

FCC CFR47 PART 15 SUBPART E CERTIFICATION TEST REPORT

FOR

802.11 a/b/g MINI PCI CARD WITH AGENCY SERIES PP2170 LAPTOP

MODEL NUMBER: J07H069.01

FCC ID: MCLJ07H06901

REPORT NUMBER: 02U1731-1B

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Prepared for AMBIT MICROSYSTEMS, INC. 5F-1, 5 HSIN-AN ROAD, HSINCHU SCIENCE-BASED INDUSTRAIL PARK, TAIWAN. R.O.C.

> 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:	AMBIT MICROSYSTEMS 5F-1, 5 HSIN-AN ROAD, HSINCU SCIENCE BASED INDUSTRIAL PARK, TAIWAN, R.O.C.		
EUT DESCRIPTION:	802.11 A/B/G MINI PCI CARD WITH AGENCY SERIES PP2170 LAPTOP		
MODEL NAME:	J07H069.01		
DATE TESTED:	DECEMBER 20, 2002 – FEBRUARY 21, 2003		
	APPLICABLE STANDARDS		
STANDARD	TEST RESULTS		
FCC PART 15 SUBI	PART 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:

MH

MIKE HECKROTTE CHIEF ENGINEER COMPLIANCE CERTIFICATION SERVICES

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NEELESH RAJ EMC ENGINEER COMPLIANCE CERTIFICATION SERVICES

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2. EUT DESCRIPTION

The J07H069.01 card is an 802.11a/b/g Mini-PCI module for the Agency Series PP2170 Laptop. The module is compatible with the IEEE 802.11a standard and the IEEE 802.11g draft standard, and meets the mechanical specifications of the Type IIIA Mini-PCI form factor. The operational frequency range includes:

5.15 to 5.32 GHz

It is based upon an Atheros Communications AR5001 three-chipset reference design. The three chips include the AR5111 integrated 5GHz CMOS radio transceiver, the AR2111 5GHz/2.4GHz integrated up/down-converter, and the AR5212 MAC/baseband processor.

The rated conducted output power of the transmitter when operating in 802.11a mode is 17.46 dBm in the 5.15 to 5.35 band. When the J07H069.01 module is installed in the Agency Series PP2170 laptop, each antenna port connector is attached to a stamped metal, PIFA antenna. These antennas are embedded in each side of the laptop display.

The peak gains of these antennas vs. frequency are:

Peak gain in the 5.15 to 5.35 GHz band is 2.33 dBi.

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3. 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.

4. FACILITIES AND ACCREDITATION 4.1. 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."

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4.2. TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	FC 1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	VCCI 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 _{ELA 117}
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 _{ELA-171}
Taiwan	BSMI	CNS 13438	(本) SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	Canada IC2324 A,B,C, and F

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5. CALIBRATION AND UNCERTAINTY 5.1. 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.

5.2. 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 Conducted Emission			
150kHz – 30MHz +/-2.9			

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

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5.3. TEST AND MEASUREMENT EQUIPMENT

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

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		
Preamplifier	HP	8447D	2944A06833	8/22/03		
Log Periodic Antenna	EMCO	3146	9107-3163	3/30/03		
Biconical Antenna	Eaton	94455-1	1197	3/30/03		
Spectrum Analyzer	HP	8564E	3943A01643	7/22/03		
Spectrum Analyzer	HP	8593EM	3710A00205	6/11/03		
Preamplifier (1 - 26.5GHz)	HP	8449B	3008A00369	6/30/03		
Preamplifier (1 - 26.5GHz)	Miteq	NSP10023988	646456	4/26/03		
Horn Antenna (1 - 18GHz)	EMCO	3115	6717	1/31/03		
Horn Antenna (1 - 18GHz)	EMCO	3115	6739	1/31/03		
Horn Antenna (18 – 26.5GHz)	ARA	MWH 1826/B	1013	1/31/03		
High Pass Filter (4.57GHz)	FSY Microwave	FM-4570-9SS	003	N.C.R.		
High Pass Filter (7.600GHz)	FSY Microwave	FM-7600	N/A	N.C.R		
Harmonic Mixer	HP	11970A	3008A04190	10/14/05		
Spectrum Analyzer	HP	E4404B	ID 963805	3/25/03		
PSA Series Spectrum Analyzer	Aglient	E4446A	US42070220	1/13/04		
PSA Series Spectrum Analyzer	Aglient	E4440A	US42221737	9/24/03		

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6. SETUP OF EQUIPMENT UNDER TEST

SETUP INFORMATION FOR TRANSMITTER TESTS

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST					
Device Type Manufacturer Model Serial Number FCC ID					
Laptop	HP	SAPPHIRE	J311500PV143	N/A	
AC Adapter	COMPAQ	PPP0009L	3102162204	N/A	

I/O CABLES

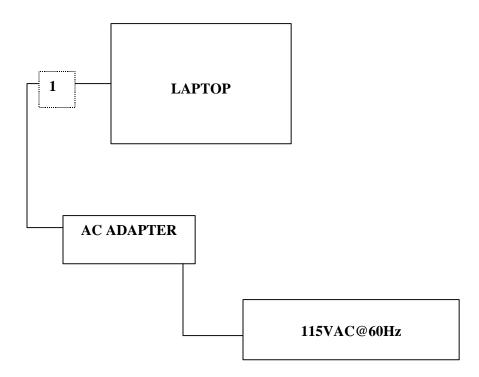
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	¹ / ₄ DC PWR	Unshielded	1.86 m	N/A

TEST SETUP

The EUT was installed in the bottom internal slot of the laptop. The antennas are embedded in the laptop display.

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SETUP DIAGRAM FOR TRANSMITTER TESTS



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SETUP INFORMATION FOR DIGITAL DEVICE TESTS

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST					
Device Type	Manufacturer	Model	Serial Number	FCC ID	
LAPTOP	HP	SAPPHIRE	J311500PV143	N/A	
AC ADAPTER	COMPAQ	PPP0009L	3102162204	N/A	
MONITOR	DELL	828FI	BH68-3055OK-01	828-FI	
USB MOUSE	LOGITECH	M-VA34	LTC70500299	DZL211087	

I/O CABLES

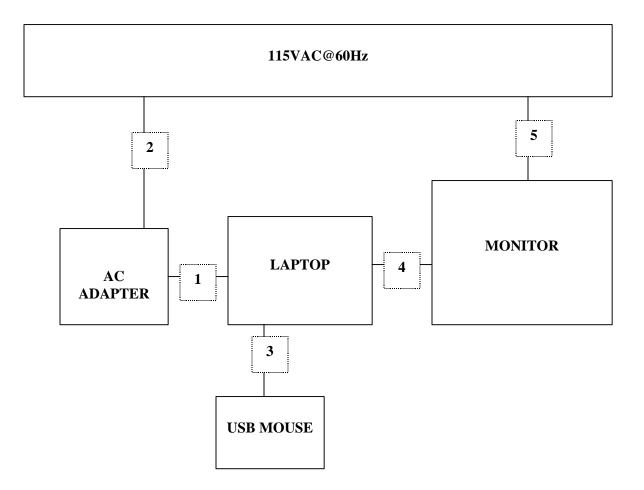
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	PWR	1	¹ / ₄ DC PWR	UNSHIELDED	1.8M	N/A
2	PWR	1	AC PWR	UNSHIELDED	1.8M	N/A
3	USB	2	USB	SHIELDED	1.8M	N/A
4	VIDEO	1	DB-15	SHIELDED	1.8M	FERRITE ON BOTH ENDS
5	PWR	1	AC PWR	UNSHIELDED	1.8M	N/A

TEST SETUP

The EUT was installed in the bottom internal slot of the laptop. The antennas are embedded in the laptop display.

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SETUP DIAGRAM FOR DIGITAL DEVICE TESTS



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7. 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 $4 \text{ dBm} + 10 \log B$, 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.

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<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.

§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.

<u>§15.407(b)- UNDESIRABLE EMISSION LIMITS</u>

(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 -27dBm / 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.

§15.407(c)- TRANSMISSION IN CASE OF ABSENCE OF INFORMATION

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signalling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

§15.407(d)- ANTENNA TYPE

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.

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REPORT NO: 02U1731-1BDATE: FEBRUARY 20, 2003 EUT: 802.11 a/b/g MINI PCI CARD WITH AGENCY SERIES PP2170 LAPTOP FCC ID: MCLJ07H06901 §15.407(f)- RADIO FREQUENCY EXPOSURE

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
¹ 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	(²)
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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§15.207- CONDUCTED LIMITS

(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 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

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

Frequency of Emission (MHz)	Conducted L	imit (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.

§15.209- RADIATED EMISSION LIMITS

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

** 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.

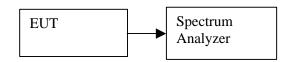
(b) In the emission table above, the tighter limit applies at the band edges.

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8. TEST SETUP, PROCEDURE AND RESULT

8.1. 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

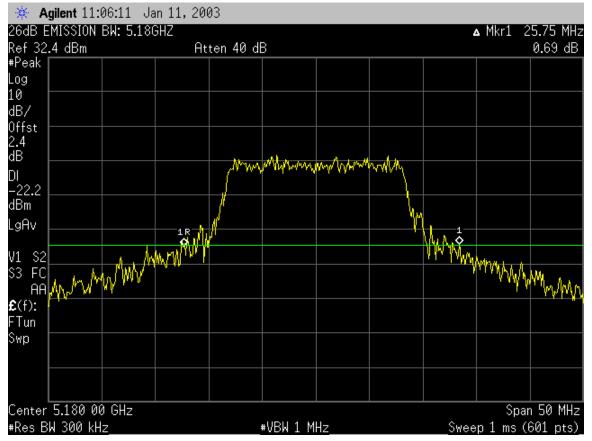
Duse Mode			
Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5180	25.75	14.11
Middle	5240	41.42	16.17
Middle	5260	38.92	15.9
High	5320	27.42	14.38

Turbo Mode

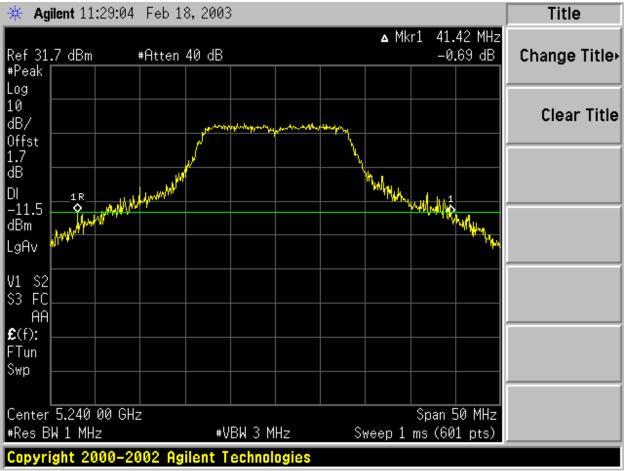
Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5210	59.00	17.71
Middle	5250	68.00	18.33
High	5290	62.00	17.92

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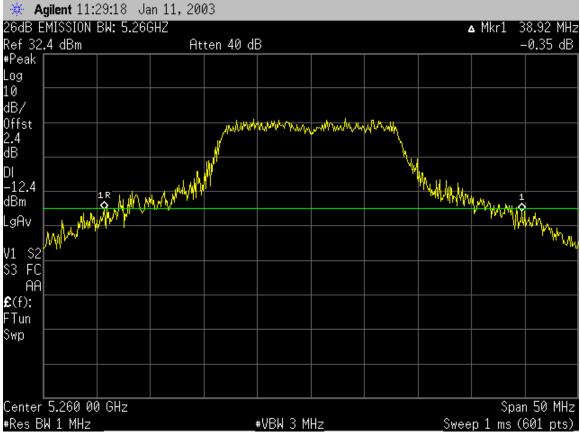
EMISSION BANDWIDTH (NORMAL MODE)



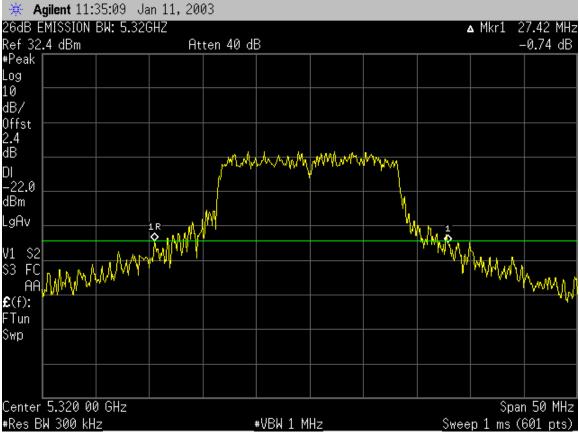
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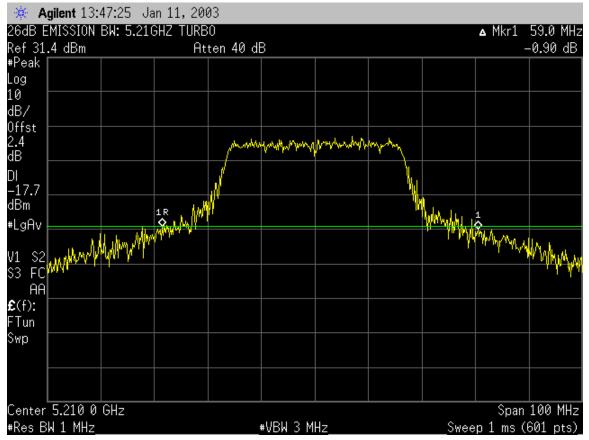


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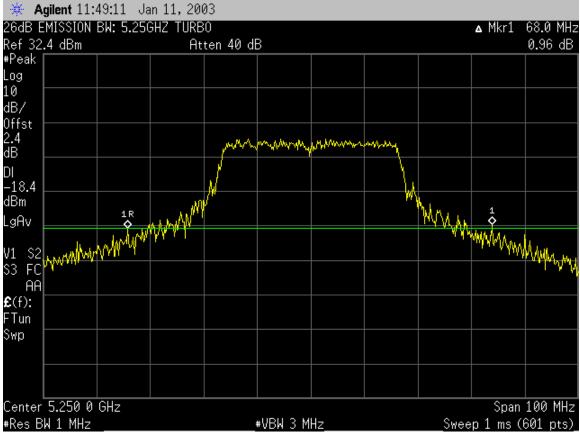


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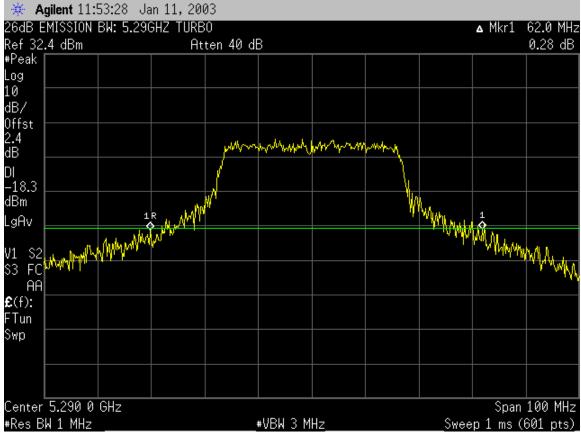
EMISSION BANDWIDTH (TURBO MODE)



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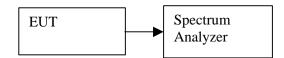
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8.2. PEAK POWER

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 operates continuously therefore Method # 1 is used.

SPECIFICATION LIMIT:

Limit in 5150 to 5250 MHz Band

Mode	Frequency	Fixed Limit	4 + 10 Log B Limit	Power Limit
	(MHz)	(dBm)	(dBm)	(dBm)
Base	5180	17	18.11	17.0
Base	5240	17	20.17	17.0
Turbo	5210	17	21.71	17.0
Turbo	5250	17	22.33	17.0

Limit in 5250 to 5350 MHz Band

Mode	Frequency	Fixed Limit	11 + 10 Log B Limit	Power Limit
	(MHz)	(dBm)	(dBm)	(dBm)
Base	5260	24	26.9	24.0
Base	5320	24	25.38	24.0
Turbo	5290	24	28.92	24.0

Maximum antenna gain = 2.33 dBi, therefore there is no reduction due to antenna gain.

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RESULTS

No non-compliance noted:

Base Mode

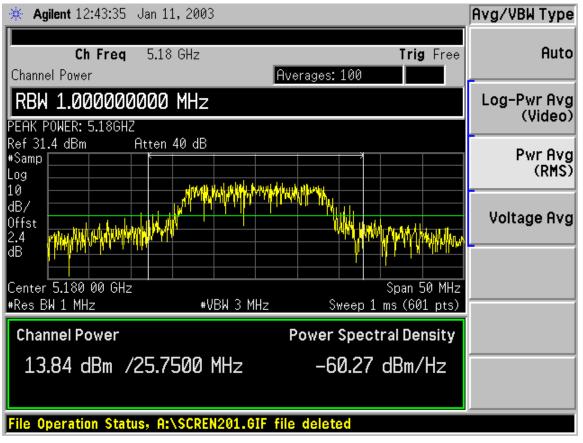
Channel	Frequency	Peak Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	13.84	17	-3.16
Middle	5240	16.45	17	-0.55
Middle	5260	17.46	24	-6.54
High	5320	13.88	24	-10.12

Turbo Mode

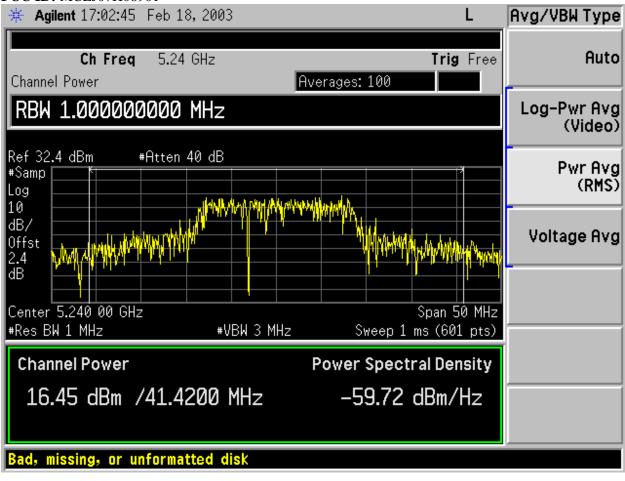
Channel	Frequency	Peak Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5210	15.62	17	-1.38
Middle	5250	15.83	17	-1.17
High	5290	15.01	24	-8.99

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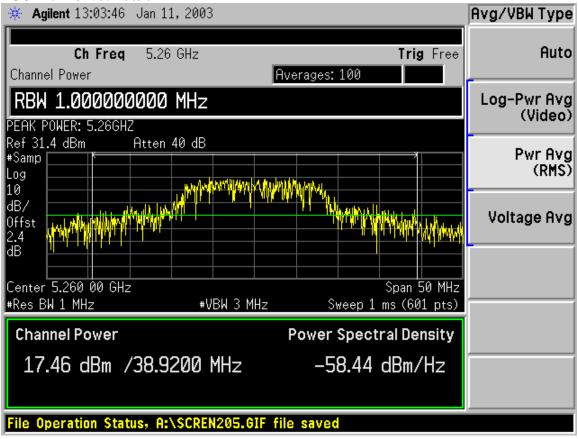
PEAK POWER (NORMAL MODE)



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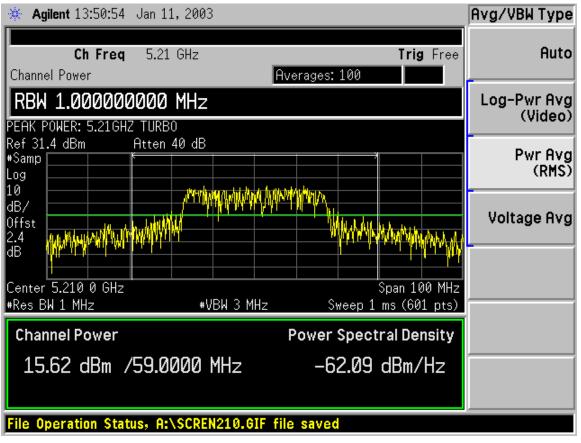


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🔆 Agilent 13:09:11 Jan 11, 2003	Avg/VBW Type
Ch Freq 5.32 GHz Trig Free Channel Power Averages: 100	Auto
RBW 1.000000000 MHz PEAK POWER: 5.32GHZ	Log-Pwr Avg (Video)
Ref 31.4 dBm Atten 40 dB #Samp Log	Pwr Avg (RMS)
	Voltage Avg
Center 5.320 00 GHz Span 50 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1 ms (601 pts)	
Channel Power Power Spectral Density	
13.88 dBm /27.4200 MHz -60.50 dBm/Hz	
File Operation Status, A:\SCREN206.GIF file saved	

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PEAK POWER (TURBO MODE)



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🔆 Agilent 13:16:12 Jan 11, 2003	Avg/VBW Type
Ch Freq 5.25 GHz Trig Free Channel Power Averages: 100	Auto
RBW 1.000000000 MHz PEAK POWER: 5.25GHZ TURBO	Log-Pwr Avg (Video)
Ref 31.4 dBm Atten 40 dB #Samp Atten 40 dB Log Annatat MA Manatat Annatat	PwrAvg (RMS)
dB/ Offst 2.4 dB	Voltage Avg
Center 5.250 0 GHz Span 100 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1 ms (601 pts)	
Channel Power Power Spectral Density	
15.83 dBm /68.0000 MHz -62.50 dBm/Hz	
File Operation Status, A:\SCREN207.GIF file saved	

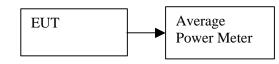
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ዡ Agilent 13:37:48 Jan 11, 2003	Avg/VBW Type
Ch Freq 5.29 GHz Trig Free Channel Power Averages: 100	Auto
RBW 1.000000000 MHz PEAK POWER: 5.29GHZ TURBO	Log-Pwr Avg (Video)
Ref 31.4 dBm Atten 40 dB #Samp Atten 40 dB Log Attensorie United States and Attension	PwrAvg (RMS)
dB/ Offst 2.4 but Maan Wert Wert Wert	Voltage Avg
dB Center 5.290 0 GHz #Res BW 1 MHz #VBW 3 MHz Sweep 1 ms (601 pts)	
Channel Power Power Spectral Density	
15.01 dBm /62.0000 MHz -62.91 dBm/Hz	
File Operation Status, A:\SCREN208.GIF file saved	

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8.3. AVERAGE POWER

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the power meter. The power meter is set to read average power.

<u>LIMIT</u>

None, reporting only.

<u>RESULTS</u>

No non-compliance noted:

Normal Mode

Channel	Frequency	Average Power			
	(MHz)	(dBm)			
Low	5180	13.84			
Middle	5240	17.70			
Middle	5260	17.39			
High	5320	14.03			

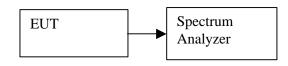
Turbo Mode

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	5210	15.65
Middle	5250	15.50
High	5290	15.34

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8.4. 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. PPSD method #2 was used.

SPECIFICATION LIMIT:

The maximum antenna gain = 2.33 dBi, therefore there is no reduction due to antenna gain.

RESULTS

No non-compliance noted:

Base Mode

Channel	Eroquonou	PPSD	Limit	Morgin
Chaimer	Frequency			Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	-0.008	4	-4.008
Middle	5240	3.118	4	-0.882
Middle	5260	3.308	11	-7.692
High	5320	-0.205	11	-11.205

Turbo Mode

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5210	-1.440	4	-5.44
Middle	5250	-1.768	4	-5.768
High	5290	-1.891	11	-12.891

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PPSD (NORMAL MODE)

🔆 Agilent 14	:09:57 Jan 1	3,2003				Peak Search
Ref 10 dBm #Samp	#Atten	20 dB		Mkr1	5.182 58 GH: -0.008 dBm	
Lin						Next Pk Right
0ffst 2.4 dB						Next Pk Left
	er 2580000 008 dBm	GHz	1			Min Search
100 V1 S2 S3 FC			VMANNA			Pk-Pk Search
AA £(f): FTun Swp						Mkr → CF
Center 5.180				human	Span 50 MHz	
#Res BW 1 MH File Operation	z n Status, A:	#VBW 3 \ scren003 .			ms (601 pts)	

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🔆 Ag	jilent 14	:05:29	Jan 13	, 2003							System
Ref 10 #Samp	dBm	#	Atten 3	30 dB				Mkr1		08 GHz .8 dBm	Show Errors•
Lin											Power On/ Preset
Offst 2.4 dB						1					Time/Date⊦
#PAvg				MAY	Millindung	MAM	444h				Alignments⊦
100 V1 S2 S3 FC AA				1							Config I/O
€(f): FTun Swp											Reference ⊦
	5.240 3W 1 MH	00 GHz z	and the second	#V	ВМЗМ	Hz _		weep <u>1</u>	Span ! ms (60	50 MHz 1 pts)	More 1 of 3
File 0	peratio	n Statu	is, C:\	STATE	002 . S	TA file	save	d			

Page 38 of 101

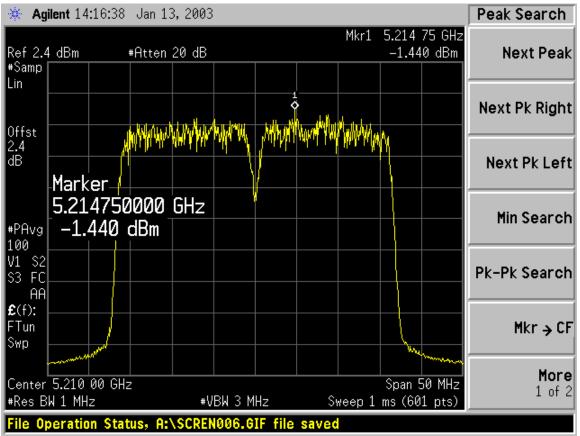
🔆 Ag	jilent 14	:12:39	Jan 13	3,2003							Peak Search
Ref 10 #Samp	dBm		#Atten	30 dB				Mkr1		17 GHz)8 dBm	Next Peak
Lin											Next Pk Right
Offst 2.4 dB	Mark	or									Next Pk Left
#PAvg 100	5.25	4170 308 (0000 dBm	GHZ	hindiphedi.	polonylus	, ul /Wh				Min Search
V1 S2 S3 FC AA											Pk-Pk Search
€(f): FTun Swp				J							Mkr → CF
	5.260 3W 1 MH:		Z	#V	вы з м	lHz	s	weep 1	Span ms (60	50 MHz 1 pts)	More 1 of 2
File O	peratio	n Stat	tus, A:`	SCREN	1004 . G	IF file	save				

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🔆 Ag	j ilent 14	:14:22	Jan 13	3,2003	;					Peak Search
Ref 10 #Samp	dBm		#Atten	20 dB				Mkr1	92 GHz)5 dBm	Next Peak
Lin										Next Pk Right
Offst 2.4 dB	Mont									Next Pk Left
#PAvg			0000 dBm	GHz			1			Min Search
100 V1 S2 S3 FC AA	L			and and	wWww.rviyy	production of				Pk-Pk Search
€(f): F⊤un Swp										Mkr → CF
	5.320 W 1 MH			۲ #V	ви з м	Hz	s s	weep 1	50 MHz 1 pts)	More 1 of 2
File 0	peratio	n Stat	us, A:'	SCRE	1005.G	IF file	save	1		

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PPSD (TURBO MODE)



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🔆 Agilent 14:18:09 🛛 Jan 1	3,2003			Peak Search
Ref 2.4 dBm #Atten #Samp	20 dB	Mkr1	5.246 17 GHz -1.768 dBm	Next Peak
Offst				Next Pk Right
dB Marker	mary any Jaw	mammun		Next Pk Left
5.246170000 #PAvg −1.768 dBm 100	GHz			Min Search
V1 S2 S3 FC AA				Pk-Pk Search
£(f): FTun Swp				Mkr → CF
Center 5.250 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Sweep 1	Span 50 MHz ms (601 pts)	More 1 of 2
File Operation Status, A:	SCREN007.GIF fil	e saved		

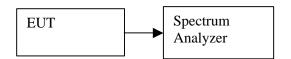
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🔆 Agilent 14:20:57 🛛 Jan 10	3,2003		Peak Search
Ref 2.4 dBm #Atten #Samp	20 dB		04 08 GHz .891 dBm NextPeak
Lin			Next Pk Right
0ffst 2.4 dB	anaryalahannya jawaha	ativite the test of the second s	Next Pk Left
Marker 5.304080000 ∗PAvg −1.891 dBm	GHz		Min Search
100 V1 S2 S3 FC			Pk-Pk Search
AA £(f): FTun			Mkr → CF
Swp Center 5.290 00 GHz		Spa	an 50 MHz 1 of 2
<pre>#Res BW 1 MHz File Operation Status, A:</pre>	#VBW 3 MHz \SCREN008.GIF file	Sweep 1 ms saved	(601 pts)

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8.5. 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 # 1 was used for peak power measurements, Method # 1 is used for the second PPSD trace.

RESULTS

No non-compliance noted:

Base Mode

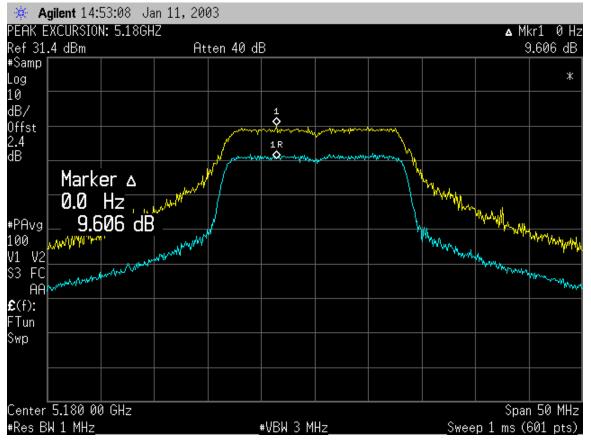
Duse mode				
Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5180	9.606	13	-3.394
Middle	5240	10.313	13	-2.687
Middle	5260	8.933	13	-4.067
High	5320	9.716	13	-3.284

Turbo Mode

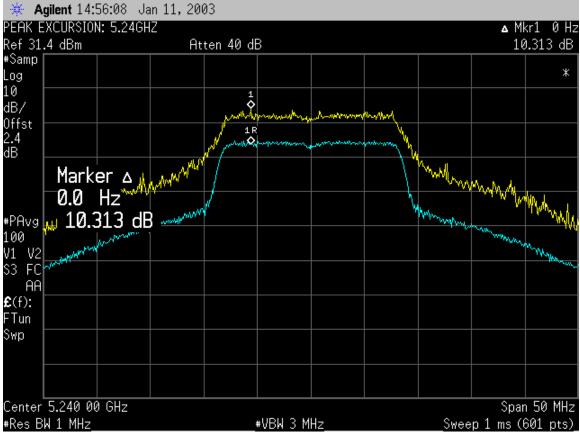
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5210	9.13	13	-3.87
Middle	5250	8.674	13	-4.326
High	5290	9.114	13	-3.886

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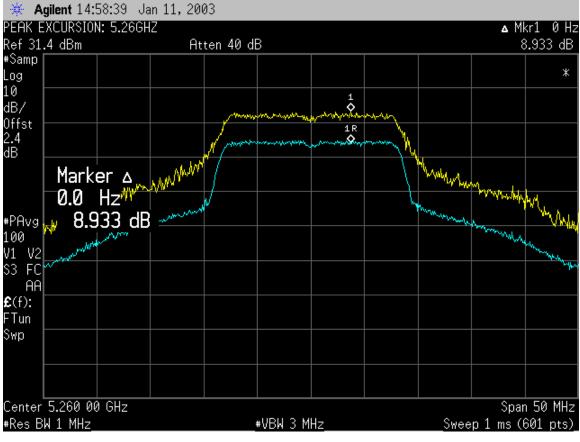
PEAK EXCURSION (NORMAL MODE)



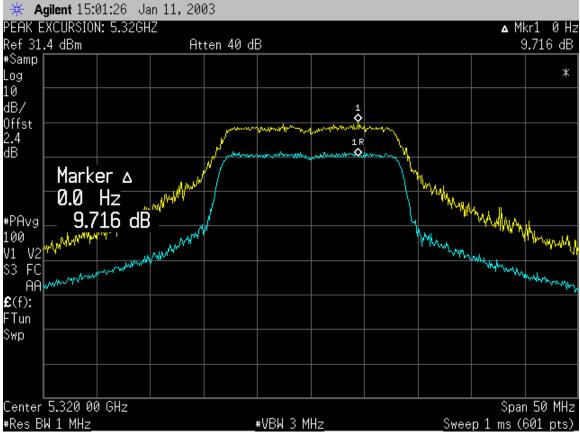
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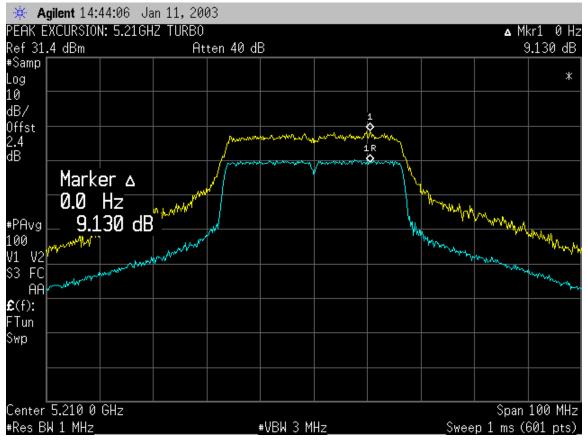


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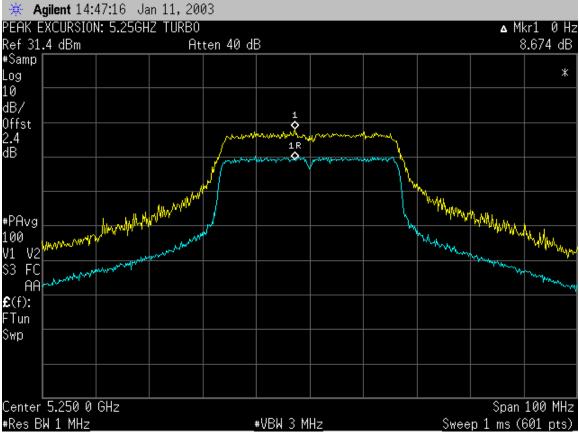


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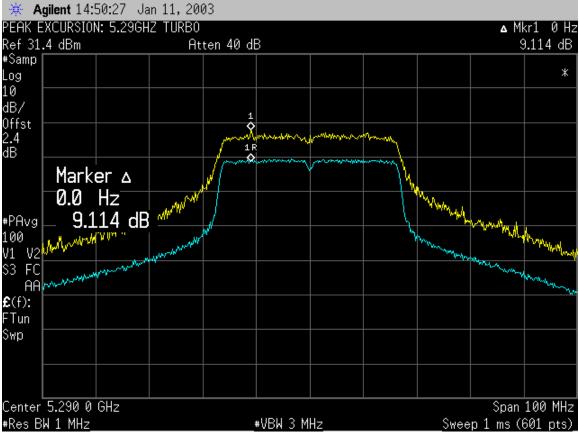
PEAK EXCURSION (TURBO MODE)



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8.6. TRANSMISSION IN THE ABSENCE OF DATA

RESULTS

No non-compliance noted:

See theory of operation

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8.7. TYPE OF ANTENNA

RESULTS

No non-compliance noted:

Antenna is integral.

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8.8. 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 metersS = 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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REPORT NO: 02U1731-1BDATE: FEBRUARY 20, 2003 EUT: 802.11 a/b/g MINI PCI CARD WITH AGENCY SERIES PP2170 LAPTOP FCC ID: MCLJ07H06901 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

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

Equation (1)

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 = 17.46 dBmAntenna Gain = 2.33 dBiS = $1.0 \text{ mW} / \text{cm}^2$ from 1.1310 Table 1

Substituting these parameters into Equation (1) above:

MPE Safe Distance = 2.75 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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8.9. FREQUENCY STABILITY

RESULTS

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.

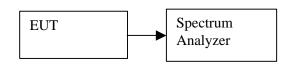
An examination of the band edge plots shows that the emission will stay within the authorized band over the entire temperature range.

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8.10. CONDUCTED UNDESIRABLE EMISSIONS

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.

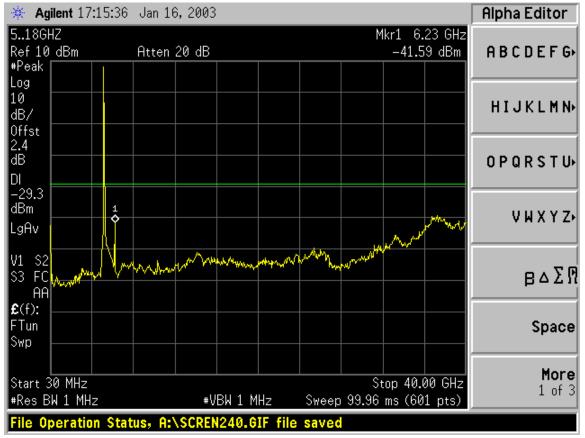
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

RESULTS

No non-compliance noted:

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CONDUCTED SPURIOUS (NORMAL MODE)



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🔆 Ag	ilent 17	:14:17	Jan 10	6,2003							Title
5.24GH Ref 10			Atten	20 dB				М		29 GHz 0 dBm	Change Title
#Peak Log 10											
dB/ Offst											Clear Title
2.4 dB											
DI -29.3											
dBm LgAv		1 \$								and the second s	
V1 S2		M.	mlu	where the	www.	Manan	w/4mm	where we want the	all the star		
S3 FC AA €(f):		¥, ,									
FTun Swp											
									00 10	00 CU-	
Start 3 #Res B	SU MHZ W 1 MH:	z		#V	BW 1 M	Hz	Sweep	5t 99.96		00 GHz 1 pts)	
File 0	peratio	n Stat	us, A:	SCREM	239.6	IF file	savec				

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🔆 Agilent 17:12:35 Jan 16, 2003	Alpha Editor
5.26GHZ Mkr1 6.29 GHz Ref 10 dBm Atten 20 dB -41.11 dBm #Peak	A B C D E F G
Log 10 dB/ Offst	HIJKLMN⊳
2.4 dB DI	0 P Q R S T U∙
-29.3 dBm LgAv	V W X Y Z⊦
V1 S2 S3 FC AA	B ⊽ Σ 🖞
£(f):	Space
Start 30 MHz Stop 40.00 GHz #Res BW 1 MHz #VBW 1 MHz Sweep 99.96 ms (601 pts)	More 1 of 3
File Operation Status, A:\SCREN238.GIF file saved	

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🔆 Ag	ilent 17	:10:01	Jan 1	6,2003							Alpha Editor
5.32GH Ref 10 #Peak			Atten	20 dB				Mk		62 GHz 2 dBm	A B C D E F G
Log 10 dB/ Offst											HIJKLMN→
Offst 2.4 dB DI											0 P Q R S T U∙
-29.3 dBm LgAv									and mark	and the second second	V W X Y Z⊧
V1 S2 S3 FC AA	Spensor and	Nr	mh	www	Harlymy	on hand	www.	and a start of the	.		B ⊽ Σ ₩
€(f): FTun Swp											Space
	30 MHz W 1 MH	z		#V	BW 1 M	Hz	Sweet	51 0 99.96		00 GHz 1 pts)	More 1 of 3
Copyri	ight 20	00-2	002 Ag	ilent T	echnol	ogies					

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REPORT NO: 02U1731-1BDATE: FEBRUARY 20, 2003 EUT: 802.11 a/b/g MINI PCI CARD WITH AGENCY SERIES PP2170 LAPTOP FCC ID: MCLJ07H06901 CONDUCTED SPURIOUS (TURBO MODE)

* Agilent 16:59:54 Jan 16, 2003		Title
5.21GHZ	Mkr1 6.23 GHz	
Ref 10 dBm Atten 20 dB	-38.78 dBm	Change Title
#Peak Log		
10		Clear Title
dB/		clear ritie
Offst 2.4		
2.4 dB		
DI		
dBm		
LgAv	. And Mark	
V1 S2	Harry Harry Warder Langer Harry Har	
JJ FUM MARKAN AND AND AND AND AND AND AND AND AND A		
AA £ (f):		
FTun		
Swp		
Start 30 MHz	Stop 40.00 GHz	
	1 MHz Sweep 99.96 ms (601 pts)	
File Operation Status, A:\SCREN23	5.GIF file saved	

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🔆 Agilent 16:58:21 Jan 16,	2003	Title
5.25GHZ Ref 10 dBm Atten 20	Mkr1 6.29 GHz)dB -40.34 dBm	Change Title
#Peak Log 10		
dB/ Offst		Clear Title
2.4 dB		
DI -29.3 dBm 1		
LgAv		
VI S2 S3 FCmborn Northon	Manual providence and the second seco	
AA £(f):		
FTun Swp		
Start 30 MHz #Res BW 1 MHz	Stop 40.00 GHz #VBW 1 MHz Sweep 99.96 ms (601 pts)	
File Operation Status, A:\S		

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8.11. RADIATED UNDESIRABLE EMISSIONS

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.

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SAMPLE CALCULATIONS

Given

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

where

E = Field Strength in Volts / meter

P = Power in watts

G = Numeric antenna gain

d = distance in meters

Rearranging terms yields:

 $P * G = (d * E) ^ 2 / 30$

Converting to the logarithmic form and changing to units of mW and uV/m, using:

P (mW) = P (W) / 1000 and E (uV/m) = E (V/m) / 1000000

yields

$$10 \log (P * G) = 10 \log (d^2) + 10 \log (E^2) - 10 \log (30) - 10 \log (10^9)$$

= 20 log (d) + 20 log (E) - 104.77

In this logarithmic form

10 log (P * G) is PG in dBm and 20 log (E) is E in dBuV/m

Since EIRP = P * G, then at a specification distance of 3 meters, the EIRP in terms of field strength is:

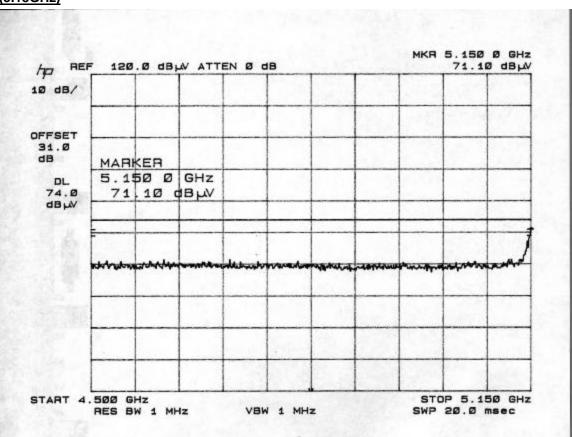
EIRP (dBm) = P * G (dBm) = E (dBuV/m) - 95.2

TEST RESULTS

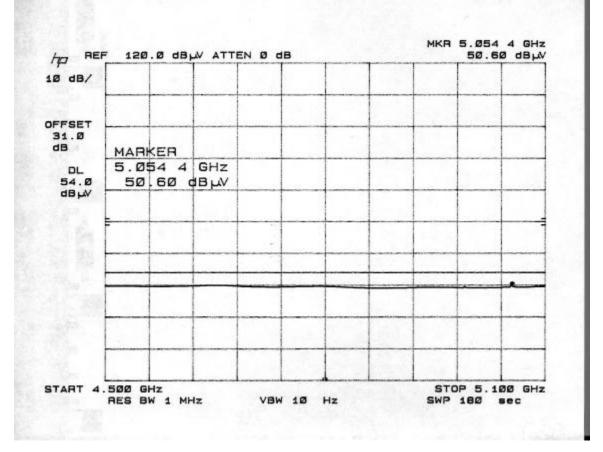
No non-compliance noted:

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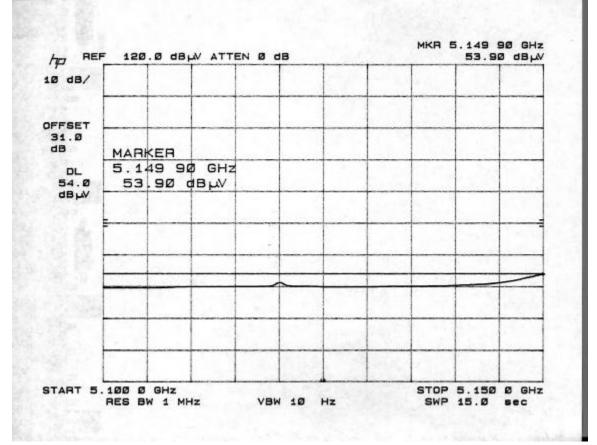
<u>RESTRICTED BAND RADIATED EMISSIONS (NORMAL MODE, VERTICAL POLARIZATION)</u> (5.18GHz)



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HO REF 120.0 08 ATTEN 0 08						MKR 5.150 0 GHz 67.60 dBHV				
10 dB/							1	1		
							-			
OFFSET										
dB	DIS	PLAY	LINE	(
DL 74.0 dB	74	Ødi	Vu e							
	-									7
		Anthen	march	Anna	misleyba	when	percepter	minton	mhou	manut
									-	

RESTRICTED BAND RADIATED EMISSIONS (NORMAL MODE, HORIZONTAL POLARIZATION) (5.18GHz)

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