



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

CERTIFICATION TEST REPORT

FOR

APPLE WATCH

MODEL NUMBER: A1554 & 1638

**FCC ID: BCG-E2871
IC: 579C-E2871**

REPORT NUMBER: 14U19371-E4, REVISION C

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Prepared for
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NVLAP LAB CODE 200065-0

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--	02/20/2015	Initial Issue	M. Mekuria
B	02/28/2015	To addresses TCB questions	M. Mekuria
C	03/03/2015	To addresses TCB questions	T. Chu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: APPLE WATCH

MODEL: A1554 & A1638 **Error! Reference source not found.**

SERIAL NUMBER: FG7NF0GFFY2F (CONDUCTED) & FG7NO8NFY2F (RADIATED)

DATE TESTED: DECEMBER 1 TO 12, 2014

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 8, Annex 2	Pass
INDUSTRY CANADA RSS-GEN Issue 4	Pass

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.

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UL Verification Services Inc. By:

Tested By:



CHIN PANG
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

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UL VERIFICATION SERVICES INC.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, and FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-210 Issue 8.

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
	☐ Chamber G
	☐ Chamber H

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 an Apple Watch with WLAN, Bluetooth and NFC support. The EUT has two mode or type (Type A and B) based on the NFC-Forum Standards. The two types of NFC modes are having different kinds of coding and modulation schemes.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak radiated output power as follows:

Frequency Range (MHz)	Mode	E field at 30 m distance (dBuV/M)
13.56 - 13.56	Type A	-6.43
	Type B	-1.50

5.3. SOFTWARE AND FIRMWARE

The test utility software used during testing was Star Links 1.9, Links.

5.4. WORST-CASE CONFIGURATION AND MODE

The following configurations were investigated and EUT powered by AC/DC adapter was the worst-case scenario. AC power line and below 1G radiated tests were conducted on configuration 1.

Configuration	Descriptions
1	EUT powered by AC/DC adapter via USB cable with wireless charger
2	EUT powered by host PC via USB cable with wireless charger

Power line conducted emissions were performed with the EUT charging with metal base charger and plastic base charger. Plastic base charger was determined to be worst case therefore all final power line data testing were performed with the plastic charger.

EUT has 3 types of enclosures and various kinds of metallic and non-metallic wristbands. There are 2 types of metallic bands; Metal Links, and Metal Mesh. Worst case configuration was investigated; and it was found that the stainless steel enclosure and metal mesh wristband was the worst case. All testing are performed on the worst case.

The fundamental of the EUT and radiated emission were investigated in five orthogonal orientations X (Flatbed), Y (Portrait), Z (Landscape), Y (portrait upside down), Z (landscape side buttons at bottom edge) .The Z (Landscape) orientation was determined to be the worst-case orientation; therefore, all final fundamental and radiated testing were performed with the EUT in Z (Portrait) orientation.

Fundamental and radiated emissions were investigated with EUT charging with plastic wireless charger, metal wireless charger and as standalone. EUT charging with metal charger was determined to be worst case. Therefore all final fundamental and radiated emissions were performed with the EUT charged by metal charger.

5.5. DESCRIPTION OF TEST SETUP

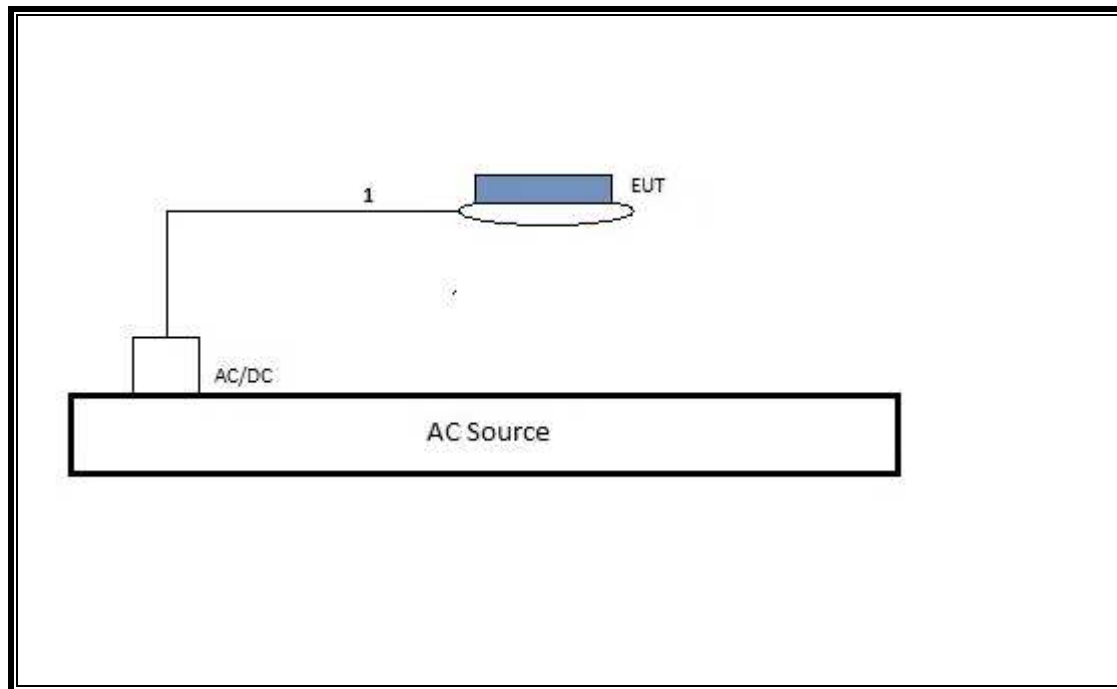
SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC adapter	Apple	A1357	N/A	N/A
Metal Base Charger	Apple	A1570	N/A	BCGA1570
Plastic Base Charger	Apple	A1598	N/A	BCGA1598

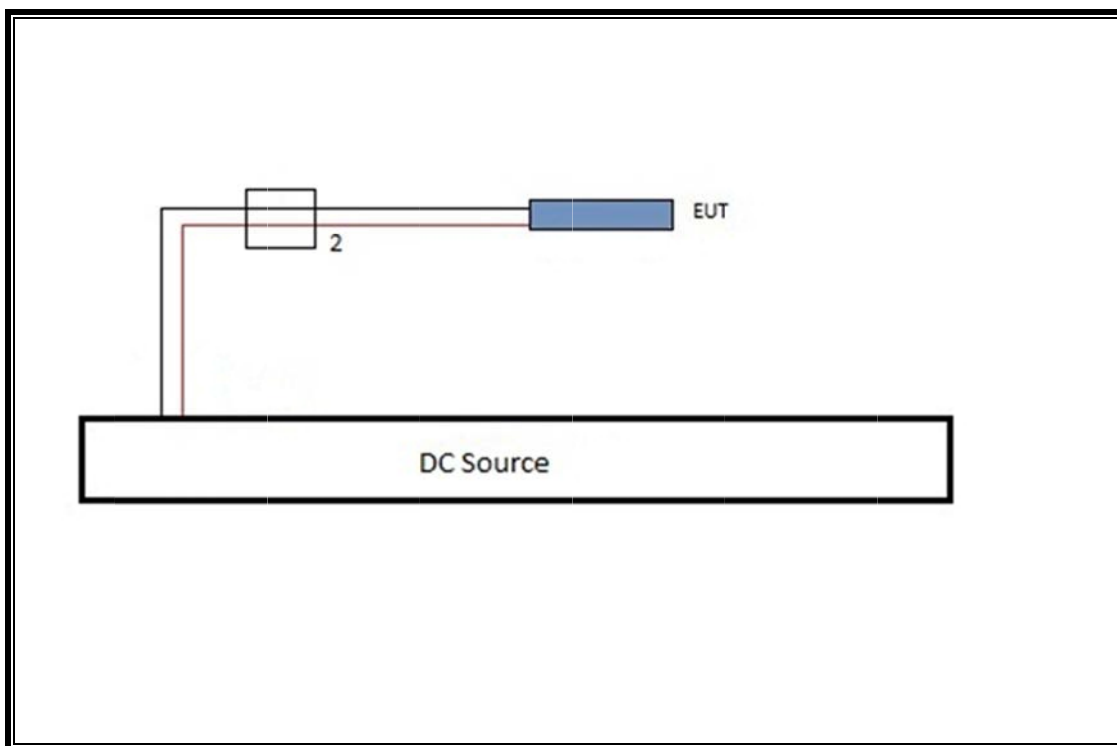
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length	Remarks
1	DC	1	USB	Un-Shielded	2m	Stainless Steel/Plastic Charging Cable
2	DC	2	Alligator	18 AWG strand	1m	Insulated cable

SETUP DIAGRAM FOR RADIATED EMISSIONS AND AC LINE



SETUP DIAGRAM FOR TEMPERATURE STABILITY



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	Serial #	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY51380911	02/12/15
Antenna, Broadband Hybrid, 30	Sunol Sciences	JB1	A121003	01/28/15
Amplifier, 10KHz to 1GHz	Sonoma	310N	185623	12/30/14
Loop Antenna	ETS Lindgren	6502	158071	10/14/15
Temperature Chamber	Cincinnati Sub	ZPHS-8-3.5-SCT/WC	F00363	04/10/15
DC Power Supply	Xantrex	XHR 60-18	C01064	CNR
EMI Test Receiver, 9 KHz-7	R & S	ESCI 7	F00092	09/16/15
LISN, 30 MHz	FCC	LISN-50/250-25-2	114	01/17/15

7. OCCUPIED BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Moduation	Frequency (MHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)
Type A	13.56	5.5657	5.368
Type B	13.56	5.7349	4.960

TYPE A



TYPE B



8. RADIATED EMISSION TEST RESULTS

LIMIT

§15.225

IC RSS-GEN, Section 8.9 and 8.10.

IC RSS-GEN, Section 7 (Receiver)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:

§15.209 (a) except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	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 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, however, operation within these frequency bands is permitted under other sections of this part, e.g. §§15.231 and 15.241

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the field strength from uV/m to dBuV/m is:

Limit (dBuV/m) = 20 log limit (uV/m)

In addition:

§15.209 (d) The emission limits shown the above table is based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

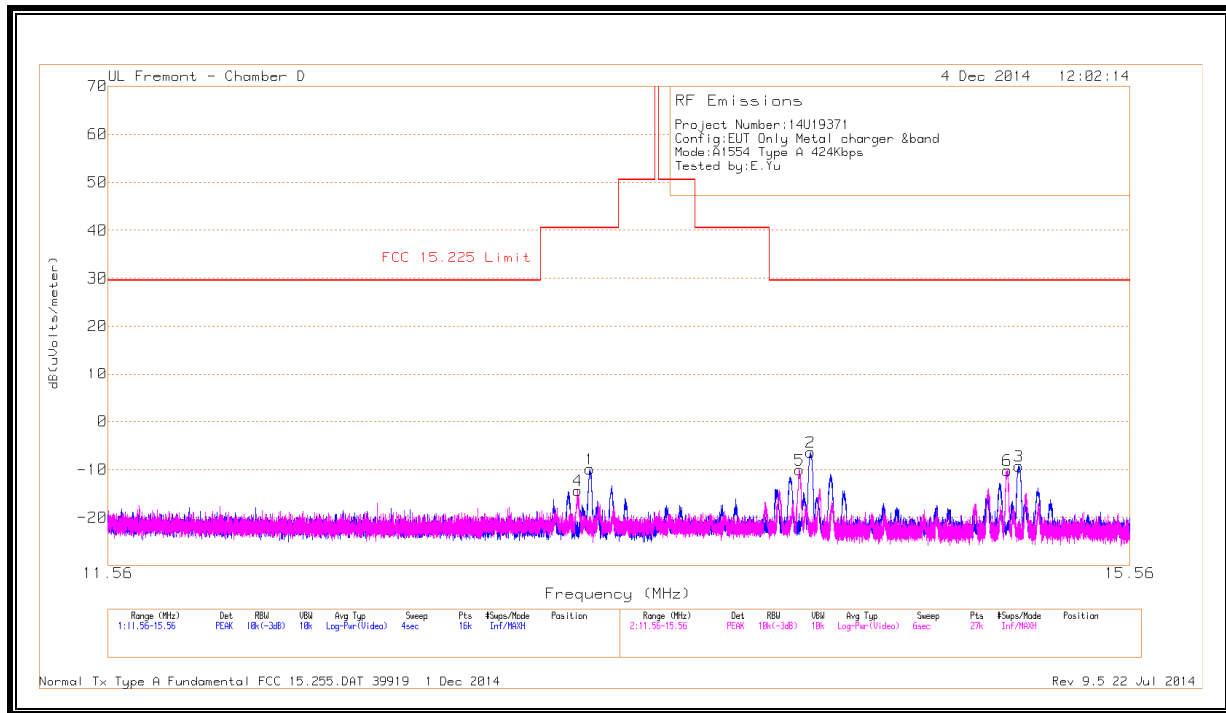
ANSI C63.4, 2009

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

RESULTS

8.1. TYPE A FUNDAMENTAL (0.15 – 30 MHz)

TYPE A, 424 Kbps

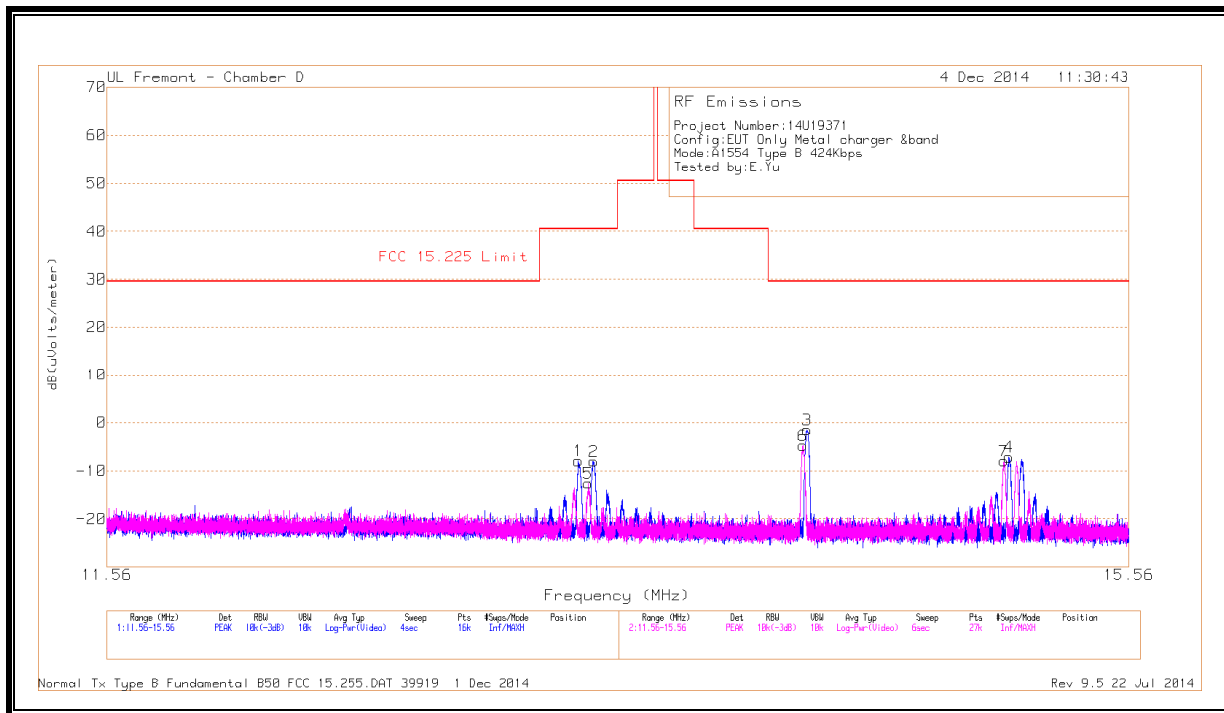


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	CF	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	Margin (dB)
4	13.25179	14.92	PK	10.7	-40	-14.38	40.51	-54.89
1	13.29925	19.37	PK	10.7	-40	-9.93	40.51	-50.44
5	14.13476	19.31	PK	10.6	-40	-10.09	29.54	-39.63
2	14.181	22.97	PK	10.6	-40	-6.43	29.54	-35.97
6	15.01521	19.18	PK	10.6	-40	-10.22	29.54	-39.76
3	15.066	20.08	PK	10.6	-40	-9.32	29.54	-38.86

PK - Peak detector

8.2. TYPE B FUNDAMENTAL (0.15 – 30 MHz)

TYPE B, 424 Kbps



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	CF	Corrected Reading dB(uVolts/ meter)	FCC 15.225 Limit	Margin (dB)
1	13.258	21.37	PK	10.7	-40	-7.93	40.51	-48.44
5	13.29619	16.68	PK	10.7	-40	-12.62	40.51	-53.13
2	13.31725	21.23	PK	10.7	-40	-8.07	40.51	-48.58
6	14.15237	24.64	PK	10.6	-40	-4.76	29.54	-34.30
3	14.1695	27.9	PK	10.6	-40	-1.5	29.54	-31.04
7	15.00485	21.45	PK	10.6	-40	-7.95	29.54	-37.49
4	15.02575	22.23	PK	10.6	-40	-7.17	29.54	-36.71

PK - Peak detector

8.3. TYPE A SPURIOUS EMISSIONS (0.15 – 30 MHz)

TYPE A, 424 Kbps

FCC Part 15, Subpart B & C 3 Meter Distance Measurement At Emissions Chamber													
Company:													
Project #: 14U19371													
Model #: B50 Type A													
Configuration: EUT + Metal Charger+Metal Band													
Tester: N. Garcia													
Date: 21-Nov-2014													
Frequency (MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	AF dB/m	Distance (m)	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes
Loop Antenna On													
11.436	12.649		--	10.34	3	-40.00	-17.01	--	29.54	--	-46.5	--	
16.714	12.449		--	10.56	3	-40.00	-16.99	--	29.54	--	-46.5	--	
Loop Antenna Off													
10.926	14.25		--	10.29	3	-40.00	-15.46	--	29.54	--	-45.0	--	
17.134	15.665		--	10.53	3	-40.00	-13.81	--	29.54	--	-43.3	--	
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 Readings													
A.F. = Antenna factor													
Rev. 11.21.14													

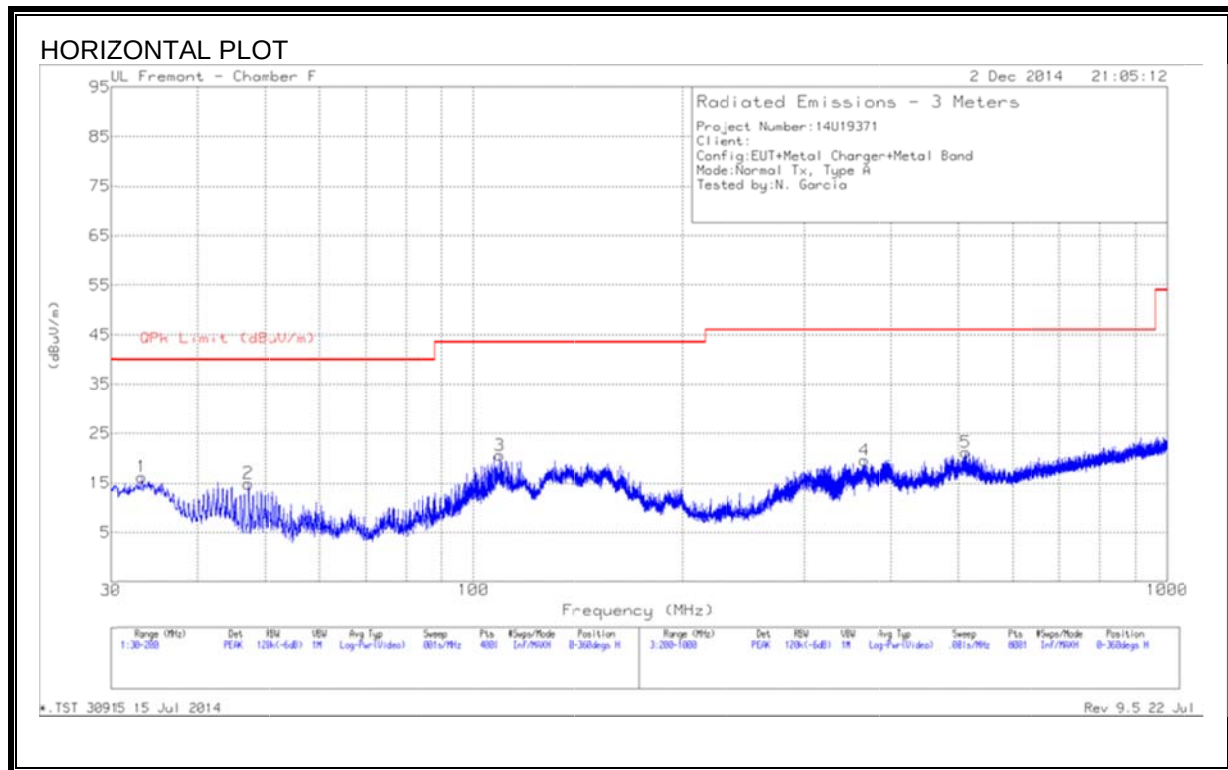
8.4. TYPE B SPURIOUS EMISSIONS (0.15 – 30 MHz)

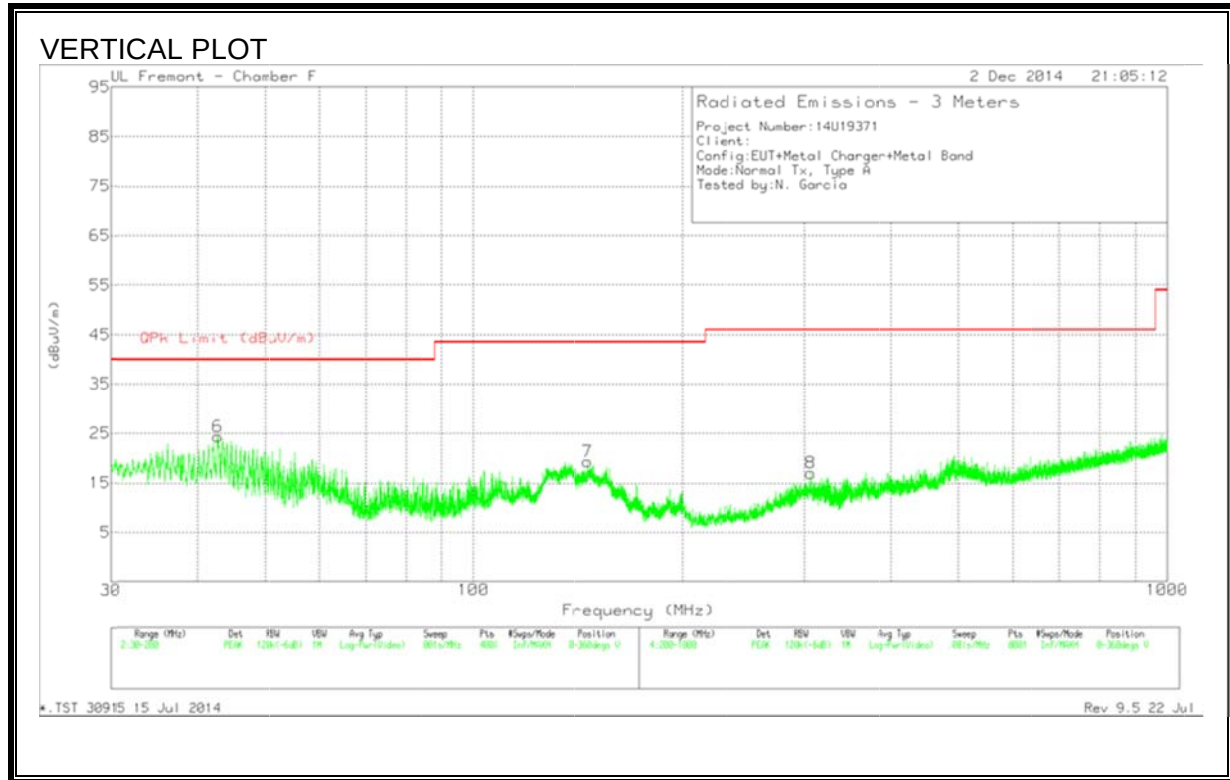
TYPE B, 424 Kbps

FCC Part 15, Subpart B & C														3 Meter Distance Measurement At Emissions Chamber	
Company:															
Project #: 14U19371															
Model #: B50 Type B															
Configuration: EUT + Metal Charger+Metal Band															
Tester: N. Garcia															
Date: 20-Nov-2014															
Frequency (MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	AF dB/m	Distance (m)	Distance Correction (dB)	PK Corrected Reading (dBuV/m)	AV Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	AV Limit (dBuV/m)	PK Margin (dB)	AV Margin (dB)	Notes		
Loop Antenna On															
16.684	13.596		--	10.57	3	-40.00	-15.84	--	29.54	--	-45.4	--			
Loop Antenna Off															
15.994	13.254		--	10.62	3	-40.00	-16.13	--	29.54	--	-45.7	--			
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 Readings A.F. = Antenna factor Rev. 11.21.14															

8.5. TYPE A TX SPURIOUS EMISSION 30 TO 1000 MHz

TYPE A, 424 Kbps





HORIZONTAL DATA AND VERTICAL DATA

Trace Markers

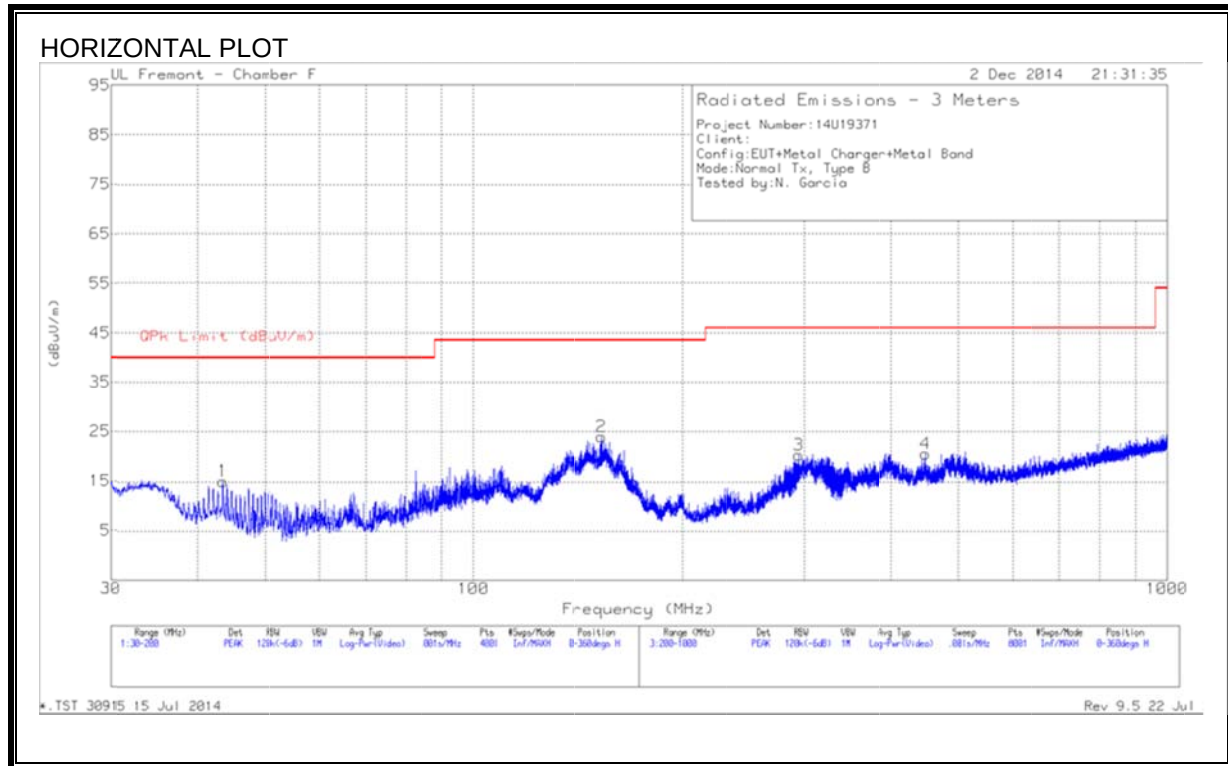
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T122 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	33.315	29.21	PK	18.9	-31.9	16.21	40	-23.79	0-360	201	H
2	47.2975	37.68	PK	9.2	-32	14.88	40	-25.12	0-360	401	H
3	* 109.05	39.46	PK	12.5	-31.4	20.56	43.52	-22.96	0-360	301	H
4	366	35.06	PK	14.9	-30.4	19.56	46.02	-26.46	0-360	100	H
5	512.8	33.42	PK	17.8	-30.1	21.12	46.02	-24.9	0-360	201	H
6	42.75	44.35	PK	11.9	-31.9	24.35	40	-15.65	0-360	100	V
7	145.9825	37.7	PK	12.8	-31.3	19.2	43.52	-24.32	0-360	100	V
8	306.1	34.21	PK	13.5	-30.7	17.01	46.02	-29.01	0-360	100	V

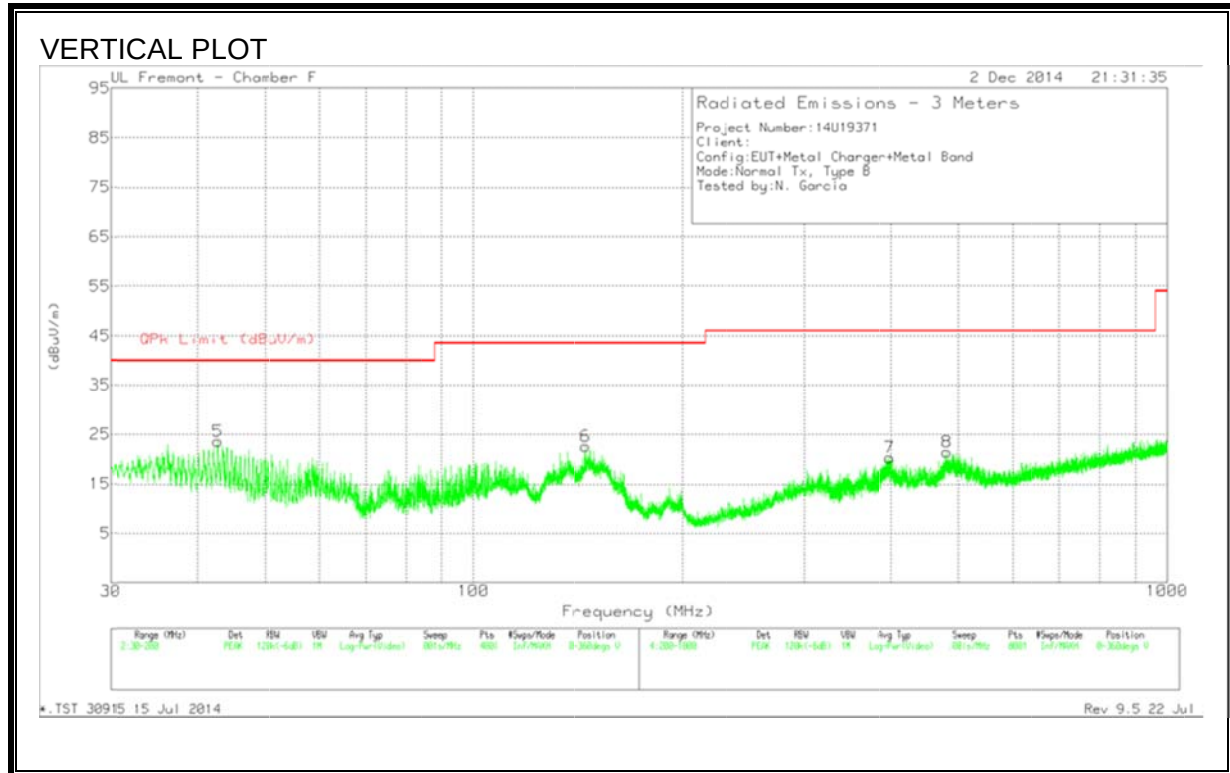
* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK - Peak detector

8.6. TYPE B TX SPURIOUS EMISSION 30 TO 1000 MHz

TYPE B, 424 Kbps





HORIZONTAL AND VERTICAL DATA

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T122 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	43.4725	35.54	PK	11.4	-31.9	15.04	40	-24.96	0-360	301	H
2	152.995	42.71	PK	12.5	-31.3	23.91	43.52	-19.61	0-360	201	H
5	42.75	43.58	PK	11.9	-31.9	23.58	40	-16.42	0-360	100	V
6	145.1325	41.11	PK	12.8	-31.3	22.61	43.52	-20.91	0-360	100	V
3	294.2	37.7	PK	13.3	-30.7	20.3	46.02	-25.72	0-360	100	H
4	449	33.87	PK	16.9	-30.3	20.47	46.02	-25.55	0-360	201	H
7	398.3	35.11	PK	15.5	-30.3	20.31	46.02	-25.71	0-360	100	V
8	481.5	34.02	PK	17.7	-30.3	21.42	46.02	-24.6	0-360	201	V

* - indicates frequency in CFR15.205/IC8.10 Restricted Band

PK - Peak detector

9. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207 (a)
IC RSS-GEN, Section 8.8

(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 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 PROCEDURE

ANSI C63.4, 2009

Note that tests have done in to two different scenarios the normal operations mode that the EUT operate under normal circumstances and terminated mode at which the antenna disconnected from its terminal and the open terminal is connected to the 26 ohms load.

RESULTS

Note: For the final fundamental reading of 13.56MHz frequency, please refer to the plot with antenna port terminated.

9.1. TYPE A, AC MAINS LINE CONDUCTED EMISSIONS

9.1.1. PLASTIC BASE EUT AT NORMAL OPERATIONS

TYPE A, 424 KBPS

6 WORST EMISSIONS

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	.204	42.93	PK	.9	0	43.83	63.4	-19.57	-	-
2	.204	33.75	Av	.9	0	34.65	-	-	53.4	-18.75
3	.5865	42.12	PK	.3	0	42.42	56	-13.58	-	-
4	.5865	31.7	Av	.3	0	32	-	-	46	-14
5	.9465	38.2	PK	.3	0	38.5	56	-17.5	-	-
6	.9465	33.63	Av	.3	0	33.93	-	-	46	-12.07
7	13.56	62.97	PK	.2	.2	63.37	60	3.37	-	-
8	13.56	62.51	Av	.2	.2	62.91	-	-	50	12.91
9	29.6835	38.7	PK	.3	.3	39.3	60	-20.7	-	-
10	29.6835	37.42	Av	.3	.3	38.02	-	-	50	-11.98

Line-L2 .15 - 30MHz

Trace Markers

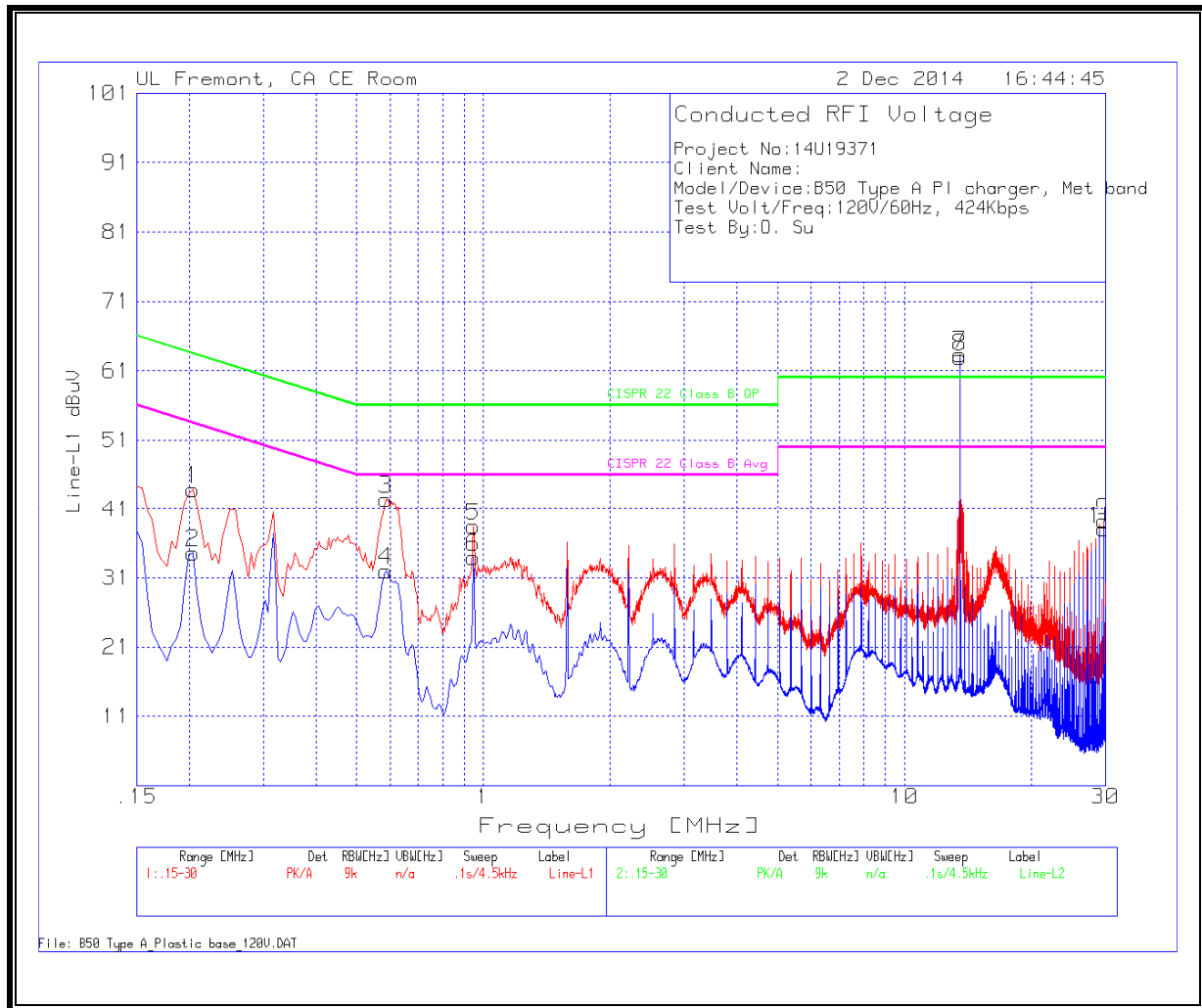
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
11	.1995	42.09	PK	1	0	43.09	63.6	-20.51	-	-
12	.1995	30.59	Av	1	0	31.59	-	-	53.6	-22.01
13	.618	37.16	PK	.3	0	37.46	56	-18.54	-	-
14	.618	21.41	Av	.3	0	21.71	-	-	46	-24.29
15	.942	28.54	PK	.3	0	28.84	56	-27.16	-	-
16	.942	13.92	Av	.3	0	14.22	-	-	46	-31.78
17	13.56	47.34	PK	.3	.2	47.84	60	-12.16	-	-
18	13.56	45.68	Av	.3	.2	46.18	-	-	50	-3.82
19	29.6835	22.57	PK	.3	.3	23.17	60	-36.83	-	-
20	29.6835	19.32	Av	.3	.3	19.92	-	-	50	-30.08

PK - Peak detector

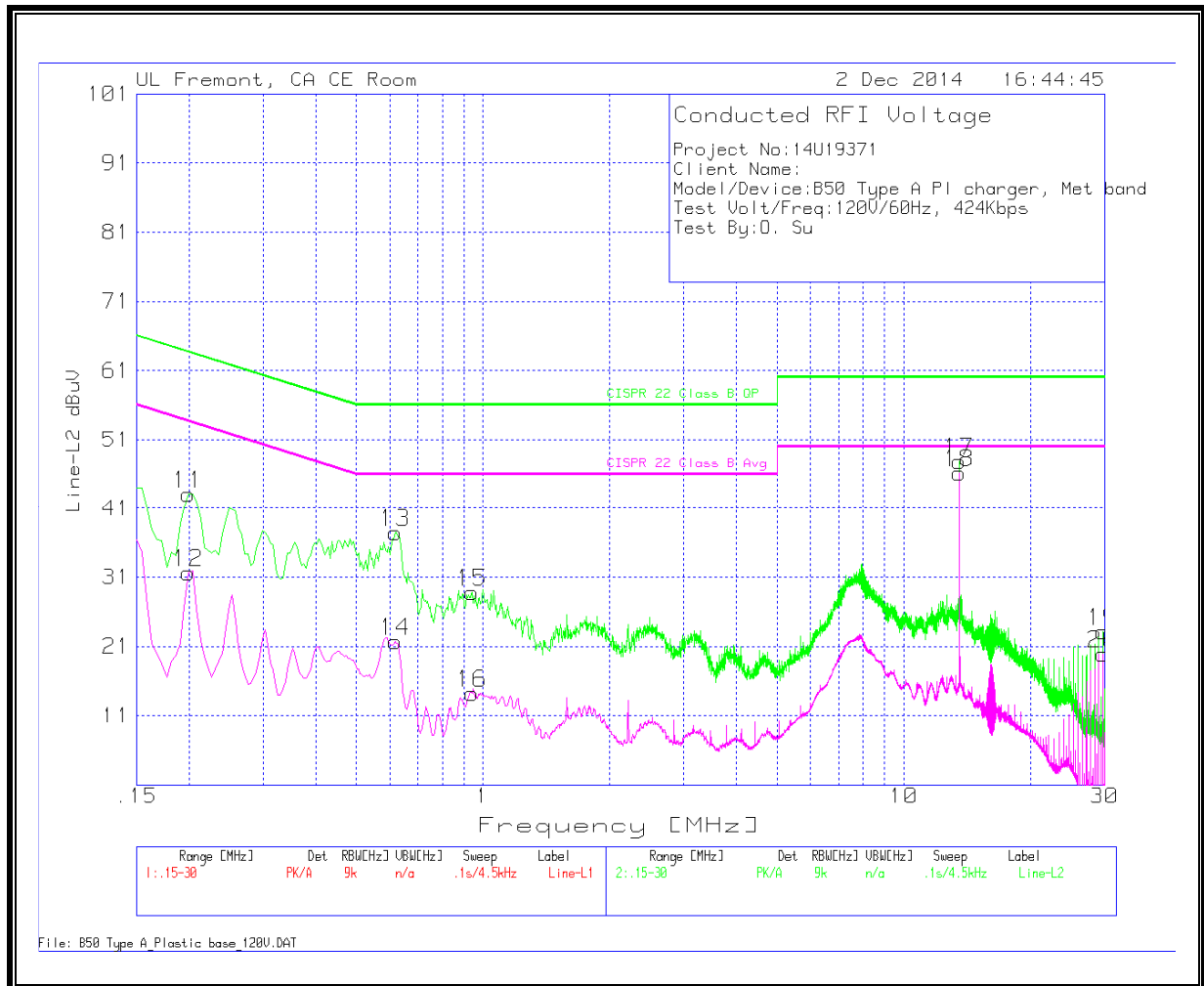
Av - average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under section 9.1.3 below indicates that when the antenna terminal is terminated the fundamental amplitude is lowering below the limit line.

LINE 1 RESULTS



LINE 2 RESULTS



9.1.2. METAL BASE EUT AT NORMAL OPERATIONS

TYPE A, 424 KBPS

6 WORST EMISSIONS

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	.15	50.36	PK	1.4	0	51.76	66	-14.24	-	-
2	.15	35.6	Av	1.4	0	37	-	-	56	-19
3	.645	40.69	PK	.3	0	40.99	56	-15.01	-	-
4	.645	29.76	Av	.3	0	30.06	-	-	46	-15.94
5	13.56	57.51	PK	.2	.2	57.91	60	-2.09	-	-
6	13.56	56.13	Av	.2	.2	56.53	-	-	50	6.53

Line-L2 .15 - 30MHz

Trace Markers

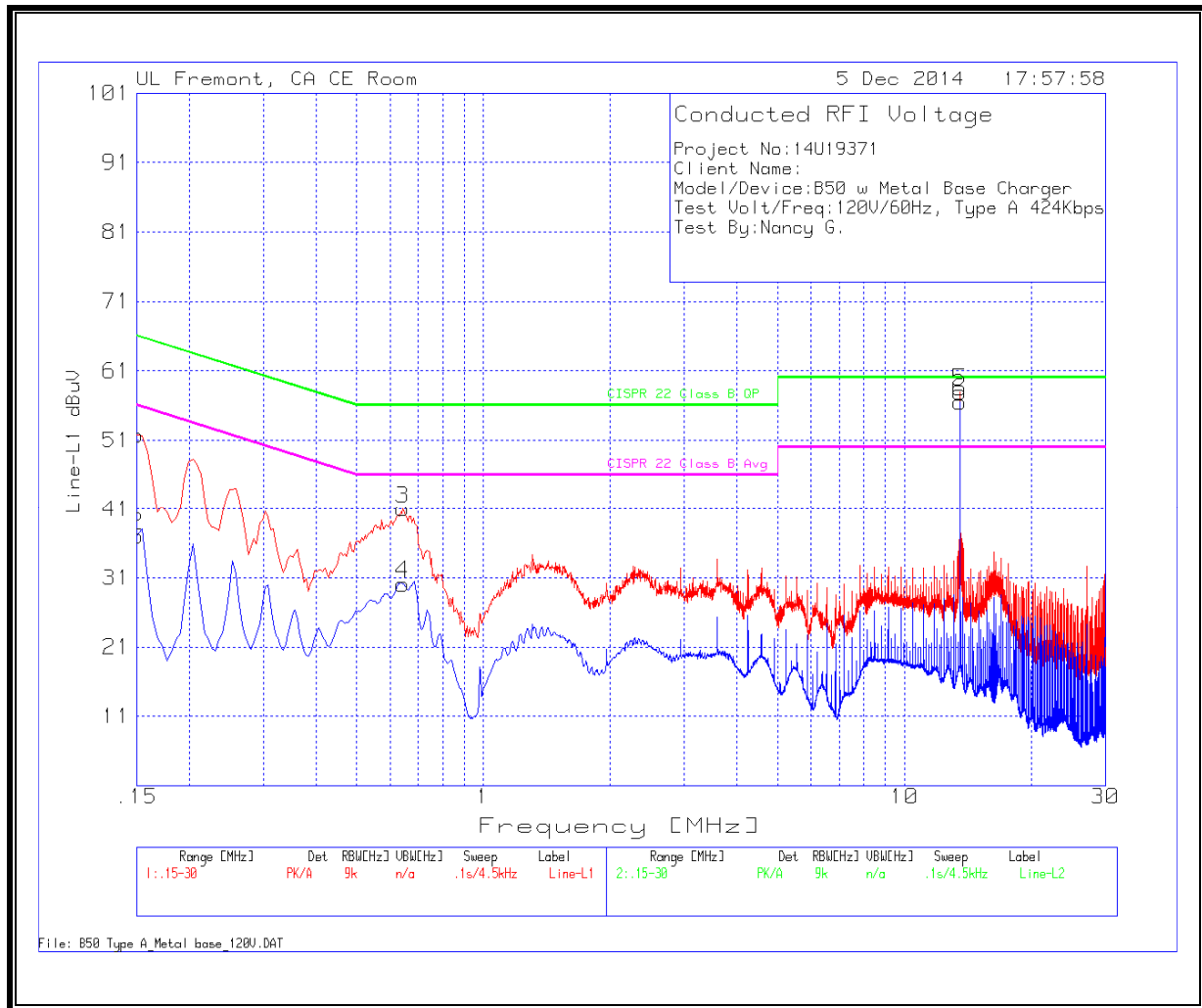
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
7	.1545	50.94	PK	1.4	0	52.34	65.8	-13.46	-	-
8	.1545	36.07	Av	1.4	0	37.47	-	-	55.8	-18.33
9	.654	32.69	PK	.3	0	32.99	56	-23.01	-	-
10	.654	18.23	Av	.3	0	18.53	-	-	46	-27.47
11	13.56	42.93	PK	.3	.2	43.43	60	-16.57	-	-
12	13.56	39.8	Av	.3	.2	40.3	-	-	50	-9.7

PK - Peak detector

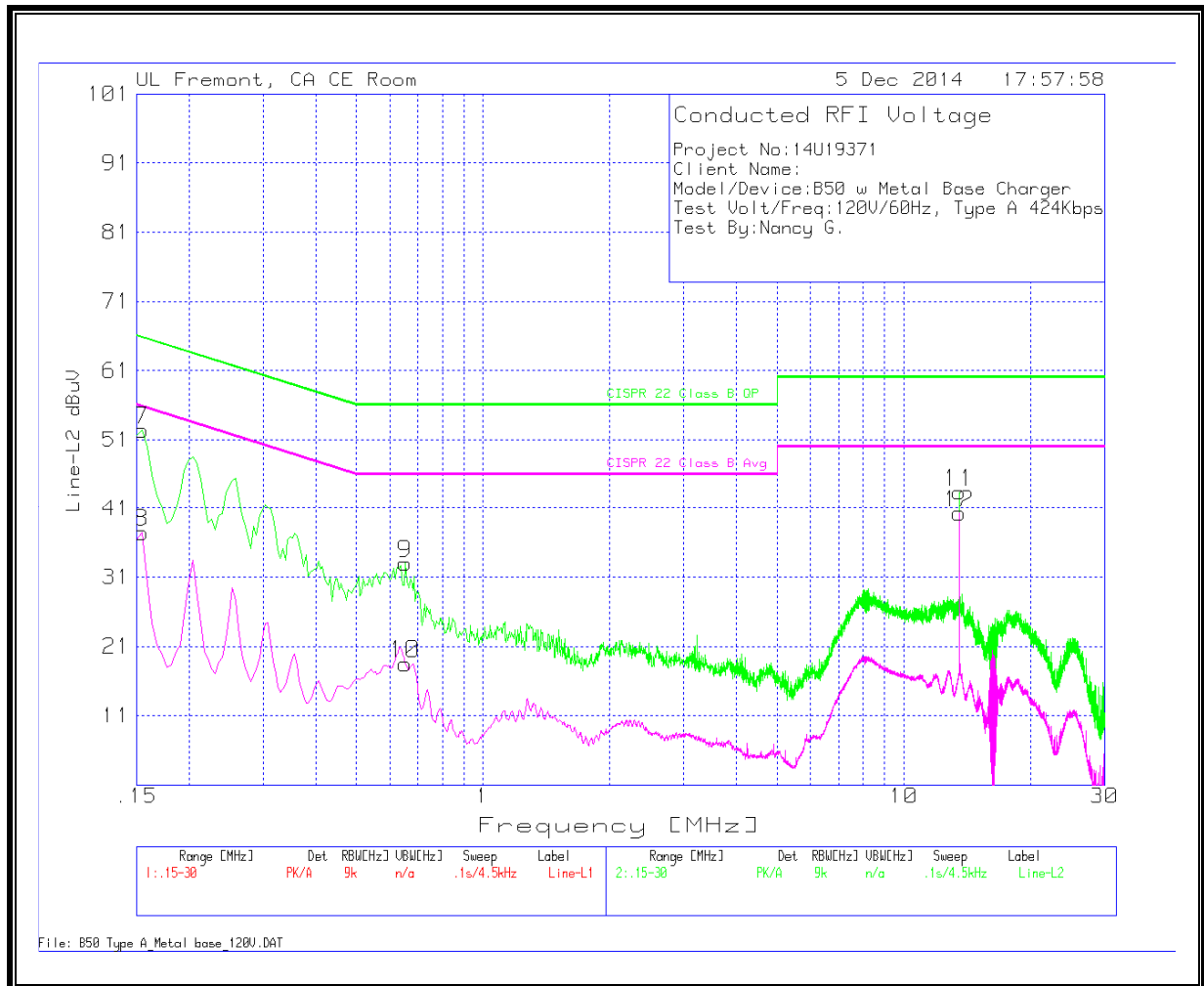
Av - average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under section 9.1.3 below indicates that when the antenna terminal is terminated the fundamental amplitude is lowering below the limit line.

LINE 1 RESULTS



LINE 2 RESULTS



9.1.3. PLASTIC BASE EUT WITH ANTENNA PORT TERMINATED

TYPE A, 424 KBPS

6 WORST EMISSIONS

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	.1635	44.64	PK	1.2	0	45.84	65.3	-19.46	-	-
2	.1635	25.48	Av	1.2	0	26.68	-	-	55.3	-28.62
3	.7755	44.8	PK	.3	0	45.1	56	-10.9	-	-
4	.7755	28.32	Av	.3	0	28.62	-	-	46	-17.38
5	13.56	50.31	PK	.2	.2	50.71	60	-9.29	-	-
6	13.56	43.41	Av	.2	.2	43.81	-	-	50	-6.19
7	27.1185	32.51	PK	.3	.3	33.11	60	-26.89	-	-
8	27.1185	21.47	Av	.3	.3	22.07	-	-	50	-27.93

Line-L2 .15 - 30MHz

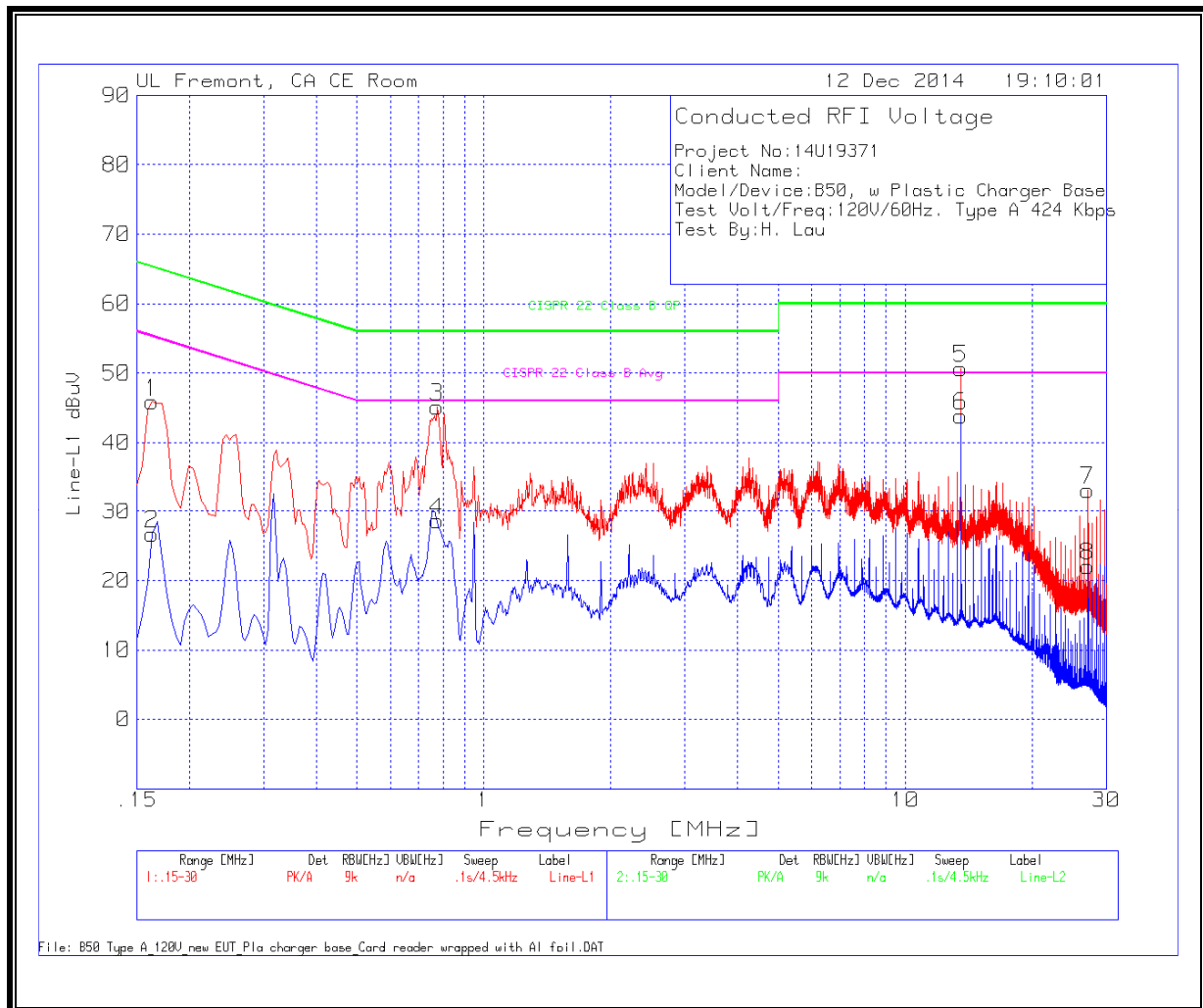
Trace Markers

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)
9	.168	45.05	PK	1.3	0	46.35	65.1	-18.75	-	-
10	.168	24.26	Av	1.3	0	25.56	-	-	55.1	-29.54
11	.744	40.94	PK	.3	0	41.24	56	-14.76	-	-
12	.744	22.01	Av	.3	0	22.31	-	-	46	-23.69
13	13.56	49.1	PK	.3	.2	49.6	60	-10.4	-	-
14	13.56	42.49	Av	.3	.2	42.99	-	-	50	-7.01
15	27.1185	32.47	PK	.3	.3	33.07	60	-26.93	-	-
16	27.1185	21.34	Av	.3	.3	21.94	-	-	50	-28.06

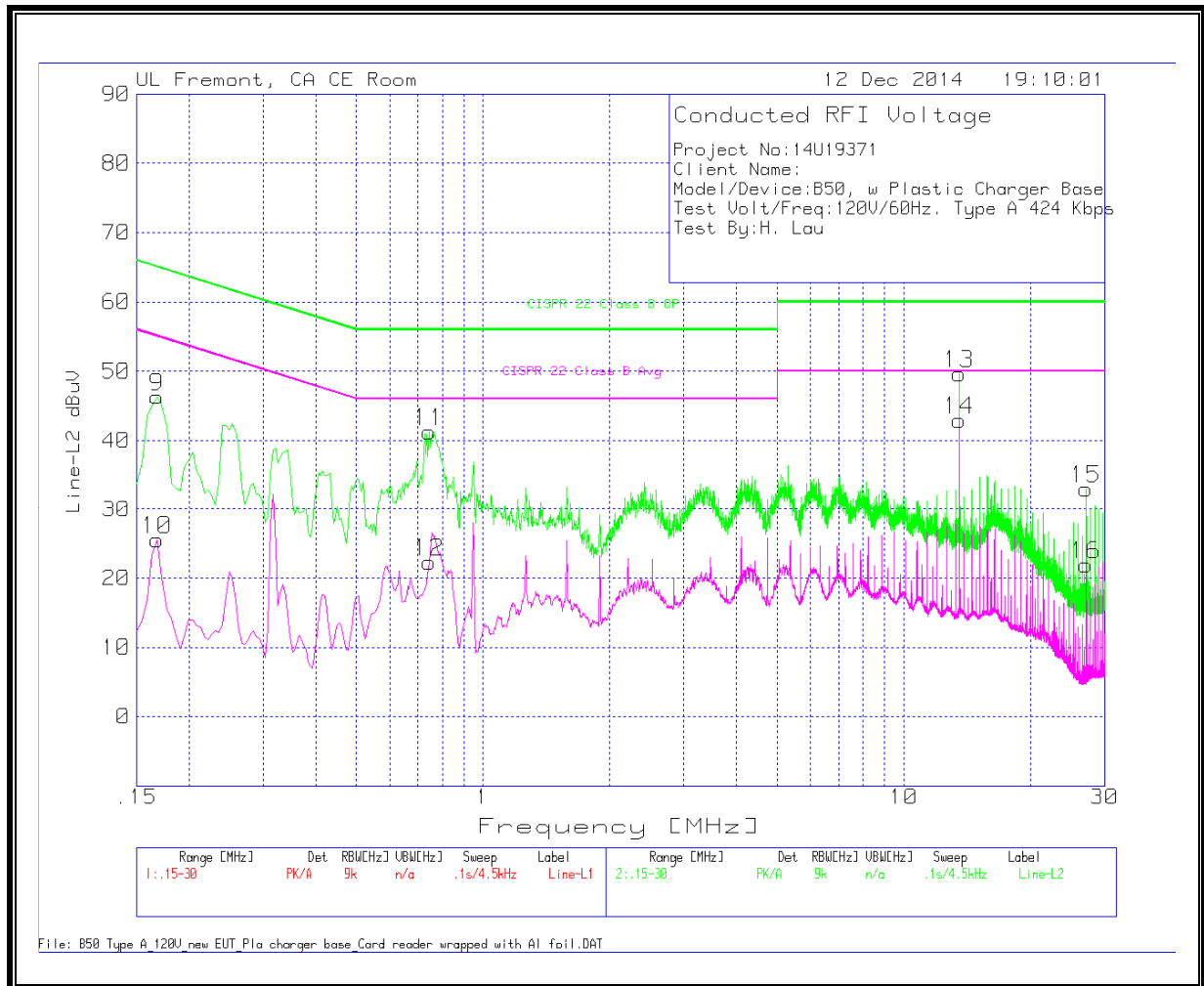
PK - Peak detector

Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS



9.2. TYPE B AC MAINS LINE CONDUCTED EMISSIONS

9.2.1. PLASTIC BASE EUT AT NORMAL OPERATIONS

TYPE B, 424 KBPS

6 WORST EMISSIONS

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	.15	43.81	PK	1.4	0	45.21	66	-20.79	-	-
2	.15	37.28	Av	1.4	0	38.68	-	-	56	-17.32
3	.591	42.53	PK	.3	0	42.83	56	-13.17	-	-
4	.591	31.47	Av	.3	0	31.77	-	-	46	-14.23
5	13.56	62.92	PK	.2	.2	63.32	60	3.32	-	-
6	13.56	62.33	Av	.2	.2	62.73	-	-	50	12.73
7	16.422	33.79	PK	.3	.2	34.29	60	-25.71	-	-
8	16.422	23.42	Av	.3	.2	23.92	-	-	50	-26.08
9	29.0535	38.31	PK	.3	.3	38.91	60	-21.09	-	-
10	29.0535	35.81	Av	.3	.3	36.41	-	-	50	-13.59

Line-L2 .15 - 30MHz

Trace Markers

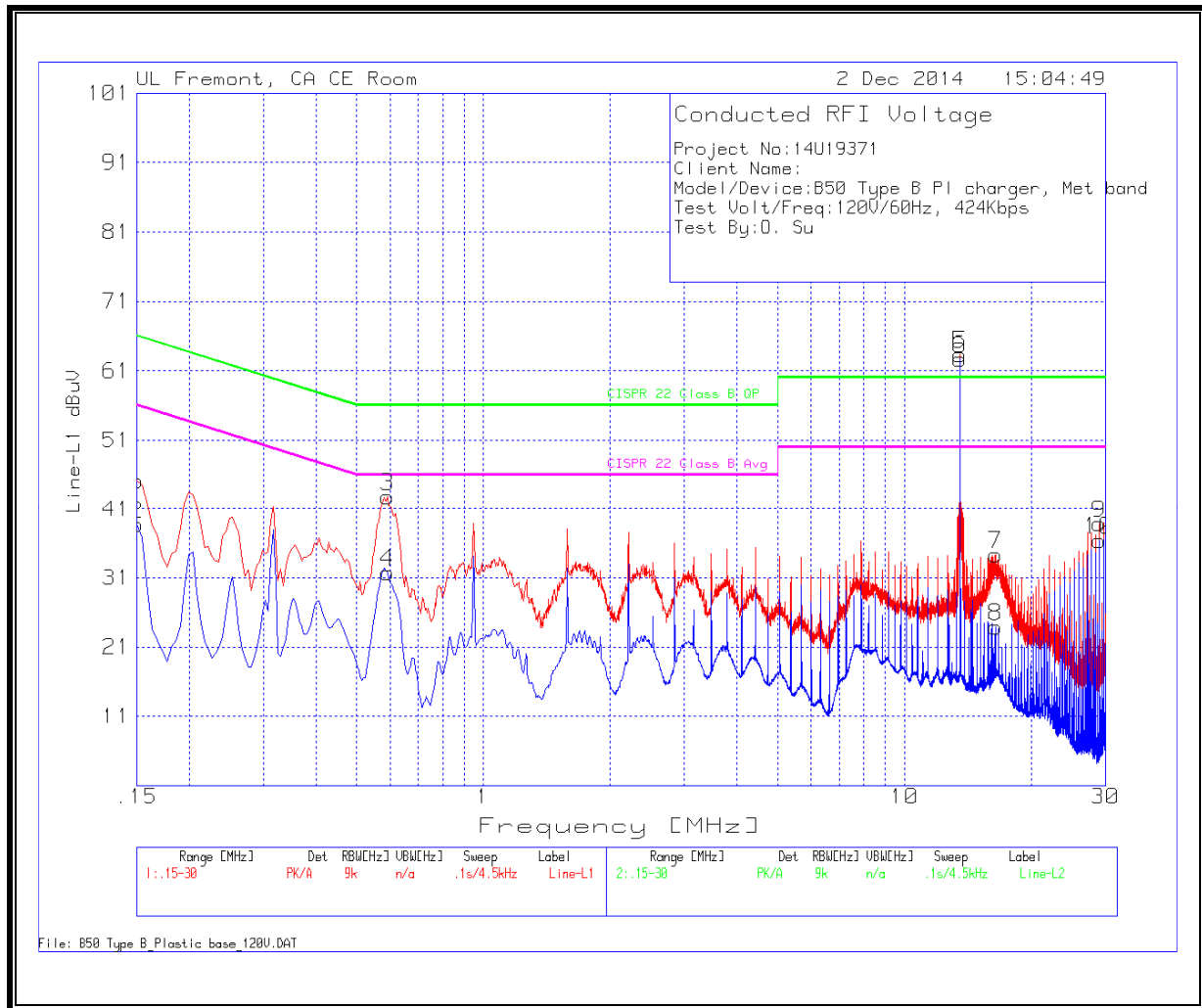
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
11	.15	43.15	PK	1.5	0	44.65	66	-21.35	-	-
12	.15	35.75	Av	1.5	0	37.25	-	-	56	-18.75
13	.204	42.37	PK	1	0	43.37	63.4	-20.03	-	-
14	.204	30.99	Av	1	0	31.99	-	-	53.4	-21.41
15	.618	38.17	PK	.3	0	38.47	56	-17.53	-	-
16	.618	20.89	Av	.3	0	21.19	-	-	46	-24.81
17	13.56	47.7	PK	.3	.2	48.2	60	-11.8	-	-
18	13.56	46.05	Av	.3	.2	46.55	-	-	50	-3.45
19	16.395	24.58	PK	.3	.2	25.08	60	-34.92	-	-
20	16.395	12.23	Av	.3	.2	12.73	-	-	50	-37.27
21	29.0535	22.34	PK	.3	.3	22.94	60	-37.06	-	-
22	29.0535	17.98	Av	.3	.3	18.58	-	-	50	-31.42

PK - Peak detector

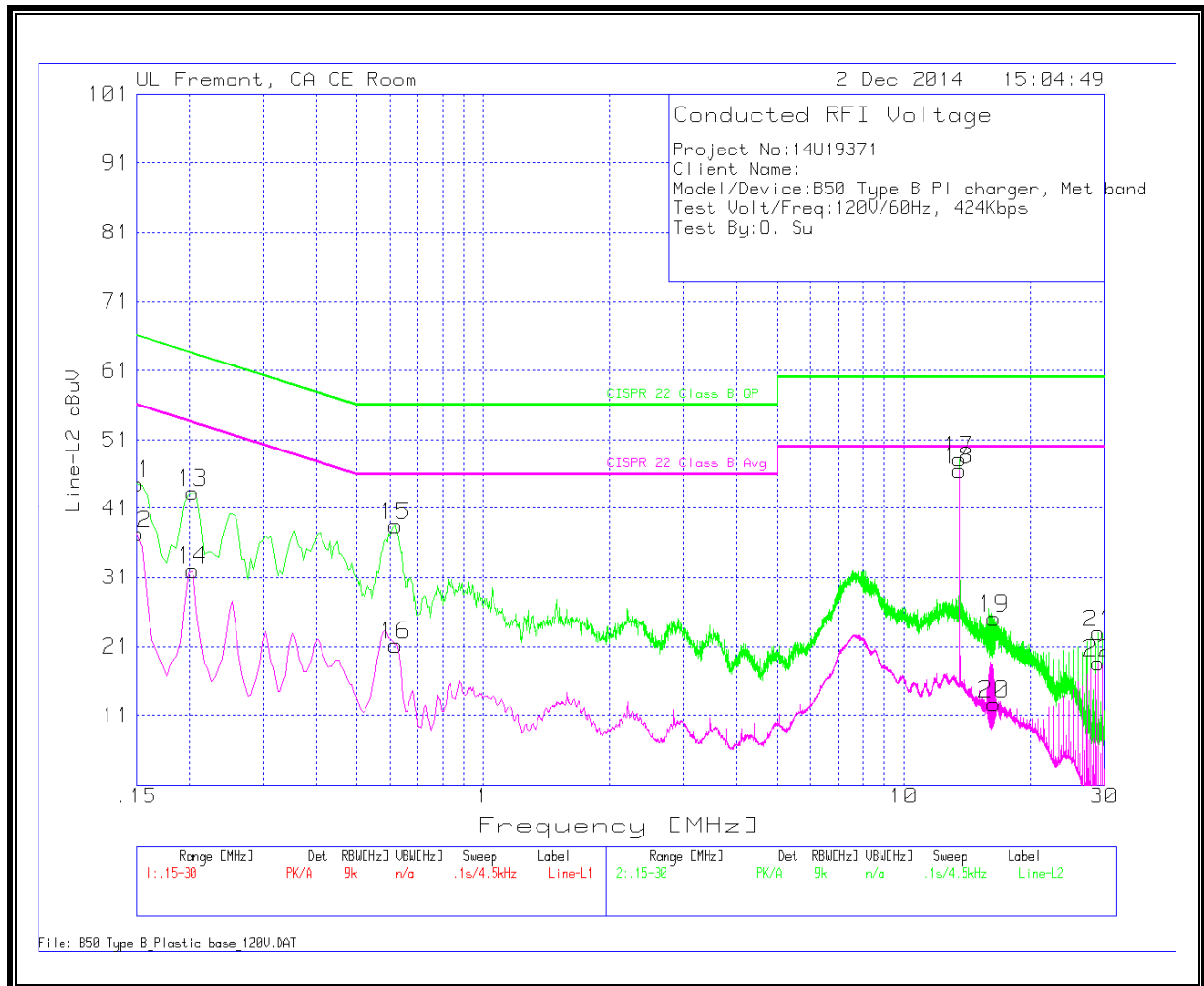
Av - average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under section 9.2.3 below indicates that when the antenna terminal is terminated the fundamental amplitude is lowering below the limit line.

LINE 1 RESULTS



LINE 2 RESULTS



9.2.2. METAL BASE EUT AT NORMAL OPERATIONS

TYPE B, 424 KBPS

6 WORST EMISSIONS

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	.15	43.91	PK	1.4	0	45.31	66	-20.69	-	-
2	.15	37.34	Av	1.4	0	38.74	-	-	56	-17.26
3	.582	41.73	PK	.3	0	42.03	56	-13.97	-	-
4	.582	30.67	Av	.3	0	30.97	-	-	46	-15.03
5	13.56	62.4	PK	.2	.2	62.8	60	2.8	-	-
6	13.56	61.41	Av	.2	.2	61.81	-	-	50	11.81
7	16.233	34.75	PK	.3	.2	35.25	60	-24.75	-	-
8	16.233	17.61	Av	.3	.2	18.11	-	-	50	-31.89
9	27.2805	39.79	PK	.3	.3	40.39	60	-19.61	-	-
10	27.2805	11.15	Av	.3	.3	11.75	-	-	50	-38.25

Line-L2 .15 - 30MHz

Trace Markers

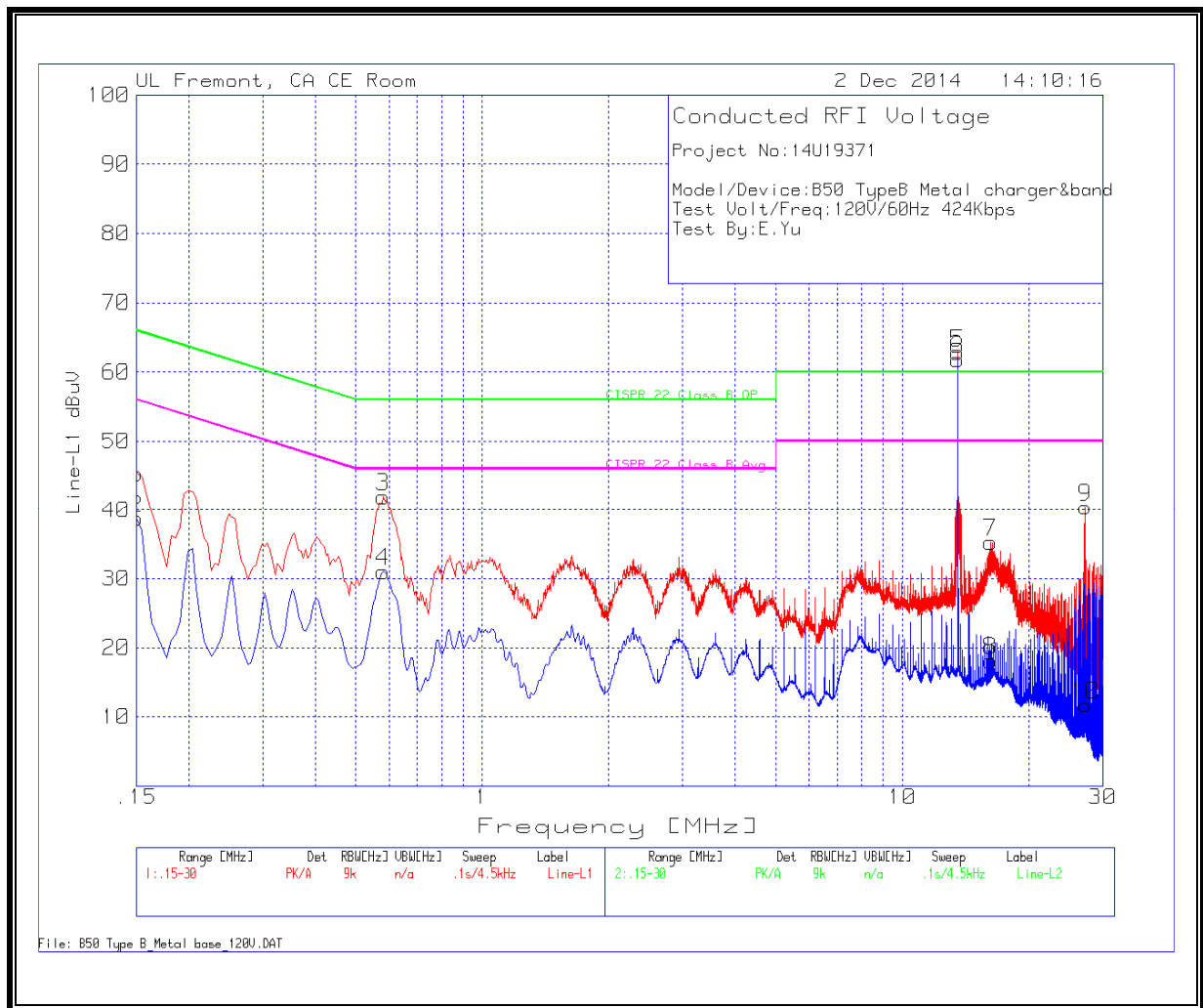
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
11	.1545	43.29	PK	1.4	0	44.69	65.8	-21.11	-	-
12	.1545	34.12	Av	1.4	0	35.52	-	-	55.8	-20.28
13	.6135	39.8	PK	.3	0	40.1	56	-15.9	-	-
14	.6135	20.68	Av	.3	0	20.98	-	-	46	-25.02
15	13.56	47.19	PK	.3	.2	47.69	60	-12.31	-	-
16	13.56	45.16	Av	.3	.2	45.66	-	-	50	-4.34
17	16.1835	24.66	PK	.3	.2	25.16	60	-34.84	-	-
18	16.1835	16.64	Av	.3	.2	17.14	-	-	50	-32.86
19	27.123	21.34	PK	.3	.3	21.94	60	-38.06	-	-
20	27.123	11.47	Av	.3	.3	12.07	-	-	50	-37.93

PK - Peak detector

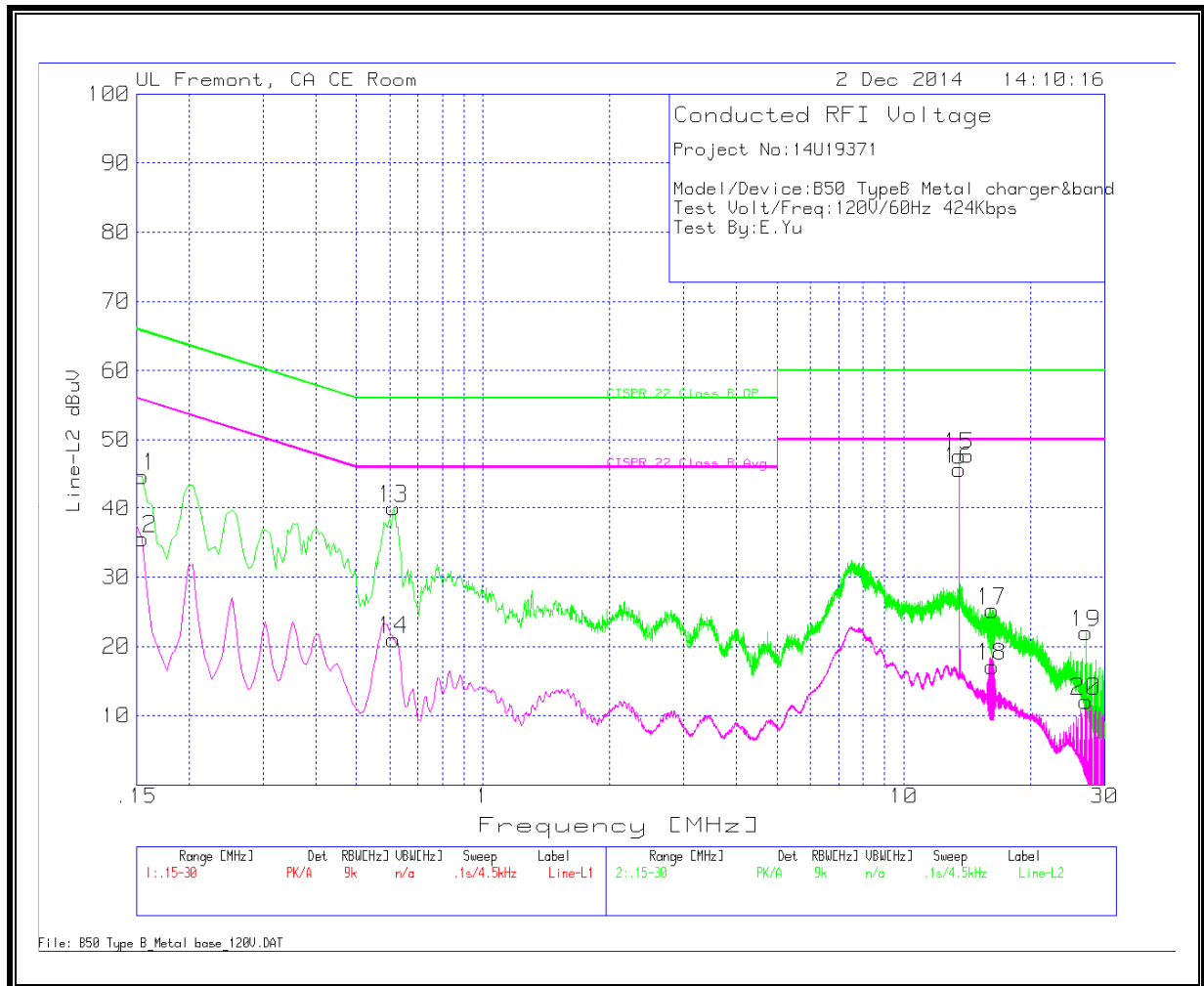
Av - average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under section 9.2.3 below indicates that when the antenna terminal is terminated the fundamental amplitude is lowering below the limit line.

LINE 1 RESULTS



LINE 2 RESULTS



9.2.3. PLASTIC BASE EUT WITH ANTENNA PORT TERMINATED

TYPE B, 424 KBPS 6 WORST EMISSIONS

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	.7845	32.47	PK	.3	0	32.77	56	-23.23	-	-
2	.7845	19.28	Av	.3	0	19.58	-	-	46	-26.42
3	13.56	49.51	PK	.2	.2	49.91	60	-10.09	-	-
4	13.56	43.79	Av	.2	.2	44.19	-	-	50	-5.81
5	16.6965	30.61	PK	.3	.2	31.11	60	-28.89	-	-
6	16.6965	10.94	Av	.3	.2	11.44	-	-	50	-38.56
7	27.123	32.37	PK	.3	.3	32.97	60	-27.03	-	-
8	27.123	22.11	Av	.3	.3	22.71	-	-	50	-27.29

Line-L2 .15 - 30MHz

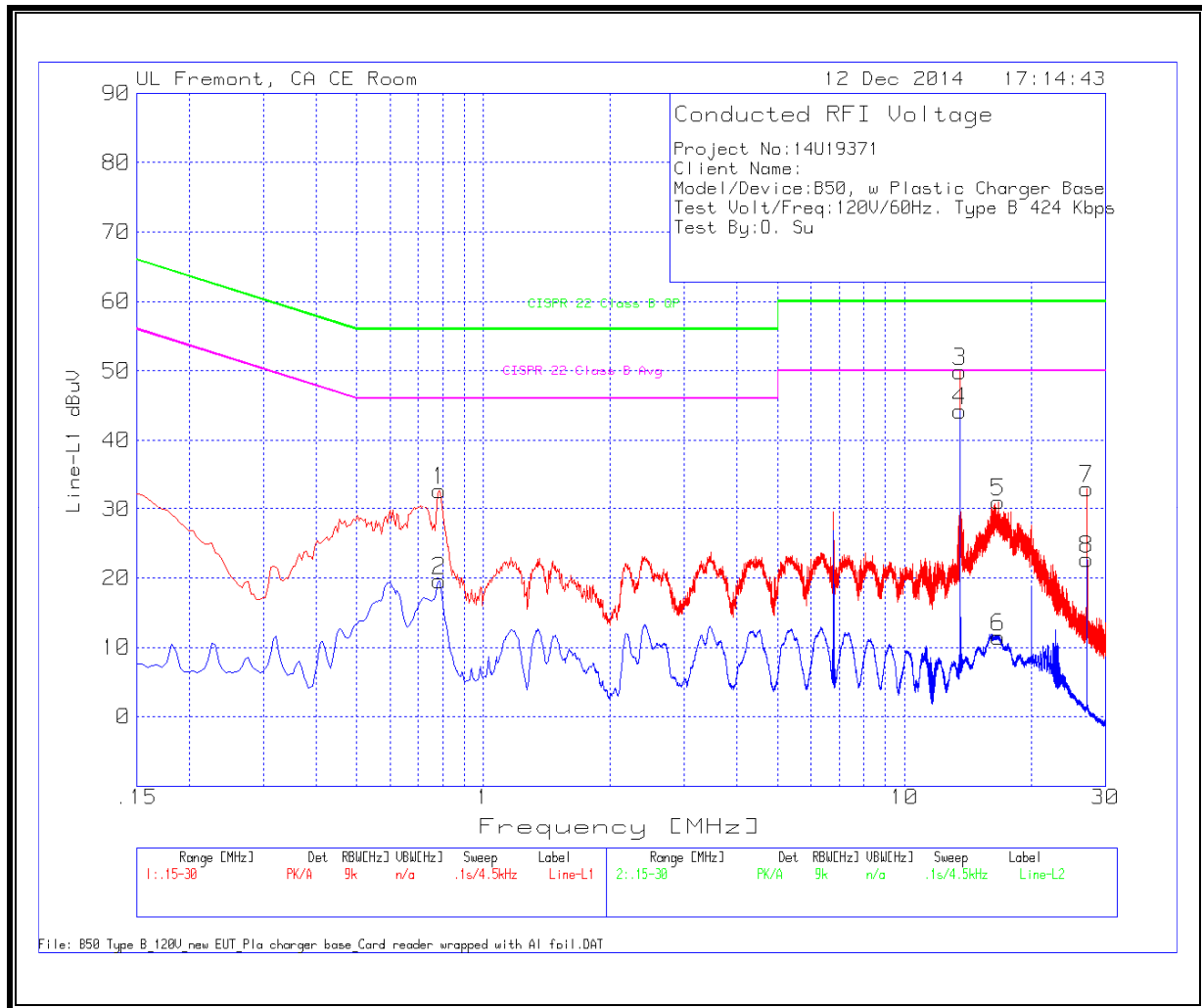
Trace Markers

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)
9	.7845	30.96	PK	.3	0	31.26	56	-24.74	-	-
10	.7845	15.2	Av	.3	0	15.5	-	-	46	-30.5
11	13.56	49.2	PK	.3	.2	49.7	60	-10.3	-	-
12	13.56	42.43	Av	.3	.2	42.93	-	-	50	-7.07
13	16.314	30.37	PK	.3	.2	30.87	60	-29.13	-	-
14	16.314	9.86	Av	.3	.2	10.36	-	-	50	-39.64
15	27.123	32.3	PK	.3	.3	32.9	60	-27.1	-	-
16	27.123	21.36	Av	.3	.3	21.96	-	-	50	-28.04

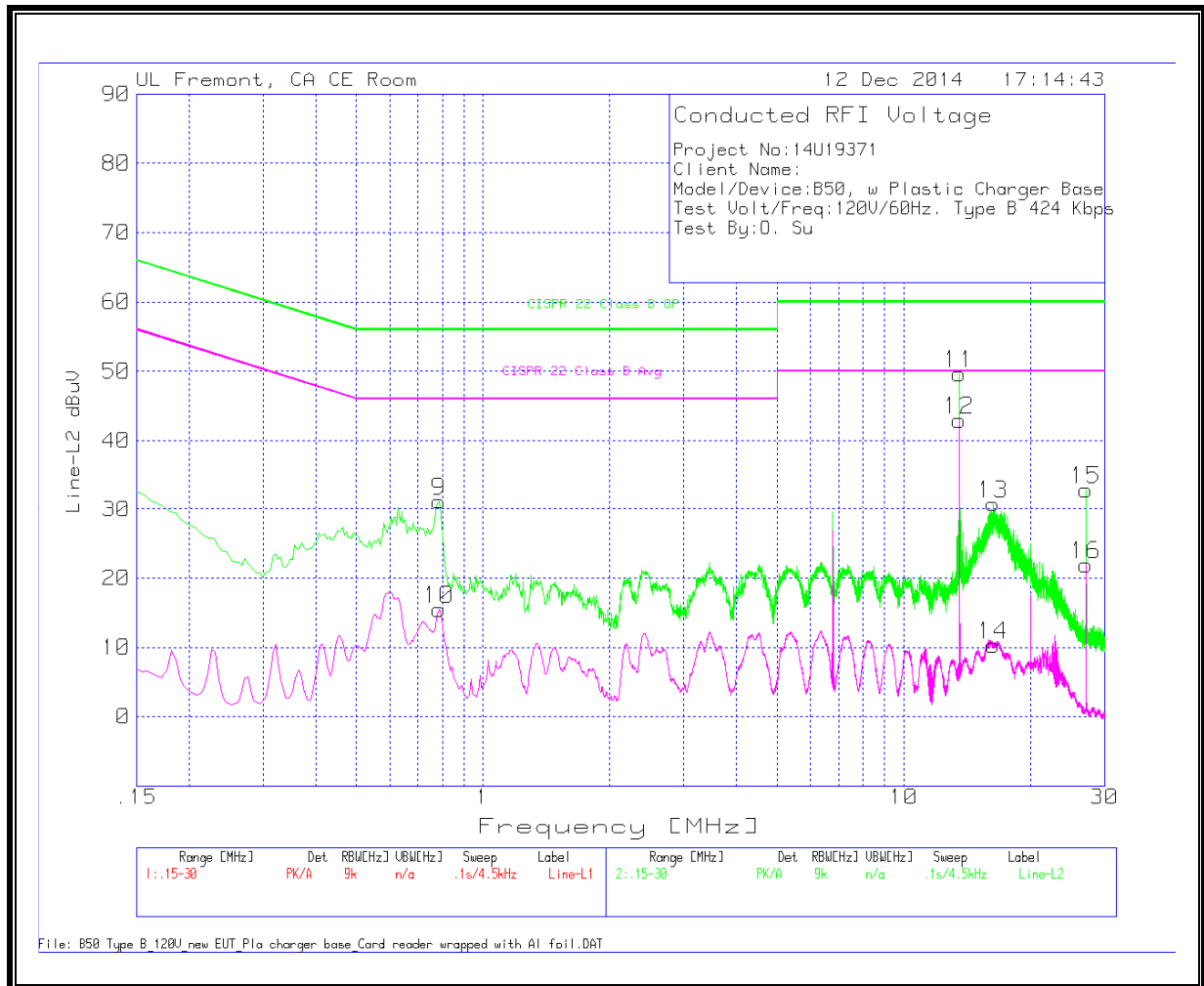
PK - Peak detector

Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS



10. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

RESULTS

No non-compliance noted.

10.1. TYPE A, FREQUENCY STABILITY

TYPE A, 424 Kbps

Reference Frequency: EUT Channel 13.560 MHz @ 20°C Limit: ± 100 ppm = 1.356 kHz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	13.5602146	0.706	± 100
3.80	40	13.5601931	2.291	± 100
3.80	30	13.5602059	1.345	± 100
3.80	20	13.5602241	0.000	± 100
3.80	10	13.5602101	1.035	± 100
3.80	0	13.5602144	0.716	± 100
3.80	-10	13.5602813	-4.214	± 100
3.80	-20	13.5602639	-2.932	± 100
3.30	20	13.5602212	0.214	± 100
4.40	20	13.5602151	0.664	± 100

10.2. TYPE B, FREQUENCY STABILITY

TYPE B, 424Kbps

Reference Frequency: EUT Channel 13.560 MHz @ 20°C Limit: ± 100 ppm = 1.356 kHz				
Power Supply (Vdc)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
3.80	50	13.5602485	-1.603	± 100
3.80	40	13.5602662	-2.912	± 100
3.80	30	13.5602665	-2.928	± 100
3.80	20	13.5602268	0.000	± 100
3.80	10	13.5602471	-1.500	± 100
3.80	0	13.5602580	-2.304	± 100
3.80	-10	13.5602601	-2.458	± 100
3.80	-20	13.5602630	-2.676	± 100
3.30	20	13.5602168	0.736	± 100
4.40	20	13.5602164	0.763	± 100