

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

### FOR

## 802.11a/b/g WIRELESS LAN CARDBUS CARD

### MODEL NUMBER: 8460-05

FCC ID: HZB-8460

## **REPORT NUMBER: 02U1692-4**

## **ISSUE DATE: JANUARY 2, 2003**

Prepared for PROXIM CORPORATION ZADELSTEDE 1-10 3431JZ NIEUWEGIAN THE NETHERLANDS

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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### **1. TEST RESULT CERTIFICATION**

COMPANY NAME:	PROXIM COR ZADELSTEDE 3431JZ NIEUW THE NETHER	2 1-10 /EGIAN				
EUT DESCRIPTION:	802.11a/b/g WI	RELESS LAN CARDBUS CARD				
MODEL NAME:	8460-05	8460-05				
DATE TESTED:	DECEMBER 9	DECEMBER 9, 2002 – JANUARY 2, 2003				
	APPLICAR	BLE STANDARDS				
STANDA	RD	TEST RESULTS				
FCC PART 15 SU	JBPART E	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.

**Note:** The 5.2 GHz band is applicable to this report; other bands of operation (2.4 and 5.8 GHz) are documented in a separate report.

Approved & Released For CCS By:

Tested By:

M to

MIKE HECKROTTE CHIEF ENGINEER COMPLIANCE CERTIFICATION SERVICES

FRANK IBRAHIM EMC ENGINEER COMPLIANCE CERTIFICATION SERVICES

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# 2. EUT DESCRIPTION

The Proxim 8460-05 is a high performance 802.11a/b/g WLAN client product intended for laptop applications. It operates in the 2.4 - 2.4835 GHz, 5.15 - 5.35 GHz and 5.725 - 5.850 GHz bands. The product uses two symmetric integral antennas for diversity operation.

The 8460 design is based on an Atheros AR5001X three-chip solution. The three chips include:

AR5211: Multiprotocol MAC/baseband processor, and CardBus/PCI bus interface.

AR5111 Radio-on-a-Chip (RoC): An all-CMOS single-chip radio transceiver that includes a power amplifier, and integrated dual conversion filters to convert signals from 5 GHz to the baseband range for use by the AR5211. The AR5111 offers fully integrated transmitter, receiver, and frequency synthesizer functions; eliminating the need for external voltage controlled oscillators (VCOs) and surface acoustic wave (SAW) filters.

AR2111 Radio-on-a-Chip (RoC): An all-CMOS single-chip radio transceiver that, when combined with the AR5111, implements a 2.4 GHz 802.11 b/g radio solution. The AR2111 offers fully integrated transmitter, receiver, and frequency synthesizer functions. Like the AR5111, the AR2111 does not require external VCOs or SAW filters.

# 3. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

1. The transmitter output filter is modified to provide improved spurious performance.

Due to the change of the filter, the antenna port conducted RF signals are retested.

2. The antennas are changed to higher gain.

The original antennas gain was 1.0 dBi. The new antenna gain is 2.69 dBi.

Due to the change of the antenna, the highest radiated spurious signals are retested.

The highest transmitter output power is 33.9 mW.

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# 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, and 15.407.

# 5. FACILITIES AND ACCREDITATION

### 5.1. FACILITIES AND EQUIPMENT

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 5.2. LABORATORY ACCREDITATIONS AND LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2)).

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### 5.3. TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	FCC Part 15, CISPR 22, AS/NZS 3548,IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC	<u>qalvn</u>
		61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11, CNS 13438	200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	<b>FCC</b> 1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	<b>VCCI</b> R-1014, R-619, C-640
Norway	NEMKO	EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1	N <sub>ELA 117</sub>
Norway	NEMKO	EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC	N <sub>ELA-171</sub>
Taiwan	BSMI	CNS 13438	SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	Canada IC2324 A,B,C, and F

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

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# 6. CALIBRATION AND UNCERTAINTY

### 6.1. MEASURING INSTRUMENT CALIBRATION

The measurement instruments utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer's recommendations, and are traceable to national standards.

### 6.2. MEASUREMENT UNCERTAINTY

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

Radiated Emission					
30MHz – 200 MHz	+/- 3.3dB				
200MHz - 1000MHz	+4.5/-2.9dB				
1000MHz - 2000MHz	+4.6/-2.2dB				
Power Line Con	ducted Emission				
150kHz – 30MHz	+/-2.9				

Any results falling within the above values are deemed to be marginal.

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### 6.3. TEST AND MEASUREMENT EQUIPMENT

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

TES	TEST AND MEASUREMENT EQUIPMENT LIST							
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due Date				
Spectrum Analyzer	HP	8566B	3014A06685	6/1/03				
Spectrum Display	HP	85662A	2152A03066	6/1/03				
Quasi-Peak Detector	HP	85650A	3145A01654	6/1/03				
Power Meter	Agilent	E4416A	GB41291160	8/9/2003				
Peak / Average Power Sensor	Agilent	E9327A	US40440755	9/5/2003				
Spectrum Analyzer	HP	8564E	3943A01643	7/22/03				
Preamplifier (1 - 26.5GHz)	Miteq	NSP10023988	646456	4/26/03				
Horn Antenna (1 - 18GHz)	EMCO	3115	6717	1/31/03				
Horn Antenna (18 – 26.5GHz)	ARA	MWH 1826/B	1013	1/31/03				
High Pass Filter (7.6GHz)	FSY Microwave	FM-7600-9SS	002	N.C.R.				
Spectrum Analyzer	HP	E4440A	US42221737	9/24/03				
Environmental Chamber	Thermotron	SE-600-10-10	29800	4/26/03				
Variable AC Power Supply	APC	AFP20080-C	J5061	N.C.R.				
Microwave Detector	Agilent	8474C	2905A04047	6/4/03				
Oscilloscope	HP	54601A	3106A00123	11/6/03				

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# 7. SETUP OF EQUIPMENT UNDER TEST

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST									
Device Type	Device Type Manufacturer Model Serial Number FCC ID								
Laptop	Personal Computer	N340S8	PB344S811902382	DoC					
AC Adapter	Lishin International	LSE9802A2060	010810241A1	N/A					

### I/O CABLES

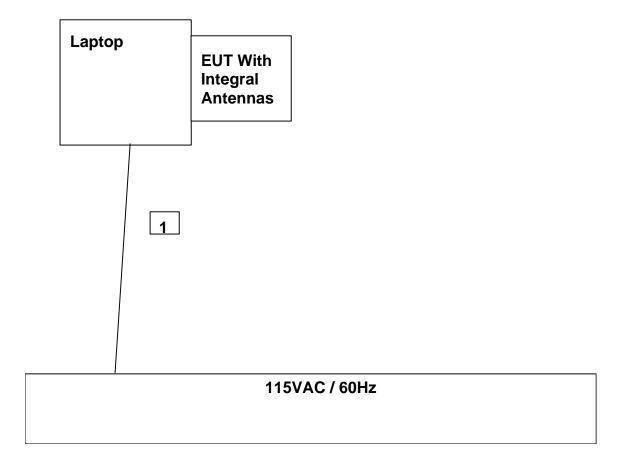
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115	Unshielded	2 m	Laptop cable is integrated with AC Adapter

### TEST SETUP

The EUT is installed in the laptop computer.

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#### SETUP DIAGRAM FOR TRANSMITTER TESTS



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# 8. APPLICABLE RULES

### §15.403- EMISSION BANDWIDTH

(c) <u>Emission bandwidth</u>. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

### §15.407(a)- POWER LIMIT

(1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW (17 dBm) or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW (24 dBm) or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### <u>§15.407(a)- PEAK POWER SPECTRAL DENSITY</u>

(1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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### §15.407(a)- PEAK EXCURSION

(6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### §15.407(b)- UNDESIRABLE EMISSION LIMITS

(1 & 2) For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

(5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(6) The provisions of §15.205 apply to intentional radiators operating under this section.

### <u>§15.407(d)- ANTENNA TYPE</u>

Any U-NII device that operates in the 5.15-5.25 GHz band shall use a transmitting antenna that is an integral part of the device.

### <u>§15.407(f)- RADIO FREQUENCY EXPOSURE</u>

U-NII devices are subject to the radio frequency radiation exposure requirements specified in §1.1307(b), §2.1091 and §2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

### <u>§15.407(g)- FREQUENCY STABILITY</u>

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

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### §15.205- RESTRICTED BANDS OF OPERATIONS

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	( <sup>2</sup> )
13.36 - 13.41			

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

 $^1$  Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.  $^2$  Above 38.6

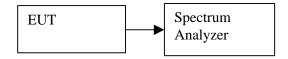
(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement 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.

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## 9. TEST SETUP, PROCEDURE AND RESULT

### 9.1. EMISSION BANDWIDTH

### TEST SETUP



### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 26 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

### **RESULTS**

No non-compliance noted:

Base Mode

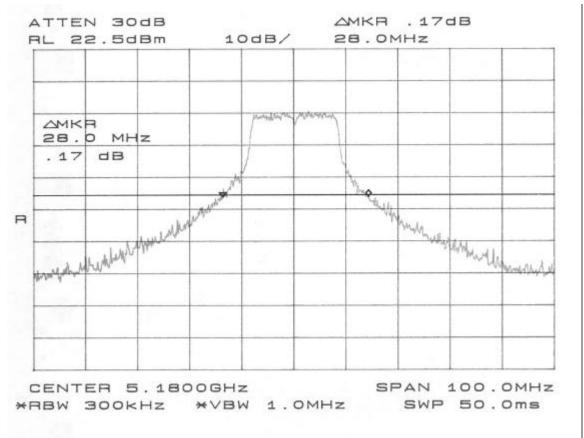
Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5180	28.0	14.5
Middle	5260	43.8	16.4
High	5320	28.3	14.5

Turbo Mode

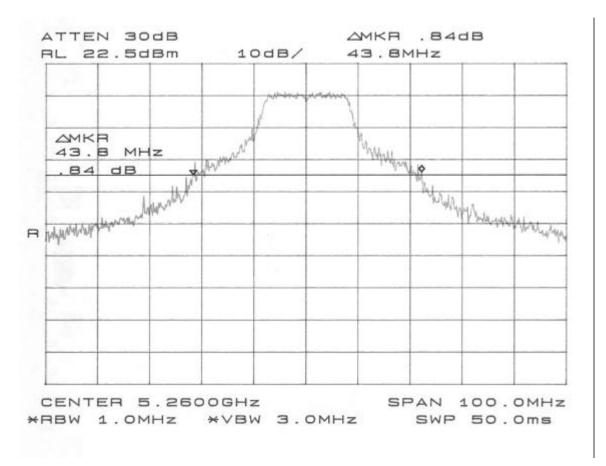
Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5210	68.3	18.3
Middle	5250	59.0	17.7
High	5290	78.8	19.0

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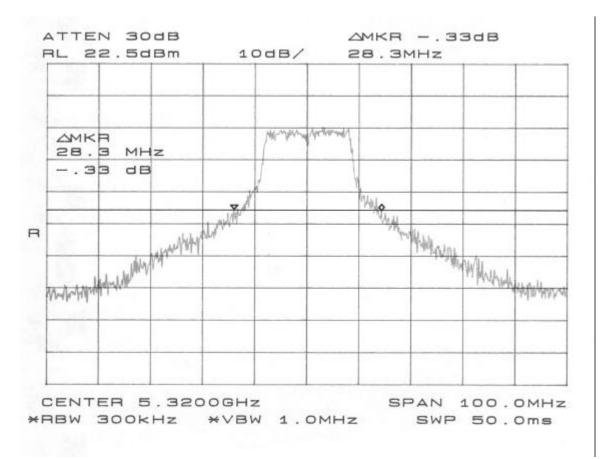
#### EMISSION BANDWIDTH (NORMAL MODE)



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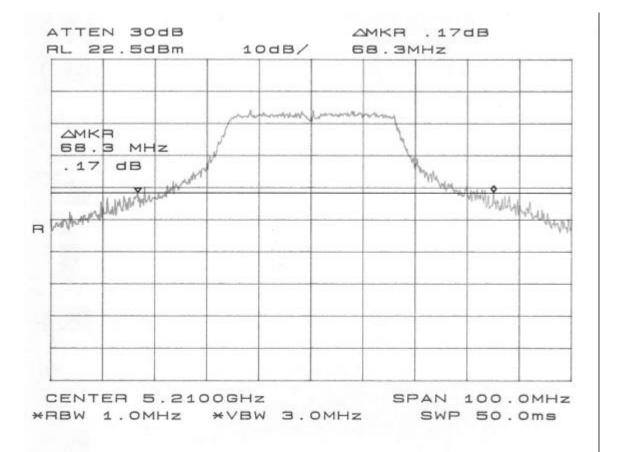


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#### EMISSION BANDWIDTH (TURBO MODE)



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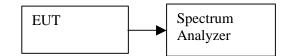
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### 9.2. PEAK POWER

### TEST SETUP



### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output is initially connected to a microwave detector and oscilloscope to measure the pulse duration, T.

Normal mode pulse duration = 1.57 ms Normal mode pulse duration = 3.14 ms

The automatic analyzer settings yield a sweep time of 50 msec. Sweep time > T and EBW > largest available RBW, therefore Method # 3 is used.

Specification Limit:

Base Mode

Channel	Frequency	10 Log B	4 + 10 Log B or	Power Limit
	(MHz)	(dB)	11 + 10 Log B (dBm)	(dBm)
Low	5180	14.5	18.5	17
Middle	5260	16.4	27.4	24
High	5320	14.5	25.4	24

Turbo Mode

Channel	Frequency	10 Log B	4 + 10 Log B or	Power Limit		
	(MHz)	(dB)	11 + 10 Log B (dBm)	(dBm)		
Low	5210	18.3	22.3	17		
Middle	5250	17.7	21.7	17		
High	5290	19.0	30.0	24		

Maximum antenna gain = 2.69 dBi, therefore there is no reduction due to antenna gain.

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#### **RESULTS**

No non-compliance noted:

Base Mode

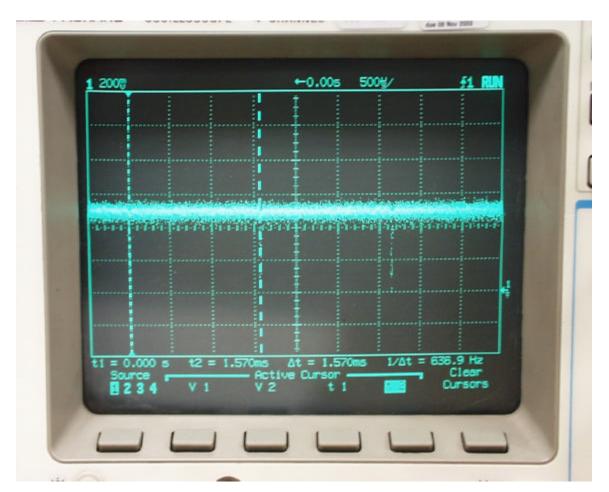
Channel	Frequency	Peak Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	12.1	17	-4.9
Middle	5260	15.3	24	-8.7
High	5320	10.3	24	-13.7

#### Turbo Mode

Channel	Frequency	Peak Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5210	12.9	17	-4.1
Middle	5250	12.3	17	-4.7
High	5290	13.7	24	-10.3

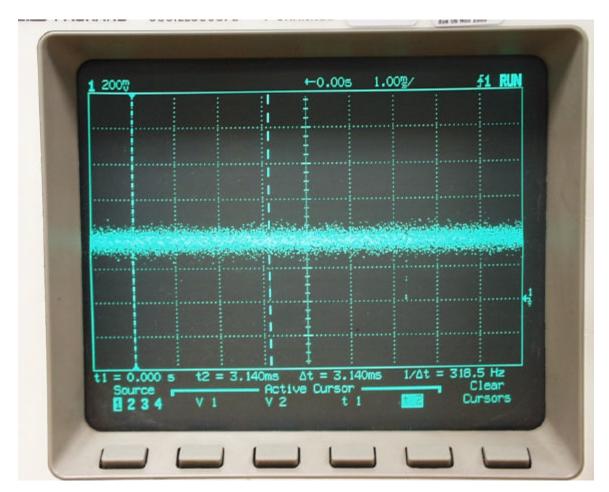
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#### PULSE DURATION (NORMAL MODE)



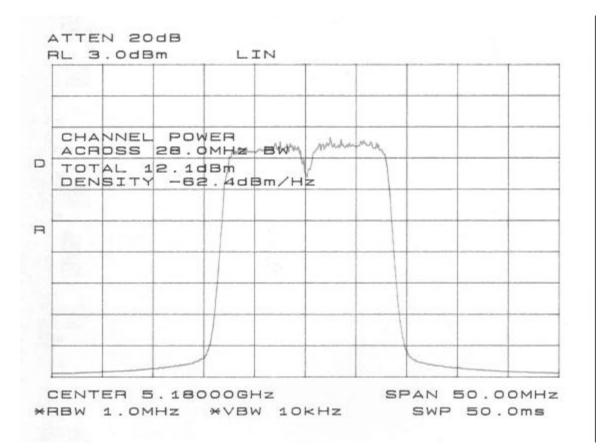
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### PULSE DURATION (TURBO MODE)



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#### PEAK POWER (NORMAL MODE)



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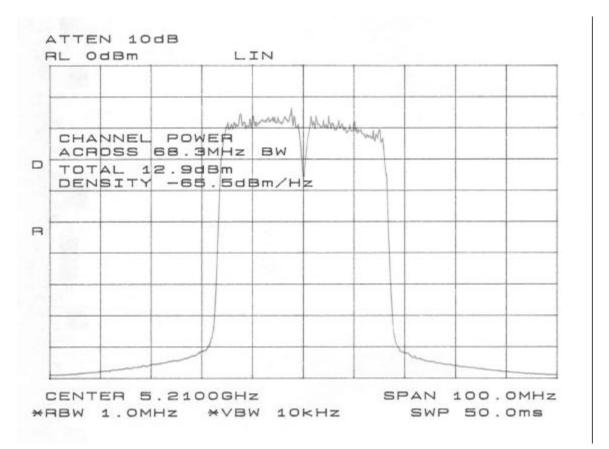
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### REPORT NO: 02U1692-4 EUT: 802.11 a/b/g WIRELESS LAN CARDBUS

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#### PEAK POWER (TURBO MODE)

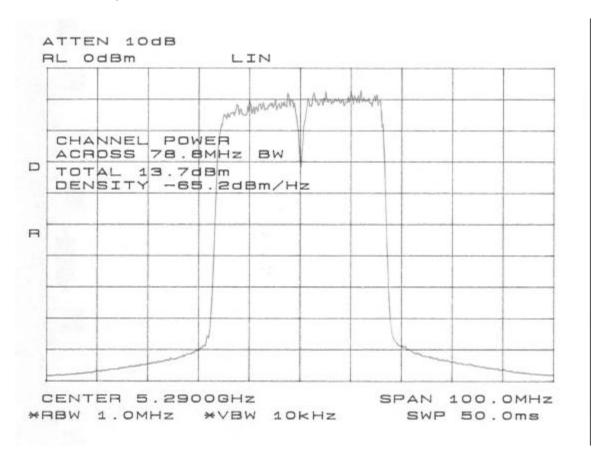


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### REPORT NO: 02U1692-4 EUT: 802.11 a/b/g WIRELESS LAN CARDBUS

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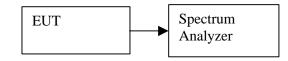
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### 9.3. PEAK POWER SPECTRAL DENSITY

### TEST SETUP



#### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002, Method 2.

Specification Limit:

Maximum antenna gain = 2.69 dBi, therefore there is no reduction due to antenna gain.

### **RESULTS**

No non-compliance noted:

Base Mode

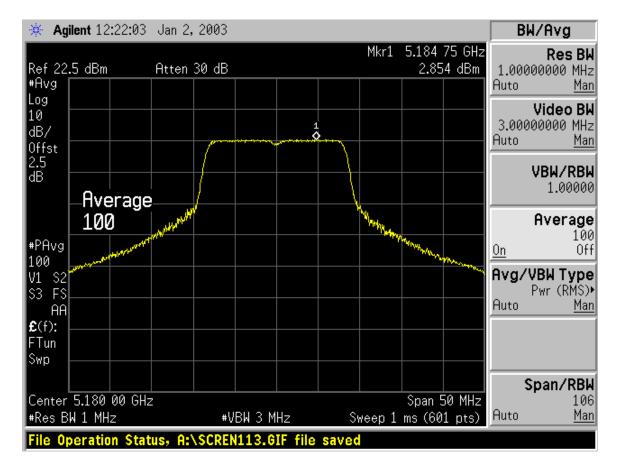
Base mode				
Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	2.854	4	-1.146
Middle	5260	6.920	11	-4.080
High	5320	2.397	11	-8.603

#### Turbo Mode

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5210	0.907	4	-3.093
Middle	5250	0.868	4	-3.132
High	High 5290		11	-8.030

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#### PPSD (NORMAL MODE)



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🔆 Ag	<b>ilent</b> 12:22	:36 Jan	2,2003						B	W/Avg
Ref 22 #Avg	.5 dBm	Atte	n 30 dB				Mkr1	42 GHz 20 dBm		Res BW 000000 MHz
Log 10 dB/					1 \$				Auto 3.00 Auto	<u>Man</u> Video BW 000000 MHz Man
Offst 2.5 dB	Avera	age				Ĺ	1 marshare			VBW/RBW 1.00000
#PAvg 100	100							 Maria Maria	<u>0n</u>	Average 100 Off
V1 S2 S3 FS AA									Avg/ Auto	<b>′VBW Type</b> Pwr (RMS)► <u>Man</u>
€(f): FTun Swp										
	5.260 00 W 1 MHz	GHz	#V	вы з м	Hz	SI	veep 1	50 MHz 1 pts)	Auto	Span/RBW 106 <u>Man</u>
File 0	peration 🔅	Status, A	A:\SCREN	114.6	IF file	saved				

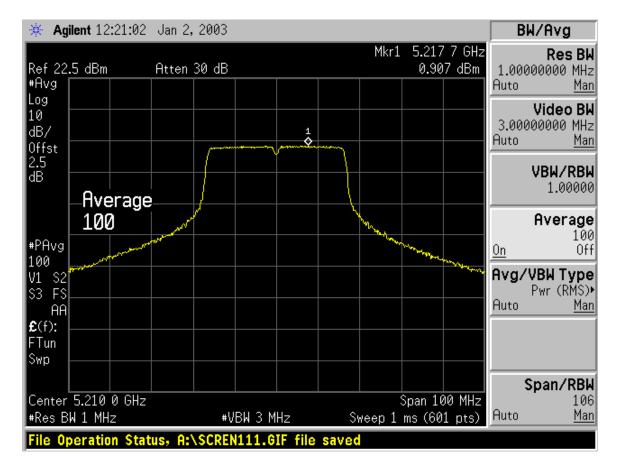
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### REPORT NO: 02U1692-4 EUT: 802.11 a/b/g WIRELESS LAN CARDBUS

🔆 Ag	<b>ilent</b> 12	:23:15	Jan 2,	2003						B	W/Avg
#Avg	.5 dBm		Atten	30 dB			Mkr1		08 GHz 7 dBm	1.00 Auto	<b>Res BW</b> 000000 MHz <u>Man</u>
Log 10 dB/ Offst						1 \$				3.00 Auto	<b>Video BW</b> 000000 MHz <u>Man</u>
Offst 2.5 dB	_Ave	erage									VBW/RBW 1.00000
#PAvg	100		Margan Carbon Mark				MARANNAL WAR	and makes more		<u>On</u>	Average 100 Off
100 V1 S2 S3 FS AA									- mar - Constant and		<b>′VBW Type</b> Pwr (RMS)∙ Man
£(f): FTun Swp											
	5.320 W 1 MH	00 GHz z	2	#V	ви з м	Hz	 weep 1	Span 5 ms (60	50 MHz 1 pts)	Auto	Span/RBW 106 <u>Man</u>
			us, A:'								

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#### PPSD (TURBO MODE)



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### REPORT NO: 02U1692-4 EUT: 802.11 a/b/g WIRELESS LAN CARDBUS

🔆 Agilent 12:19:28	Jan 2, 2003				BW/Avg
Ref 22.5 dBm #Avg	Atten 30 dB		Mkr1	5.245 7 GHz 0.868 dBm	<b>Res BW</b> 1.0000000 MHz Auto <u>Man</u>
Log 10 dB/ Offst		1			<b>Video BW</b> 3.00000000 MHz Auto <u>Man</u>
Offst 2.5 dB Average					VBW/RBW 1.00000
*PAvg 100	Survey of the second second			March and and a start	Average 100 <u>On</u> Off
V1 S2 S3 FS AA					<b>Avg/VBWType</b> Pwr(RMS)► Auto <u>Man</u>
£(f): FTun Swp					
Center 5.250 0 GHz #Res BW 1 MHz	#V	BW 3 MHz		Span 100 MHz ms (601 pts)	Span/RBW 106 Auto <u>Man</u>
File Operation Status, A:\SCREN109.GIF file saved					

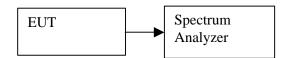
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✤ Agilent 12:20:19 Jan 2, 2	2003			BW/Avg
Ref 22.5 dBm Atten 30 #Avg	0 dB		296 0 GHz .970 dBm	<b>Res BW</b> 1.00000000 MHz Auto Man
Log 10 dB/	1			Video BW 3.00000000 MHz Auto Man
Offst 2.5 dB Average				VBW/RBW 1.00000
#PAvg			Wand Start Start Start	Average 100 On Off
100 V1 S2 S3 FS				— Avg/VBW Type Pwr (RMS)►
AA £(f): FTun				Auto <u>Man</u>
Swp				Span/RBW
Center 5.290 0 GHz #Res BW 1 MHz File Operation Status, A:\S	#VBW 3 MHz	Sweep 1 ms	100 MHz (601 pts)	106 Auto <u>Man</u>

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# 9.4. PEAK EXCURSION

## TEST SETUP



### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 3 was used for peak power measurements, Method # 3 is used for the second PPSD trace.

### RESULTS

No non-compliance noted:

Base Mode

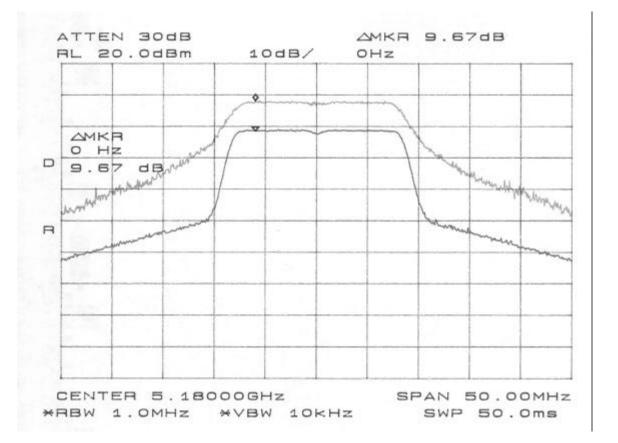
Bube mode				
Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5180	9.67	13	-3.33
Middle	5260	10.0	13	-3.0
High	5320	9.83	13	-3.17

Turbo Mode

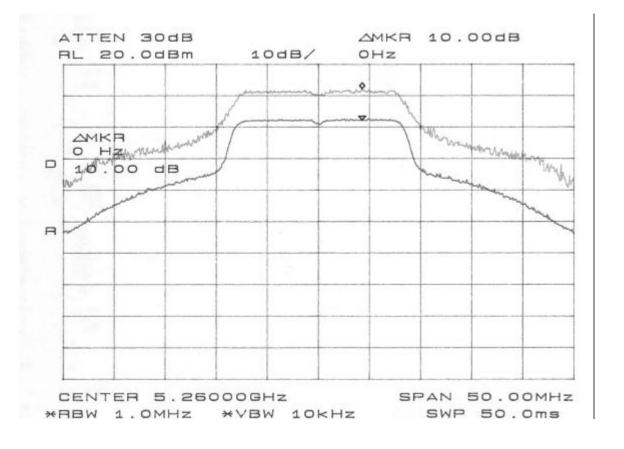
Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5210	9.5	13	-3.5
Middle	5250	9.33	13	-3.67
High	5290	9.83	13	-3.17

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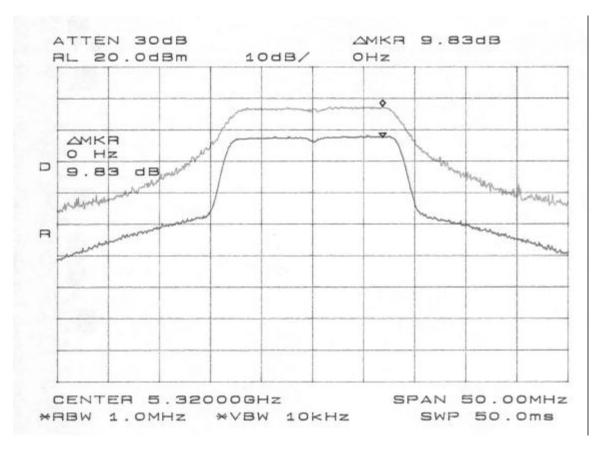
#### PEAK EXCURSION (NORMAL MODE)



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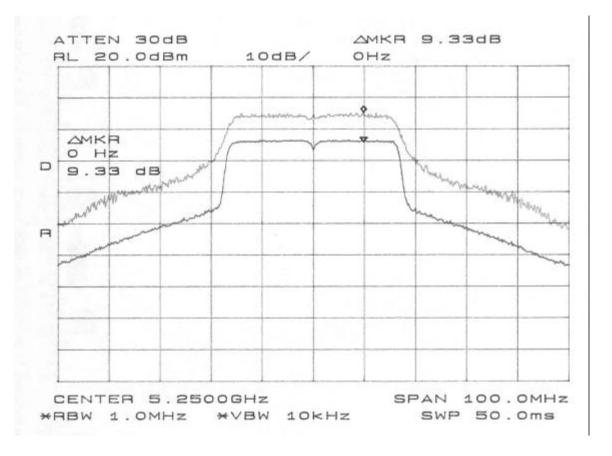


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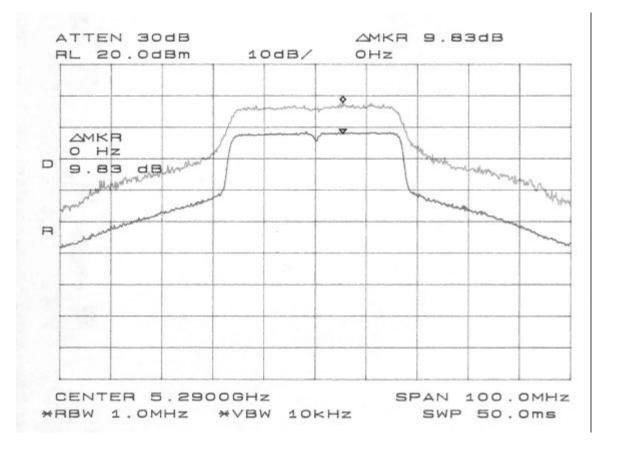
#### PEAK EXCURSION (TURBO MODE)



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# 9.5. TYPE OF ANTENNA

## **RESULTS**

No non-compliance noted:

The antenna is integral.

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## 9.6. MAXIMUM PERMISSIBLE EXPOSURE

## **CALCULATIONS**

Given

and

 $E = \sqrt{(30 * P * G)} / d$ 

 $S = E^{2}/3770$ 

where

E = Field Strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = distance in meters
S = Power Density in milliwatts / square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

 $d = \sqrt{((30 * P * G) / (3770 * S))}$ 

Changing to units of mW and cm, using:

P(mW) = P(W) / 1000 and

yields

 $d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$ 

 $d = 0.282 * \sqrt{(P * G / S)}$ 

where

d = distance in cm P = Power in mW G = Numeric antenna gain S = Power Density in mW / cm^2

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Equation (1)

Substituting the logarithmic form of power and gain using:

 $P(mW) = 10 \wedge (P(dBm) / 10)$  and

 $G (numeric) = 10 \wedge (G (dBi) / 10)$ 

yields

 $d = 0.282 * 10 \wedge ((P + G) / 20) / \sqrt{S}$ 

where

d = MPE safe distance in cm P = Power in dBm G = Antenna Gain in dBi S = Power Density Limit in mW / cm^2

## **RESULTS**

No non-compliance noted:

EUT output power = 15.3 dBmAntenna Gain = 2.69 dBiS =  $1.0 \text{ mW} / \text{cm}^2$  from 1.1310 Table 1

Substituting these parameters into Equation (1) above:

MPE Safe Distance = 2.2 cm

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

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# 9.7. FREQUENCY STABILITY

## <u>RESULTS</u>

No non-compliance noted:

Referring to the theory of operation, the crystal used to set the frequency has a temperature coefficient of +/-20 ppm over the specified rated temperature range. For a transmitter fundamental frequency of 5.35 GHz, this corresponds to +/-107 kHz.

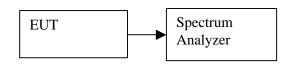
An examination of the band edge plots shows that the emission will stay within the authorized band over the entire temperature range.

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## 9.8. UNDESIRABLE EMISSIONS – CONDUCTED MEASUREMENTS

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

## TEST SETUP



## TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

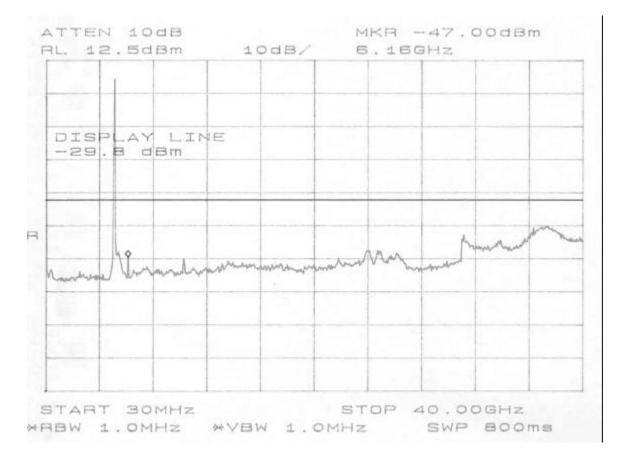
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

### **RESULTS**

No non-compliance noted:

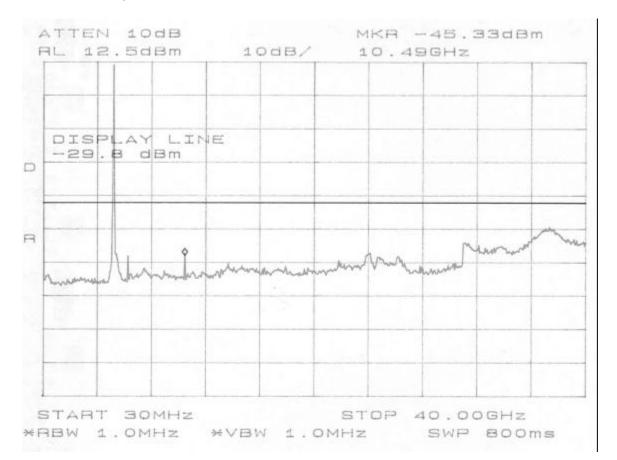
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#### **CONDUCTED SPURIOUS (NORMAL MODE)**



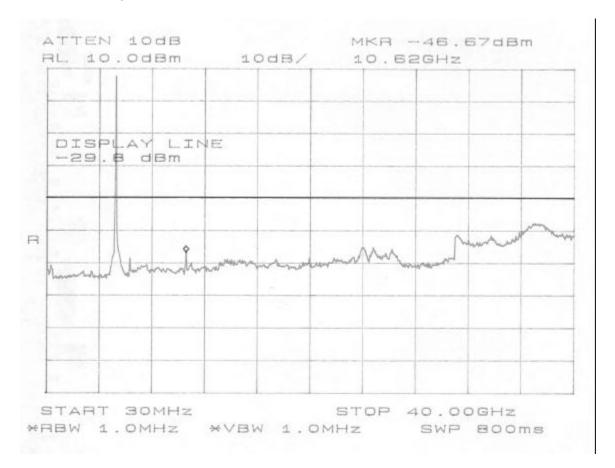
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## REPORT NO: 02U1692-4 EUT: 802.11 a/b/g WIRELESS LAN CARDBUS



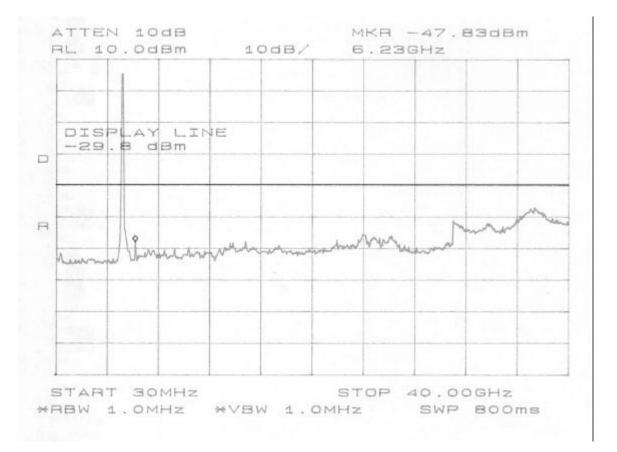
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## REPORT NO: 02U1692-4 EUT: 802.11 a/b/g WIRELESS LAN CARDBUS



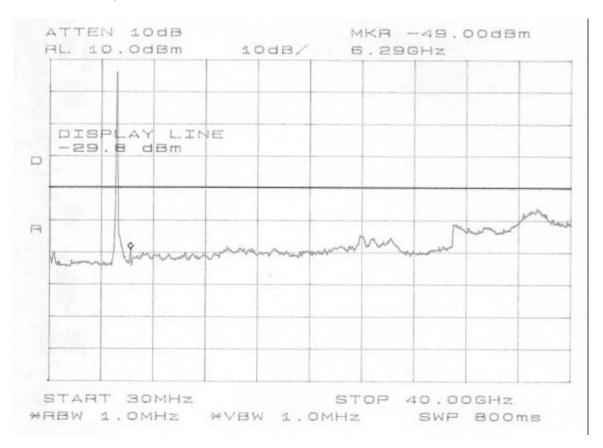
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#### CONDUCTED SPURIOUS (TURBO MODE)



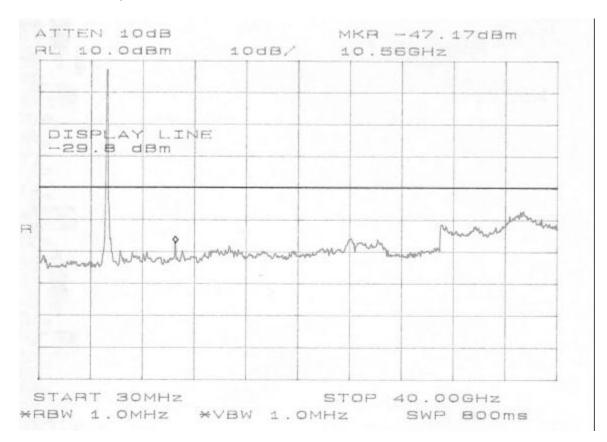
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## REPORT NO: 02U1692-4 EUT: 802.11 a/b/g WIRELESS LAN CARDBUS



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## REPORT NO: 02U1692-4 EUT: 802.11 a/b/g WIRELESS LAN CARDBUS



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## 9.9. UNDESIRABLE EMISSIONS – RADIATED MEASUREMENTS

## TEST SETUP

The EUT is placed on the wooden table. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4/1992.

The EUT is set to transmit in a continuous mode.

## TEST PROCEDURE

For measurements below 1 GHz within restricted bands 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 all other measurements, 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 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

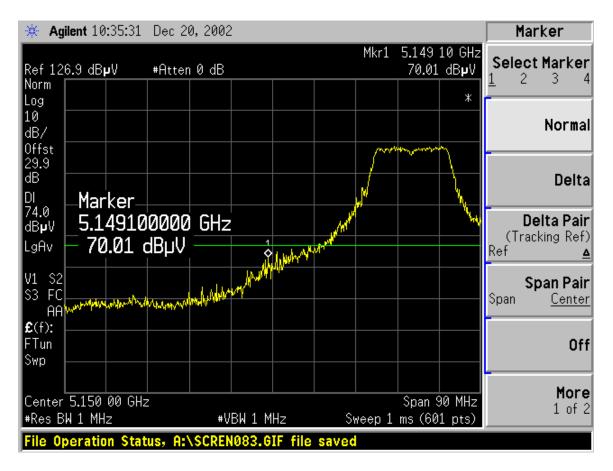
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The frequency span is set small enough to easily differentiate between broadcast stations, intermittent ambient signals and EUT emissions. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the suspected signal. Measurements were made with the antenna polarized in both the vertical and the horizontal positions.

## TEST RESULTS

No non-compliance noted:

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### LOWER RESTRICTED BAND RADIATED EMISSIONS (NORMAL MODE, VERTICAL)

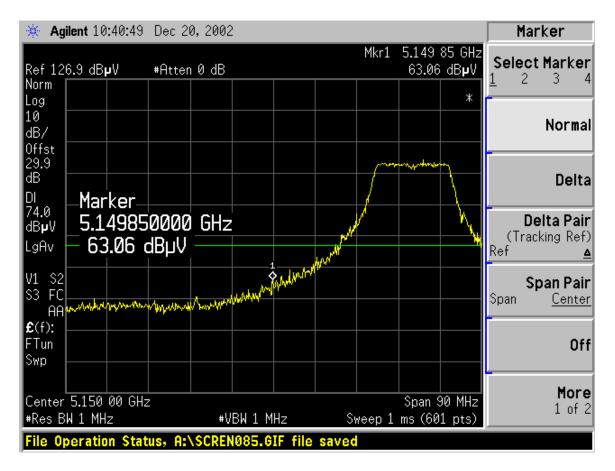


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🔆 Agilent 10:33:34 [	Dec 20, 2002		Marker
	#Atten 0 dB	Mkr1 5.148 05 G 51.13 dBµ	
Norm Log 10 dB/ Offst			Normal
29.9 dB DI 54.0 Marker			Delta
dBµV 5.148050 LgAv 51.13 df			Delta Pair (Tracking Ref) Ref
V1 S2 S3 FC AA £(f):	1		Span Pair Span <u>Center</u>
FTun Swp			Off More
Center 5.150 00 GHz #Res BW 1 MHz File Operation Status	#VBW 10 Hz s, A:\SCREN082.GIF file	Span 90 MH Sweep 7.018 s (601 pts <b>saved</b>	z 1. of 2

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## LOWER RESTRICTED BAND RADIATED EMISSIONS (NORMAL MODE, HORIZONTAL)

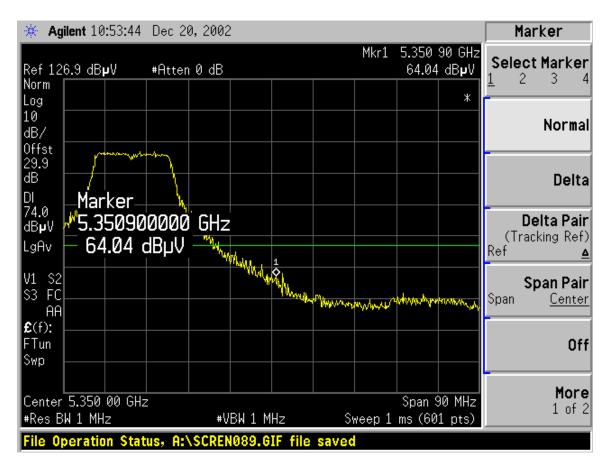


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🔆 Agil	ent 10:39:20	) Dec 20	, 2002							Marker
	.9 dB <b>µ</b> V	#Atten	0 dB				Mkr1		00 GHz 3 dB <b>µ</b> V	Select Marker
Norm Log										±
10 dB/ Offst										Normal
29.9 dB DI	_Marker_									Delta
54.0 dB <b>µ</b> V LgAv	5.1500		GHz							<b>Delta Pair</b> (Tracking Ref) Ref <b>∆</b>
V1 S2 S3 FC							J			<b>Span Pair</b> Span <u>Center</u>
AA £(f): - FTun Swp -					·					Off
	5.150 00 GH	lz	#VF	3W 10 I	Hz	Swee	en 7.01	Span : 8 s (60	90 MHz 11 pts)	<b>More</b> 1 of 2
	eration Sta	tus, A:\								

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#### UPPER RESTRICTED BAND RADIATED EMISSIONS (NORMAL MODE, VERTICAL)

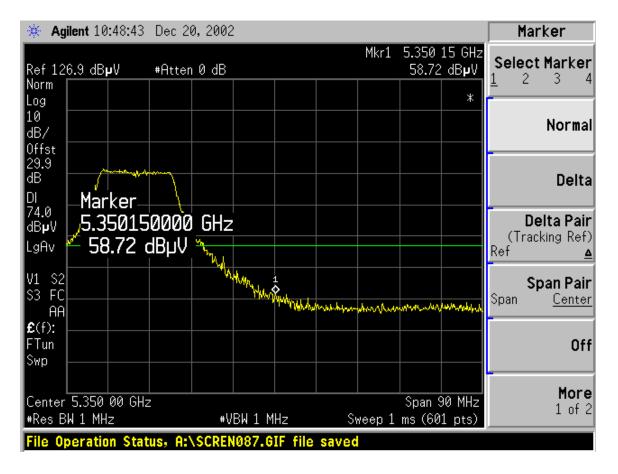


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🔆 Agilent 10:52:19 Dec 20	0,2002			Marker
Ref 126.9 dB <b>µV #</b> Atten	0 dB		.350 15 GHz 47.86 dB <b>µ</b> V	Select Marker
Norm Log				
10 dB/				Normal
Offst 29.9 dB				- Delta
DI 54.0 dByv 5.350150000				Delta Pair
dBpV 5.350150000 LgAv 47.86 dBpV				(Tracking Ref) Ref <u>▲</u>
V1 S2 S3 FC AA				<b>Span Pair</b> Span <u>Center</u>
£(f): FTun Swp	Č.			Off
Center 5.350 00 GHz	^	s	ipan 90 MHz	More
#Res BW 1 MHz	₩VBW 10 Hz	Sweep 7.018		1 of 2
File Operation Status, A:	SCREN088.GIF file	saved		

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### UPPER RESTRICTED BAND RADIATED EMISSIONS (NORMAL MODE, HORIZONTAL)

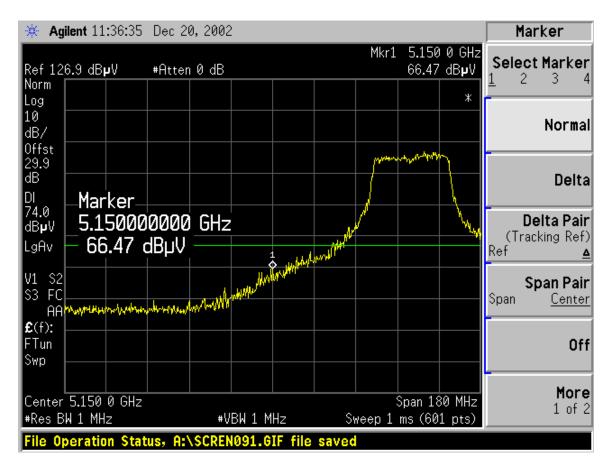


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🔆 Ag	<b>jilent</b> 10:40	7:12 Dec 2	0,2002						Marker
Ref 12 Norm	6.9 dBµV	#Atter	n Ø dB			Mkr1		00 GHz dB <b>µ</b> V	Select Marker
Log 10 dB/									 Normal
Offst 29.9 dB DI	Marke	er							- Delta
54.0 dB <b>µ</b> V LgAv	_5.350	9000000 35 dBµV	GHz						<b>Delta Pair</b> (Tracking Ref) Ref <u>≜</u>
V1 S2 S3 FC AA									<b>Span Pair</b> Span <u>Center</u>
€(f): FTun Swp				¢					Off
#Res B	5.350 00 W 1 MHz		#VBW 1				Span 9 8 s (60	0 MHz 1 pts)	More 1 of 2
File 0	peration	Status, A:	SCREN086	.GIF file	saved				

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### LOWER RESTRICTED BAND RADIATED EMISSIONS (TURBO MODE, VERTICAL)

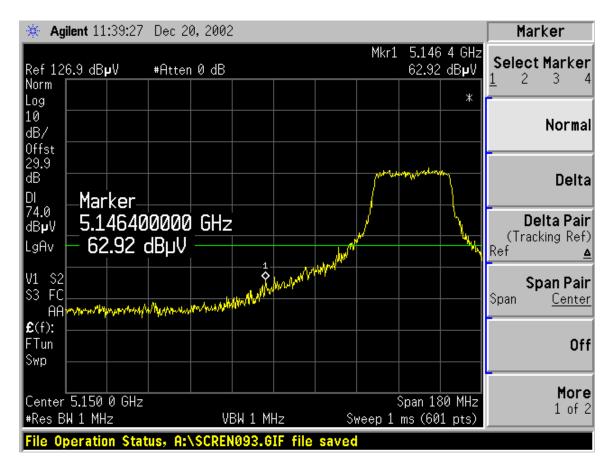


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🔆 Agilent 11:35:14	Dec 20, 2002				Marker
Ref 126.9 dB <b>µ</b> V Norm	#Atten 0 dB		Mkr1	5.150 0 GHz 51.38 dBµV	Select Marker
Log 10 dB/ Offst					- Normal
29.9 dB DI 54.0 — Marker-					Delta
dBpV 5.15000	0000 <u>GHz</u> dBµV				Delta Pair (Tracking Ref) Ref
V1 S2 S3 FC AA £(f):	0				<b>Span Pair</b> Span <u>Center</u>
FTun Swp					Off  More
Center 5.150 0 GHz #Res BW 1 MHz File Operation Stat		3W 10 Hz 090.GIF file	Sweep 14.04	Span 180 MHz 4 s (601 pts)	1 of 2

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### LOWER RESTRICTED BAND RADIATED EMISSIONS (TURBO MODE, HORIZONTAL)

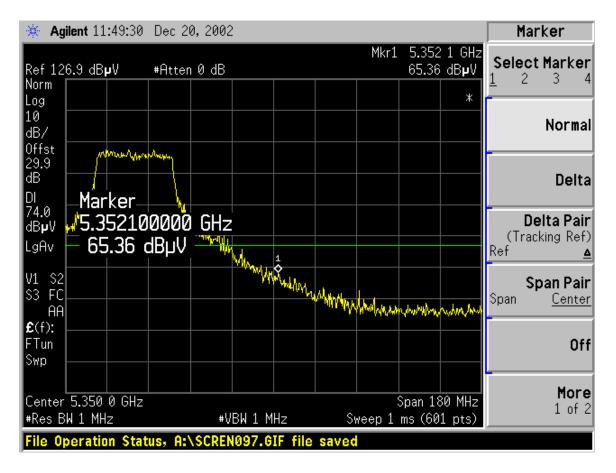


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🔆 Agi	lent 11:38:24	Dec 20,	2002						Marker
	6.9 dB <b>µ</b> V	#Atten 0	dB			Mkr1		0 GHz dB <b>µ</b> V	Select Marker
Norm Log									
10 dB/									Normal
Offst 29.9 dB									Delta
DI 54.0 dB <b>µ</b> V LgAv	_Marker_ _5.15000 _48.90 (		GHz						<b>Delta Pair</b> (Tracking Ref) Ref <b>∆</b>
W1 S2 S3 FC AA									<b>Span Pair</b> Span <u>Center</u>
£(f): FTun Swp									Off
	5.150 0 GHz W 1 MHz		+VBW 10	H <sub>7</sub>	Sweet	S 0 14.04		0 MHz 1 nts)	<b>More</b> 1 of 2
	eration Stat	us, A:\S				9 1 1.01	3 (00.	<u>r p(</u> 3)	

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## UPPER RESTRICTED BAND RADIATED EMISSIONS (TURBO MODE, VERTICAL)

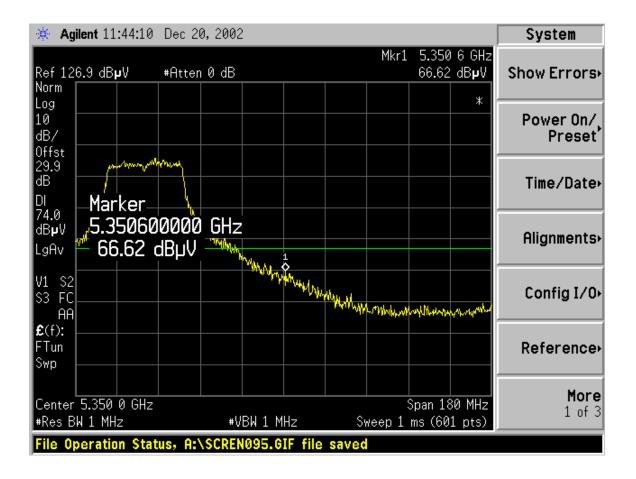


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🔆 Agilent 11:48:26 Dec	20,2002			Marker
	en 0 dB	Mkr1	5.350 0 GHz 52.82 dB <b>µ</b> V	Select Marker
Norm Log				<u> </u>
10 dB/ Offst				Normal
29.9 dB				Delta
DI 54.0 dBµV <b>5.35000000</b>				<b>Delta Pair</b> (Tracking Ref)
LgAv <b>52.82 dBµ</b>	/			Ref 🛕
S3 FC				Span Pair Span <u>Center</u>
£(f): FTun Swp		~~		Off
Center 5.350 0 GHz			pan 180 MHz	More
#Res BW 1 MHz	₩VBW 10 Hz		s (601 pts)	1 of 2
File Operation Status, A	:\SCREN096.GIF file	saved		

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#### UPPER RESTRICTED BAND RADIATED EMISSIONS (TURBO MODE, HORIZONTAL)



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🔆 Ag	jilent 11	:43:05	Dec 20	0,2002	2					Marker
Ref 12 Norm	6.9 dB	٧u	#Atten	0 dB			Mkr1		0 0 GHz 3 dB <b>µ</b> V	Select Marker
Log 10 dB/ Offst										 Normal
29.9 dB DI 54.0		ker_								Delta
dBµV LgAv	52		10000 dBµV	GHz						<b>Delta Pair</b> (Tracking Ref) Ref <u>≜</u>
V1 S2 S3 FC AA £(f):										<b>Span Pair</b> Span <u>Center</u>
FTun Swp		0.011-						- <u>-</u>		Off More
#Res B	5.350 3W 1 MH peratio	Z	us, A:\		'BW 10 <b>1094.g</b>		p 14.04		80 MHz 11 pts)	1 of 2

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#### HARMONIC AND SPURIOUS RADIATED EMISSIONS (NORMAL MODE)

Description of Test:	Radiat	ed Emis	sions - Re	stricted	Bands					
Project Number:	02U16	92								
Date:	12/23/	02								
Test Engineer:	Neeles	sh Raj								
EUT Description: Test Configuration:	Company: Ambit Microsystems Corporation Description: 802.11 a/b/g WLAN Card, Model A460-05 Configuration: EUT, Laptop of Operation: TX ON , Freq = 5.18 GHz, Normal Mode									
Specification Distance	3.0	meters								
Actual Distance	3.0	meters	Cable	Length:	15.0	feet				
Freq Pol Det SA	Dist	AF	Preamp		Cable	Field	Limit	Margin		
GHz V/H dBuV	dB	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB		
Note 1: See plots for Tx emissions in adjacent restricted bands.										
Note 2: No Tx emissions det	ected al	oove the	system no	oise floo	r in othei	r restricted	bands.			

Description of Test:	Radiat	ed Emis	sions - Re	stricted	Bands				
Project Number:	02U16	)2U1692							
Date:	12/23/0	02							
Test Engineer:	Neeles	leelesh Raj							
Company:	Ambit	Ambit Microsystems Corporation							
EUT Description:	EUT Description: 802.11 a/b/g WLAN Card, Model A460-05								
Test Configuration: EUT, Laptop									
Mode of Operation: TX ON , Freq = 5.26 GHz, Normal Mode									
Specification Distance: 3.0 meters									
Actual Distance	3.0	meters	Cable	Length:	15.0	feet			
Freq Pol Det SA	Dist	AF	Preamp	Filter	Cable	Field	Limit	Margin	
GHz V/H dBuV	dB	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
Note: No Tx emissions detected above the system noise floor in restricted bands.									

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Description of Test: Radiated Emissions - Restricted Bands								
Project Number: 02U1692								
Date: 12/23/02								
Test Engineer: Neelesh Raj								
Company: Ambit Microsystems Corporation								
EUT Description: 802.11 a/b/g WLAN Card, Model A460-05								
Test Configuration: EUT, Laptop								
Mode of Operation: TX ON , Freq = 5.32 GHz, Normal Mode								
Specification Distance: 3.0 meters								
Actual Distance: 3.0 meters Cable Length: 15.0 feet								
Freq Pol Det SA Dist AF Preamp Filter Cable Field Limit Margin								
GHz V/H dBuV dB dB/m dB dB dB dBuV/m dBuV/m dB								
Note 1: See plots for Tx emissions in adjacent restricted bands.								
Note 2: No Tx emissions detected above the system noise floor in other restricted bands.								

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#### HARMONIC AND SPURIOUS RADIATED EMISSIONS (TURBO MODE)

Description of Tes	t: Radia	ted Emis	sions - Re	stricted	Bands					
Project Numbe	: 02U16	D2U1692								
Dat	: 12/23/	02								
Test Enginee	: Neele	Neelesh Raj								
Compan	: Ambit	mbit Microsystems Corporation								
•		802.11 a/b/g WLAN Card, Model A460-05								
Test Configuratio		-								
Mode of Operation: TX ON, Freq = 5.21 GHz, Turbo Mode										
Specification Distance: 3.0 meters										
Actual Distance	e: 3.0	meters	Cable	Length:	15.0	feet				
Freq Pol Det SA	Dist	AF	Preamp	Filter	Cable	Field	Limit	Margin		
GHz V/H dBu	/ dB	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB		
Note 1: See plots for Tx er	issions i	n adjacer	nt restricte	d bands						
Note 2: No Tx emissions detected above the system noise floor in other restricted bands.										

Description of Test:	Radiat	ed Emis	sions - Re	stricted	Bands				
Project Number:	02U16								
Date:	12/23/	02							
Test Engineer:	Neeles	leelesh Raj							
Company:	Ambit	Ambit Microsystems Corporation							
EUT Description:	n: 802.11 a/b/g WLAN Card, Model A460-05								
Test Configuration: EUT, Laptop									
Mode of Operation: TX ON , Freq = 5.25 GHz, Turbo Mode									
Specification Distance: 3.0 meters									
Actual Distance	3.0	meters	Cable	Length:	15.0	feet			
Freq Pol Det SA	Dist	AF	Preamp	Filter	Cable	Field	Limit	Margin	
GHz V/H dBuV	dB	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
Note: No Tx emissions detected above the system noise floor in restricted bands.									

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Description of Test	Radiat	ted Emis	sions - Re	stricted	Bands					
Project Number	02U16									
Date	12/23/	02								
Test Engineer	Neele	Neelesh Raj								
Company	Ambit	Ambit Microsystems Corporation								
EUT Description	EUT Description: 802.11 a/b/g WLAN Card, Model A460-05									
Test Configuration: EUT, Laptop										
Mode of Operation: TX ON , Freq = 5.29 GHz, Turbo Mode										
Specification Distance: 3.0 meters										
Actual Distance	: 3.0	meters	Cable	Length:	15.0	feet				
Freq Pol Det SA	Dist	AF	Preamp	Filter	Cable	Field	Limit	Margin		
GHz V/H dBuV	dB	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB		
Note 1: See plots for Tx em	ssions ii	n adjacei	nt restricte	d bands						

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# **10. SETUP PHOTOS**

## ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



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#### **RADIATED RF MEASUREMENT SETUP**



# **END OF REPORT**

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