



**FCC 47 CFR PART 15 SUBPART B**

**CERTIFICATION TEST REPORT**

**FOR**

**GERAN/UMTS/2.4 GHz Qollector Activity Monitor**

**MODEL NUMBER: QOLLECTOR2**

**FCC ID: C9O-QOLL2**

**REPORT NUMBER: 15U21180-E1V2**

**ISSUE DATE: November 11, 2015**

**Prepared for  
SRAM LLC  
1000 W Fulton Market, 4th Floor  
Chicago, IL, 60607  
United States**

*Prepared by*  
**UL VERIFICATION SERVICES INC.  
47173 BENICIA STREET  
FREMONT, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888**

**NVLAP**<sup>®</sup>

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	08/06/15	Initial issue	C.S.OOI
V2	11/11/15	Remove Above 1GH RE test Data Add Data Transfer Mode Test Data	C.S.OOI

---

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>4</b>
<b>2. TEST METHODOLOGY .....</b>	<b>5</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>5</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>5</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i> .....	5
4.2. <i>SAMPLE CALCULATION</i> .....	5
4.3. <i>MEASUREMENT UNCERTAINTY</i> .....	5
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>6</b>
5.1. <i>DESCRIPTION OF EUT</i> .....	6
5.2. <i>PRELIMINARY TEST CONFIGURATIONS</i> .....	6
5.3. <i>MODE(S) OF OPERATION INVESTIGATED</i> .....	6
5.4. <i>MODIFICATIONS</i> .....	6
5.5. <i>DETAILS OF TESTED SYSTEM</i> .....	7
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>9</b>
<b>7. APPLICABLE LIMITS AND TEST RESULTS .....</b>	<b>11</b>
7.1. <i>RADIATED EMISSIONS</i> .....	11
7.2. <i>AC MAINS LINE CONDUCTED EMISSIONS</i> .....	16
<b>8. SETUP PHOTOS.....</b>	<b>23</b>

## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SRAM LLC  
**EUT DESCRIPTION:** GERAN/UMTS/2.4 GHz  
**MODEL:** QOLLECTOR2  
**SERIAL NUMBER:** LX-00052510  
**DATE TESTED:** July 31, 2015 –November 10, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART B	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.

Approved & Released For  
UL Verification Services Inc. By:



CHOON SIAN OOI  
CONSUMER TECHNOLOGY DIVISION  
PROJECT LEAD  
UL Verification Services Inc.

Tested By:



ANGEL ESCAMILLA  
CONSUMER TECHNOLOGY DIVISION  
LAB ENGINEER  
UL Verification Services Inc.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009.

## 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 checked="" type="checkbox"/> Chamber A(IC: 2324B-1)	<input type="checkbox"/> Chamber D(IC: 2324B-4)
<input type="checkbox"/> Chamber B(IC: 2324B-2)	<input type="checkbox"/> Chamber E(IC: 2324B-5)
<input type="checkbox"/> Chamber C(IC: 2324B-3)	<input type="checkbox"/> Chamber F(IC: 2324B-6)
	<input type="checkbox"/> Chamber G(IC: 2324B-7)
	<input type="checkbox"/> Chamber H(IC: 2324B-8)

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 GERAN/UMTS/2.4 GHz body worn monitoring and reporting application.

AC Adapter Power Requirements	Input: 100-240 VAC / 50-60 Hz, 0.15A
List of frequencies generated or used by the EUT	60MHz (Processor Clock)

### 5.2. PRELIMINARY TEST CONFIGURATIONS

The EUT was investigated in three orthogonal orientations X, Y, Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

### 5.3. MODE(S) OF OPERATION INVESTIGATED

Mode	Description
Charging Mode	Charging with supplied USB charger. EUT and its charger shall be on back edge of table, with charger connected to extension cord.
Data Transfer	Data transfer with client's Linux laptop PC via USB. PC shall be in minimum configuration per Special instructions above.

### 5.4. MODIFICATIONS

No modifications were made during testing.

## 5.5. DETAILS OF TESTED SYSTEM

### SUPPORT EQUIPMENT & PERIPHERALS

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Ethernet Switch	NETGEAR	EN106	ENT6A99003602
Laptop	ASUS	Eee PC1011PX	C10AAS088396
Laptop AC Adapter	ASUS	EXA1004UH	04G26B001130132011741

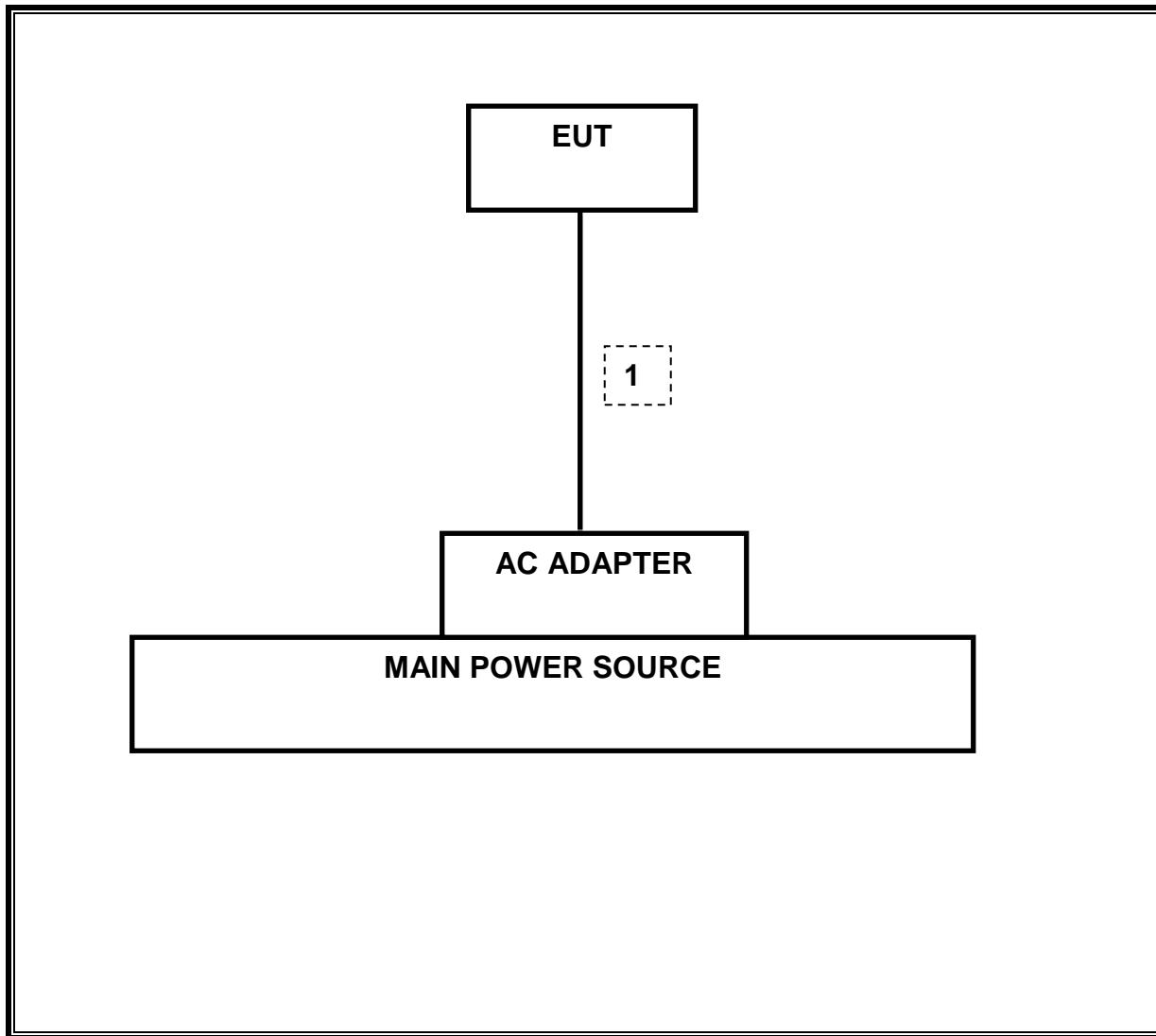
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length m	Remarks
1	USB	1	USB	Shielded	1	N/A
2	DC Power	1	Power	Shielded	1	N/A
3	Ethernet	1	RJ45	Unshielded	1	N/A
4	AC Power	1	IEC	Unshielded	1	N/A

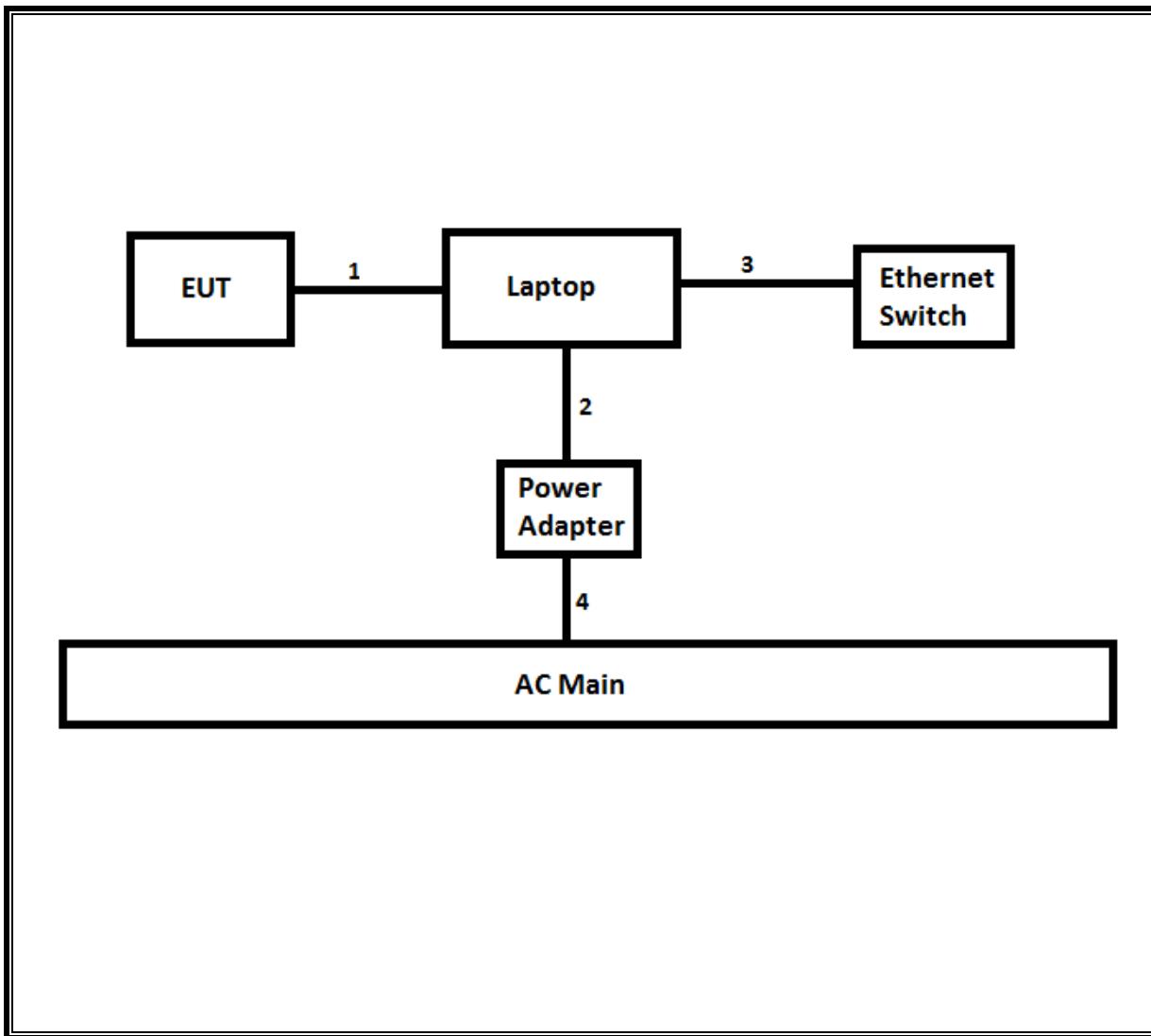
### TEST SETUP

The EUT was set in standby mode.

**TEST SETUP DIAGRAM (Charging Mode)**



**TEST SETUP DIAGRAM (Data Transfer Mode)**



## 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	S/N	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/15
Preamplifier, 1300 MHz	Agilent/HP	8447D	T10	01/16/16
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	477	6/10/2015
Preamplifier, 26.5 GHz	Agilent/HP	8449B	3008A04710	04/13/16
Antenna, Horn, 18 GHz	ETS	3117	T119	01/15/16
EMI Test Receiver, 9KHz to 7GHz	Rohde & Schwarz	ESCI 7	284	09/16/16
LISN, 30 MHz	FCC	50/250-25-2	114	01/16/16
LISN	Solar	8012-50-R-24-BNC	29	06/11/16

Test Software			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, June 24, 2015
Conducted Software	UL	UL EMC	Ver 9.5, May 26 2015

## 7. APPLICABLE LIMITS AND TEST RESULTS

### 7.1. RADIATED EMISSIONS

#### TEST PROCEDURE

ANSI C63.4: 2009

#### LIMIT

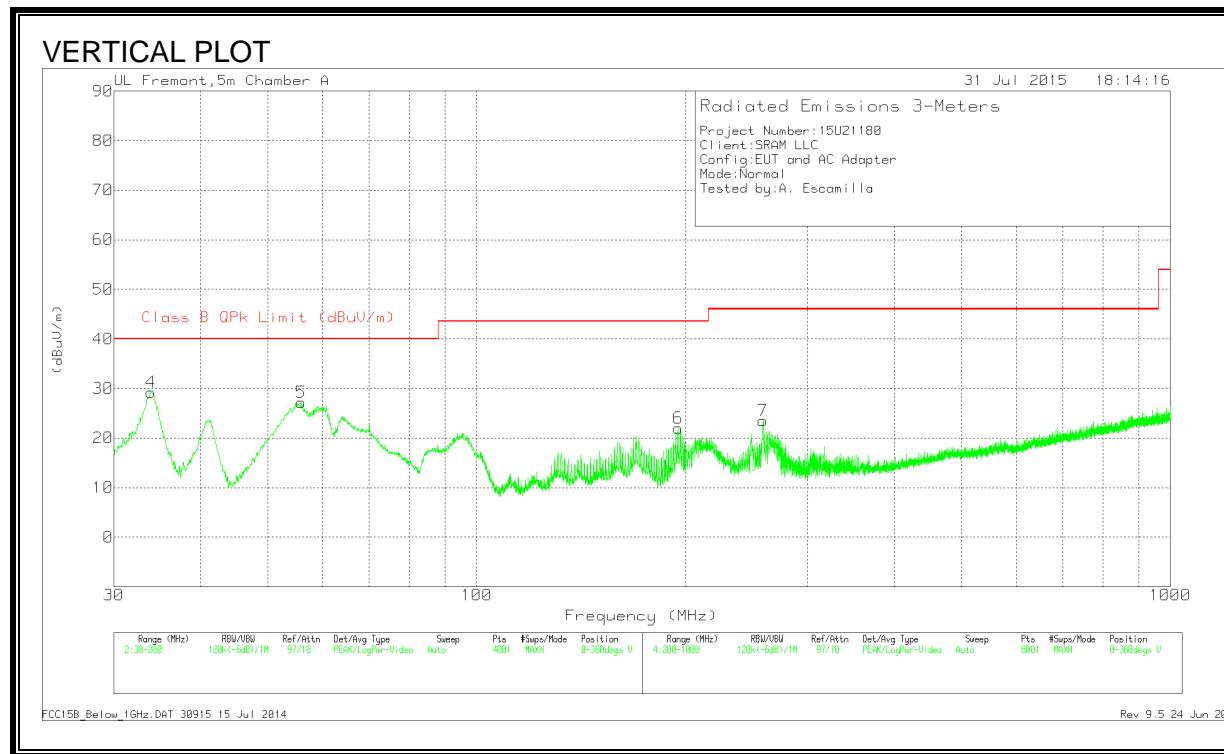
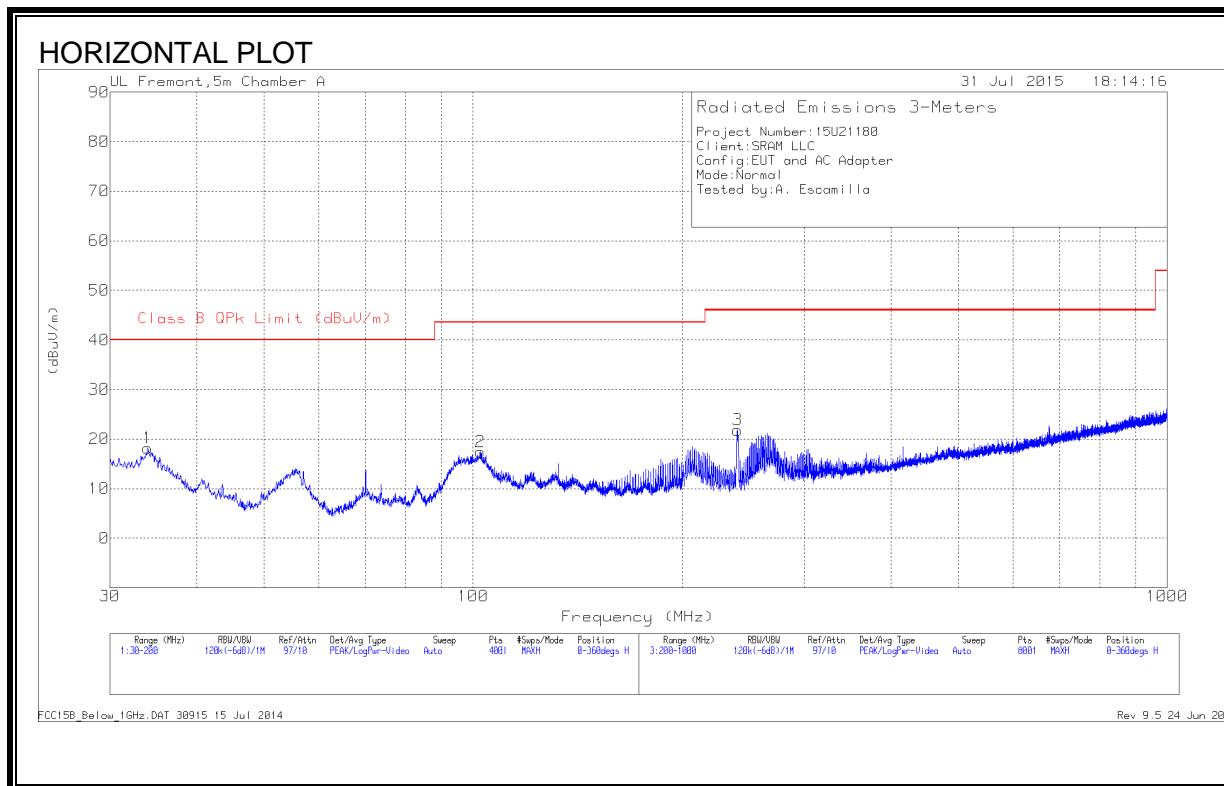
§15.109 (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Limits for radiated disturbance of Class B ITE at measuring distance of 3 m	
Frequency range (MHz)	Quasi-peak limits (dB $\mu$ V/m)
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960 MHz	54

Note: The lower limit shall apply at the transition frequency.

## RESULTS (Charging Mode)

### RADIATED EMISSIONS 30 TO 1000 MHZ (WORST-CASE CONFIGURATION)



## HORIZONTAL AND VERTICAL DATA

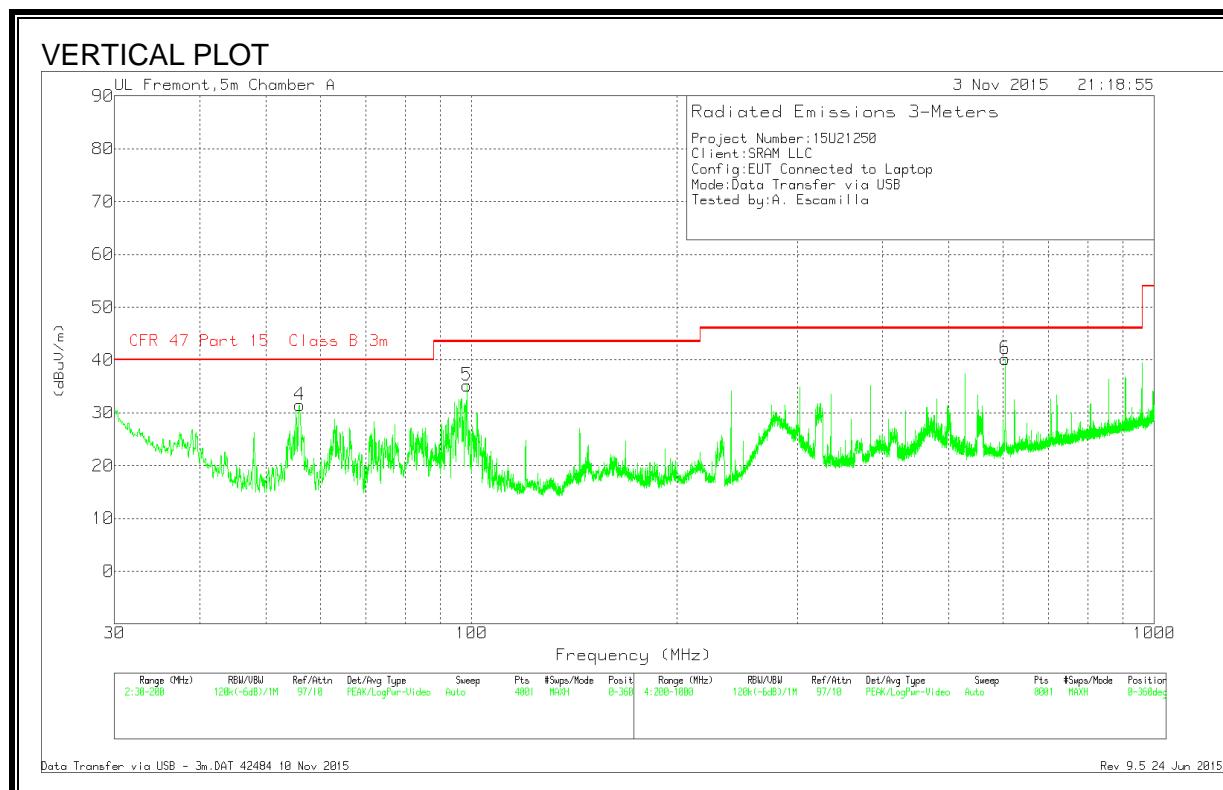
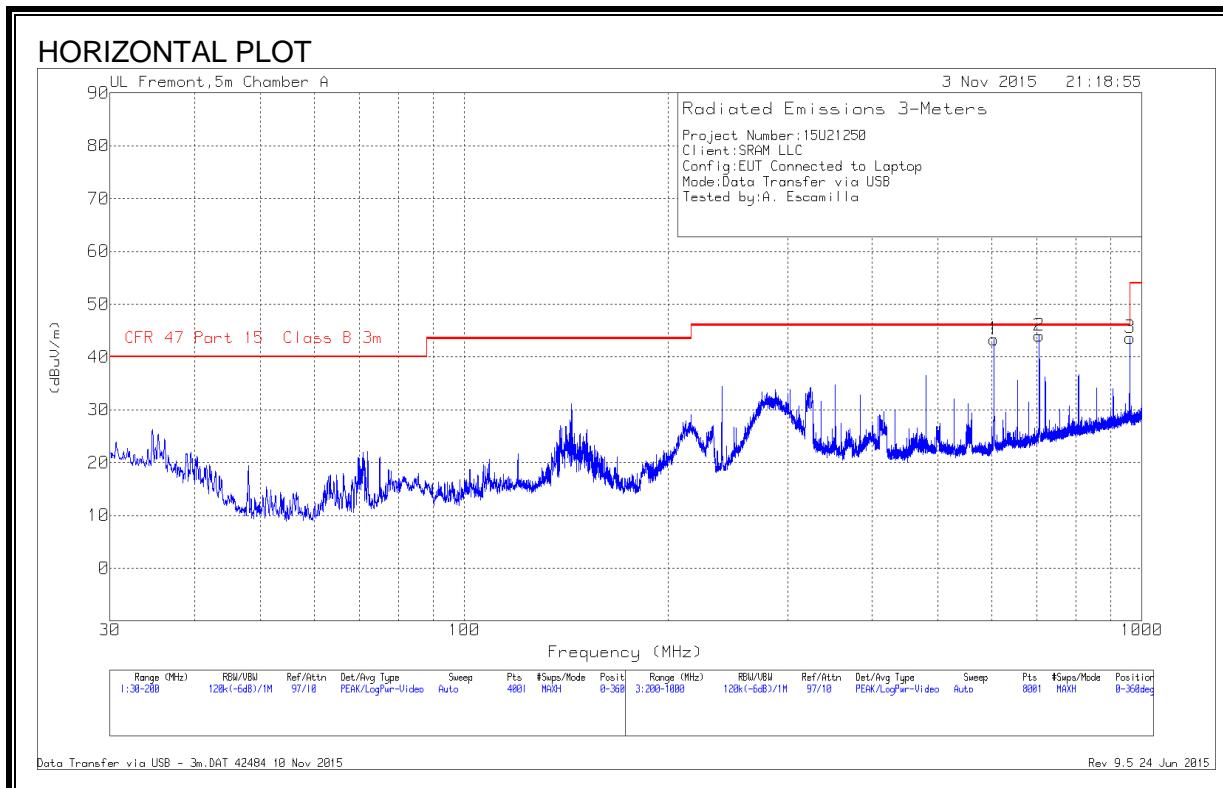
### Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	33.9525	42.03	Pk	18.4	-31.2	29.23	40	-10.77	0-360	101	V
1	33.995	31	Pk	18.4	-31.2	18.2	40	-21.8	0-360	100	H
5	55.7975	50.96	Pk	7.1	-30.9	27.16	40	-12.84	0-360	101	V
2	102.3988	37.52	Pk	10.4	-30.5	17.42	43.52	-26.1	0-360	299	H
6	195.155	40	Pk	12	-30	22	43.52	-21.52	0-360	101	V
3	240.4	40.01	Pk	11.5	-29.7	21.81	46.02	-24.21	0-360	399	H
7	258.9	41.18	Pk	11.9	-29.6	23.48	46.02	-22.54	0-360	101	V

PK - Peak detector

## RESULTS (Data Transfer Mode)

### RADIATED EMISSIONS 30 TO 1000 MHZ (WORST-CASE CONFIGURATION)



### Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	CFR 47 Part 15 Class B 3m	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	56.01	51.35	Pk	11	-30.9	31.45	40	-8.55	0-360	100	V
5	98.4675	52.1	Pk	13.7	-30.6	35.2	43.52	-8.32	0-360	100	V
1	604.8	49.24	Pk	22.6	-28.5	43.34	46.02	-2.68	0-360	101	H
6	604.8	46.12	Pk	22.6	-28.5	40.22	46.02	-5.8	0-360	101	V
2	705.6	47.82	Pk	24.3	-28.1	44.02	46.02	-2	0-360	101	H
3	960.2	43.64	Pk	26.9	-26.9	43.64	53.97	-10.33	0-360	101	H

Pk - Peak detector

### Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	CFR 47 Part 15 Class B 3m	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
55.8487	43.58	Qp	11	-30.9	23.68	40	-16.32	77	109	V
98.4492	47.72	Qp	13.7	-30.6	30.82	43.52	-12.7	134	106	V
604.8178	45.45	Qp	22.6	-28.5	39.55	46.02	-6.47	198	101	V
604.8192	48.39	Qp	22.6	-28.5	42.49	46.02	-3.53	106	123	H
705.6394	47.25	Qp	24.3	-28.1	43.45	46.02	-2.57	167	101	H
960.1467	31.98	Qp	26.9	-26.9	31.98	53.97	-21.99	191	181	H

Qp - Quasi-Peak detector

Data Transfer via USB - 3m.DAT 42484 10 Nov 2015  
Rev 9.5 24 Jun 2015

## 7.2. AC MAINS LINE CONDUCTED EMISSIONS

### TEST PROCEDURE

ANSI C63.4: 2009

### LIMIT

§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  $\mu$ 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 $\mu$ 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

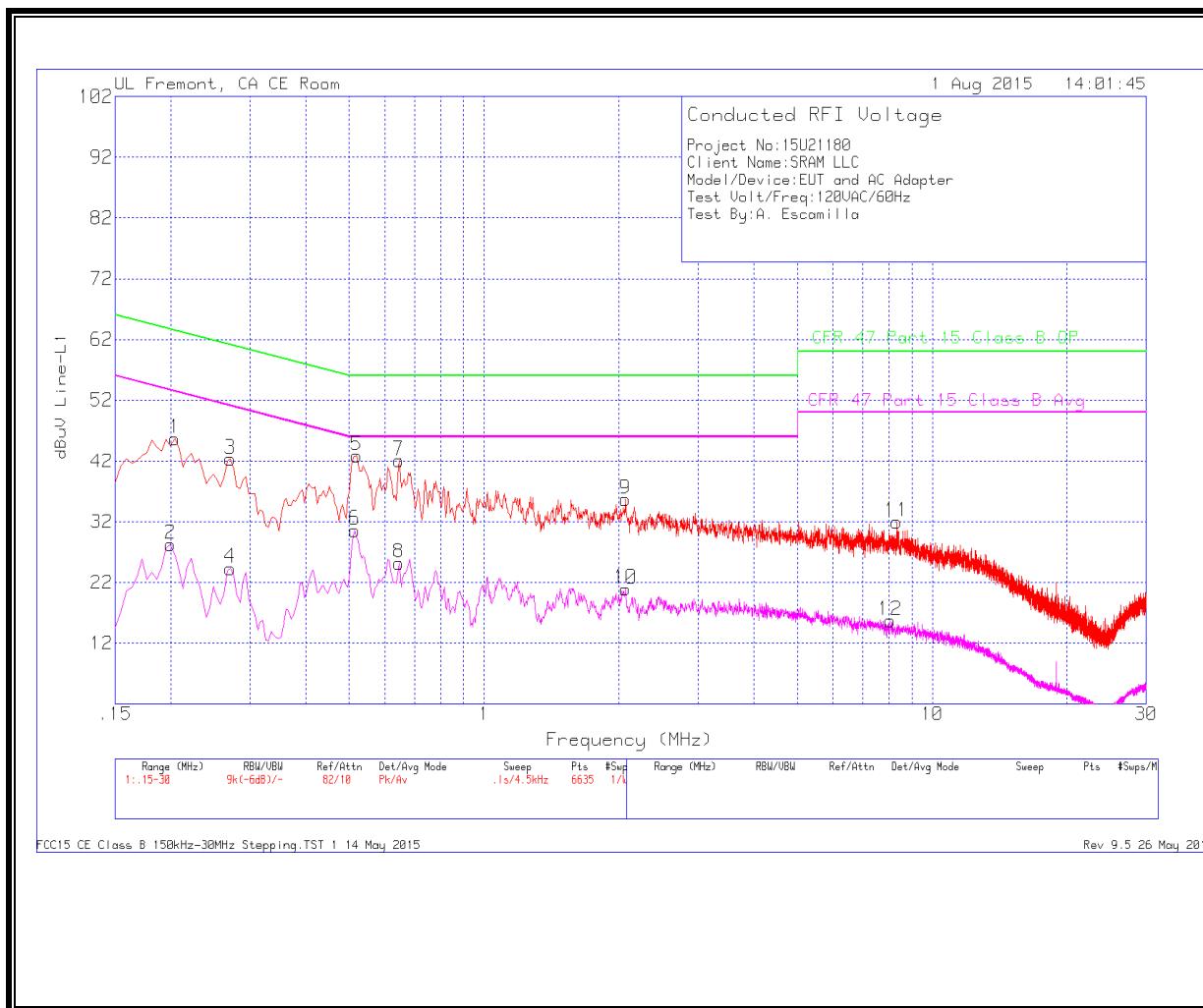
Notes:

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.

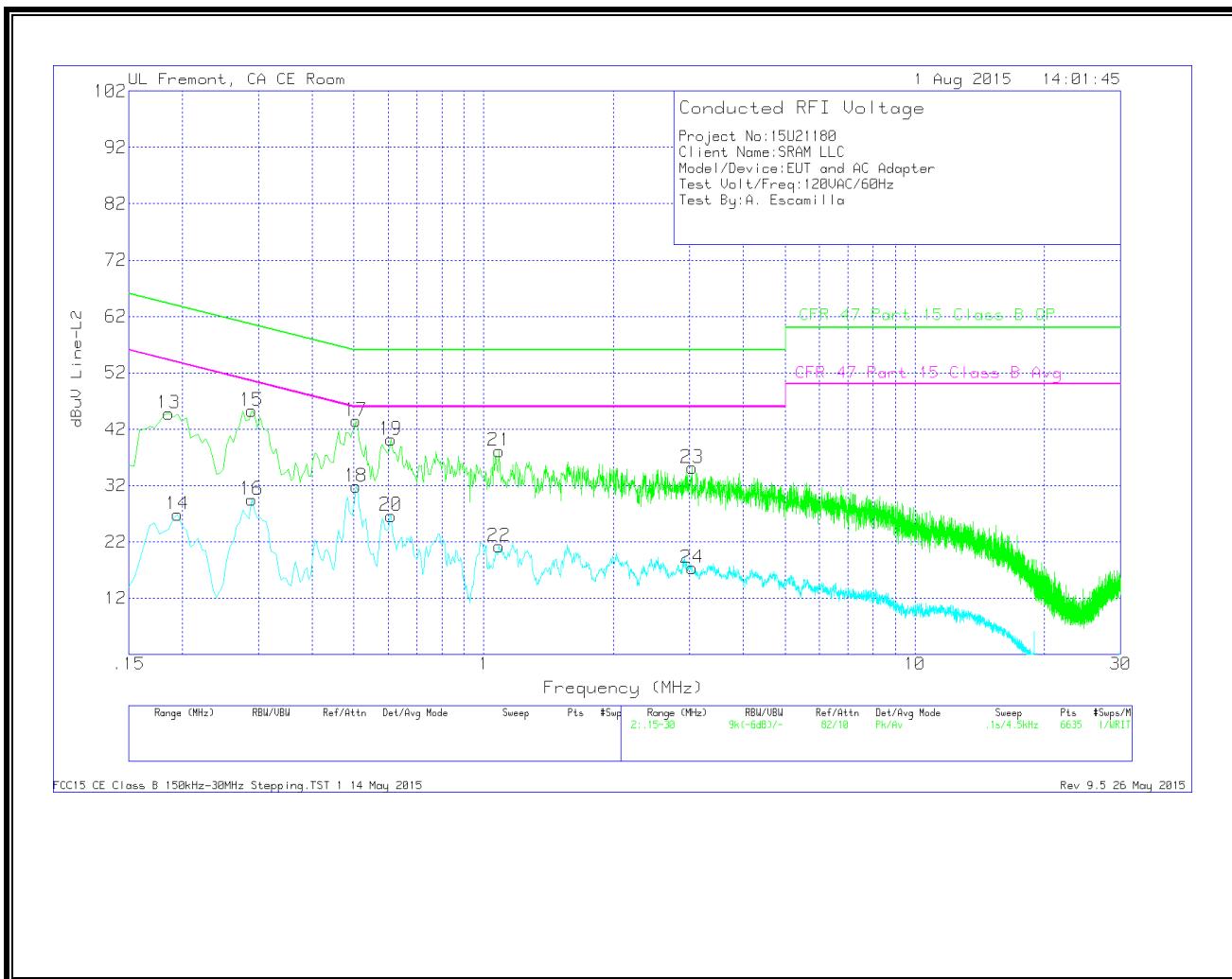
### RESULTS

### Charging Mode

#### Line-L1 .15 - 30MHz



**Line-L2 .15 - 30MHz**



## RESULTS

### Trace Markers

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
1	.204	44.81	Pk	.9	0	45.71	63.45	-17.74	-	-
2	.1995	27.39	Av	.9	0	28.29	-	-	53.63	-25.34
3	.2715	41.7	Pk	.6	0	42.3	61.07	-18.77	-	-
4	.2715	23.73	Av	.6	0	24.33	-	-	51.07	-26.74
5	.519	42.54	Pk	.3	0	42.84	56	-13.16	-	-
6	.5145	30.31	Av	.3	0	30.61	-	-	46	-15.39
7	.645	41.75	Pk	.3	0	42.05	56	-13.95	-	-
8	.645	24.91	Av	.3	0	25.21	-	-	46	-20.79
9	2.067	35.37	Pk	.2	.1	35.67	56	-20.33	-	-
10	2.067	20.61	Av	.2	.1	20.91	-	-	46	-25.09
11	8.3175	31.65	Pk	.2	.1	31.95	60	-28.05	-	-
12	8.052	15.39	Av	.2	.1	15.69	-	-	50	-34.31

Pk - Peak detector

Av - Average detection

Range 2: Line-L2 .15 - 30MHz

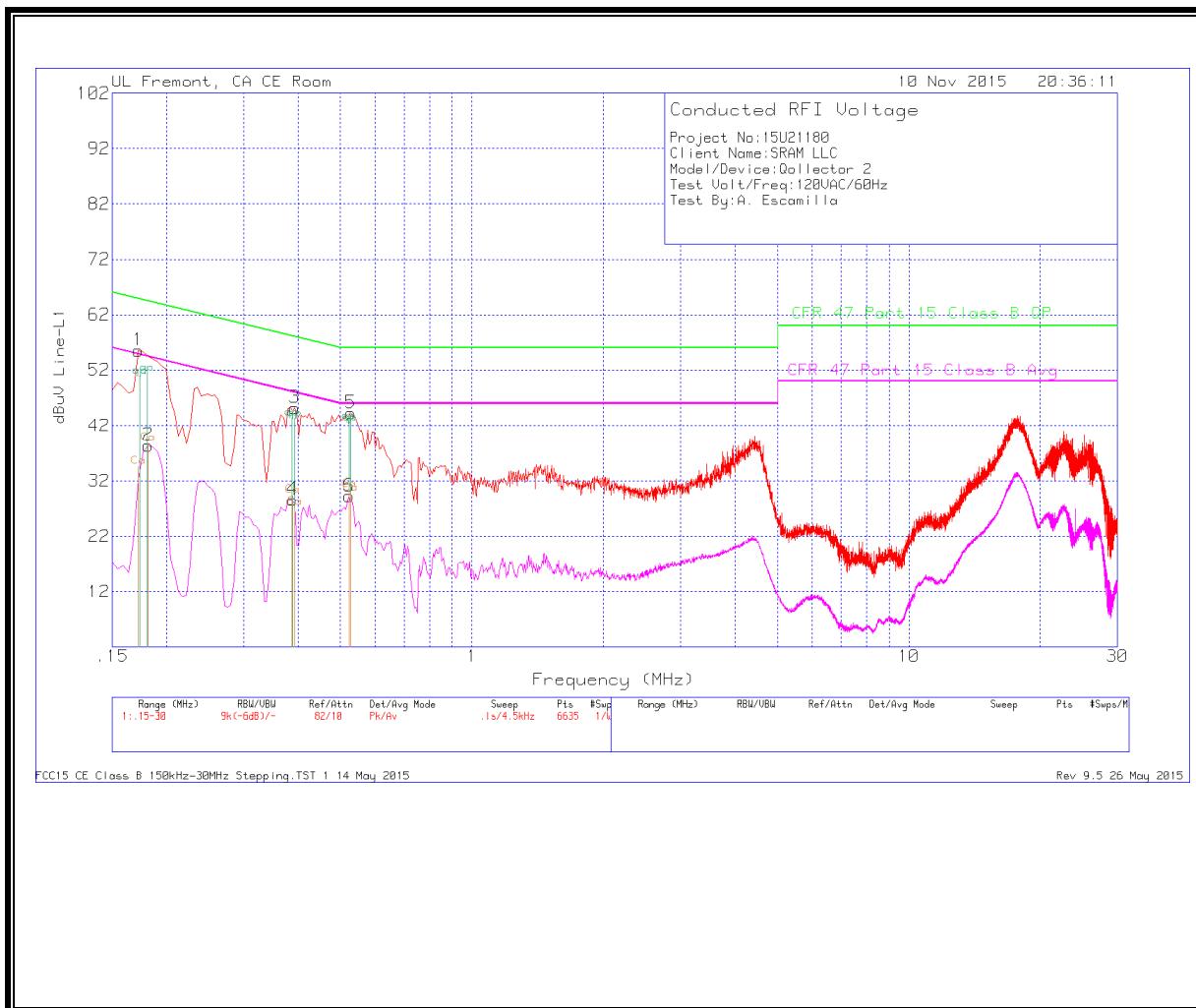
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
13	.186	43.7	Pk	1.1	0	44.8	64.21	-19.41	-	-
14	.195	25.86	Av	1	0	26.86	-	-	53.82	-26.96
15	.2895	44.66	Pk	.6	0	45.26	60.54	-15.28	-	-
16	.2895	28.89	Av	.6	0	29.49	-	-	50.54	-21.05
17	.5055	43.07	Pk	.4	0	43.47	56	-12.53	-	-
18	.5055	31.41	Av	.4	0	31.81	-	-	46	-14.19
19	.609	39.84	Pk	.3	0	40.14	56	-15.86	-	-
20	.609	26.34	Av	.3	0	26.64	-	-	46	-19.36
21	1.086	37.85	Pk	.3	0	38.15	56	-17.85	-	-
22	1.086	20.94	Av	.3	0	21.24	-	-	46	-24.76
23	3.0435	34.83	Pk	.2	.1	35.13	56	-20.87	-	-
24	3.0435	17.05	Av	.2	.1	17.35	-	-	46	-28.65

Pk - Peak detector

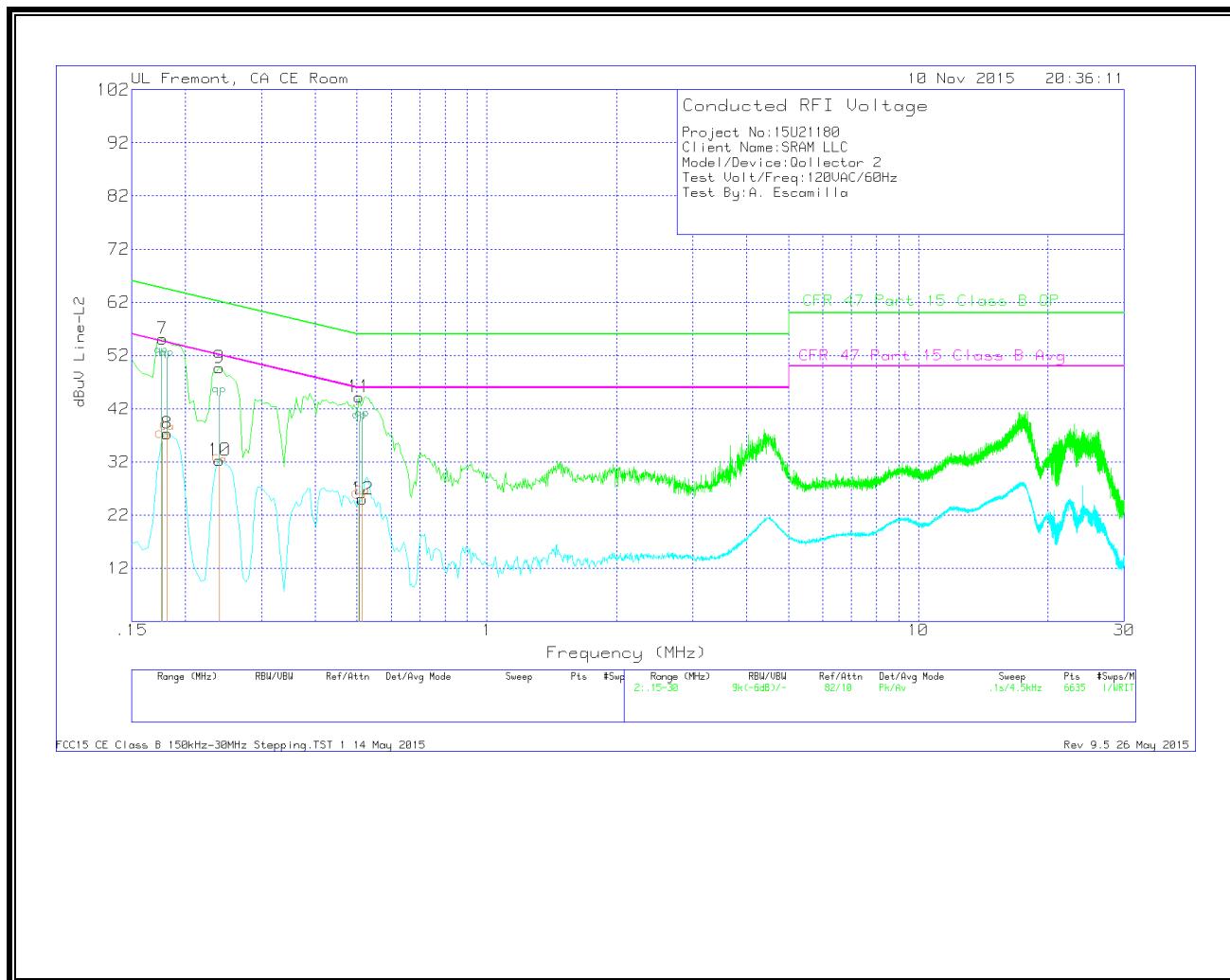
Av - Average detection

**Data Transfer Mode**

**Line-L1 .15 - 30MHz**



**Line-L2 .15 - 30MHz**



## RESULTS

### Trace Markers

Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B	Margin (dB)
1	.1725	54.46	Pk	1.1	0	55.56	64.84	-9.28	-	-
2	.1815	37.31	Av	1.1	0	38.41	-	-	54.42	-16.01
3	.393	44.79	Pk	.4	0	45.19	58	-12.81	-	-
4	.3885	28.17	Av	.4	0	28.57	-	-	48.1	-19.53
5	.528	43.93	Pk	.3	0	44.23	56	-11.77	-	-
6	.5235	28.95	Av	.3	0	29.25	-	-	46	-16.75

Pk - Peak detector

Av - Average detection

Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B	Margin (dB)
7	.177	53.94	Pk	1.2	0	55.14	64.63	-9.49	-	-
8	.1815	36.15	Av	1.2	0	37.35	-	-	54.42	-17.07
9	.24	48.91	Pk	.8	0	49.71	62.1	-12.39	-	-
10	.24	31.49	Av	.8	0	32.29	-	-	52.1	-19.81
11	.5055	43.8	Pk	.4	0	44.2	56	-11.8	-	-
12	.5145	24.63	Av	.4	0	25.03	-	-	46	-20.97

Pk - Peak detector

Av - Average detection