



FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

58 KHz ELECTRONIC ARTICLE SURVEILLANCE SYSTEM

MODEL OF TEST: WG WF PP

MODEL OF DIFFERENCE: WG WF PG, WG WF AG, WG WF AGX and WG WF LG

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Prepared for

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/06/2014	Initial Issue	T. Chan
A	12/03/2014	Address TCB Reviewer's Questions of Section 7.1	M. Mekuria
B	12/10/2014	Address TCB Reviewer's Questions of Sections 5.2, 5.5, 5.6, 7.1 and 7.2	O. Su
C	03/10/2015	Address TCB Reviewer's Questions of Section 5.5 and 7.1	T. Chu

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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

MODEL OF TEST: WG WF PP

***MODEL OF DIFFERENCE:** WG WF PG, WG WF AG, WG WF AGX and WG WF LG

SERIAL NUMBER: 13/11 00001

DATE TESTED: DECEMBER 16 -20, 2013

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:



Thu Chan
Operation Manager
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
☐ Chamber A	☒ Chamber D
☐ Chamber B	☐ Chamber E
☐ Chamber C	☐ 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:

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

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 article surveillance system and consists of a pedestal, detection tag 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.

The EUT is powered by an external “smart” power supply, input rating 100-120/220-240 V, 50-60 Hz, output rating 26 VAC, 1.9 A.

5.2. DESCRIPTION OF MODELS DIFFERENCES

The WG WF PP version is the largest of the five models. The manufacturer confirmed that the all 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 (TX) and a loop coil set (RX). The differences in the TX/RX coil parameters are as follows:

Model	Loop coil antenna area (m ²)		Length, single turn (m)		Number of turns		Length, all turns (m)	
	Figure-8	Loop	Figure-8	Loop	Figure-8	Loop	Figure-8	Loop
WG WF PP	<0.64	<0.64	4.62	3.62	7	8	32.34	28.96
WG WF PG	<0.42	<0.42	3.91	3.2	8	9	31.28	28.80
WG WF AGX	<0.49	<0.38	4.02	2.915	8	9	32.16	26.235
WG WF AG	<0.29	<0.22	3.47	2.88	9	10	31.23	28.80
WG WF LG	<0.4	<0.4	3.45	2.65	9	10	31.05	26.50

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").

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

Models Items	WG WF PP	WG WF AGX	WG WF PG	WG WF LG	WG WF AG
Fundamental (58KHz) measured level (dBuv)	106.438	104.98	104.487	104.065	100.32
Tx Ant size Figure-8, Area (m ²)	<0.64	<0.49	<0.42	<0.4	<0.29
Rx Ant size, Loop Area (m ²)	<0.64	<0.38	<0.42	<0.4	<0.22

Notes: The model WG WF PP represented for all other models WG WF PG, WG WF AGX, WG WF AG and WG WF LG in this test. Because of all models have the same AC power supply and circuitries, except for the antenna size.

5.6. DESCRIPTION OF TEST SETUP

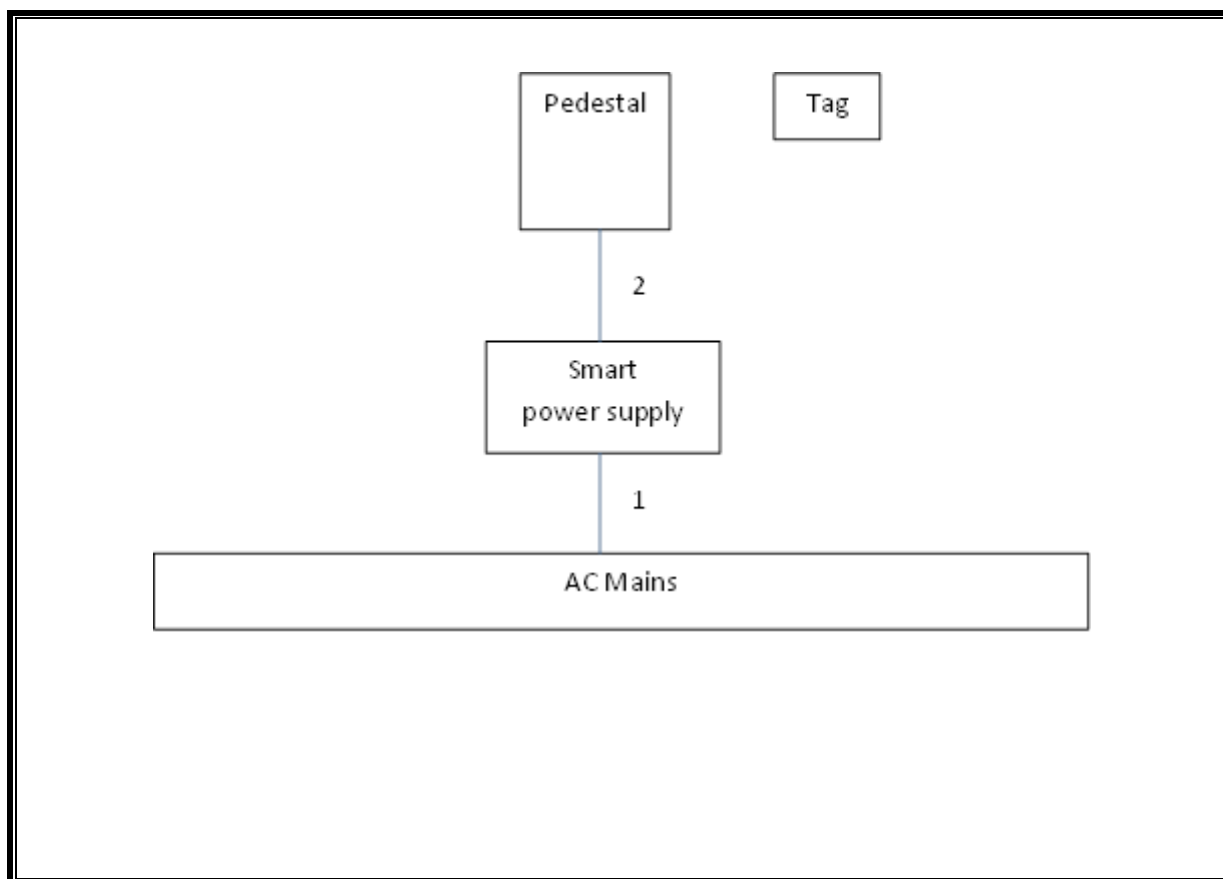
SUPPORT EQUIPMENT

The EUT was a stand-alone device (also called pedestal) and powered by an external “smart” power supply, WG Security, Model SPS-24, input rating 100-120/220-240 V 50-60 Hz, output rating 26 VAC, 1.9 A. No other 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	26 VAC Output and I/O Line	1	2 and 4-Pin SIP	Unshielded	1 m	None

SETUP DIAGRAM FOE TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	Asset	Cal Due
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	05/21/14
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00027	03/07/14
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	T284	09/05/14
EMI Test Receiver, 30 MHz	R & S	ESHS20	N02396	03/23/14

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 #: 13U16686

EUT configuration #: EUT (WIFI PP) with AC Power Supply

Mode of operation: Tx

Tester: O. Su

Date: 12/16/13

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	93.74	87.6	77.8	11.06	0.05	-59.08	39.63	29.83	52.34	32.34	-12.7	-2.5	10m distance
0.116	35.58	27.72	23.85	10.49	0.05	-59.08	-20.83	-24.70	46.32	26.32	-67.1	-51.0	10m distance
0.174	66.89	55.6	36.59	10.44	0.05	-59.08	7.01	-12.00	42.79	22.79	-35.8	-34.8	10m distance
0.232	48.7	38.6	31.94	10.4	0.05	-59.08	-10.03	-16.69	40.29	20.29	-50.3	-37.0	10m distance
0.29	59.51	48.62	42.03	10.36	0.05	-59.08	-0.06	-6.65	38.36	18.36	-38.4	-25.0	10m distance
0.348	47.6	38.21	29.54	10.31	0.05	-59.08	-10.51	-19.18	36.77	16.77	-47.3	-36.0	10m distance
0.406	54.31	46.54	30.8	10.27	0.05	-59.08	-2.22	-17.96	35.43	15.43	-37.7	-33.4	10m distance
0.464	47.21	36.7	27.9	10.23	0.05	-59.08	-12.11	-20.91	34.27	14.27	-46.4	-35.2	10m distance
Loop Antenna Face Off:													
0.058	73.97	66.95	53.6	11.06	0.05	-59.08	18.98	5.63	52.34	32.34	-33.4	-26.7	10m distance
0.116	26.15	20.19	19.8	10.49	0.05	-59.08	-28.36	-28.75	46.32	26.32	-74.7	-55.1	10m distance
0.174	48.6	39.26	33.14	10.44	0.05	-59.08	-9.33	-15.45	42.79	22.79	-52.1	-38.2	10m distance
0.232	41.87	36.6	31.06	10.4	0.05	-59.08	-12.03	-17.57	40.29	20.29	-52.3	-37.9	10m distance
0.29	49.5	41.1	32.9	10.36	0.05	-59.08	-7.58	-15.78	38.36	18.36	-45.9	-34.1	10m distance
0.348	41.85	35.42	29.1	10.31	0.05	-59.08	-13.30	-19.62	36.77	16.77	-50.1	-36.4	10m distance
0.406	43	35.11	28.7	10.27	0.05	-59.08	-13.65	-20.06	35.43	15.43	-49.1	-35.5	10m distance
0.464	39.1	32.65	27.65	10.23	0.05	-59.08	-16.16	-21.16	34.27	14.27	-50.4	-35.4	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 (MODEL: WG WF PP, WORST-CASE)

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 dB/m	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
65.2358	56.15	QP	8	-31.8	32.35	40	-7.65	147	285	H
74.1259	59.87	QP	8.3	-31.8	36.37	40	-3.63	204	196	V
78.1877	54.61	QP	8	-31.7	30.91	40	-9.09	171	191	H
78.7825	61.88	QP	7.8	-31.7	37.98	40	-2.02	15	235	V
138.0715	52.68	QP	13.1	-31.4	34.38	43.52	-9.14	256	165	V
199.097	37.35	QP	12.2	-31.1	18.45	43.52	-25.07	65	102	H

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
☒ EMI Test Receiver	R & S	ESHS 20	827129/006	08/09/2014
☒ LISN, 10 kHz - 30 MHz	FCC	LISN50/250-25-2	2023	01/14/2015

RESULTS

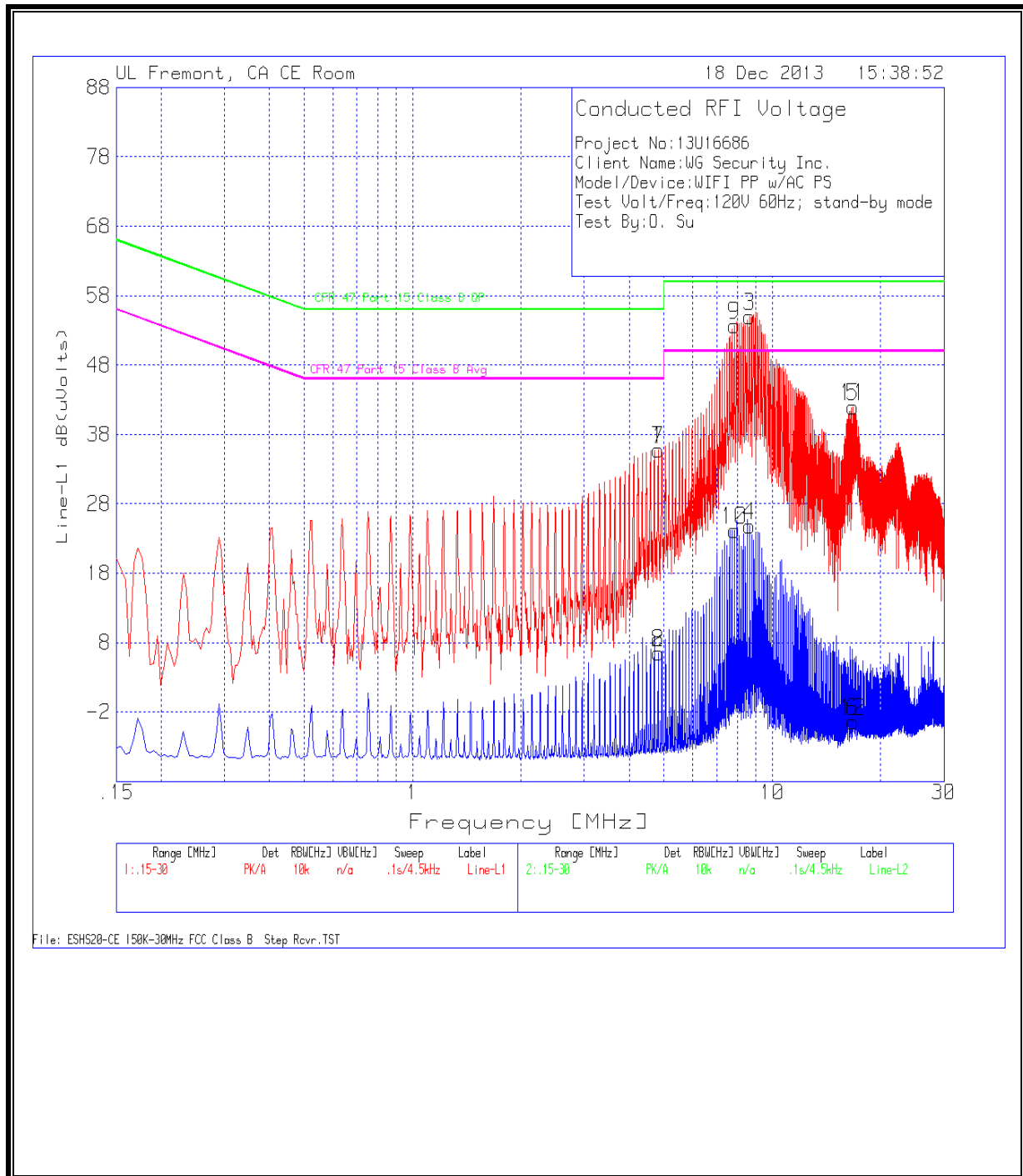
WG WF PP, BEEP OFF

Line-L1 .15 - 30MHz

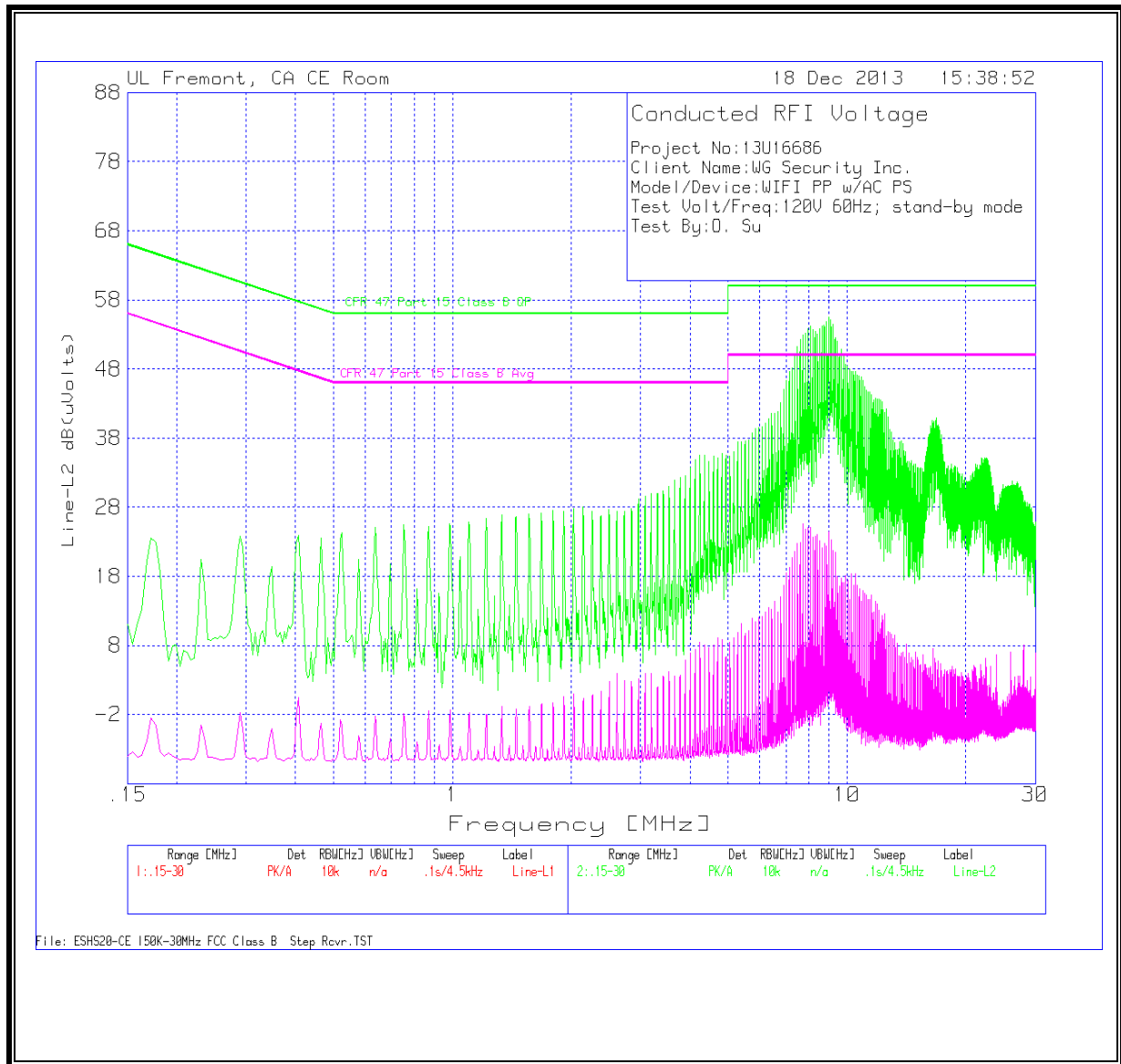
Trace Markers										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dB(uVolts)	CFR 47 Part 15 Class B QP	Margin to Limit (dB)	CFR 47 Part 15 Class B Avg	Margin to Limit (dB)
1	4.8165	35.61	PK	.1	.1	35.81	56	-20.19	-	-
2	4.8165	6.37	Av	.1	.1	6.57	-	-	46	-39.43
3	8.646	54.74	PK	.1	.1	54.94	60	-5.06	-	-
4	8.646	24.62	Av	.1	.1	24.82	-	-	50	-25.18
5	16.737	41.52	PK	.2	.2	41.92	60	-18.08	-	-
6	16.737	-3.84	Av	.2	.2	-3.44	-	-	50	-53.44

Line-L2 .15 - 30MHz

Trace Markers										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dB(uVolts)	CFR 47 Part 15 Class B QP	Margin to Limit (dB)	CFR 47 Part 15 Class B Avg	Margin to Limit (dB)
7	4.8165	35.61	PK	.1	.1	35.81	56	-20.19	-	-
8	4.8165	6.37	Av	.1	.1	6.57	-	-	46	-39.43
9	7.8315	53.53	PK	.1	.1	53.73	60	-6.27	-	-
10	7.8315	23.98	Av	.1	.1	24.18	-	-	50	-25.82
11	16.737	41.52	PK	.2	.2	41.92	60	-18.08	-	-
12	16.737	-3.84	Av	.2	.2	-3.44	-	-	50	-53.44



LINE 2 RESULTS



WG WF PP, BEEP ON

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dB(uVolts)	CFR 47 Part 15 Class B QP	Margin to Limit (dB)	CFR 47 Part 15 Class B Avg	Margin to Limit (dB)
1	3.1875	30.92	PK	.1	.1	31.12	56	-24.88	-	-
2	3.1875	-1.57	Av	.1	.1	-1.37	-	-	46	-46.37
3	7.836	54.49	PK	.1	.1	54.69	60	-5.31	-	-
4	7.836	-1.19	Av	.1	.1	-1.99	-	-	50	-50.99
5	8.826	53.49	PK	.1	.1	53.69	60	-6.31	-	-
6	8.826	10.24	Av	.1	.1	10.44	-	-	50	-39.56

Line-L2 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dB(uVolts)	CFR 47 Part 15 Class B QP	Margin to Limit (dB)	CFR 47 Part 15 Class B Avg	Margin to Limit (dB)
7	4.8165	35.78	PK	.1	.1	35.98	56	-20.02	-	-
8	4.8165	-1.73	Av	.1	.1	-1.53	-	-	46	-47.53
9	7.71	52.11	PK	.1	.1	52.31	60	-7.69	-	-
10	7.71	-1.31	Av	.1	.1	-1.11	-	-	50	-51.11
11	9.1725	51.08	PK	.1	.2	51.38	60	-8.62	-	-
12	9.1725	5.09	Av	.1	.2	5.39	-	-	50	-44.61

PK - Peak detector

Av - average detection

LINE 2 RESULTS

