



**FCC 47 CFR PART 15 SUBPART B
ICES-003 ISSUE 5**

CERTIFICATION TEST REPORT

FOR

2x2 802.11a/b/g/n +BT Module (SiP)

MODEL NUMBER: QCA6234

**FCC ID: PPD-QCA6234
IC: 4104A-QCA6234**

REPORT NUMBER: 13U14995-9, Revision A

ISSUE DATE: JULY 1, 2013

Prepared for
QUALCOMM AHEROS, INC
1700 TECHNOLOGY DRIVE
SAN JOSE, CA 95110

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

NVLAP[®]

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/25/13	Initial Issue	F. de Anda
A	07/01/13	Corrected EUT Description	AAumentado

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. <i>MEASURING INSTRUMENT CALIBRATION</i>	5
4.2. <i>SAMPLE CALCULATION</i>	5
4.3. <i>MEASUREMENT UNCERTAINTY</i>	5
5. EQUIPMENT UNDER TEST	6
5.1. <i>DESCRIPTION OF EUT</i>	6
5.2. <i>TEST CONFIGURATION</i>	6
5.3. <i>SOFTWARE AND FIRMWARE</i>	6
5.4. <i>WORST-CASE CONFIGURATION AND MODE</i>	6
5.5. <i>MODIFICATIONS</i>	6
5.6. <i>DETAILS OF TESTED SYSTEM</i>	8
6. TEST AND MEASUREMENT EQUIPMENT	10
APPLICABLE LIMITS AND TEST RESULTS	11
6.1. <i>RADIATED EMISSIONS</i>	11
6.2. <i>AC MAINS LINE CONDUCTED EMISSIONS</i>	18
7. SETUP PHOTOS.....	25

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: QUALCOMM ATHEROS, INC
1700 TECHNOLOGY DRIVE
SAN JOSE, CA 95110

EUT DESCRIPTION: 2x2 802.11a/b/g/n +BT Module (SiP)

MODEL: QCA6234

SERIAL NUMBER: 75720064

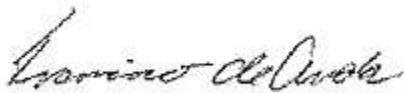
DATE TESTED: May 18, 2013 - May 31, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART B	Pass
ICES-003 ISSUE 5	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.

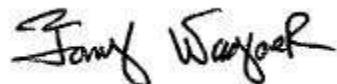
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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:



FRANCISCO DE ANDA
PROJECT LEAD
UL Verification Services Inc.

Tested By:



TONY WAGONER
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009 and CAN/CSA-CEI/IEC CISPR 22-10 as referenced by ICES-003 Issue 5.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

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 2x2 802.11a/b/g/n WLAN and Bluetooth (BT) 4.0 combo SiP (System in Package) module with (1) SDIO or (2) HSIC interfaces for WLAN and UART interface for BT.

Three boards variants are provided, no filter version, 3G filter version and LTE filter version. Test were done to worst case among the three boards.

The radio module is manufactured by Qualcomm Atheros, Inc..

GENERAL INFORMATION

Power Requirements	5 Vdc
List of frequencies generated or used by the EUT	26, 50, 240 MHz

5.2. TEST CONFIGURATION

EUT Configuration	Description
Per Manufacturer	The EUT is installed in a laptop computer which was used as support equipment during the tests. Test software exercised the radio card.

5.3. SOFTWARE AND FIRMWARE

The test utility software used during testing was ART2-GUI version 2.3, CART version 4.4

5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

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

5.5. MODIFICATIONS

No modifications were made during testing.

5.6. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT

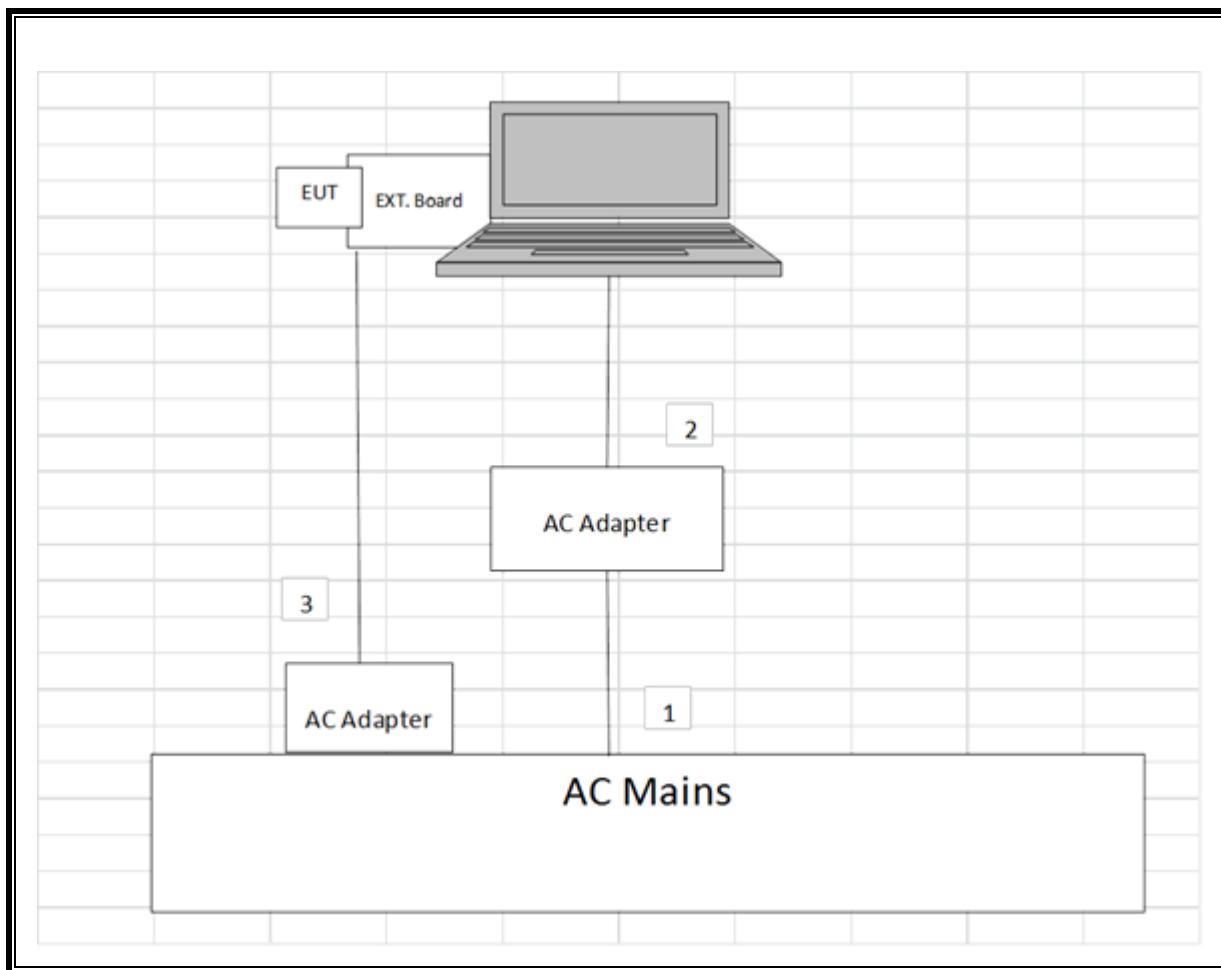
Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	T430 Thinkpad	QCA-REG17	DoC
AC adapter	Lenovo	92P1105	963SOMR	DoC
AC adapter(Ext. Card)	CUI Inc.	EA-161W05A	0931 A	N/A
Bluetooth to USB	Qualcomm Atheros	TB639-030-D0277	250-02293-C30	N/A

I/O CABLES

Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	2-prong	Un-Shielded	1m	NA
2	DC	1	Barrel	Un-Shielded	1.5m	NA
3	DC	1	Barrel	Un-Shielded	1m	NA

The EUT is installed in a laptop computer which was used as support equipment during the tests. Test software exercised the radio card.

TEST SETUP DIAGRAM



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
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	02/26/14
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	02/13/14
Antenna, Horn, 18 GHz	ETS	3117	C01006	12/11/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	03/23/14
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	10/22/13
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/14
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/08/13

APPLICABLE LIMITS AND TEST RESULTS

6.1. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4
CAN/CSA-CEI/IEC CISPR 22

The frequency range investigated was from 30 MHz to 18000 MHz.

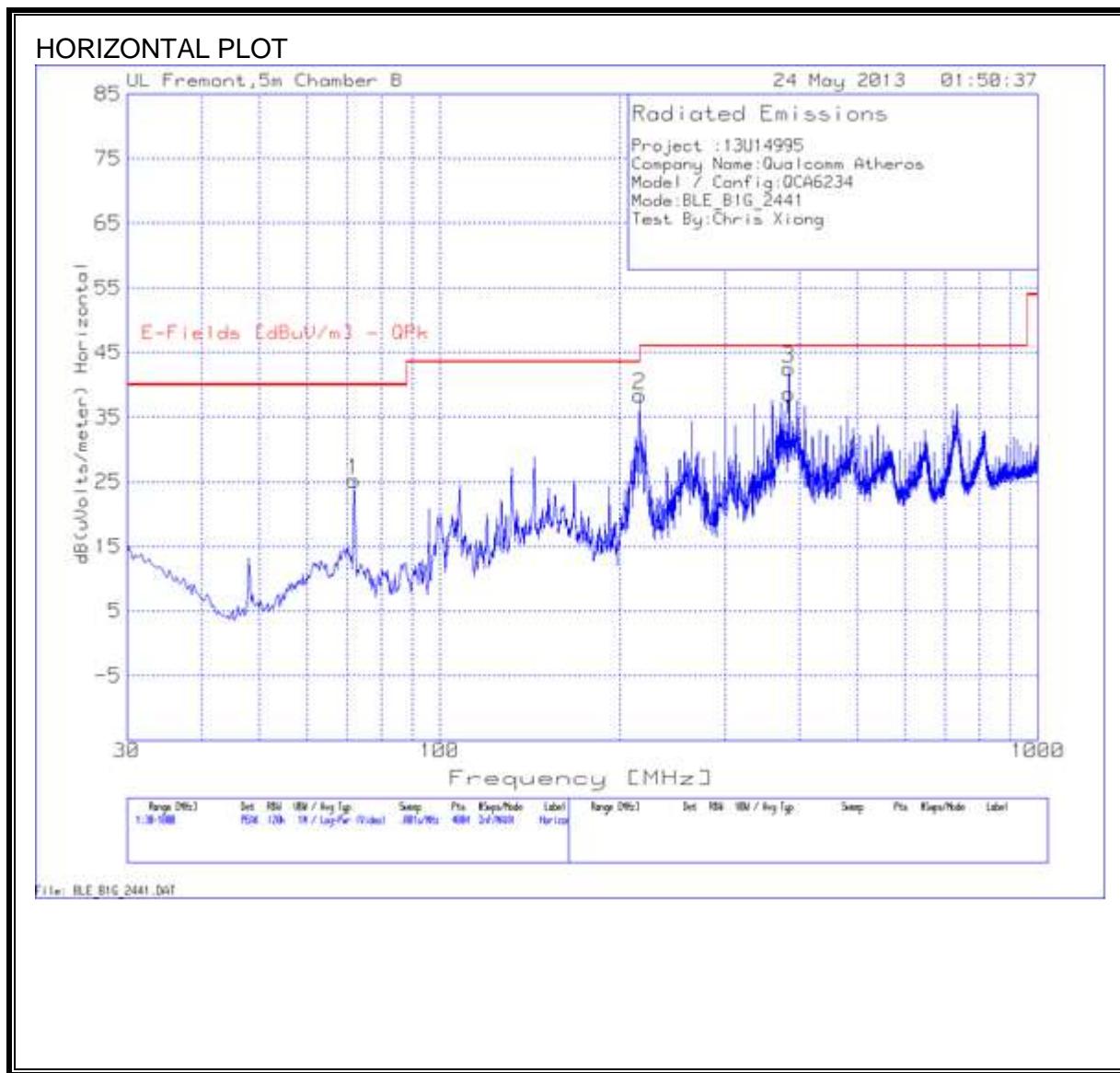
LIMIT

§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:

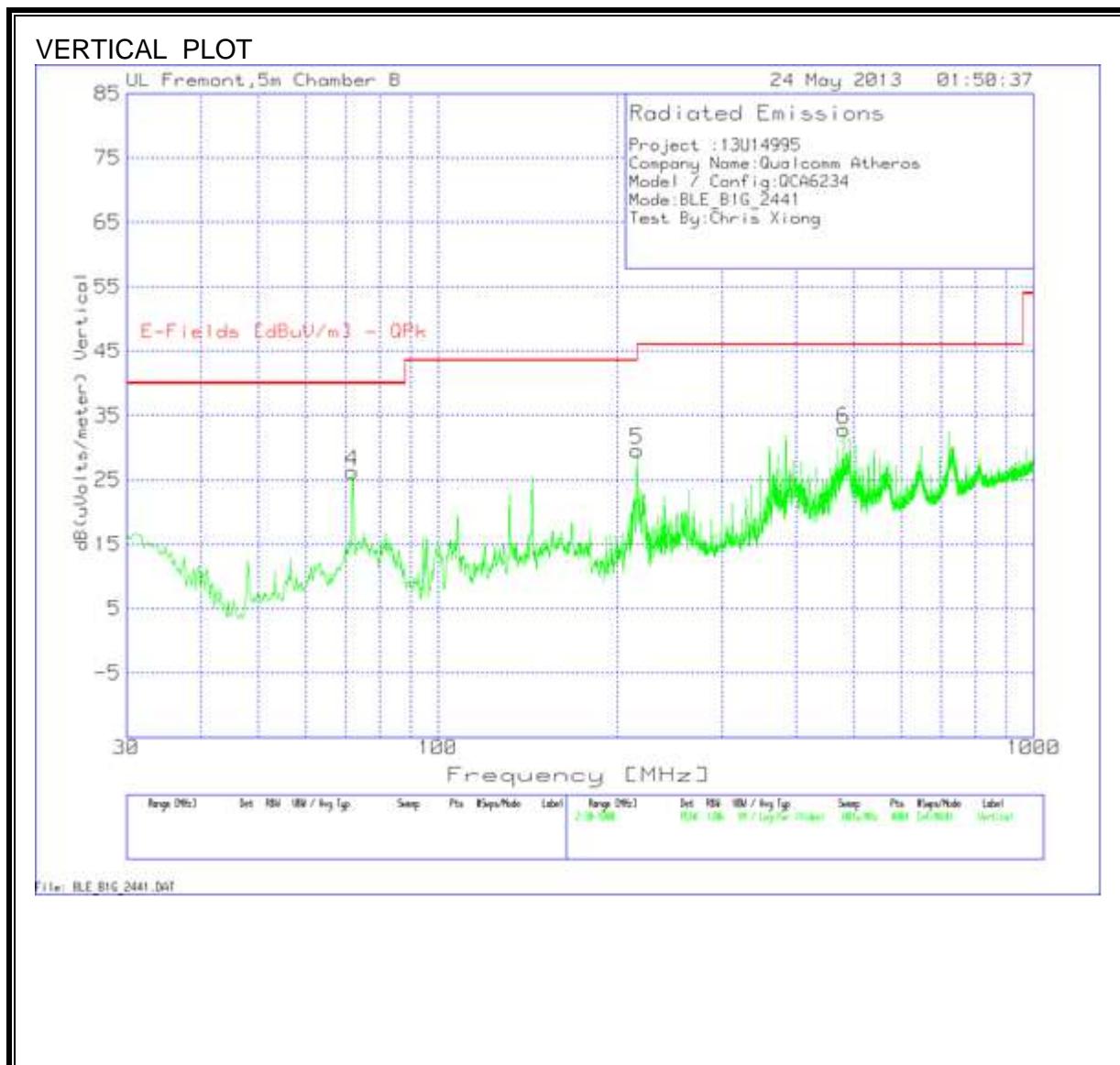
Limits for radiated disturbance of Class B ITE at measuring distance of 3 m	
Frequency range (MHz)	Quasi-peak limits (dB μ V/m)
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960 MHz	54

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

RESULTS - RADIATED EMISSIONS 30 TO 1000 MHz



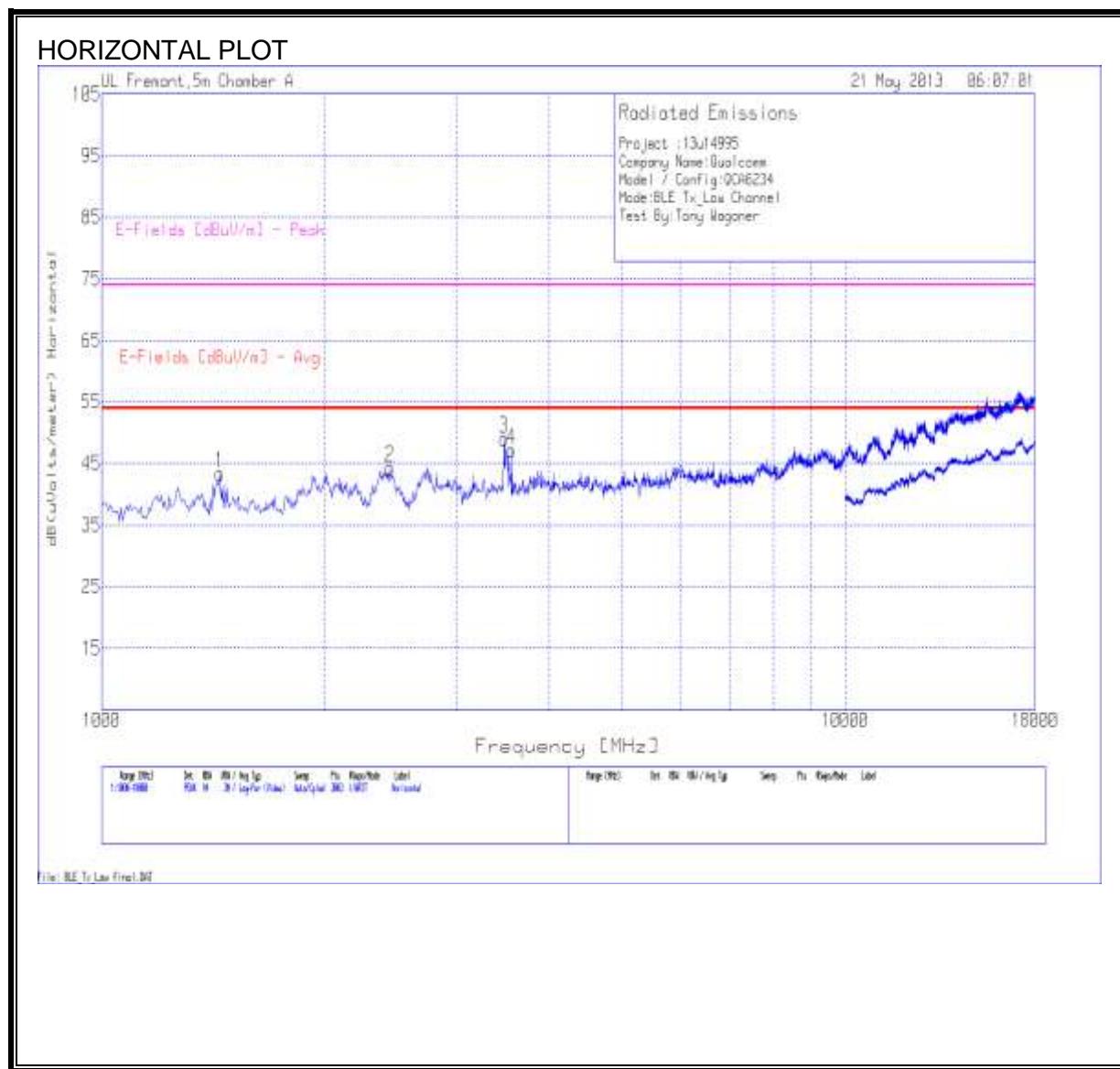
RADIATED EMISSIONS 30 TO 1000 MHz



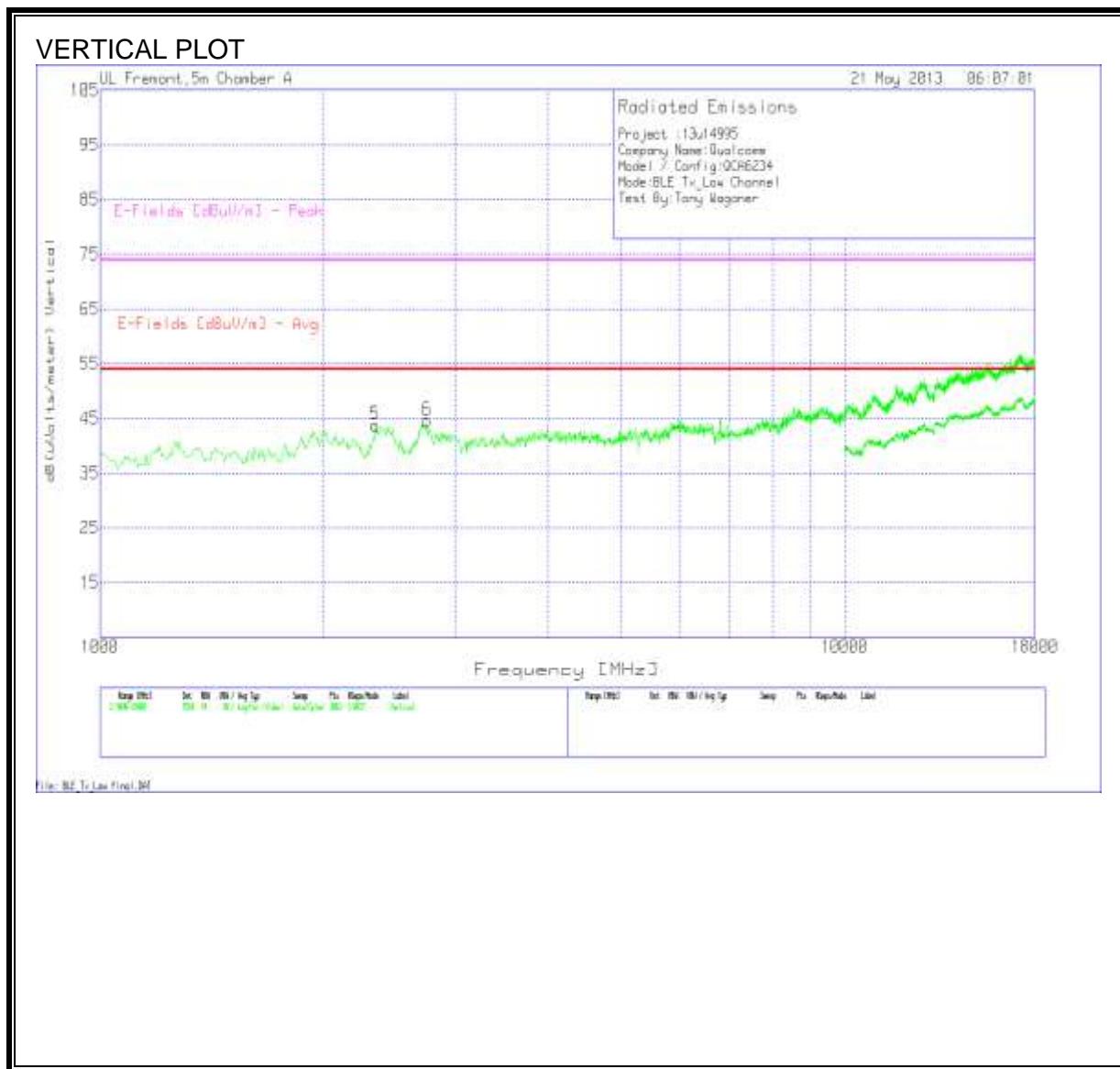
WORST EMISSIONS

DATA SUMMARY – HORIZONTAL / VERTICAL										
Marker No.	Test Frequency MHz	Meter Reading (dB μ V)	Detector	T243 Antenna Factor dB/m	T10 preamp/ Cable loss [dB]	Corrected dB(μ V/m)	FCC Class B Limit	Margin (dB)	Height [cm]	Polarity
Horizontal 30 - 1000MHz										
1	71.9211	45.96	PK	7.9	-28.7	25.16	40	-14.84	300	Horz
2	216.1004	54.96	PK	10.5	-27.1	38.36	46	-7.64	100	Horz
3	384.027	53.86	PK	15.1	-26.4	42.56	46	-3.44	100	Horz
	384.1331	40.11	QP	15.1	-25.3	29.91	46	-16.09	208	Horz
Vertical 30 - 1000MHz										
4	71.9211	47.07	PK	7.9	-28.7	26.27	40	-13.73	200	Vert
5	215.8581	46.23	PK	10.5	-27.1	29.63	43.5	-13.87	200	Vert
6	479.985	41.6	PK	17.7	-26.5	32.8	46	-13.2	200	Vert
PK - Peak detector										
QP - Quasi-Peak detector										

RESULTS – RADIATED EMISSIONS ABOVE 1000 MHz



RADIATED EMISSIONS - ABOVE 1000 MHz



WORST EMISSIONS

DATA SUMMARY – HORIZONTAL / VERTICAL														
Marker No.	Test Frequency MHz	Meter Reading dB μ V	Detector	T136 Ant Factor	T144 Preamp Gain dB	Cable Factor dB	T160 BRF dB	corrected dB(μ V/m)	FCC Class B Limit Avg	Margin dB	FCC Class B Limit Peak	Margin dB	Height cm	Polarity
1	1441.706	47.91	PK	29.4	-37.9	3.5	0.5	43.41	54	-10.59	74	-30.59	101	Horz
2	2444.037	43.53	PK	32.3	-36.9	4.5	0.9	44.33	54	-9.67	74	-29.67	101	Horz
3	3480.346	46.39	PK	33.1	-36.3	5.5	0.4	49.09	54	-4.91	74	-24.91	200	Horz
4	3559.627	44.34	PK	33.1	-36.3	5.6	0.5	47.24	54	-6.76	74	-26.76	200	Horz
5	2342.105	43.57	PK	31.8	-36.9	4.4	0.9	43.77	54	-10.23	74	-30.23	100	Vert
6	2749.833	43	PK	32.7	-36.8	4.8	0.9	44.6	54	-9.4	74	-29.4	100	Vert
PK - Peak detector														

6.2. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.4
CAN/CSA-CEI/IEC CISPR 22

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 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.

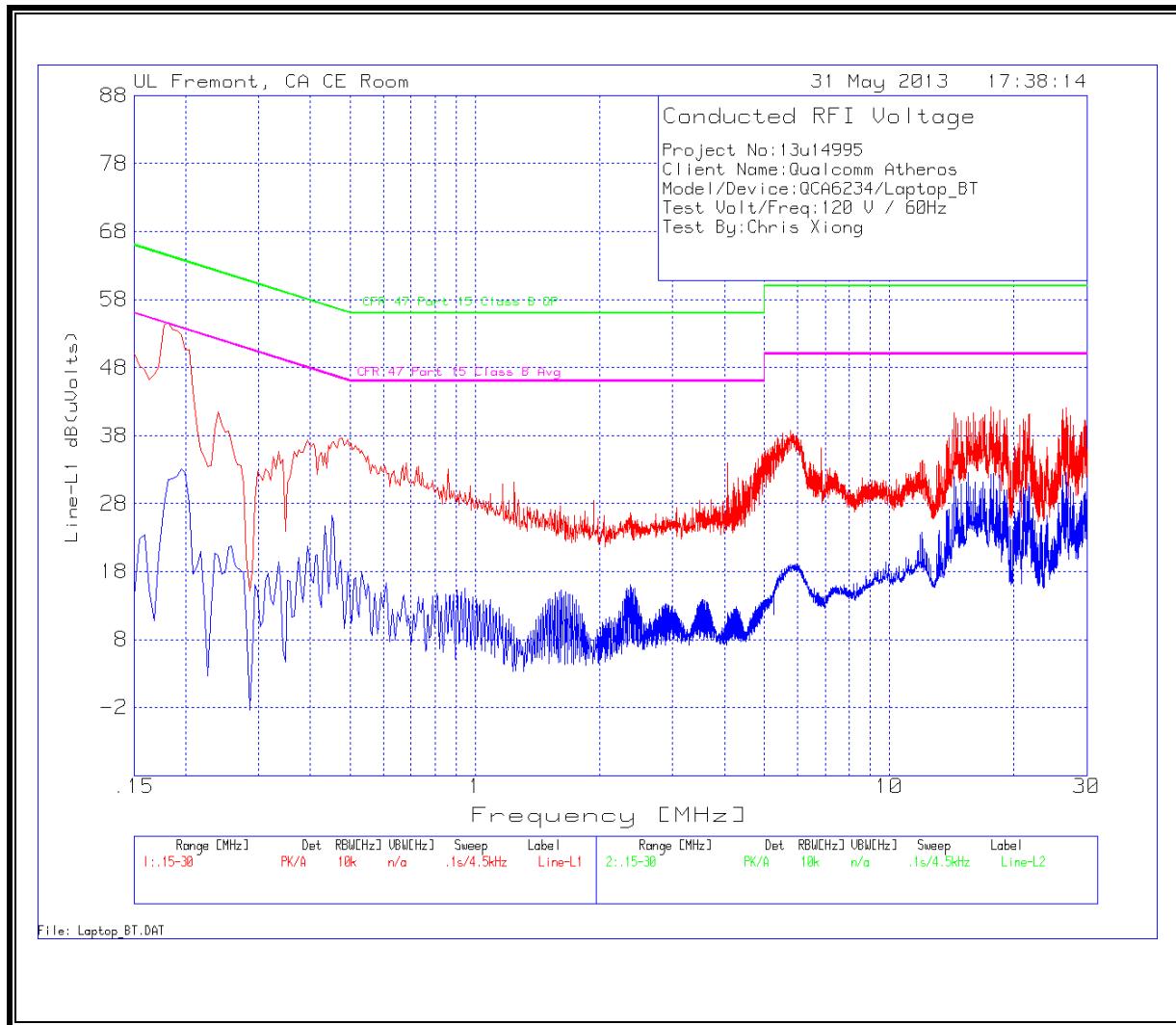
Frequency range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Notes:

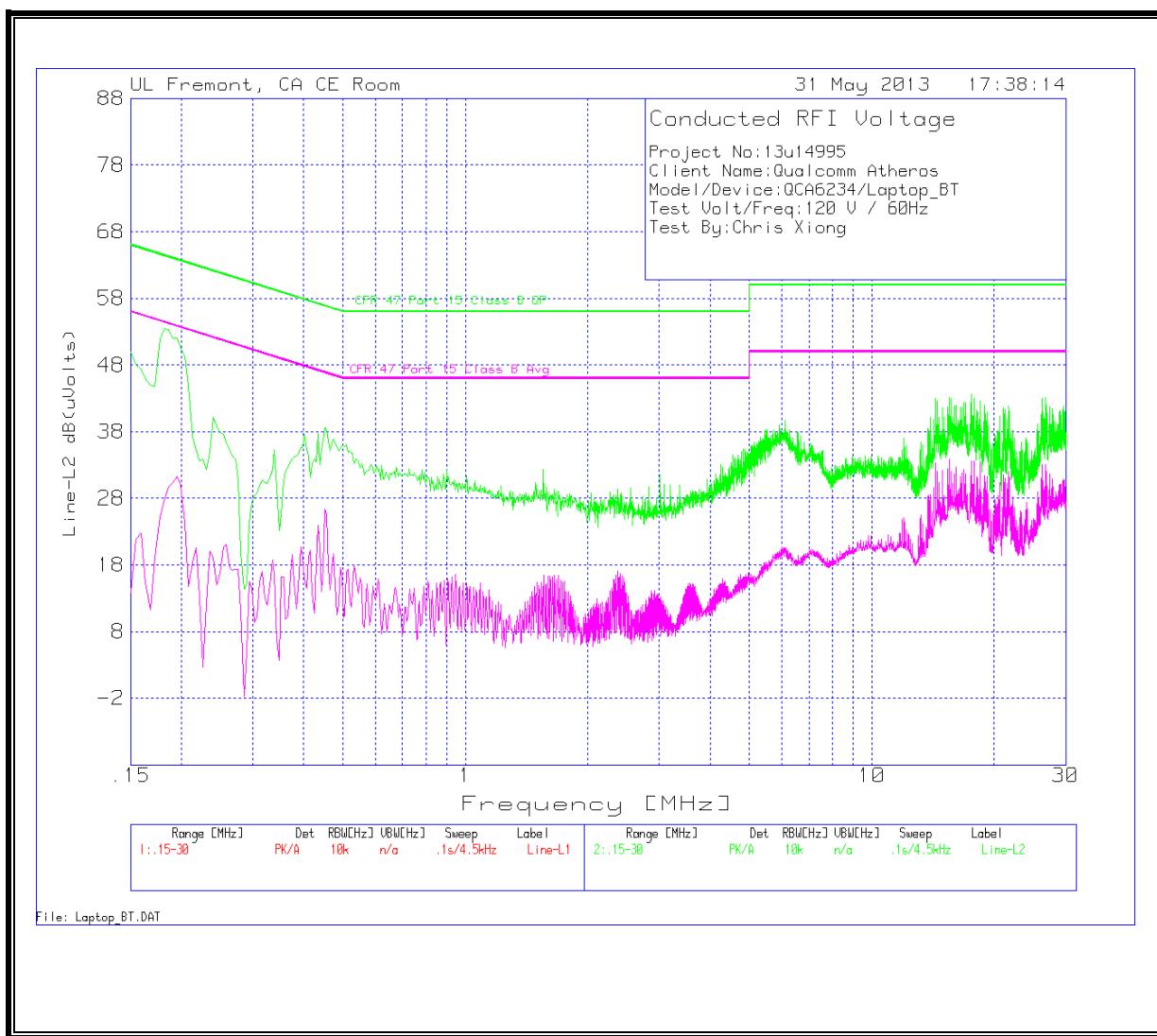
1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

RESULTS- LAPTOP AC ADAPTER

LINE 1 RESULTS



LINE 2 RESULTS

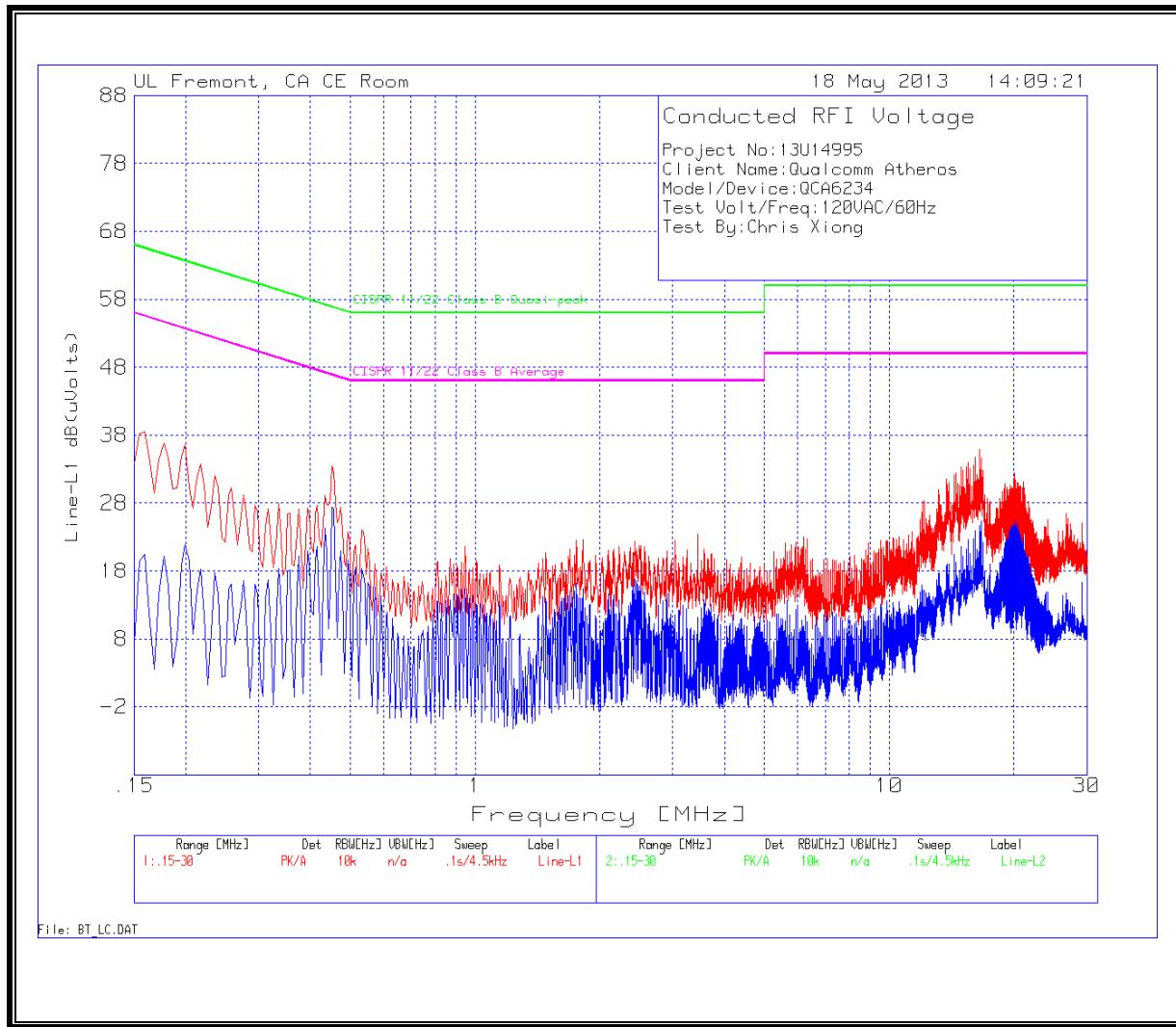


WORST EMISSIONS

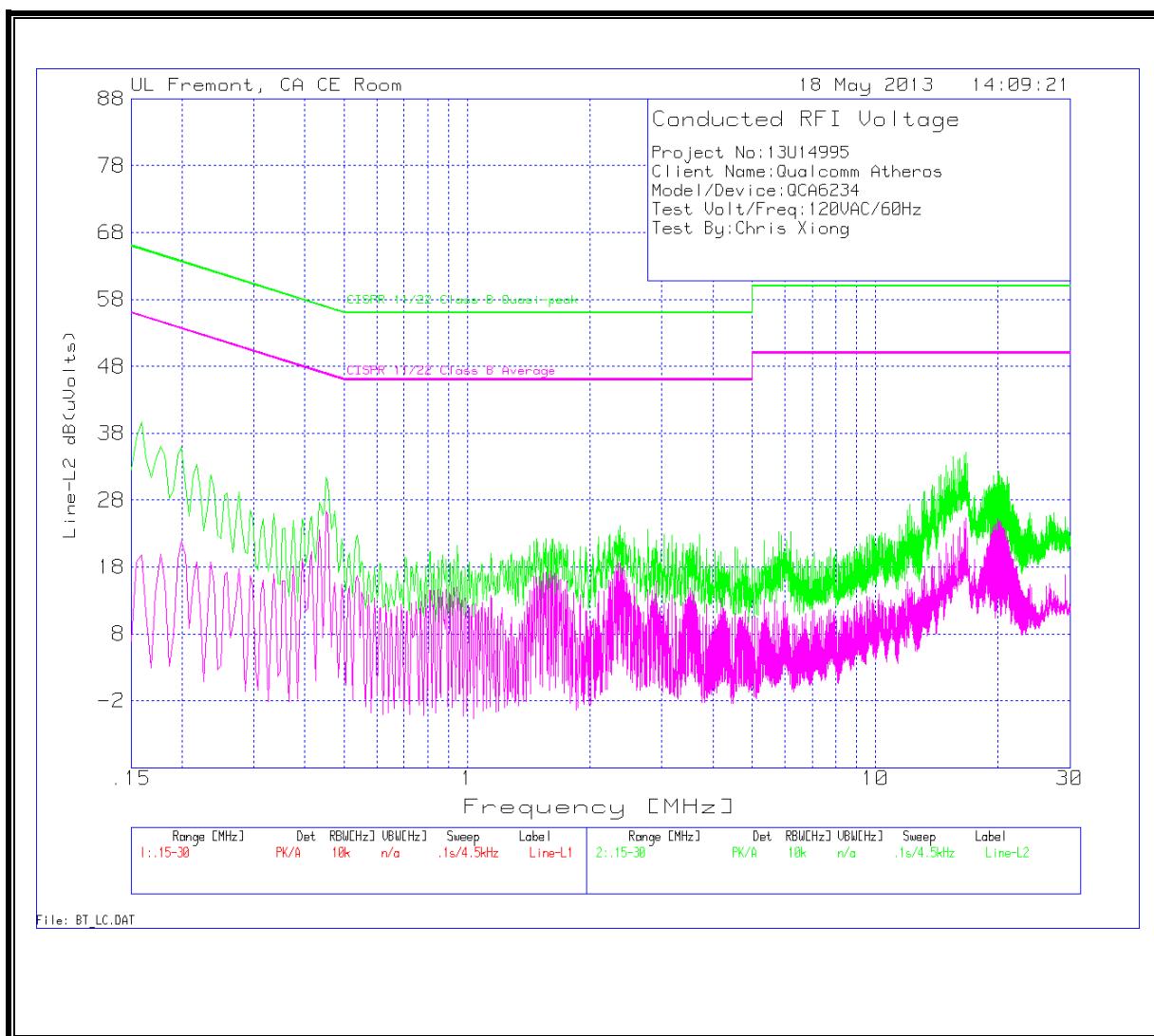
HORIZONTAL AND VERTICAL DATA									
Project No:		13U14995							
Client Name:		Qualcomm Atheros							
Model/Device:		QCA6234 /Laptop							
Test Volt/Freq:		120VAC/60Hz							
Test By:		Chris Xiong							
Test Frequency MHz	Meter Reading dB μ V	Detector	T24 LISN dB	Cable Loss dB	Corrected dB(μ Volts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
Line-L1 .15 - 30MHz									
0.1815	54.54	PK	0.1	0	54.64	64.4	-9.76	-	-
0.1815	31.46	Av	0.1	0	31.56	-	-	54.4	-22.84
5.775	38.51	PK	0.1	0.1	38.71	60	-21.29	-	-
5.775	18.79	Av	0.1	0.1	18.99	-	-	50	-31.01
26.7855	41.31	PK	0.5	0.3	42.11	60	-17.89	-	-
26.7855	31.74	Av	0.5	0.3	32.54	-	-	50	-17.46
Line-L2 .15 - 30MHz									
0.1815	53.36	PK	0.1	0	53.46	64.4	-10.94	-	-
0.1815	27.58	Av	0.1	0	27.68	-	-	54.4	-26.72
0.4515	38.5	PK	0.1	0	38.6	56.8	-18.2	-	-
0.4515	26.26	Av	0.1	0	26.36	-	-	46.8	-20.44
6.108	39.44	PK	0.1	0.1	39.64	60	-20.36	-	-
6.108	20.19	Av	0.1	0.1	20.39	-	-	50	-29.61
PK - Peak detector									
Av - Average detector									

RESULTS – EXTENDER CARD AC ADAPTER

LINE 1 RESULTS



LINE 2 RESULTS



WORST EMISSIONS

HORIZONTAL AND VERTICAL DATA

Project No:	13U14995								
Client Name:	Qualcomm Atheros								
Model/Device:	QCA6234								
Test Volt/Freq:	120VAC/60Hz								
Test By:	Chris Xiong								
Test Frequency MHz	Meter Reading dB μ V	Detector	T24 LISN dB	Cable Loss dB	Corrected dB(μ Volts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
Line-L1 .15 - 30MHz									
0.4515	33.41	PK	0.1	0	33.51	56.8	-23.29	-	-
0.4515	27.33	Av	0.1	0	27.43	-	-	46.8	-19.37
3.444	23.26	PK	0.1	0.1	23.46	56	-32.54	-	-
3.444	10.81	Av	0.1	0.1	11.01	-	-	46	-34.99
16.5435	35.45	PK	0.2	0.2	35.85	60	-24.15	-	-
16.5435	24.31	Av	0.2	0.2	24.71	-	-	50	-25.29
Line-L2 .15 - 30MHz									
0.159	39.53	PK	0.1	0	39.63	65.5	-25.87	-	-
0.159	19.71	Av	0.1	0	19.81	-	-	55.5	-35.69
2.3685	23.98	PK	0.1	0.1	24.18	56	-31.82	-	-
2.3685	18.43	Av	0.1	0.1	18.63	-	-	46	-27.37
16.6875	34.8	PK	0.2	0.2	35.2	60	-24.8	-	-
16.6875	24.98	Av	0.2	0.2	25.38	-	-	50	-24.62
PK - Peak detector									
Av - Average detector									