



# FCC CFR47 PART 15 SUBPART C CLASS II PERMISSIVE CHANGE TEST REPORT

Per

# FCC PART 15 SUBPART C TECHNICAL REQUIREMENT WI-FI BASE STATION

MODEL NAME: VP2200 (IDU); VP2210 (ODU)

FCC ID: QLNVSH24SWP

**REPORT NUMBER: 04U2788-1** 

**ISSUE DATE: JULY 7, 2004** 

Prepared for VIVATO, INC. 12610 E. MIRABEAU PARKWAY, #900 SPOKANE, WA 99216, USA

*Prepared by* 

COMPLIANCE CERTIFICATION SERVICES 561F MONTEREY ROAD, MORGAN HILL, CA 95037, USA

TEL: (408) 463-0885 FAX: (408) 463-0888



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REPORT NO: 04U2788-1 EUT: Wi-Fi BASE STATION

## 1. TEST RESULT CERTIFICATION

**COMPANY NAME:** VIVATO, INC.

12610 E. MIRABEAU PARKWAY, #900

SPOKANE, WA 99216

**EUT DESCRIPTION:** 802.11b/g Wi-Fi Base Station

**MODEL:** VP2200 (IDU); VP2210 (ODU)

MODEL DIFFERENCE: VP2200 is designed for indoor uses while VP2210 is for outdoor uses.

VP2210 uses the same electronics and antenna as VP2200 does.

DATE: JULY 7, 2004

FCC ID: OLNVSH24SWP

**DATE TESTED:** June 28, 2004

#### APPLICABLE STANDARDS

STANDARD TEST RESULTS

FCC PART 15 SUBPART C NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note**: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Approved & Released For CCS By: Tested By:

Kland Marie

THU CHAN DAVID GARCIA EMC SUPERVISOR EMC ENGINEER

COMPLIANCE CERTIFICATION SERVICES COMPLIANCE CERTIFICATION SERVICES

## 2. EUT DESCRIPTION

The EUT is a wireless device operating in the 2.4GHz band, providing network connections to Wi-Fi (802.11b/g) client deices.

## 3. CLASS II PERMISSIVE CHANGE DESCRIPTION

This is a Class II permissive change for FCC ID: QLNVSH24SWP, originally granted on April 16, 2004.

The major change filed under this application includes:

1. VP2200 (Indoor unit) - Replaced the original power supply PCA with a new power supply PCA;

DATE: JULY 7, 2004

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- 2. VP2210 (Outdoor unit) Placed existing antenna and electronics that are used in VP2200 into a weather-tight enclosure;
- 3. Added a transient surge protection PCA for the I/O ports to the outdoor VP2210;
- 4. Added a transient surge protection/environmental control PCA for the incoming input voltage to the outdoor VP2210. This PCA will also control a fan and a heater plate;
- 5. Request that the same FCC IC#: QLNVSH24SWP be used for both the VP2200 and VP2210.

## 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/2001, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

## 5. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.



No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

## 6. CALIBRATION AND UNCERTAINTY

## 6.1. 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.

DATE: JULY 7, 2004 FCC ID: OLNVSH24SWP

#### 6.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

# 6.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

DATE: JULY 7, 2004

FCC ID: QLNVSH24SWP

## FOR VP2200

TEST EQUIPMENT LIST								
Name of Equipment	Manufacturer	Model No.	Serial No.	<b>Due Date</b>				
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/2004				
LISN, $10 \text{ kHz} \sim 30 \text{ MHz}$	FCC	50/250-25-2	114	10/13/2004				
LISN, $10 \text{ kHz} \sim 30 \text{ MHz}$	Solar	8012-50-R-24-BNC	8379443	10/13/2004				
Site A Line Stabilizer / Conditioner	Tripplite	LC-1800a	A0051681	CNR				
Site B Antenna, Bilog	Chase	CBL6112B	2586	3/8/2005				
RF Preselector, 20 Hz ~ 2 GHz	HP	85685A	2817A00756	8/22/2004				
SA RF Section, 1.5 GHz	HP	85680B	2814A04227	2/22/2005				
SA Display Section 2	HP	85662A	2816A16696	5/24/2005				
Quasi-Peak Adaptor	HP	85650A	2811A01155	5/24/2005				

TEST EQUIPMENT LIST								
Name of Equipment	Manufacturer	Model No.	Serial No.	<b>Due Date</b>				
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/2004				
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	10/13/2004				
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/13/2004				
Site A Line Stabilizer / Conditioner	Tripplite	LC-1800a	A0051681	CNR				
30MHz 2Ghz	<b>Sunol Sciences</b>	JB1 Antenna	A121003	12/22/2004				
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/21/2004				
RF Filter Section	HP	85420E	3705A00256	11/21/2004				
]								

# 7. EQUIPMENT MODIFICATIONS

To achieve compliance to FCC Section 15.247 technical limits, the following change(s) were made during compliance testing:

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Ferrite cores were added to the internal LAN cables of the outdoor unit VP2210 as shown in the photo in the Setup Photos Section.

# 8. SETUP OF EQUIPMENT UNDER TEST

## **SUPPORT EQUIPMENT**

		TEST		
		PERIPHERALS		
Device Type	Manufacturer	Model Number	Serial Number	FCC ID
Laptop	IBM	X24	FX-GU403	AN0SY4W2662DFJ
USB/Serial Adapter	Belkin	FSU109	N/A	N/A

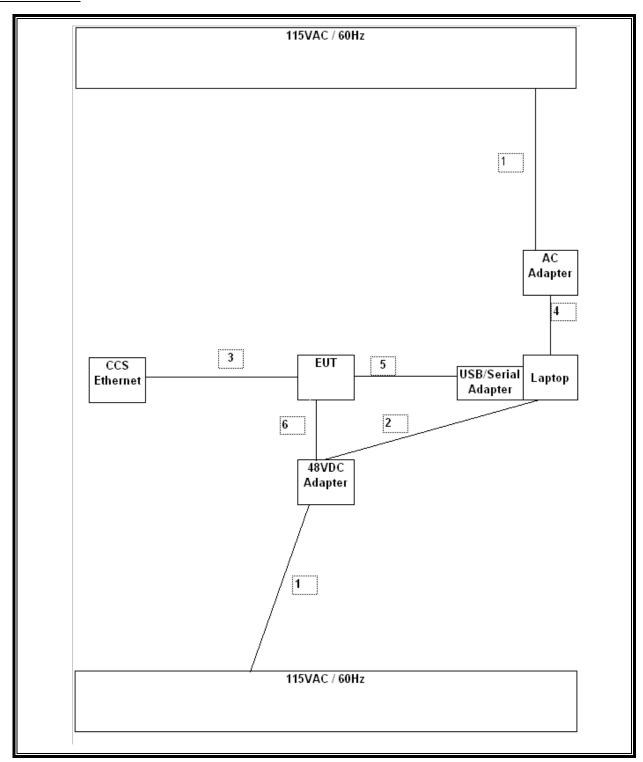
## **I/O CABLES**

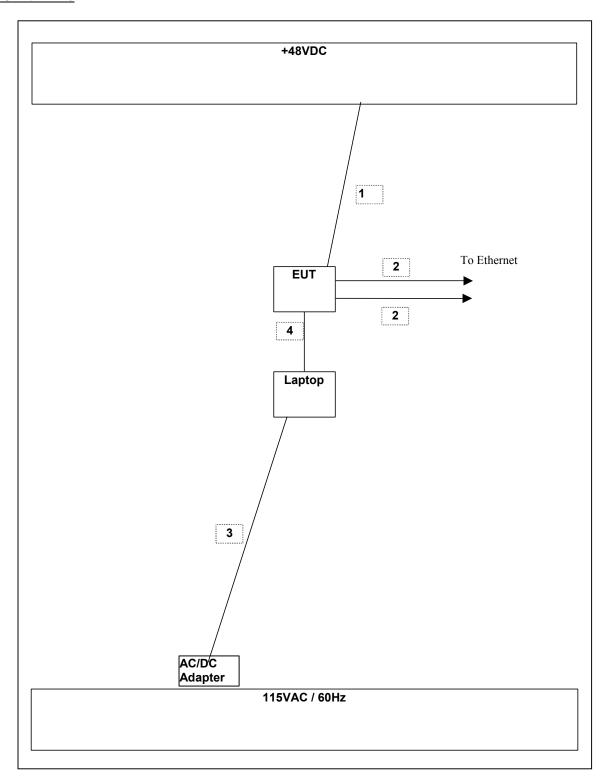
## FOR VP2200

				TEST I / O CABLES					
Cable	I/O	# of I/O	Connector	Type of	Cable	Data			
No	Port	Port	Type	Cable	Length	Traffic	Bundled	Remark	
1	AC	2	IEC	unshielded	1.5 meters	no	yes	N/A	
2	LAN	1	RJ45	unshielded	3+30 meters	yes	no	Crossover Cable	
3	LAN	1	RJ45	unshielded	3+30 meters	no	no	LAN/DC over LAN	
4	DC	1	DC	unshielded	1 meter	no	no	DC from Adapter	
5	Serial	1	RJ45	unshielded	3 meters	yes	yes	Serial interface	
6	DC/LAN	1	RJ45	unshielded	3 meters	yes	no	DC over LAN	

		-	-		TEST I / O	-	•	
					<b>CABLES</b>			
Cable	I/O	# of I/O	Connector	Type of	Cable	Data		
No	Port	Port	Type	Cable	Length	Traffic	Bundled	Remark
1	DC	1	screw clamp	unshielded	6 meters	no	yes	DC supply cable
2	LAN	2	RJ45	unshielded	3+30 meters	yes	no	Ethernet
3	AC/DC	1	DC	unshielded	2 meters	no	no	Laptop AC/DC supply
4	Serial	1	RJ45	unshielded	3 meters	ves	no	Serial interface

# **SETUP DIAGRAM FOR TESTS**





## 9. APPLICABLE LIMITS AND TEST RESULTS

### 9.1. RADIATED EMISSIONS

## 9.1.1. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

#### **LIMITS**

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	$\binom{2}{}$
13.36 - 13.41			

<sup>&</sup>lt;sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

<sup>&</sup>lt;sup>2</sup> Above 38 6

§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:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

<sup>\*\*</sup> 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., Sections 15.231 and 15.241.

be altered or revised by Compliance Certification Services personnel only, and shall be noted in the

revision section of the document.

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

## **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

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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 of 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 of the 5.8 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.

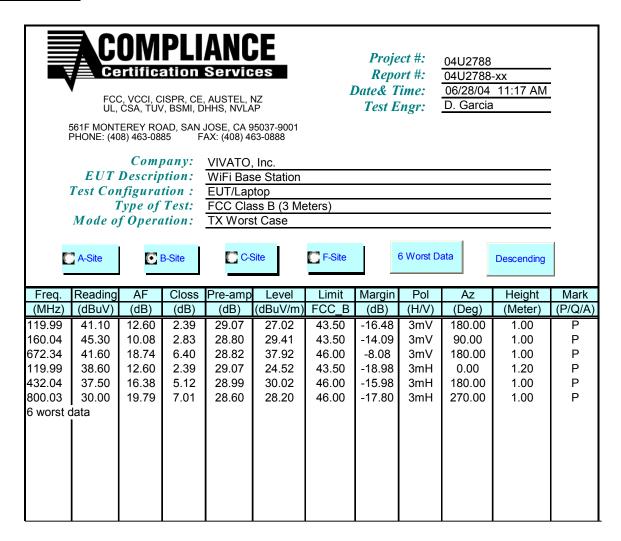
#### **RESULTS**

No non-compliance noted:

## DATE: JULY 7, 2004 FCC ID: OLNVSH24SWP

## **WORST-CASE RADIATED EMISSIONS BELOW 1 GHz**

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

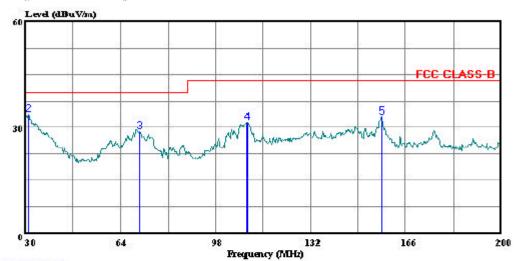


#### FOR VP2210 – HORIZONTAL (30-200MHz)



561F Monterey Road San Jose, CA 95131 Tel: (408) 463-0888 Fax: (408) 463-0885

Data#: 23 File#: 04u2788.emi Date: 06-29-2004 Time: 12:21:49



(Audix ATC)

Trace: 22 Ref Trace:

Condition: FCC CLASS-B SUNOL BILOG 12/22/04 HORIZONTAL

Test Operator: : David Garcia Project #: : 04U2788-2 Company: : Vivato,Inc.

BUT: : WiFi Outdoor Base Station

Model No: : VP2210 Configuration: : EUT/Laptop Target of Test: : FCC Class B Mode of Operation: TX Worst Case

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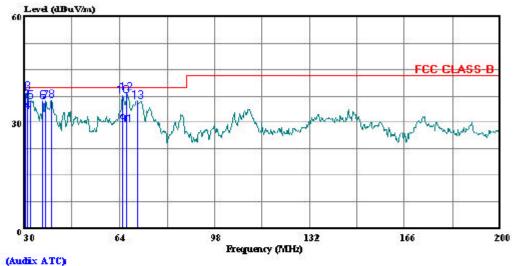
	Freq	Remark	Read Level	Factor	Level	Limit Line	Over Limit	ruge.
	MHz		dBuV	db	$\overline{\text{dBuV}/\text{m}}$	dBu√/m	dB	
1 2 3 4 5	30.000 31.190 70.630 109.390 157.330	Peak Peak Peak	19.42 18.04	22.06 9.39 13.33	33.66 28.83 31.37	40.00 40.00 40.00 43.50 43.50	-6.34 -11.19 -12.13	

#### FOR VP2210 - VERTICAL (30-200MHz)



561F Monterey Road San Jose, CA 95131 Tel: (408) 463-0888 Fax: (408) 463-0885

Data#: 19 File#: 04u2788.emi Date: 06-29-2004 Time: 11:56:23



Trace: 16 Ref Trace:

Condition: FCC CLASS-B SUNOL BILOG 12/22/04 VERTICAL

Test Operator: : David Garcia Project #: : 04U2788-2 Company: : Vivato,Inc.

EUT: : WiFi Outdoor Base Station

Model No: : VP2210
Configuration: : EUT/Laptop
Target of Test: : FCC Class B
Mode of Operation: TX Worst Case

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								Page: 1
			Read			Limit	over	
	Freq	Remark	Level	Factor	Level	Line	Limit	
	MHZ		dBuV	dв	dBuV/m	dBuV/m	dB	
1	30.340	Peak	15.51	22.75	38.26	40.00	-1.74	
2	30.340	QP	13.62	22.70	36.32	40.00	-3.68	
3	31.190	Peak	16.76	22.06	38.82	40.00	-1.18	
4	31.190	QP	11.13	22.03	33.16	40.00	-6.84	
5	32.380	Peak	14.95	21.18	36.13	40.00	-3.87	
6	36.630	Peak	18.07	18.12	36.19	40.00	-3.81	
7	37.480	Peak	18.46	17.55	36.00	40.00	-4.00	
8	39.690	Peak	20.50	15.84	36.34	40.00	-3.66	
9	65.190	QP	20.00	9.27	29.27	40.00	-10.73	
10	65.190	Peak	28.51	9.27	37.78	40.00	-2.22	
11	66.380	QP	20.00	9.31	29.31	40.00	-10.69	
12	66.380	Peak	29.16	9.31	38.47	40.00	-1.53	
13	70.290	Peak	26.68	9.40	36.08	40.00	-3.92	

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## FOR VP2210 – HORIZONTAL (200-1000MHz)



561F Monterey Road San Jose, CA 95131 Tel: (408) 463-0888 Fax: (408) 463-0885

Data#: 25 File#: 04u2788.emi Date: 06-29-2004 Time: 12:26:23

Level (dBuV/m)

FCC CLASS-B

30

200
360
520
Requency (MHz)

(Audix ATC)

Trace: 24 Ref Trace:

Condition: FCC CLASS-B SUNOL BILOG 12/22/04 HORIZONTAL

Test Operator: : David Garcia Project #: : 04U2788-2 Company: : Vivato,Inc.

BUT: : WiFi Outdoor Base Station

Model No: : VP2210
Configuration: : EUT/Laptop
Target of Test: : FCC Class B
Mode of Operation: TX Worst Case

D,	age	 ٦.
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Limit

over

	Freq	Remark	Level :	Factor	Level	Line	Limit
	MHz		dBuV	dB	dBuV/m	dBuV/m	dB
1	233.600	Peak	16.54	13.41	29.95	46.00	-16.05
2	253.600	Peak	16.05	14.26	30.31	46.00	-15.69
3	333.600	Peak	17.08	16.55	33.63	46.00	-12.37

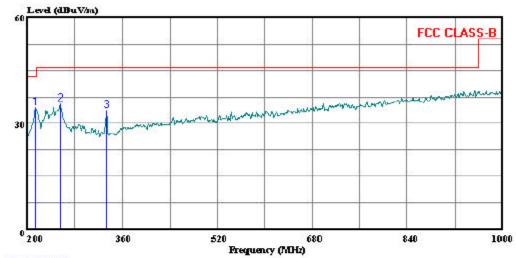
Read

#### FOR VP2210 – VERTICAL (200-1000MHz)



561F Monterey Road San Jose, CA 95131 Tel: (408) 463-0888 Fax: (408) 463-0885

Data#: 21 File#: 04u2788.emi Date: 06-29-2004 Time: 12:15:14



(Audix ATC)

Trace: 20 Ref Trace:

Condition: FCC CLASS-B SUNOL BILOG 12/22/04 VERTICAL

Test Operator: : David Garcia : 04U2788-2 Project #: Company: : Vivato, Inc.

EUT: : WiFi Outdoor Base Station

Model No: : VP2210 Configuration: : EUT/Laptop Target of Test: : FCC Class B Mode of Operation: TX Worst Case

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	Freq	Remark	Read Level :	Factor	Level	Limit Line		
	MHz		dBuV	dB	dBuV/m ∂	iBuV/m	dB	
1 2 3	213.600 255.200 333.600	Peak	21.20	14.35	34.44 35.55 33.68	46.00	-10.45	

## 9.2. POWERLINE CONDUCTED EMISSIONS

## <u>LIMIT</u>

 $\S15.207$  (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  $\mu$ 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.

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The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted I	Conducted Limit (dBuV)			
	Quasi-peak	Average			
0.15-0.5	66 to 56 *	56 to 46 *			
0.5-5	56	46			
5-30	60	50			

Decreases with the logarithm of the frequency.

#### **TEST PROCEDURE**

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

## **RESULTS**

No non-compliance noted:

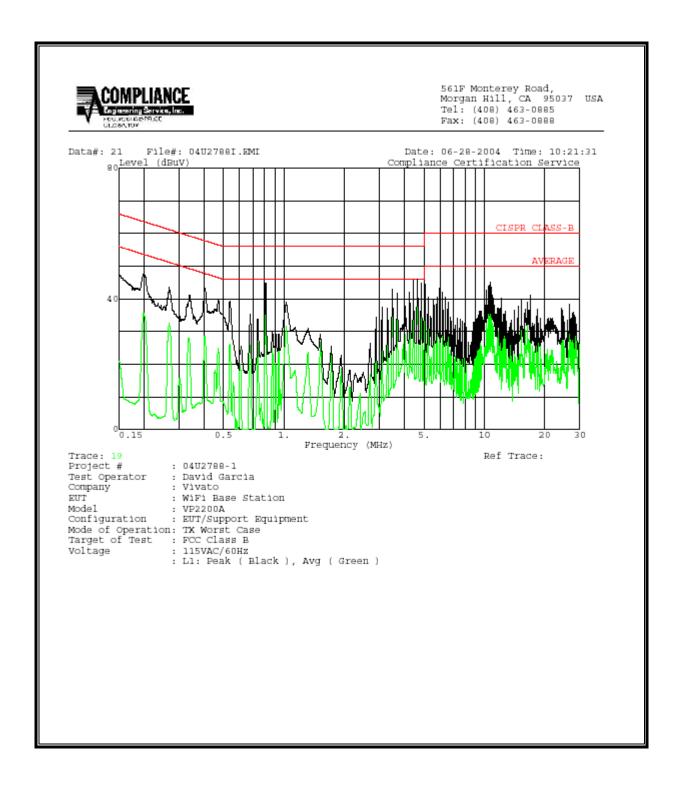
## **6 WORST EMISSIONS**

## FOR VP2200

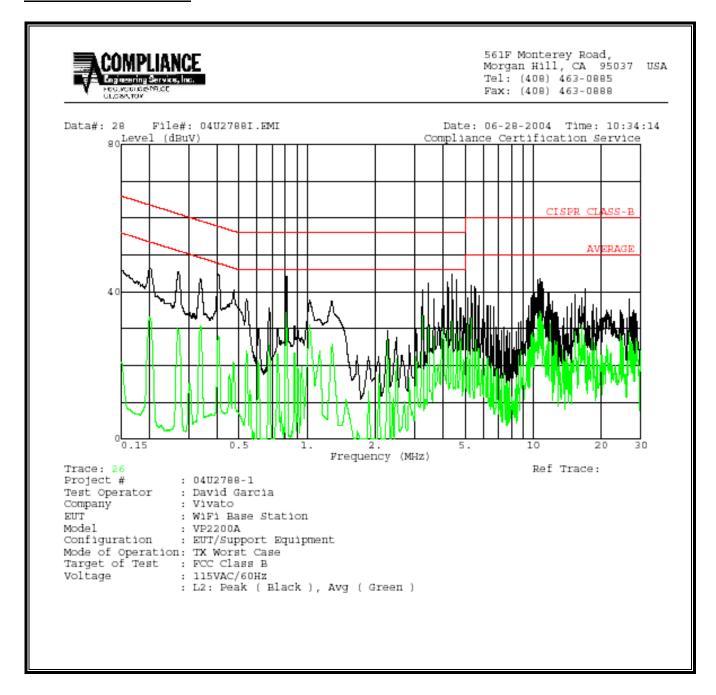
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
4.43	45.62			0.00	56.00	46.00	-10.38	-0.38	L1
4.65	45.90			0.00	56.00	46.00	-10.10	-0.10	L1
10.68	44.96			0.00	60.00	50.00	-15.04	-5.04	L1
0.81	44.24			0.00	56.00	46.00	-11.76	-1.76	L2
4.38	44.86			0.00	56.00	46.00	-11.14	-1.14	L2
10.68	43.72			0.00	60.00	50.00	-16.28	-6.28	L2
6 Worst I	) Data								

CONDUCTED EMISSIONS DATA (48VDC)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.15	55.48		54.92	0.00	65.94	55.94	-10.46	-1.02	L1
0.31	49.42		48.00	0.00	61.51	51.51	-12.09	-3.51	L1
0.46	44.86		43.39	0.00	57.11	47.11	-12.25	-3.72	L1
0.15	55.32		54.94	0.00	65.91	55.91	-10.59	-0.97	L2
0.31	48.98		47.68	0.00	61.51	51.51	-12.53	-3.83	L2
0.46	48.58		43.16	0.00	57.17	47.17	-8.59	-4.01	L2
6 Worst Data									

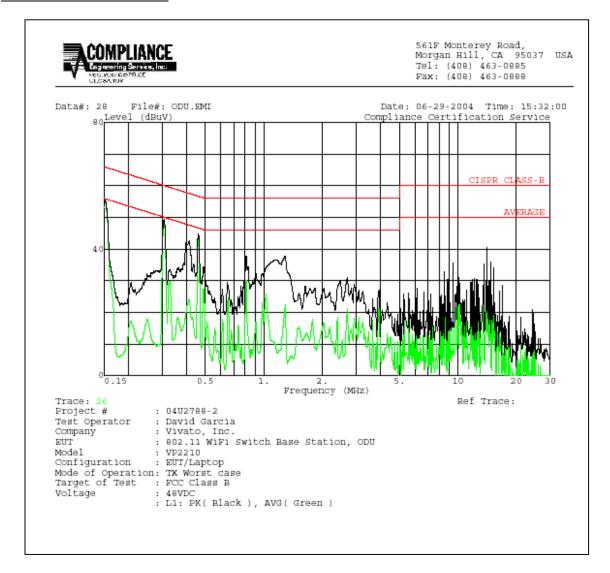
## VP2200 - LINE 1 RESULT



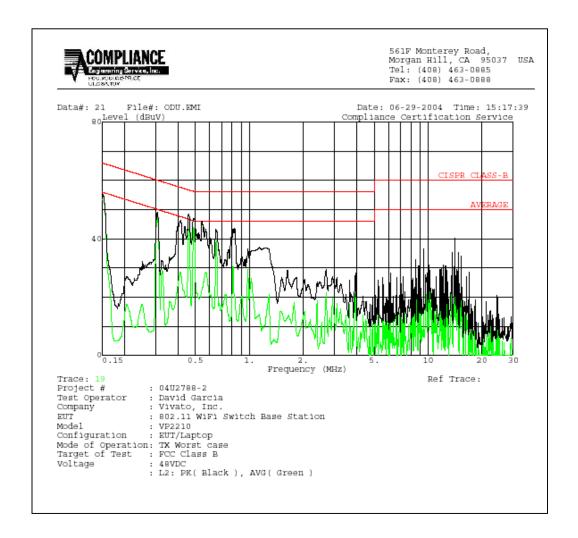
#### **VP2200 - LINE 2 RESULTS**



#### VP2210 - LINE 1 RESULT



#### VP2210 - LINE 2 RESULT

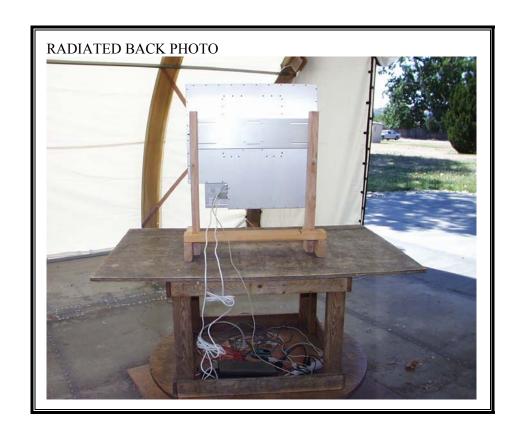


# 10. SETUP PHOTOS

## **RADIATED RF MEASUREMENT SETUP**

## **VP2200**





## **VP2210**





## POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

## <u>VP2200</u>





# <u>VP2210</u>





# Equipment modification on VP2210



# **END OF REPORT**

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