



**FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8
CLASS II PERMISSIVE CHANGE**

CERTIFICATION TEST REPORT

FOR

802.11a/g/n 3x3 MIMO WLAN + BT COMBO PCI-E MINI CARD

MODEL NUMBER: BCM94331PCIEBT4

**FCC ID: QDS-BRCM1055
IC: 4324A-BRCM1055**

REPORT NUMBER: 11U14192-6

ISSUE DATE: JANUARY 20, 2012

Prepared for
**BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A.**

Prepared by
**COMPLIANCE CERTIFICATION SERVICES (UL CCS)
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
--	01/20/12	Initial Issue	T. Chan

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>MAXIMUM OUTPUT POWER.....</i>	6
5.1. <i>DESCRIPTION OF CLASS II PERMISSIVE CHANGE.....</i>	6
5.2. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	6
5.3. <i>SOFTWARE AND FIRMWARE</i>	6
5.4. <i>WORST-CASE CONFIGURATION AND MODE.....</i>	6
5.1. <i>DESCRIPTION OF TEST SETUP</i>	7
6. TEST AND MEASUREMENT EQUIPMENT	9
7. ANTENNA PORT TEST RESULTS	10
7.1.1. CONDUCTED SPURIOUS EMISSIONS.....	10
8. RADIATED TEST RESULTS	13
8.1. <i>LIMITS AND PROCEDURE</i>	13
8.1. <i>TRANSMITTER ABOVE 1 GHz</i>	14
8.1.1. ENHANCED DATA RATE 8PSK MODULATION.....	14
9. SETUP PHOTOS.....	17

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, USA

EUT DESCRIPTION: 802.11a/g/n 3x3 MIMO WLAN + BT Combo PCI-E Mini Card

MODEL: BCM94331PCIEBT4

SERIAL NUMBER: 2 (P300)

DATE TESTED: JANUARY 04 – 19, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

Compliance Certification Services (UL CCS) 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 CCS 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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 CCS By:



THU CHAN
ENGINEERING MANAGER
UL CCS

Tested By:



VIEN TRAN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

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

UL CCS 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 802.11a/g/n 3x3 MIMO WLAN + BT Combo PCI-E Mini Card.

The radio module is manufactured by Broadcom.

5.2. MAXIMUM OUTPUT POWER

The measurement passed within $\pm 0.5\text{dBm}$ of the original output power.

5.1. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is:

The Bluetooth Low Energy functionality (BLE) is added to the Bluetooth chipset. The modified chipset is pin for pin compatible and the BT functionality, the maximum output power and frequencies of operation remain the same as the original approval.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Bluetooth antenna, with a maximum gain of -2.95 dBi.

5.3. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom Bluetooth Version 5.1.0.1400

The test utility software used during testing was Bluetool, rev. 1.5.2.8.

5.4. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined with the highest output power. The tests were performed on bandedge and spurious harmonic at high channel (2480MHz) of 8PSK TX mode @ 3Mbps as worst case of spot check.

5.1. DESCRIPTION OF TEST SETUP

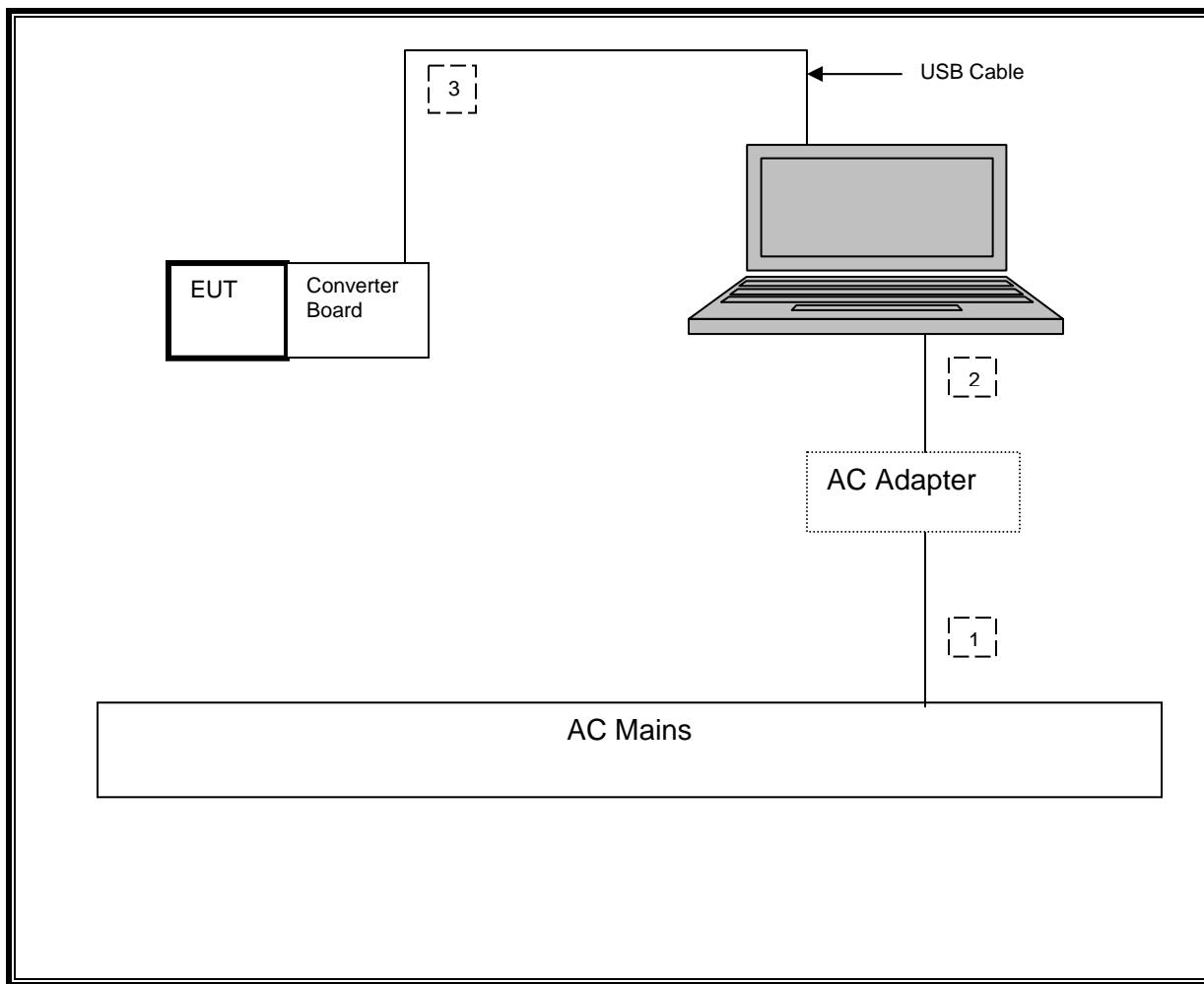
SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	Pavillion DV6000	CNF6463KP7	DoC
AC Adapter	HP	PPP009L	592C40CRGUBR9B	DoC
Converter Board	Broadcom	BCM94331PCIEBT4HAD	276	N/A
USB Cable	N/A	N/A	N/A	N/A

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Shielded	1.5m	NA
2	DC	1	DC	Un-shielded	1.5m	Ferrite at laptop's end
4	USB	1	USB	Un-shielded	1.8m	NA

SETUP DIAGRAM



TEST SETUP

The EUT was tested as an external module that installed on a converter board connected to a host Laptop PC via USB cable.

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, 44 GHz	Agilent / HP	E4446A	C01159	05/11/12
Antenna, Horn, 18 GHz	EMCO	3115	C00872	06/29/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	07/18/12
Highpass Filter, 4.0 GHz	Micro-Tronics	HPM13351	N02709	CNR
Peak Power Meter	Agilent / HP	E4416A	C00963	03/22/12
Peak Power Sensor	Agilent / HP	E9327A	C00964	04/13/12

7. ANTENNA PORT TEST RESULTS

7.1.1. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

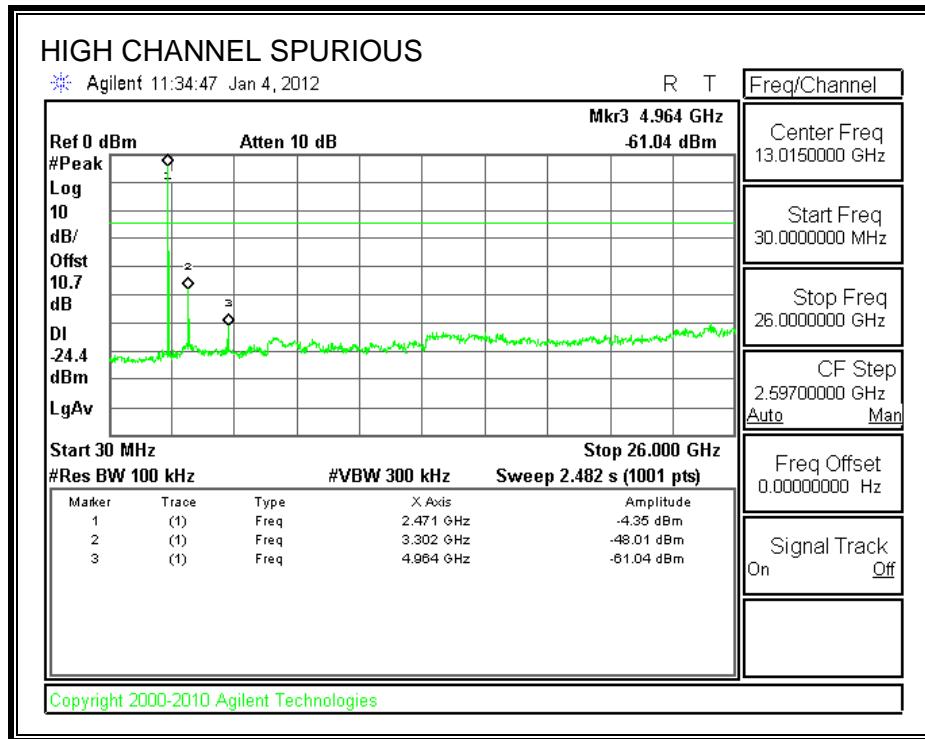
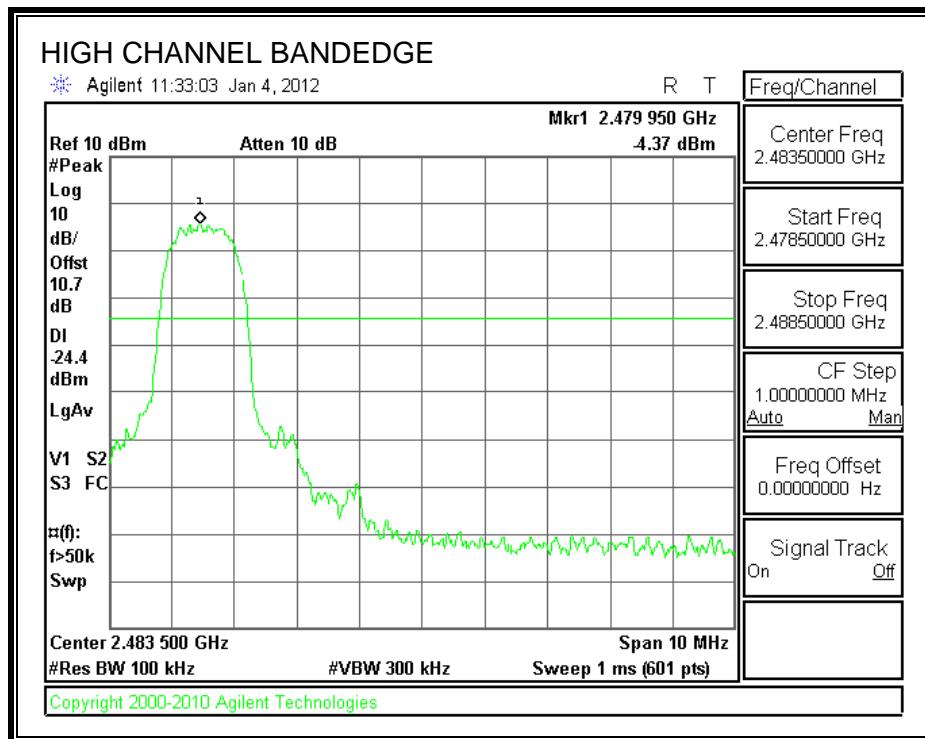
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

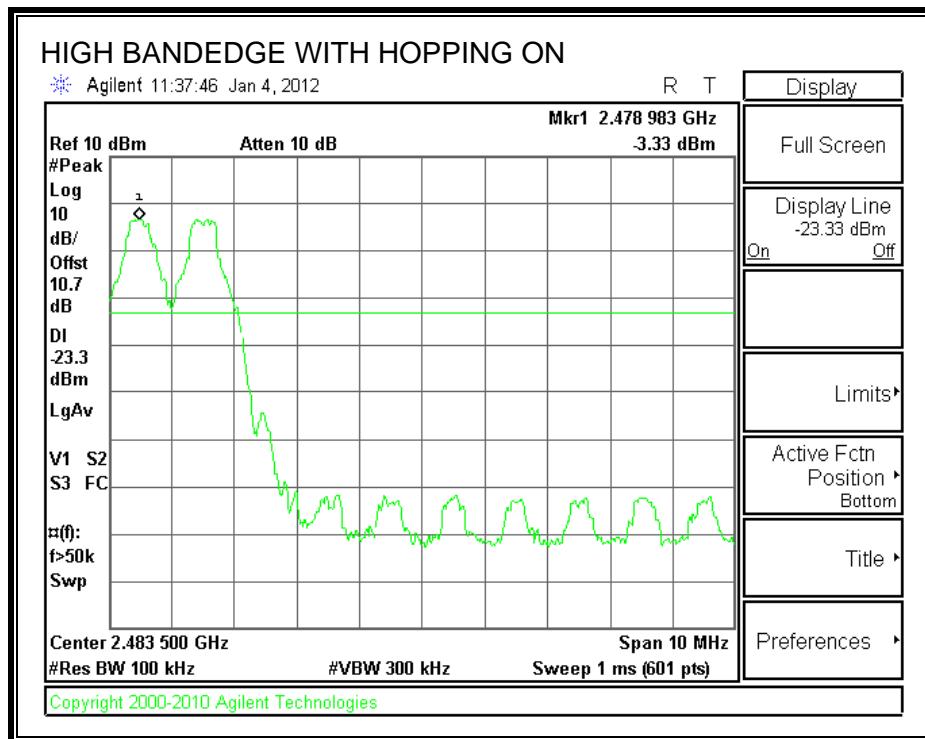
The band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

SPURIOUS EMISSIONS, HIGH CHANNEL



SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

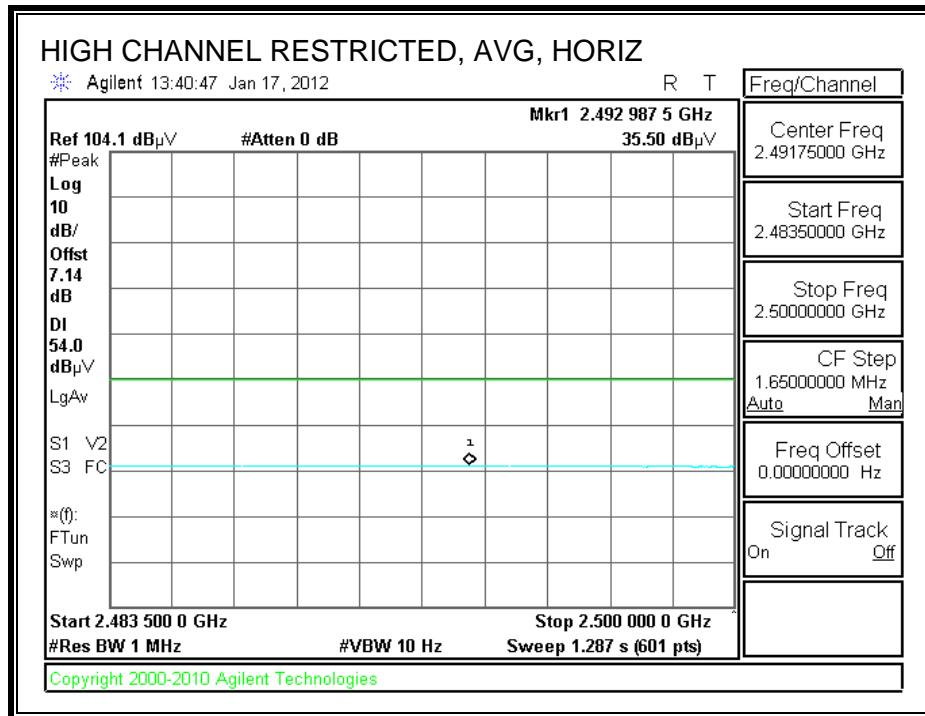
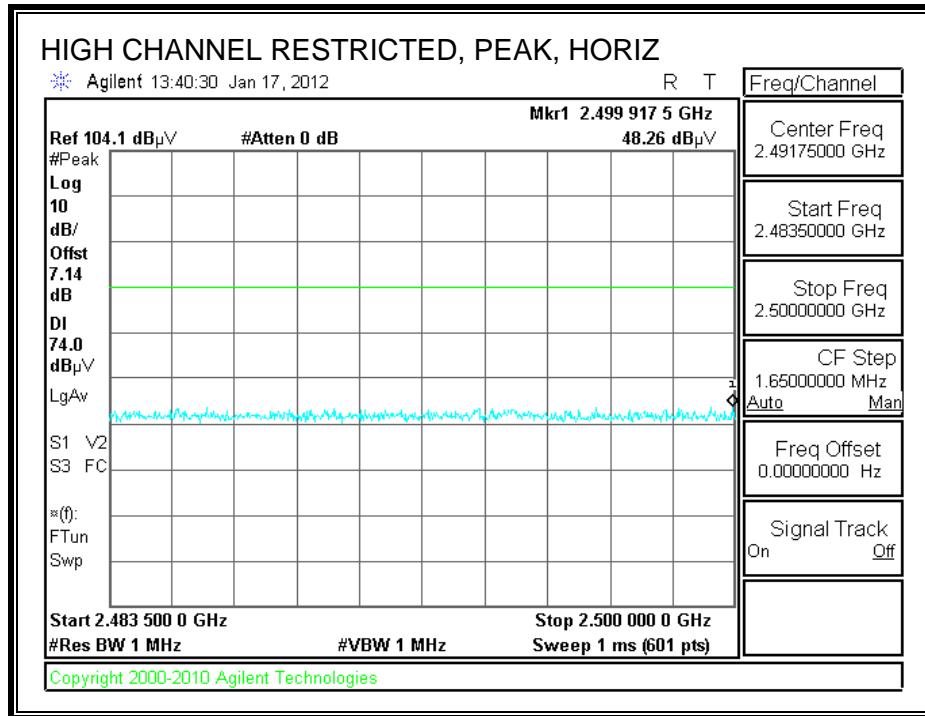
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

RESULTS

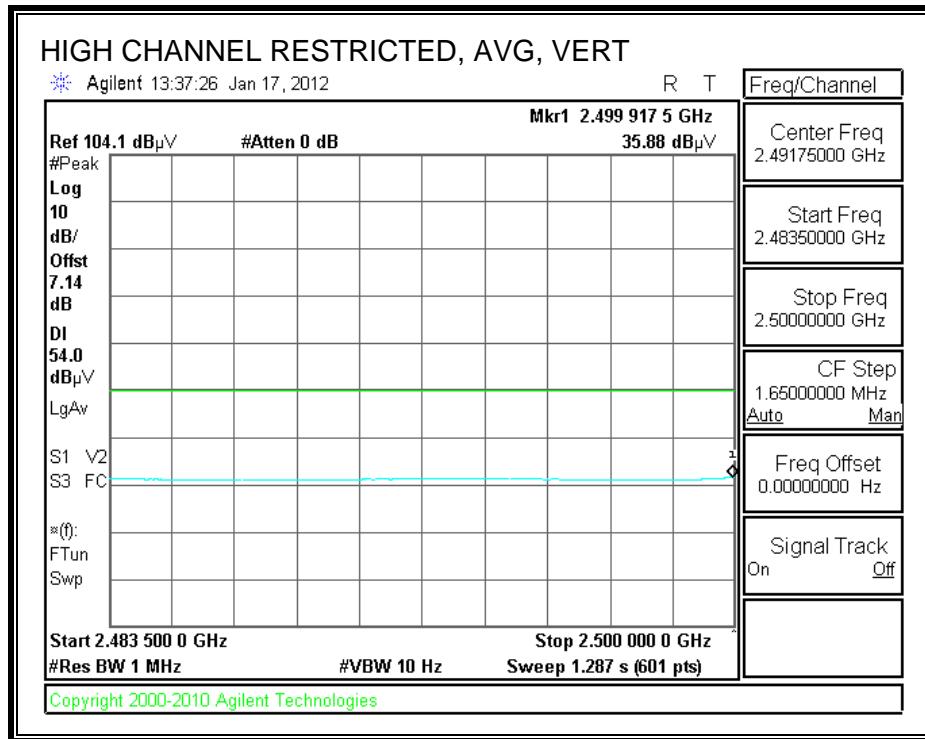
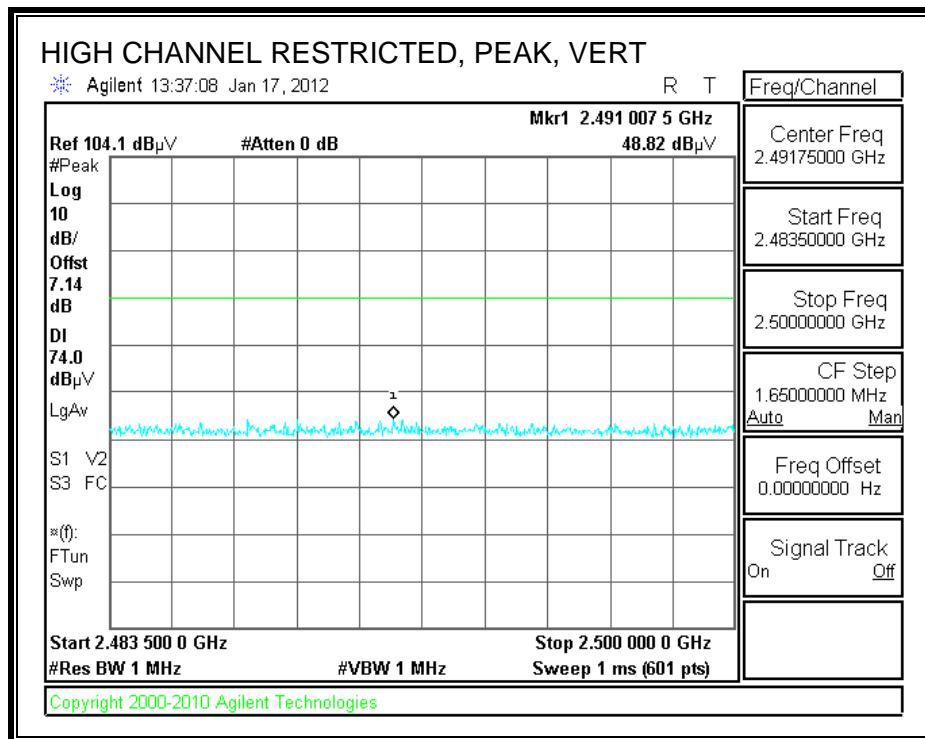
8.1. TRANSMITTER ABOVE 1 GHz

8.1.1. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Vien Tran
Date: 01/19/12
Project #: 11U14192
Company: Broadcom
Test Target: FCC 15.247
Mode Oper: Tx 8PSK Mode_High Channel Only_Worst-Case

f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter	

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
4.960	3.0	40.6	33.3	5.9	-34.9	0.0	0.0	44.9	74.0	-29.1	H	P	175.0	1.6	
4.960	3.0	29.9	33.3	5.9	-34.9	0.0	0.0	34.3	54.0	-19.7	H	A	175.0	1.6	
7.440	3.0	37.1	36.4	7.3	-34.6	0.0	0.0	46.1	74.0	-27.9	H	P	197.4	30.6	
7.440	3.0	24.1	36.4	7.3	-34.6	0.0	0.0	33.1	54.0	-20.9	H	A	197.4	30.6	
4.960	3.0	41.7	33.3	5.9	-34.9	0.0	0.0	46.1	74.0	-27.9	V	P	108.6	200.3	
4.960	3.0	33.0	33.3	5.9	-34.9	0.0	0.0	37.4	54.0	-16.6	V	A	108.6	200.3	
7.440	3.0	36.2	36.4	7.3	-34.6	0.0	0.0	45.3	74.0	-28.7	V	P	100.4	339.6	
7.440	3.0	24.1	36.4	7.3	-34.6	0.0	0.0	33.1	54.0	-20.9	V	A	100.4	339.6	

Rev. 4.1.2.7

Note: No other emissions were detected above the system noise floor.