

FCC CFR47 PART 15 SUBPART E CERTIFICATION TEST REPORT

FOR

802.11 ag /DRAFT 802.11n WIRELESS LAN PCI-E MINI CARD

MODEL NUMBER: BCM94321MC

FCC ID: QDS-BRCM1022HR1

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1. ATTESTATION OF TEST RESULTS

FCC PART 15 SUB			
STANDARI	D TEST RESULTS		
	APPLICABLE STANDARDS		
DATE TESTED:	NOVEMBER 10 TO APRIL 15, 2007		
SERIAL NUMBER: 6F632058LWQXE & 6F634002HWQXE			
MODEL:	BCM94321MC		
EUT DESCRIPTION:	802.11 AG /DRAFT 802.11n WIRELESS LAN PCI-E MINI CARD		
	SUNNYVALE, CA 94086, USA		
COMPANY NAME:	BROADCOM CORP. 190 MATHILDA PLACE		

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: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by 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. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

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MH

MICHAEL HECKROTTE ENGINEERING MANAGER COMPLIANCE CERTIFICATION SERVICES

VIEN TRAN EMC ENGINEER COMPLIANCE CERTIFICATION SERVICES

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15 and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION".

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, and 47173 Benicia Street, Fremont, 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 <u>http://www.ccsemc.com</u>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. 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%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11n MIMO transceiver chipset. The chipset is installed on a Mini PCI–E card, model number BCM94321MC.

The radio module is manufactured by Broadcom Corp.

5.2. TEST RESULT CONCLUSIONS

The worst-case data rate in each mode is based on investigations of PSD, peak power, average power, conducted emissions, plus bandedge and 2nd harmonic (5GHz only) radiated emissions across all the data rates, bandwidths, modulations and spatial stream modes.

Based upon pre-testing across all transmit modes, the worst case data rates are as follows: For the Legacy Mode, the worst case is 1Mb/s @ 11b mode & 6Mb/s @ 11ag mode. For MCS Index and MIMO operation modes covered under this evaluation it was determined that MCS Index 0 is worst case for all 20MHz bandwidth modes. MCS Index 32 is worst case for 40MHz mode. Both MCS 0 and MCS 32 were set to CDD mode.

Based on the preliminary test results, the following modes were tested:

2.4 GHz DTS BAND

1/ LEGACY MODE:
_802.11b Legacy Mode
_802.11g Legacy Mode
_802.11n Mode 20 MHz SISO is covered by the worst case 802.11g Mode Legacy testing
_802.11n Mode 40 MHz SISO

2/ MIMO MODE:
_802.11g Mode Legacy CDD is covered by the worst case 802.11n Mode 20 MHz CDD MCS0.
_802.11n Mode 20 MHz CDD MCS 0:
_802.11n 40 MHz CDD MCS 32
_802.11n 40 MHz SDM MCS 15

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5.2 GHz and 5.5 GHz UNII BANDS

1/ LEGACY MODE:
_802.11a Legacy Mode
_802.11n 20 MHz SISO is covered by the worst case 802.11a Legacy Mode testing)
_802.11n 40 MHz SISO

2/ MIMO MODE: _802.11a Mode CDD is covered by the worst case 802.11n Mode 20 MHz CDD MCS0. _802.11n 20 MHz CDD MCS 0 _802.11n 40 MHz CDD MCS 32 _802.11n 40 MHz SDM MCS 15

5.8 GHz DTS BAND

1/ LEGACY MODE:
_802.11a Legacy Mode
_802.11n Mode 20 MHz SISO is covered by the worst case 802.11a Mode Legacy testing
_802.11n Mode 40 MHz SISO

2/ MIMO MODE: _802.11a Mode CDD is covered by the worst case 802.11n Mode 20 MHz CDD MCS0. _802.11n Mode 20 MHz CDD MCS 0 _802.11n 40 MHz CDD MCS 32

Comparative test results for Output Power and PPSD in the MIMO modes demonstrated close correlation (on the order of +/-0.1 to 0.4 dB) between the mathematical addition of Chain 0 and Chain 1 (using linear units), as compared to measurements made using an RF combiner. Therefore all results presented in this report for the above parameters are Chain 0, Chain 1, and the mathematical sum of Chain 0 + Chain 1.

Comparative test results for Conducted Spurious in the MIMO modes demonstrated close correlation (on the order of +/-1 dB) between individual chain and measurements made using an RF combiner. Therefore all results presented in this report for the above parameter is Chain 0 and Chain 1.

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5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

5150 to 5350 MHz Authorized Band

Frequency Range (MHz)	Mode	Peak Power Chain 0 (dBm)	Peak Power Chain 1 (dBm)	Total Peak Power (dBm)	Output Power (mW)
5180 - 5240	802.11a Legacy	N/A	N/A	14.22	26.42
5260 - 5320	802.11a Legacy	N/A	N/A	17.63	57.94
5180 - 5320	802.11n 20MHz SISO	covered by the we	orst case 802.11a	Legacy testing	
5190 - 5230	802.11n 40MHz SISO	N/A	N/A	16.54	45.08
5270 - 5310	802.11n 40MHz SISO	N/A	N/A	17.08	51.05
5180 - 5320	802.11a CDD Mode	covered by the we	orst case 802.11n	20 MHz CDD	
5190	802.11n 40MHz SDM	12.56	12.59	15.59	36.19

Power with Antenna Array Gain up to 6 dBi						
5180 - 5240	802.11n 20MHz CDD	10.09	10.2	13.16	20.68	
5260 - 5320	802.11n 20MHz CDD	17.22	17.34	20.29	106.92	
5190 - 5230	802.11n 40MHz CDD	12.37	12.36	15.38	34.48	
5270 - 5310	802.11n 40MHz CDD	15.53	15.83	18.69	74.01	

Power with Antenna Array Gain up to 7.077 dBi in 5150 - 5250 Band						
5180 - 5240 802.11n 20MHz CDD 9.11 9.34 12.24 16.74						
5190 - 5230	802.11n 40MHz CDD	11.59	12.19	14.91	30.98	

Power with Antenna Array Gain up to 8.677 dBi in 5250 - 5350 Band						
5260 - 5320	802.11n 20MHz CDD	14.51	14.65	17.59	57.42	
5270 - 5310	802.11n 40MHz CDD	15.53	15.83	18.69	74.01	

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Frequency Range (MHz)	Mode	Peak Power Chain 0 (dBm)	Peak Power Chain 1 (dBm)	Total Peak Power (dBm)	Output Power (mW)
5500 - 5700	802.11a Legacy	N/A	N/A	17.75	59.57
5500 - 5700	802.11n 20MHz SISO	covered by the worst case 802.11a Legacy testing			
5510 - 5670	802.11n 40MHz SISO	N/A	N/A	18.23	66.53
5500 - 5700	802.11a CDD Mode	covered by the worst case 802.11n 20 MHz CDD			

5470 - 5725 MHz Authorized Band

Power with Antenna Array Gain up to 6 dBi								
5500 - 5700	5500 - 5700 802.11n 20MHz CDD 17.21 17.24 20.24 105.57							
5510 - 5670	5510 - 5670 802.11n 40MHz CDD 19.38 19.39 22.40 173.59							

Power with Antenna Array Gain up to 8.75 dBi							
5500 - 5700 802.11n 20MHz CDD 14.63 14.65 17.65 58.21							
5510 - 5670	802.11n 40MHz CDD	16.67	16.81	19.75	94.42		

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5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT has 2 Tx/Rx antennas that are automatically selected for use as per the MCS index and STF mode selections. The EUT was tested with PCB antennas described below:

Band	Ant Main	Ant Aux	10^(Ant Main /10)	10^(Ant Aux/10)	10^(ant main/10)+10^(ant aux/10)	10*log[10*(ant main/10)+10*(ant aux/10)] (dBm)
Acon						
2.4-2.4835GHz	3.36	2.89	2.168	1.945	4.113	6.142
5.4-5.725GHz	6.02	5.44	3.999	3.499	7.499	8.750
5.725-5.825GHz	6.02	5.01	3.999	3.170	7.169	8.555
Foxconn						
5.15-5.25GHz	3.74	4.37	2.366	2.735	5.101	7.077
5.25-5.35GHz	6.23	5.02	4.198	3.177	7.374	8.677

On selected UNII channels and/or sub-bands, a higher output power is specified for antenna pairs of the same type with an array gain of 6 dBi or less. For these channels and/or sub-bands the maximum power was limited by Output Power and PPSD, rather than Spurious emissions performance. All Spurious testing was performed at the worst-case combination of the highest output power and the highest antenna array gain. This worst-case combination will not be marketed on those channels that would not comply with the Power or PPSD limits.

The conducted Output Power and PPSD measurements at the highest power level are applied to the maximum 6 dBi array gain for the Output Power and PPSD calculations. Additional conducted Output Power and PPSD measurements were made at the reduced power level, and these measurements are applied to the 7.077 / 8.677 / 8.750 dBi array gain for the respective Output Power and PPSD calculations.

5.5. SOFTWARE AND FIRMWARE

The EUT was tested in the following manner:

- "epi_ttcp.exe" was used to transmit UDP packets to a broadcast IP address (192.168.66.255) – i.e. no ACK required. This test mode sends a continuous packetized data stream with duty cycles that vary dependant upon data rate/MCS Index selected.

- "wl ampdu" and "frameburst" were enabled to ensure worst case data packet transfer and duty cycle.

- Worst case packet length have also been used to ensure max duty cycle

5.6. CONFIGURATION AND MODE

Operating modes were changed directly in software with no other changes to the set up. Power levels were verified across all the MCS Index at the start of test and as required throughout testing.

Prior to each test a power meter was used to tune the gated average power within a Tx packet. The channel gates on the meter were set to ensure that, at the time of recording, only packet power was captured without including duty cycle off time.

Power was tuned for different modes, channels and antennas based on the power tuning table contained in the Operational Description submitted under the same filing.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST						
Description Manufacturer Model Serial Number FCC						
Laptop PC	Dell	Inspiron 0000	CN-901014-70166-57K-01JT	DOC		
AC Adapter	Dell	PA-1600-06D1	F9710	DOC		

I/O CABLES

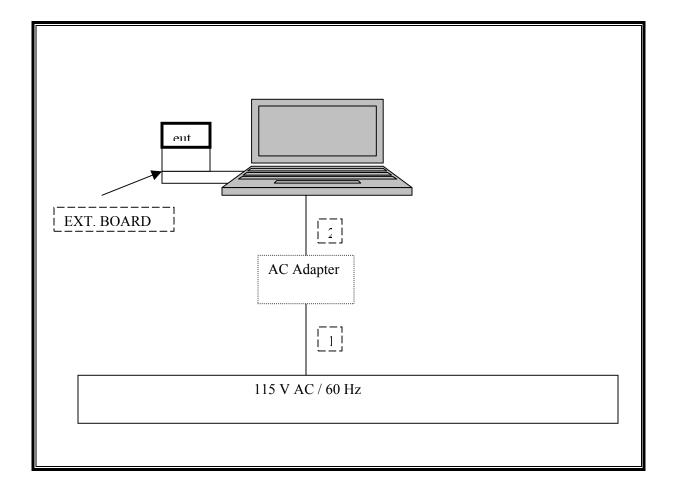
	I/O CABLE LIST							
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks		
1	AC	1	AC	Unshielded	1.2 m	N/A		
2	DC	1	DC	Unshielded	1.2 m	N/A		

TEST SETUP

The EUT is installed in a host laptop computer via Express card to MiniPCI-E adapter boards during the tests. Test software exercised the radio card.

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SETUP DIAGRAM



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6. TEST AND MEASUREMENT EQUIPMENT

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

	TEST EQUIPMENT LIST							
Description	Manufacturer	Model	Serial Number	Cal Due				
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	US42510266	10/19/2007				
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	4/15/2008				
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00561	10/3/2007				
Preamplifier, 26 ~ 40 GHz	Miteq	NSP4000-SP2	924343	8/18/2007				
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	8/30/2007				
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	8/30/2007				
EMI Test Receiver	R & S	ESHS 20	827129/006	11/3/2007				
AC Power Source, 10 kVA	ACS	AFC-10K-AFC-2	J1568	CNR				
Quasi-Peak Adaptor	Agilent / HP	85650A	2521A01038	01/11/08				
SA Display Section 2	Agilent / HP	85662A	2816A16696	04/07/08				
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	01/07/08				
Preamp 30-1000MHz	Sonoma Instrument	310N	185623	01/20/08				
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	08/13/07				
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	6/12/2008				
RF Filter Section	Agilent / HP	85420E	3705A00256	6/12/2008				
4.0 High Pass Filter	Micro Tronics	HPM13351	3	N/A				
2.4 - 2.5 Band Reject Filter	Micro Tronics	N/A	1	N/A				
2.0 - 4.2 GHz Combiner	Mini-Circuits	ZA4PD-4	SF380100518	N/A				
4.6 - 5.8 GHz Combiner	Mini-Circuits	ZB4PD1-5.8	SN649900514	N/A				
Peak Power Meter	Agilent / HP	E4416A	GB41291160	12/2/2007				
Antenna, Horn, 18 ~ 26 GHz	ARA	MWH-1826/B	1013	8/6/2007				
Antenna, Horn 26 ~ 40 GHz	ARA	MWH-2640/B	1029	4/11/2008				
4.0 GHz High Pass Filter	Micro Tronics	HPM13351	3	N/A				
2.4 - 2.5 Reject Filter	Micro Tronics	BRM50702	3	N/A				
7.6 GHz High Pass Filter	Micro Tronics	HPM13350	1	N/A				
5.75 - 5.8 Reject Filter	Micro Tronics	BRC13192	2	N/A				

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7. LIMITS AND RESULT

5150 TO 5350 MHz BAND

LEGACY MODE

7.1. CHANNEL TESTS FOR THE 5150 TO 5350 MHz BAND

7.1.1. EMISSION BANDWIDTH

<u>LIMIT</u>

§15.403 (i) <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.

TEST PROCEDURE

The transmitter output is connected to a 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:

	Б	D	
Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5180	19.62	12.93
Middle	5260	33.69	15.28
High	5320	19.81	12.97

802.11a LEGACY MODE

802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

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802.11n 40 MHz SISO MODE

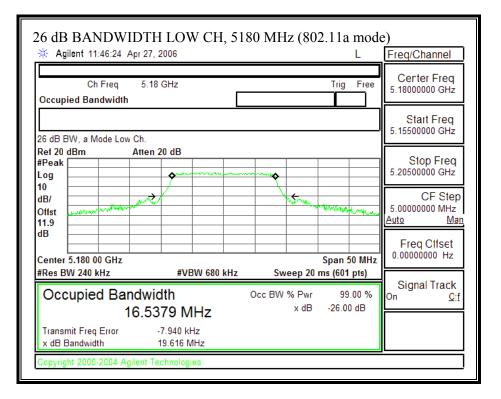
802.11a Mode

Channel	Frequency	В	10 Log B	
	(MHz)	(MHz)	(dB)	
Low	5190	39.17	15.93	
Middle	5270	73.74	18.68	
High	5310	39.87	16.01	

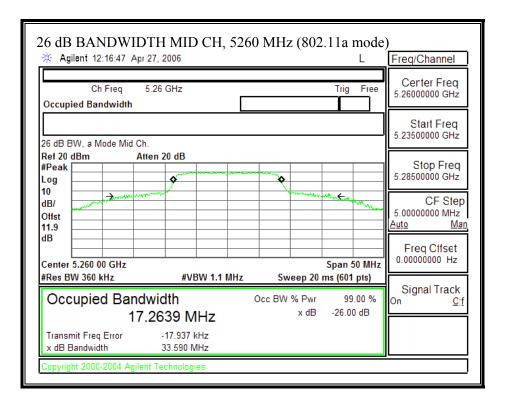
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802.11a MODE

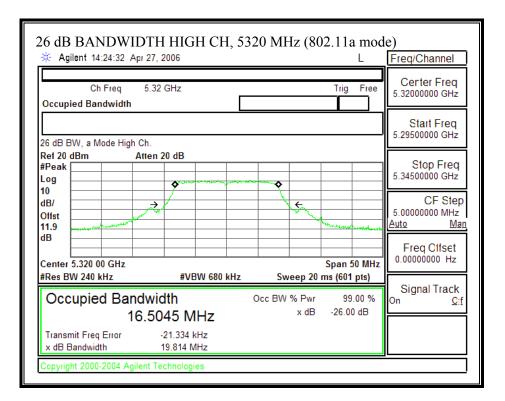
26 dB EMISSION BANDWIDTH (802.11a MODE)



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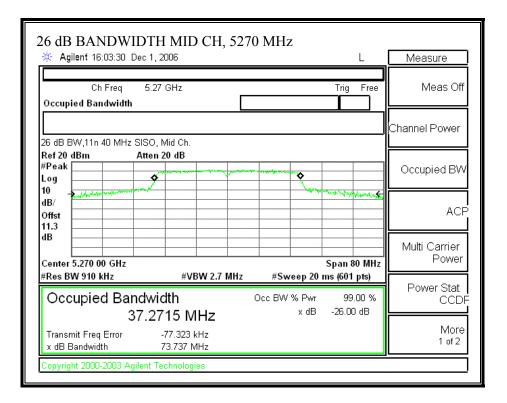
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11n 40 MHz SISO MODE

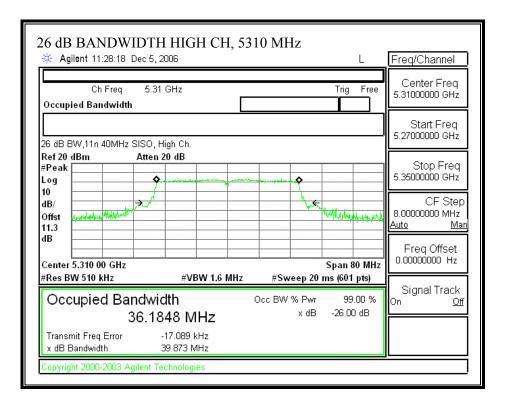
26 dB EMISSION BANDWIDTH (802.11n 40MHz SISO MODE)

26 dB BANDWID	-	, 5190 MHz	I	Freq/Channel
	.19 GHz		Trig Free	Center Freq 5.19000000 GHz
26 dB BW, 11n 40MHz SIS	D, Low Ch.			Start Freq 5.15000000 GHz
#Peak	en 20 dB	hand the second s		Stop Freq 5.23000000 GHz
10 dB/ Offst			and the second second	CF Step 8.0000000 MHz <u>Auto Man</u>
dB Center 5.190 00 GHz #Res BW 470 kHz	#VBW 1.5 M		Span 80 MHz	Freq Offset 0.00000000 Hz
Occupied Bandw		Occ BW % Pw x dE		Signal Track On <u>Off</u>
Transmit Freq Error x dB Bandwidth	-19.448 kHz 39.169 MHz			
Copyright 2000-2003 Agilent	Technologies			

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7.1.2. PEAK POWER

<u>LIMIT</u>

\$15.407 (a) (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 + 10 log B, where B is the 26-dB emission bandwidth in MHz. 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) (1) 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 + 10 log B, where B is the 26-dB emission bandwidth in MHz. 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.

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.

THE ANTENNA GAIN:

5.15 – 5.25 GHz: 4.37dBi 5.25 – 5.35 GHz: 6.23dBi

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802.11a MODE

LIMITS AND RESULTS FOR TRANSMIT POWER

Limit in 5150 to 5250 MHz Band

Channel	Frequency	Fixed	В	4 + 10 Log	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)

Limit in 5250 to 5350 MHz Band

Channel	Frequency	Fixed	В	11 + 10	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Mid	5260	24	33.59	26.262	6.230	23.77
High	5300	24	33.22	26.214	6.230	23.77
High	5320	24	19.81	23.970	6.230	23.74

Results

Channel	Frequency	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	14.22	16.93	-2.71
Mid	5260	17.63	23.77	-6.14
High	5300	17.59	23.77	-6.18
High	5320	14.64	23.74	-9.10

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802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

802.11n 40 MHz SISO MODE

No non-compliance noted:

Limit in 5150 to 5250 MHz Band

Channel	Frequency	Fixed	В	4 + 10 Log	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5190	17	39.170	19.930	6.230	16.77
Low	5230	17	61.693	21.902	6.230	16.77

Limit in 5250 to 5350 MHz Band

Channel	Frequency	Fixed	В	11 + 10	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Mid	5270	24	73.74	29.677	6.230	23.77
High	5310	24	39.87	27.006	6.230	23.77

Results

Channel	Frequency	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5190	13.33	16.77	-3.44
Low	5230	16.54	16.77	-0.23
Mid	5270	17.08	23.77	-6.69
High	5310	12.95	23.77	-10.82

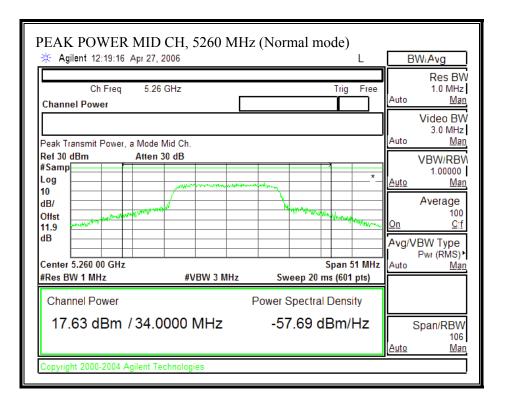
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802.11a MODE

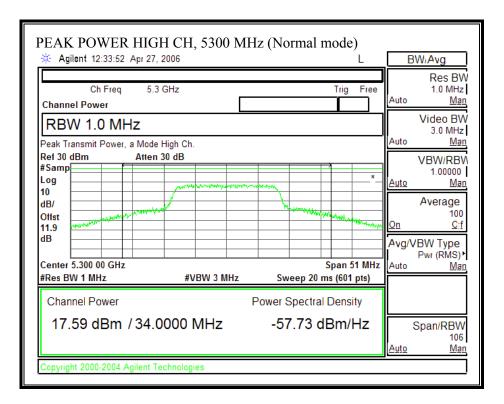
PEAK POWER (NORMAL MODE)

PEAK POWER LOW CH, 5180 MHz (Normal mode) Agilent 11:49:22 Apr 27, 2006	BW/Avg
Ch Freq 5.18 GHz Trig Free Channel Power	Res BW 1.0 MHz Auto <u>Man</u>
VBW 3.0 MHz Peak Transmit Power, a Mode Low Ch.	Video BW 3.0 MHz Auto <u>Man</u>
Ref 30 dBm Atten 30 dB #Samp	VBW/RBV 1.00000 Auto Man
10 dB/ Offst 11.9	Average 100 <u>On <u>C</u>!f</u>
dB Center 5.180 00 GHz Span 30 MHz	Avg/VBW Type Pwr (RMS) • Auto <u>Man</u>
#Res BW 1 MHz #VBW 3 MHz Sweep 20 ms (601 pts) Channel Power Power Spectral Density	
14.22 dBm / 20.0000 MHz -58.79 dBm/Hz	Span/RBW 106 <u>Auto Man</u>
Copyright 2000-2004 Agilent Technologies	

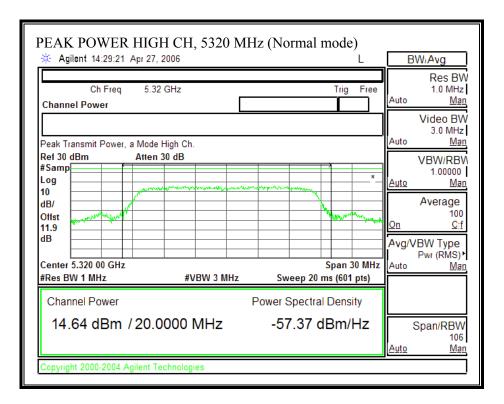
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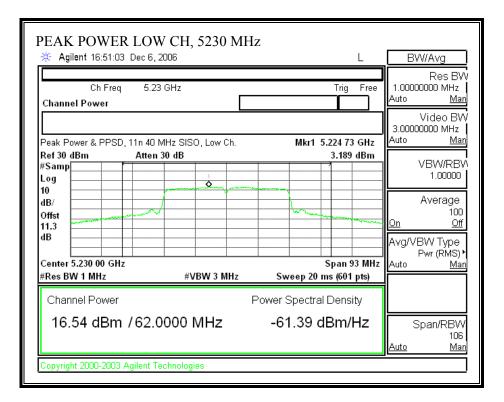
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802.11n 40 MHz SISO MODE

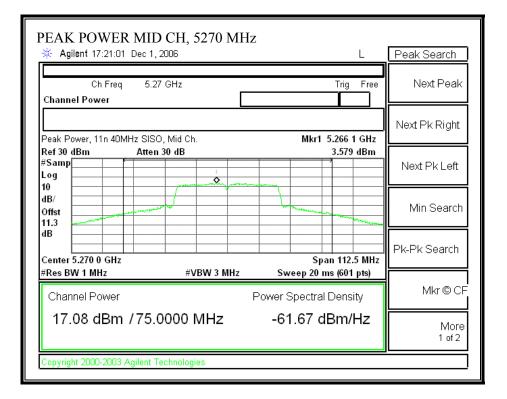
PEAK POWER (11n 40MHz SISO MODE)

🔆 Agilent 10:51:36 Dec 5, 2	/ CH, 5190 MH2 2006	L	BW/Avg
Ch Freq 5.19 Channel Power	GHz	Trig Free	Res BV 1.0000000 MHz <u>Auto Mar</u> Video BV
Peak Power & PPSD, 11n 40M Ref 30 dBm Atten ¥Samp Log	•	Mkr1 5.185 50 GHz -0.233 dBm	3.00000000 MHz Auto Mar VBW/RBV 1.00000
10 dB/ 0ffst 11.3 dB			Average 100 <u>On Off</u> Avg/VBW Type
Center 5.190 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span 60 MH Sweep 20 ms (601 pts)	Z Auto Mar
Channel Power 13.33 dBm /40.0	Span/RBW 106 Auto Mar		

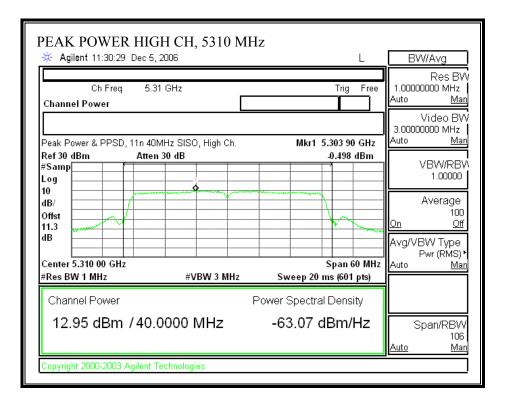
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7.1.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

\$1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Lim	its for Occupational	/Controlled Exposu	res	
0.3–3.0 3.0–30 30–300 300–1500 1500–100,000	614 1842/f 61.4	1.63 4.89/f 0.163	*(100) *(900/f²) 1.0 f/300 5	6 6 6 6 6
(B) Limits	for General Populati	on/Uncontrolled Exp	posure	
0.3–1.34 1.34–30	614 824/f	1.63 2.19/f	*(100) *(180/f ²)	30 30

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)-Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
30–300 300–1500 1500–100,000	27.5	0.073	0.2 f/1500 1.0	30 30 30

f = frequency in MHz
 * = Plane-wave equivalent power density NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occu-pational/controlled limits apply provided he or she is made aware of the potential for exposure. NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be ex-posed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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CALCULATIONS

Given

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

and

 $S = E^{2}/3770$

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 Power to mW and Distance to cm, using:

P(mW) = P(W) / 1000 and d(cm) = 100 * d(m)yields $d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$ $d = 0.282 * \sqrt{(P * G / S)}$ where d = distance in cmP = Power in mWG = Numeric antenna gain $S = Power Density in mW/cm^2$ Substituting the logarithmic form of power and gain using: $P(mW) = 10^{(H)} (P(dBm) / 10)$ and $G (numeric) = 10^{(G(dBi) / 10)}$ yields $d = 0.282 * 10^{(P+G)} / 20) / \sqrt{S}$ where d = MPE distance in cm P = Power in dBm

G = Antenna Gain in dBi S = Power Density Limit in mW/cm^2

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{(P+G)} / 10) / (d^2)$$

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LIMITS

From 1.1310 Table 1 (B), S = 1.0 mW/cm² in the 5.2 / 5.3 GHz band.

RESULTS

No non-compliance noted

Mode	MPE	Output	Antenna	Power
	Distance	Power	Gain	Density
	(cm)	(dBm)	(dBi)	(mW/cm^2)
802.11a	20.0	17.59	6.23	0.05

802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

Mode	MPE	Output	Antenna	Power
	Distance	Power	Gain	Density
	(cm)	(dBm)	(dBi)	(mW/cm^2)
802.11n 40 MHz SISO	20.0	17.08	6.23	0.04

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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7.1.4. PEAK POWER SPECTRAL DENSITY

<u>LIMIT</u>

§15.407 (a) (1) For the band 5.15-5.25 GHz, 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.

§15.407 (a) (1) For the band 5.25-5.35 GHz, 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.

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.

THE ANTENNA GAIN:

5.15 – 5.25 GHz: 4.37dBi, limit = 4 dBm 5.25 – 5.35 GHz: 6.23dBi, limit = 10.77 dBm

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RESULTS

No non-compliance noted:

802.11a MODE

802.11a Mode

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	3.13	4.000	-0.87
Middle	5260	8.26	10.770	-2.51
High	5300	7.63	10.770	-3.14
High	5320	6.07	10.770	-4.70

802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

802.11n 40 MHz SISO MODE

802.11a Mode

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5190	-0.23	4.000	-4.23
Middle	5230	3.19	10.770	-7.58
High	5270	3.58	10.770	-7.19
High	5310	-0.50	10.770	-11.27

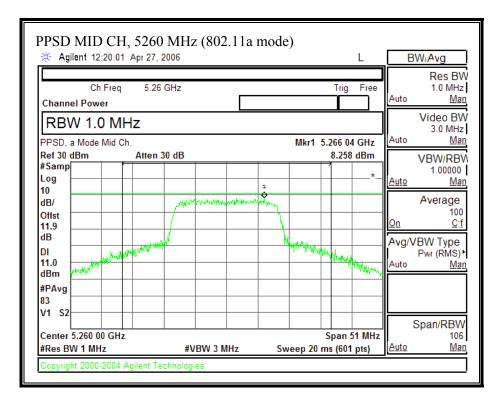
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802.11a MODE

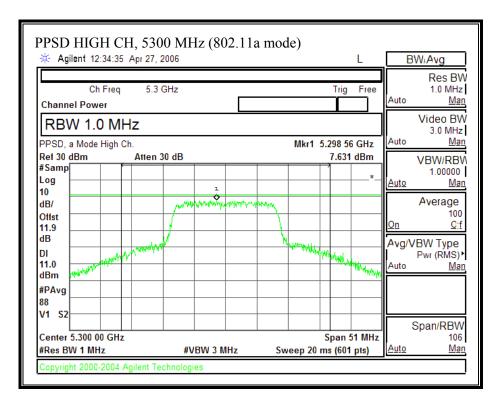
PEAK POWER SPECTRAL DENSITY (802.11a MODE)

PPSD LOW CH, :	5180 MHz (802.1) 1 27, 2006	l a mode) L	BW/Avg
Ch Freq Channel Power	5.18 GHz	Trig Free	Res BW 1.0 MHz Auto <u>Man</u>
PPSD, a Mode Low Ch.		Mkr1 5.177 50 GHz	Video BW 3.0 MHz Auto <u>Man</u>
Ref 30 dBm A #Samp Log 10	tten 30 dB	3.131 dBm	VBW/RBW 1.00000 <u>Auto Man</u>
dB/ Offst 11.9	1-		Average 100 <u>On <u>O</u>!f</u>
dB DI 4.0 dBm			Avg/VBW Type Pwr (RMS) • Auto <u>Man</u>
#PAvg 100 W1 S2			
Center 5.180 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span 30 MHz Sweep 20 ms (601 pts)	Span/RBW 106 <u>Auto Man</u>
Copyright 2000-2004 Agile	ent Technologies		

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🔆 Agilent 14:29:52 Apr 27	7, 2006				L	B	WiAvg
Ch Freq 5.3 Channel Power	32 GHz			Trig	Free	Auto	Res BV 1.0 MHz <u>Mar</u>
PPSD, a Mode High Ch.			Mkr1 5.	321 4	i GHz	Auto	Video BV 3.0 MHz <u>Mar</u>
Ref 30 dBm Atte #Samp	n 30 dB	1		6.070	dBm *_	<u>Auto</u>	VBW/RBV 1.00000 <u>Mar</u>
dB/ Offst 11.9	what we are a failed and the state of the		arainan 1			<u>On</u>	Average 100 <u>Cif</u>
dB DI 11.0 grad from the second secon				MW.	"myongod	Avg/∖ Auto	BW Type Pwr (RMS) Mar
#PAvg 51 V1 S2							
Center 5.320 00 GHz #Res BW 1 MHz	#VBW 3 MI	Hz Sv	veep 20 m		80 MHz pts)	Auto :	Span/RBW 106 <u>Mar</u>

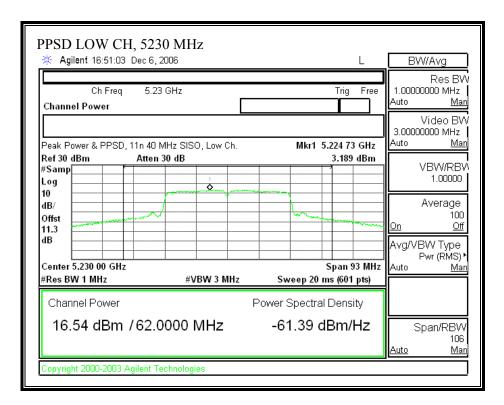
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802.11n 40 MHz SISO MODE

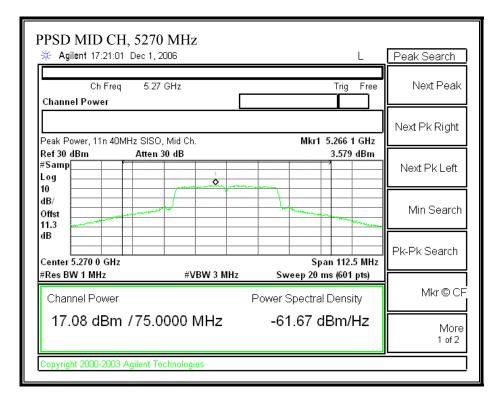
PEAK POWER SPECTRAL DENSITY (802.11n 40MHz SISO MODE)

🔆 Agilent 10:51:36 Dec 5,2	2006	L	BW/Avg
Ch Freq 5.19 Channel Power	GHz	Trig Free	Res B ¹ 1.00000000 MHz Auto <u>Ma</u>
Peak Power & PPSD, 11n 40N Ref 30 dBm Atten	•	Mkr1 5.185 50 GHz -0.233 dBm	Video B 3.00000000 MHz Auto <u>Ma</u>
¥Samp Atten Log III			VBW/RB 1.00000
dB/ / /			Average 100 0n 01
dB		Span 60 MHz	Avg/VBW Type Pwr (RMS) Auto <u>Ma</u>
≭Res BW 1 MHz	#VBW 3 MHz	Sweep 20 ms (601 pts)	
Channel Power	F	ower Spectral Density	
13.33 dBm /40.0	0000 MHz	-62.69 dBm/Hz	Span/RBV 100 <u>Auto Ma</u>

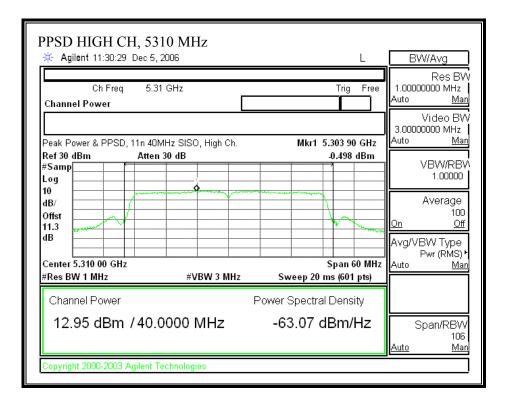
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7.1.5. PEAK EXCURSION

<u>LIMIT</u>

§15.407 (a) (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.

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 settings are used for the second PPSD trace.

RESULTS

No non-compliance noted:

802.11a MODE

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5180	7.76	13	-5.24
Middle	5260	9.21	13	-3.79
High	5300	11.25	13	-1.75
High	5320	8.05	13	-4.95

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802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

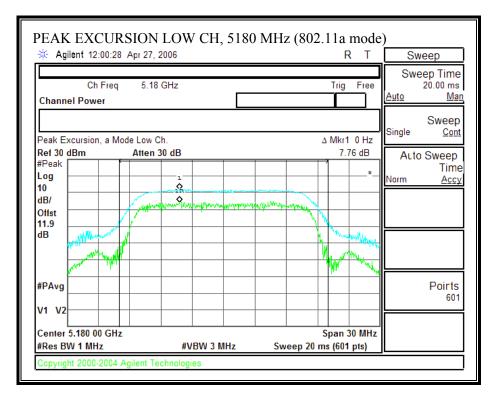
802.11n 40 MHz MODE

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5190	9.24	13	-3.76
Low	5230	10.72	13	-2.28
Middle	5270	11.70	13	-1.30
High	5310	9.82	13	-3.18

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802.11a MODE

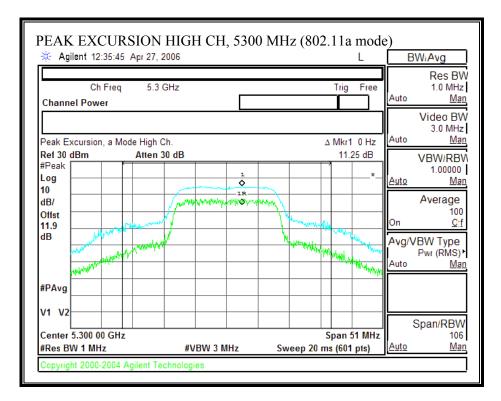
PEAK EXCURSION (802.11a MODE)



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Agilent 12:23:05 Apr 27,	2006		L	B۷	N/Avg
Ch Freq 5.26 Channel Power	6 GHz	Triç	g Free	Auto	Res BV 1.0 MHz <u>Ma</u>
VBW 3.0 MHz Peak Excursion, a Mode Mid (Ch.	Δ Mk	r1 0 Hz	Auto	Video BV 3.0 MHz <u>Ma</u>
#Peak	30 dB		.21 dB	Auto	VBW/RB 1.00000 <u>Ma</u>
10 dB/ Offst 11.9	IR MUN Strainmanhammanhamman Ingen Strainmanhamman	Martin J. Marine Martin		On	Average 100 <u>Oit</u>
dB		Margarithan Maria	Martin Comp		BW Type Pwr (RMS) <u>Ma</u>
#PAvg					
V1 V2				S	pan/RBW
Center 5.260 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span Sweep 20 ms (60	51 MHz	<u>Auto</u>	106 Ma

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🔆 Agilent 14:30:46 Apr 27,	2006		L	BW	hAvg
Ch Freq 5.32 Channel Power	GHz		Trig Free	Auto	Res B\ 1.0 MHz <u>Ma</u> Video B\
Peak Excursion, a Mode High (Ch	Δ	Mkr1 0 Hz	Auto	3.0 MHz <u>Ma</u>
Ref 30 dBm Atten #Peak Log			8.05 dB	۷ <u>Auto</u>	/BW/RB 1.00000 <u>M</u> a
Offst	y marting and a second	Manus and	<u>.</u>	/ On	Average 100 <u>0</u> 1
dB			Martin provide		W Type ^P wr (RMS) <u>Ma</u>
#PAvg					
V1 V2				St	oan/RBV
Center 5.320 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Sweep 20 m	pan 30 MHz s (601 pts)	Auto	106 Ma

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802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

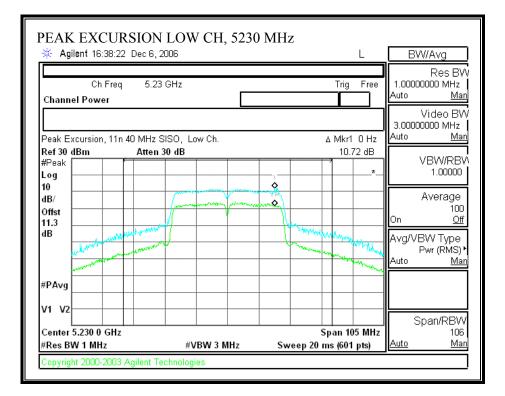
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802.11n 40 MHz SISO MODE

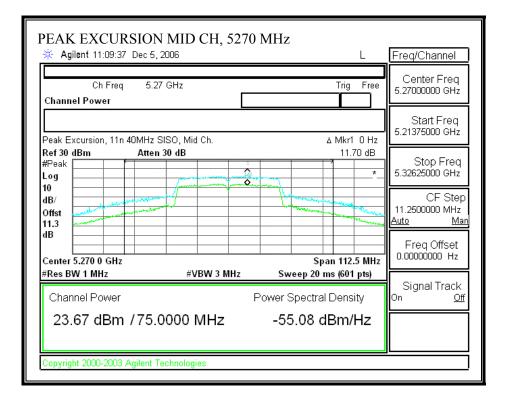
PEAK EXCURSION (802.11n 40MHz SISO MODE)

🌾 Agilent 10:53:43 Dec 5, 2	2006	L	BW/Avg
Ch Freq 5.19 Channel Power	GHz	Trig Free	Res B ¹ 1.00000000 MHz Auto <u>Ma</u>
Peak Excursion, 11n 40MHz S	•	∆ Mkr1 0 Hz	Video B\ 3.00000000 MHz Auto <u>Ma</u>
Ref 30 dBm Atten #Peak		9.24 dB	VBW/RB 1.00000
IB/ IB/ Dffst			Average 100 0n <u>01</u>
IB		Span 60 MHz	Avg/VBW Type Pwr (RMS) Auto <u>Ma</u>
⊄Res BW 1 MHz	#VBW 3 MHz	Sweep 20 ms (601 pts)	
Channel Power	I	Power Spectral Density	
19.65 dBm /40.0	000 MHz	-56.37 dBm/Hz	Span/RBV 106 Auto Ma

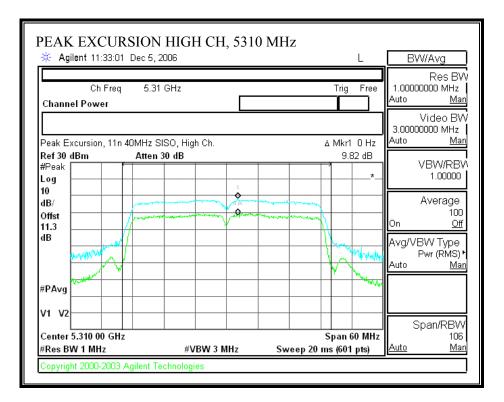
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7.1.6. CONDUCTED SPURIOUS EMISSIONS

<u>LIMITS</u>

§15.407 (b) (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.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are 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.

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.

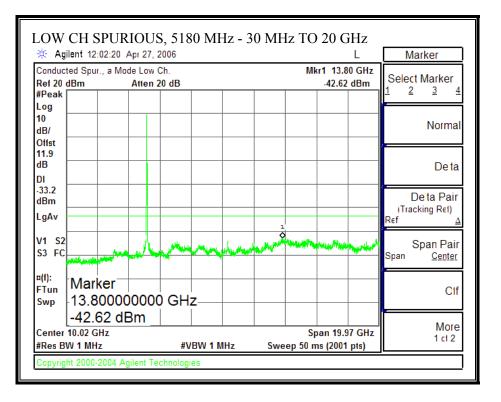
RESULTS

No non-compliance noted:

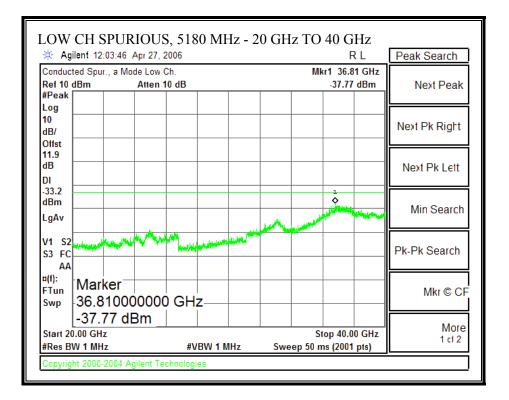
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802.11a MODE

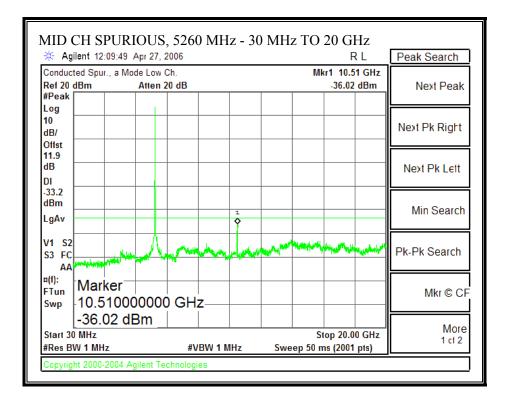
SPURIOUS EMISSIONS (802.11a MODE)



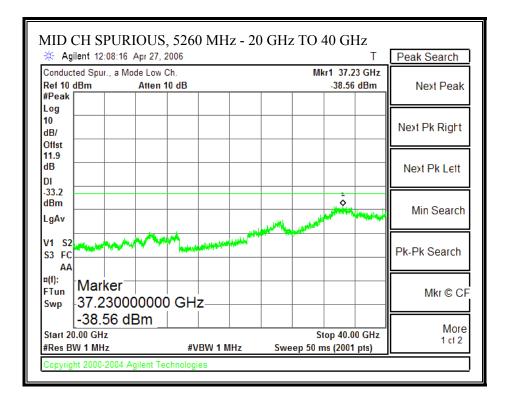
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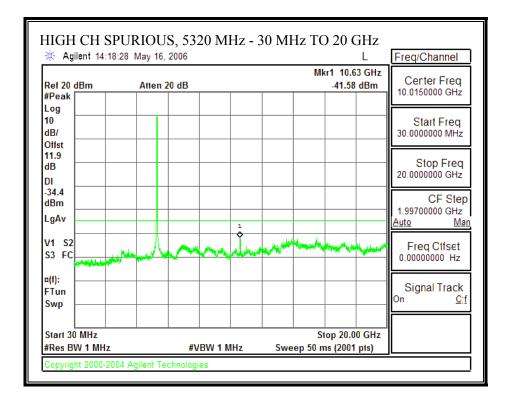
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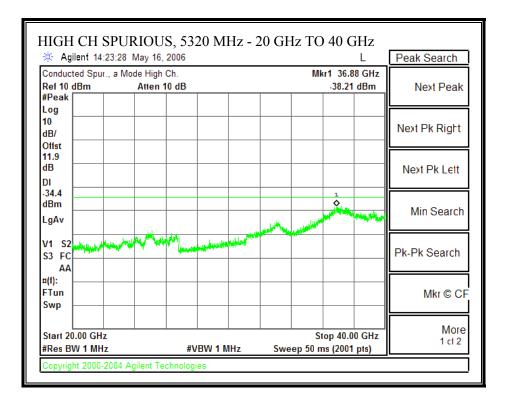
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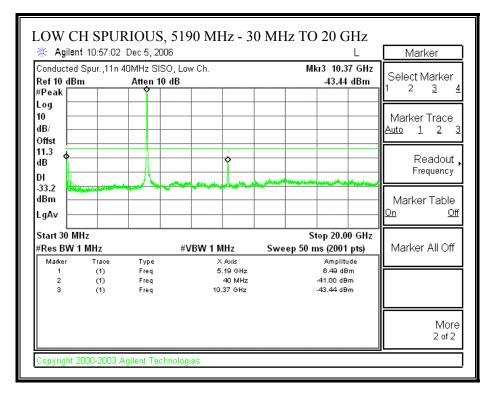
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802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

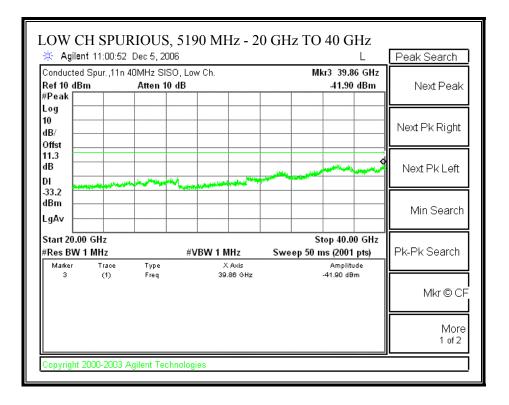
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802.11n 40 MHz SISO MODE

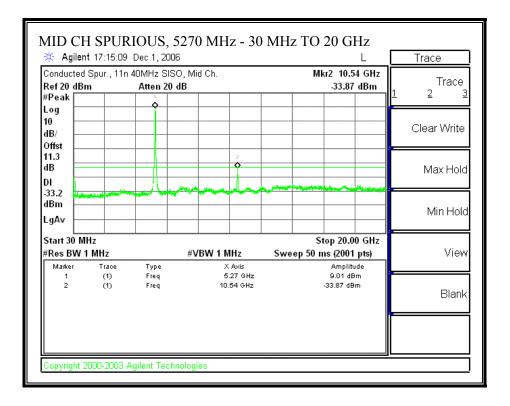
SPURIOUS EMISSIONS (802.11n 40MHz SISO MODE)



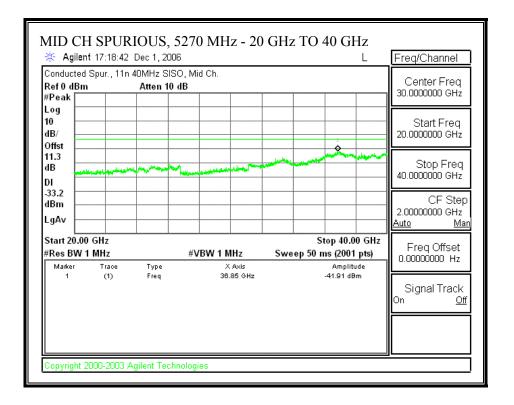
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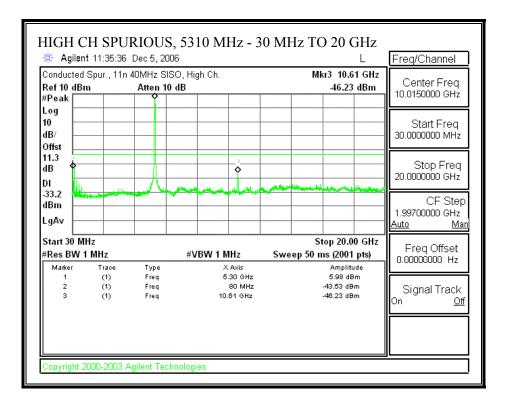
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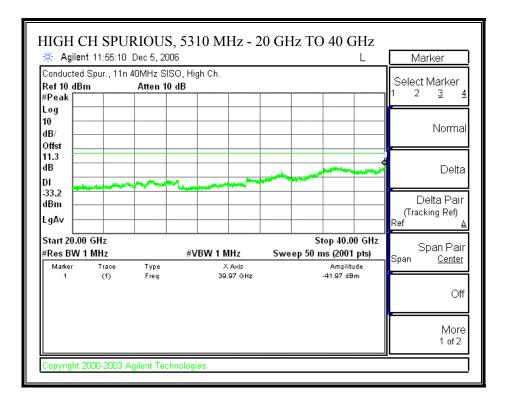
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MIMO MODE

7.2. CHANNEL TESTS FOR THE 5150 TO 5350 MHz BAND

7.2.1. EMISSION BANDWIDTH

<u>LIMIT</u>

§15.403 (i) <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.

TEST PROCEDURE

The transmitter output is connected to a 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:

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802.11a CDD MODE is covered by worst case 802.11n 20 MHz CDD MCS 0

802.11n 20 MHz CDD MCS 0

Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5180	19.255	12.845
Middle	5260	23.272	13.668
High	5320	37.726	15.766

802.11 - 20 MHz Tx BANDWIDTH - CHAIN 0

802.11 - 20 MHz Tx BANDWIDTH - CHAIN 1

Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5180	22.998	13.617
Middle	5260	23.834	13.772
High	5320	34.464	15.374

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802.11n 40 MHz CDD MCS 32

802.11 - 40 MHz Tx BANDWIDTH - CHAIN 0

Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5190	44.836	16.516
Middle	5270	76.184	18.819
High	5310	65.430	18.158

802.11 - 40 MHz Tx BANDWIDTH - CHAIN 1

Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5190	39.829	16.002
Middle	5270	74.998	18.750
High	5310	61.061	17.858

802.11n 40 MHz SDM MCS 15

802.11 - 40 MHz Tx BANDWIDTH - CHAIN 0

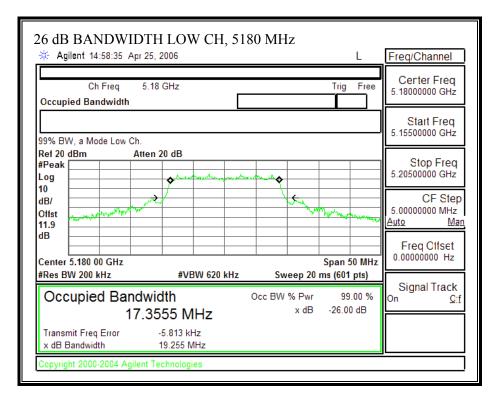
Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5190	42.020	16.235

802.11 - 40 MHz Tx BANDWIDTH - CHAIN 1

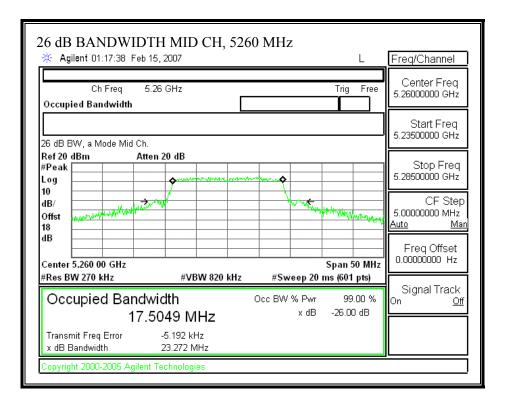
Channel	Frequency	В	10 Log B	
	(MHz)	(MHz)	(dB)	
Low	5190	39.804	15.999	

802.11n 20 MHz CDD MCS 0

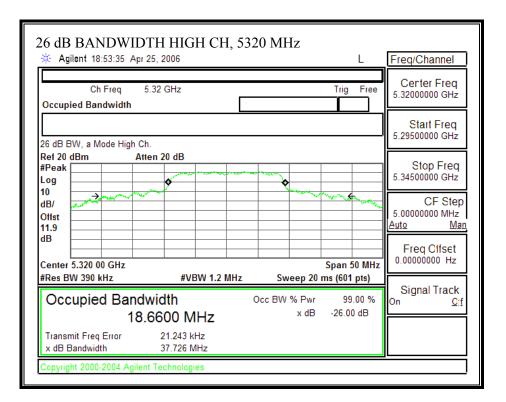
26 dB EMISSION BANDWIDTH (802.11 - 20 MHz TX BANDWIDTH- CHAIN 0)



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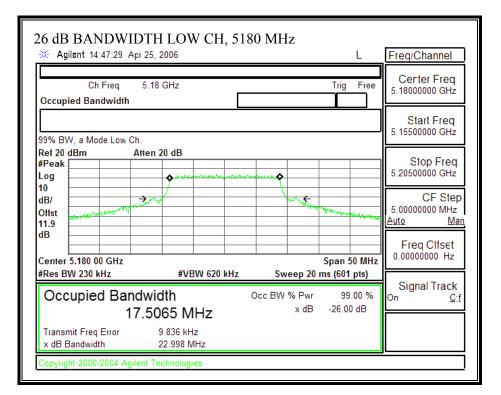


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26 dB EMISSION BANDWIDTH (802.11 - 20 MHz TX BANDWIDTH- CHAIN 1)



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26 dB BANDWIDTH	,	5260 MHz		L	Freq/Channel
Ch Freq 5.26 Occupied Bandwidth	GHz		Trig	Free	Center Freq 5.26000000 GHz
26 dB BW, a Mode Mid Ch.					Start Freq 5.23500000 GHz
Ref 20 dBm Atten 2 #Peak	A	Auropania antima			Stop Freq 5.28500000 GHz
dB/ Offst 18			and the second providence	Noncekiege	CF Step 5.0000000 MHz <u>Auto Man</u>
dB Center 5.260 00 GHz #Res BW 300 kHz	#VBW 910 ki	H7 #Swee	Span 5 sp 20 ms (601		Freq Offset 0.00000000 Hz
Occupied Bandwid		Occ BW %	•	00 %	Signal Track On <u>Off</u>
x dB Bandwidth	2.527 kHz 23.834 MHz				
Copyright 2000-2005 Agilent Te	chnologies				

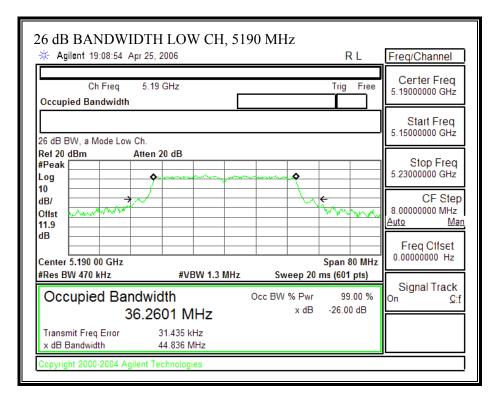
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26 dB BAND Agilent 18:57:34	WIDTH HIGH CH 4 Apr 25, 2006	I, 5320 MHz	RТ	Freq/Channel
Ch Freq Occupied Bandwic	•		Trig Free	Certer Freq 5.32000000 GHz
				Start Freq 5.29500000 GHz
dB/ Offst 11.9	High Ch. Atten 20 dB		Anne far an ann an	Stop Freq 5.34500000 GHz CF Step 5.00000000 MHz Auto Man
dB Center 5.320 00 GH #Res BW 360 kHz	Iz #VBW 1.1 I	MHz Sweep 20 r	Span 50 MHz ns (601 pts)	Freq Ctfset 0.00000000 Hz
Occupied B	andwidth 18.0666 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Signal Track On <u>Cif</u>
Transmit Freq Error x dB Bandwidth	r -20.914 kHz 34.464 MHz			
Copyright 2000-2004	Agilent Technologies			

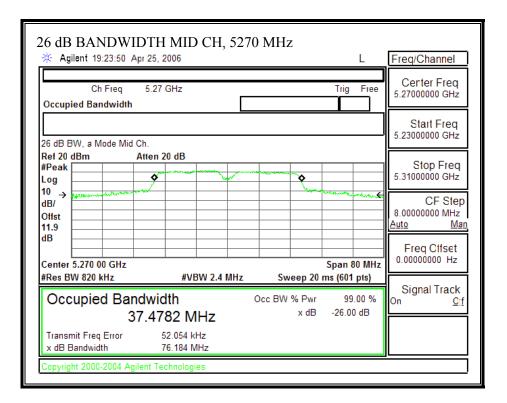
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802.11n 40 MHz CDD MCS 32

26 dB EMISSION BANDWIDTH (802.11 - 40 MHz TX BANDWIDTH- CHAIN 0)



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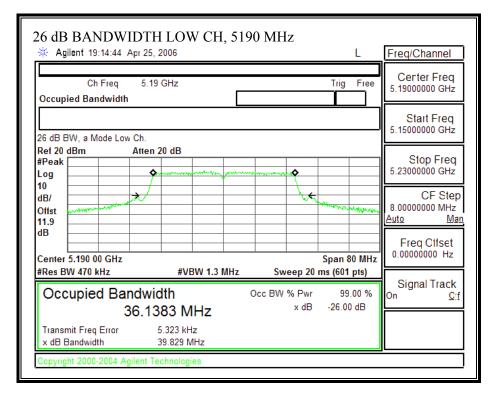


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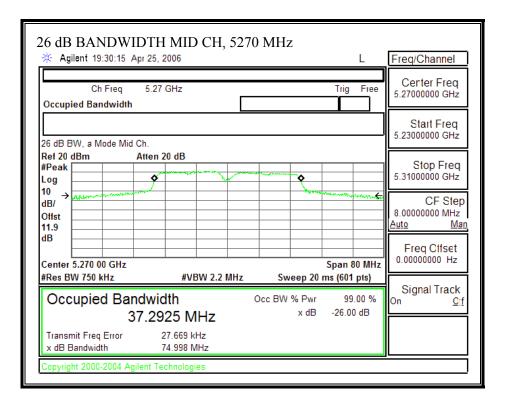
26 dB BANDWIDT	· · · · ·	310 MHz	L	Freq/Channel
Ch Freq 5.3 Occupied Bandwidth	1 GHz		Trig Free	Certer Freq 5.31000000 GHz
				Start Freq 5.27000000 GHz
#Peak Log 10 dB/ Offst 11.9	20 dB		~~~~ 	Stop Freq 5.35000000 GHz CF Step 8.00000000 MHz <u>Auto</u>
dB Center 5.310 00 GHz #Res BW 820 kHz	#VBW 2.4 MHz	Sweep 20	Span 80 MHz ms (601 pts)	Freq Otfset 0.00000000 Hz
Occupied Bandwidth Occ BW % Pwr 99.00 % On Q:f 37.1679 MHz x dB -26.00 dB Image: Constraint of the second secon				
Transmit Freq Error x dB Bandwidth	114.597 kHz 65.430 MHz			
Copyright 2000-2004 Agilent T	echnologies			

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26 dB EMISSION BANDWIDTH (802.11 - 40 MHz TX BANDWIDTH- CHAIN 1)



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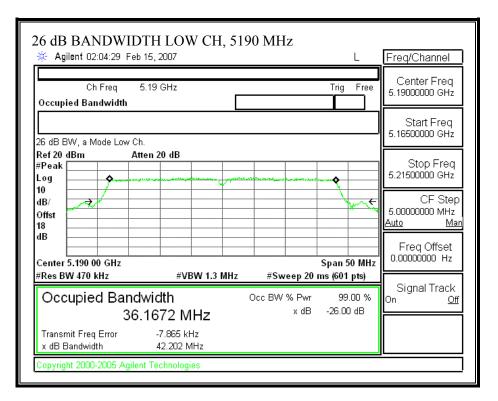
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26 dB BANDWID Agilent 19:52:27 Apr 2	· · · · ·	310 MHz	L	Freq/Channel
Ch Freq 5 Occupied Bandwidth	31 GHz		Trig Free	Certer Freq 5.31000000 GHz
26 dB BW, a Mode High Ch				Start Freq 5.27000000 GHz
Ref 20 dBm Atte #Peak	en 20 dB	********** *		Stop Freq 5.3500000 GHz
10 dB/ Offst 11.9 dB				CF Step 8.0000000 MHz <u>Auto Man</u>
Center 5.310 00 GHz #Res BW 680 kHz	#VBW 2 MHz	Sweep 20	Span 80 MHz ms (601 pts)	Freq Ctfset 0.00000000 Hz
Occupied Bandy 36.8	vidth 3989 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Signal Track ^{On <u>Q</u>:f}
Transmit Freq Error x dB Bandwidth	14.976 kHz 61.061 MHz			<u> </u>
Copyright 2000-2004 Agilent	Technologies			

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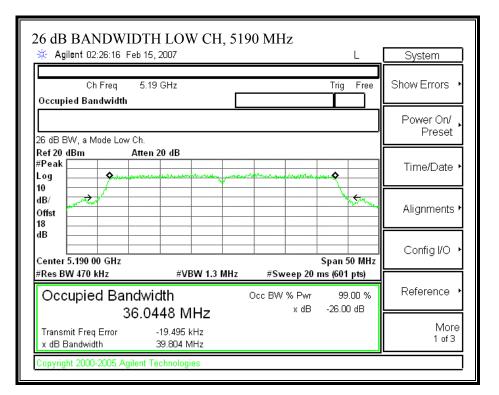
802.11n 40 MHz SDM MCS 15

26 dB EMISSION BANDWIDTH (802.11 - 40 MHz TX BANDWIDTH- CHAIN 0)



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26 dB EMISSION BANDWIDTH (802.11 - 40 MHz TX BANDWIDTH- CHAIN 1)



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7.2.2. PEAK POWER

<u>LIMIT</u>

§15.407 (a) (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 + 10 log B, where B is the 26-dB emission bandwidth in MHz. 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) (1) 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 + 10 log B, where B is the 26-dB emission bandwidth in MHz. 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.

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.

LIMITS AND RESULTS

The cable assembly insertion loss of 11.9 dB (including 10 dB pad and 1.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS,

Total peak power calculation formula: $10 \log (10^{(Pchain0 / 10) + 10^{(Pchain1 / 10))})$

Note: Pchain 0 and Pchain1 are in dBm

For combiner: Following formula to calculate the array gain:

Array gain = $10*\log(10^{(main gain/10)} + 10^{(aux gain/10)})$

5.15 – 5.25GHz band: 7.077dBi 5.25 – 5.35GHz band: 8.677dBi

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802.11n 20 MHz CDD MCS 0

7.077dBi for low band & 8.677dBi for high band

Limit in 5150 to 5250 MHz Band

Channel	Frequency	Fixed	В	В	4 + 10 Log B	Antenna	Limit
		Limit	Chain 0	Chain 1	Limit	Gain	
	(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5180	17	19.255	22.998	16.845	7.08	15.77

Limit in 5250 to 5350 MHz Band

Channel	Frequency	Fixed	В	В	11 + 10 Log B	Antenna	Limit
		Limit			Limit	Gain	
	(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
Mid	5260	24	23.272	23.834	24.668	8.68	21.32
High	5320	24	37.726	34.464	26.374	8.68	21.32

Results

Channel	Frequency	Power	Power	Total	Limit	Margin
	(MHz)	Chain 0	Chain 1	Power	(dBm)	(dB)
		(dBm)	(dBm)	(dBm)		
Low	5180	9.11	9.34	12.24	15.77	-3.53
Mid	5260	14.51	14.65	17.59	21.32	-3.73
High	5320	13.07	13.04	16.07	21.32	-5.26

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<u>6dBi Antenna</u>

Note: The high channel utilizes the same power level for all antennas, high channel power data in table below is from 8.677 dBi data.

Limit in 5150 to 5250 MHz Band

Channel	Frequency	Fixed	В	B 4 + 10 Log B		Antenna	Limit
		Limit	Chain 0	Chain 1	Chain 1 Limit		
	(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5180	17	19.255	22.998	16.845	6.00	16.85

Limit in 5250 to 5350 MHz Band

Channel	Frequency	Fixed	В	В	11 + 10 Log B	Antenna	Limit
		Limit			Limit	Gain	
	(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
Mid	5260	24	23.272	23.834	24.668	6.00	24.00
High	5320	24	37.726	34.464	26.374	6.00	24.00

Results

Channel	Frequency (MHz)	Power Chain 0 (dBm)	Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	10.09	10.20	13.16	16.85	-3.69
Mid	5260	17.22	17.34	20.29	24.00	-3.71
High	5320	13.07	13.04	16.07	24.00	-7.93

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802.11n 40 MHz CDD MCS 32

7.077dBi for low band & 8.677dBi for high band

Limit in 5150 to 5250 MHz Band

	Channel	Frequency	Fixed	В	В	4 + 10 Log B	Antenna	Limit
			Limit	Chain 0	Chain 1 Limit		Gain	
		(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
ſ	Low	5190	17	44.836	39.829	20.002	7.08	15.92

Limit in 5250 to 5350 MHz Band

Channel	Frequency	Fixed	В	В	11 + 10 Log B	Antenna	Limit
		Limit	Chain 0	Chain 1	Limit	Gain	
	(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
Mid	5270	24	76.184	74.998	29.750	8.67	21.33
High	5310	24	65.430	61.061	28.858	8.67	21.33

Results

Channel	Frequency (MHz)	Power Chain 0 (dBm)	Power Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	11.59	12.19	14.91	15.92	-1.01
Mid	5270	15.53	15.83	18.69	21.33	-2.64
High	5310	12.17	12.12	15.16	21.33	-6.18

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<u>6Bi Antenna</u>

Note: The mid and high channels utilize the same power level for all antennas, mid and high channel power data in table below is from 8.677 dBi data.

Limit in 5150 to 5250 MHz Band

Channel	Frequency	Fixed	В	В	4 + 10 Log B	Antenna	Limit
		Limit	Chain 0	Chain 1	Limit	Gain	
	(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5190	17	44.836	39.829	20.002	6.00	17.00

Limit in 5250 to 5350 MHz Band

Channel	Frequency	Fixed	В	В	11 + 10 Log B	Antenna	Limit
		Limit	Chain 0	Chain 1	Limit	Gain	
	(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
Mid	5270	24	76.184	74.998	29.750	6.00	24.00
High	5310	24	65.430	61.061	28.858	6.00	24.00

Results

Channel	Frequency	Power	Power	Total	Limit	Margin
	(MHz)	Chain 0	Chain 1	Power	(dBm)	(dB)
		(dBm)	(dBm)	(dBm)		
Low	5190	12.37	12.36	15.38	17.00	-1.62
Mid	5270	15.53	15.83	18.69	24.00	-5.31
High	5310	12.17	12.12	15.16	24.00	-8.84

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802.11n 40 MHz SDM

LIMITS AND RESULTS FOR EIRP:

Limit in 5150 to 5250 MHz Band

Channel	Frequency	Fixed	В	B 4 + 10 Log B		Antenna	Limit
		Limit	Chain 0	Chain 1	Limit	Gain	
	(MHz)	(dBm)	(MHz)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5190	17	42.202	39.804	19.999	4.37	17.00

Results

Channel	Frequency	Power	Power	Total	Limit	Margin
	(MHz)	Chain 0	Chain 1	Power	(dBm)	(dB)
		(dBm)	(dBm)	(dBm)		
Low	5190	12.56	12.59	15.59	17.00	-1.41

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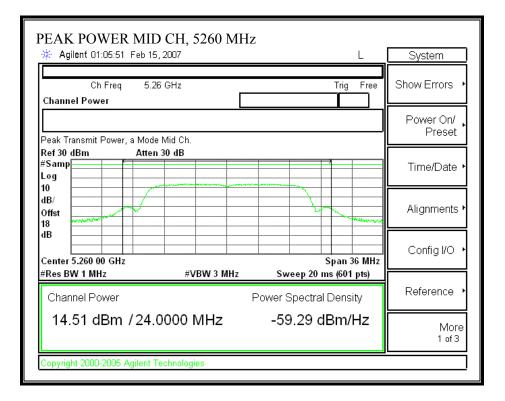
802.11n 20 MHz CDD MCS 0

8.677dBi Antenna

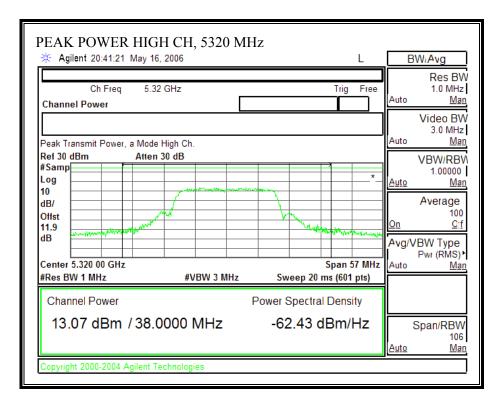
PEAK POWER (802.11 - 20MHz TX BANDWIDTH - CHAIN 0)

PEAK POWER LOW CH, 5180 MHz * Agilent 17:27:36 Jun 26, 2006 R L	Peak Search
Ch Freq 5.18 GHz Trig Free	Next Peak
Mkr1 5.175 05 GHz	Next Pk Right
Ref 14.5 dBm Atten 20 dB -0.891 dBm #Samp	Next Pk Lett
dB/ Offst	Min Search
dB Center 5.180 00 GHz Span 30 MHz	Pk-Pk Search
#Res BW 1 MHz #VBW 3 MHz Sweep 20 ms (601 pts) Channel Power Power Spectral Density	Mkr © CF
9.11 dBm / 20.0000 MHz -63.90 dBm/Hz	More 1 ct 2
Copyright 2000-2003 Agilent Technologies	

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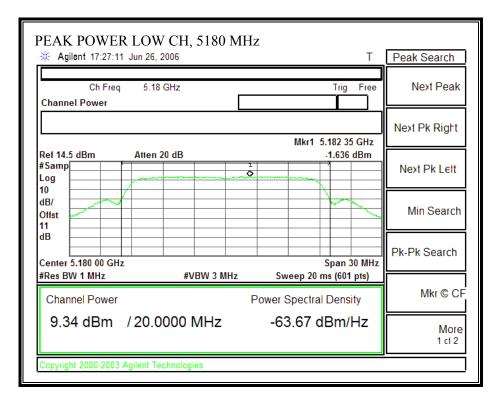


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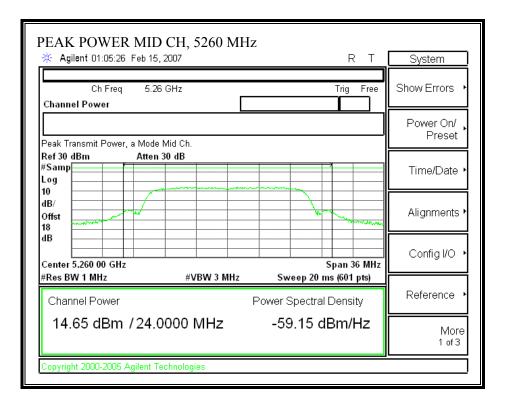


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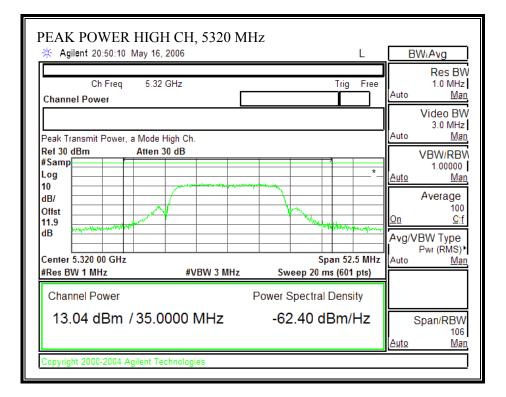
PEAK POWER (802.11 – 20MHz TX BANDWIDTH – CHAIN 1)



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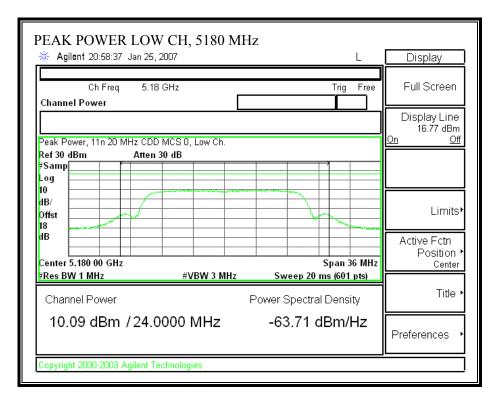
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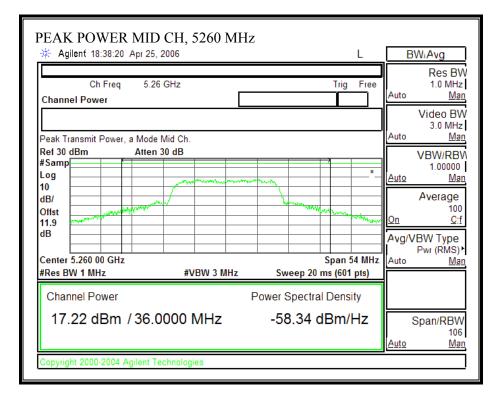
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6dBi Antenna

PEAK POWER (802.11 - 20MHz TX BANDWIDTH - CHAIN 0)

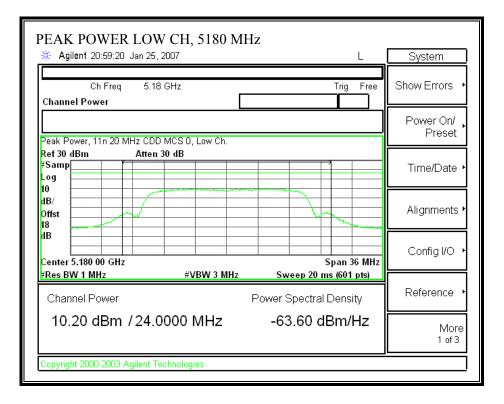


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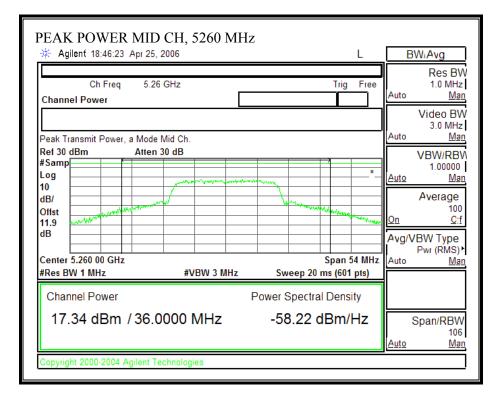


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PEAK POWER (802.11 – 20MHz TX BANDWIDTH – CHAIN 1)



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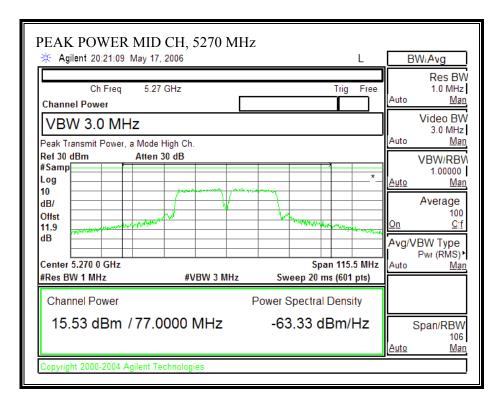
802.11n 40 MHz CDD MCS 32

8.677dBi antenna

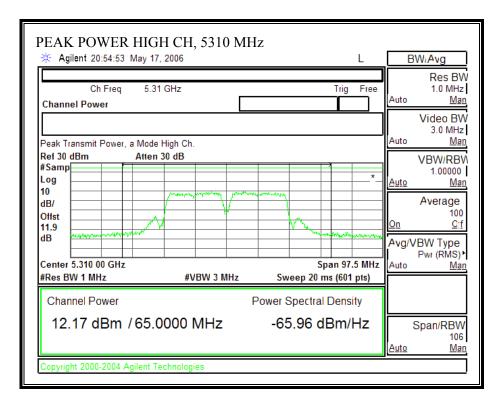
PEAK POWER (802.11 - 40MHz TX BANDWIDTH - CHAIN 0)

PEAK POWER LOV Agilent 17:48:57 Jun 26,		T	Peak Search
Ch Freq 5.1 Channel Power) GHz	Trig Free	Next Peak
		Mkr1 5.185 16 GHz	Next Pk Right
#Samp	20 dB	-0.880 dBm	Next Pk Lett
10 dB/ Offst 11			Min Search
dB Center 5.190 00 GHz		Span 67.5 MHz	Pk-Pk Search
#Res BW 1 MHz Channel Power	#VBW 3 MHz	Sweep 20 ms (601 pts) Power Spectral Density	Mkr © CF
11.59 dBm / 45.0	0000 MHz	-64.94 dBm/Hz	More 1 ct 2
Copyright 2000-2003 Agilent T	echnologies		

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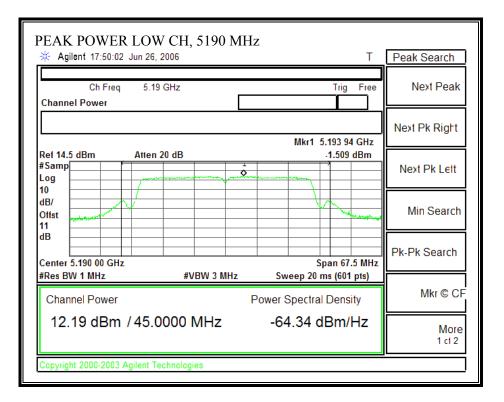


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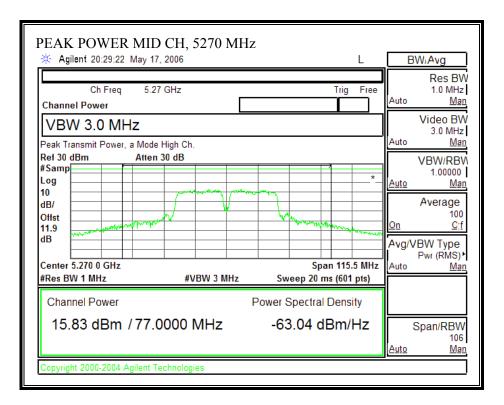


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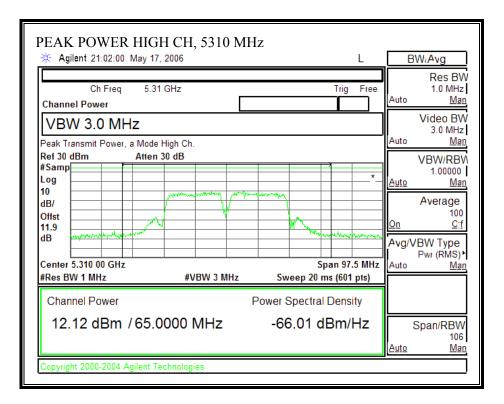
PEAK POWER (802.11 – 40MHz TX BANDWIDTH – CHAIN 1)



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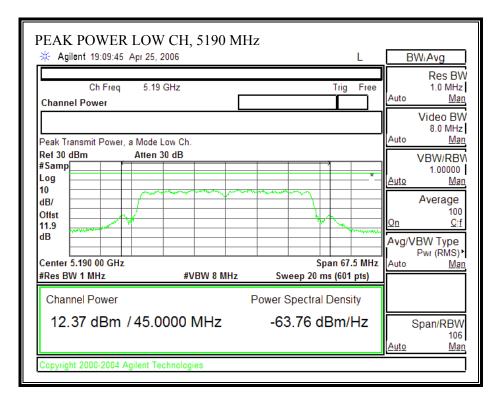
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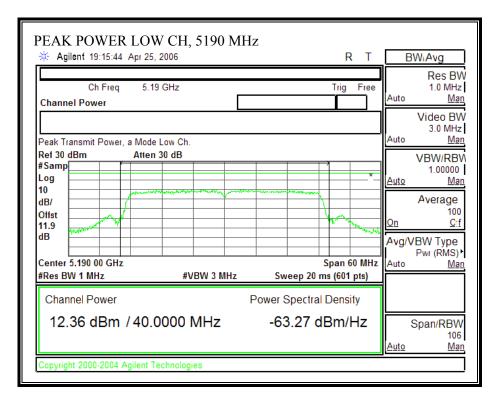
<u>6dBi antenna</u>

PEAK POWER (802.11 - 40MHz TX BANDWIDTH - CHAIN 0)



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PEAK POWER (802.11 – 40MHz TX BANDWIDTH – CHAIN 1)



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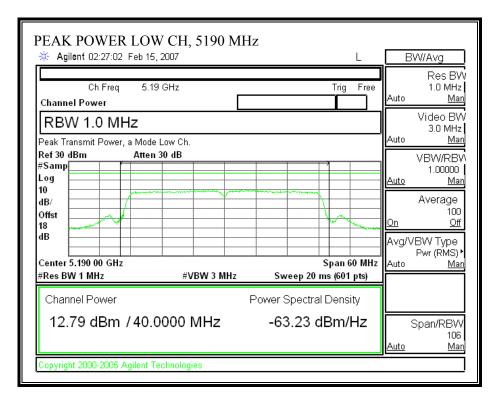
802.11n 40 MHz SDM MCS 15

PEAK POWER (802.11 - 40MHz TX BANDWIDTH - CHAIN 0)

PEAK POWER LOW		Z	
🔆 Agilent 02:06:21 Feb 15,	2007	L	BW/Avg
Ch Freq 5.19 Channel Power	GHz	Trig Free	Res BW 1.0 MHz Auto <u>Man</u>
RBW 1.0 MHz			Video BVV 3.0 MHz Auto Man
Peak Transmit Power, a Mode Ref 30 dBm Atten #Samp Log 10 dB/ Offst 18 dB Center 5.190 00 GHz #Res BW 1 MHz		Span 67.5 MHz Sweep 20 ms (601 pts)	VBW/RBW 1.00000 <u>Auto Man</u> Average 100 <u>On Off</u> Avg/VBW Type Pwr (RMS) •
Channel Power 12.73 dBm /45.0		Power Spectral Density -63.81 dBm/Hz	Span/RBW 106 <u>Auto Man</u>
Copyright 2000-2005 Agilent Te	chnologies		

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PEAK POWER (802.11 – 40MHz TX BANDWIDTH – CHAIN 1)



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7.2.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

\$1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	strength strength		Averaging time (minutes)
(A) Lim	its for Occupational	l/Controlled Exposu	res	
0.3–3.0 3.0–30 30–300 300–1500 1500–100,000	614 1842/f 61.4	1.63 4.89/f 0.163	*(100) *(900/f²) 1.0 f/300 5	6 6 6 6
(B) Limits	for General Populati	on/Uncontrolled Exp	posure	
0.3–1.34 1.34–30	614 824/f	1.63 2.19/f	*(100) *(180/f ²)	30 30

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)-Continued

Frequency range (MHz) Electric field strength (V/m)		Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
30–300 300–1500 1500–100,000	27.5	0.073	0.2 f/1500 1.0	30 30 30

f = frequency in MHz
 * = Plane-wave equivalent power density NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occu-pational/controlled limits apply provided he or she is made aware of the potential for exposure. NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be ex-posed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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CALCULATIONS

Given

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

and

 $S = E^{2} / 3770$

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 Power to mW and Distance to cm, using:

P(mW) = P(W) / 1000 and d(cm) = 100 * d(m)yields $d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$ $d = 0.282 * \sqrt{(P * G / S)}$ where d = distance in cmP = Power in mWG = Numeric antenna gain $S = Power Density in mW/cm^2$ Substituting the logarithmic form of power and gain using: $P(mW) = 10^{(H)} (P(dBm) / 10)$ and $G (numeric) = 10^{(G(dBi) / 10)}$ yields $d = 0.282 * 10^{(P+G)} / 20) / \sqrt{S}$ where d = MPE distance in cm P = Power in dBmG = Antenna Gain in dBi

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{(P+G)} / 10) / (d^2)$$

S = Power Density Limit in mW/cm^2

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LIMITS

From 1.1310 Table 1 (B), S = 1.0 mW/cm² in the 5.2 / 5.3 GHz band.

RESULTS

No non-compliance noted.

Note: The MPE calculations below use the highest power and where applicable, the highest array gain, both of which are in the 5250 - 5350 MHz band, as a worst-case representation that also covers the 5150 - 5250 MHz band.

802.11a CDD MODE is covered by worst case 802.11n 20 MHz CDD.

802.11n 20 MHz CDD

8.677dBi Antenna

Mode	MPE	Total	Antenna	Power
	Distance	Power	Gain	Density
	(cm)	(dBm)	(dBi)	(mW/cm^2)
802.11n 20 MHz CDD	20.0	17.59	8.68	0.08

6dBi Antenna

Mode	MPE	Total	Antenna	Power
	Distance	Power	Gain	Density
	(cm)	(dBm)	(dBi)	(mW/cm^2)
802.11n 20 MHz CDD	20.0	20.29	6.00	0.08

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802.11n 40MHz CDD

8.677dBi Antenna

Mode	MPE	MPE Total A		Power	
	Distance	Power	Gain	Density	
	(cm)	(dBm)	(dBi)	(mW/cm^2)	
802.11n 40 MHz CDD	20.0	18.69	8.68	0.11	

6dBi Antenna

Mode	MPE	Total	Antenna	Power
	Distance	Power	Gain	Density
	(cm)	(dBm)	(dBi)	(mW/cm^2)
802.11n 40 MHz CDD	20.0	18.69	6.00	0.06

802.11n 40 MHz SDM

5.02 dBi Antenna

Mode	MPE	Total	Antenna	Power
	Distance	Power	Gain	Density
	(cm)	(dBm)	(dBi)	(mW/cm^2)
802.11n 40 MHz SDM	20.0	18.69	5.02	0.05

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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7.2.4. PEAK POWER SPECTRAL DENSITY

<u>LIMIT</u>

§15.407 (a) (1) For the band 5.15-5.25 GHz, 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.

§15.407 (a) (1) For the band 5.25-5.35 GHz, 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.

The maximum antenna gain > 6dBi for CDD modes, therefore there is a reduction due to antenna gain.

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.

For combiner: Following formula to calculate the array gain:

Array gain = $10*\log(10^{\circ} (\text{main gain}/10) + 10^{\circ} (\text{aux gain}/10))$

5.15 – 5.25GHz band: 7.077dBi, limit = 2.92 dBm 5.25 – 5.35GHz band: 8.677dBi, limit = 8.32 dBm

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802.11a CDD is covered by worst case 802.11n 20 MHz CDD MCS 0

Channel	Frequency	PPSD	PPSD	PPSD Total	Limit	Margin
		Chain 0	Chain 1			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	-0.89	-1.64	1.76	2.92	-1.16
Middle	5260	4.05	4.24	7.16	8.32	-1.17
High	5320	3.66	2.49	6.13	8.32	-2.19

802.11n 20 MHz CDD MCS 0 (7.077dBi antenna for low band & 8.677dBi antenna for hi band)

802.11n 20 MHz CDD MCS 0 (6dBi antenna)

Channel	Frequency	PPSD	PPSD	PPSD Total	Limit	Margin
		Chain 0	Chain 1			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Middle	5260	7.79	7.34	10.58	11.00	-0.42

Low & high channels meet the limit of high antenna gain

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802.11n 40 MHz CDD MCS 0

Channel	Frequency	PPSD	PPSD	PPSD Total	Limit	Margin
		Chain 0	Chain 1			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5190	-0.88	-1.51	1.83	2.92	-1.10
Middle	5270	3.08	2.73	5.92	8.32	-2.41
High	5310	-0.85	-0.94	2.12	8.32	-6.20

802.11n 40 MHz SDM MCS 15

Channel	Frequency	PPSD	PPSD	PPSD Total	Limit	Margin
		Chain 0	Chain 1			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5190	-0.69	-0.81	2.26	4.00	-1.74

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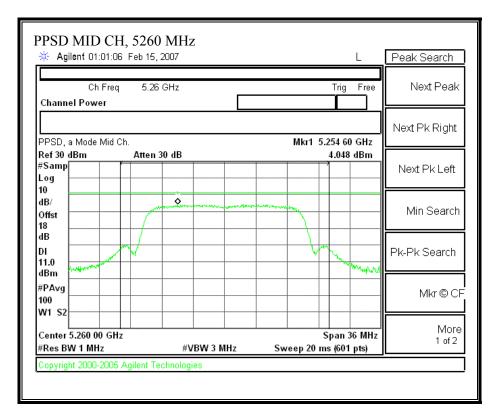
802.11n 20 MHz CDD MCS 0

PEAK POWER SPECTRAL DENSITY (802.11 - 20 MHz TX BANDWIDTH - CHAIN 0)

PPSD LOW CH, 518			
🔆 Agilent 17:27:36 Jun 26,	2006	RL	Peak Search
Ch Freq 5.18 Channel Power	GHz	Trig Free	Next Peak
		Mkr1 5.175 05 GHz	Next Pk Right
Ref 14.5 dBm Atten #Samp Log	20 dB	-0.891 dBm	Next Pk Lett
10 dB/ Offst			Min Search
dB		Span 30 MHz	Pk-Pk Search
#Res BW 1 MHz	#VBW 3 MHz	Sweep 20 ms (601 pts)	<u> </u>
Channel Power	Mkr © CF		
9.11 dBm /20.0	More 1 ct 2		
Copyright 2000-2003 Agilent Te	echnologies		IL

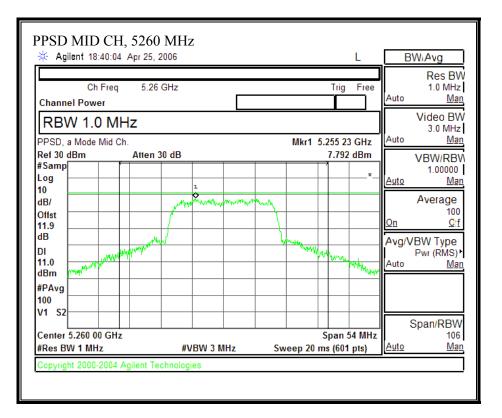
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8.677dBi Antenna Gain

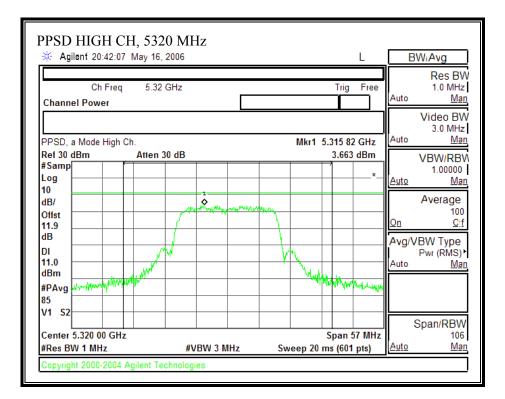


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6dBi Antenna

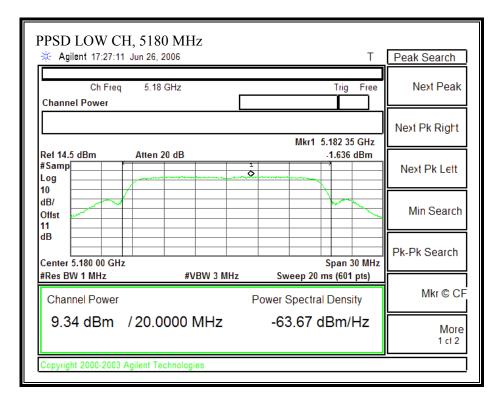


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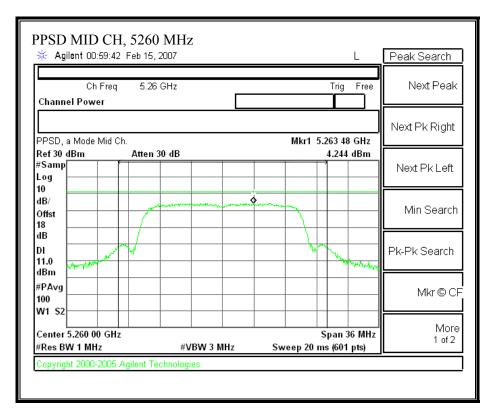
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PEAK POWER SPECTRAL DENSITY (802.11 - 20 MHz TX BANDWIDTH - CHAIN 1)



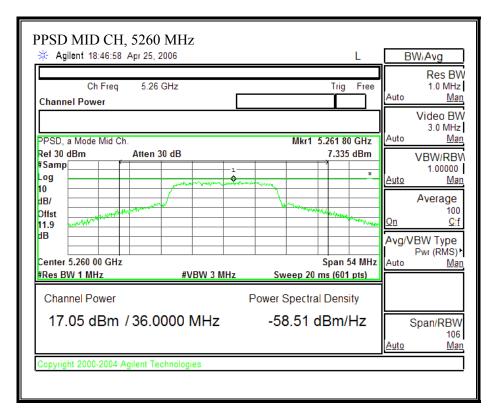
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8.677dBi Antenna

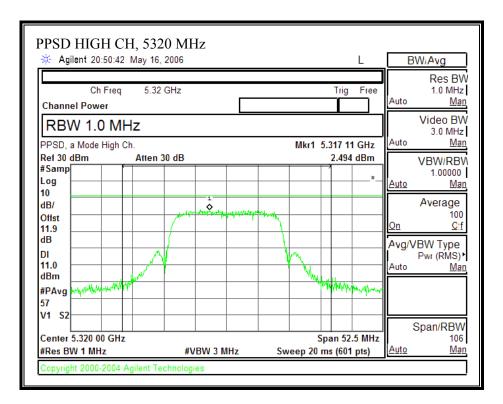


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6dBi Antenna



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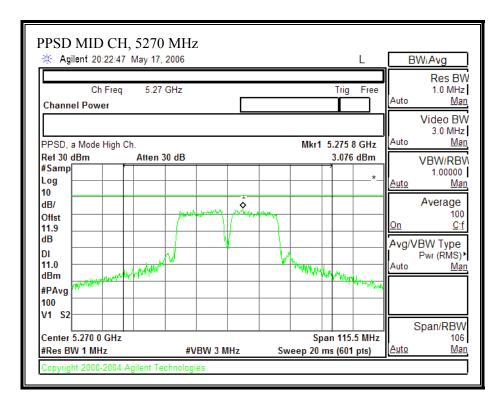
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802.11n 40 MHz CDD MCS 32

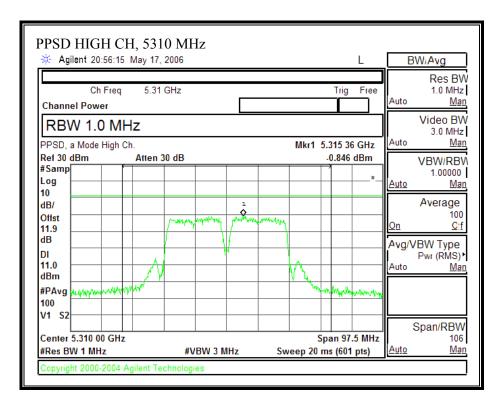
PEAK POWER SPECTRAL DENSITY (802.11 - 40 MHz TX BANDWIDTH - CHAIN 0)

PPSD LOW CH, 519		_	
🔆 Agilent 17:48:57 Jun 26,	2006	T	Peak Search
Ch Freq 5.19 Channel Power	GHz	Trig Free	Next Peak
		I I	Next Pk Right
		Mkr1 5.185 16 GHz	
Ref 14.5 dBm Atten #Samp Log	20 dB	-0.880 dBm	Next Pk Lett
10 dB/ Offst			Min Search
11 dB			
Center 5.190 00 GHz #Res BW 1 MHz	Pk-Pk Search		
Channel Power	Mkr © CF		
11.59 dBm / 45.0	More 1 ci 2		
Copyright 2000-2003 Agilent Technologies			

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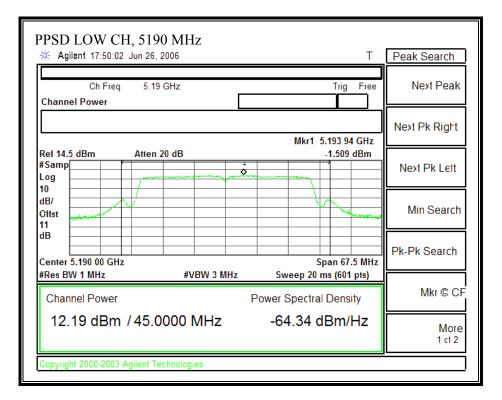


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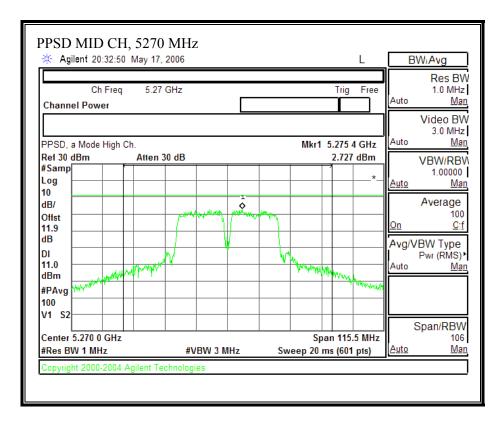


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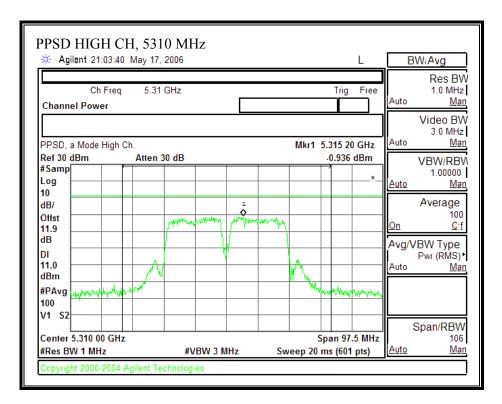
PEAK POWER SPECTRAL DENSITY (802.11 - 40 MHz TX BANDWIDTH - CHAIN 1)



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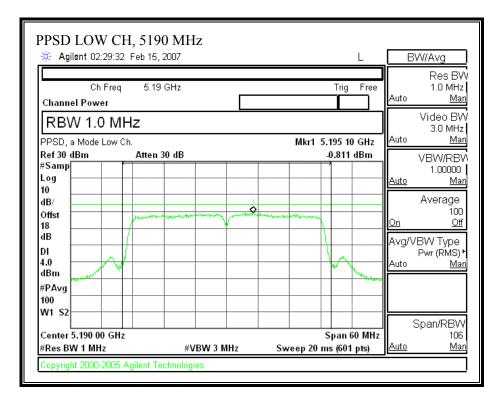
802.11n 40 MHz SDM MCS 15

PEAK POWER SPECTRAL DENSITY (802.11 - 40 MHz TX BANDWIDTH - CHAIN 0)

PPSD LOW CH, 5190 MHz		
Agilent 02:09:57 Feb 15, 2007		eak Search
Ch Freq 5.19 GHz Channel Power	Trig Free	Next Peak
PPSD, a Mode Low Ch.	Mkr1 5.184 94 GHz	ext Pk Right
Ref 30 dBm Atten 30 dB #Samp	-0.694 dBm	Next Pk Left
dB/ 0ffst 18		Min Search
dB	Span 67.5 MHz	-Pk Search
#Res BW 1 MHz #VBW 8 MHz Channel Power	Sweep 20 ms (601 pts) Power Spectral Density	Mkr © CF
/45.0000 MHz		More 1 of 2
Copyright 2000-2005 Agilent Technologies		

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PEAK POWER SPECTRAL DENSITY (802.11 - 40 MHz TX BANDWIDTH - CHAIN 1)



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7.2.5. PEAK EXCURSION

<u>LIMIT</u>

§15.407 (a) (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.

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 settings are used for the second PPSD trace.

RESULTS

No non-compliance noted:

802.11a CDD is covered by worst case 802.11n 20 MHz CDD MCS 0 MODE

802.11n 20 MHz CDD MCS 0

20 MHz TX BANDWIDTH - CHAIN 0

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	Chain 0 (dB)	(dB)	(dB)
Low	5180	8.60	13	-4.40
Middle	5260	8.31	13	-4.69
High	5320	9.14	13	-3.86

20 MHz TX BANDWIDTH - CHAIN 1

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	Chain 1 (dB)	(dB)	(dB)
Low	5180	10.72	13	-2.28
Middle	5260	8.01	13	-4.99
High	5320	11.25	13	-1.75

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802.11n 40 MHz CDD MCS 32

40 MHz TX BANDWIDTH - CHAIN 0

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	Chain 0 (dB)	(dB)	(dB)
Low	5190	11.18	13	-1.82
Middle	5270	9.57	13	-3.43
High	5310	9.23	13	-3.77

40 MHz TX BANDWIDTH - CHAIN 1

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	Chain 1 (dB)	(dB)	(dB)
Low	5190	10.34	13	-2.66
Middle	5270	11.72	13	-1.28
High	5310	9.60	13	-3.40

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802.11n 40 MHz SDM MCS15

40 MHz TX BANDWIDTH - CHAIN 0

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	Chain 0 (dB)	(dB)	(dB)
Low	5190	12.03	13	-0.97

40 MHz TX BANDWIDTH - CHAIN 1

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	Chain 1 (dB)	(dB)	(dB)
Low	5190	12.18	13	-0.82

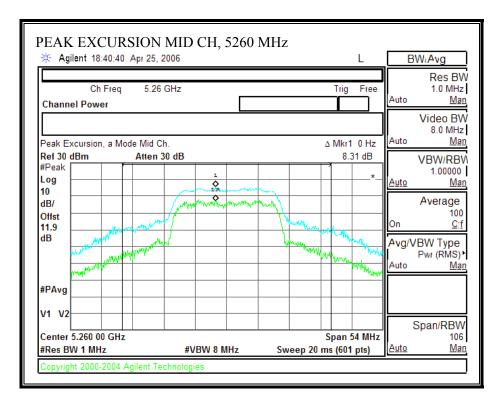
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802.11n 20 MHz CDD MCS 0

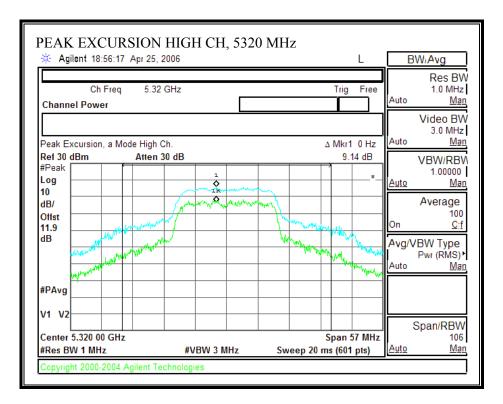
PEAK EXCURSION (802.11 - 20 MHz TX BANDWIDTH - CHAIN 0)



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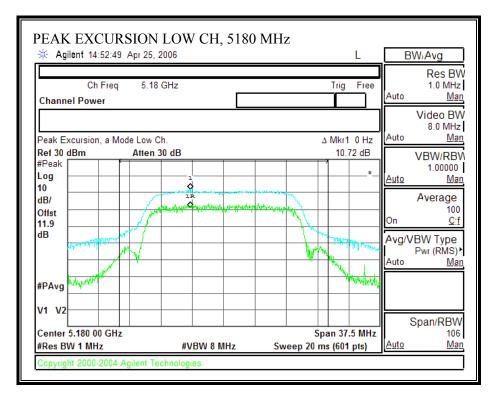


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PEAK EXCURSION (802.11 - 20 MHz TX BANDWIDTH - CHAIN 1)



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🔆 Agilent 18:47:52 Apr 25, 3	2006				L	B	WiAvg
Ch Freq 5.26 Channel Power	GHz			Trig	Free	Auto	Res B\ 1.0 MHz <u>Ma</u>
Peak Excursion, a Mode Mid C	h.		Δ	Mkr1	0 Hz	Auto	Video BV 8.0 MHz <u>Ma</u>
Ref 30 dBm Atten 3 #Peak Log 10	1 1			8.0	1 dB	<u>Auto</u>	VBW/RB 1.00000 <u>Ma</u>
dB/ Offst		(menous and	Million and a marked			On	Average 100 <u>Ot</u>
11.9 dB	W		1 minutes	1111111-111 1-11111-111	Martin and	Avg/V Auto	BW Type Pwr (RMS) Ma
#PAvg					109 1 00		
V1 V2							Span/RBW
Center 5.260 00 GHz #Res BW 1 MHz	#VBW 8 N	IHz Sv	S veep 20 m		4 MHz pts)	Auto	106 <u>Ma</u>

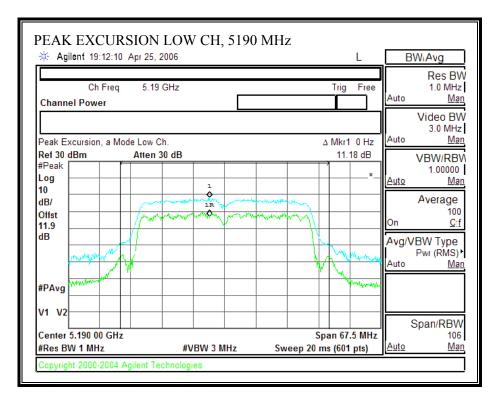
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PEAK EXCURSION	· · ·) MHZ	L	В	WiAvg
Ch Freq 5.32 (Channel Power	GHz		Trig Free	Auto	Res BV 1.0 MHz <u>Mar</u>
VBW 3.0 MHz Peak Excursion, a Mode High C	h.	Δ	Mkr1 0 Hz	Auto	Video BW 3.0 MHz <u>Mar</u>
Ref 30 dBm Atten 3 #Peak Log	0 dB		11.25 dB	Auto	VBW/RBV 1.00000 <u>Mar</u>
10 dB/ Offst 11.9	Martin Contraction (1)	Marken and Construction		On	Average 100 <u>Cif</u>
11.9 dB	/	N. I.	Martin Martin Martin		/BW Type Pwr (RMS)
#PAvg			- Andrews	Auto	Mar
V1 V2					Span/RBW
Center 5.320 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Spa Sweep 20 m	an 52.5 MHz s (601 pts)	<u>Auto</u>	106 <u>Mar</u>

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802.11n 40 MHz CDD MCS 32

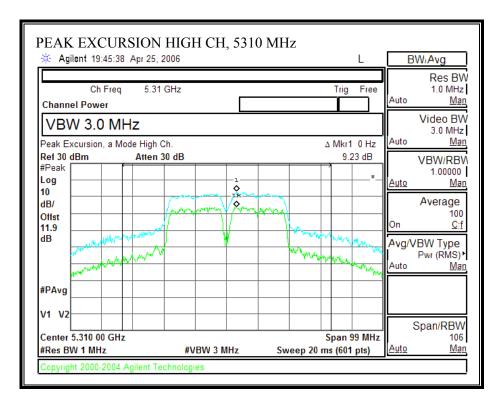
PEAK EXCURSION (802.11 - 40 MHz TX BANDWIDTH - CHAIN 0)



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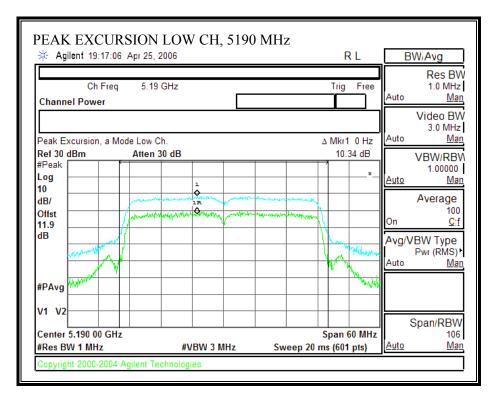
Agilent 19:27:02 Apr 25,	2006					L	B	WiAvg
Ch Freq 5.2 Channel Power	7 GHz				Trig	Free	Auto	Res B\ 1.0 MHz <u>Ma</u>
Peak Excursion, a Mode Mid	Ch.			Δ	Mkr1	0 Hz	Auto	Video BV 3.0 MHz <u>Ma</u>
#Peak	30 dB	1			9.(57 dB	<u>Auto</u>	VBW/RB 1.00000 <u>Ma</u>
10 dB/ Offst 11.9	print		m				On	Average 100 <u>Ott</u>
dB	~			Marker Mark	-with	Mannan .	Avg/V Auto	BW Type Pwr (RMS) Ma
#PAvg						- YTUNNY		
V1 V2								Span/RBV
Center 5.270 0 GHz #Res BW 1 MHz	#VBV	N 3 MHz	Sw	Spa eep 20 m		.5 MHz pts)	Auto	106 <u>Ma</u>

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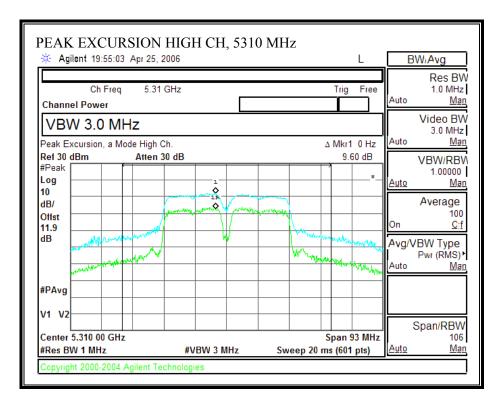
PEAK EXCURSION (802.11 - 40 MHz TX BANDWIDTH - CHAIN 1)



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🔆 Agilent 19:35:42 Apr 25	lgilent 19:35:42 Apr 25, 2006		BW/Avg		
Ch Freq 5.2 Channel Power	7 GHz		Trig Free	Auto	Res B\ 1.0 MHz <u>Ma</u>
VBW 3.0 MHz Peak Excursion, a Mode Mid	Ch.	Δ	Mkr1 0 Hz	Auto	Video BV 3.0 MHz <u>Ma</u>
Ref 30 dBm Atter #Peak Log 10	1 30 dB		11.72 dB	<u>Auto</u>	VBW/RB 1.00000 <u>Ma</u>
dB/ Offst	LR.			On	Average 100 <u>O</u> tt
dB		- Contraction of the	and the second s	Avg/\ Auto	/BW Type Pwr (RMS) <u>Ma</u>
#PAvg					
V1 V2					Span/RBV
Center 5.270 0 GHz #Res BW 1 MHz	#VBW 3 MHz	Spa Sweep 20 m	n 115.5 MHz s (601 pts)	Auto	106 <u>Ma</u>

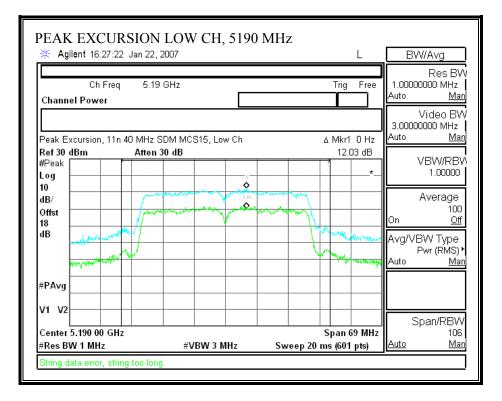
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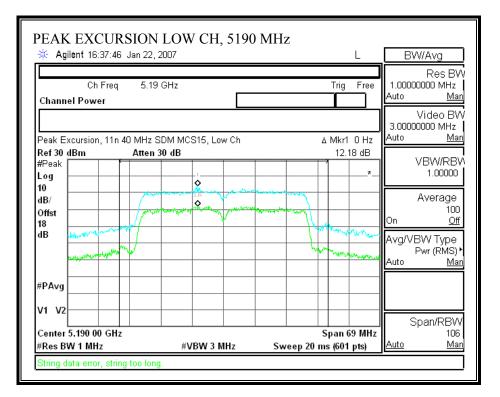
802.11n 40 MHz SDM MCS 15

PEAK EXCURSION (802.11 - 40 MHz TX BANDWIDTH - CHAIN 0)



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PEAK EXCURSION (802.11 - 40 MHz TX BANDWIDTH - CHAIN 1)



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7.2.6. CONDUCTED SPURIOUS EMISSIONS

<u>LIMITS</u>

§15.407 (b) (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.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are 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.

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

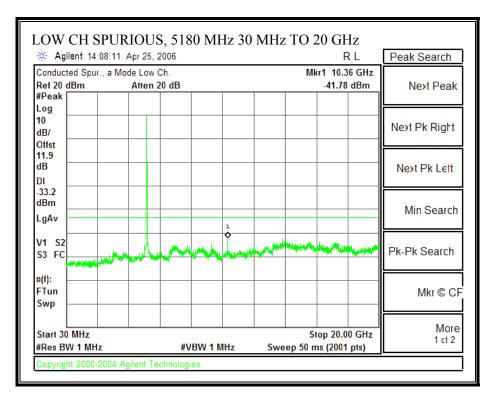
No non-compliance noted:

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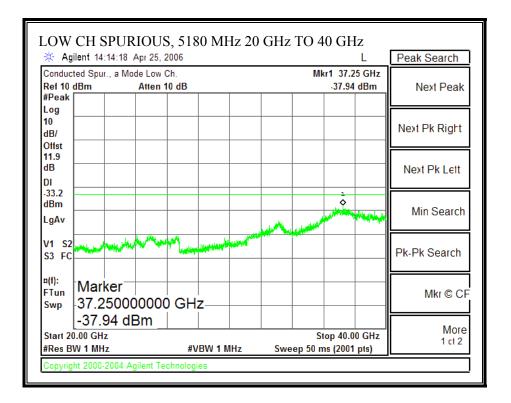
802.11a CDD is covered by worst case 802.11n 20 MHz CDD MCS 0

802.11n 20 MHz CDD MCS 0

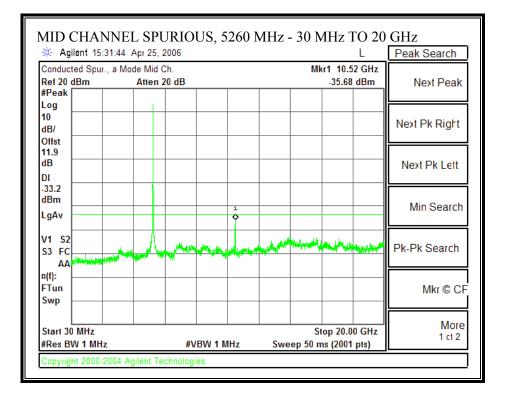
SPURIOUS EMISSIONS - 802.11a -20 MHz TX BANDWIDTH - CHAIN 0



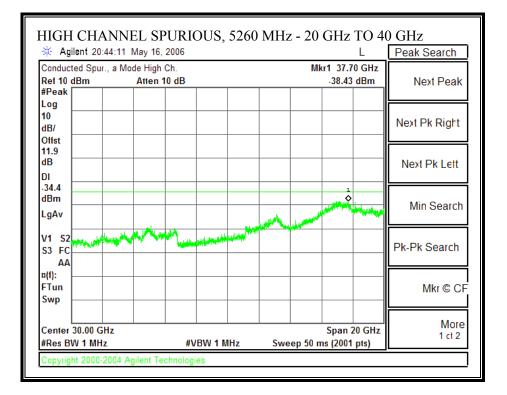
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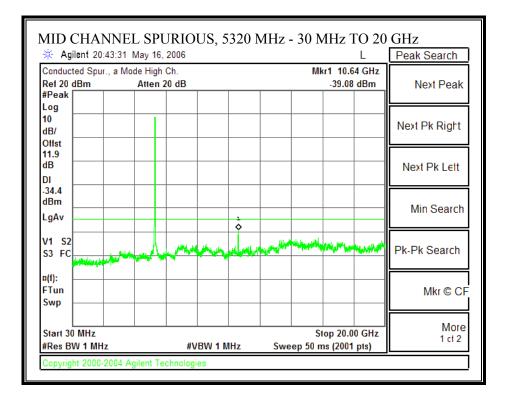
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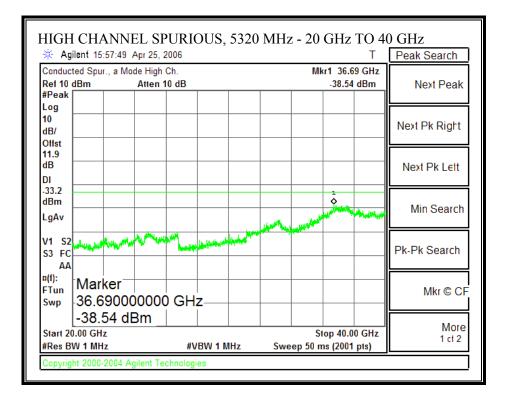
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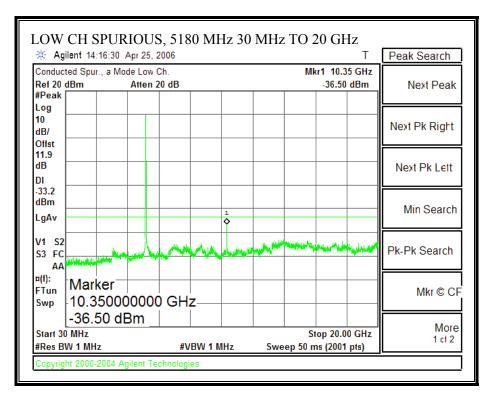


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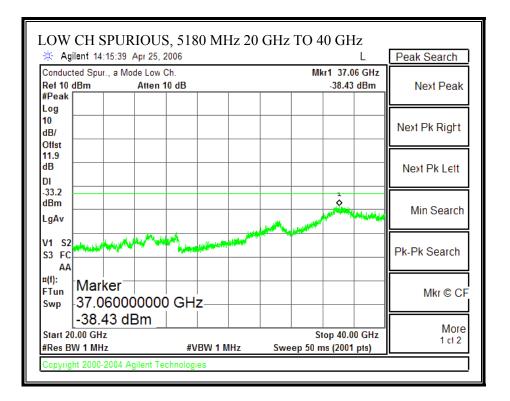


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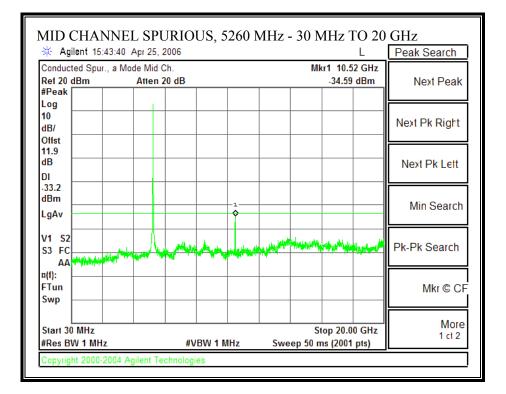
SPURIOUS EMISSIONS - 802.11a -20 MHz TX BANDWIDTH - CHAIN 1



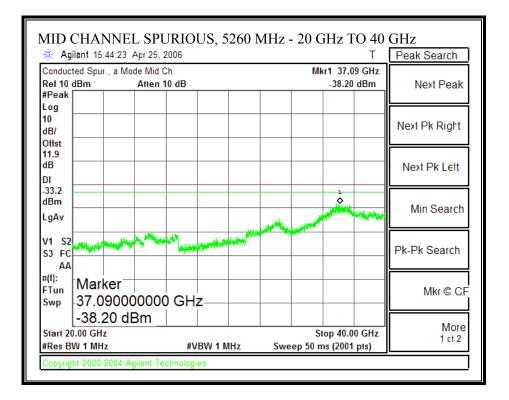
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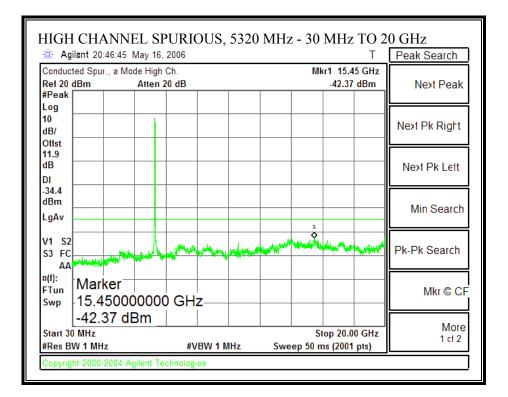
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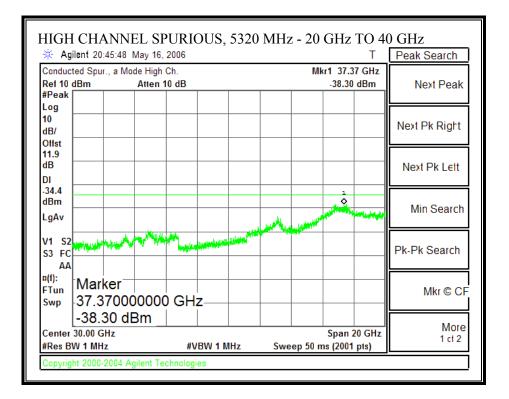
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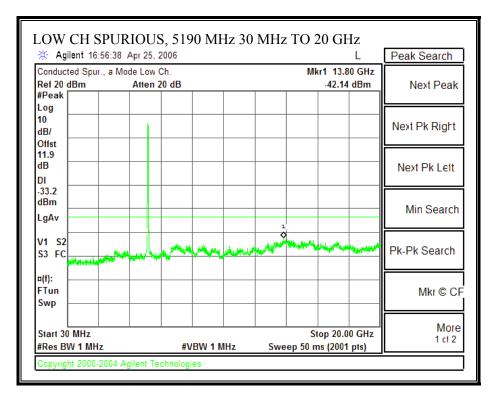
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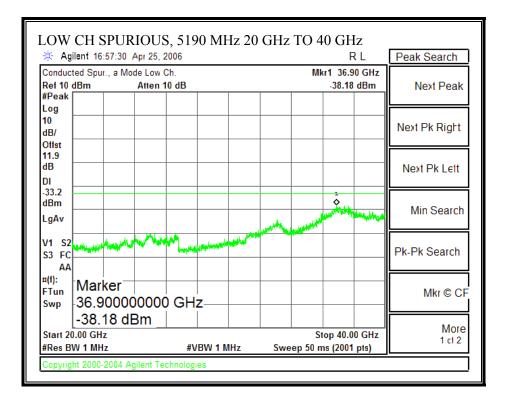
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802.11n 40 MHz CDD MCS 32

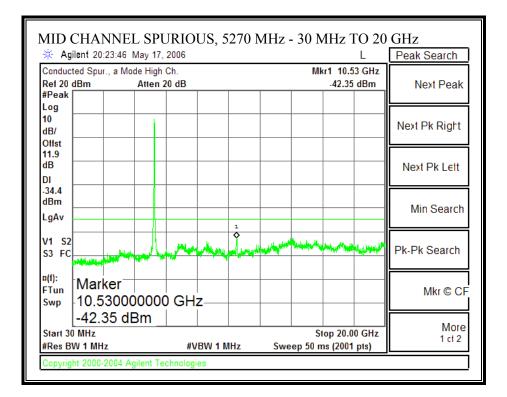
SPURIOUS EMISSIONS - 802.11a -40 MHz TX BANDWIDTH - CHAIN 0



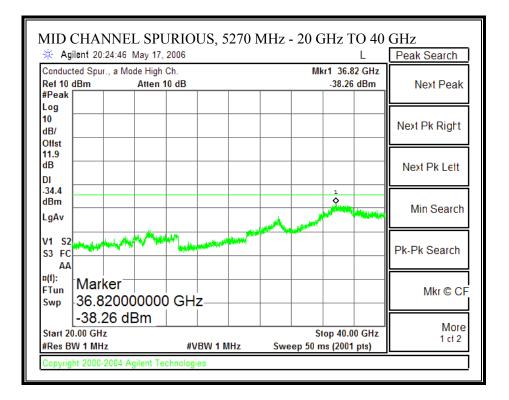
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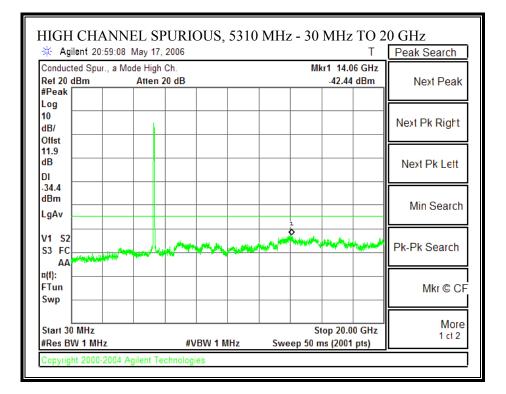
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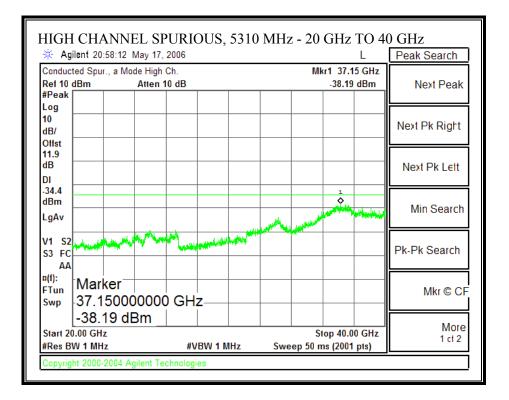
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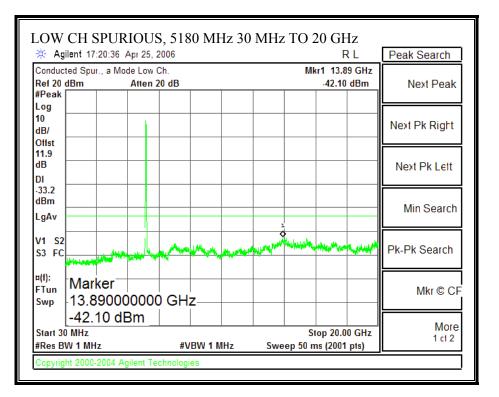


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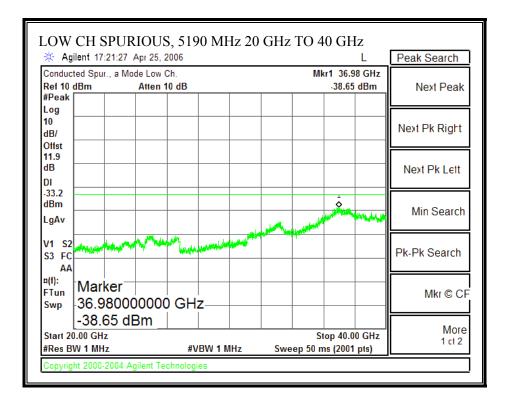


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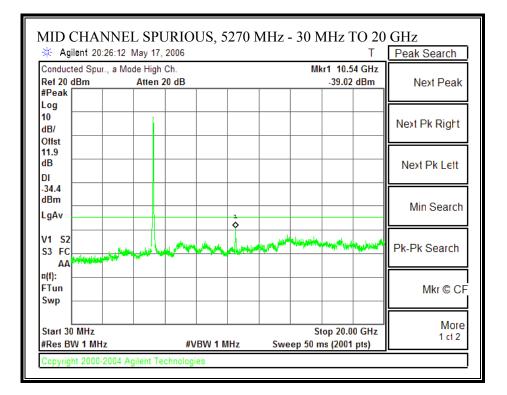
SPURIOUS EMISSIONS - 802.11a -40 MHz TX BANDWIDTH - CHAIN 1



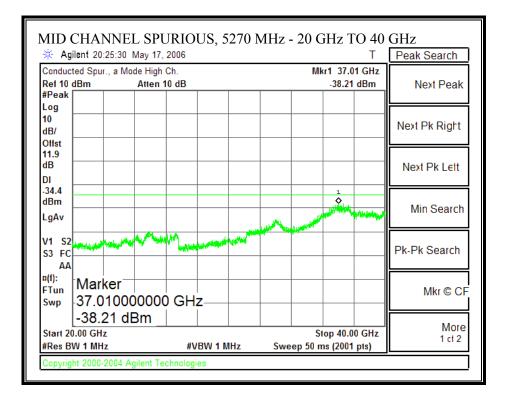
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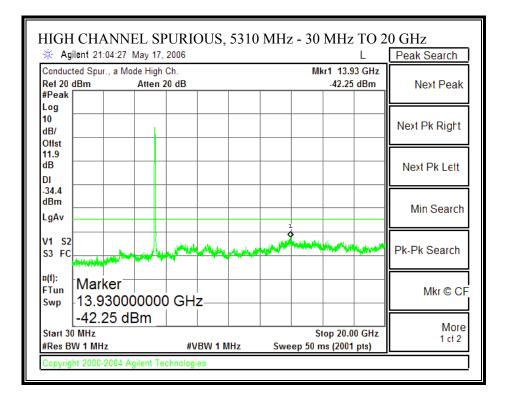
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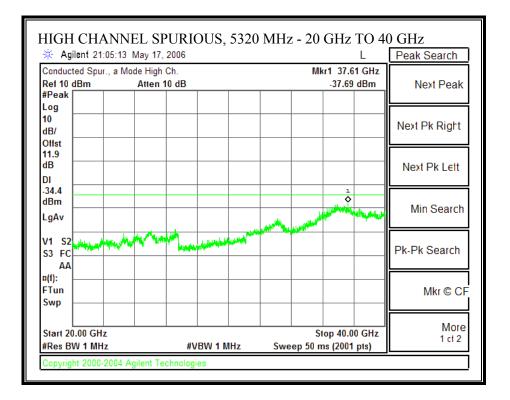
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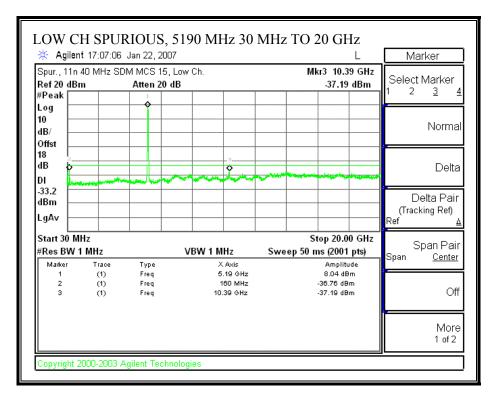
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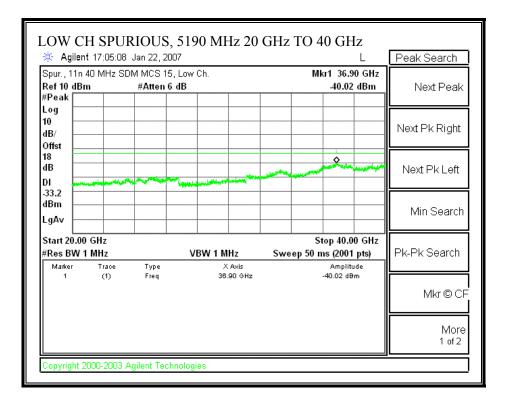
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802.11n 40 MHz SDM MCS 15

SPURIOUS EMISSIONS - 802.11a -40 MHz TX BANDWIDTH - CHAIN 0

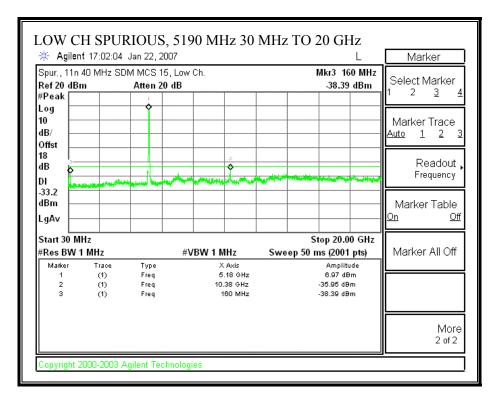


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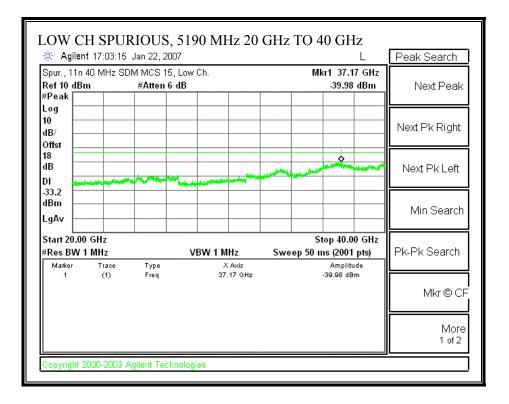


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SPURIOUS EMISSIONS - 802.11a -40 MHz TX BANDWIDTH - CHAIN 1



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<u>5470 TO 5725 MHz BAND</u>

LEGACY MODE

7.3. CHANNEL TESTS FOR THE 5470 TO 5725 MHz BAND

7.3.1. EMISSION BANDWIDTH

<u>LIMIT</u>

§15.403 (i) <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.

TEST PROCEDURE

The transmitter output is connected to a 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:

802.11a LEGACY MODE

Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5500	29.64	14.72
Middle	5600	31.93	15.04
High	5700	32.49	15.12

802.11n 20 MHz SISO MCS 0 MODE is covered by the worst case Legacy testing

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802.11n 40 MHz SISO MCS 32 MODE

Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5510	48.77	16.88
Middle	5590	49.04	16.91
High	5670	43.37	16.37

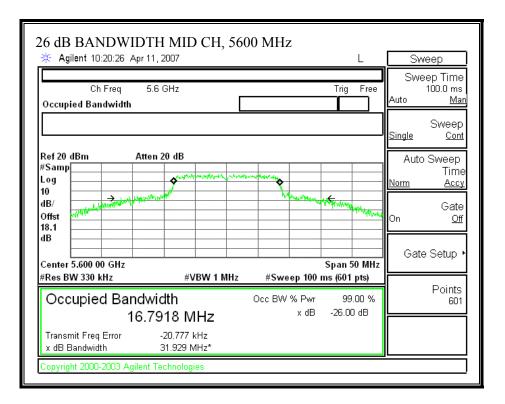
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802.11a MODE

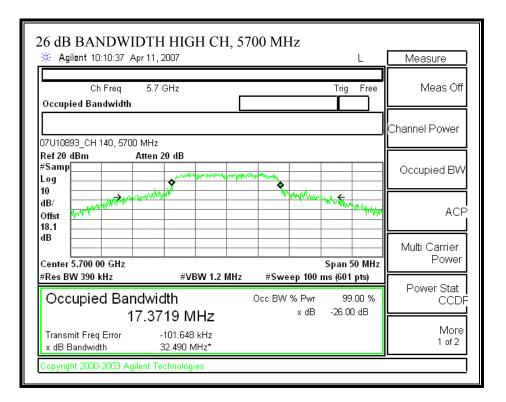
26 dB EMISSION BANDWIDTH (802.11a MODE)

26 dB BANDWIDTH LOW CH, 5500 MHz	L	Sweep
Ch Freq 5.5 GHz Occupied Bandwidth	Trig Free	Sweep Time 100.0 ms Auto <u>Man</u>
		Sweep <u>Single Cont</u>
Ref 20 dBm Atten 20 dB #Samp Log 10		Auto Sweep Time <u>Norm Accy</u>
18.1	and the second	Gate On <u>Off</u>
dB Center 5.500 00 GHz #Res BW 330 kHz #VBW 1 MHz #Sweep 100 r	Span 50 MHz	Gate Setup 🕨
Occupied Bandwidth Occ BW % Pwr 16.8036 MHz × dB	99.00 % -26.00 dB	Points 601
Transmit Freq Error -59.702 kHz x dB Bandwidth 29.639 MHz*		
Copyright 2000-2003 Agilent Technologies		

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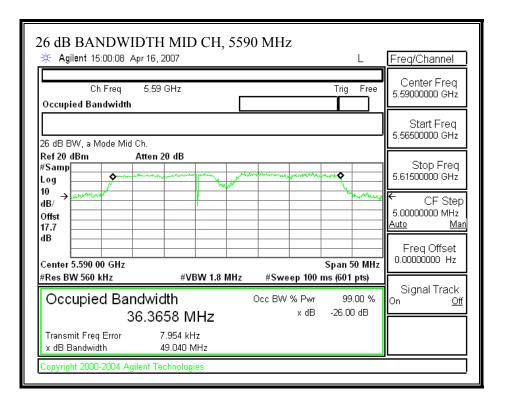
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11n 40 MHz SISO MCS 32 MODE

26 dB EMISSION BANDWIDTH

26 dB BANDWID ☆ Agilent 12:00:17 Apr		5510 WITZ	L	Measure
Ch Freq Occupied Bandwidth	5.51 GHz		Trig Free	Meas Off
26 dB BW, a Mode Low Cl	h			Channel Power
•	tten 20 dB			Occupied BW
10 dB/ Offst 17.7	****	Murph	WANN MANG MANA AND AND AND AND AND AND AND AND AND	ACF
dB Center 5.510 0 GHz #Res BW 560 kHz	#VBW 1.8 M		Span 100 MHz ms (601 pts)	Multi Carrier Power
Occupied Band 36	lwidth .5105 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Power Stat CCDI
Transmit Freq Error x dB Bandwidth	25.615 kHz 48.765 MHz			More 1 of 2
Copyright 2000-2004 Agile	nt Technologies			-

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26 dB BANDWIDTH HIGH CH, 5670 MHz	Measure
Ch Freq 5.67 GHz Trig Free Occupied Bandwidth	Meas Off
26 dB BW, a Mode High Ch.	Channel Power
Ref 20 dBm Atten 20 dB #Samp Log 10 Atten 20 dB	Occupied BW
dB/ dB/ Offst 17.7	ACP
dB Center 5.670 00 GHz #Res BW 560 kHz #VBW 1.8 MHz #Sweep 100 ms (601 pts)	Multi Carrier Power
Occupied Bandwidth Occ BW % Pwr 99.00 % 36.2541 MHz × dB -26.00 dB	Power Stat CCDF
Transmit Freq Error -96.009 kHz x dB Bandwidth 43.366 MHz*	More 1 of 2
Copyright 2000-2004 Agilent Technologies	

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7.3.2. PEAK POWER

<u>LIMIT</u>

§15.407 (a) (2) For the 5.47–5.725 GHz band, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. 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.

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.

LIMITS AND RESULTS

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

THE ANTENNA GAIN:

5.470 – 5.725 GHz: 6.02dB

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LIMITS AND RESULTS

No non-compliance noted:

802.11a MODE

LIMITS AND RESULTS FOR TRANSMIT POWER:

Transmit Power Limit

Channel	Frequency	Fixed	В	11 + 10 Log B	Limit
		Limit		Limit	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBm)
Low	5500	24	16.80	23.25	23.25
Mid	5600	24	16.79	23.25	23.25
High	5700	24	17.37	23.40	23.40

Transmit Power Results

Channel	Frequency	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5500	17.34	23.25	-5.91
Mid	5600	17.59	23.25	-5.66
High	5700	17.75	23.40	-5.65

LIMITS AND RESULTS FOR EIRP:

EIRP Limit

Channel	Frequency	Fixed	В	17 + 10 Log B	Limit
		Limit		Limit	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBm)
Low	5500	30	16.80	29.25	29.25
Middle	5600	30	16.79	29.25	29.25
High	5700	30	17.37	29.40	29.40

EIRP Results

Channel	Frequency	Power	Antenna	EIRP	Limit	Margin
			Gain			
	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
Low	5500	17.34	6.02	23.36	29.25	-5.89
Middle	5600	17.59	6.02	23.61	29.25	-5.64
High	5700	17.75	6.02	23.77	29.40	-5.63

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802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

802.11n 40 MHz SISO MCS 32 MODE

LIMITS AND RESULTS FOR TRANSMIT POWER:

Transmit Power Limit

Channel	Frequency	Fixed	В	11 + 10 Log B	Limit
		Limit		Limit	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBm)
Low	5510	24	36.51	26.62	24.00
Mid	5590	24	36.37	26.61	24.00
High	5670	24	36.25	26.59	24.00

Transmit Power Results

Channel	Frequency	equency Power		Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5510	15.45	24.00	-8.55
Mid	5590	17.99	24.00	-6.01
High	5670	18.23	24.00	-5.77

LIMITS AND RESULTS FOR EIRP:

EIRP Limit

Channel	Frequency	Fixed	В	17 + 10 Log B	Limit
		Limit		Limit	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBm)
Low	5510	30	16.80	29.25	29.25
Middle	5590	30	16.79	29.25	29.25
High	5670	30	17.37	29.40	29.40

EIRP Results

Channel	Frequency	Power	Antenna	EIRP	Limit	Margin
			Gain			
	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
Low	5510	15.45	6.02	21.47	29.25	-7.78
Middle	5590	17.99	6.02	24.01	29.25	-5.24
High	5670	18.23	6.02	24.25	29.40	-5.15

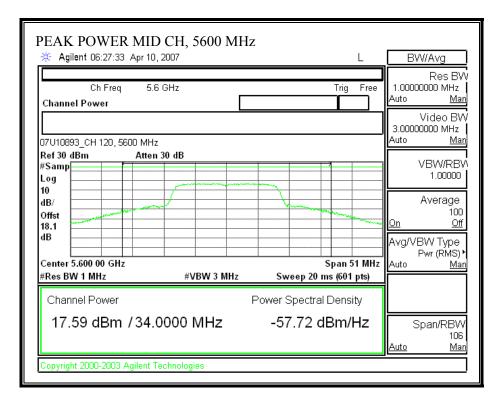
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802.11a MODE

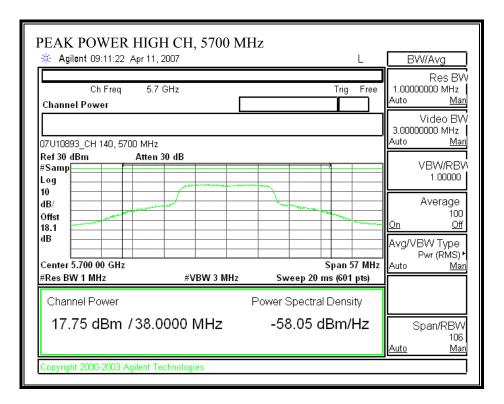
PEAK POWER

PEAK POWER LOW	,	Z	BW/Avg
Ch Freq 5.5 Channel Power	GHz	Trig Free	Res BW 1.00000000 MHz Auto <u>Man</u> Video BW 3.00000000 MHz
07U10893_CH 100, 5500 MHz Ref 30 dBm Atten 3 #Samp Log 10 dB/ Offst 18.1 dB	60 dB		Auto <u>Man</u> VBW/RBV 1.00000 Average 100 On <u>Off</u> Avg/VBW Type
Center 5.500 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span 51 MH Sweep 20 ms (601 pts)	Z Auto Man
Channel Power 17.34 dBm / 34.0		Power Spectral Density -57.57 dBm/Hz	Span/RBW 106 <u>Auto Man</u>
Copyright 2000-2003 Agilent Te	chnologies		

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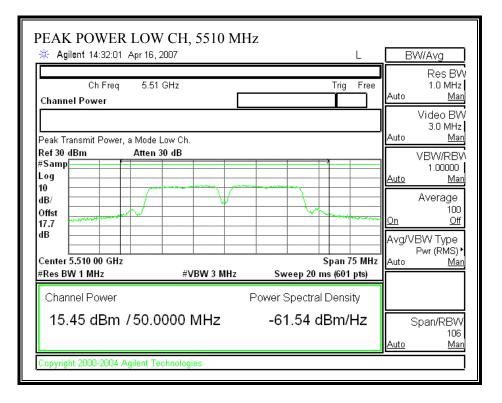
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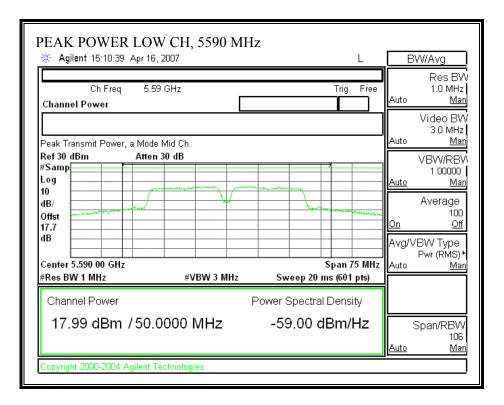
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802.11n 40 MHz SISO MCS 32 MODE

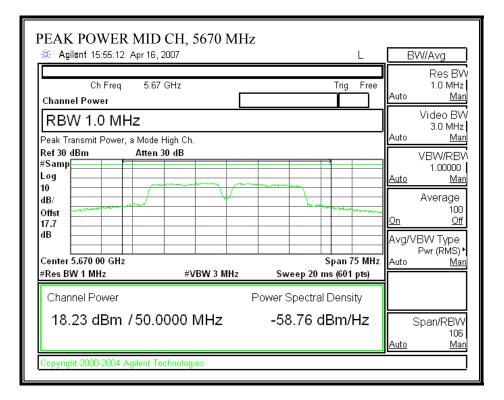
PEAK POWER



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7.3.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

\$1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Lim	its for Occupational	/Controlled Exposu	res	
0.3–3.0 3.0–30 30–300 300–1500 1500–100,000	614 1842/f 61.4	1.63 4.89/f 0.163	*(100) *(900/f²) 1.0 f/300 5	6 6 6 6 6
(B) Limits	for General Populati	on/Uncontrolled Exp	posure	
0.3–1.34 1.34–30	614 824/f	1.63 2.19/f	*(100) *(180/f ²)	30 30

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)-Continued

Frequency range (MHz)	Electric field Magnetic field strength (V/m) (A/m)		Power density (mW/cm ²) Averaging time (minutes)	
30–300 300–1500 1500–100,000	27.5	0.073	0.2 f/1500 1.0	30 30 30

f = frequency in MHz
 * = Plane-wave equivalent power density NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occu-pational/controlled limits apply provided he or she is made aware of the potential for exposure. NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be ex-posed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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CALCULATIONS

Given

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

and

 $S = E^{2}/3770$

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 Power to mW and Distance to cm, using:

P(mW) = P(W) / 1000 and d(cm) = 100 * d(m)yields $d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$ $d = 0.282 * \sqrt{(P * G / S)}$ where d = distance in cmP = Power in mWG = Numeric antenna gain $S = Power Density in mW/cm^2$ Substituting the logarithmic form of power and gain using: $P(mW) = 10^{(H)} (P(dBm) / 10)$ and $G (numeric) = 10 \land (G (dBi) / 10)$ yields $d = 0.282 * 10^{(P+G)} / 20) / \sqrt{S}$ where d = MPE distance in cm P = Power in dBmG = Antenna Gain in dBi

 $S = Power Density Limit in mW/cm^2$

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{(P+G)} / 10) / (d^2)$$

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LIMITS

From 1.1310 Table 1 (B), S = 1.0 mW/cm² in the 5.6 GHz band.

RESULTS

No non-compliance noted

802.11a LEGACY MODE

Mode	MPE	Output	Antenna	Power
	Distance	Power	Gain	Density
	(cm)	(dBm)	(dBi)	(mW/cm^2)
802.11a LEGACY	20.0	17.75	6.02	0.05

802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

802.11n 40 MHz SISO

Mode	MPE	Output	Antenna	Power
	Distance	Power	Gain	Density
	(cm)	(dBm)	(dBi)	(mW/cm^2)
802.11n 40 MHz SISO	20.0	18.23	6.02	0.05

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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7.3.4. PEAK POWER SPECTRAL DENSITY

<u>LIMIT</u>

§15.407 (a) (2) For the 5.47–5.725 GHz band, 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.

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.

RESULTS

No non-compliance noted:

THE ANTENNA GAIN:

5.470 – 5.725 GHz: 6.02dBi, limit = 10.98 dBm

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RESULTS

No non-compliance noted:

802.11a MODE

802.11a Mode

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5500	7.67	10.980	-3.31
Middle	5560	6.97	10.980	-4.01
High	5570	7.41	10.980	-3.57

802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

802.11n 40 MHz SISO MCS 32 MODE

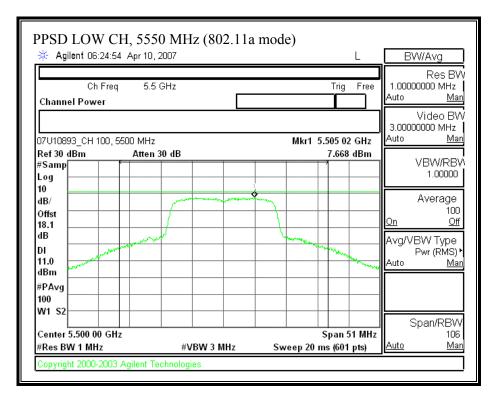
802.11a Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5510	2.60	10.980	-8.38
Middle	5590	4.71	10.980	-6.27
High	5570	4.65	10.980	-6.33

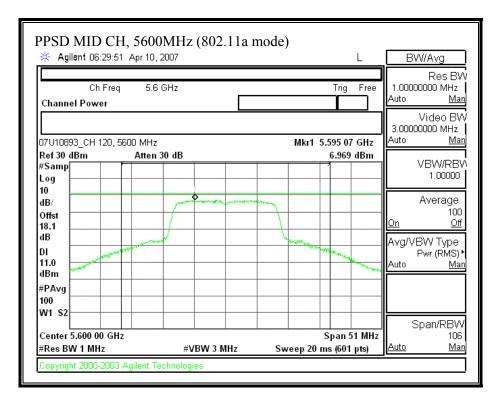
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802.11a MODE

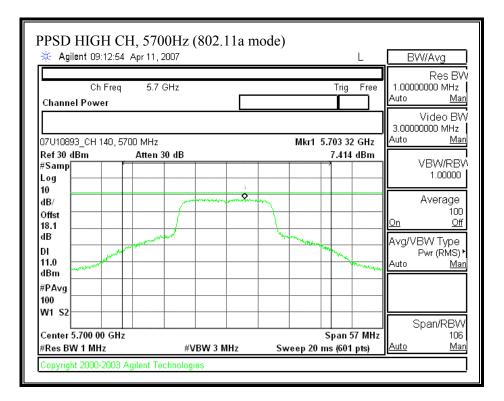
PEAK POWER SPECTRAL DENSITY (802.11a MODE)



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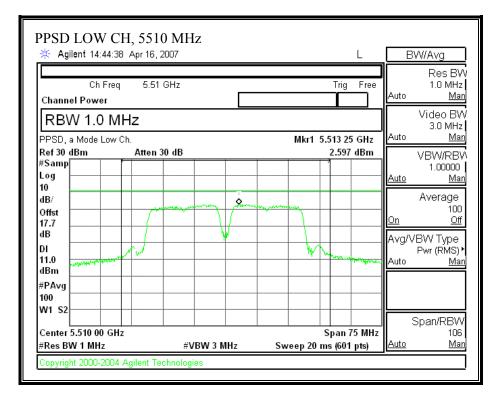
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802.11n 40 MHz SISO MCS 32 MODE

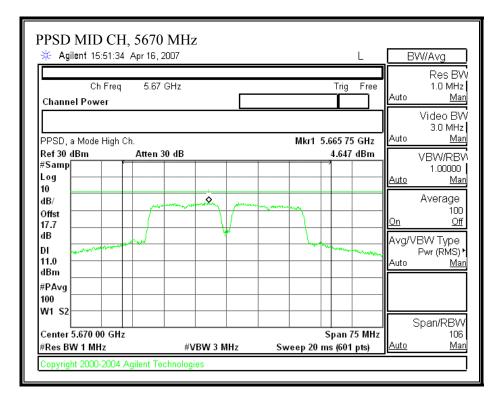
PEAK POWER SPECTRAL DENSITY



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🔆 Agilent 15:12:2	24 Apr 16, 20)07					L	В	W/Avg
Ch Fre Channel Power	q 5.59 G	ЭНz				Trig	Free	Auto	Res BV 1.0 MHz <u>Ma</u>
RBW 1.0 N PPSD, a Mode Mid				Mki	1 5.5	95 00) GHz	Auto	Video BV 3.0 MHz <u>Ma</u>
Ref 30 dBm #Samp Log	Atten 30	dB				4.711	dBm	<u>Auto</u>	VBW/RB 1.00000 <u>Ma</u>
10 dB/ Offst 17.7 dB	^~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~							<u>On</u>	Average 100 <u>Off</u>
DI manana and and and and and and and and an						*~~p*~~~		Avg/v Auto	/BW Type Pwr (RMS) <u>Ma</u>
#PAvg 100 W1 S2									Span/RBV
Center 5.590 00 GI #Res BW 1 MHz	lz	#VBW 3	MHz	Sweep			'5 MHz	Auto	106 Ma

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7.3.5. PEAK EXCURSION

<u>LIMIT</u>

§15.407 (a) (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.

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 settings are used for the second PPSD trace.

RESULTS

No non-compliance noted:

802.11a MODE

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5500	8.30	13	-4.70
Middle	5600	9.92	13	-3.08
High	5700	9.54	13	-3.46

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802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

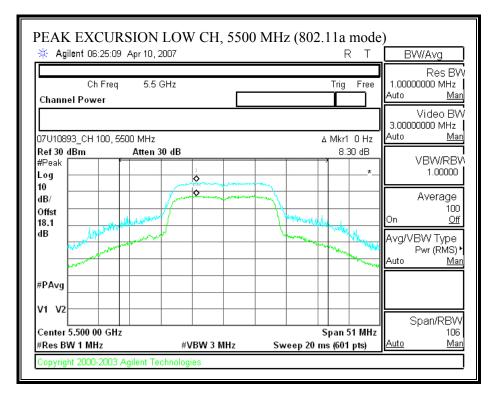
802.11n 40 MHz SISO MCS 32 MODE

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5510	9.36	13	-3.64
Middle	5590	12.34	13	-0.66
High	5670	10.20	13	-2.80

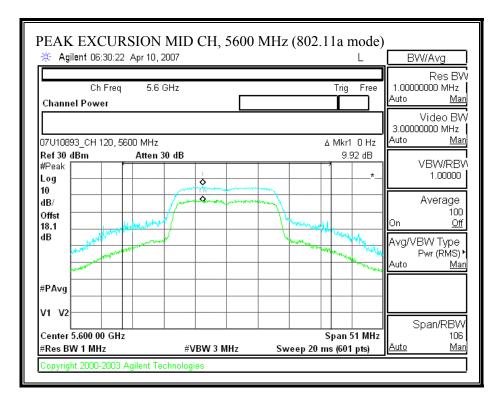
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802.11a MODE

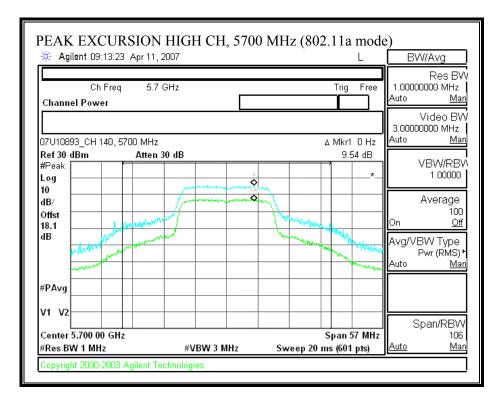
PEAK EXCURSION (802.11a MODE)



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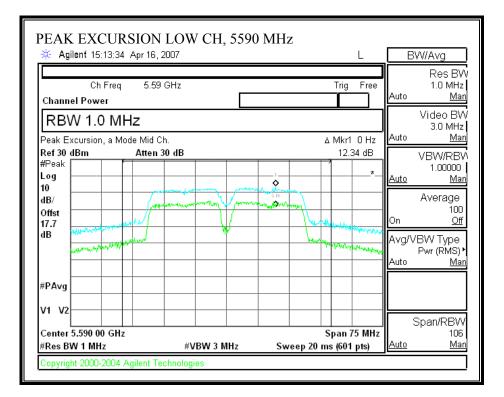
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802.11n 40 MHz SISO MCS 32 MODE

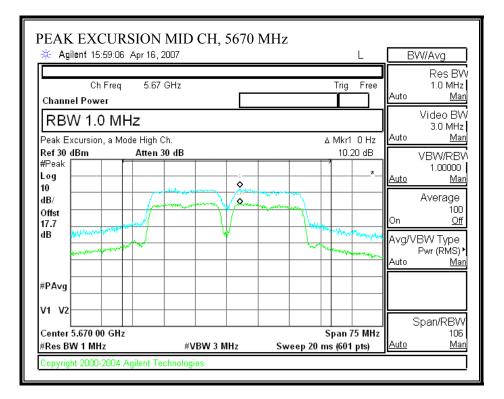
PEAK EXCURSION

🔆 Agilent 14:46:55 Apr 16, 2	,) MHz L	BW/Avg
Ch Freq 5.51 (Channel Power	GHz	Trig Fr	Res BV ee 1.0 MHz Auto <u>Man</u>
RBW 1.0 MHz Peak Excursion, a Mode Low Cl	ı.	∆ Mkr1 0 F	Video BW 3.0 MHz Hz Auto <u>Man</u>
Ref 30 dBm Atten 3 #Peak		9.36 di	3 VBW/RBV * <u>Auto Mar</u> Average 0n 0ff
dB		1 Northe 1	www.Avg/VBW Type Pwr (RMS)► Mynq Auto <u>Man</u>
#PAvg			
Center 5.510 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span 75 M Sweep 20 ms (601 pts)	

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7.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

15.407 (b) (3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are 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.

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.

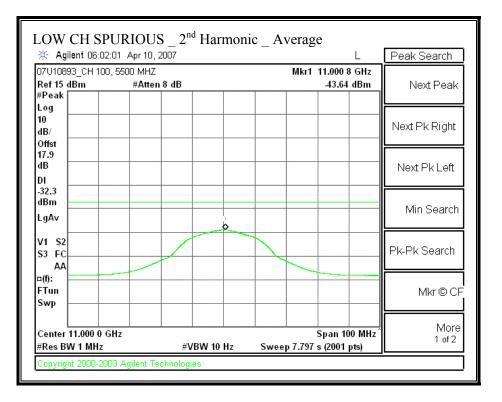
RESULTS

No non-compliance noted:

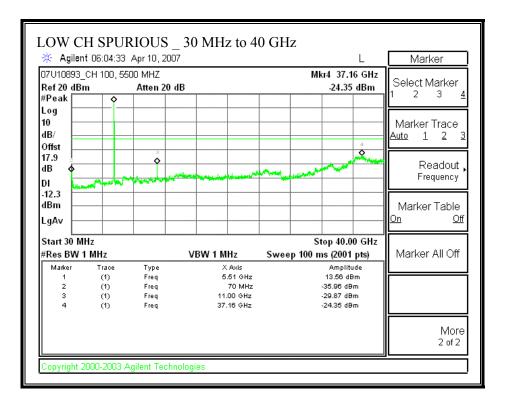
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802.11a MODE

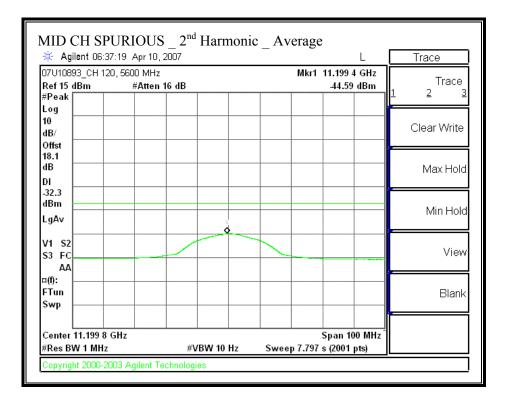
SPURIOUS EMISSIONS (802.11a MODE)



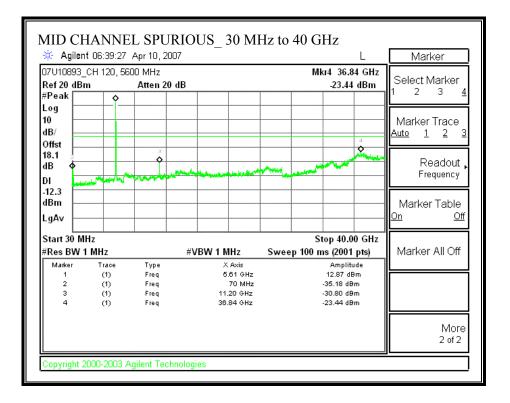
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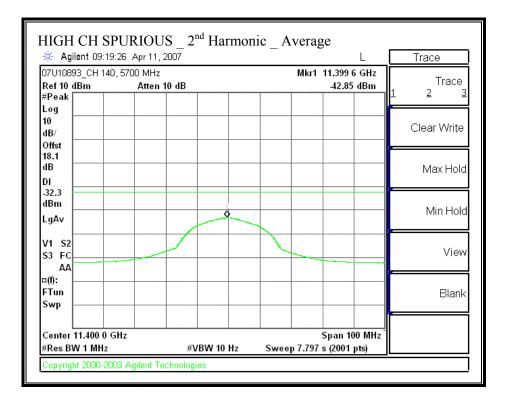
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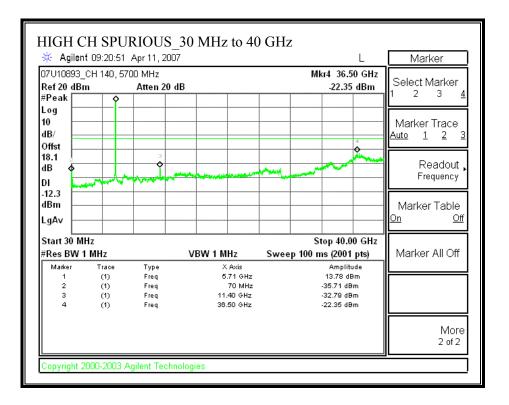
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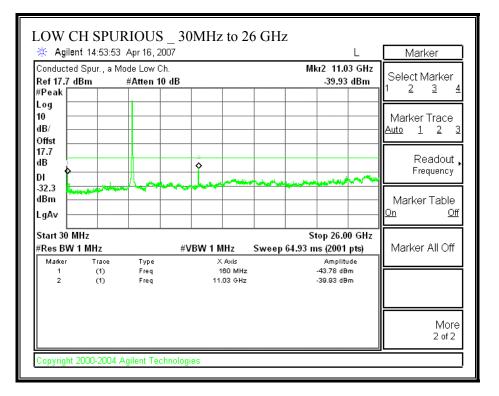
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802.11n 20 MHz SISO MODE is covered by the worst case Legacy testing

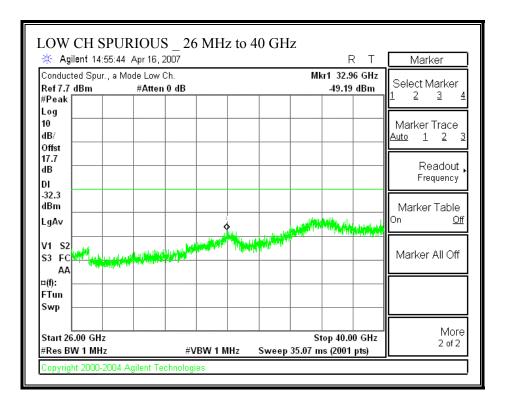
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802.11n 40 MHz SISO MCS 32 MODE

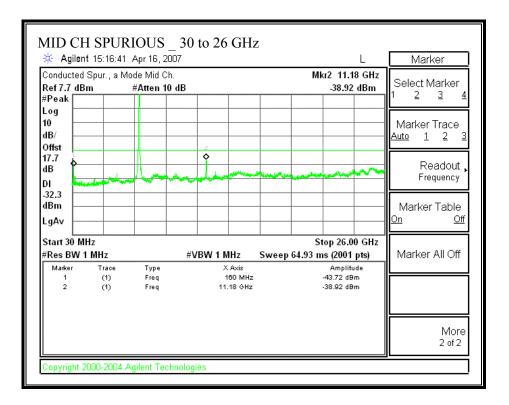
SPURIOUS EMISSIONS



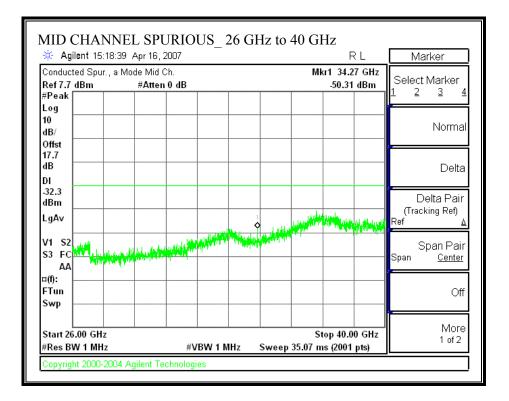
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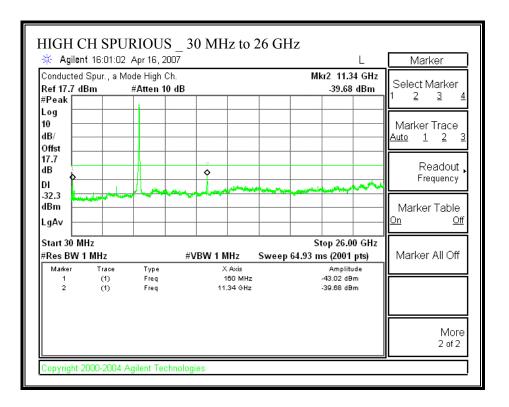
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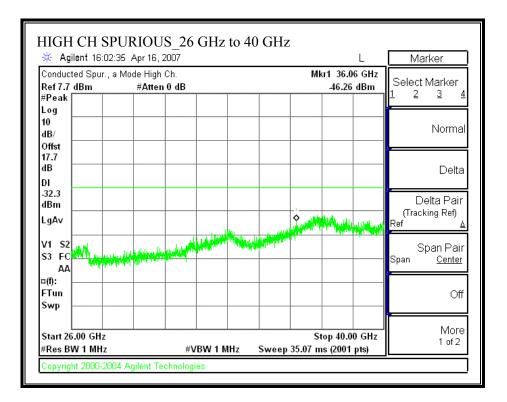
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MIMO MODE

7.4. CHANNEL TESTS FOR THE 5470 TO 5725 MHz BAND

7.4.1. EMISSION BANDWIDTH

<u>LIMIT</u>

§15.403 (i) <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.

TEST PROCEDURE

The transmitter output is connected to a 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:

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802.11a CDD MODE is covered by worst case 802.11n 20 MHz CDD MCS 0 MODE

802.11n 20 MHz CDD MCS 0 MODE

Channel Frequency B 10 Log B (MHz) (MHz) (**dB**) 29.169 14.649 Low 5500 Middle 5560 35.640 15.519 5700 40.440 High 16.068

802.11 - 20 MHz Tx BANDWIDTH - CHAIN 0

802.11 - 20 MHz Tx BANDWIDTH - CHAIN 1

Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5500	32.658	15.140
Middle	5560	33.139	15.203
High	5700	37.214	15.707

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802.11n 40 MHz CDD MCS 32 MODE

802.11 - 40 MHz Tx BANDWIDTH - CHAIN 0

Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5510	51.364	17.107
Middle	5590	78.442	18.945
High	5670	67.147	18.270

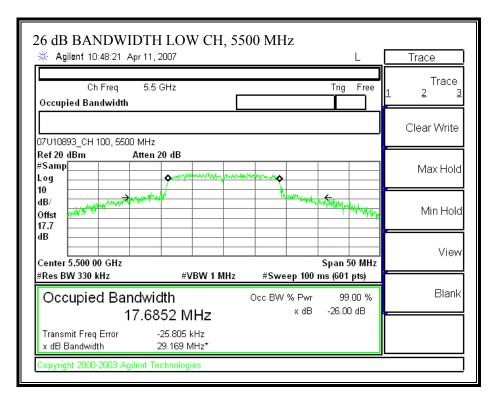
802.11 - 40 MHz Tx BANDWIDTH - CHAIN 1

Channel	Frequency	В	10 Log B
	(MHz)	(MHz)	(dB)
Low	5510	49.658	16.960
Middle	5590	77.880	18.914
High	5670	64.891	18.122

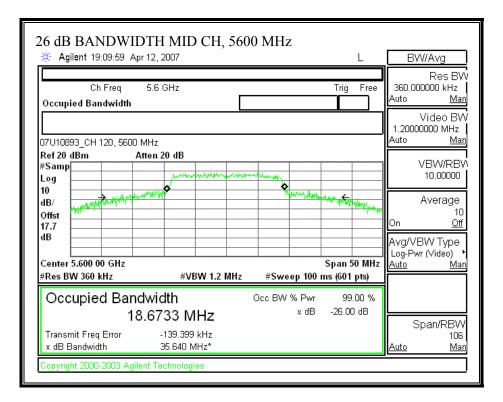
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802.11n 20 MHz CDD MCS 0

26 dB EMISSION BANDWIDTH (802.11 - 20 MHz TX BANDWIDTH- CHAIN 0)



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Ch Frea 5.7 GHz Tria Free	
Ch Freq 5.7 GHz Trig Free Occupied Bandwidth	Sweep Time 100.0 ms Auto <u>Man</u>
7U10893_CH140, 5700 MHz	Sweep <u>Single Cont</u>
Atten 20 dB Atten 20 dB Samp	Auto Sweep Time <u>Norm Accy</u> Gate On <u>Off</u>
IB Span 50 MHz Center 5.700 00 GHz Span 50 MHz Res BW 470 kHz #VBW 1.5 MHz #Sweep 100 ms (601 pts)	Gate Setup
Occupied Bandwidth Occ BW % Pwr 99.00 % 20.8151 MHz × dB -26.00 dB	Points 601
Transmit Freq Error 66.661 kHz x dB Bandwidth 40.440 MHz*	

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