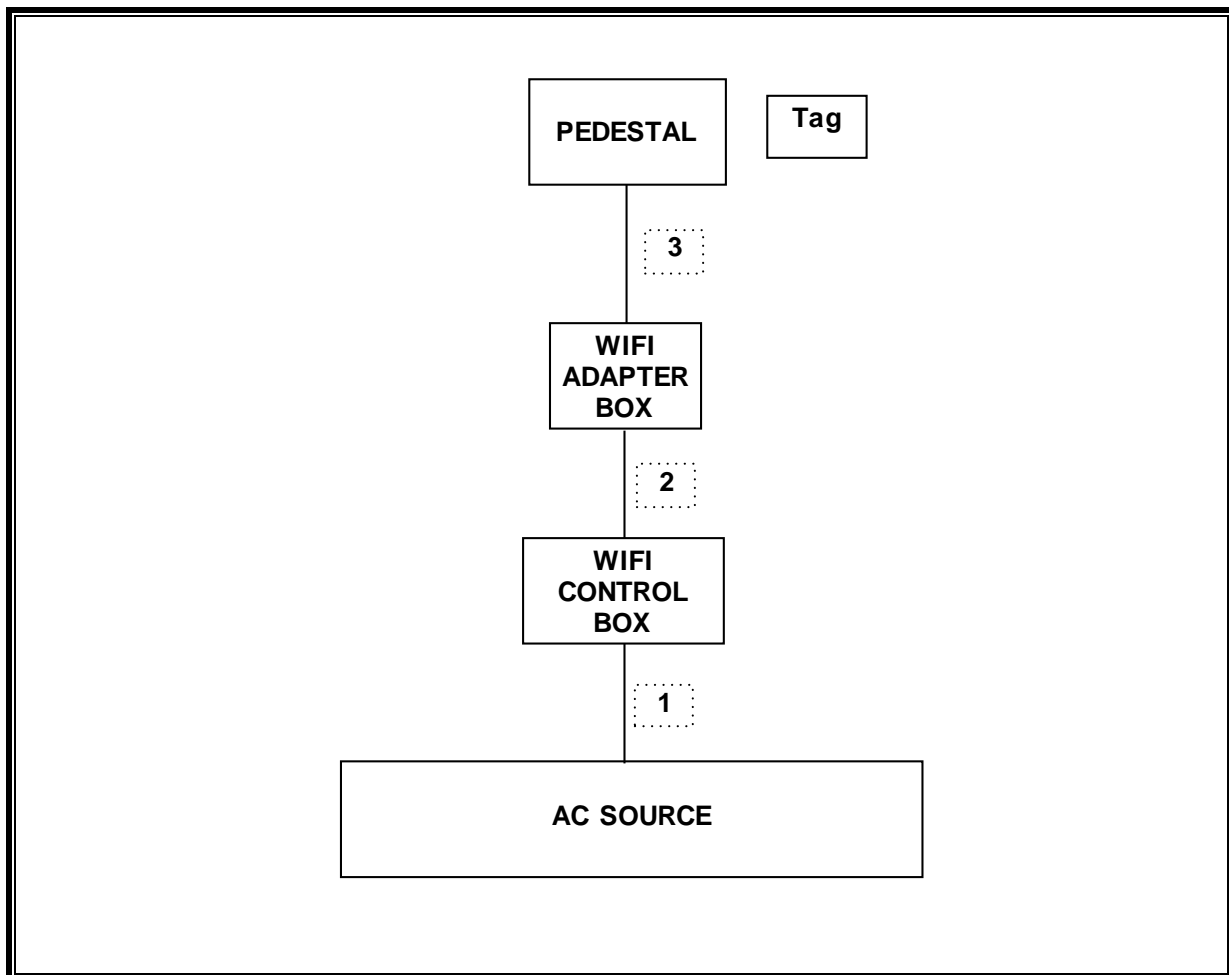
SUPPORT EQUIPMENT

The EUT was a stand-alone device and no support equipment was required for operation.

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	Mains Input	1	3-Prong	Unshielded	1.5 m	None
2	24 VAC Output and I/O Line	1	2 and 4-Pin SIP	Unshielded	3.5m	None
3	I/O Line	2	2 and 4-Pin SIP	Unshielded	3.5m	None

SETUP DIAGRAM FOF TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Description	Manufacturer	Model	Asset	Cal Due
Preamplifier, 1300 MHz	Sonma	310	F00008	05/28/15
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00168	03/28/15
Spectrum Analyzer, 44GHz	Agilent	N9030A	F00129	02/22/15
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/15
Antenna, Loop, 30 MHz	ETS Lindgren	6502	F00366	10/04/14
EMI Test Receiver, 9KHz-7GHz	R & S	ESCI 7	1000741	08/13/14
EMI Test Receiver, 9KHz-7GHz	R & S	ESCI 7	F00092	09/05/14

7. EMISSIONS LIMITS AND RESULTS

7.1. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.10.

The EUT is an intentional radiator that incorporates a digital device. The highest fundamental frequency generated or used in the device is 58 kHz, while the highest frequency generated or used in the device is 24 MHz. Therefore, the frequency range was investigated from 9 KHz to 1000 MHz.

LIMIT

FCC §15.209 (a)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960 MHz	500	3
Note: The lower limit shall apply at the transition frequency.		

RESULTS

7.2. TX SPURIOUS EMISSIONS 9 KHz TO 30 MHz

FCC Part 15, Subpart B & C 10 Meter Distance Measurement At Open Field

Company: WG Security

Project #: 1417696

EUT configuration #: EUT (WG WFFG) with AC Power Supply

Mode of operation: EUT (WG WFFG) was on, without Tag

Tester: O Su / T Wang

Date: 5-8-2014

Frequency (MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	AF dB/m	CL dB	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes
Loop Antenna Face On:													
0.058	91.16	83.8	70.9	11.06	0.05	-59.08	35.83	22.93	52.34	32.34	-16.5	-9.4	10m distance
0.116	39.8	31.25	23.8	10.49	0.05	-59.08	-17.30	-24.75	46.32	26.32	-63.6	-51.1	10m distance
0.174	62.67	50.83	35.94	10.44	0.05	-59.08	2.24	-12.65	42.79	22.79	-40.6	-35.4	10m distance
0.232	50.45	42.5	32.35	10.4	0.05	-59.08	-6.13	-16.28	40.29	20.29	-46.4	-36.6	10m distance
0.290	53.1	42.81	32.03	10.36	0.05	-59.08	-5.87	-16.65	38.36	18.36	-44.2	-35.0	10m distance
0.348	42.87	35.57	29.01	10.31	0.05	-59.08	-13.15	-19.71	36.77	16.77	-49.9	-36.5	10m distance
0.406	47.5	36.6	28.04	10.27	0.05	-59.08	-12.15	-20.72	35.43	15.43	-47.6	-36.2	10m distance
0.463	40.12	32.54	26.73	10.23	0.05	-59.08	-16.27	-22.08	34.29	14.29	-50.6	-36.4	10m distance
0.523	44.8	33.9		10.2	0.05	-19.08	25.07		33.23		-8.2		10m distance
Tx spur													
2.468	30.43	23.8	18.9	10.23	0.05	-19.08	14.99	10.09	19.76		-4.8		10m distance
Loop Antenna Face Off:													
0.058	60.8	53.28	41.27	11.06	0.05	-59.08	5.31	-6.70	52.34	32.34	-47.0	-39.0	10m distance
0.116	27	20.01	17.04	10.49	0.05	-59.08	-28.54	-31.51	46.32	26.32	-74.9	-57.8	10m distance
0.174	48.33	41.04	35.0	10.44	0.05	-59.08	-7.55	-13.57	42.79	22.79	-50.3	-36.4	10m distance
0.232	45.24	40.1	34.05	10.4	0.05	-59.08	-8.49	-14.58	40.29	20.29	-48.8	-34.9	10m distance
0.290	50.01	43.7	39.35	10.36	0.05	-59.08	-4.95	-9.33	38.36	18.36	-43.3	-27.7	10m distance
0.348	41.08	36.71	36.02	10.31	0.05	-59.08	-12.01	-12.70	36.77	16.77	-48.8	-29.5	10m distance
0.406	49.04	43.47	31.52	10.27	0.05	-59.08	-5.29	-17.24	35.43	15.43	-40.7	-32.7	10m distance
0.463	38.33	32.41	26.8	10.23	0.05	-59.08	-16.40	-22.01	34.29	14.29	-50.7	-36.3	10m distance
0.523	44.28	39.5		10.2	0.05	-19.08	30.68		33.23		-2.6		10m distance
Tx spur													
2.588	32.8	22.7		10.22	0.05	-19.08	13.89		19.34		-5.5		10m distance

* No more emissions were found up to 30MHz

Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 10000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

P.K. = Peak

Q.P. = Quasi Peak Reading

A.F. = Antenna factor

Below 150kHz => RBW=VBW=200 or 300Hz

Above 150kHz =>RBW=VBW=9 or 10kHz (Average => VBW=10Hz)

7.3. RADIATED EMISSIONS 30 to 1000 MHz**RADIATED EMISSIONS 30 TO 1000 MHz (MODE: WG WFFG)**

Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 73.4206	54.82	QP	8.1	-31.5	31.42	40	-8.58	5	300	H
* 114.9905	31.06	QP	13.2	-31.2	13.06	43.52	-30.46	5	300	V
* 115.0748	32.43	QP	13.2	-31.2	14.43	43.52	-29.09	5	300	V
197.4914	48.09	QP	12	-30.8	29.29	43.52	-14.23	5	300	V
200.0315	51.92	QP	12.4	-30.7	33.62	43.52	-9.9	5	300	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

QP - Quasi-Peak detector

7.4. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.10.

The EUT was tested while connected to 120 V, 60 Hz.

LIMITS

§15.107 (a) Except for Class A digital devices, for equipment 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 μ H/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 band edges.

Frequency range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes:		
1. The lower limit shall apply at the transition frequencies		
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

TEST AND MEASUREMENT EQUIPMENT

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Calibration Due
<input checked="" type="checkbox"/> EMI Test Receiver	R & S	ESHS 17	827129/006	08/09/2014
<input checked="" type="checkbox"/> LISN, 10 kHz - 30 MHz	FCC	LISN50/250-25-2	2023	01/14/2015

RESULTS

FLOORGUARD, WITHOUT TAG

Line-L1 .15 - 30MHz

Trace Markers

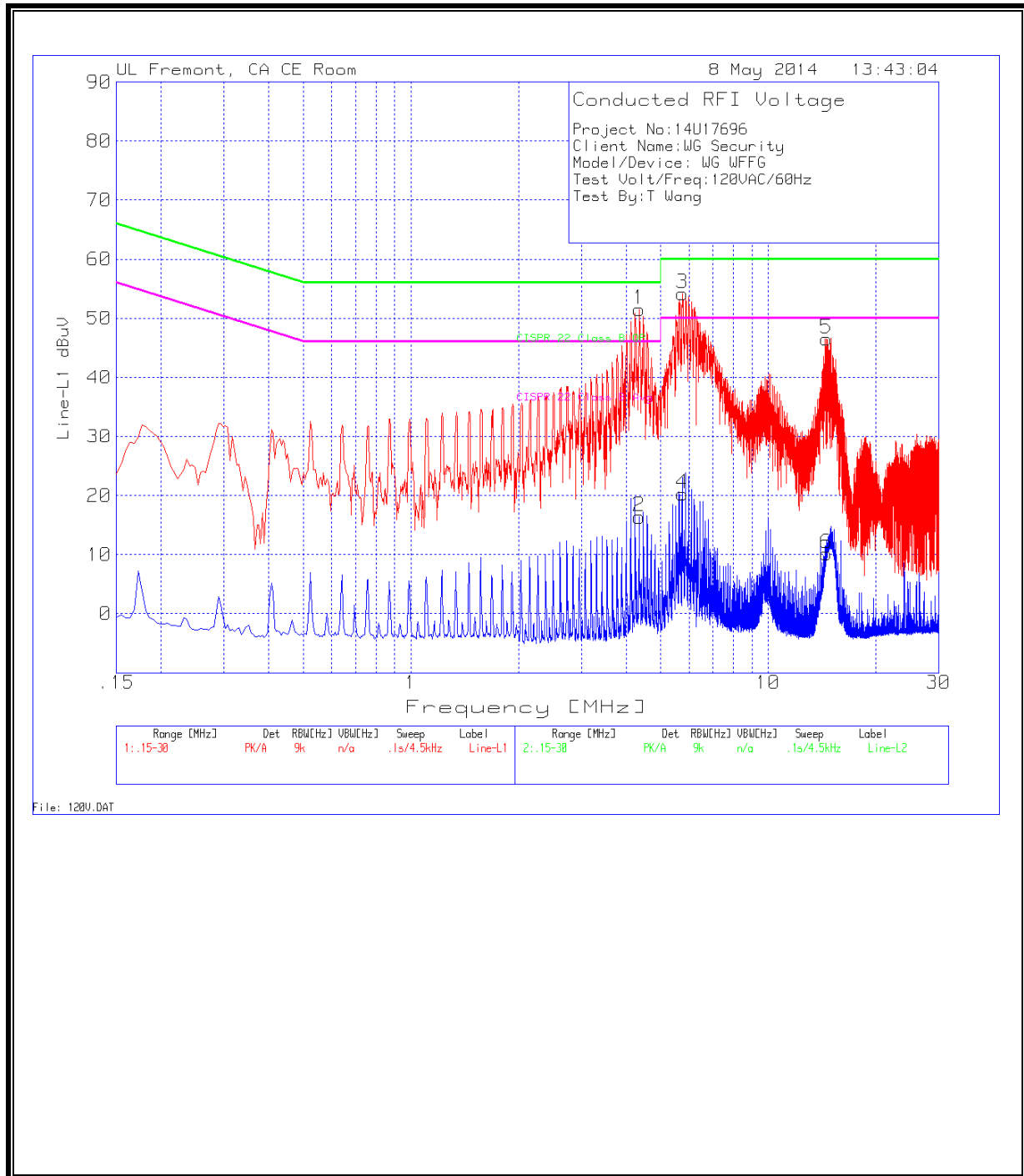
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
1	4.353	51.24	PK	.2	.1	51.54	56	-4.46	-	-
2	4.353	16.08	Av	.2	.1	16.38	-	-	46	-29.62
3	5.748	53.84	PK	.2	.1	54.14	60	-5.86	-	-
4	5.748	20.02	Av	.2	.1	20.32	-	-	50	-29.68
5	14.5815	46.07	PK	.2	.2	46.47	60	-13.53	-	-
6	14.5815	9.81	Av	.2	.2	10.21	-	-	50	-39.79

Line-L2 .15 - 30MHz

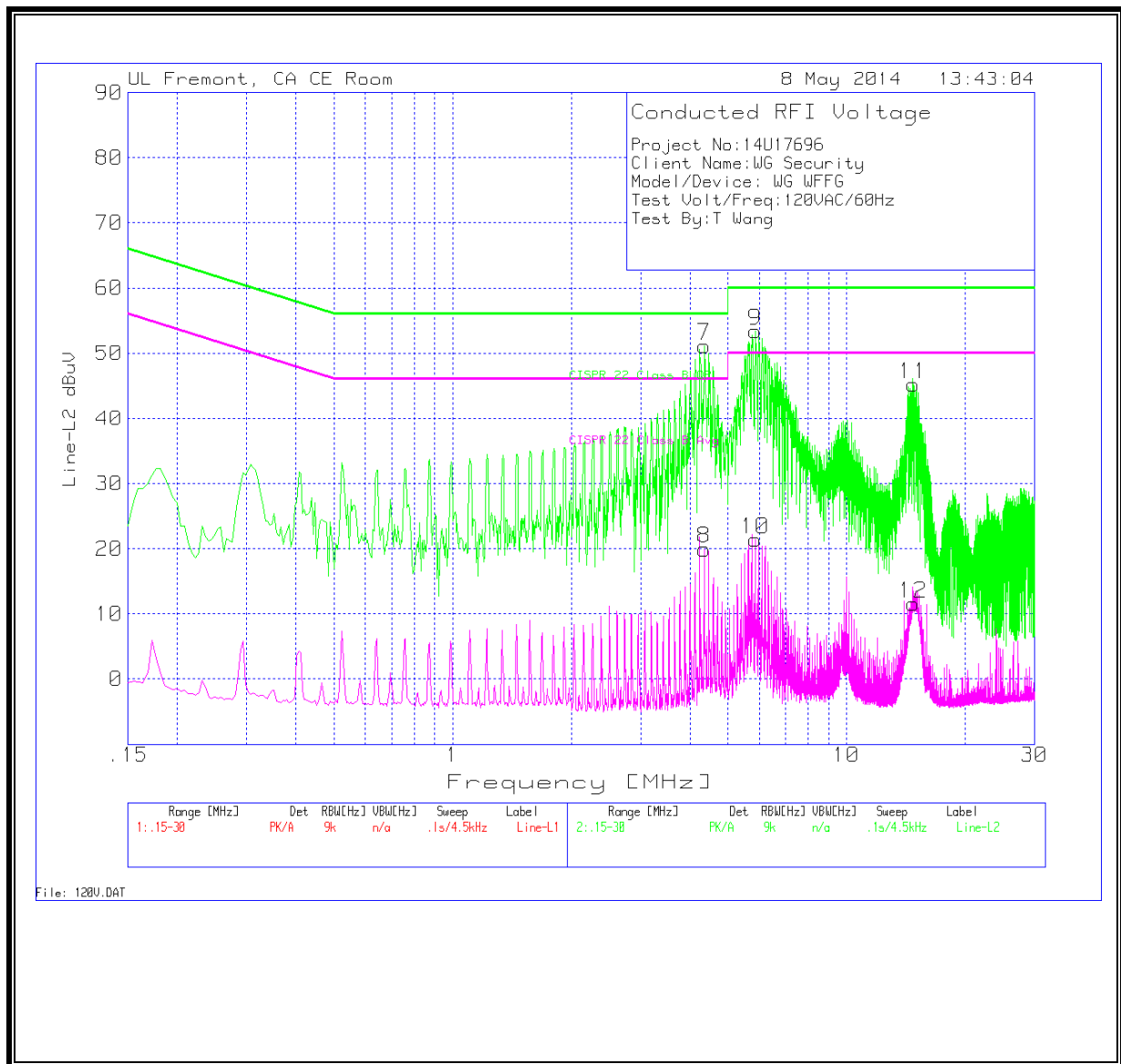
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
7	4.353	50.87	PK	.2	.1	51.17	56	-4.83	-	-
8	4.353	19.66	Av	.2	.1	19.96	-	-	46	-26.04
9	5.8605	53.11	PK	.2	.1	53.41	60	-6.59	-	-
10	5.8605	21.16	Av	.2	.1	21.46	-	-	50	-28.54
11	14.784	44.78	PK	.3	.2	45.28	60	-14.72	-	-
12	14.784	11.05	Av	.3	.2	11.55	-	-	50	-38.45

LINE 1 RESULTS



LINE 2 RESULTS



FLOORGUARD, WITH TAG

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
1	4.614	41.54	PK	.2	.1	41.84	56	-14.16	-	-
2	4.614	2.71	Av	.2	.1	3.01	-	-	46	-42.99
3	5.793	48.53	PK	.2	.1	48.83	60	-11.17	-	-
4	5.793	5.35	Av	.2	.1	5.65	-	-	50	-44.35
5	15.171	34.4	PK	.3	.2	34.9	60	-25.1	-	-
6	15.171	8.69	Av	.3	.2	9.19	-	-	50	-40.81

Line-L2 .15 - 30MHz

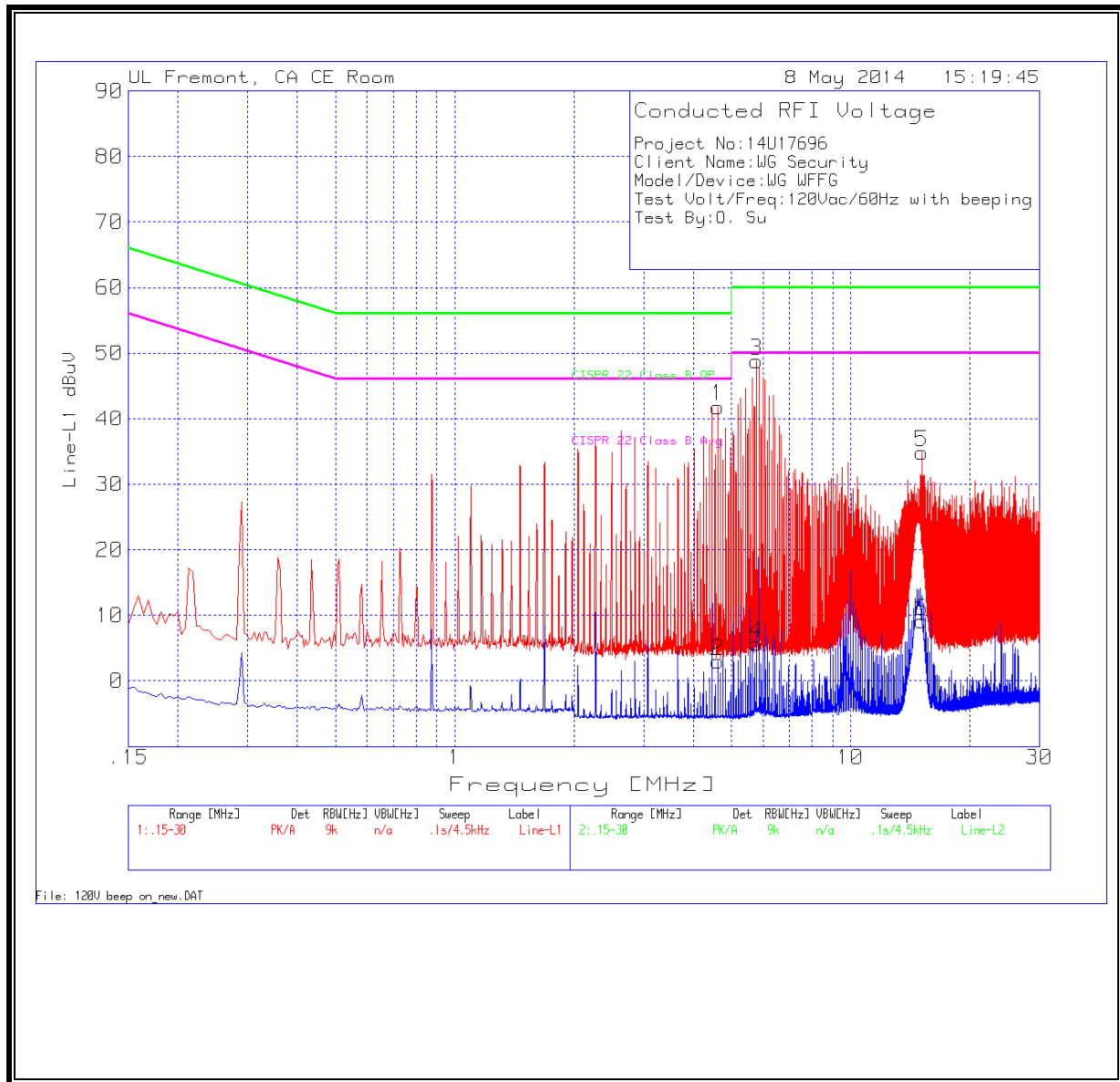
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
7	4.5825	41.02	PK	.2	.1	41.32	56	-14.68	-	-
8	4.5825	3.63	Av	.2	.1	3.93	-	-	46	-42.07
9	5.676	48.26	PK	.2	.1	48.56	60	-11.44	-	-
10	5.676	4.31	Av	.2	.1	4.61	-	-	50	-45.39
11	15.189	33.03	PK	.3	.2	33.53	60	-26.47	-	-
12	15.189	6.99	Av	.3	.2	7.49	-	-	50	-42.51

PK - Peak detector

Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS