

# FCC CFR47 PART 15 SUBPART E INDUSTRY CANADA RSS-210 ISSUE 7

## **CERTIFICATION TEST REPORT**

FOR 802.11ag/Draft 802.11n WLAN PCI-E Mini Card

> MODEL NUMBER: BCM94322USA FCC ID: QDS-BRCM1038 IC: 4324A-BRCM1038

REPORT NUMBER: 08U11756-2B ISSUE DATE: JULY 11, 2008

Prepared for BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086, USA

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NVLAP LAB CODE 200065-0

#### Revision History

Rev.	lssue Date	Revisions	Revised By
	July 9, 2008	Initial Issue	Sunny Shih
A	July 9, 2008	Removed standard description "NCC LOW POWER 0002 (LP0002)" from cover page and page 8.	A. Zaffar
В	July 11, 2008	Clarified antenna combinations used for test purposes, clarified DFS test results, added TPC description.	Sunny Shih

Page 2 of 334

# TABLE OF CONTENTS

1.	ATT	ESTATION OF TEST RESULTS	8
2.	TES	T METHODOLOGY	9
3.	FAC	ILITIES AND ACCREDITATION	9
4.	CAL	IBRATION AND UNCERTAINTY	9
4	.1.	MEASURING INSTRUMENT CALIBRATION	9
4	.2.	MEASUREMENT UNCERTAINTY	9
5.	EQU	IPMENT UNDER TEST	10
5	.1.	DESCRIPTION OF EUT	10
5	.2.	MAXIMUM OUTPUT POWER	10
5	.3.	DESCRIPTION OF AVAILABLE ANTENNAS	11
5	.4.	SOFTWARE AND FIRMWARE	11
5	.5.	WORST-CASE CONFIGURATION AND MODE	12
5	.6.	DESCRIPTION OF TEST SETUP	13
6.	TES	T AND MEASUREMENT EQUIPMENT	15
7.	ANT	ENNA PORT TEST RESULTS FOR 5.15–5.25 GHZ BAND	16
7.	.1.	802.11a MODE	16
	7.1.1	. 26 dB and 99% BANDWIDTH	16
	7.1.2	2. OUTPUT POWER	18
	7.1.3	B. PEAK POWER SPECTRAL DENSITY	21
	7.1.4	PEAK EXCURSION	24
	7.1.5	6. CONDUCTED SPURIOUS EMISSIONS	27
7.	.2.	802.11n HT20 MODE	31
	7.2.1	. 26 dB and 99% BANDWIDTH	31
	7.2.2	2. OUTPUT POWER	33
	7.2.3		38
	7.2.3 7.2.4	B. PEAK POWER SPECTRAL DENSITY	
	-	B. PEAK POWER SPECTRAL DENSITY PEAK EXCURSION	41
7.	7.2.4	B. PEAK POWER SPECTRAL DENSITY PEAK EXCURSION	41 46
7.	7.2.4 7.2.5	<ul> <li>PEAK POWER SPECTRAL DENSITY</li> <li>PEAK EXCURSION</li> <li>CONDUCTED SPURIOUS EMISSIONS</li></ul>	41 46 48
7.	7.2.4 7.2.5 .3.	<ul> <li>PEAK POWER SPECTRAL DENSITY</li> <li>PEAK EXCURSION</li> <li>CONDUCTED SPURIOUS EMISSIONS</li></ul>	41 46 48 48
7.	7.2.4 7.2.5 .3. 7.3.1	<ul> <li>PEAK POWER SPECTRAL DENSITY</li> <li>PEAK EXCURSION</li></ul>	41 46 48 48 50

Page 3 of 334

7	7.3.5.	CONDUCTED SPURIOUS EMISSIONS	56
7.4	4. 802.	11n HT40 MODE	59
7	7.4.1.	26 dB and 99% BANDWIDTH	59
7	7.4.2.	OUTPUT POWER	61
7	7.4.3.	PEAK POWER SPECTRAL DENSITY	64
7	7.4.4.	PEAK EXCURSION	66
7	7.4.5.	CONDUCTED SPURIOUS EMISSIONS	69
8. /	ANTENN	A PORT TEST RESULTS FOR 5.25–5.35 GHZ BAND	71
8.1	. 802.	11a MODE	71
8	3.1.1.	26 dB and 99% BANDWIDTH	71
8	3.1.2.	OUTPUT POWER	73
8	3.1.3.	PEAK POWER SPECTRAL DENSITY	76
8	3.1.4.	PEAK EXCURSION	79
8	3.1.5.	CONDUCTED SPURIOUS EMISSIONS	82
8.2	2. 802.	11n HT20 MODE	86
8	3.2.1.	26 dB and 99% BANDWIDTH	86
8	3.2.2.	OUTPUT POWER	88
8	3.2.3.	PEAK POWER SPECTRAL DENSITY	95
8	3.2.4.	PEAK EXCURSION	99
8	3.2.5.	CONDUCTED SPURIOUS EMISSIONS 1	04
8.3	8. 802.	11n HT40 SISO MODE	08
8	3.3.1.	26 dB and 99% BANDWIDTH1	80
8	3.3.2.	OUTPUT POWER 1	10
8	3.3.3.	PEAK POWER SPECTRAL DENSITY	12
8	3.3.4.	PEAK EXCURSION1	14
8	3.3.5.	CONDUCTED SPURIOUS EMISSIONS 1	16
8.4	4. 802.	11n HT40 MODE1	19
8	3.4.1.	26 dB and 99% BANDWIDTH1	19
8	3.4.2.	OUTPUT POWER 1	21
8	3.4.3.	PEAK POWER SPECTRAL DENSITY	24
8	3.4.4.	PEAK EXCURSION1	26
8	3.4.5.	CONDUCTED SPURIOUS EMISSIONS1	29
9. /	ANTENN	A PORT TEST RESULTS FOR 5.47–5.725 GHz BAND1	32
9.1	1. 802.	11a MODE	32
ę	9.1.1.	26 dB and 99% BANDWIDTH1	32

Page 4 of 334

9.1.2.	OUTPUT POWER	134
9.1.3.	PEAK POWER SPECTRAL DENSITY	137
9.1.4.	PEAK EXCURSION	140
9.1.5.	CONDUCTED SPURIOUS EMISSIONS	143
9.2. 802	2.11n HT20 MODE	147
9.2.1.	26 dB and 99% BANDWIDTH	147
9.2.2.	OUTPUT POWER	150
9.2.3.	PEAK POWER SPECTRAL DENSITY	160
9.2.4.	PEAK EXCURSION	165
9.2.5.	CONDUCTED SPURIOUS EMISSIONS	170
9.3. 802	2.11n HT40 SISO MODE	174
9.3.1.	26 dB and 99% BANDWIDTH	174
9.3.2.	OUTPUT POWER	176
9.3.3.	PEAK POWER SPECTRAL DENSITY	179
9.3.4.	PEAK EXCURSION	
9.3.5.	CONDUCTED SPURIOUS EMISSIONS	185
9.4. 802	2.11n HT40 MODE	
9.4.1.	26 dB and 99% BANDWIDTH	189
9.4.2.	OUTPUT POWER	192
9.4.3.	PEAK POWER SPECTRAL DENSITY	201
9.4.4.	PEAK EXCURSION	205
9.4.5.	CONDUCTED SPURIOUS EMISSIONS	210
10. RADI	ATED TEST RESULTS	214
10.1. LIM	ITS AND PROCEDURE	214
10.2. TR/	ANSMITTER ABOVE 1 GHz	215
10.2.1.	5.15–5.25 GHz BAND	215
10.2.1.1	802.11a MODE With Hi Slot Antenna Gain	215
10.2.1.2	802.11a MODE With Hi PIFA Antenna Gain	219
10.2.1.3	802.11n HT20 MODE With Hi PIFA and Hi SLOT Antenna Gains.	222
10.2.1.4	802.11n HT40 SISO MODE With Hi Slot Antenna Gain	226
10.2.1.5	802.11n HT40 SISO MODE With Hi PIFA Antenna Gain	230
10.2.1.6	802.11n HT40 MODE With Hi PIFA & Hi Slot Antenna Gains	234
10.2.2.	5.25–5.35 GHz BAND	238
10.2.2.1	802.11a MODE With Hi Slot Antenna Gain	238
10.2.2.2	802.11a MODE With Hi PIFA Antenna Gain	242

Page 5 of 334

10.2.2.3		
40.0.0.4	802.11n HT20 MODE With Hi PIFA & Hi SLOT Antenna Gains	246
10.2.2.4	802.11n HT40 SISO MODE Hi With Slot Antenna Gain	
10.2.2.5	802.11n HT40 SISO MODE With Hi PIFA Antenna Gain	254
10.2.2.6	802.11n HT40 MODE With Hi PIFA & Hi SLOT Antenna Gains	258
10.2.3.	5.47–5.725 GHz Band	
10.2.3.1	802.11a MODE With Hi Slot Antenna Gain	
10.2.3.2	802.11a MODE With Hi PIFA Antenna Gain	
10.2.3.3	802.11n HT20 MODE With Hi PIFA & Hi SLOT Antenna Gains	272
10.2.3.4	802.11n HT40 SISO MODE With Hi Slot Antenna Gain	277
10.2.3.5	802.11n HT40 SISO MODE With Hi PIFA Antenna Gain	
10.2.3.6	802.11n HT40 MODE With Hi PIFA & Hi Slot Antenna Gains	
10.3. RE	CEIVER ABOVE 1 GHz	
10.3.1.	20 MHz BANDWIDTH	
10.3.2.	40 MHz BANDWIDTH	
10.4. WC	DRST-CASE BELOW 1 GHz	
11. AC P	OWER LINE CONDUCTED EMISSIONS	
12. DYNA	MIC FREQUENCY SELECTION	
12.1. OV	ERVIEW	
12.1.1.	LIMITS	
12.1.2.	TEST AND MEASUREMENT SYSTEM	
12.1.3.	SETUP OF EUT	
12.1.4.	DESCRIPTION OF EUT	
	DESCRIPTION OF EUT SULTS FOR 20 MHz BANDWIDTH	
		307 309
12.2. RE	SULTS FOR 20 MHz BANDWIDTH	
12.2. RE 12.2.1.	SULTS FOR 20 MHz BANDWIDTH TEST CHANNEL	
12.2. RE 12.2.1. 12.2.2.	SULTS FOR 20 MHz BANDWIDTH TEST CHANNEL PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC	
12.2. RE 12.2.1. 12.2.2. 12.2.3. 12.2.4.	SULTS FOR 20 MHz BANDWIDTH TEST CHANNEL PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC MOVE AND CLOSING TIME.	
12.2. RE 12.2.1. 12.2.2. 12.2.3. 12.2.4.	SULTS FOR 20 MHz BANDWIDTH TEST CHANNEL PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC MOVE AND CLOSING TIME. NON-OCCUPANCY	
12.2. RE 12.2.1. 12.2.2. 12.2.3. 12.2.4. 12.3. RE	SULTS FOR 20 MHz BANDWIDTH TEST CHANNEL PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC MOVE AND CLOSING TIME. NON-OCCUPANCY SULTS FOR 40 MHz BANDWIDTH.	
12.2. RE 12.2.1. 12.2.2. 12.2.3. 12.2.4. 12.3. RE 12.3.1.	SULTS FOR 20 MHz BANDWIDTH TEST CHANNEL PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC MOVE AND CLOSING TIME. NON-OCCUPANCY SULTS FOR 40 MHz BANDWIDTH TEST CHANNEL	
12.2. RE 12.2.1. 12.2.2. 12.2.3. 12.2.4. 12.3. RE 12.3.1. 12.3.2.	SULTS FOR 20 MHz BANDWIDTH TEST CHANNEL PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC MOVE AND CLOSING TIME NON-OCCUPANCY SULTS FOR 40 MHz BANDWIDTH TEST CHANNEL PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC	
12.2. RE 12.2.1. 12.2.2. 12.2.3. 12.2.4. 12.3. RE 12.3.1. 12.3.2. 12.3.2. 12.3.3. 12.3.4.	SULTS FOR 20 MHz BANDWIDTH TEST CHANNEL. PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC MOVE AND CLOSING TIME NON-OCCUPANCY SULTS FOR 40 MHz BANDWIDTH TEST CHANNEL. PLOTS OF RADAR WAVEFORM AND WLAN TRAFFIC MOVE AND CLOSING TIME	

Page 6 of 334

Page 7 of 334

## **1. ATTESTATION OF TEST RESULTS**

INDUSTRY CANADA RSS-GEN Issue 2

COMPANY NAME:BROADCOM CORPORATION190 MATHILDA PLACESUNNYVALE, CA 94086, USA				
EUT DESCRIPTION:	802.11ag / Draft 802n WLAN PCI-E MINI CARD			
MODEL: BCM94322USA				
SERIAL NUMBER:	973 (P405)			
DATE TESTED:	JUNE 06 - JULY 7, 2008			
	APPLICABLE STANDARDS			
STA	ANDARD	TEST RESULTS		
CFR 47 Pa	art 15 Subpart E	Pass		
INDUSTRY CANADA	RSS-210 Issue 7 Annex 9	Pass		
		_		

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS 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:

Tested By:

Sunay Shih

SUNNY SHIH EMC SUPERVISOR COMPLIANCE CERTIFICATION SERVICES

VIEN TRAN EMC ENGINEER COMPLIANCE CERTIFICATION SERVICES

Pass

Page 8 of 334

# 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, FCC MO&O 06-96, RSS-GEN Issue 2, and RSS-210 Issue 7.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

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	
Power Line Conducted Emission	+/- 2.3 dB	
Radiated Emission	+/- 3.4 dB	

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

Page 9 of 334

## 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is an 802.11ag/Draft 802.11n Wireless LAN transceiver card and manufactured by Broadcom. Model number is BCM94322USA.

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency		Peak Power	Peak Power	Total Peak	Output Power
Range (MHz)	Mode	Chain 0 (dBm)		Power (dBm)	(mW)
5180 - 5240	802.11a Legacy	,		14.23	26.49
5180 - 5240	802.11n 20MHz SISO	Covered by the	worst case 802.	-	
5180 - 5240	802.11a CDD Mode		worst case 802.		
5180 - 5240	802.11n 20MHz CDD	9.43	9.69	12.57	18.08
5190 - 5230	802.11n 40MHz SISO			16.57	45.39
5190 - 5230	802.11n 40MHz CDD	12.25	12.26	15.27	33.61
5250 - 5350 MH	Iz Authorized Band	•			
Frequency Range (MHz)	Mode	Peak Power Chain 0 (dBm)	Peak Power Chain 1 (dBm)	Total Peak Power (dBm)	Output Power (mW)
5260 - 5320	802.11a Legacy			17.86	61.09
5260 - 5320	802.11n 20MHz SISO	Covered by the	worst case 802.	11a Legacy test	ting
5260 - 5320	802.11a CDD Mode	Covered by the	worst case 802.	11n 20 MHz CE	D
5270 -5310	802.11n 40MHz SISO			17.29	53.58
Power with Ante	enna Array Gain up to 6.72 c	lBi			
5260 - 5320	802.11n 20MHz CDD	16.29	16.10	19.21	83.30
5270 -5310	802.11n 40MHz CDD	15.42	15.76	18.60	72.50
Power with Ante	enna Array Gain up to 7.84 c	IBi			
5260 - 5320	802.11n 20MHz CDD	15.27	15.22	18.26	66.92
5470 - 5725 MH	Iz Authorized Band				
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			17.38	54.70
5500 - 5700	802.11n 20MHz SISO	Covered by the	worst case 802.	11a Legacy test	ting
5500 - 5700	802.11a CDD Mode	Covered by the	worst case 802.	11n 20 MHz CE	D
5510 - 5670	802.11n 40MHz SISO			18.35	68.39
Power with Ante	enna Array Gain up to 5.83 c	lBi			
5500 - 5700	802.11n 20MHz CDD	16.70	16.71	19.72	93.65
5510 - 5670	802.11n 40MHz CDD	17.43	18.53	21.03	126.62
Power with Ante	enna Array Gain up to 8.80 c	IBi			
5500 - 5700	802.11n 20MHz CDD	14.27	14.16	17.23	52.79
5510 - 5670	802.11n 40MHz CDD	16.65	17.52	20.12	102.73

5150 to 5250 MHz Authorized Band

Page 10 of 334

# 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes with two different types of antenna, with the maximum gain as table below

Antenna Manufacturer	Antenna Type	Model	Peak gain (dBi) @ 5150MHz	Peak gain (dBi) @ 5350MHz	Peak gain (dBi) @ 5470MHz	Peak gain (dBi) @ 5700MHz
Тусо	PIFA	M97PIFA	5.35	6.42	7.48	7.45
Foxconn	PIFA	WDAN-HQAT80-03-DF	2.99	2.99	2.01	2.19
Тусо	Slot antenna	M97SLTAP1	0.63	2.28	2.99	2.47
Тусо	Slot antenna	K5SLT	4.11	4.32	3.50	3.36

Antennas combinations for all 2x2 (CCD) modes test (Low Slot ant gain + Hi PIFA ant gain & Hi Slot ant gain + Low PIFA ant gain)

Frequency Band	Antennas conbination	SLOT Antenna Gain	PIFA Antenna gain	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)
5.2 GHz	SLOT Low / PIFA Hi	0.63	5.35	1.156	3.428	4.584	6.61
	SLOT Hi / PIFA Low	4.11	2.99	2.576	1.991	4.567	6.60
5.3 GHz	SLOT Low / PIFA Hi	2.28	6.42	1.690	4.385	6.076	7.84
	SLOT Hi / PIFA Low	4.32	2.99	2.704	1.991	4.695	6.72
5.5 GHz	SLOT Low / PIFA Hi	2.99	7.48	1.991	5.598	7.588	8.80
	SLOT Hi / PIFA Low	3.50	2.01	2.239	1.589	3.827	5.83

The highest gains of each type of antennas for all legacy/SISO modes test

Band	SLOT Ant Gain	PIFA Ant Gain
5.2 GHz	4.11	5.35
5.3 GHz	4.32	6.42
5.5 GHz	3.50	7.48

# 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was BCMWL5, rev. 4.170.83.0. The test utility software used during testing was wl\_tool, rev. 4.170. RC83.0.

Page 11 of 334

# 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate for each mode is determined to be as follows, based on preliminary tests of the chipset utilized in this radio.

All final tests in the 802.11a mode were made at 6 Mb/s.

All final tests in the 802.11n HT20 mode were made at MCS0.

All final tests in the 802.11n HT40 mode were made at MCS0 & MCS15

For radiated emissions below 1 GHz the worst-case configuration is determined to be the mode and channel with the highest output power.

Radiated emissions tests were performed with the following antenna configurations:

All legacy/SISO modes were measured with the highest gain for each type of antenna (PIFA and Slot).

All MIMO modes were measured with the highest combination of gains for each type of antenna (PIFA Hi and Slot Hi). Note that this combination of antennas will not be implemented in the end product. This combination was selected for testing purposes only, to accommodate the highest gain of each antenna type in one single test configuration. The combined gain of this test configuration is higher than any combined gain that will be implemented in the end product.

Page 12 of 334

## 5.6. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT & PERIPHERALS

PERIPHERAL SUPPORT EQUIPMENT LIST							
Description	Manufacturer	Model	Serial Number	FCC ID			
Monitor	LG	Microline 186	512MXAY0A752	DoC			
Keyboard	Microsoft	KC-0405	7.6198E+12	DoC			
Mouse	Dell	0YH958	HC6450C2BP9	DoC			
Desktop	Dell	DCNE	FR17YD1	DoC			

#### I/O CABLES

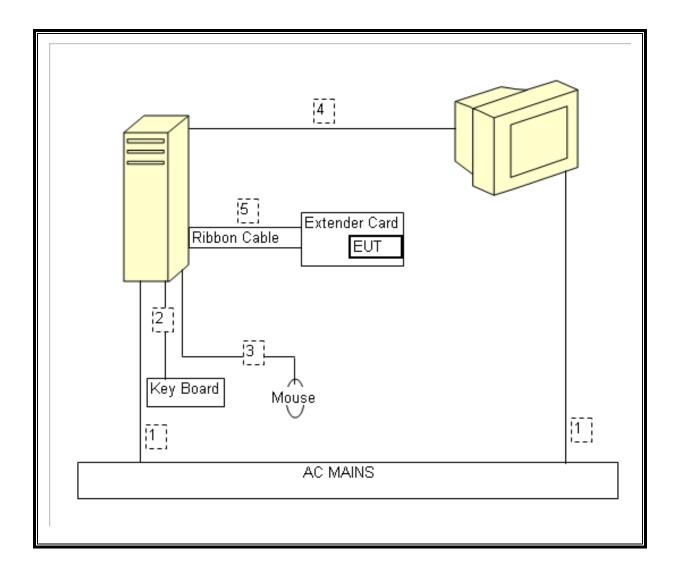
	I/O CABLE LIST							
Cable	Port	# of	Connector	Cable	Cable	Remarks		
No.		Identical	Туре	Туре	Length			
		Ports						
1	AC	2	US 115V	Un-shielded	2m	N/A		
2	USB Key Board	1	USB	Shielded	1m	N/A		
3	USB Mouse	1	USB	Shielded	1m	N/A		
4	Video	1	DB15	Shielded	1m	N/A		
5	Ribbon Cable	1	Ribbon Cable	Un-shielded	0.4m	N/A		

#### TEST SETUP

The EUT is installed in a host desktop computer via a ribbon cable & an express card to Mini PCI-E adapter boards during the tests. Test software exercised the radio card.

Page 13 of 334

#### SETUP DIAGRAM FOR TESTS



# 6. TEST AND MEASUREMENT EQUIPMENT

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

	TEST EQUIPMENT LIST						
Description	Manufacturer	Model	Asset	Cal Date	Cal Due		
EMI Receiver, 2.9 GHz	Agilent / HP	8542E	C00957	2/6/2008	6/12/2009		
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	2/6/2008	6/12/2009		
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	5/9/2007	5/9/2009		
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/25/2007	10/25/2008		
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/25/2007	10/25/2008		
EMI Test Receiver, 30 MHz	R&S	ESHS 20	N02396	10/16/2007	1/27/2009		
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	5/2/2006	8/7/2008		
Antenna, Horn, 18 GHz	ETS	3117	C01006	4/15/2008	4/15/09		
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	8/3/2007	8/3/08		
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	10/13/2007	10/13/08		
Peak Power Meter	Agilent / HP	E4416A	C00963	02/14/07	12/02/08		
Peak / Average Power Sensor	Agilent	E9327A	C00964	02/14/07	12/02/08		
Antenna, Horn 26 ~ 40 GHz	ARA	MWH-2640/B	C01009	4/13/2008	4/13/2009		
7.6 GHz High Pass Filter	Micro Tronics	HPM13350	N/A	N/A	N/A		
5.75 - 5.8 Reject Filter	Micro Tronics	BRC13192	N/A	N/A	N/A		

Page 15 of 334

# 7. ANTENNA PORT TEST RESULTS FOR 5.15–5.25 GHZ BAND

## 7.1. 802.11a MODE

### 7.1.1. 26 dB and 99% BANDWIDTH

#### <u>LIMITS</u>

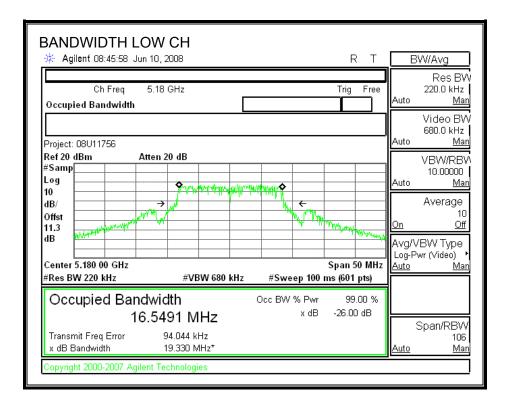
None; for reporting purposes only.

#### TEST PROCEDURE

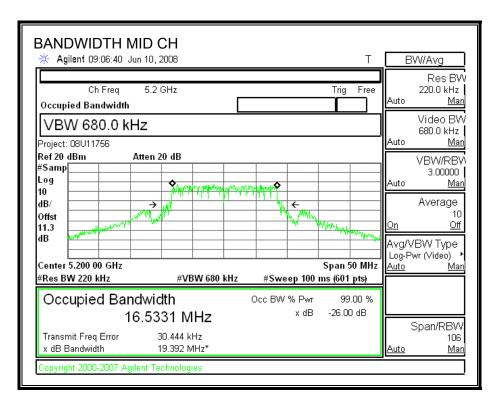
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

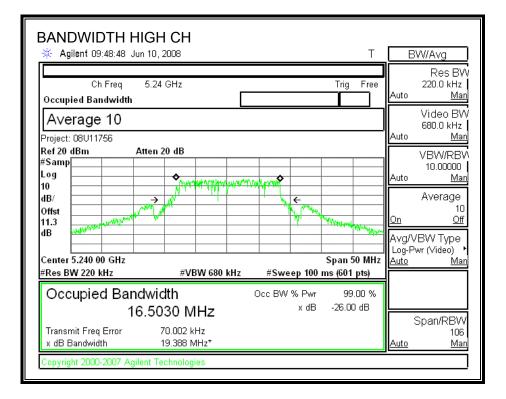
#### **RESULTS**

Channel	Frequency	26 dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	5180	19.330	16.5491
Middle	5200	19.392	16.5331
High	5240	19.388	16.5030



Page 16 of 334





Page 17 of 334

### 7.1.2. OUTPUT POWER

#### <u>LIMITS</u>

FCC §15.407 (a) (1) & IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output 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.

The maximum antenna gain is 5.35 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.

#### **RESULTS**

Limit						
Channel	Frequency	Fixed	В	4 + 10 Log B	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5180	17	19.330	16.86	5.35	16.86
Mid	5200	17	19.392	16.88	5.35	16.88
High	5240	17	19.388	16.88	5.35	16.88

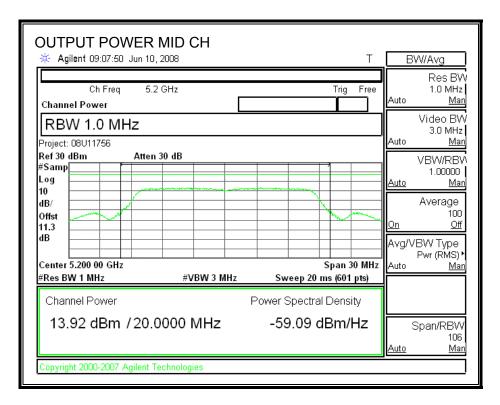
Results

Channel	Frequency	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	14.08	16.86	-2.78
Mid	5200	13.92	16.88	-2.96
High	5240	14.23	16.88	-2.65

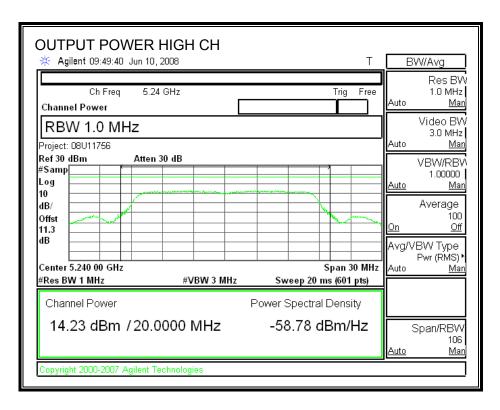
Page 18 of 334

#### **OUTPUT POWER**

OUTPUT POWER LOW CH	BW/Avg
Ch Freq 5.18 GHz Trig Free Channel Power	Res BW 1.0 MHz Auto <u>Man</u>
RBW 1.0 MHz	Video BW 3.0 MHz Auto <u>Man</u>
Ref 30 dBm         Atten 30 dB           #Samp	VBW/RBV 1.00000 <u>Auto Man</u> Average 100 <u>On Off</u>
	Avg/VBW Type Pwr (RMS) <b>^</b> Auto <u>Man</u>
Channel Power Power Spectral Density 14.08 dBm / 20.0000 MHz -58.93 dBm/Hz	Span/RBW 106 <u>Auto Man</u>
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Page 19 of 334



Page 20 of 334

### 7.1.3. PEAK POWER SPECTRAL DENSITY

#### <u>LIMITS</u>

FCC §15.407 (a) (1) & IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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.

The maximum antenna gain is 5.35 dBi, therefore the limit is 4 dBm.

#### 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.

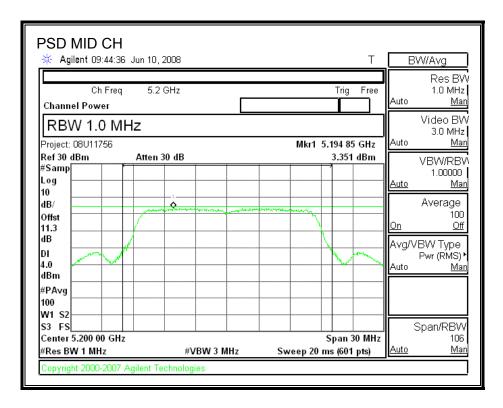
#### **RESULTS**

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	3.299	4.00	-0.70
Middle	5200	3.351	4.00	-0.65
High	5240	3.190	4.00	-0.81

Page 21 of 334

#### **POWER SPECTRAL DENSITY**

PSD LOW CH	2008	т	Measure
Ch Freq 5.18 Channel Power	GHz	Trig Free	Meas Off
RBW 1.0 MHz Project: 08U11756		Mkr1 5.176 65 GHz	Channel Power
Ref 30 dBm Atten 3 #Samp Log	30 dB	3.299 dBm	Occupied BW
10 dB/ Offst 11.3	1.		ACP
dB Dl 4.0			Multi Carrier Power
dBm #PAvg 100 W1 S2			Power Stat CCDF
Center 5.180 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span 30 MHz Sweep 20 ms (601 pts)	More 1 of 2
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Page 22 of 334

PSD HIGH CH	2008		Т	BV	W/Avg
Ch Freq 5.24 Channel Power	GHz	Trig	Free	Auto	Res BV 1.0 MHz <u>Mar</u>
RBW 1.0 MHz Project: 08U11756		Mkr1 5.244 3		Auto	Video BW 3.0 MHz <u>Mar</u>
Ref 30 dBm Atten 3 #Samp Log 10	30 dB	3.19	0 dBm	Auto	VBW/RBV 1.00000 <u>Mar</u>
dB/	and the second	1		<u>On</u>	Average 100 <u>Off</u>
dB DI 4.0 dBm					BW Type Pwr (RMS)∙ <u>Mar</u>
#PAvg 100 W1 S2					
S3 FS Center 5.240 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span Sweep 20 ms (60	30 MHz 1 pts)	S <u>Auto</u>	ipan/RBW 106 <u>Mar</u>

Page 23 of 334

### 7.1.4. PEAK EXCURSION

#### <u>LIMITS</u>

FCC §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.

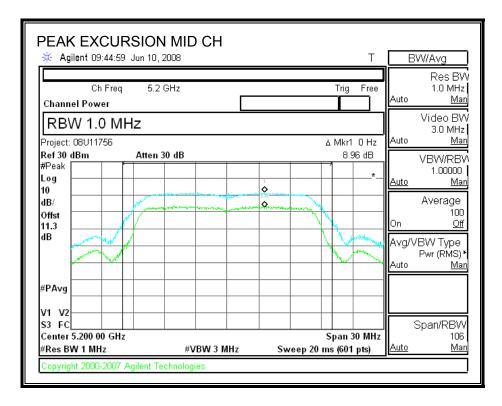
#### **RESULTS**

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5180	9.35	13	-3.65
Middle	5200	8.96	13	-4.04
High	5240	9.75	13	-3.25

Page 24 of 334

#### PEAK EXCURSION

PEAK EXCURSION	LOW CH		
🔆 🔆 Agilent 08:53:16 Jun 10, 2	:008	Т	Measure
Ch Freq 5.18 Channel Power	GHz	Trig Free	Meas Off
RBW 1.0 MHz Project: 08U11756		∆ Mkr1 0 Hz	Channel Power
Ref 30 dBm Atten 3 #Peak Log 10	0 dB	9.35 dB	Occupied BW
dB/ Offst 11.3			ACP
dB			Multi Carrier Power
#PAvg			Power Stat CCDF
Center 5.180 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span 30 MHz Sweep 20 ms (601 pts)	More 1 of 2
Copyright 2000-2007 Agilent Teo	chnologies		



Page 25 of 334

PEAK EXCURSION		Т	DIAIIAva
Ch Freq 5.24 Channel Power		Trig Free	BW/Avg Res BW 1.0 MHz Auto <u>Man</u>
RBW 1.0 MHz Project: 08U11756		▲ Mkr1 O Hz	Video BW 3.0 MHz Auto <u>Man</u>
Ref 30 dBm Atten 3 #Peak Log 10	0 dB	9.75 dB	VBW/RBW 1.00000 <u>Auto Man</u>
dB/ Offst 11.3	1k	muniment the	Average 100 On <u>Off</u>
dB			Avg/VBW Type Pwr (RMS) • Auto <u>Man</u>
#PAvg			-
V1 V2 S3 FC Center 5.240 00 GHz		Span 30 MHz	Span/RBVV
#Res BW 1 MHz	#VBW 3 MHz	Span 50 MHz Sweep 20 ms (601 pts)	Auto Man
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Page 26 of 334

### 7.1.5. CONDUCTED SPURIOUS EMISSIONS

#### LIMITS

FCC §15.407 (b) (1) & IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

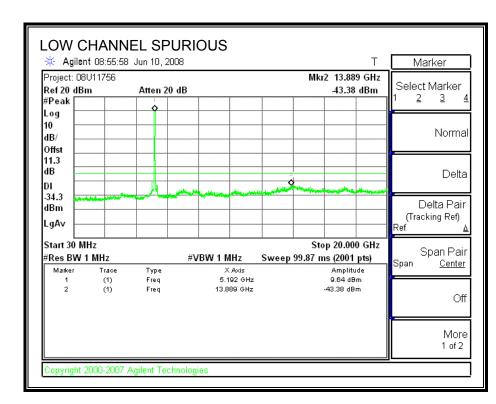
Limit line = -27 - EUT Antenna Gain

#### TEST PROCEDURE

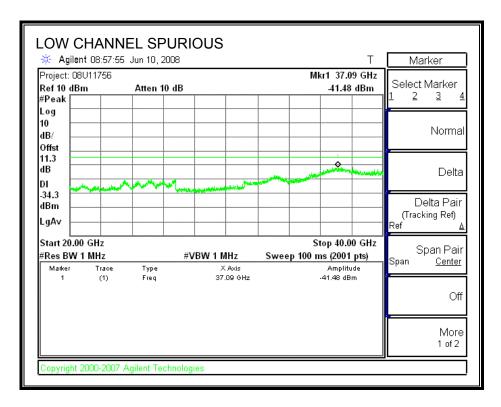
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

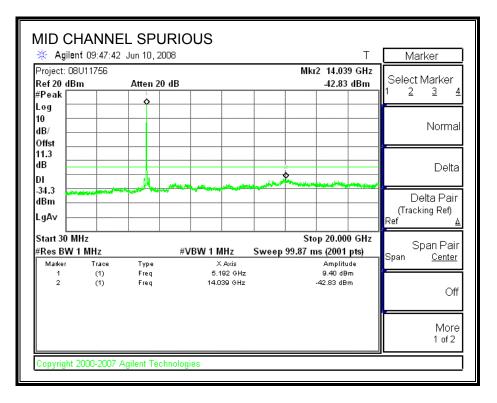
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

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

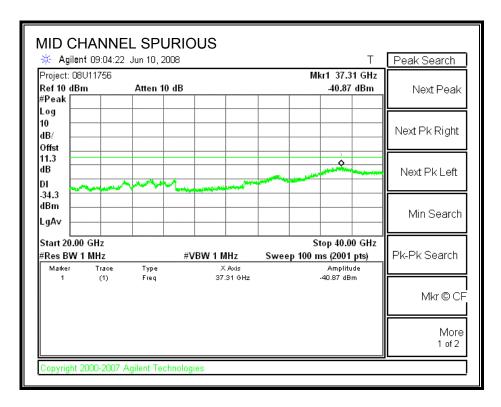


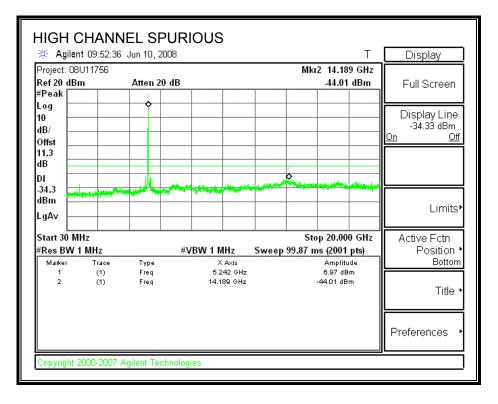
**RESULTS** 



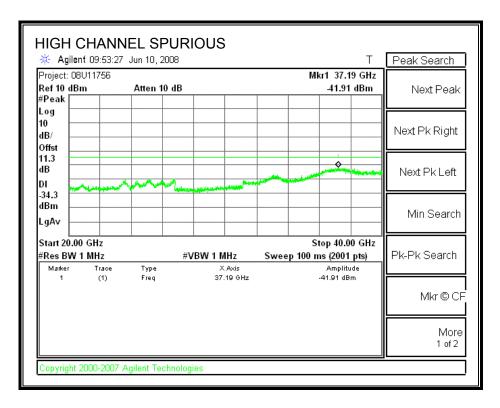


Page 28 of 334





Page 29 of 334



Page 30 of 334

### 7.2. 802.11n HT20 MODE

### 7.2.1. 26 dB and 99% BANDWIDTH

#### LIMITS

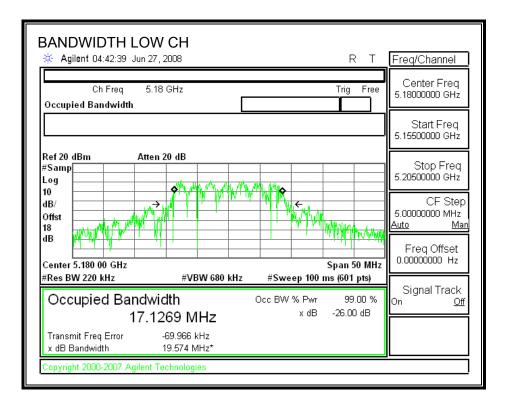
None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

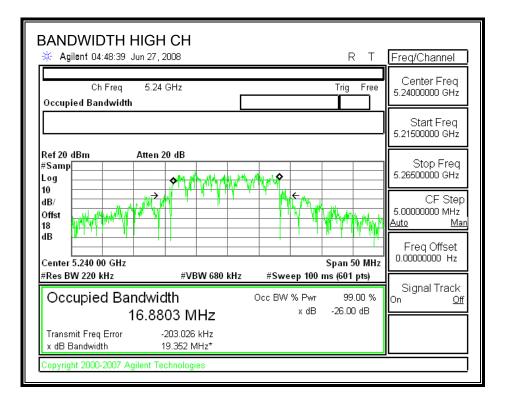
#### **RESULTS**

Channel	Frequency	26 dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	5180	19.574	17.1269
Middle	5200	19.252	17.1736
High	5240	19.352	16.8803



Page 31 of 334

BANDWIDTH MID CH		RT	Freq/Channel
Ch Freq 5.2 GHz Occupied Bandwidth		Trig Free	Center Freq 5.20000000 GHz
			Start Freq 5.17500000 GHz
Ref 20 dBm Atten 20 dB #Samp Log		>	Stop Freq 5.2250000 GHz
10 dB/ Offst 18			CF Step 5.0000000 MHz <u>Auto Man</u>
dB		Span 50 MHz	Freq Offset 0.00000000 Hz
#Res BW 220 kHz # Occupied Bandwidth		<b>veep 100 ms (601 pts)</b> V % Pwr 99.00 %	Signal Track On <u>Off</u>
17.1736	MHz	x dB -26.00 dB	<u> </u>
Transmit Freq Error 16.58 x dB Bandwidth 19.25	7 kHz 2 MHz*		
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Page 32 of 334

### 7.2.2. OUTPUT POWER

#### **LIMITS**

FCC §15.407 (a) (1); IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output 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.

- Composite Antenna Gains:
  - X9 PIFA (5.35 dBi) plus X9 Slot (0.63 dBi) = 6.61 dBi
  - Foxconn PIFA (2.99 dBi) plus X 9 Slot (4.11 dBi) = 6.60 dBi

The maximum antenna gain is 6.61 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.

#### **RESULTS**

Limit

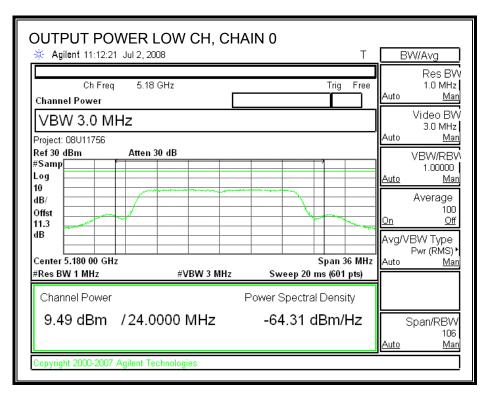
Channel	Frequency	Fixed	В	4 + 10 Log B	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5180	17	19.574	16.92	6.61	16.30
Mid	5200	17	19.252	16.84	6.61	16.23
High	5240	17	19.352	16.87	6.61	16.26

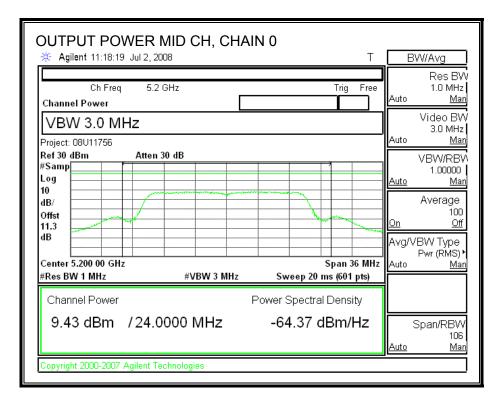
#### Individual Chain Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5180	9.49	9.54	12.53	16.30	-3.78
Mid	5200	9.43	9.69	12.57	16.23	-3.66
High	5240	9.53	9.57	12.56	16.26	-3.69

Page 33 of 334

#### CHAIN 0 OUTPUT POWER



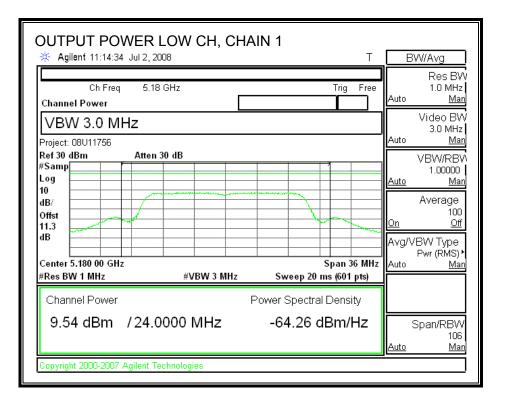


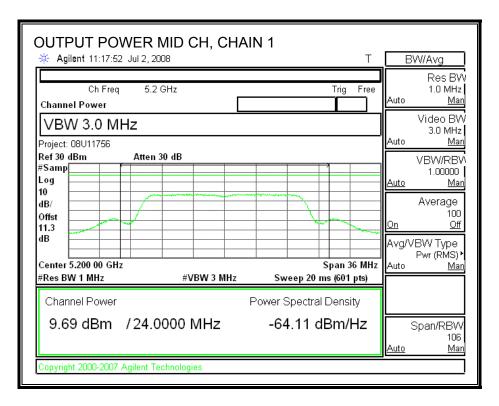
Page 34 of 334

Ch Freq       5.24 GHz       Trig       Free         Channel Power       I.0 MHz         Project:       08U11756         Ref 30 dBm       Atten 30 dB         Y Samp       I.0 MHz         Log       II.0 MHz         10       II.0 MHz         dB/       II.0 MHz         Offst       II.0 MHz         11.3       II.0 MHz         MB       II.0 MHz         VBW/RBW       II.0000         Auto       Man         VBW/RBW       II.0000         Auto       Man         VBW/RBW       II.0000         Auto       Man         VBW/RBW       II.0000         Auto       Man         Average       100         Offst       Span 36 MHz         #Res BW 1 MHz       VBW 1 MHz       Sweep 20 ms (601 pts)         Channel Power       Power Spectral Density         9.53 dBm       / 24.0000 MHz       -64.27 dBm/Hz         Span/RBW       106         Auto       Man	OUTPUT POWER HIGH CH, CHAIN 0 Agilent 11:15:52 Jul 2, 2008 T	BW/Avg
Project: 08U11756 Ref 30 dBm Atten 30 dB #Samp Log 10 dB/ Offst 11.3 dB Center 5.240 00 GHz #Res BW 1 MHz VBW 1 MHz Sweep 20 ms (601 pts) Channel Power 9.53 dBm / 24.0000 MHz -64.27 dBm/Hz Span/RBW/ 106	Ch Freq 5.24 GHz Trig Free	Res BW 1.0 MHz Auto <u>Man</u> Video BW
#Res BW 1 MHz         VBW 1 MHz         Sweep 20 ms (601 pts)           Channel Power         Power Spectral Density           9.53 dBm         / 24.0000 MHz         -64.27 dBm/Hz           Span/RBW 106	Ref 30 dBm Atten 30 dB #Samp defined and d	Auto Man VBW/RBW 1.00000 Auto Man Average 100 On Off Avg/VBW Type
9.53 dBm / 24.0000 MHz -64.27 dBm/Hz Span/RBW		Auto <u>Man</u>
Copyright 2000-2007 Agilent Technologies	9.53 dBm / 24.0000 MHz -64.27 dBm/Hz	106

Page 35 of 334

#### CHAIN 1 OUTPUT POWER





Page 36 of 334

OUTPUT POWER HIGH CH, CHAIN 1 Agilent 11:16:13 Jul 2, 2008 T	BW/Avg
Ch Freq 5.24 GHz Trig Free	Res BW 1.0 MHz Auto <u>Man</u> Video BW 1.0 MHz
dB	Auto Man VBW/RBW 1.00000 Auto Man Average 100 On Off Avg/VBW Type Pwr (RMS) •
Center 5.240 00 GHz Span 36 MHz #Res BW 1 MHz VBW 1 MHz Sweep 20 ms (601 pts)	Auto <u>Man</u>
Channel Power Power Spectral Density 9.57 dBm / 24.0000 MHz -64.23 dBm/Hz	Span/RBW 106 <u>Auto Man</u>
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Page 37 of 334

## 7.2.3. PEAK POWER SPECTRAL DENSITY

## LIMITS

FCC §15.407 (a) (1); IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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.

- Composite Antenna Gains:
  - X9 PIFA (5.35 dBi) plus X9 Slot (0.63 dBi) = 6.61 dBi
  - Foxcom PIFA (2.99 dBi) plus X 9 Slot (4.11 dBi) = 6.60 dBi

The maximum antenna gain is 6.61 dBi, therefore the limit is 3.39 dBm.

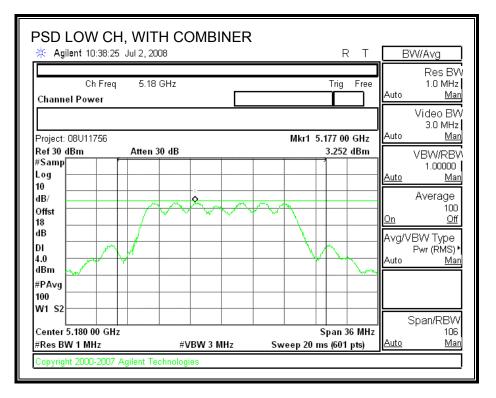
## TEST PROCEDURE

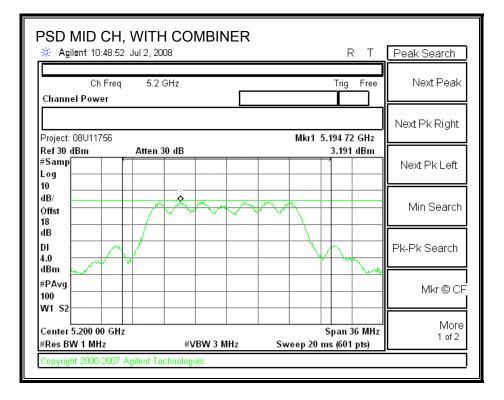
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

## **RESULTS**

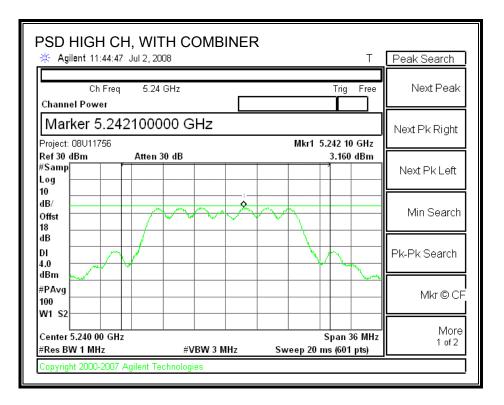
Channel	Frequency	PPSD With Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5180	3.252	3.39	-0.14
Middle	5200	3.191	3.39	-0.20
High	5240	3.160	3.39	-0.23

#### POWER SPECTRAL DENSITY WITH COMBINER





Page 39 of 334



Page 40 of 334

## 7.2.4. PEAK EXCURSION

## LIMITS

FCC §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 transmitter outputs are connected to the spectrum analyzer.

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.

## <u>RESULTS</u>

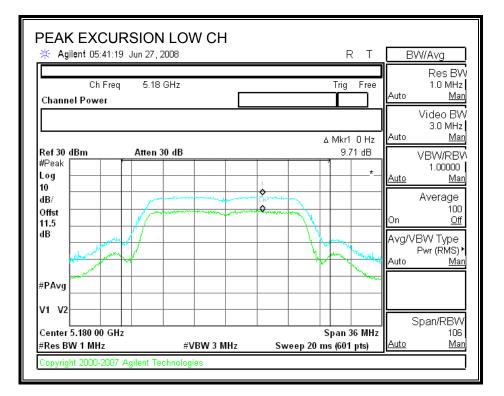
Chain 0

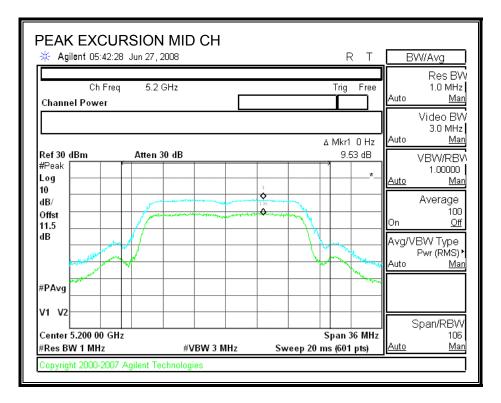
Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5180	9.71	13	-3.29
Middle	5200	9.53	13	-3.47
High	5240	8.13	13	-4.87

Chain 1

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5180	9.74	13	-3.26
Middle	5200	9.38	13	-3.62
High	5240	9.98	13	-3.02

### PEAK EXCURSION (CHAIN 0)



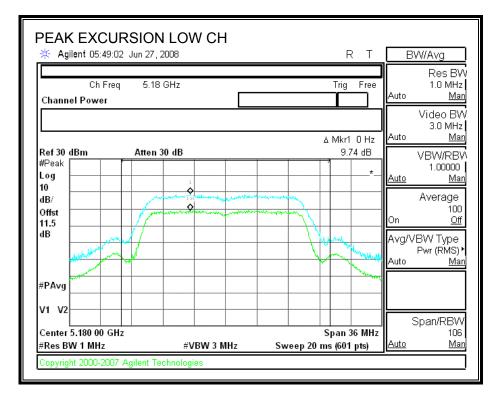


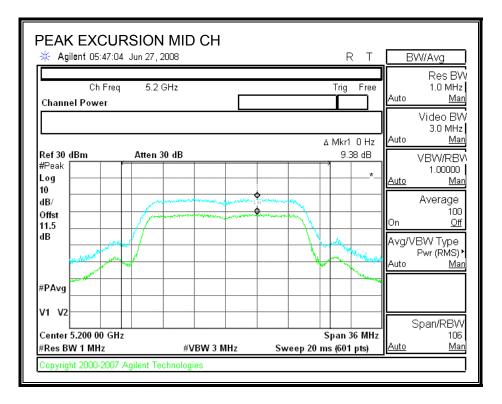
Page 42 of 334

🔆 Agilent 05:43:37 Jun 27	, 2008		RΤ	В	W/Avg
Ch Freq 5.2 Channel Power	4 GHz		Trig Free	Auto	Res BV 1.0 MHz <u>Ma</u>
	E		Mkr1 0 Hz	Auto	Video BV 3.0 MHz <u>Ma</u>
Ref 30 dBm Atter #Peak Log 10	1 30 dB		8.13 dB	<u>Auto</u>	VBW/RB\ 1.00000 <u>Mar</u>
dB/ 0ffst 11.5	****	and the second sec		On	Average 100 <u>Off</u>
dB			and the second second	A∨g/∖ Auto	/BW Type Pwr (RMS) <u>Ma</u>
#PAvg					
V1 V2					Span/RBV
Center 5.240 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Sweep 20 m	Span 36 MHz s (601 nts)	Auto	106 Mai

Page 43 of 334

## PEAK EXCURSION (CHAIN 1)





Page 44 of 334

🔆 Agilent 05:45:09 Jun 23	7, 2008			RΤ	E	3W/Avg
Ch Freq 5.3 Channel Power	24 GHz			Trig Free	Auto	Res BV 1.0 MHz <u>Mar</u>
RBW 1.0 MHz			۵	Mkr1 0 Hz	Auto	Video BV 3.0 MHz <u>Mar</u>
#Peak Log	n 30 dB	1	,	9.98 dB	Auto	VBW/RB\ 1.00000 <u>Mar</u>
10 dB/ Offst 11.5	and a second				On	Average 100 <u>Off</u>
dB				man where the	Avg/\	/BW Type Pwr (RMS) <sup>I</sup> <u>Mar</u>
#PAvg						
V1 V2						Span/RBW
Center 5.240 00 GHz #Res BW 1 MHz	#VBW 3 N	AHZ S	weep 20 ms	pan 36 MH: s (601 pts)	z Auto	106 <u>Mar</u>

Page 45 of 334

## 7.2.5. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.407 (b) (1); IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

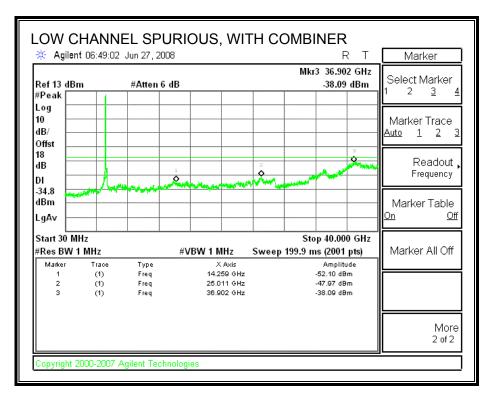
Limit line = -27 - EUT Antenna Gain

#### 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.

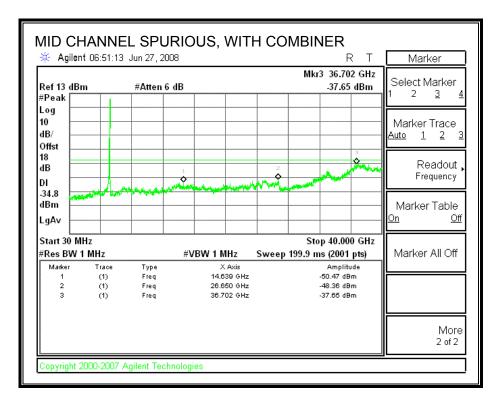
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

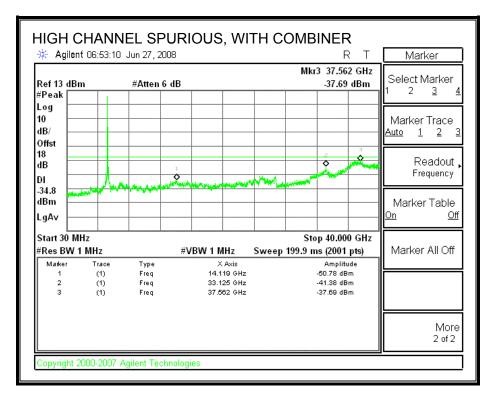
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.



## **RESULTS**

Page 46 of 334





Page 47 of 334

# 7.3. 802.11n HT40 SISO MODE

## 7.3.1. 26 dB and 99% BANDWIDTH

## LIMITS

None; for reporting purposes only.

## TEST PROCEDURE

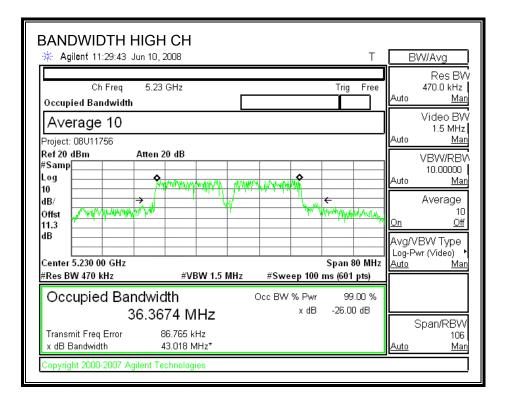
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

#### **RESULTS**

Channel	Frequency	26 dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	5190	38.942	36.064
High	5230	43.018	36.367

Page 48 of 334

Ch Freq 5.19 GHz Trig Free Occupied Bandwidth Average 10 Project: 08U11756 Ref 20 dBm Atten 20 dB	Auto <u>Man</u> Video BW 1.3 MHz Auto <u>Man</u>
Project: 08U11756	1.3 MHz Auto <u>Man</u>
Ref 20 dBm Atten 20 dB	
#Samp Log 10 dB/ Offst 11.3 dB	VBW/RBV 10.0000   Auto <u>Man</u> Average 10 0n <u>Off</u> Avg/VBW Type
Center 5.190 00 GHz Span 80 MH #Res BW 470 kHz #VBW 1.3 MHz #Sweep 100 ms (601 pts)	Log-Pwr (Video) I Z <u>Auto Man</u>
Occupied Bandwidth         Occ BW % Pwr         99.00 %           36.0640 MHz         × dB         -26.00 dB	Span/RBW
Transmit Freq Error 165.286 kHz x dB Bandwidth 38.942 MHz* Copyright 2000-2007 Agilent Technologies	106 Auto Man



Page 49 of 334

## 7.3.2. OUTPUT POWER

## <u>LIMITS</u>

FCC §15.407 (a) (1) & IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output 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.

The maximum antenna gain is 5.35 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.

### **RESULTS**

#### Limit

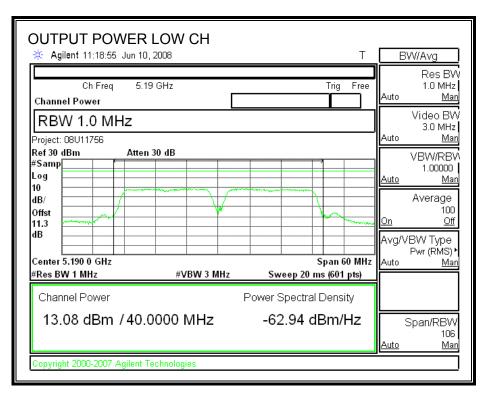
Channel	Frequency	Fixed	В	4 + 10 Log B	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5190	17	38.942	19.90	5.35	17.00
High	5230	17	43.018	20.34	5.35	17.00

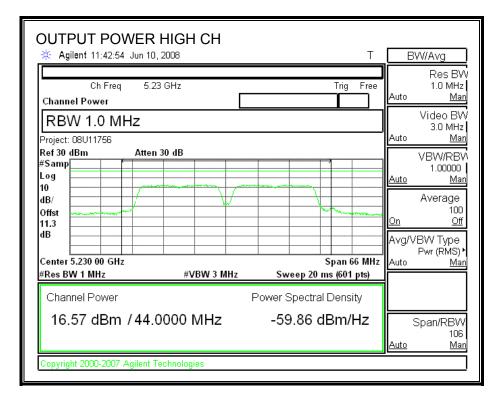
Results

Channel	Frequency	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5190	13.08	17.00	-3.92
High	5230	16.57	17.00	-0.43

Page 50 of 334

### OUTPUT POWER





Page 51 of 334

## 7.3.3. PEAK POWER SPECTRAL DENSITY

### LIMITS

FCC §15.407 (a) (1) & IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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.

The maximum antenna gain is 5.35 dBi, therefore the limit is 4 dBm.

### 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.

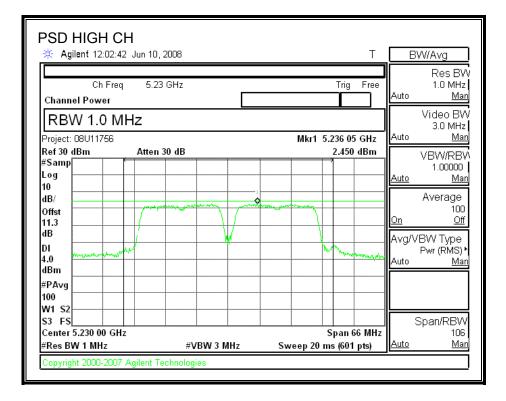
#### **RESULTS**

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5190	-0.496	4.00	-4.50
High	5230	2.450	4.00	-1.55

Page 52 of 334

### POWER SPECTRAL DENSITY

PSD LOW CH	2008	Т	BW/Avg
	9 GHz	Trig Fre	Res BW
Channel Power RBW 1.0 MHz			Auto <u>Man</u> Video BW
Project: 08U11756		Mkr1 5.195 5 GHz	3.0 MHz Auto <u>Man</u>
Ref 30 dBm Atten #Samp Log 10	30 dB	-0.496 dBm	VBW/RBW 1.00000 <u>Auto Man</u>
dB/ Offst 11.3			Average 100 <u>On Off</u>
dB /	¥		Avg/VBW Type Pwr (RMS) • Auto <u>Man</u>
#PAvg 100 W1 S2			
S3 FS Center 5.190 0 GHz #Res BW 1 MHz	#VBW 3 MHz	Span 60 MH Sweep 20 ms (601 pts)	z Span/RBW z 106 <u>Auto Man</u>
Copyright 2000-2007 Agilent T	echnologies		



Page 53 of 334

## 7.3.4. PEAK EXCURSION

### <u>LIMITS</u>

FCC §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.

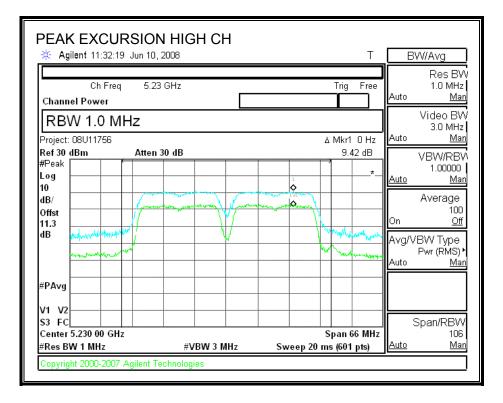
#### **RESULTS**

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5190	8.56	13	-4.44
High	5230	9.42	13	-3.58

Page 54 of 334

#### PEAK EXCURSION

PEAK EXCURSION			Т	E B	W/Avg
Ch Freq 5.19 Channel Power			Trig Free	Auto	Res BW 1.0 MHz <u>Man</u>
RBW 1.0 MHz Project: 08U11756		۵	Mkr1 0 Hz	Auto	Video BW 3.0 MHz <u>Man</u>
Ref 30 dBm Atten 3 #Peak Log 10	0 dB	,	8.56 dB	<u>Auto</u>	VBW/RBV 1.00000 <u>Man</u>
dB/ Offst 11.3				On	Average 100 <u>Off</u>
dB			Martin Martin	Avg/V Auto	′BW Type Pwr (RMS)► <u>Man</u>
#PAvg					
S3 FC Center 5.190 0 GHz #Res BW 1 MHz	#VBW 3 MHz	Sweep 20 ms	pan 60 MHz s (601 pts)	< <u>Auto</u>	Span/RBW 106 <u>Man</u>
Copyright 2000-2007 Agilent Te	chnologies				



Page 55 of 334

## 7.3.5. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.407 (b) (1) & IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

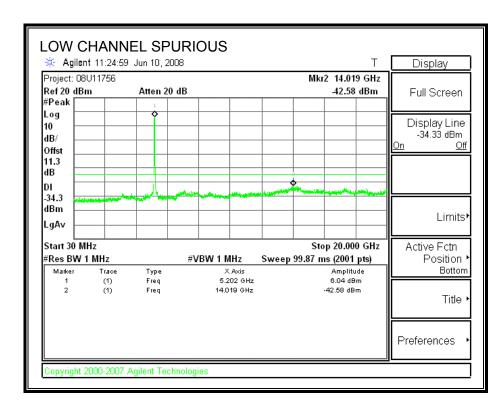
Limit line = -27 - EUT Antenna Gain

#### TEST PROCEDURE

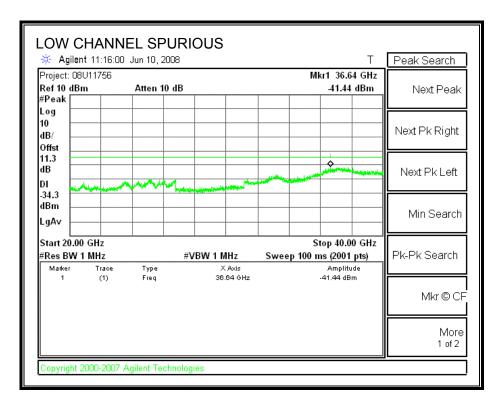
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

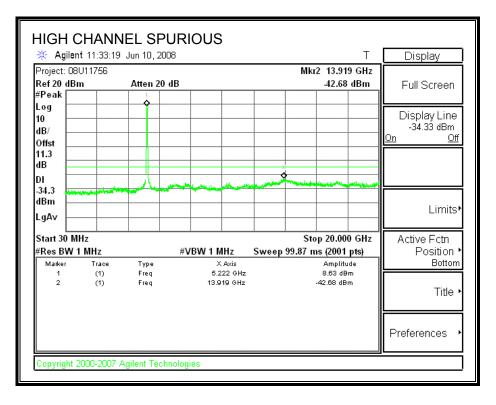
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

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

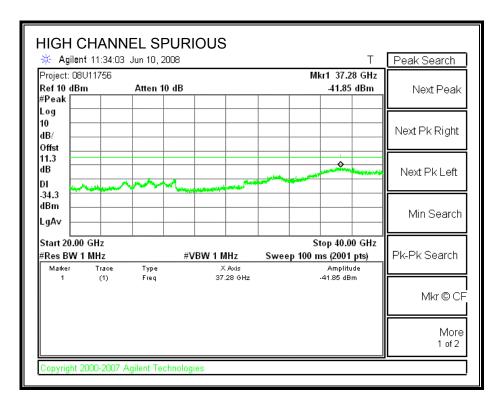


**RESULTS** 





Page 57 of 334



Page 58 of 334

## 7.4. 802.11n HT40 MODE

## 7.4.1. 26 dB and 99% BANDWIDTH

## <u>LIMITS</u>

None; for reporting purposes only.

## TEST PROCEDURE

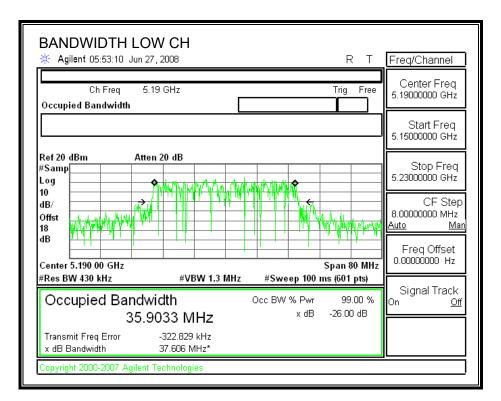
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

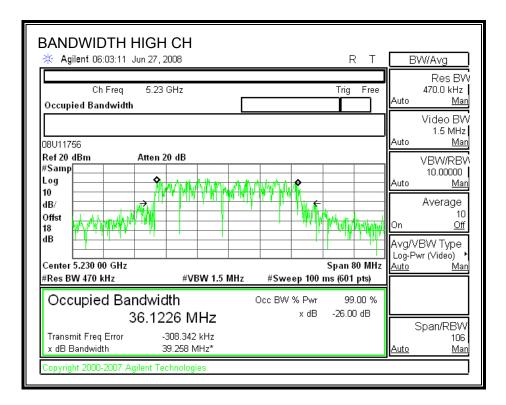
#### **RESULTS**

Channel	Frequency	26 dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	5190	37.606	35.9033
High	5230	39.258	36.1226

Page 59 of 334

#### 26 dB and 99% BANDWIDTH





Page 60 of 334

## 7.4.2. OUTPUT POWER

## **LIMITS**

## FCC §15.407 (a) (1); IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output 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.

- Composite Antenna Gains:
  - X9 PIFA (5.35 dBi) plus X9 Slot (0.63 dBi) = 6.61 dBi
  - Foxconn PIFA (2.99 dBi) plus X 9 Slot (4.11 dBi) = 6.60 dBi

The maximum antenna gain is 6.61 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.

## **RESULTS**

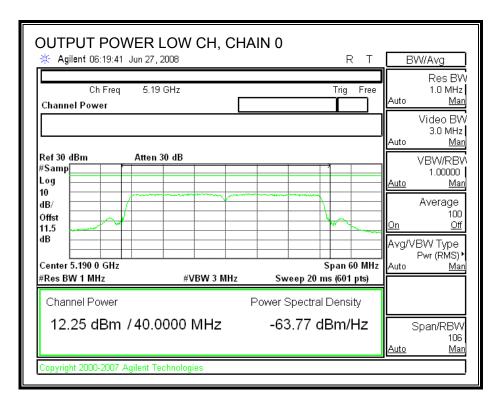
Limit

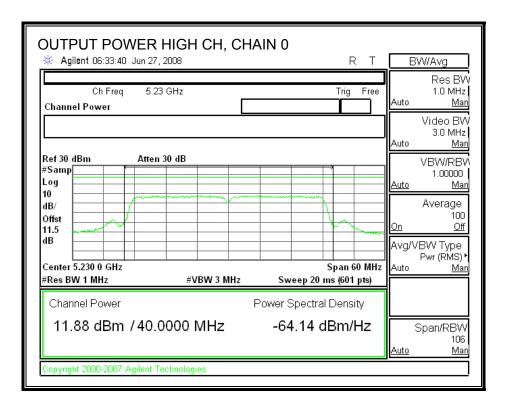
Channel	Frequency	Fixed	В	4 + 10 Log B	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5190	17	37.606	19.75	6.61	16.39
High	5230	17	39.258	19.94	6.61	16.39

Individual Chain Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5190	12.25	12.26	15.27	16.39	-1.12
High	5230	11.88	12.51	15.22	16.39	-1.17

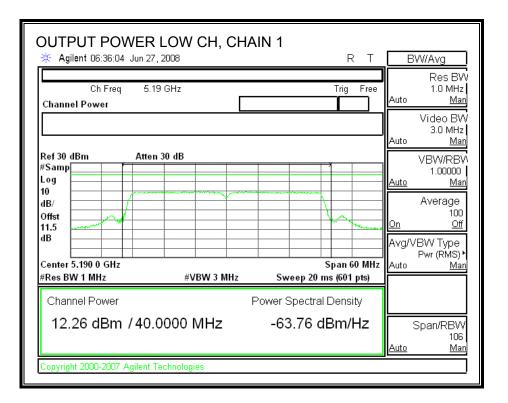
## CHAIN 0 OUTPUT POWER

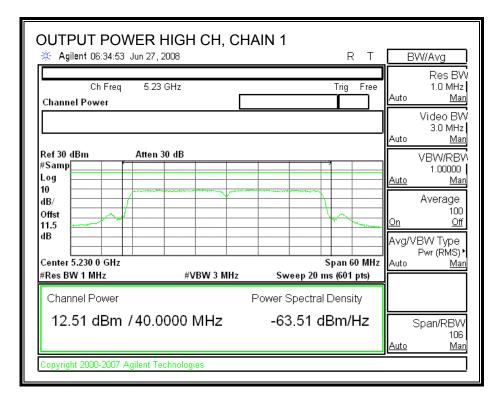




Page 62 of 334

#### CHAIN 1 OUTPUT POWER





Page 63 of 334

## 7.4.3. PEAK POWER SPECTRAL DENSITY

## **LIMITS**

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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.

- Composite Antenna Gains:
  - X9 PIFA (5.35 dBi) plus X9 Slot (0.63 dBi) = 6.61 dBi
  - Foxcom PIFA (2.99 dBi) plus X 9 Slot (4.11 dBi) = 6.60 dBi

The maximum antenna gain is 6.61 dBi, therefore the limit is 3.39 dBm.

## TEST PROCEDURE

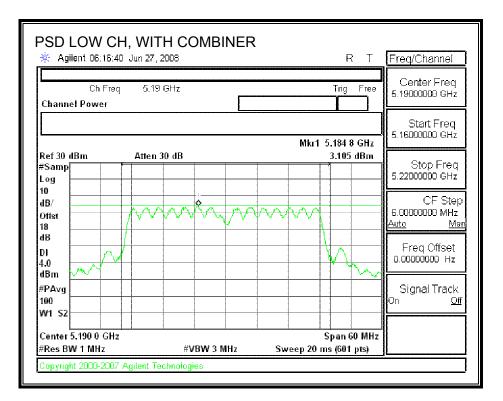
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

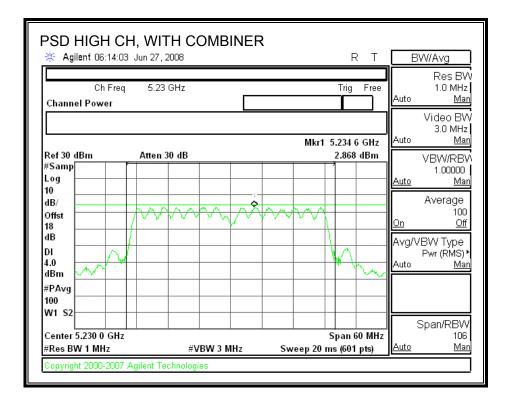
#### **RESULTS**

Channel	Frequency	PPSD With Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5190	3.105	3.39	-0.28
High	5230	2.868	3.39	-0.52

Page 64 of 334

### POWER SPECTRAL DENSITY WITH COMBINER





Page 65 of 334

## 7.4.4. PEAK EXCURSION

## **LIMITS**

FCC §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 transmitter outputs are connected to the spectrum analyzer via a combiner.

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.

## <u>RESULTS</u>

CHAIN 0

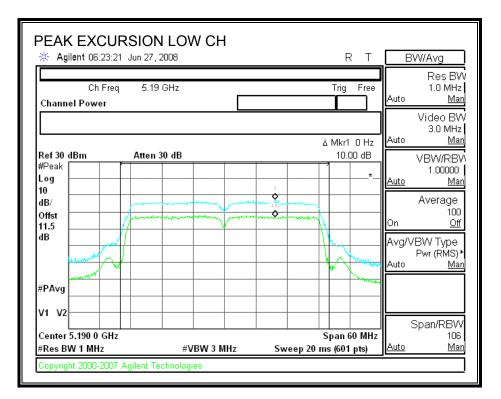
Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5190	10.00	13	-3.00
High	5230	11.60	13	-1.40

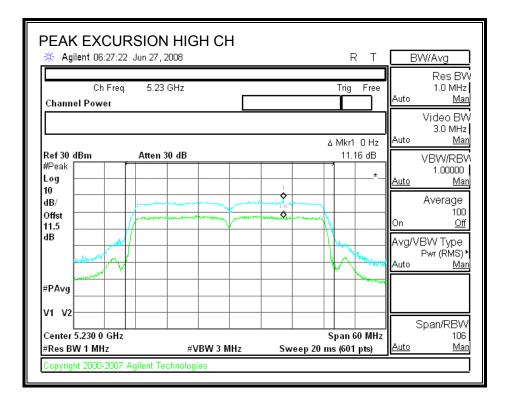
CHAIN 1

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5190	10.47	13	-2.53
High	5230	10.64	13	-2.36

Page 66 of 334

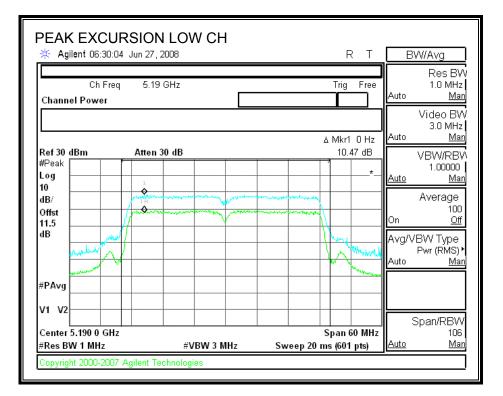
### PEAK EXCURSION (CHAIN 0)

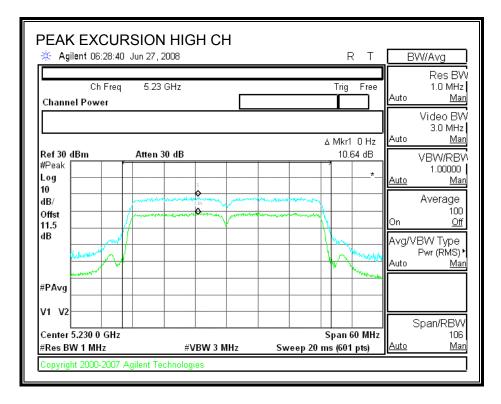




Page 67 of 334

## PEAK EXCURSION (CHAIN 1)





Page 68 of 334

## 7.4.5. CONDUCTED SPURIOUS EMISSIONS

## LIMITS

FCC §15.407 (b) (1); IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

Limit line = -27 - EUT Antenna Gain

### 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.

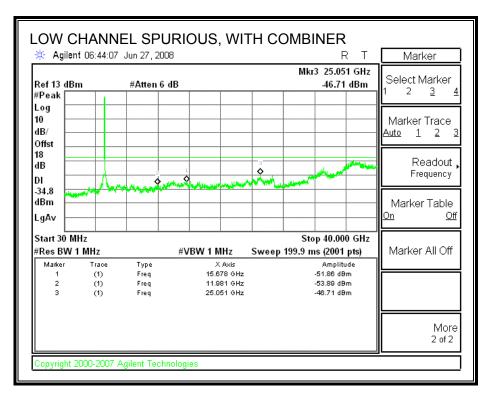
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

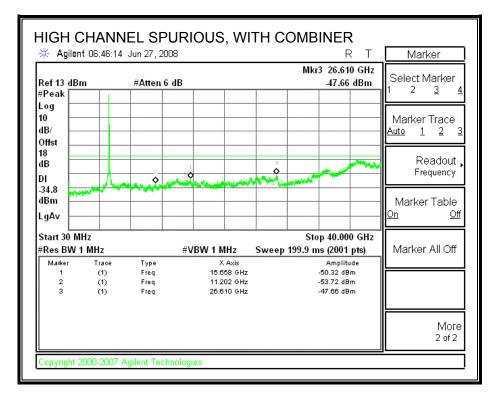
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**RESULTS** 

Page 69 of 334

### SPURIOUS EMISSIONS WITH COMBINER





Page 70 of 334

# 8. ANTENNA PORT TEST RESULTS FOR 5.25–5.35 GHZ BAND

# 8.1. 802.11a MODE

## 8.1.1. 26 dB and 99% BANDWIDTH

## <u>LIMITS</u>

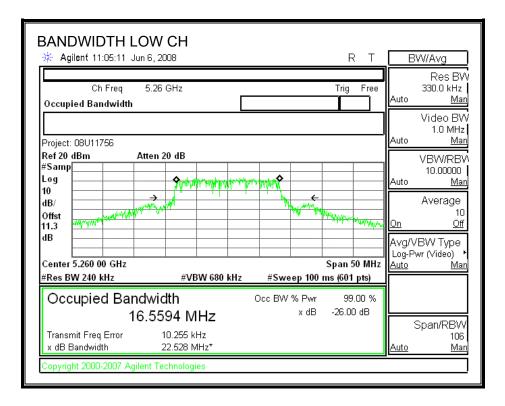
None; for reporting purposes only.

## TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

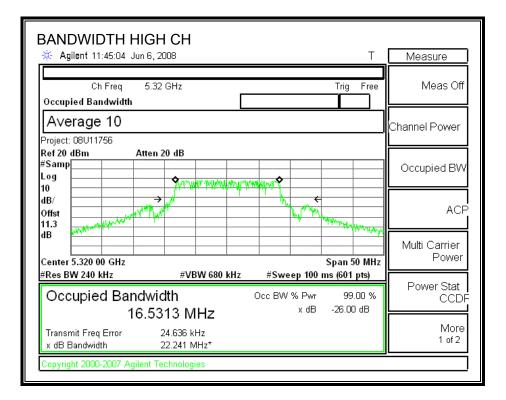
#### **RESULTS**

Channel	Frequency	26 dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	5260	22.528	16.5594
Middle	5300	22.844	16.5778
High	5320	22.241	16.5313



Page 71 of 334

BANDWIDTH MID CH	Measure
Ch Freq 5.3 GHz Trig Free Occupied Bandwidth	Meas Off
Average 10	Channel Power
Project: 08U11756 Ref 20 dBm Atten 20 dB #Samp Log	Occupied BW
Log 10 10 dB/ Offst 1.3 VM/VM/M	ACP
dB Center 5.300 00 GHz Span 50 MHz	Multi Carrier Power
#Res BW 240 kHz #VBW 680 kHz #Sweep 100 ms (601 pts)	Power Stat
Occupied Bandwidth Occ BW % Pwr 99.00 % 16.5778 MHz × dB -26.00 dB	CCDF
Transmit Freq Error 53.848 kHz x dB Bandwidth 22.844 MHz*	More 1 of 2
Copyright 2000-2007 Agilent Technologies	



Page 72 of 334

# 8.1.2. OUTPUT POWER

# <u>LIMITS</u>

# FCC §15.407 (a) (2); IC RSS-210 A9.2 (2)

For the 5.25-5.35 GHz band, the maximum conducted output 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.

The maximum antenna gain is 6.42 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.

# **RESULTS**

Limit

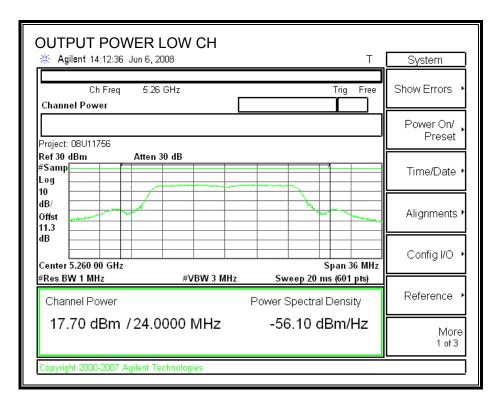
LIIIIC						
Channel	Frequency	Fixed	В	11 + 10 Log B	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5260	24	22.528	24.53	6.42	23.58
Mid	5300	24	22.844	24.59	6.42	23.58
High	5320	24	22.241	24.47	6.42	23.58

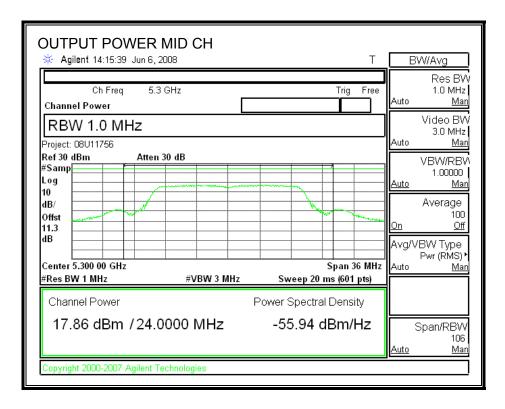
Results

Channel	Frequency	Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5260	17.70	23.58	-5.88
Mid	5300	17.86	23.58	-5.72
High	5320	14.80	23.58	-8.78

Page 73 of 334

### OUTPUT POWER





Page 74 of 334

OUTPUT POWER * Agilent 14:19:16 Jun 6,		Т	System
Ch Freq 5.3 Channel Power	2 GHz	Trig Free	Show Errors
Project: 08U11756			Power On/ Preset
#Samp Log	30 dB		Time/Date ▸
10 dB/ Offst 11.3			Alignments •
dB Center 5.320 00 GHz		Span 36 MHz	Config I/O 🔸
#Res BW 1 MHz Channel Power	#VBW 3 MHz	Sweep 20 ms (601 pts) Power Spectral Density	Reference 🕨
14.80 dBm /24.	More 1 of 3		
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Page 75 of 334

# 8.1.3. PEAK POWER SPECTRAL DENSITY

### <u>LIMITS</u>

FCC §15.407 (a) (2); IC RSS-210 A9.2 (2)

For the 5.25–5.35 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.

The maximum antenna gain is 6.42 dBi, therefore the limit is 10.58 dBm.

### TEST PROCEDURE

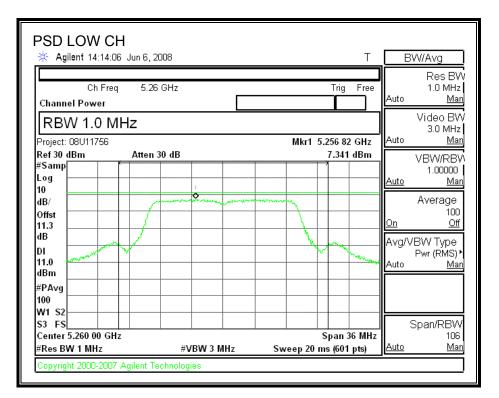
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

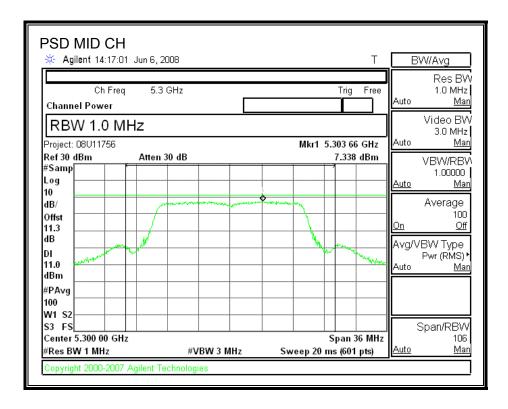
#### **RESULTS**

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5260	7.341	10.58	-3.24
Middle	5300	7.338	10.58	-3.24
High	5320	4.434	10.58	-6.15

Page 76 of 334

### **POWER SPECTRAL DENSITY**





Page 77 of 334

PSD HIGH CH			Т	В	W/Avg
Ch Freq Channel Power	5.32 GHz		Trig Free	Auto	Res BW 1.0 MHz <u>Man</u>
RBW 1.0 M	Ηz	Mkr1	5.323 48 GHz	Auto	Video BW 3.0 MHz <u>Man</u>
Ref 30 dBm #Samp Log 10	Atten 30 dB		4.434 dBm	<u>Auto</u>	VBW/RBV 1.00000 <u>Man</u>
dB/ Offst 11.3				<u>On</u>	Average 100 <u>Off</u>
dB DI 11.0 dBm				Avg/V Auto	′BW Type Pwr (RMS)≛ <u>Mar</u>
#PAvg 100 W1 S2					
S3 FS Center 5.320 00 GHz #Res BW 1 MHz	#VBW 3 I	MHz Sweep 20	Span 36 MHz ms (601 pts)	< <u>Auto</u>	Span/RBW 106 <u>Man</u>
Copyright 2000-2007 /	Agilent Technologies				

Page 78 of 334

# 8.1.4. PEAK EXCURSION

### LIMITS

FCC §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.

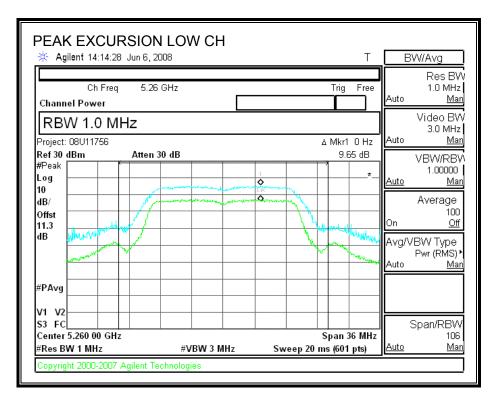
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

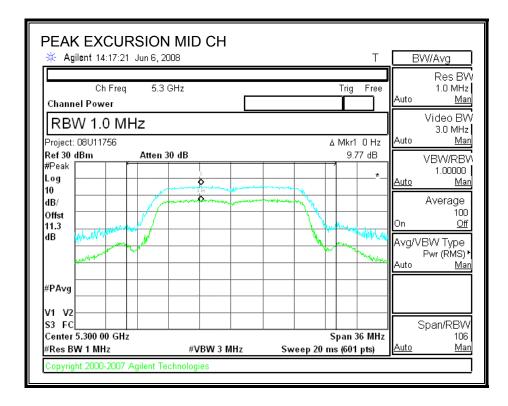
Channel	Frequency	equency Peak Excursion		Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5260	9.65	13	-3.35
Middle	5300	9.77	13	-3.23
High	5320	9.57	13	-3.43

#### RESULTS

Page 79 of 334

#### PEAK EXCURSION





Page 80 of 334

PEAK EXCURSION		Т	BW/Avg
Ch Freq 5.32 Channel Power		Trig Free	Res BW 1.0 MHz Auto <u>Man</u>
RBW 1.0 MHz Project: 08U11756		۵ Mkr1 O Hz	Video BVV 3.0 MHz Auto <u>Man</u>
Ref 30 dBm Atten 3 #Peak Log 10	10 dB	9.57 dB	VBW/RBW 1.00000 <u>Auto Man</u>
dB/ Offst 11.3			Average 100 On <u>Off</u>
dB			Avg/VBW Type Pwr (RMS)► Auto <u>Man</u>
#PAvg			-
V1 V2 S3 FC Center 5.320 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Span 36 MHz Sweep 20 ms (601 pts)	Span/RBW
Copyright 2000-2007 Agilent Te		5 4 6 6 7 2 6 ma (0 1 pta)	

Page 81 of 334

# 8.1.5. CONDUCTED SPURIOUS EMISSIONS

# <u>LIMITS</u>

FCC §15.407 (b) (2); IC RSS-210 A9.3 (2)

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.25-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

Limit line = -27 - EUT Antenna Gain

### 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.

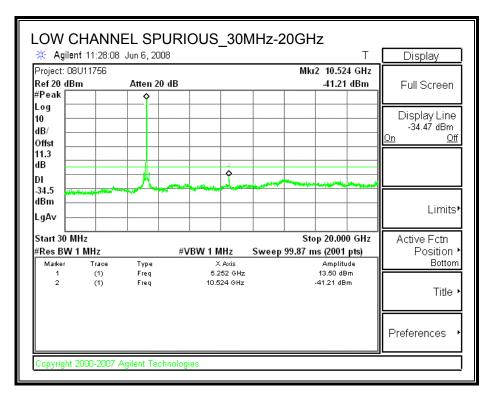
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

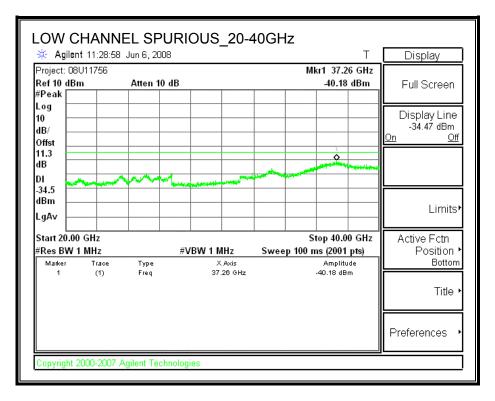
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**RESULTS** 

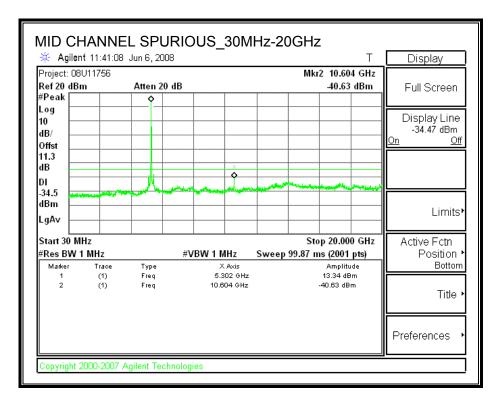
Page 82 of 334

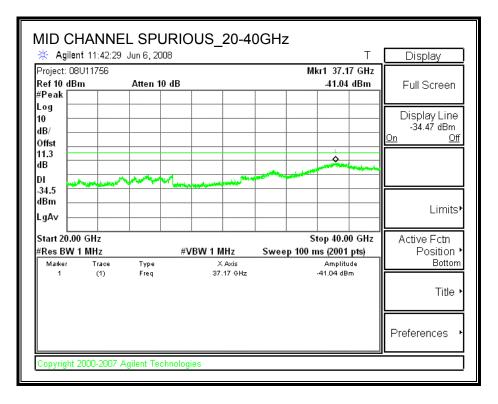
### SPURIOUS EMISSIONS



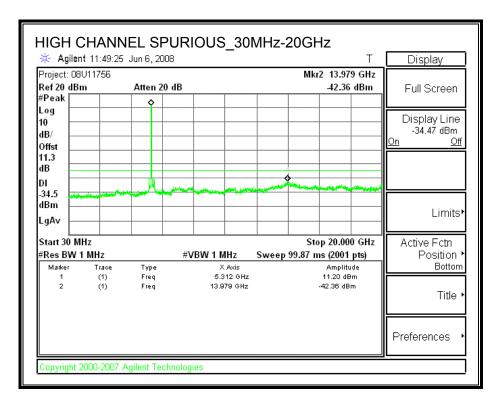


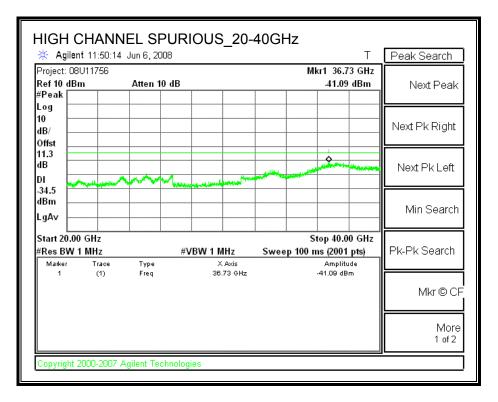
Page 83 of 334





Page 84 of 334





Page 85 of 334

# 8.2. 802.11n HT20 MODE

# 8.2.1. 26 dB and 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

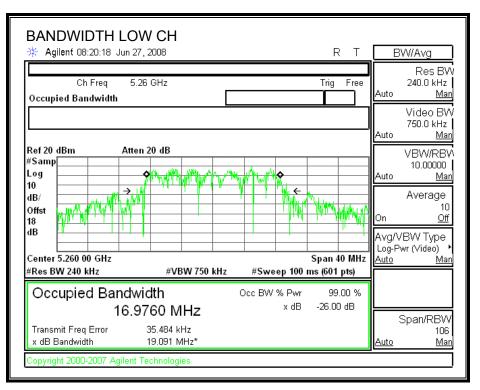
# TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

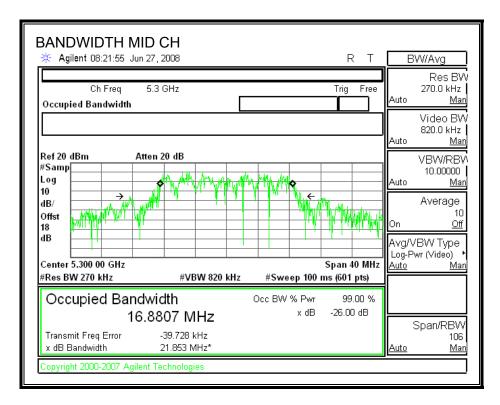
#### RESULTS

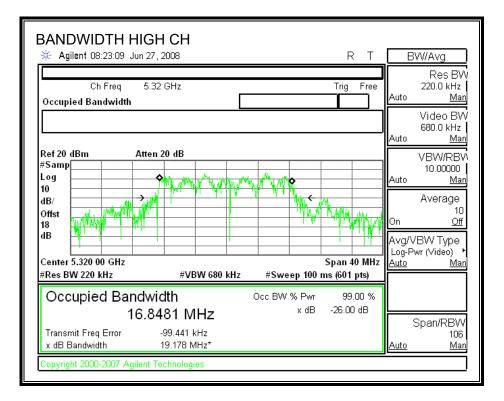
Channel	Frequency 26 dB Bandwidth		99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	5260	19.091	16.976
Middle	5300	21.853	16.8807
High	5320	19.178	16.8481

### 26 dB and 99% BANDWIDTH



Page 86 of 334





Page 87 of 334

# 8.2.2. OUTPUT POWER

# <u>LIMITS</u>

# FCC §15.407 (a) (2); IC RSS-210 A9.2 (2)

For the 5.25-5.35 GHz band, the maximum conducted output 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.

### **RESULTS**

Antenna Combination:

Foxconn PIFA WDAN-HQAT80-03-DF (2.99 dBi) plus X 9 Slot K5SLT (4.32 dBi) = 6.72 dBi

Limit						
Channel	Frequency	Fixed	В	11 + 10 Log B	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5260	24	19.091	23.81	6.72	23.09
Mid	5300	24	21.853	24.40	6.72	23.28
High	5320	24	19.178	23.83	6.72	23.11

Individual Chain Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	16.29	16.10	19.21	23.09	-3.89
Mid	5300	16.22	16.03	19.14	23.28	-4.15

Note: The high channel at 13dBm meets the spec of highest & lowest antenna gain combinations. Data in the table above only shows the low & mid channels; see table below for high channel.

# Antenna Combination:

# Tyco PIFA M97PFTAP2 (6.42 dBi) plus Tyco Slot M97SLTAP1 (2.28 dBi) = 7.84 dBi

Limit

Channel	Frequency	Fixed	В	11 + 10 Log B	Antenna	Limit
		Limit		Limit	Gain	
	(MHz)	(dBm)	(MHz)	(dBm)	(dBi)	(dBm)
Low	5260	24	19.091	23.81	7.84	21.97
Mid	5300	24	21.853	24.40	7.84	22.16
High	5320	24	19.178	23.83	7.84	21.99

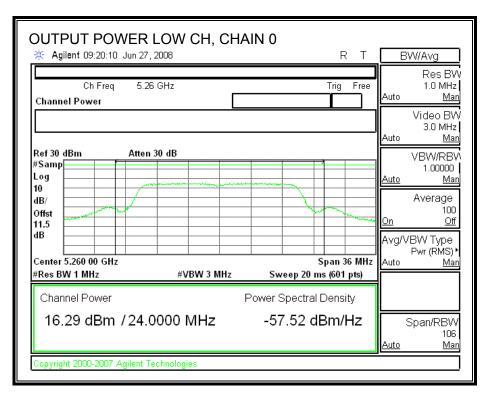
Individual Chain Results

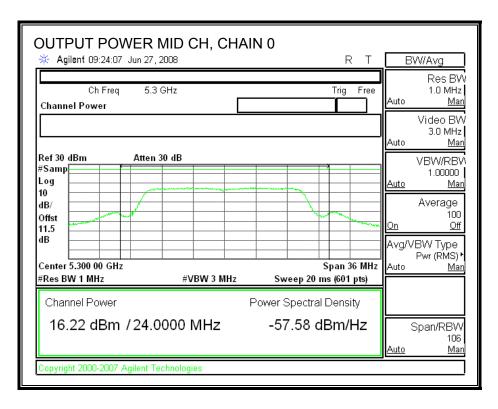
Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5260	15.02	15.07	18.06	21.97	-3.92
Mid	5300	15.27	15.22	18.26	22.16	-3.91
High	5320	13.38	13.30	16.35	21.99	-5.64

Page 89 of 334

#### Antenna Combination: Low PIFA / Hi Slot = 6.72 dBi

#### **CHAIN 0 OUTPUT POWER**

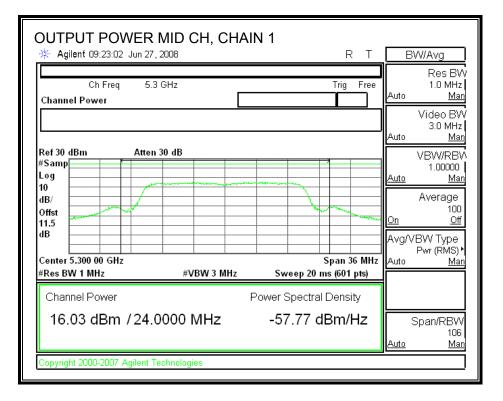




Page 90 of 334

#### **CHAIN 1 - OUTPUT POWER**

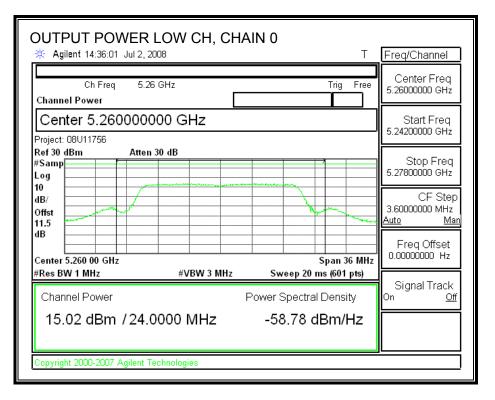
OUTPUT POWER LO	,	AIN 1	D T		0//0
- 🔆 Agilent 09:21:36 Jun 27, 2008	i		RT		W/Avg
Ch Freq 5.26 GH: Channel Power	z		Trig Free	Auto	Res BW 1.0 MHz <u>Man</u>
				Auto	Video BW 3.0 MHz <u>Man</u>
Ref 30 dBm         Atten 30 d           #Samp	B			<u>Auto</u> On Avg/V	VBW/RBW 1.00000 <u>Man</u> Average 100 <u>Off</u> BW Type Pwr (RMS)*
Center 5.260 00 GHz #Res BW 1 MHz	#VBW 3 MHz	Sweep 20 r	Span 36 MHz ns (601 pts)	Auto	Man
Channel Power		Power Spectral	Density		
16.10 dBm / 24.000	0 MHz	-57.70 d	lBm/Hz	S Auto	Span/RBW 106 <u>Man</u>
Copyright 2000-2007 Agilent Techno	ologies			•	

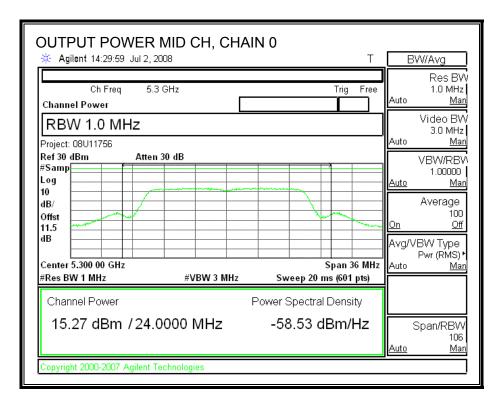


Page 91 of 334

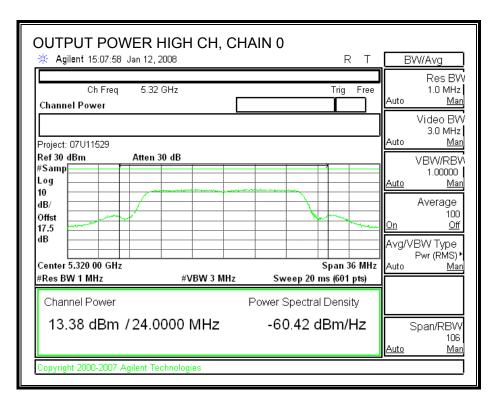
# Antenna Combination: Hi PIFA / Low Slot = 7.84 dBi

#### **CHAIN 0 OUTPUT POWER**

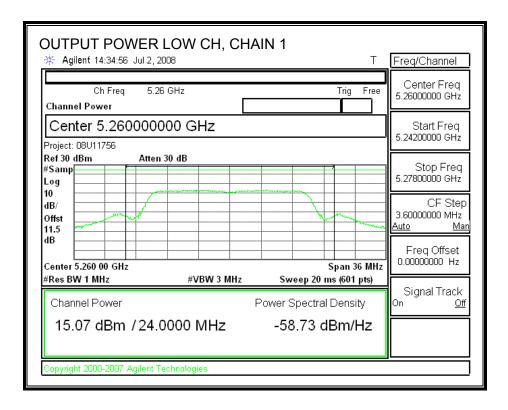




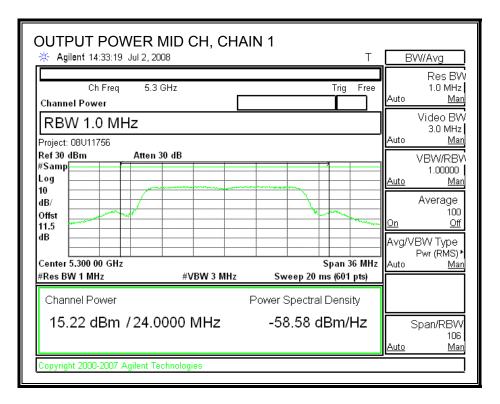
Page 92 of 334

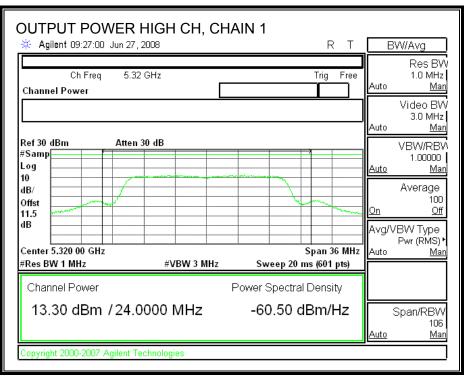


# CHAIN 1 - OUTPUT POWER



Page 93 of 334





Page 94 of 334

# 8.2.3. PEAK POWER SPECTRAL DENSITY

# <u>LIMITS</u>

FCC §15.407 (a) (2); IC RSS-210 A9.2 (2)

For the 5.25-5.35 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.

The maximum antenna gain is 6.72 dBi, therefore the limit is 10.28 dBm.

The maximum antenna gain is 7.84 dBi, therefore the limit is 9.16 dBm.

# 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**

Antenna Combination: Low PIFA / Hi Slot = 6.72dBi Foxconn PIFA WDAN-HQAT80-03-DF (2.99 dBi) plus X 9 Slot K5SLT (4.32 dBi) = 6.72 dBi

Channel	Frequency	PPSD With Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5260	10.240	10.28	-0.04
Middle	5300	10.148	10.28	-0.13

Note: The high channel at 13dBm meets the spec of highest & lowest antenna gain combinations. Data in the table above only shows the low & mid channels; see table below for high channel.

# **RESULTS**

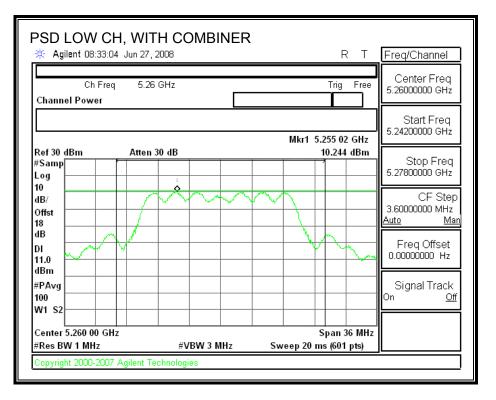
Antenna Combination: Hi PIFA / Low Slot = 7.84dBi Tyco PIFA M97PFTAP2 (6.42 dBi) plus Tyco Slot M97SLTAP1 (2.28 dBi) = 7.84 dBi

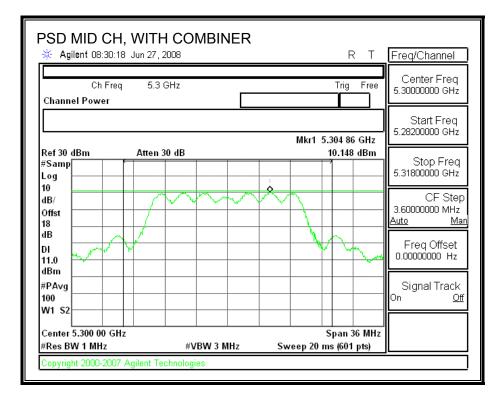
Channel	Frequency	PPSD With Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5260	8.970	9.16	-0.19
Middle	5300	8.900	9.16	-0.26
High	5320	6.950	9.16	-2.21

Page 95 of 334

Antenna Combination: Low PIFA / Hi Slot = 6.72dBi

#### POWER SPECTRAL DENSITY WITH COMBINER

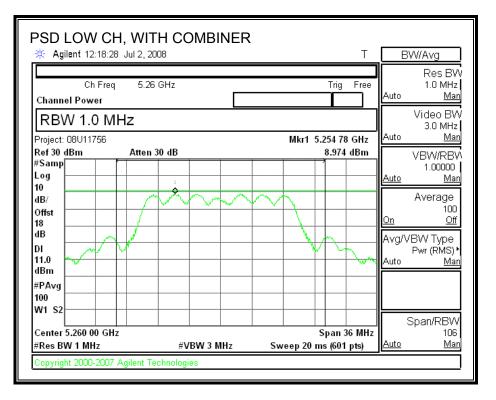


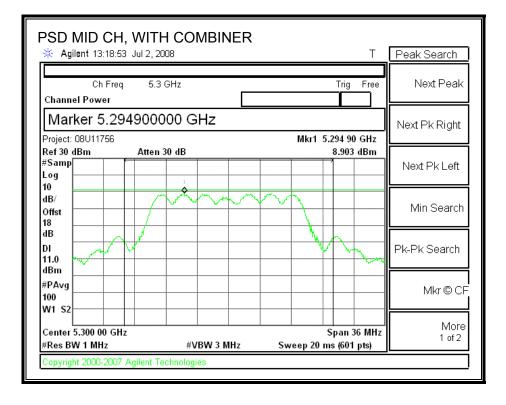


Page 96 of 334

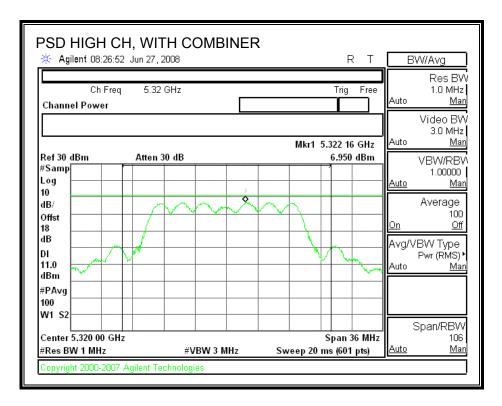
Antenna Combination: Hi PIFA / Low Slot = 7.84 dBi

#### POWER SPECTRAL DENSITY WITH COMBINER





Page 97 of 334



Page 98 of 334

# 8.2.4. PEAK EXCURSION

# **LIMITS**

FCC §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 transmitter outputs are connected to the spectrum analyzer.

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**

Chain 0

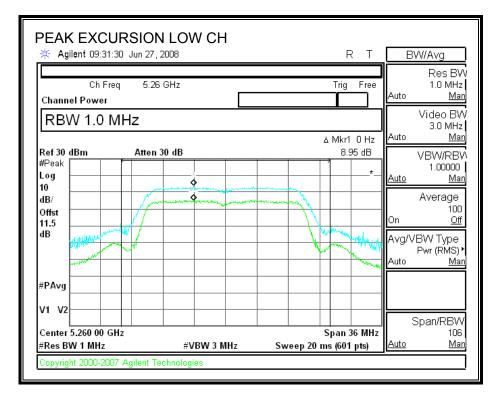
Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5260	8.95	13	-4.05
Middle	5300	9.11	13	-3.89
High	5320	10.53	13	-2.47

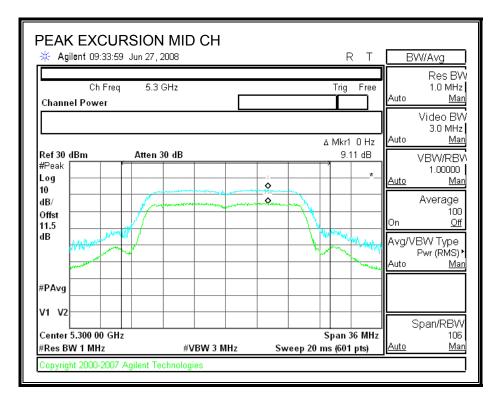
Chain 1

Channel	Frequency	Peak Excursion	Limit	Margin
	(MHz)	(dB)	(dB)	(dB)
Low	5260	10.30	13	-2.70
Middle	5300	8.92	13	-4.08
High	5320	9.62	13	-3.38

Page 99 of 334

### PEAK EXCURSION (CHAIN 0)





Page 100 of 334