



**FCC CFR47 PART 15 SUBPART C**

**CLASS II PERMISSIVE CHANGE  
TEST REPORT**

**FOR**

**802.11a/b/g/n 2x2 Radio Module with 2.4GHz Whip Antenna**

**MODEL NUMBER: WL11A**

**FCC ID: ACJ9TGWL11A**

**REPORT NUMBER: 11J13843-1**

**ISSUE DATE: JUNE 15, 2011**

*Prepared for*

**PANASONIC CORPORATION OF NORTH AMERICA  
ONE PANASONIC WAY, 4B-8  
SECAUCUS, NEW JERSEY 07094, U.S.A.**

*Prepared by*

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NVLAP LAB CODE 200065-0

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	06/15/11	Initial Issue	F. Ibrahim



# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** PANASONIC CORPORATION OF NORTH AMERICA  
ONE PANASONIC WAY, 4B-8  
SECAUCUS, NEW JERSEY 07094, U.S.A.

**EUT DESCRIPTION:** 802.11a/b/g/n 2x2 Radio Module with 2.4GHz Whip Antenna

**MODEL:** WL11A

**SERIAL NUMBER:** 34

**DATE TESTED:** JUNE 01 AND 06, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	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.

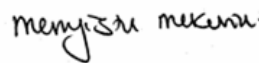
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of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



FRANK IBRAHIM  
EMC SUPERVISOR  
UL CCS

Tested By:



MENGISTU MEKURIA  
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, and FCC CFR 47 Part 15.

## 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:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

### 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 802.11a/b/g/n is an Intel Corporation Centrino advanced-N 6205 which is a PCIe half mini card form factor IEEE 802.11 a/b/g/n wireless network adaptor that operates in both the 2.4GHz and 5 GHz spectra. The card supports 2x2 MIMO for 802.11n in both the 20MHz and 40MHz channels and in legacy modes 1x2 operation is supported.

The radio module is manufactured by Intel.

### **5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE**

The major change filed under this application is adding external antenna.

### **5.3. MAXIMUM OUTPUT POWER**

Same power values were used from original reports.

### **5.4. DESCRIPTION OF ADDING ANTENNA**

Whip antenna with 5dBi in 2.4GHz is added.

### **5.5. SOFTWARE AND FIRMWARE**

The test utility software used during testing was DRTU, version. 1.1.3.

Driver software is V14.1.4.115.

## 5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. Radiated Emissions below 1 GHz was performed with EUT set to transmit at the channel with highest output power.

Worst-case data rates used per input from the client are as follows:

- 11b: 1Mbps
- 11g: 6 Mbps
- 11n HT20: MCS0
- 11n HT40: MCS0

Worst-case modes were selected for BE and Harmonics based on an investigation of the original reports, as shown in the summary table below:

Worst-case Modes to test					
2.4 GHz			5.8 GHz		
Low BE	High BE	Harmonics	Low BE	High BE	Harmonics
11n 20M Chain A Channel 2 Pwr AV=16.1 dBm Margin= -0.7 dB	11n 40M Chain A Channel 9 Pwr AV=9.6 dBm Margin= -1.1 dB	11b Chain A Channel 11 Pwr AV=15.8 dBm AV Margin= -6.1 dB Freq= 4924 MHz	No need to test	No need to test	11n 20M Chain A+B Channel 165 (5825MHz) Pwr AV=16.6, 16.8 dBm AV Margin= -6.9 dB Freq= 11649.9 MHz
5.2 GHz			5.3 GHz		
Low BE	High BE	Harmonics	Low BE	High BE	Harmonics
11n 20M Chain A+B Channel 36 (5180MHz) Pwr AV=12.4, 12.5 dBm Margin= -1.1 dB	No need to test	11n 20M Chain A+B Channel 40 (5200MHz) Pwr AV=16.5 dBm AV Margin= -6.3 dB Freq= 11000.3 MHz	No need to test	11n 20M Chain A+B Channel 64 (5320MHz) Pwr AV=13.2, 13.1 dBm Margin= -5.4 dB	No need to test
5.6 GHz					
Low BE	High BE	Harmonics			
11n 40M Chain A+B Channel 102 (5510MHz) Pwr AV=12.6, 12.4 dBm Margin= -4.6 dB	11n 20M Chain A+B Channel 140 (5700MHz) Pwr AV=13.4, 13.6 dBm Margin= -16.5 dB	11a 20M Chain B Channel 100 (5500MHz) Pwr AV=16.1, 16 dBm AV Margin= -9.7 dB Freq= 7500.1 MHz			

## 5.6 DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Panasonic	Toughbook (CF-31)	34	DoC
Laptop Deck	Panasonic	CF-VEB272	9DKSA 02245	DoC
AC/DC	Panasonic	CF-AA5713A M1	5713AM110Z12971A	DoC

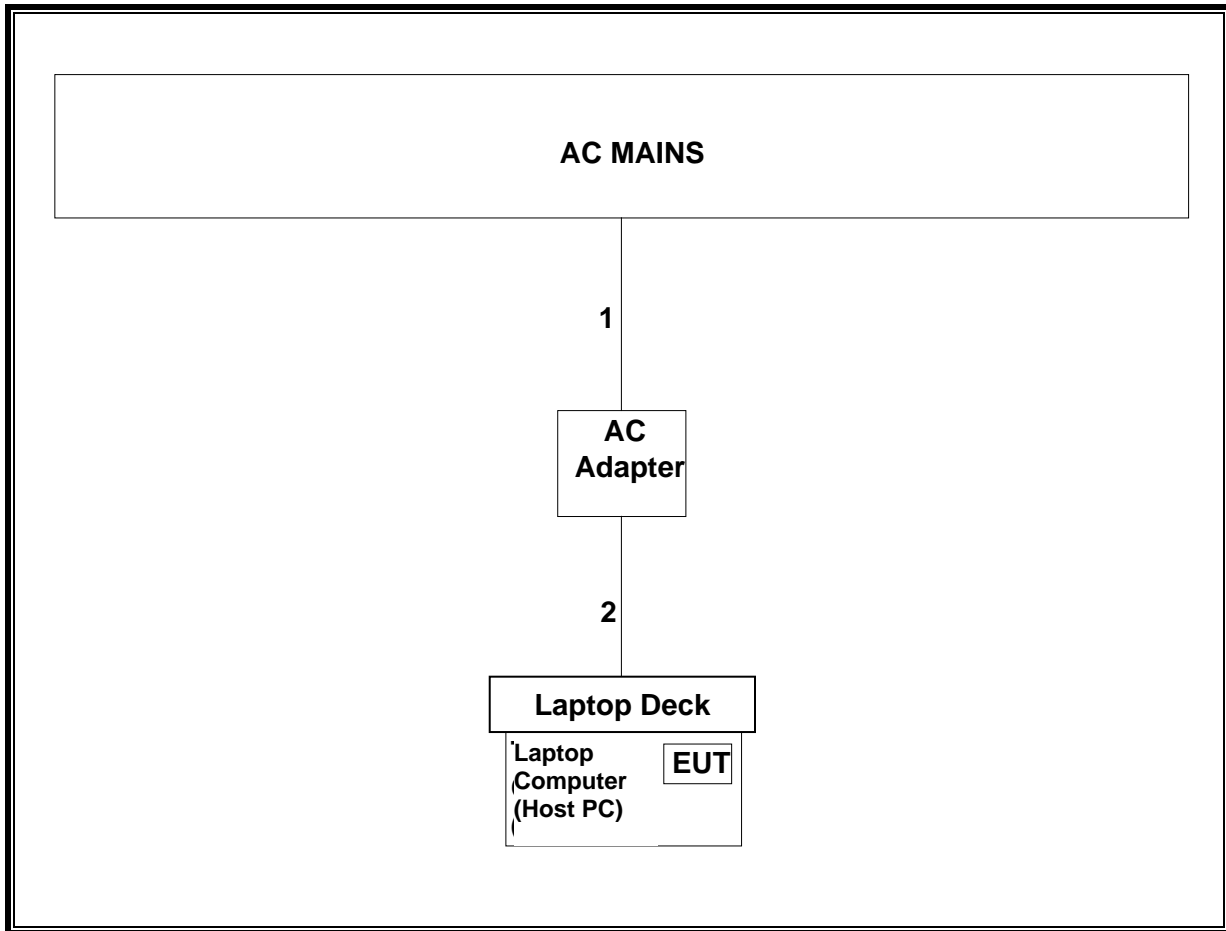
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Un-Sheilded	180 cm	N/A
2	DC	1	DC	Un-Sheilded	180 cm	N/A

### TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card. A laptop computer was used to configure the EUT to continuously transmit at a specified output power or continuously receive on the channel specified in the test data. For transmit modes the worst case was evaluated.

**SETUP DIAGRAM FOR 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 Date	Cal Due
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/10	07/12/11
Antenna, Horn, 18 GHz	EMCO	3115	C00783	06/29/10	06/29/11
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	07/14/10	07/14/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/27/11	01/27/12
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02677		CNR
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRC13192	N02683		CNR
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	06/08/11	06/05/13
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/30/10	08/30/11
LISN, 30 MHz	FCC	LISN-50/250-2	N02625	11/10/10	11/10/11

## 7. RADIATED TEST RESULTS

### 7.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

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.

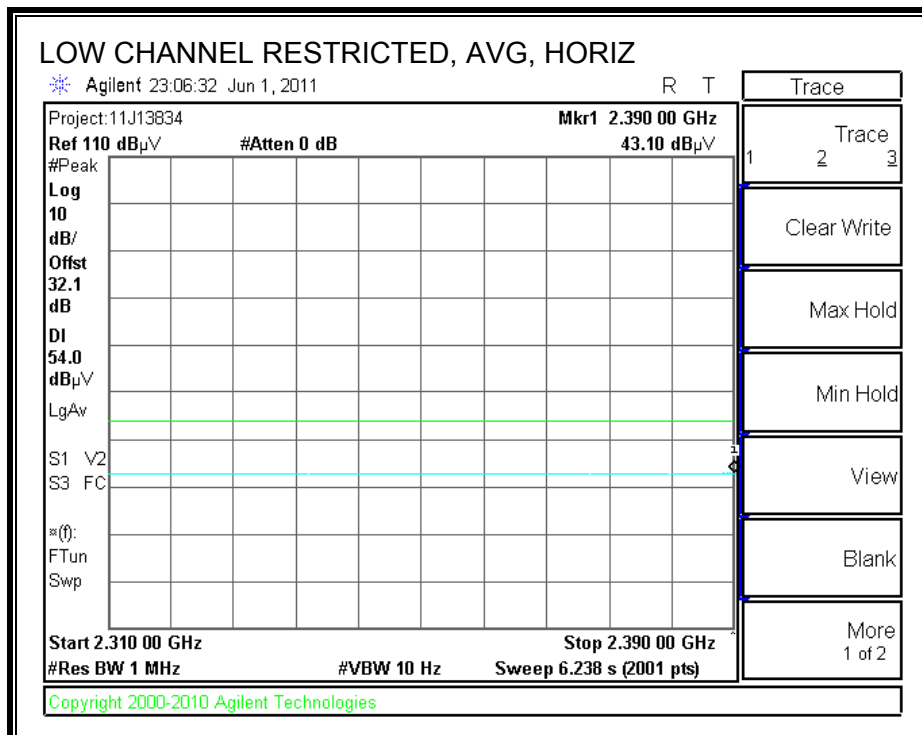
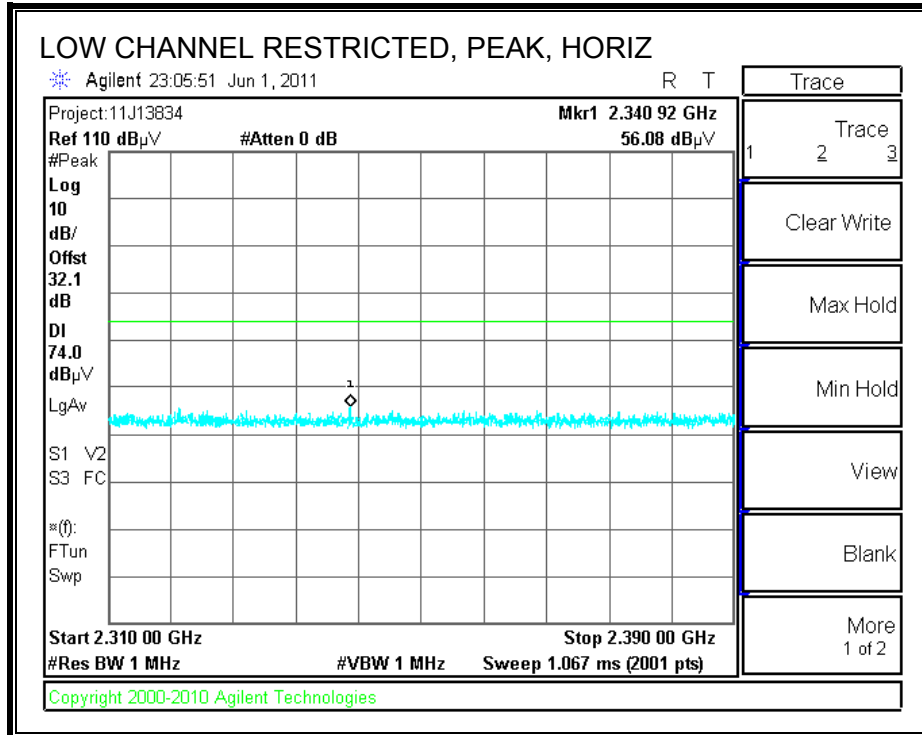
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

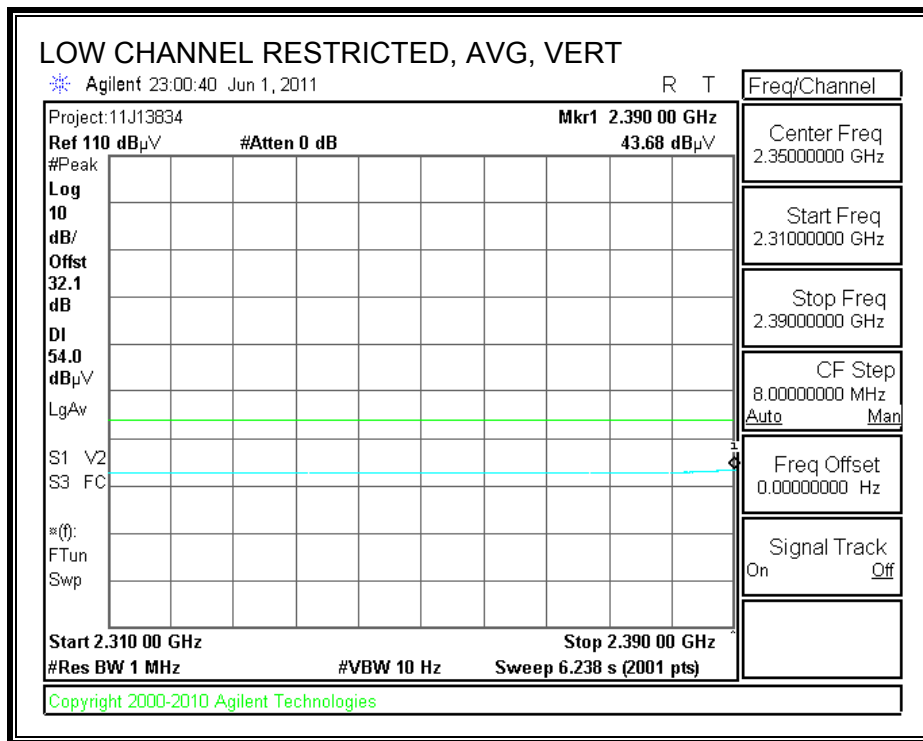
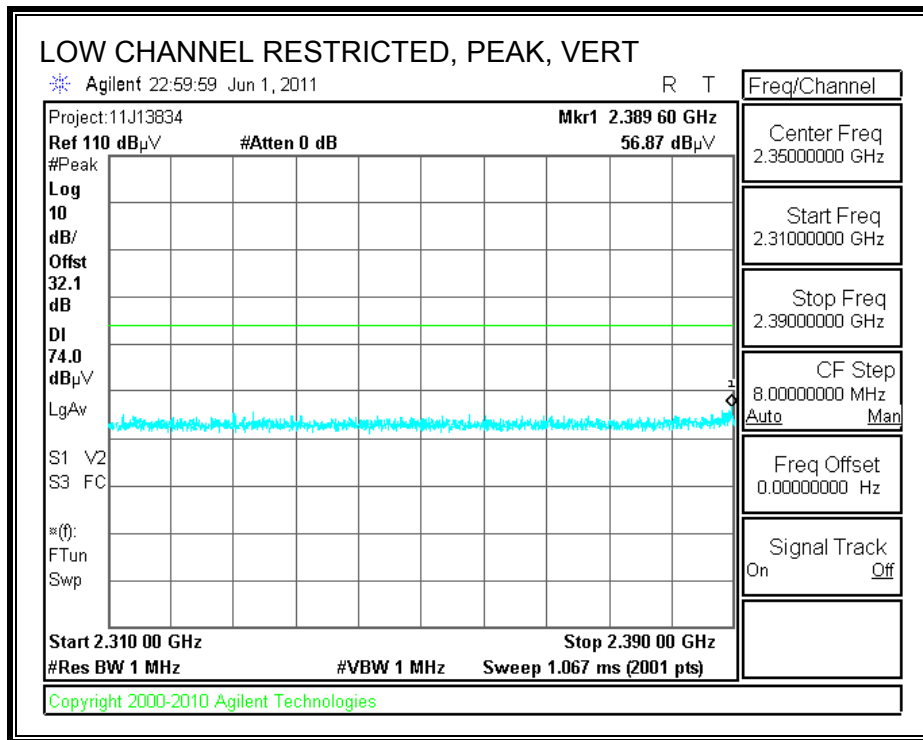
## 7.2. TRANSMITTER ABOVE 1 GHz (worst-case modes)

### 7.2.1. 2.4 GHz BAND

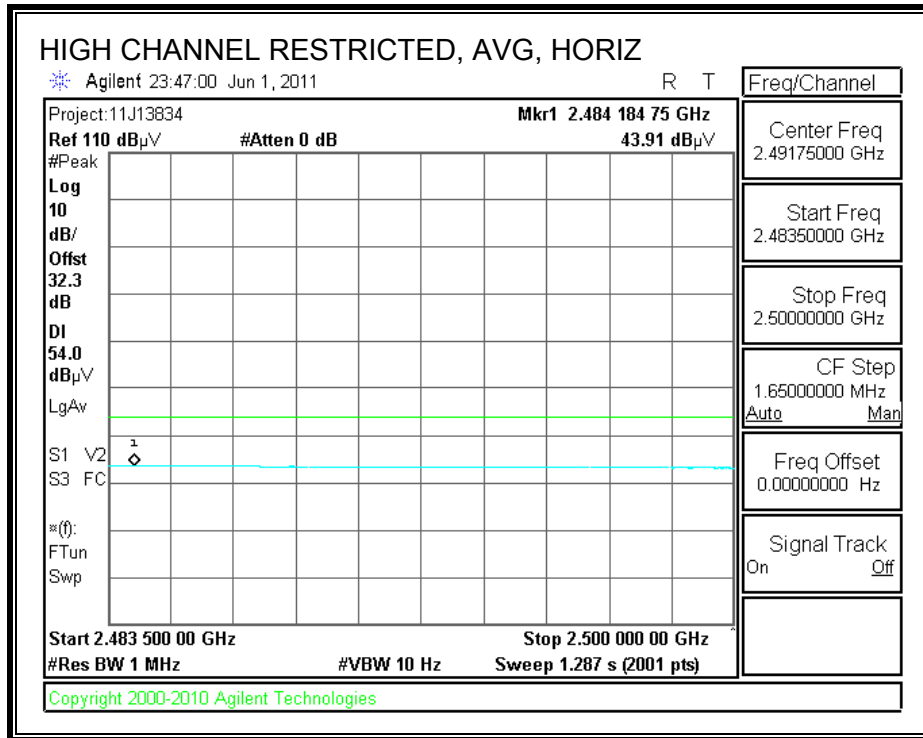
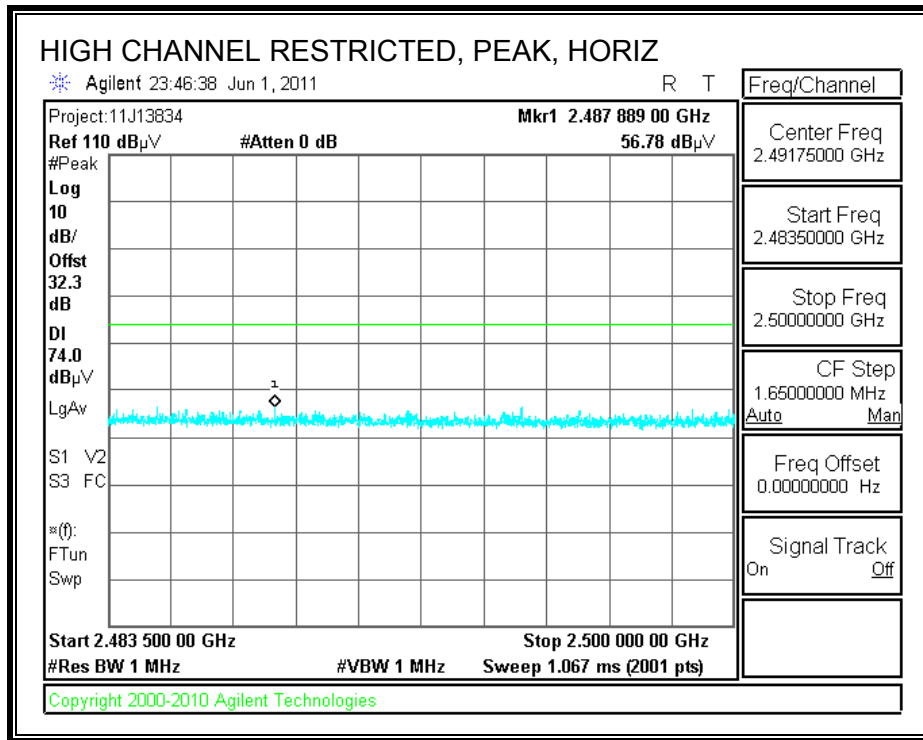
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



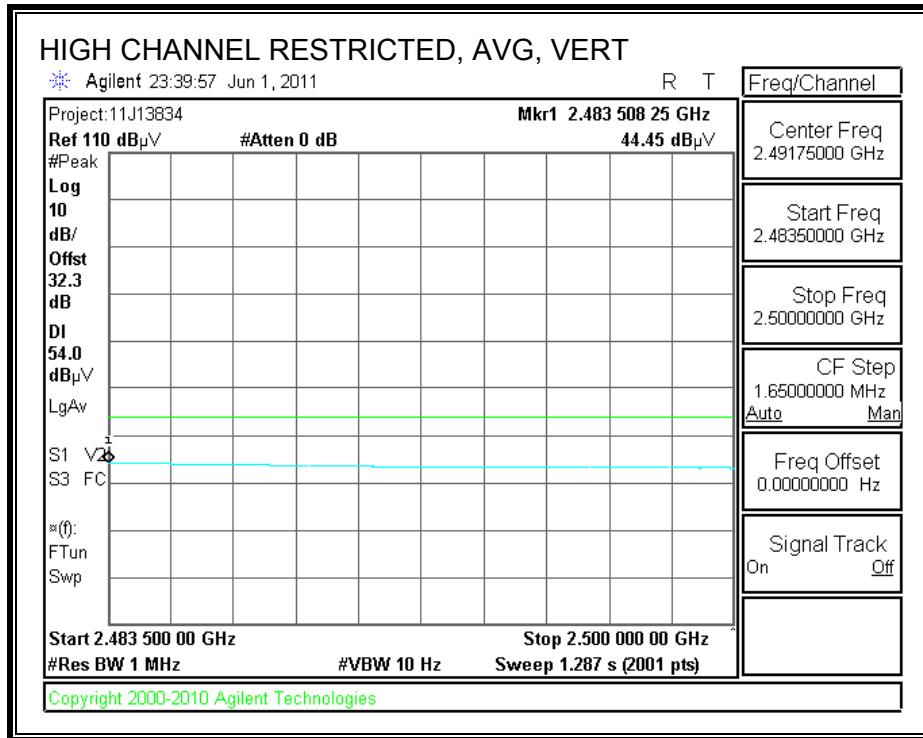
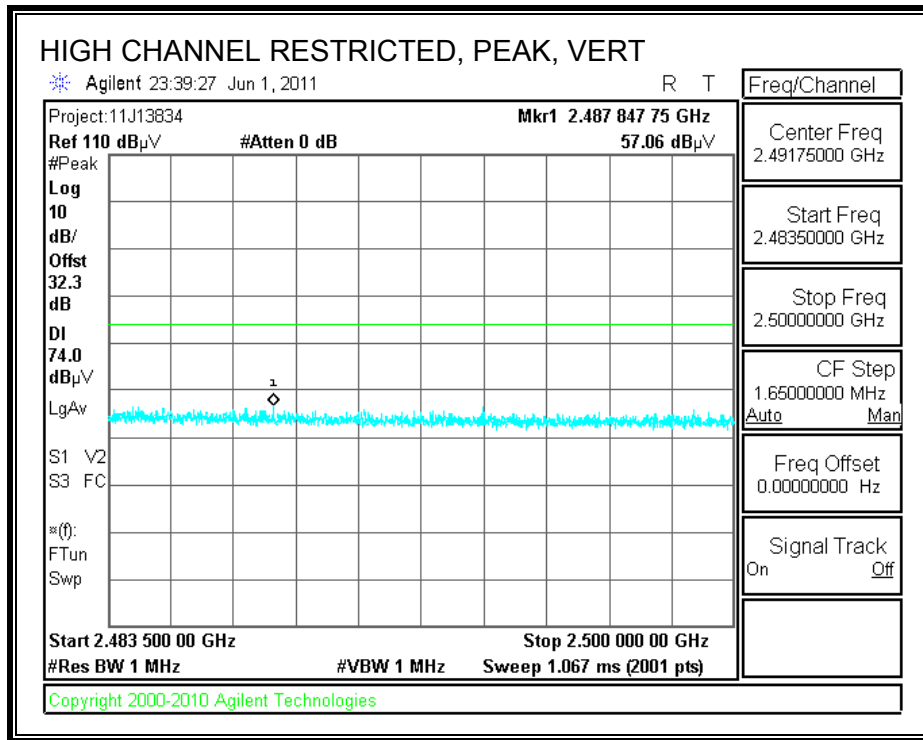
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

**Company:** PANASONIC  
**Project #:** 11J13843  
**Date:** 1/6/2011  
**Test Engineer:** MENGISTU MEKURIA  
**Configuration:** EUT INSIDE LAPTOP, LAPTOP DUCK, AND EXTERNAL ANTENNA  
**Mode:** TX b MODE

**Test Equipment:**

<b>Horn 1-18GHz</b>	<b>Pre-amplifer 1-26GHz</b>	<b>Pre-amplifer 26-40GHz</b>	<b>Horn &gt; 18GHz</b>	<b>Limit</b>
T59; S/N: 3245 @3m	T145 Agilent 3008A005		T125; ARA 18-26GHz; S/N:1007	FCC 15.205

Hi Frequency Cables

<b>3' cable 22807700</b>	<b>12' cable 22807600</b>	<b>20' cable 22807500</b>	<b>HPF</b>	<b>Reject Filter</b>	<b>Peak Measurements</b> RBW=VBW=1MHz <b>Average Measurements</b> RBW=1MHz ; VBW=10Hz
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001	

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>Hi CHANNEL (2462 MHz)</b>															
4.924	3.0	41.4	32.4	32.8	5.9	-34.9	0.0	0.0	45.3	36.3	74	54	-28.7	-17.7	V
7.386	3.0	37.7	24.8	35.3	7.3	-34.6	0.0	0.0	45.6	32.8	74	54	-28.4	-21.2	V
4.924	3.0	41.2	33.4	32.8	5.9	-34.9	0.0	0.0	45.0	37.2	74	54	-29.0	-16.8	H
7.386	3.0	38.3	25.0	35.3	7.3	-34.6	0.0	0.0	46.3	33.0	74	54	-27.7	-21.0	H

Rev. 07.22.09

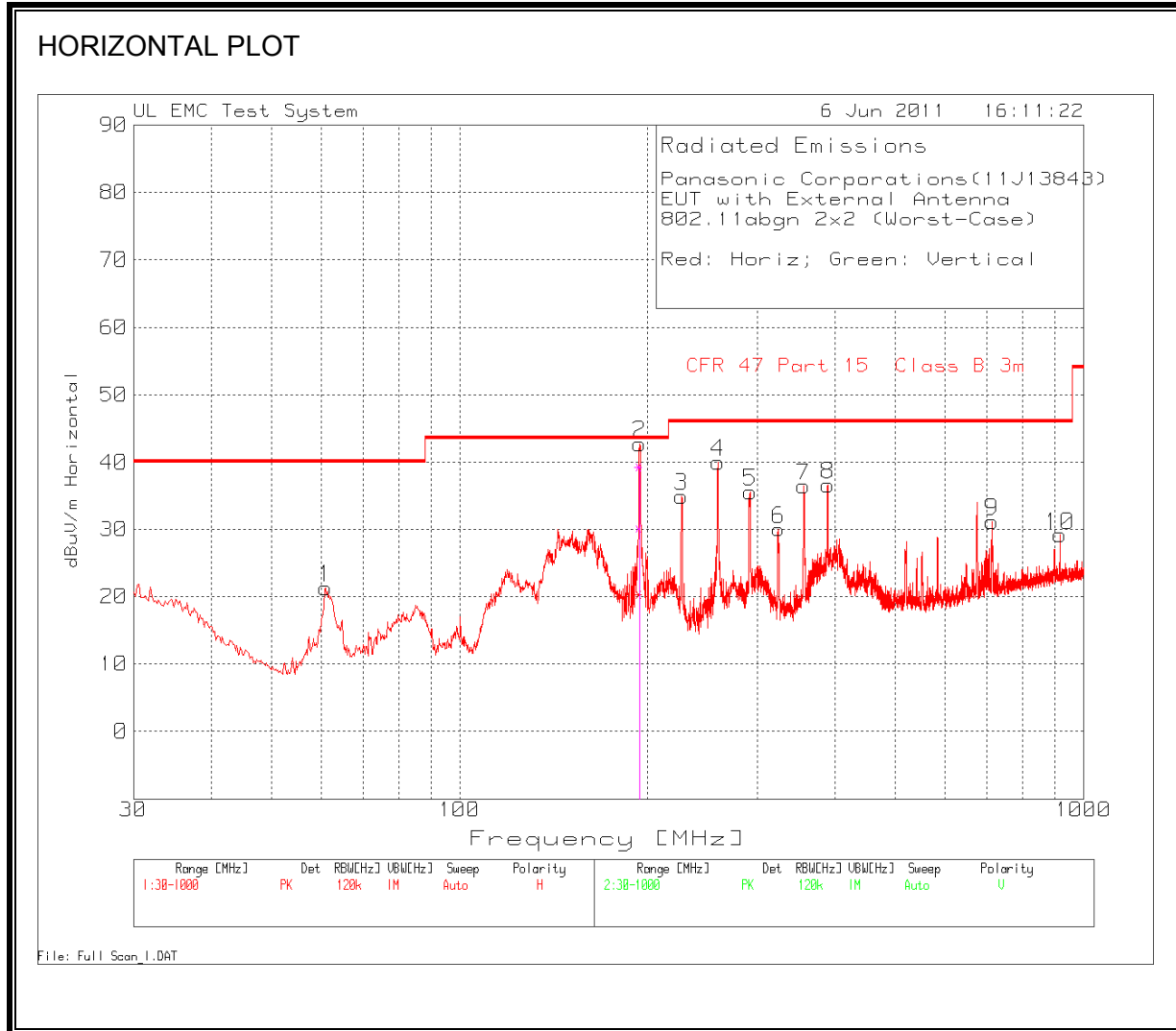
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

### 7.2.2. 5.8 GHZ BAND

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber																	
Test Engr:		Joe Danisi															
Date:		April 4th to April 8th 2011															
Project #:		11J13739															
Company:		PANASONIC CORP.															
Configuration:		Chain A&B															
Mode Oper:		11n 20M															
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	Dist	Read	AF	CL	Amp	D Corr	Filtr	Corr.	Limit	Margin	Ant. Pol.	Det.	Ant.High	Table Angle	Notes		
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	cm	Degree			
11.650	3.0	34.3	38.2	9.6	-32.9	0.0	0.0	49.2	74.0	-24.8	V	P	100.0	310.2			
11.650	3.0	22.0	38.2	9.6	-32.9	0.0	0.0	36.9	54.0	-17.1	V	A	100.0	310.2			
11.650	3.0	34.4	38.2	9.6	-32.9	0.0	0.0	49.3	74.0	-24.7	H	P	125.6	109.3			
11.650	3.0	22.5	38.2	9.6	-32.9	0.0	0.0	37.3	54.0	-16.7	H	A	125.6	109.3			
Rev. 4.1.2.7																	
Note: No other emissions were detected above the system noise floor.																	

### 7.3. WORST-CASE BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

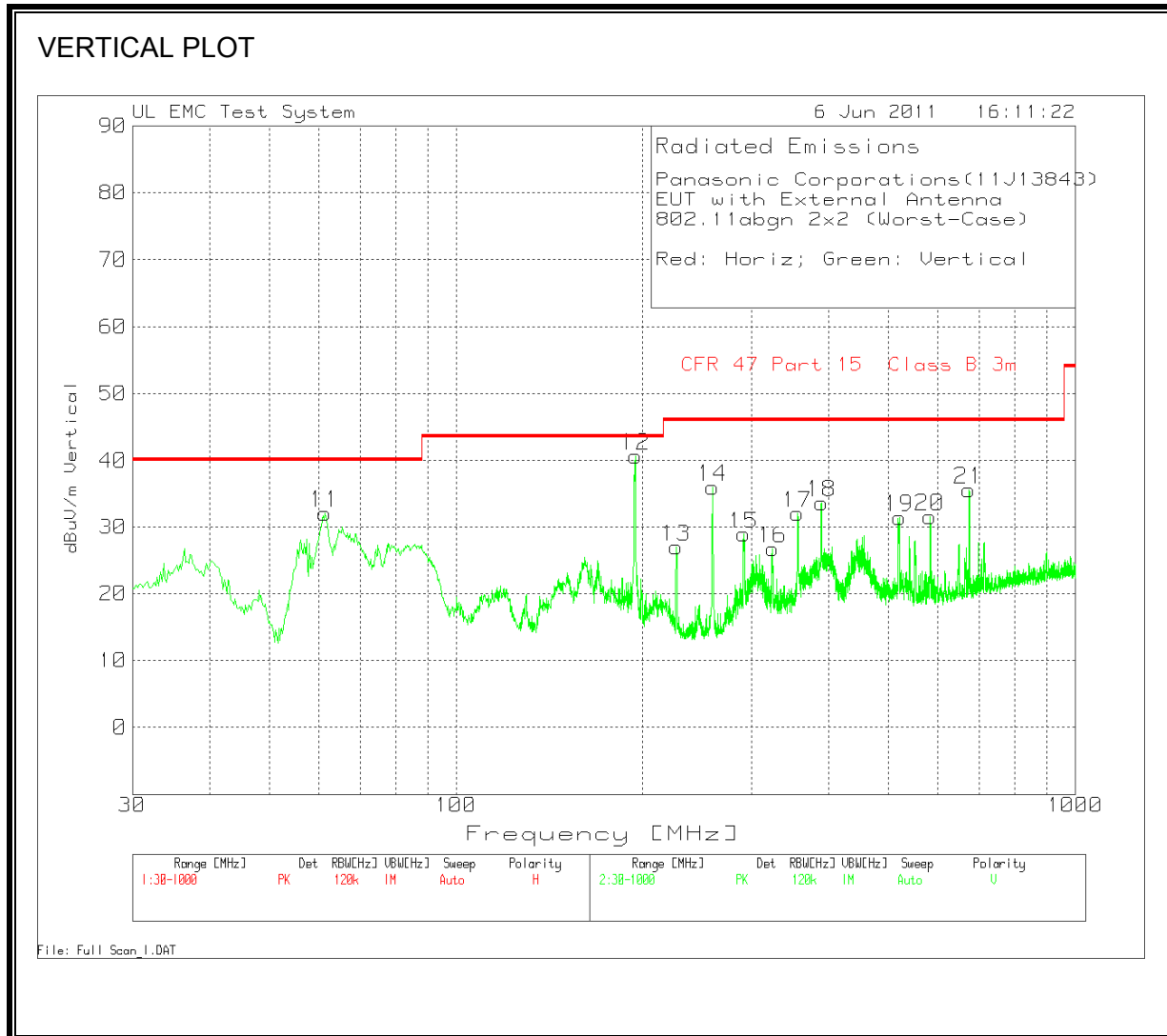


**HORIZONTAL DATA**

Panasonic Corporations(11J13843)											
EUT with External Antenna											
802.11abgn 2x2 (Worst-Case)											
Red: Horiz; Green: Vertical											
Range 1 30 - 1000MHz											
Test Freq	Meter Rea	Detector	5m A Cabl	5m A T64	5m A T122	dBuV/m	CFR 47 Par	Margin	Height [cn	Polarity	
61.0152	40.9	PK	0.8	-28.3	7.9	21.3	40	-18.7	300	Horz	
194.3805	57.72	PK	1.5	-28.1	11.6	42.72	43.5	-0.78	91	Horz	
226.5588	49.59	PK	1.6	-28.1	11.9	34.99	46	-11.01	91	Horz	
259.9001	54.29	PK	1.7	-28	12.1	40.09	46	-5.91	91	Horz	
292.466	48.57	PK	1.9	-28	13.2	35.67	46	-10.33	91	Horz	
324.8381	42.31	PK	2	-28	13.8	30.11	46	-15.89	91	Horz	
355.8533	47.98	PK	2.1	-27.9	14.3	36.48	46	-9.52	91	Horz	
389.7762	47.57	PK	2.2	-27.9	14.8	36.67	46	-9.33	91	Horz	
714.2726	35.47	PK	3	-27	19.8	31.27	46	-14.73	91	Horz	
916.8405	31.18	PK	3.4	-27.4	22	29.18	46	-16.82	200	Horz	
Test Freq	Meter Rea	Detector	5m A Cabl	5m A T64	5m A T122	dBuV/m	CFR 47 Par	Margin	Azimuth [	Height [cn	Polarity
194.2	54.26	QP	1.5	-28.1	11.6	39.26	43.5	-4.24	274	116	Horz

Note: No other emissions were detected above noise floor

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**



**VERTICAL DATA**

Panasonic Corporations(11J13843)											
EUT with External Antenna											
802.11abgn 2x2 (Worst-Case)											
Red: Horiz; Green: Vertical											
Range 2 30 - 1000MHz											
Test Freq	Meter Re	Detector	5m A Cabl	5m A T64	5m A T122	dBuV/m	CFR 47 Pa	Margin	Height [cn	Polarity	
61.4029	51.71	PK	0.8	-28.3	7.9	32.11	40	-7.89	300	Vert	
194.7682	55.7	PK	1.5	-28.1	11.6	40.7	43.5	-2.8	200	Vert	
226.5588	41.57	PK	1.6	-28.1	11.9	26.97	46	-19.03	100	Vert	
259.9001	50.27	PK	1.7	-28	12.1	36.07	46	-9.93	200	Vert	
291.303	41.95	PK	1.8	-28	13.1	28.85	46	-17.15	100	Vert	
324.8381	38.88	PK	2	-28	13.8	26.68	46	-19.32	200	Vert	
355.8533	43.58	PK	2.1	-27.9	14.3	32.08	46	-13.92	200	Vert	
389.7762	44.58	PK	2.2	-27.9	14.8	33.68	46	-12.32	100	Vert	
519.8461	39.45	PK	2.5	-27.6	17.1	31.45	46	-14.55	100	Vert	
582.458	38.28	PK	2.7	-27.4	18.1	31.68	46	-14.32	100	Vert	
674.1467	40.5	PK	2.9	-27.1	19.3	35.6	46	-10.4	100	Vert	
Range 1 30 - 1000MHz											
Test Freq	Meter Re	Detector	5m A Cabl	5m A T64	5m A T122	dBuV/m	CFR 47 Pa	Margin	Azimuth [	Height [cn	Polarity
194.1928	45.11	QP	1.5	-28.1	11.6	30.11	43.5	-13.39	161	100	Vert

Note: No other emissions were detected above noise floor

## 7.4. AC MAINS LINE CONDUCTED EMISSIONS

### TEST PROCEDURE

ANSI C63.4

### 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

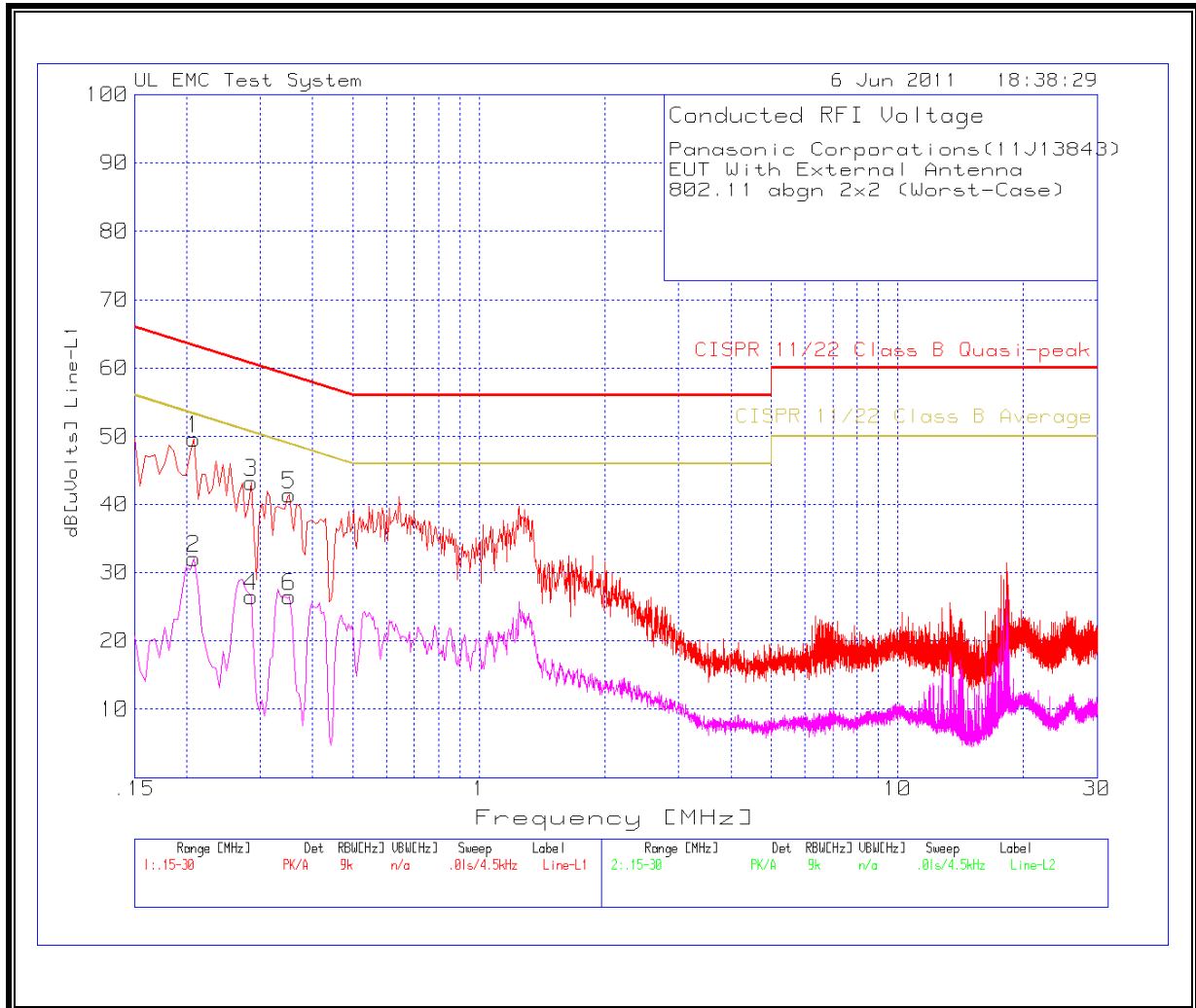
Notes:  
 1. The lower limit shall apply at the transition frequencies  
 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

**RESULTS**

**6 WORST EMISSIONS**

Panasonic Corporations(11J13843)									
EUT With External Antenna									
802.11 abgn 2x2 (Worst-Case)									
Line-L1 .15 - 30MHz									
Test Freq	Meter Res	Detector	LISN [dB]	Conducte	dB[uVolts	CISPR 11/22 C	Margin	CISPR 11/22 C	Margin
0.2085	49.6	PK	0	0	49.6	63.3	-13.7	53.3	-3.7
0.2085	31.99	Av	0	0	31.99	-	-	53.3	-21.31
0.285	43.36	PK	0	0	43.36	60.7	-17.34	50.7	-7.34
0.285	26.54	Av	0	0	26.54	-	-	50.7	-24.16
0.3525	41.53	PK	0	0	41.53	58.9	-17.37	48.9	-7.37
0.3525	26.5	Av	0	0	26.5	-	-	48.9	-22.4
Line-L2 .15 - 30MHz									
Test Freq	Meter Res	Detector	LISN [dB]	Conducte	dB[uVolts	CISPR 11/22 C	Margin	CISPR 11/22 C	Margin
0.204	41.24	PK	0	0	41.24	63.4	-22.16	53.4	-12.16
0.204	28.75	Av	0	0	28.75	-	-	53.4	-24.65
0.276	36.84	PK	0	0	36.84	60.9	-24.06	50.9	-14.06
0.276	20.7	Av	0	0	20.7	-	-	50.9	-30.2
0.474	32.36	PK	0	0	32.36	56.4	-24.04	46.4	-14.04
0.474	21.1	Av	0	0	21.1	-	-	46.4	-25.3

**LINE 1 RESULTS**



**LINE 2 RESULTS**

