

### FCC CFR47 PART 15 SUBPART C INDUSTRY CANADA RSS-210 ISSUE 7 INDUSTRY CANADA RSS-GEN ISSUE 2

**CERTIFICATION TEST REPORT** 

FOR

802.11a/b/g/n PCI Module

MODEL NUMBER: AR5BMB82

FCC ID: PPD-AR5BMB82

IC: 4104A-AR5BMB82

**REPORT NUMBER: 07U11326-2, REVISION B** 

**ISSUE DATE: DECEMBER 3, 2007** 

Prepared for ATHEROS COMMUNICATIONS, INC. 5480 GREAT AMERICA PARKWAY SANTA CLARA, CA 95054, U.S.A.

Prepared by COMPLIANCE CERTIFICATION SERVICES 47173 BENICIA STREET FREMONT, CA 94538, U.S.A. TEL: (510) 771-1000 FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

#### **Revision History**

Rev.	lssue Date	Revisions	Revised By
	10/29/07	Initial Issue	F. Ibrahim
А	11/12/07	Editorial changes.	F. Ibrahim
В	12/3/07	Clarified multiple transmitting chains and spatial separation of antennas in MPE section	F. Ibrahim

Page 2 of 2

# TABLE OF CONTENTS

1.	ATTESTATION OF TEST RESULTS	5
2.	TEST METHODOLOGY	6
3.	FACILITIES AND ACCREDITATION	6
4.	CALIBRATION AND UNCERTAINTY	6
4	.1. MEASURING INSTRUMENT CALIBRATION	6
4	2. MEASUREMENT UNCERTAINTY	6
5.	EQUIPMENT UNDER TEST	7
5	.1. DESCRIPTION OF EUT	7
5	2. MAXIMUM OUTPUT POWER	7
5	3.3. DESCRIPTION OF AVAILABLE ANTENNAS	7
5	.4. SOFTWARE AND FIRMWARE	7
5	5.5. WORST-CASE CONFIGURATION AND MODE	
5	6. DESCRIPTION OF TEST SETUP	9
6.	TEST AND MEASUREMENT EQUIPMENT	.11
7.	ANTENNA PORT TEST RESULTS	.12
7.	<ul> <li>802.11b THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND</li> <li>6 dB BANDWIDTH</li> <li>7.1.2. 99% BANDWIDTH</li> <li>7.1.3. OUTPUT POWER</li> <li>7.1.4. AVERAGE POWER FOR LEGACY 11b MODE (2.4GHz)</li> <li>7.1.5. POWER SPECTRAL DENSITY</li></ul>	.12 .15 .18 .21 .22
7.	<ul> <li>802.11g THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND</li> <li>6 dB BANDWIDTH</li> <li>7.2.2. 99% BANDWIDTH</li> <li>7.2.3. OUTPUT POWER</li></ul>	.34 .37 .40 .43 .44
	<ul> <li>802.11n THREE CHAINS HT20 MODE IN THE 2.4 GHz BAND</li> <li>6 dB BANDWIDTH</li> <li>7.3.2. 99% BANDWIDTH</li> <li>7.3.3. OUTPUT POWER</li> <li>7.3.4. AVERAGE POWER FOR HT20 MODES (2.4GHz)</li> <li>7.3.5. POWER SPECTRAL DENSITY</li> <li>7.3.6. CONDUCTED SPURIOUS EMISSIONS</li> <li>7.4. 802.11n THREE CHAINS HT40 MODE IN THE 2.4 GHz BAND</li> </ul>	.50 .53 .56 .59 .60 .62
1	7.4.1. 6 dB BANDWIDTH	

Page 3 of 3

7.4.5. POWER SPECTRAL DENSI	TY
7.4.6. CONDUCTED SPURIOUS E	MISSIONS84
	IN THE 5.8 GHz BAND
7.5.3. OUTPUT POWER	
	GACY MODES (5.8GHz)101
	TY102 MISSIONS
	100 100 IN THE 5.8 GHz BAND
	,000 IN THE 5.8 GHZ BAND
7.6.2. 99% BANDWIDTH	
7.6.4. AVERAGE POWER FOR HT 7.6.5. POWER SPECTRAL DENSI	20 MODES (5.8GHz)117 TY
	MISSIONS122
7.7. 802.11n THREE CHAINS HT40 M	126 IN THE 5.8 GHz BAND
7.7.4. AVERAGE POWER FOR HT	40 MODES (5.8GHz)133
	TY
7.7.6. CONDUCTED SPURIOUS E	MISSIONS138
8. RADIATED TEST RESULTS	141
8.1. LIMITS AND PROCEDURE	
•	THREE CHAINS LEGACY MODE, 2.4 GHz
	THREE CHAINS LEGACY MODE, 2.4 GHz
, - ,	HT40 MODE, 2.4 GHz
	THREE CHAINS LEGACY MODE, 5.8 GHz
	HT20 MODE, 5.8 GHz161 HT40 MODE, 5.8 GHz162
	3ANDWIDTH, 2.4 GHz
8.3.2. RX ABOVE 1 GHz, 20 MHz I	3ANDWIDTH, 5.8 GHz164
8.4. WORST-CASE BELOW 1 GHz	
9. AC POWER LINE CONDUCTED EMI	SSIONS
10. MAXIMUM PERMISSIBLE EXPOS	URE
11. SETUP PHOTOS	

Page 4 of 4

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

COMPANY NAME:	ATHEROS COMMUNICATIONS, INC. 5480 GREAT AMERICA PARKWAY SANTA CLARA, CA 95054, U.S.A.
EUT DESCRIPTION:	802.11a/b/g/n PCI Module

- MODEL: AR5BMB82
- SERIAL NUMBER: MB82-031-S0263

**DATE TESTED:** OCTOBER 18 - 24, 2007

APPLICABLE STANDARDS				
STANDARD	TEST RESULTS			
CFR 47 Part 15 Subpart C	No Non-Compliance Noted			
INDUSTRY CANADA RSS-210 Issue 7	No Non-Compliance Noted			
INDUSTRY CANADA RSS-GEN ISSUE 2	No Non-Compliance Noted			

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

**Note**: 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:

FRANK IBRAHIM EMC SUPERVISOR COMPLIANCE CERTIFICATION SERVICES

Tested By:

DEVIN CHANG EMC ENGINEER COMPLIANCE CERTIFICATION SERVICES

Page 5 of 5

# 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, 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 http://www.ccsemc.com.

# 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%.

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is a 3x3 802.11a/b/g/n PCI Module.

The radio module is manufactured by ATHEROS COMMUNICATIONS, INC.

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range	Mode	Output Power	Output Power
(MHz)		(dBm)	(mW)
2412 - 2462	802.11b	27.75	595.66
2412 - 2462	802.11g	26.78	476.43
2412 - 2462	802.11n HT20	26.63	460.26
2422 - 2452	802.11n HT40	27.32	539.51
5745 - 5825	802.11a	24.89	308.32
5745 - 5825	802.11n HT20	24.79	301.30
5755 - 5795	802.11n HT40	24.74	297.85

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Dipole Antenna, model: TWF-614C-406, with a maximum gain of 3 dBi in the 2.4 GHz bands, and 5 dBi in the 5GHz bands.

# 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was ART revision 0.5 Build # 20, ART\_11n. For TX-related testing, the program puts the EUT in continuous transmitting mode with a duty cycle of 99%, for RX-related testing, the program puts the EUT in continuous receiving mode.

## 5.5. WORST-CASE CONFIGURATION AND MODE

EUT was tested as an external module inserted to a host Laptop PC.

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

802.11b Mode (20 MHz BW operation): 1Mbps, CCK, Spatial Stream 1 802.11g Mode (20 MHz BW operation): 9 Mbps, OFDM, Spatial Stream 1 802.11n MIMO HT20 Mode: MCS0, 6.5Mbps, OFDM, Spatial Stream 1 802.11n MIMO HT40 Mode: MCS0, 13.5Mbps, OFDM, Spatial Stream 1

802.11a Mode (20 MHz BW operation): 9Mbps, OFDM, Spatial Stream 1 802.11n MIMO HT20 Mode: MCS0, 6.5Mbps, OFDM, Spatial Stream 1 802.11n MIMO HT40 Mode: MCS0, 13.5Mbps, OFDM, Spatial Stream 1

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was the mode and channel with the highest output power, that was determined to be 11b/1Mbps, Mid Channel.

#### In the 2.4 GHz band:

For each mode, preliminary testing was performed on Low Channel for PPSD and Conducted Spurious for both individual chains and combiner to determine worst-case configuration, and the worst-case configuration was used for mid and high channels for that mode. For all modes in the 2.4 GHz, it was determined that using a combiner is worst case for PPSD results. For Conducted Spurious, individual chains were worst case for 11b, HT20 and HT40, while combiner was worst case for 11g.

In the 5 GHz bands:

For all modes, worst chain was used for 26 dB BW and 99% BW, that was determined to be Chain 2 from preliminary testing.

For all modes, preliminary testing on Conducted Spurious showed that using combiner is worse than individual chains; therefore, final testing was performed using a combiner.

Page 8 of 8

### 5.6. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST							
Description Manufacturer Model Serial Number FCC ID							
Laptop PC	LENOVO	T43	L3-AB1GT	DOC			
AC/DC Adapter	IBM	08K8204	11S08K8204Z1Z	N/A			
Cardbus to MINI-PCI	VYTEK	stcbmpi3	244	N/A			

#### I/O CABLES

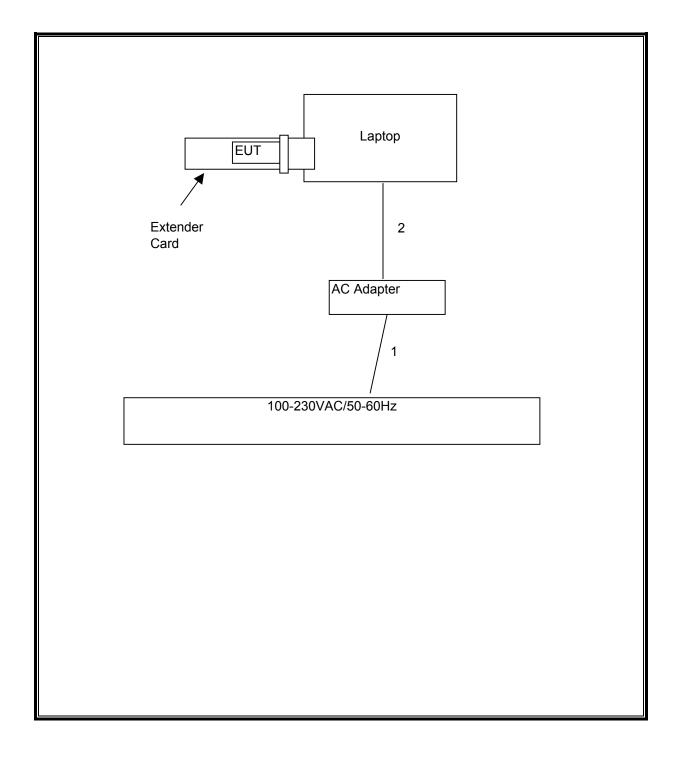
	I/O CABLE LIST							
Cable	Port	# of	Connector	Cable	Cable	Remarks		
No.		Identical Ports	Туре	Туре	Length			
1	AC	1	US 115V	Un-shielded	0.8m	N/A		
2	DC	1	DC	Un-shielded	1.8m	Ferrite at one end		

#### TEST SETUP

The EUT is connected to a laptop PC via a PCI extension card during the tests. Test software exercised the radio card.

Page 9 of 9

#### **SETUP DIAGRAM FOR TESTS**



Page 10 of 10

# 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	S/N	Cal Due		
Power Meter	Agilent / HP	438A	C01068	09/12/08		
Power Sensor, 18 GHz	Agilent / HP	8481A	N02782	39560		
RF Filter Section	Agilent / HP	85420E	C00958	06/12/08		
Harmonic Mixer Cable	Agilent / HP	5061-5458	C00627*	CNR		
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	08/07/08		
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	09/28/08		
Preamplifier, 1300 MHz	Agilent / HP	8447D	0	05/09/08		
Antenna, Horn, 18 GHz	EMCO	3115	C00945	04/15/08		
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	08/03/08		
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/30/08		
EMI Test Receiver, 30 MHz	R&S	ESHS 20	N02396	01/27/08		
2.4-2.5 GHz Reject Filter	Micro-Tronics	BRM50702	1	CNR		
Reject Filter, 5.15-5.35 GHz	Micro-Tronics	BRC13190	N02679	CNR		
Reject Filter, 5.47-5.725 GHz	Micro-Tronics	BRC13191	N02678	CNR		
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02677	CNR		
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	10/11/08		
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	09/28/08		
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	04/11/08		

Page 11 of 11

# 7. ANTENNA PORT TEST RESULTS

## 7.1. 802.11b THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND

### 7.1.1.6 dB BANDWIDTH

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

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

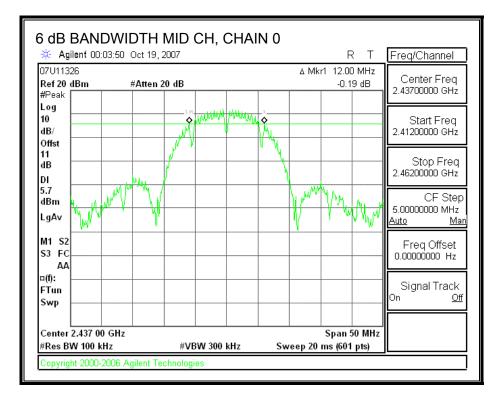
#### **RESULTS**

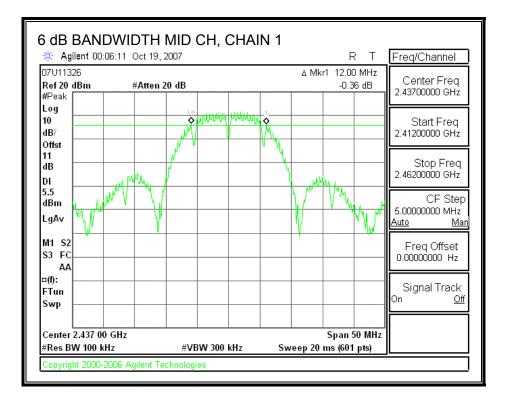
Channel	Frequency	Chain 0	Chain 1	Chain 2	Minimum Limit
		6 dB BW	6 dB BW	6 dB BW	
	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
Low	2412	12	12	12	0.5
Middle	2437	12	12	12	0.5
High	2462	12	12	12	0.5

Middle Channel plots are included hereafter.

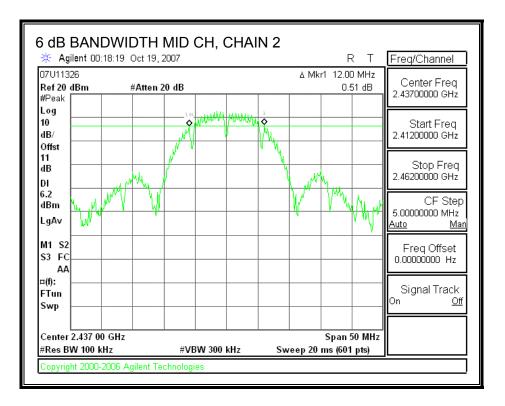
Page 12 of 12

#### 6 dB BANDWIDTH





Page 13 of 13



Page 14 of 14

### 7.1.2. 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 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

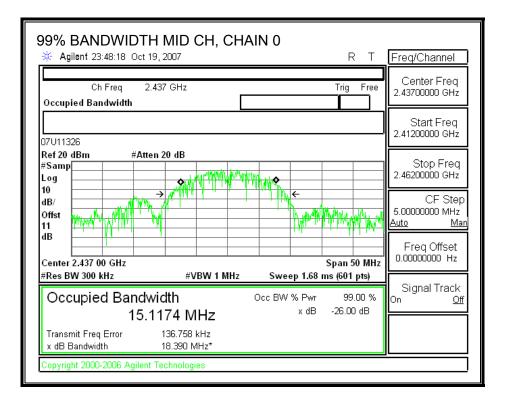
#### RESULTS

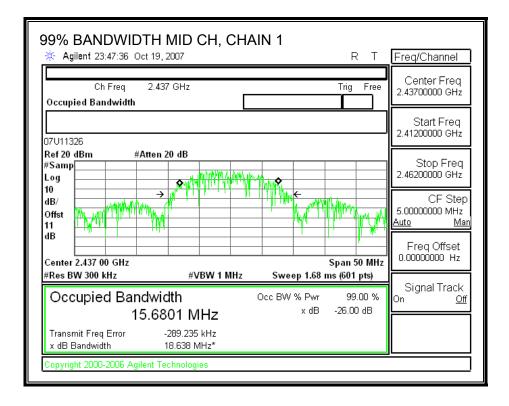
Channel	Frequency	Chain 0	Chain 1	Chain 2
		99% Bandwidth	99% Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)	(MHz)
Low	2412	15.0830	15.6301	15.6638
Middle	2437	15.1174	15.6801	15.5809
High	2462	15.5653	15.3153	15.3969

Middle channel plots are included hereafter.

Page 15 of 15

#### 99% BANDWIDTH





Page 16 of 16

99% BANDWIDTH MID CH, CHAIN 2 Agilent 23:45:10 Oct 19, 2007 R T	Freq/Channel
Ch Freq 2.437 GHz Trig Free Occupied Bandwidth	Center Freq 2.43700000 GHz
07U11326	Start Freq 2.41200000 GHz
Ref 20 dBm #Atten 20 dB #Samp Log <b>Quantum Parts of the Constant</b>	Stop Freq 2.46200000 GHz
10 → A 1 + + + + + + + + + + + + + + + + + +	CF Step 5.0000000 MHz <u>Auto Man</u>
dB	Freq Offset 0.00000000 Hz
#Res BW 300 kHz         #VBW 1 MHz         Sweep 1.68 ms (601 pts)           Occupied Bandwidth         Occ BW % Pwr         99.00 %           15.5809 MHz         × dB         -26.00 dB	Signal Track On <u>Off</u>
Transmit Freq Error 39.500 kHz x dB Bandwidth 18.519 MHz*	
Copyright 2000-2006 Agilent Technologies	

Page 17 of 17

### 7.1.3. OUTPUT POWER

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

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna	10 Log	Effective
Gain	(# Tx Chains)	Legacy Gain
(dBi)	(dB)	(dBi)
3	4.77	7.77

The maximum effective antenna gain is 7.77 dBi for other than fixed, point-to-point operations, therefore the limit is 28.23 dBm.

#### TEST PROCEDURE

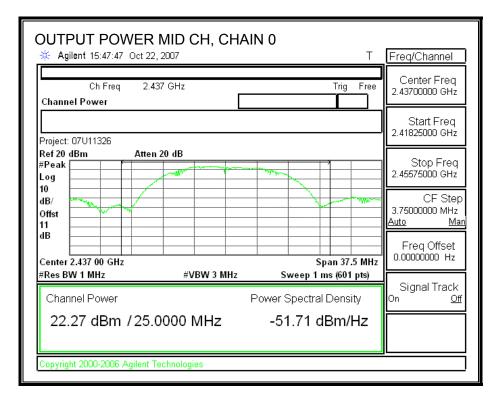
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

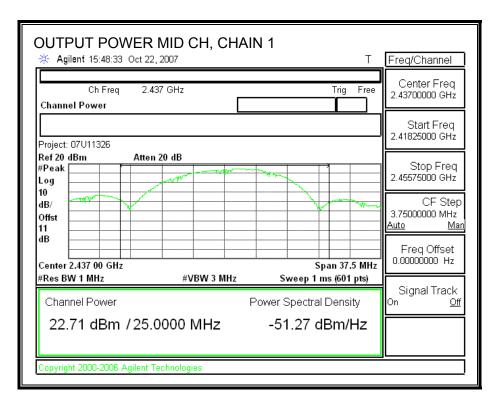
#### **RESULTS**

Channel	Frequency	Chain 0	Chain 1	Chain 2	Total	Limit	Margin
		Power	Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	22.08	21.84	22.22	26.82	28.23	-1.41
Mid	2437	22.27	22.71	23.82	27.75	28.23	-0.48
High	2462	21.08	19.73	21.76	25.71	28.23	-2.52

Middle channel plots are included hereafter.

#### **OUTPUT POWER**





Page 19 of 19

OUTPUT POWER MID CH, CH	IAIN 2	Freq/Channel		
Ch Freq 2.437 GHz Channel Power	Trig Free	Center Freq 2.43700000 GHz		
Project: 07U11326		Start Freq 2.41825000 GHz		
Ref 20 dBm Atten 20 dB #Peak		Stop Freq 2.45575000 GHz		
10 dB/ Offst 11		CF Step 3.7500000 MHz <u>Auto Man</u>		
dB Center 2.437 00 GHz	Span 37.5 MHz	Freq Offset 0.00000000 Hz		
#Res BW 1 MHz #VBW 3 MHz Channel Power	Signal Track On <u>Off</u>			
23.82 dBm / 25.0000 MHz -50.16 dBm/Hz				
Copyright 2000-2006 Agilent Technologies				

Page 20 of 20

### 7.1.4. AVERAGE POWER FOR LEGACY 11b MODE (2.4GHz)

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

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Chain 0	Chain 1	Chain 2	Total Power
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	2412	19.44	19.23	19.64	24.21
Middle	2437	19.95	19.57	19.99	24.61
High	2462	18.61	17.79	18.97	23.26

Page 21 of 21

### 7.1.5. POWER SPECTRAL DENSITY

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

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

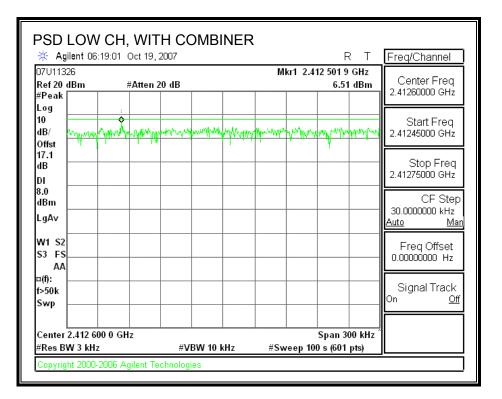
#### <u>RESULTS</u>

Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2412	6.51	8	-1.49
Middle	2437	6.33	8	-1.67
High	2462	4.36	8	-3.64

Low channel plot is included hereafter.

Page 22 of 22

#### POWER SPECTRAL DENSITY, WITH COMBINER



Page 23 of 23

### 7.1.6. CONDUCTED SPURIOUS EMISSIONS

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

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

#### TEST PROCEDURE

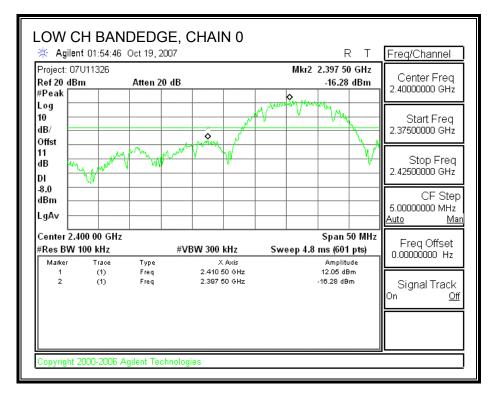
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

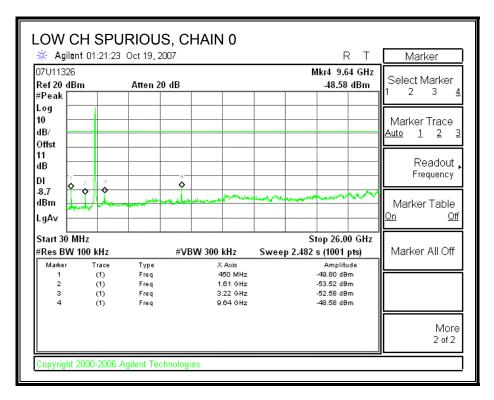
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

#### **RESULTS**

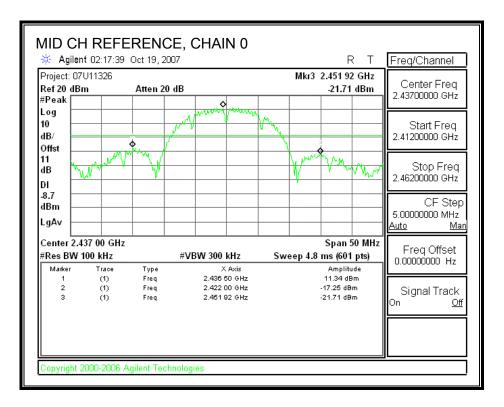
Page 24 of 24

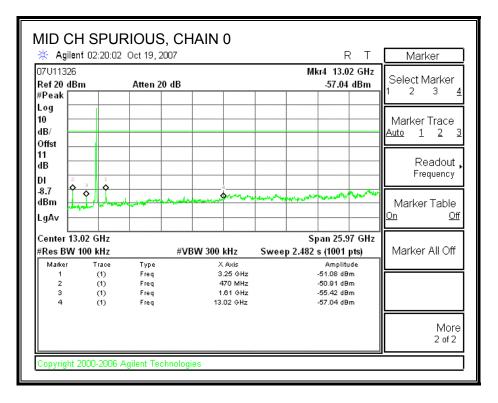
#### **CHAIN 0 SPURIOUS EMISSIONS**



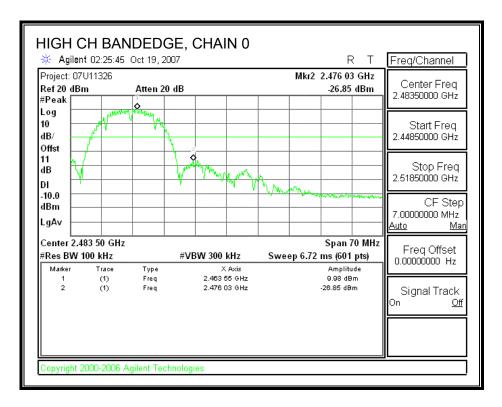


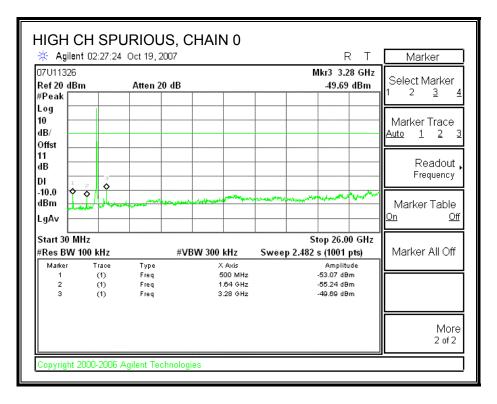
Page 25 of 25





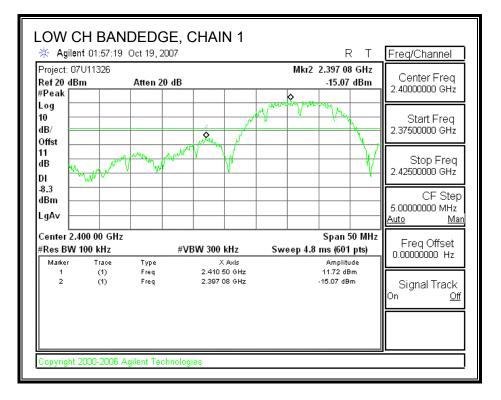
Page 26 of 26

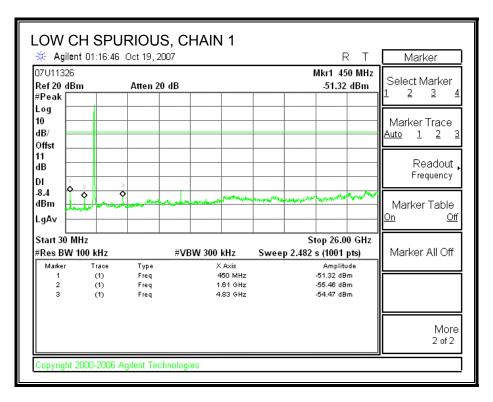




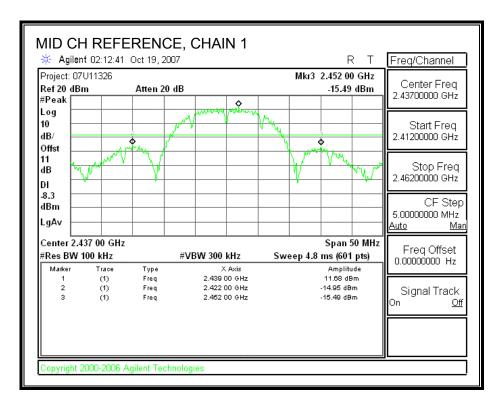
Page 27 of 27

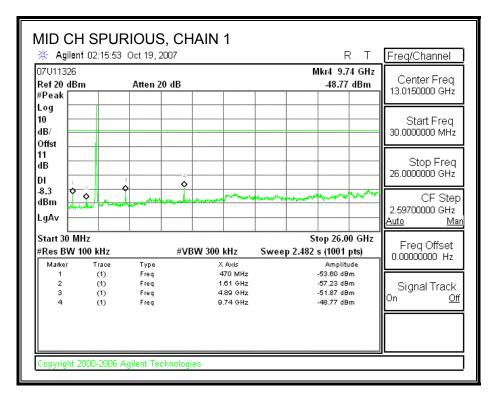
#### **CHAIN 1 SPURIOUS EMISSIONS**



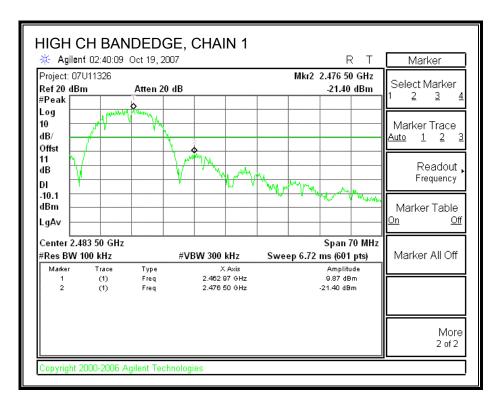


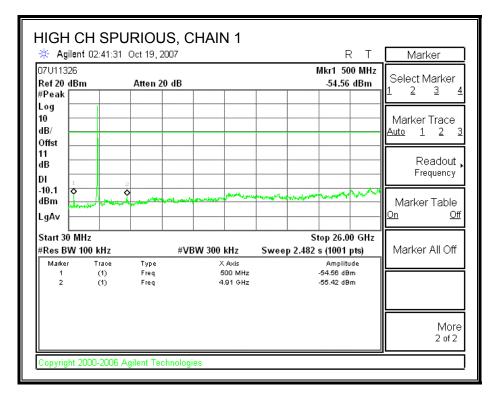
Page 28 of 28





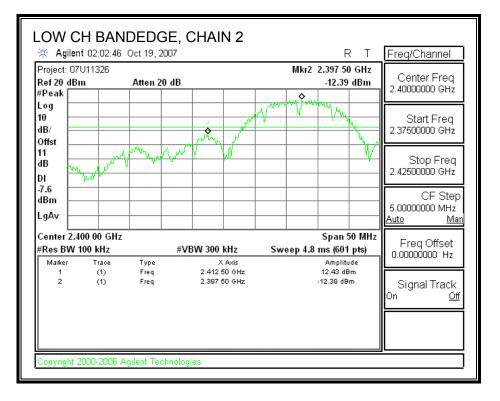
Page 29 of 29

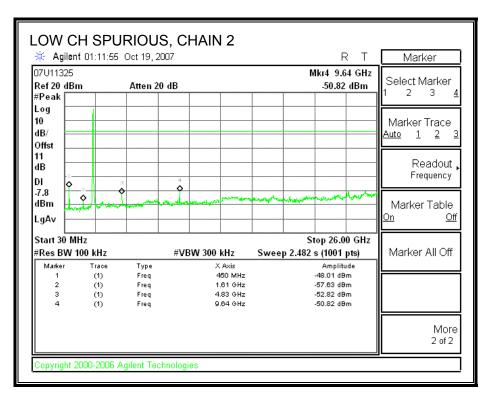




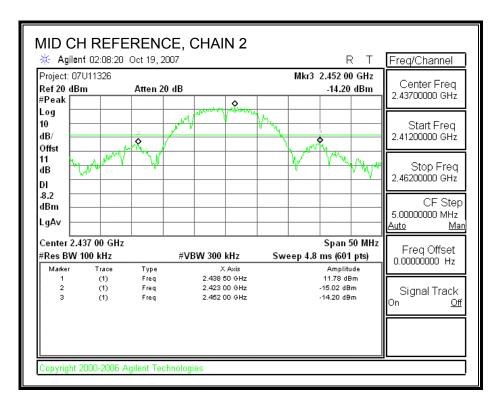
Page 30 of 30

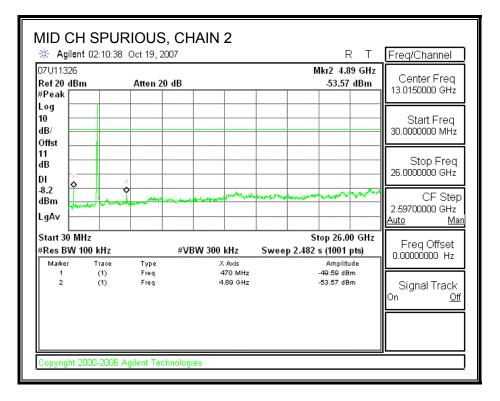
#### **CHAIN 2 SPURIOUS EMISSIONS**



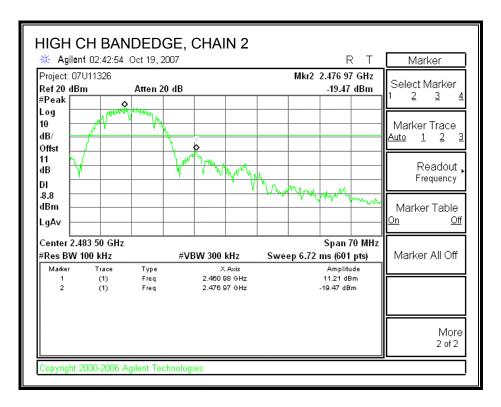


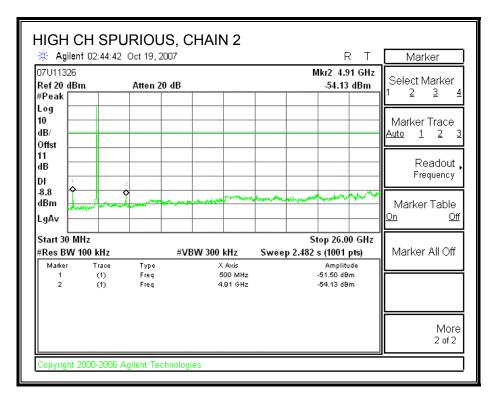
Page 31 of 31





Page 32 of 32





Page 33 of 33

## 7.2. 802.11g THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND

### 7.2.1. 6 dB BANDWIDTH

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

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

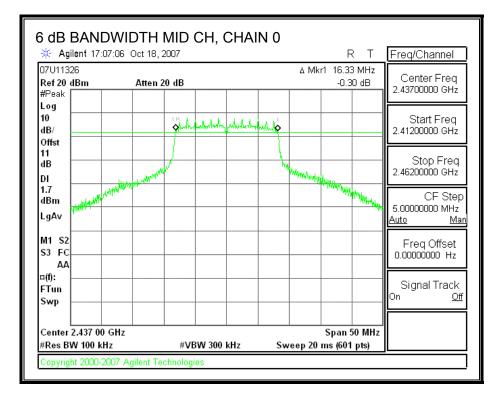
#### **RESULTS**

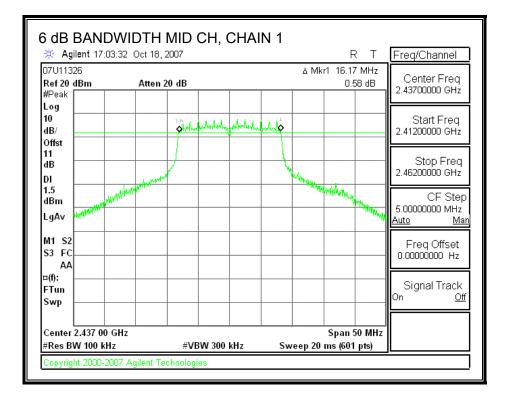
Channel	Frequency	Chain 0	Chain 1	Chain 2	Minimum Limit
		6 dB BW	6 dB BW	6 dB BW	
	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
Low	2412	16.08	16.25	16.00	0.5
Middle	2437	16.33	16.17	16.33	0.5
High	2462	16.17	16.33	16.33	0.5

Middle channel plots are included hereafter.

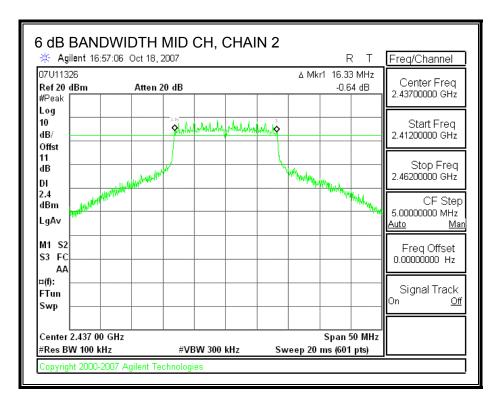
Page 34 of 34

#### 6 dB BANDWIDTH





Page 35 of 35



Page 36 of 36

# 7.2.2. 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 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

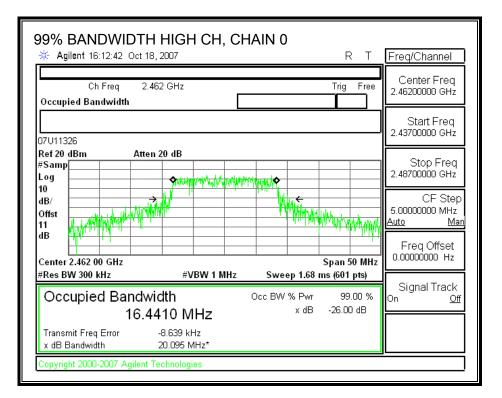
#### RESULTS

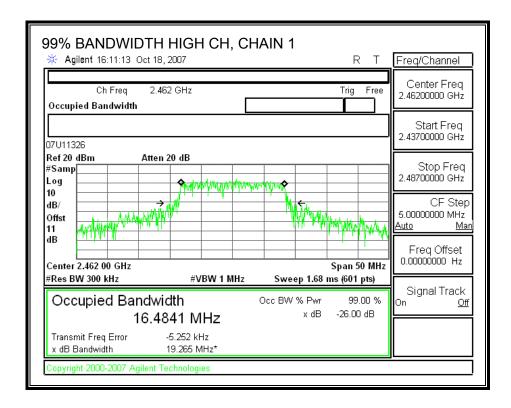
Channel	Frequency	Chain 0	Chain 1	Chain 2
		99% Bandwidth	99% Bandwidth	99% Bandwidth
	(MHz)	(MHz) (MHz) (MHz)		(MHz)
Low	2412	16.5424	16.4031	16.4962
Middle	2437	16.4893	16.4363	16.4980
High	2462	16.4410	16.4841	16.5425

High channel plots are included hereafter.

Page 37 of 37

#### 99% BANDWIDTH





Page 38 of 38

99% BANDWIDTH HIGH CH, CHAIN 2	Freq/Channel
Ch Freq 2.462 GHz Trig Free Occupied Bandwidth	Center Freq 2.46200000 GHz
07U11326	Start Freq 2.43700000 GHz
Ref 20 dBm Atten 20 dB #Samp Log 10	Stop Freq 2.48700000 GHz
dB/ Offst 11	CF Step 5.0000000 MHz <u>Auto Man</u>
dB Center 2.462 00 GHz Span 50 MHz	Freq Offset 0.00000000 Hz
#Res BW 300 kHz         #VBW 1 MHz         Sweep 1.68 ms (601 pts)           Occupied Bandwidth         Occ BW % Pwr         99.00 %           16.5425 MHz         × dB         -26.00 dB	Signal Track On <u>Off</u>
Transmit Freq Error -33.344 kHz x dB Bandwidth 20.117 MHz*	
Copyright 2000-2007 Agilent Technologies	

Page 39 of 39

# 7.2.3. OUTPUT POWER

### <u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna	10 Log	Effective
Gain	(# Tx Chains)	Legacy Gain
(dBi)	(dB)	(dBi)
3	4.77	7.77

The maximum effective antenna gain is 7.77 dBi for other than fixed, point-to-point operations, therefore the limit is 28.23 dBm.

#### TEST PROCEDURE

Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

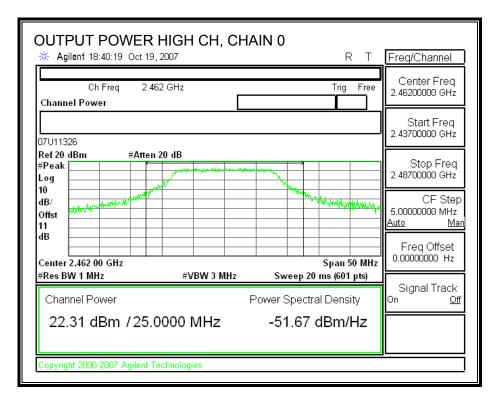
#### **RESULTS**

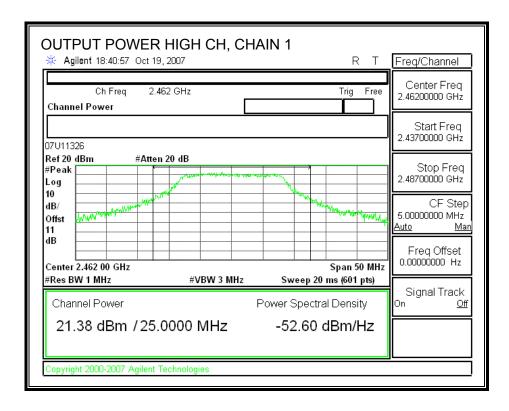
Channel	Frequency	Chain 0	Chain 1	Chain 2	Total	Limit	Margin
		Power	Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	20.47	20.01	20.92	25.25	28.23	-2.98
Mid	2437	21.72	21.00	22.56	26.58	28.23	-1.65
High	2462	22.31	21.38	22.26	26.78	28.23	-1.45

High channel plots are included hereafter.

Page 40 of 40

# OUTPUT POWER





Page 41 of 41

OUTPUT POWER HIGH CH, CHAIN 2	Freq/Channel
Ch Freq 2.462 GHz Trig Free Channel Power	Center Freq 2.46200000 GHz
07U11326	Start Freq 2.43700000 GHz
Ref 20 dBm #Atten 20 dB #Peak Log	Stop Freq 2.48700000 GHz
dB/	CF Step 5.00000000 MHz <u>Auto Man</u>
dB Center 2.462 00 GHz Span 50 MHz	Freq Offset 0.00000000 Hz
#Res BW 1 MHz         #VBW 3 MHz         Sweep 20 ms (601 pts)           Channel Power         Power Spectral Density	Signal Track On <u>Off</u>
22.26 dBm / 25.0000 MHz -51.72 dBm/Hz	
Copyright 2000-2007 Agilent Technologies	

Page 42 of 42

# 7.2.4. AVERAGE POWER FOR LEGACY 11g MODE (2.4GHz)

### <u>LIMITS</u>

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Chain 0	Chain 1	Chain 2	Total
		Power	Power	Power	Power
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	2412	16.56	16.19	16.66	21.25
Middle	2437	16.84	16.15	17.81	21.76
High	2462	14.44	13.54	14.68	19.02

Page 43 of 43

# 7.2.5. POWER SPECTRAL DENSITY

### <u>LIMITS</u>

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

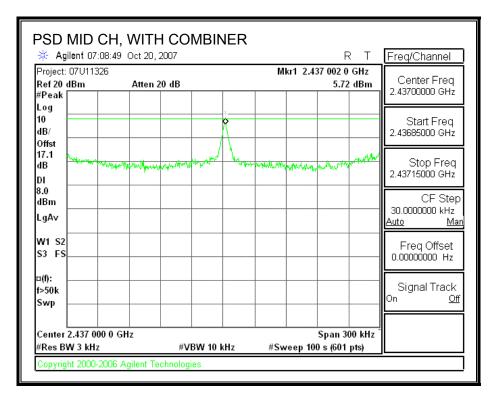
# <u>RESULTS</u>

Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2412	4.64	8	-3.36
Middle	2437	5.72	8	-2.28
High	2462	2.77	8	-5.23

Middle channel plot is included hereafter.

Page 44 of 44

#### POWER SPECTRAL DENSITY, WITH COMBINER



Page 45 of 45

# 7.2.6. CONDUCTED SPURIOUS EMISSIONS

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

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

#### TEST PROCEDURE

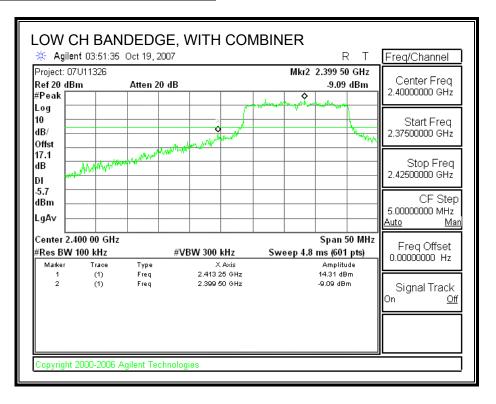
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

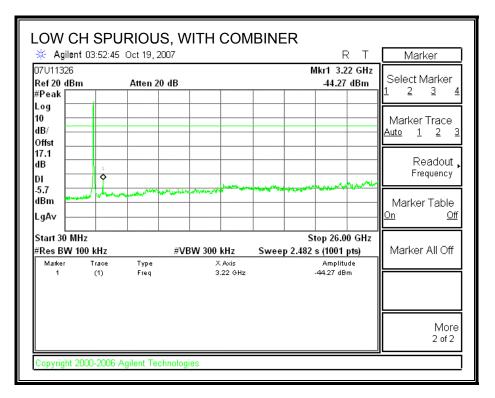
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

#### **RESULTS**

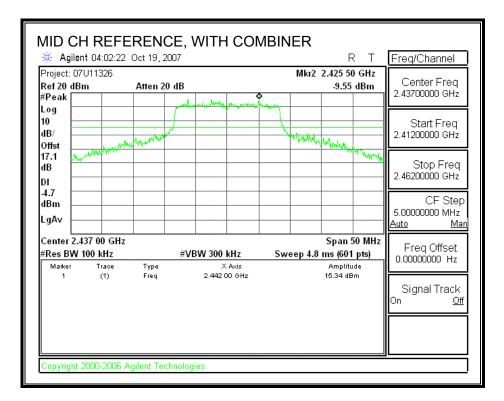
Page 46 of 46

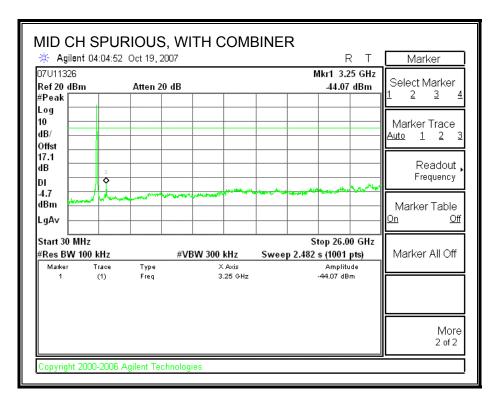
#### SPURIOUS EMISSIONS WITH COMBINER



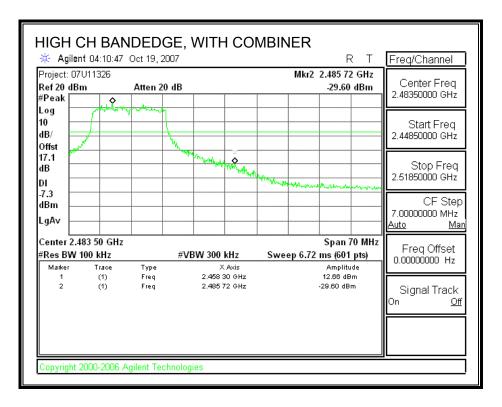


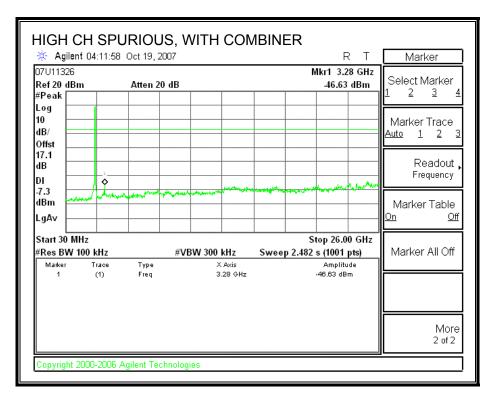
Page 47 of 47





Page 48 of 48





Page 49 of 49

# 7.3. 802.11n THREE CHAINS HT20 MODE IN THE 2.4 GHz BAND

# 7.3.1. 6 dB BANDWIDTH

# <u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

# TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

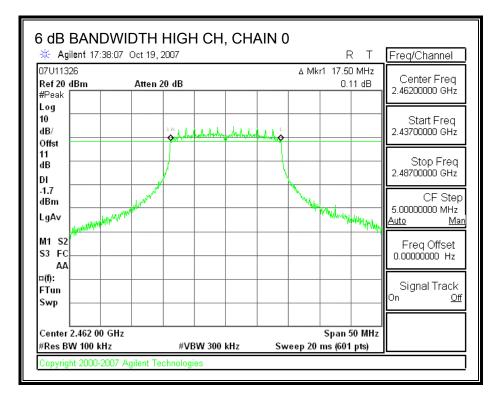
# **RESULTS**

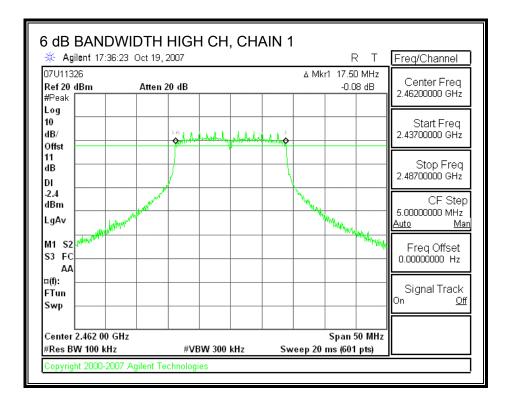
Channel	Frequency	Chain 0	Chain 1	Chain 2	Minimum Limit
		6 dB BW	6 dB BW	6 dB BW	
	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
Low	2412	16.33	16.67	16.25	0.5
Middle	2437	16.75	16.92	16.83	0.5
High	2462	17.50	17.50	17.17	0.5

High channel plots are included hereafter.

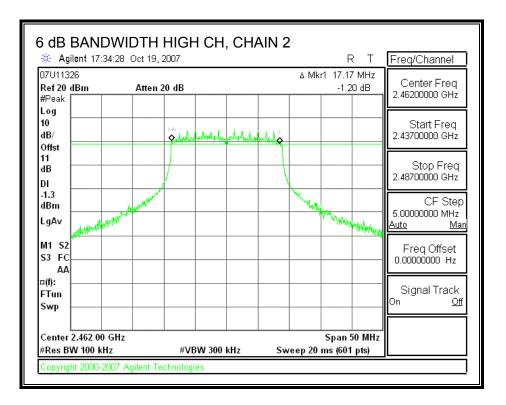
Page 50 of 50

#### 6 dB BANDWIDTH





Page 51 of 51



Page 52 of 52

# 7.3.2. 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 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

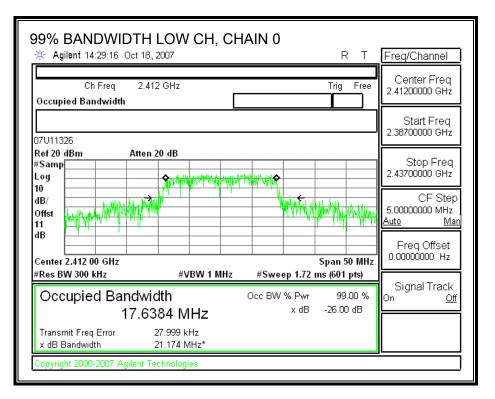
#### **RESULTS**

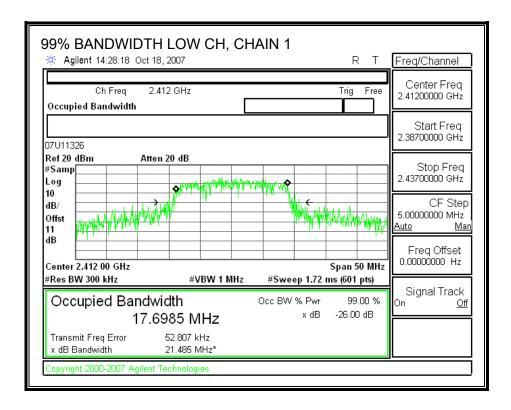
Channel	Frequency	Chain 0	Chain 1	Chain 2
		99% Bandwidth	99% Bandwidth	99% Bandwidth
	(MHz)	(MHz) (MHz) (MHz)		(MHz)
Low	2412	17.6384	17.6985	17.6515
Middle	2437	17.6669	17.6552	17.6329
High	2462	17.6351	16.6333	17.6311

Low channel plots are included hereafter.

Page 53 of 53

### 99% BANDWIDTH





Page 54 of 54

99% BANDWIDTH LOW CH, CHA	R T Freq/Channel
Ch Freq 2.412 GHz Occupied Bandwidth	Trig Free Center Freq 2.41200000 GHz
07U11326	Start Freq 2.38700000 GHz
Ref 20 dBm Atten 20 dB #Samp Log 40	Stop Freq 2.43700000 GHz
10 dB/ Offst	CF Step 5.0000000 MHz Auto Man
dB	Span 50 MHz
	#Sweep 1.72 ms (601 pts) Signal Track cc BW % Pwr 99.00 % On Off
17.6515 MHz	x dB -26.00 dB
Transmit Freq Error54.454 kHzx dB Bandwidth24.269 MHz*	
Copyright 2000-2007 Agilent Technologies	

Page 55 of 55

# 7.3.3. OUTPUT POWER

# <u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is 3 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

#### TEST PROCEDURE

Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

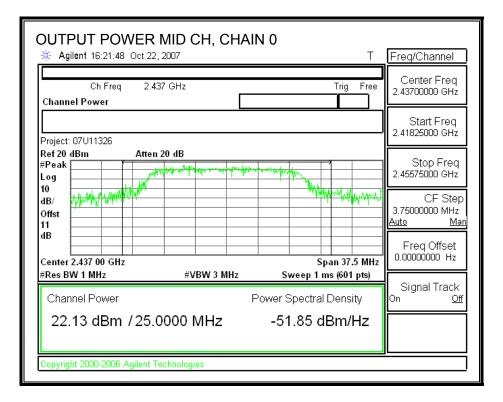
#### <u>RESULTS</u>

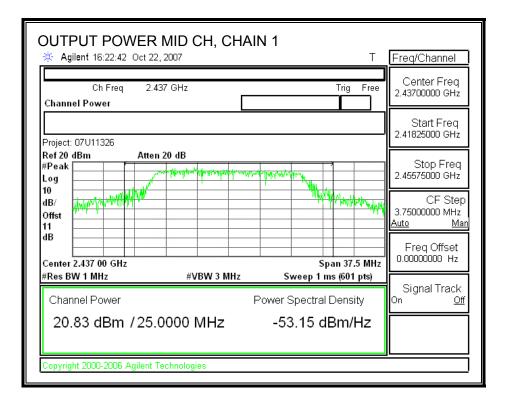
Channel	Frequency	Chain 0	Chain 1	Chain 2	Total	Limit	Margin
		Power	Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2412	19.82	20.04	21.03	25.10	30.00	-4.90
Mid	2437	22.13	20.83	22.46	26.63	30.00	-3.37
High	2462	21.35	21.01	22.19	26.32	30.00	-3.68

Middle channel plots are included hereafter.

Page 56 of 56

#### **OUTPUT POWER**





Page 57 of 57

OUTPUT POWER I		IN 2	Т	Freq/Channel
Ch Freq 2.43 Channel Power	7 GHz	Ti	ig Free	Center Freq 2.43700000 GHz
Project: 07U11326				Start Freq 2.41825000 GHz
Ref 20 dBm Atten 2 #Peak	20 dB			Stop Freq 2.45575000 GHz
10 dB/ Offst			ter of the	CF Step 3.7500000 MHz <u>Auto Man</u>
dB Center 2.437 00 GHz		•	37.5 MHz	Freq Offset 0.00000000 Hz
#Res BW 1 MHz Channel Power	#VBW 3 MHz	Sweep 1 ms ( Power Spectral De	. ,	Signal Track On <u>Off</u>
22.46 dBm / 25.0	000 MHz	-51.52 dBn	n/Hz	
Copyright 2000-2006 Agilent Te	chnologies			][]

Page 58 of 58

# 7.3.4. AVERAGE POWER FOR HT20 MODES (2.4GHz)

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Chain 0	Chain 1	Chain 2	Total Power
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	2412	16.36	16.03	16.72	21.15
Middle	2437	17.51	17.09	18.02	22.33
High	2462	14.93	14.26	14.90	19.48

Page 59 of 59

# 7.3.5. POWER SPECTRAL DENSITY

# <u>LIMITS</u>

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

# TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

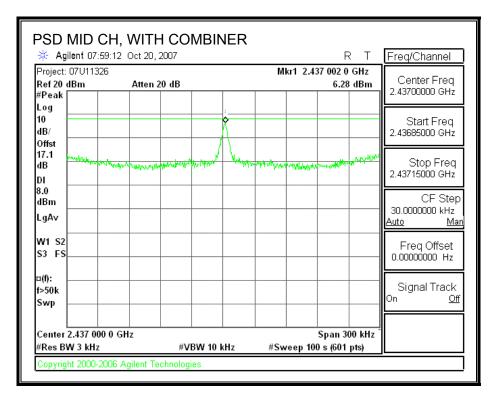
# <u>RESULTS</u>

Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2412	4.67	8	-3.33
Middle	2437	6.28	8	-1.72
High	2462	2.60	8	-5.40

Middle channel plot is included hereafter.

Page 60 of 60

#### POWER SPECTRAL DENSITY, WITH COMBINER



Page 61 of 61

# 7.3.6. CONDUCTED SPURIOUS EMISSIONS

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

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

#### TEST PROCEDURE

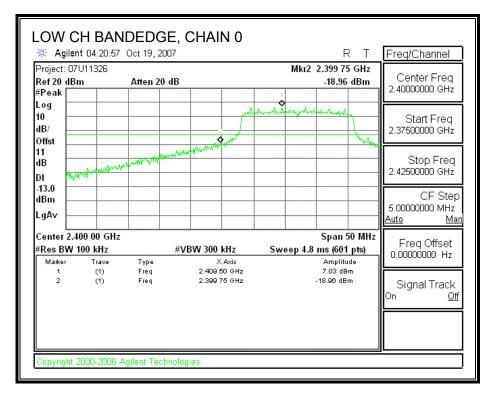
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

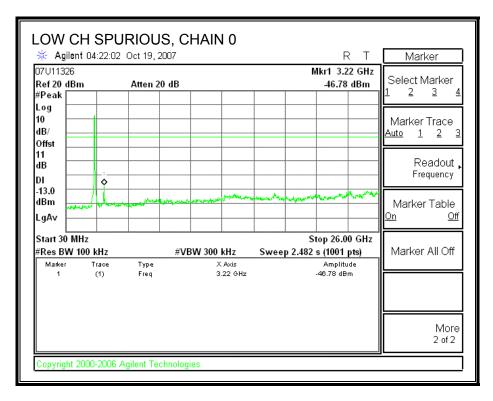
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

#### **RESULTS**

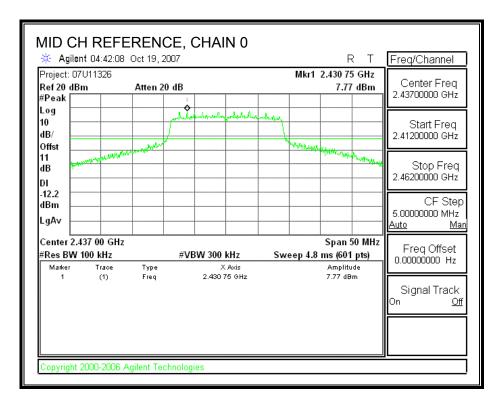
Page 62 of 62

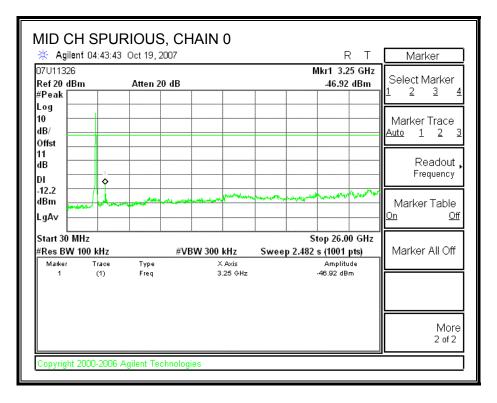
#### **CHAIN 0 SPURIOUS EMISSIONS**



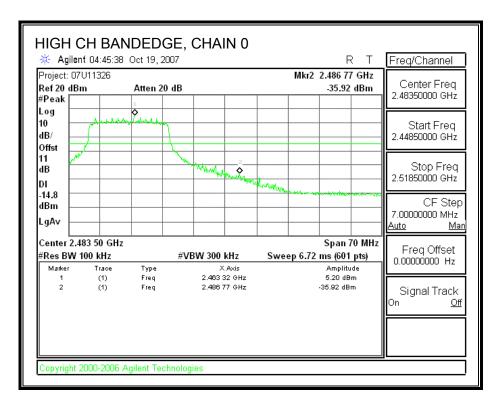


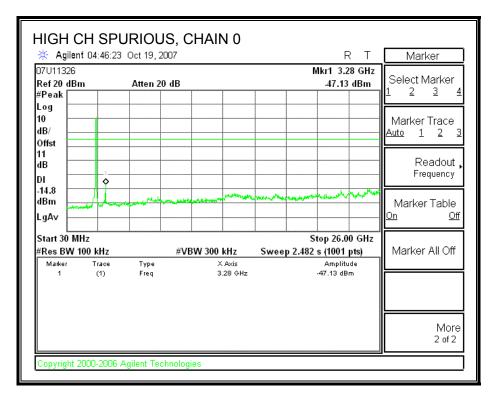
Page 63 of 63





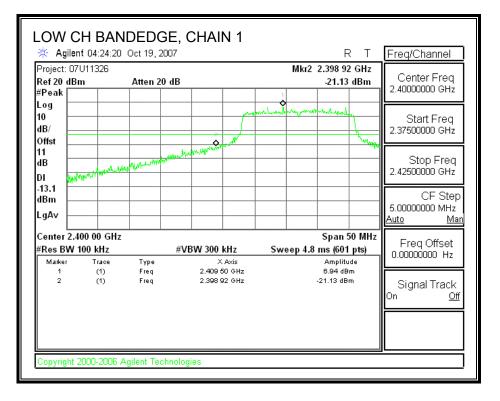
Page 64 of 64

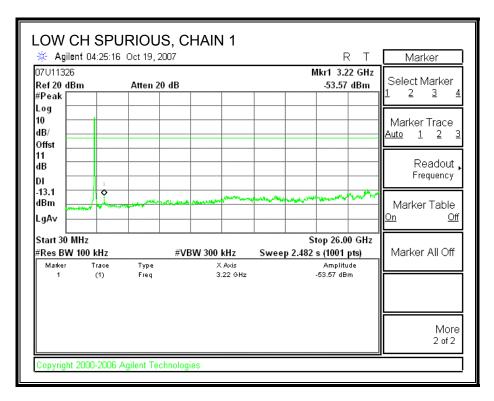




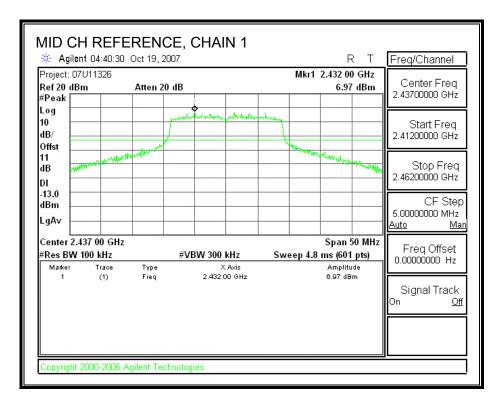
Page 65 of 65

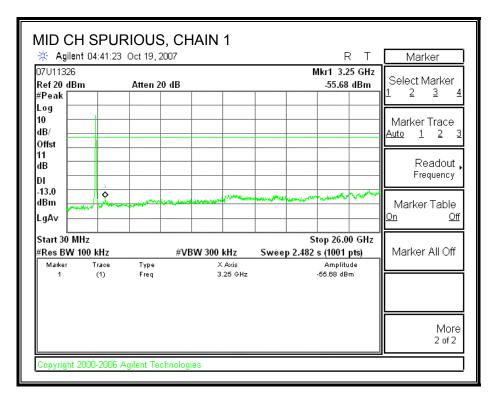
#### **CHAIN 1 SPURIOUS EMISSIONS**



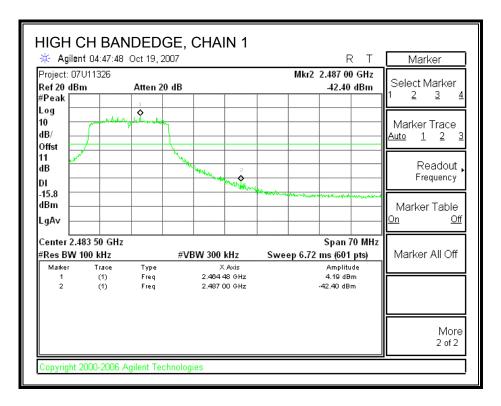


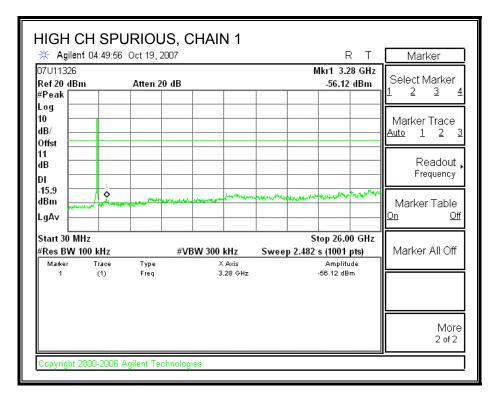
Page 66 of 66





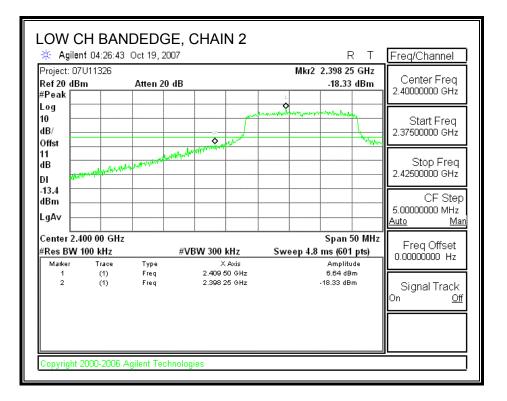
Page 67 of 67

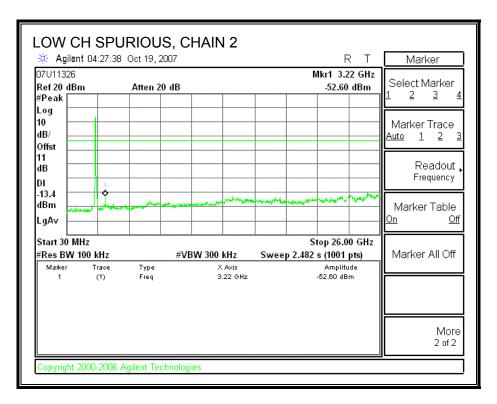




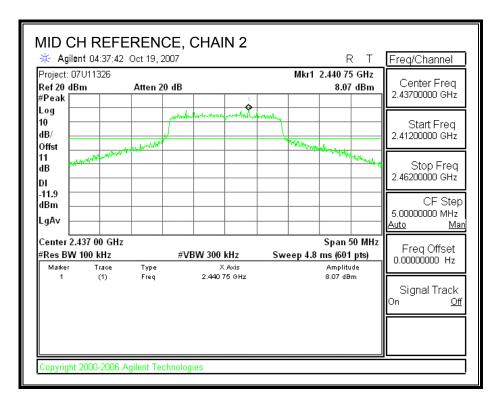
Page 68 of 68

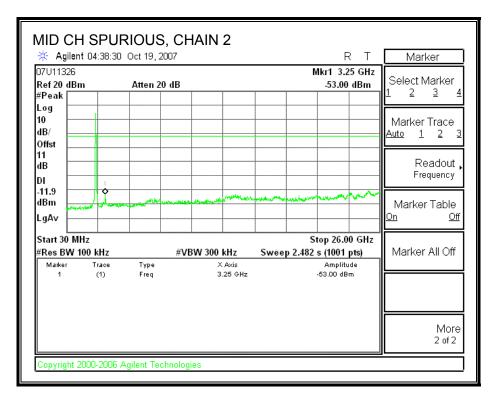
### **CHAIN 2 SPURIOUS EMISSIONS**



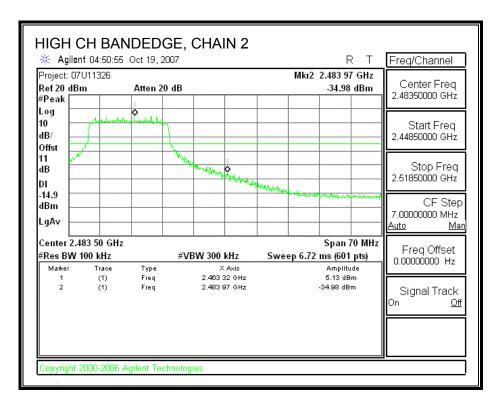


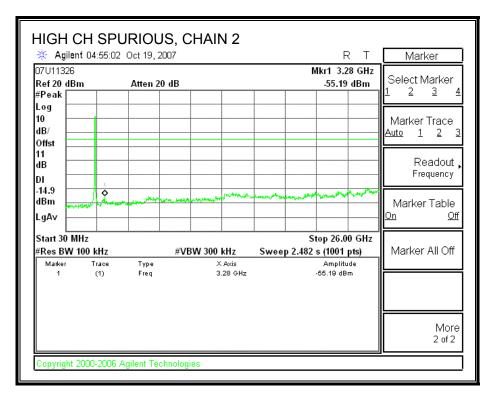
Page 69 of 69





Page 70 of 70





Page 71 of 71

# 7.4. 802.11n THREE CHAINS HT40 MODE IN THE 2.4 GHz BAND

# 7.4.1. 6 dB BANDWIDTH

# <u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

# TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

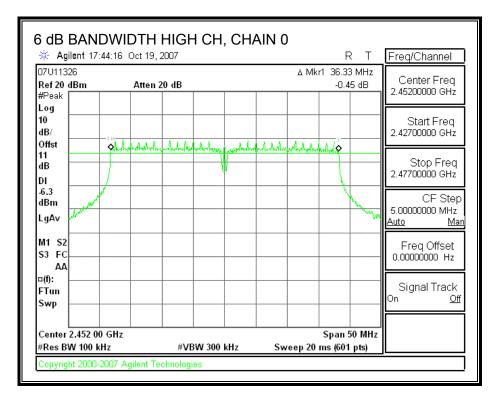
# **RESULTS**

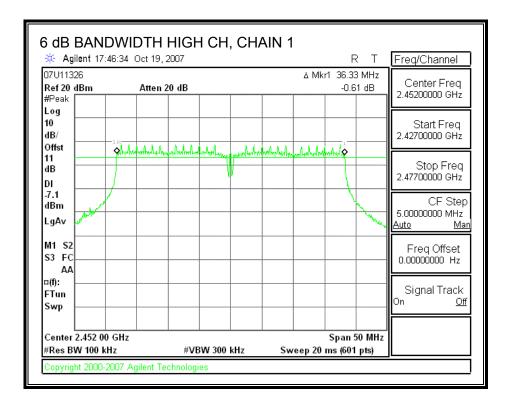
Channel	Frequency	Chain 0	Chain 1	Chain 2	Minimum Limit
		6 dB BW	6 dB BW	6 dB BW	
	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
Low	2422	36.33	36.33	36.25	0.5
Middle	2437	36.33	36.25	36.33	0.5
High	2452	36.33	36.33	36.33	0.5

High channel plots are included hereafter.

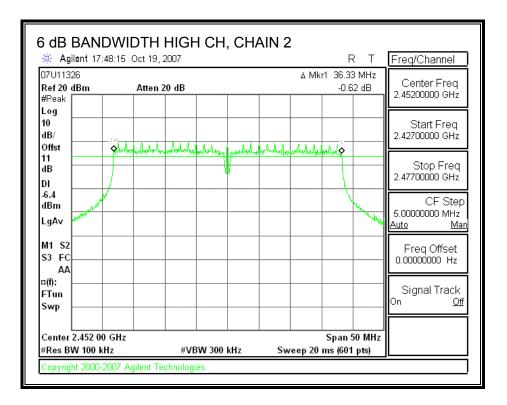
Page 72 of 72

#### 6 dB BANDWIDTH





Page 73 of 73



Page 74 of 74

# 7.4.2. 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 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

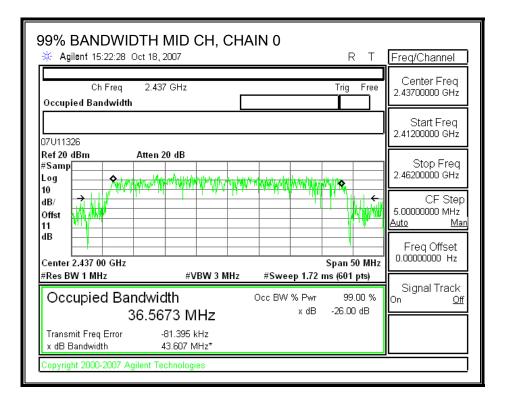
#### RESULTS

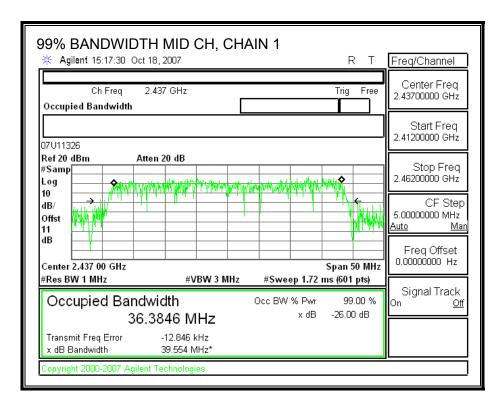
Channel	Frequency	Chain 0	Chain 1	Chain 2
		99% Bandwidth	99% Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)	(MHz)
Low	2422	36.5749	36.5185	36.4997
Middle	2437	36.5673	36.3846	36.7400
High	2452	36.5763	36.4149	36.5138

Middle channel plots are included hereafter.

Page 75 of 75

#### 99% BANDWIDTH





Page 76 of 76

99% BANDWIDTH MID CH, CHAIN 2	Freq/Channel
Ch Freq 2.437 GHz Trig Free Occupied Bandwidth	Center Freq 2.43700000 GHz
07U11326	Start Freq 2.41200000 GHz
Ref 20 dBm Atten 20 dB #Samp Log Sector Anthenet	Stop Freq 2.4620000 GHz
10 dB/ Offst	CF Step 5.00000000 MHz <u>Auto Man</u>
dB Center 2.437 00 GHz Span 50 MHz	Freq Offset 0.00000000 Hz
#Res BW 1 MHz #VBW 3 MHz #Sweep 1.72 ms (601 pts)	
Occupied Bandwidth         Occ BW % Pwr         99.00 %           36.7400 MHz         × dB         -26.00 dB	Signal Track On <u>Off</u>
Transmit Freq Error27.970 kHzx dB Bandwidth40.732 MHz*	
Copyright 2000-2007 Agilent Technologies	

Page 77 of 77

# 7.4.3. OUTPUT POWER

## <u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum effective antenna gain is 3 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

#### TEST PROCEDURE

Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

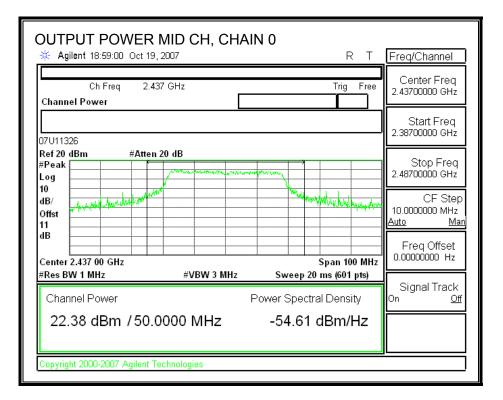
#### RESULTS

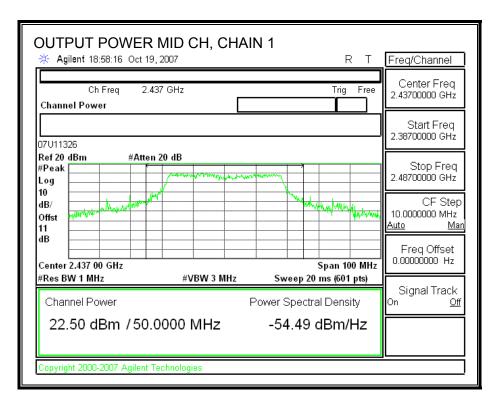
Channel	Frequency	Chain 0	Chain 1	Chain 2	Total	Limit	Margin
		Power	Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2422	17.08	17.79	18.04	22.43	30.00	-7.57
Mid	2437	22.38	22.50	22.75	27.32	30.00	-2.68
High	2452	15.65	15.73	16.32	20.68	30.00	-9.32

Middle channel plots are included hereafter.

Page 78 of 78

### **OUTPUT POWER**





Page 79 of 79

OUTPUT POWER MID CH, CHAIN 2	Freq/Channel				
Ch Freq 2.437 GHz Trig Free Channel Power	Center Freq 2.43700000 GHz				
07U11326	Start Freq 2.38700000 GHz				
Ref 20 dBm #Atten 20 dB #Peak	Stop Freq 2.48700000 GHz				
10 dB/ Offst 11	CF Step 10.000000 MHz <u>Auto Man</u>				
dB Center 2.437 00 GHz Span 100 MHz	Freq Offset 0.00000000 Hz				
#Res BW 1 MHz         #VBW 3 MHz         Sweep 20 ms (601 pts)           Channel Power         Power Spectral Density	Signal Track On <u>Off</u>				
22.75 dBm / 50.0000 MHz -54.24 dBm/Hz					
Copyright 2000-2007 Agilent Technologies					

Page 80 of 80

# 7.4.4. AVERAGE POWER FOR HT40 MODES (2.4GHz)

### <u>LIMITS</u>

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Chain 0	Chain 1	Chain 2	Total Power
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	2422	13.53	13.47	13.95	18.42
Middle	2437	15.81	15.64	16.31	20.70
High	2452	12.07	11.65	12.51	16.86

Page 81 of 81

# 7.4.5. POWER SPECTRAL DENSITY

# <u>LIMITS</u>

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

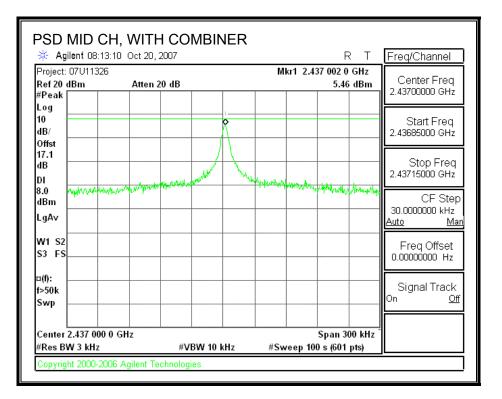
## <u>RESULTS</u>

Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2422	2.94	8	-5.06
Middle	2437	5.46	8	-2.54
High	2452	2.28	8	-5.72

Middle channel plot is included hereafter.

Page 82 of 82

#### POWER SPECTRAL DENSITY, WITH COMBINER



Page 83 of 83

# 7.4.6. CONDUCTED SPURIOUS EMISSIONS

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

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

#### TEST PROCEDURE

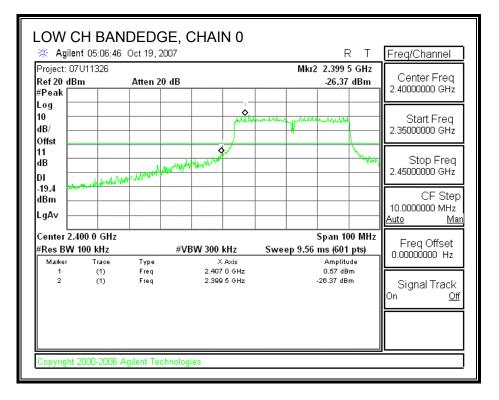
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

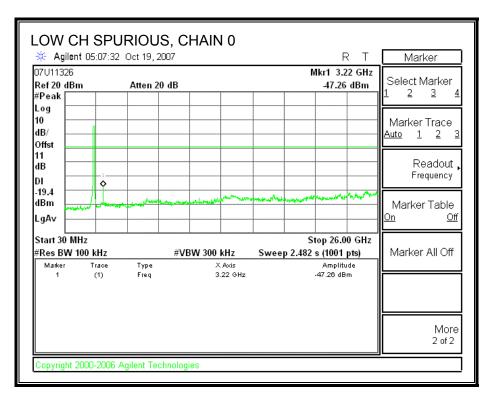
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

#### **RESULTS**

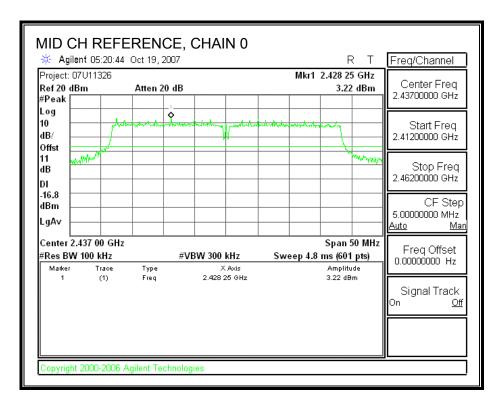
Page 84 of 84

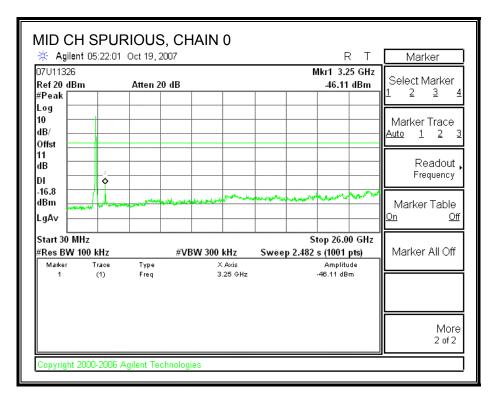
#### **CHAIN 0 SPURIOUS EMISSIONS**



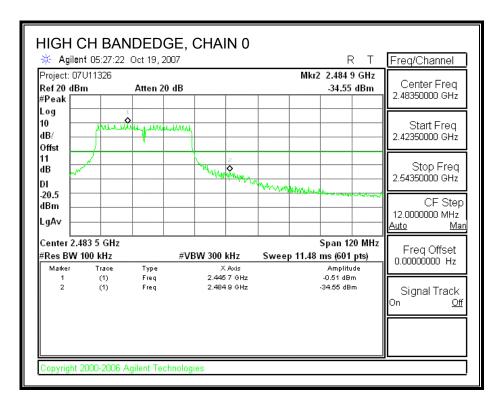


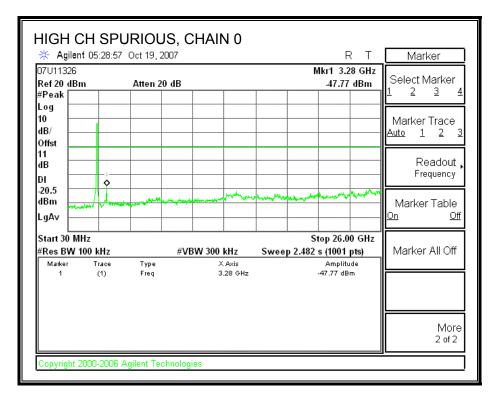
Page 85 of 85





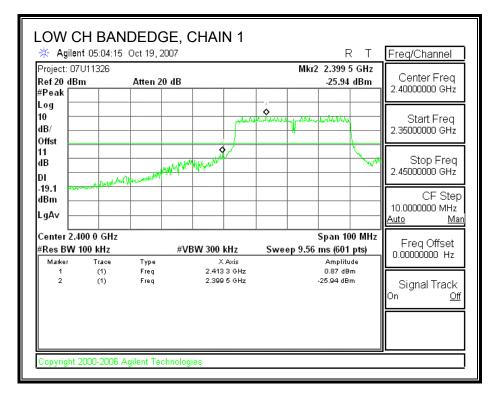
Page 86 of 86

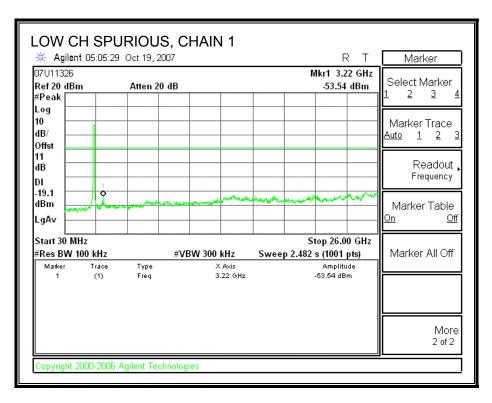




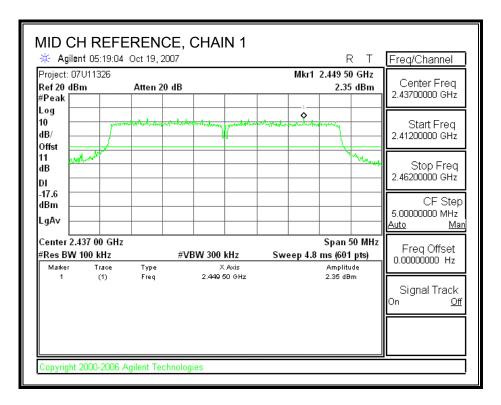
Page 87 of 87

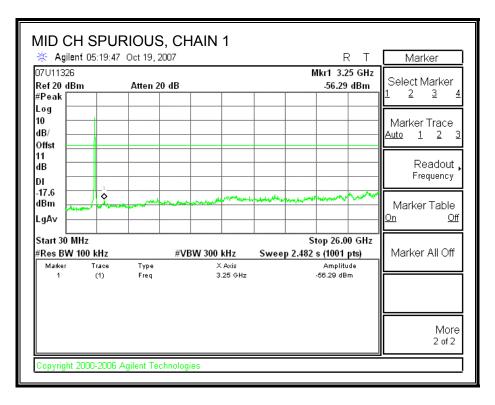
#### **CHAIN 1 SPURIOUS EMISSIONS**



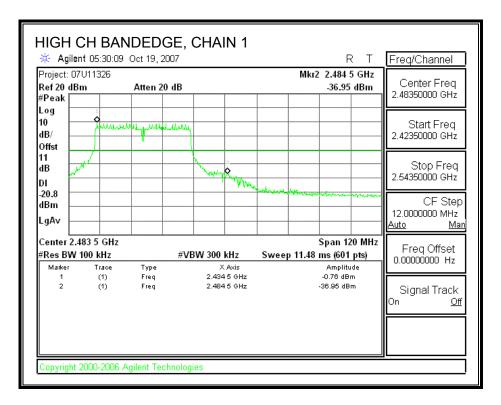


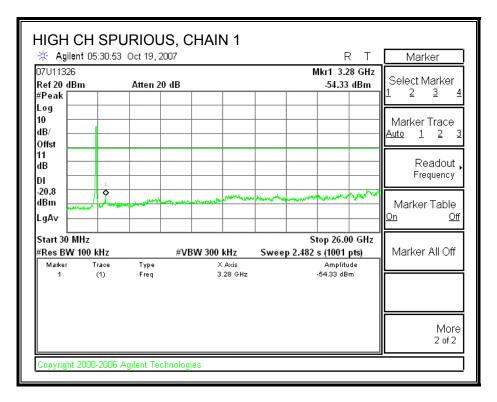
Page 88 of 88





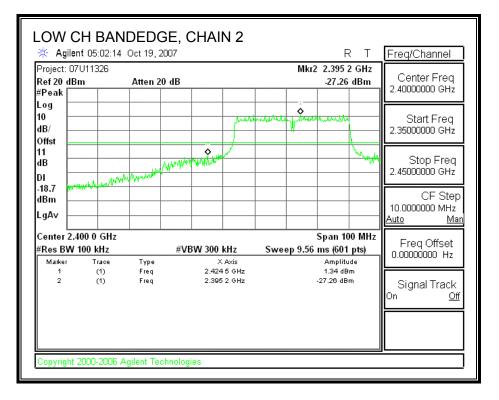
Page 89 of 89

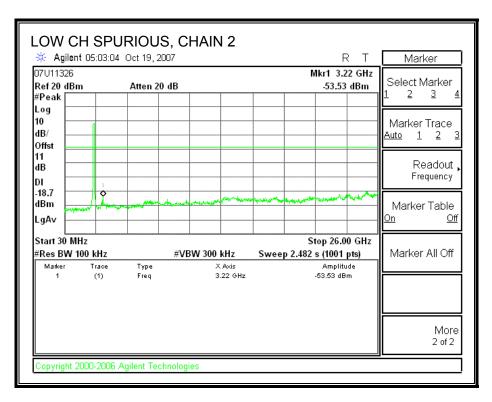




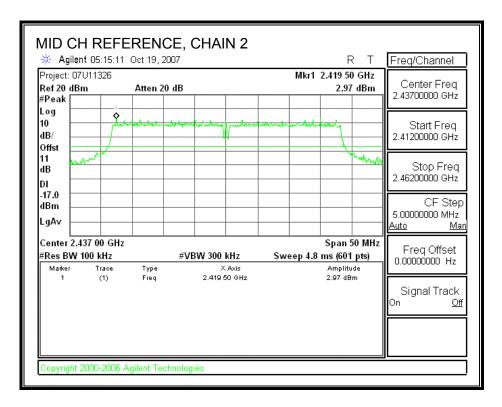
Page 90 of 90

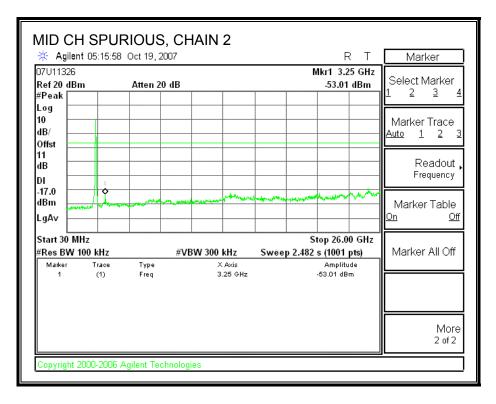
#### **CHAIN 2 SPURIOUS EMISSIONS**



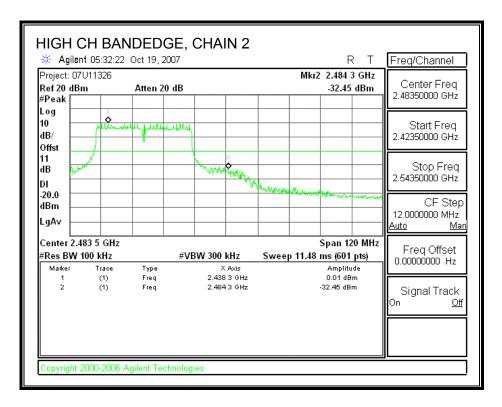


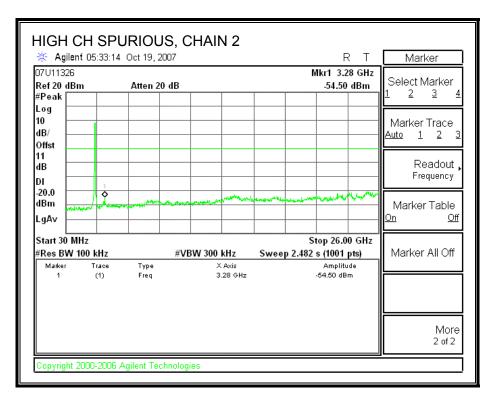
Page 91 of 91





Page 92 of 92





Page 93 of 93

# 7.5. 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND

# 7.5.1. 6 dB BANDWIDTH

## <u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

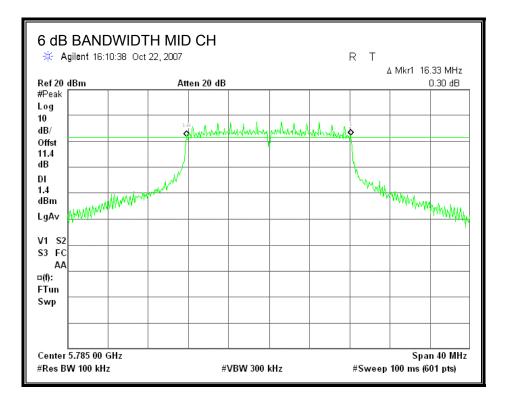
#### **RESULTS**

Channel	Frequency 6 dB BW		Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	5745	16.33	0.5
Middle	5785	16.33	0.5
High	5825	16.33	0.5

Middle channel plot is included hereafter.

Page 94 of 94

#### 6 dB BANDWIDTH



Page 95 of 95

# 7.5.2. 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 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

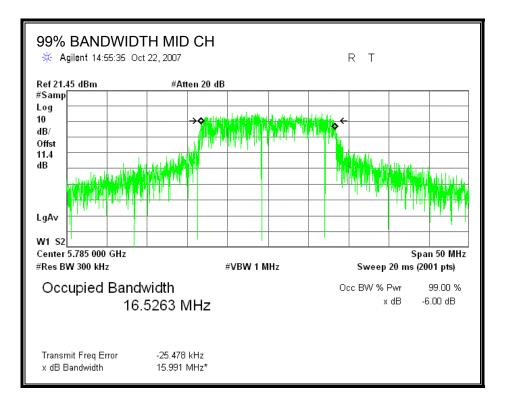
#### RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5745	16.5047
Middle	5785	16.5263
High	5825	16.5226

Middle channel plot is included hereafter.

Page 96 of 96

#### 99% BANDWIDTH



Page 97 of 97

# 7.5.3. OUTPUT POWER

## LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna	10 Log	Effective
Gain	(# Tx Chains)	Legacy Gain
(dBi)	(dB)	(dBi)
5	4.77	9.77

The maximum effective antenna gain is 9.77 dBi for other than fixed, point-to-point operations, therefore the limit is 26.23 dBm.

#### TEST PROCEDURE

Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

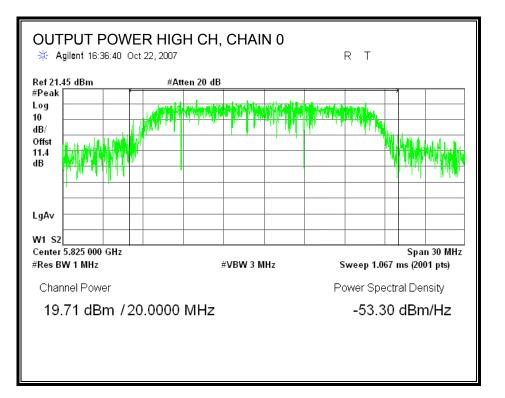
#### **RESULTS**

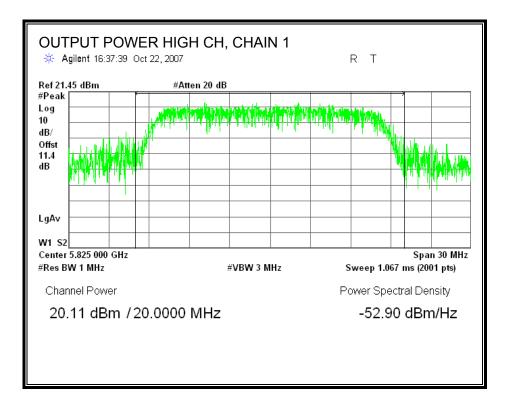
Channel	Frequency	Chain 0	Chain 1	Chain 2	Total	Limit	Margin
		Power	Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5745	20.14	19.98	20.05	24.83	26.23	-1.40
Mid	5785	19.37	20.14	20.06	24.64	26.23	-1.59
High	5825	19.71	20.11	20.51	24.89	26.23	-1.34

High channel plots are included hereafter.

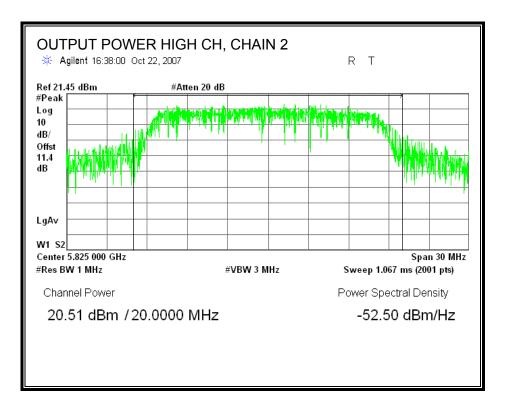
Page 98 of 98

#### **OUTPUT POWER**





Page 99 of 99



Page 100 of 100

# 7.5.4. AVERAGE POWER FOR LEGACY MODES (5.8GHz)

### <u>LIMITS</u>

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11.45 dB (including 10 dB pad and 1.45 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Chain 0	Chain 1	Chain 2	Total Power
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5745	17.52	17.54	17.62	22.33
Middle	5785	17.46	17.98	17.67	22.48
High	5825	17.65	18.02	18.23	22.74

Page 101 of 101

# 7.5.5. POWER SPECTRAL DENSITY

## <u>LIMITS</u>

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

## RESULTS:

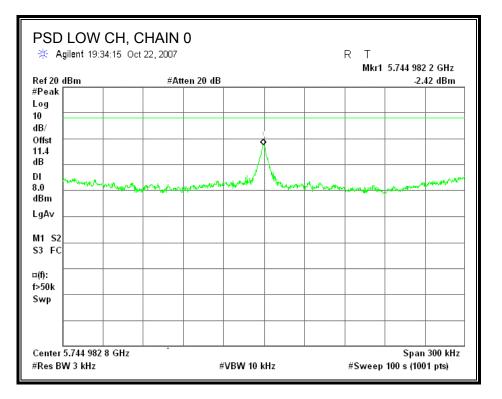
Channel	Frequency	Chain 0	Chain 1	Chain 2	Limit
		PSD	PSD	PSD	
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5745	-2.42	-3.96	-5.91	8
Middle	5785	-3.14	-4.66	-7.23	8
High	5825	-4.08	-4.23	-4.86	8

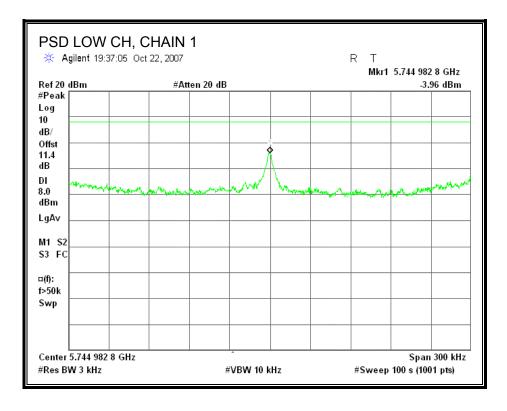
Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5745	4.93	8	-3.07
Middle	5785	4.30	8	-3.70
High	5825	3.95	8	-4.05

Low channel plots are included hereafter.

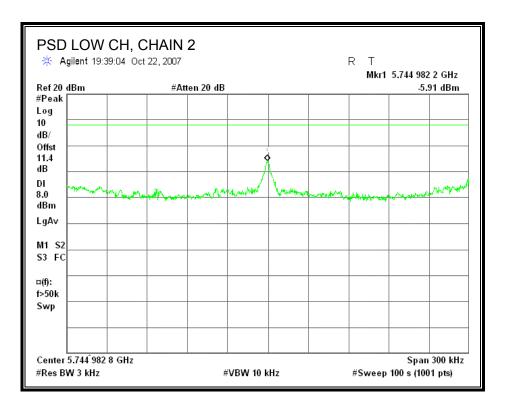
Page 102 of 102

#### **POWER SPECTRAL DENSITY**



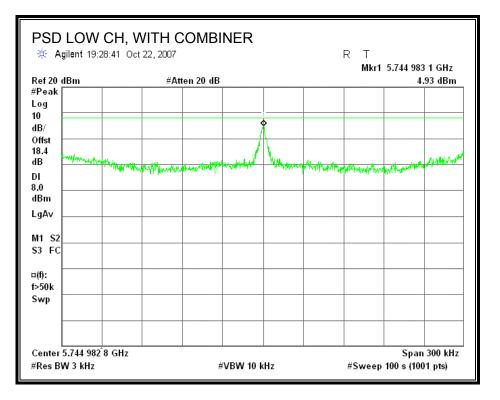


Page 103 of 103



Page 104 of 104

### POWER SPECTRAL DENSITY, WITH COMBINER



Page 105 of 105

# 7.5.6. CONDUCTED SPURIOUS EMISSIONS

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

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

#### TEST PROCEDURE

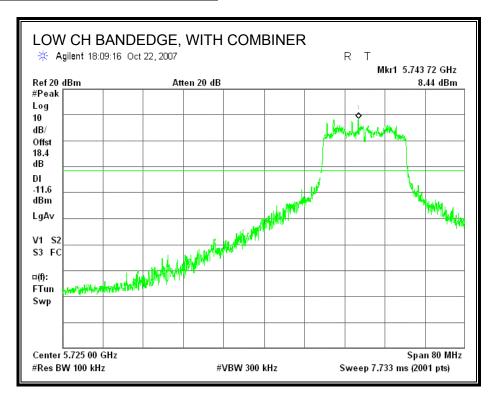
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

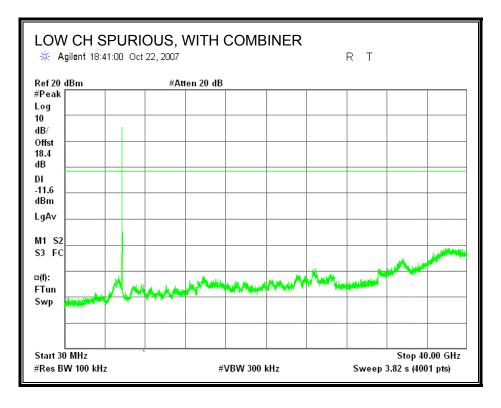
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

#### **RESULTS**

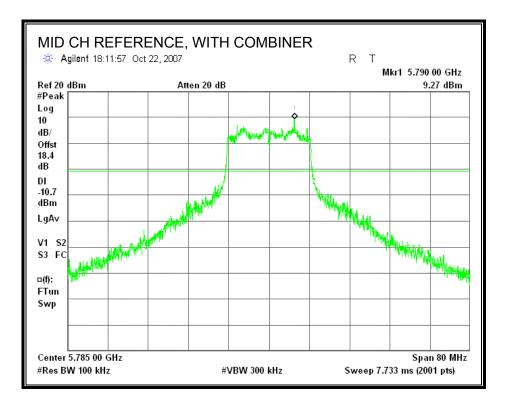
Page 106 of 106

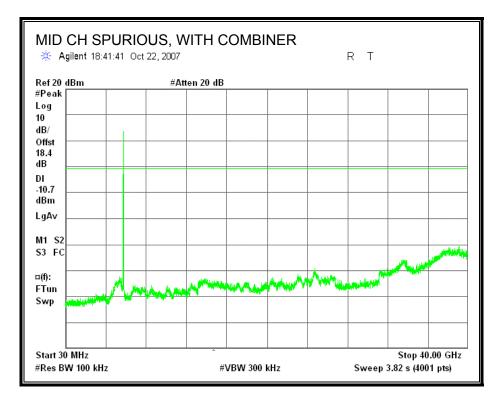
#### SPURIOUS EMISSIONS WITH COMBINER



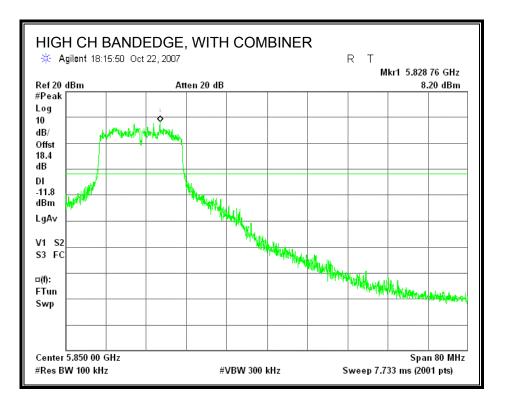


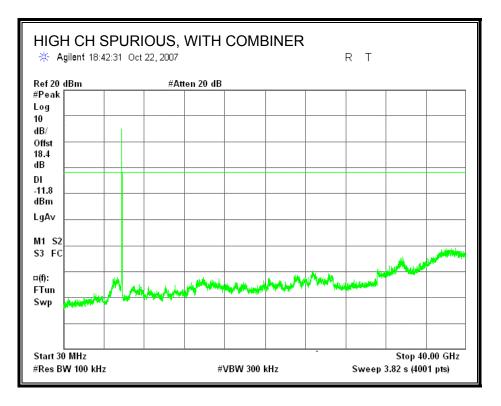
Page 107 of 107





Page 108 of 108





Page 109 of 109

# 7.6. 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND

# 7.6.1. 6 dB BANDWIDTH

# <u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

## TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

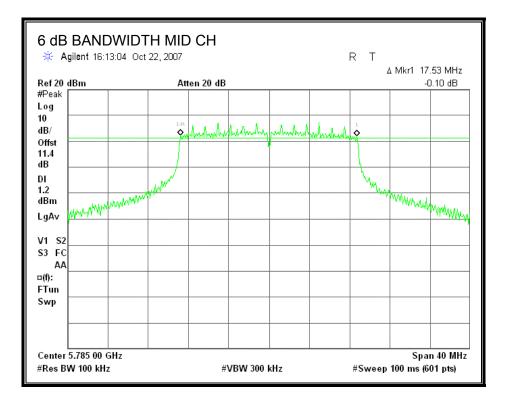
## **RESULTS**

Channel	Frequency	6 dB BW	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	5745	17.20	0.5
Middle	5785	17.53	0.5
High	5825	17.20	0.5

Middle channel plot is included hereafter.

Page 110 of 110

#### 6 dB BANDWIDTH



Page 111 of 111

# 7.6.2. 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 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

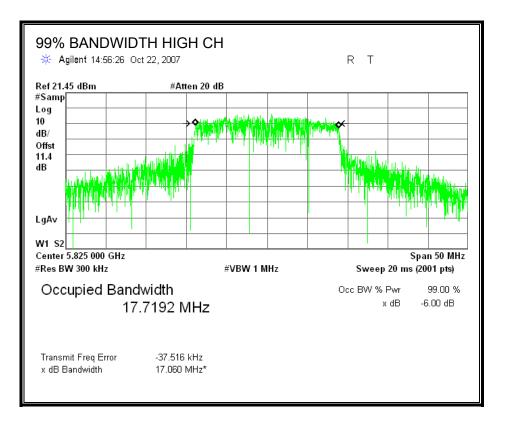
#### **RESULTS**

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5745	17.7012
Middle	5785	17.7110
High	5825	17.7192

High channel plot is included hereafter.

Page 112 of 112

# 99% BANDWIDTH



Page 113 of 113

# 7.6.3. OUTPUT POWER

# <u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum effective antenna gain is 5 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

## TEST PROCEDURE

Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

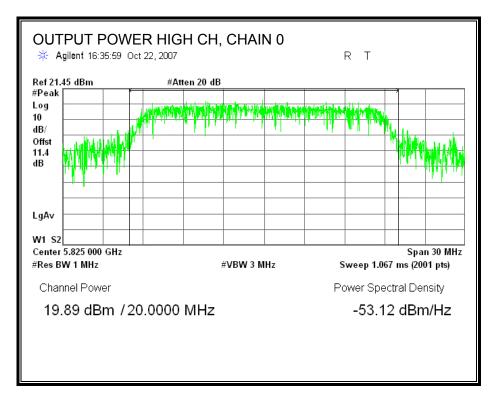
#### <u>RESULTS</u>

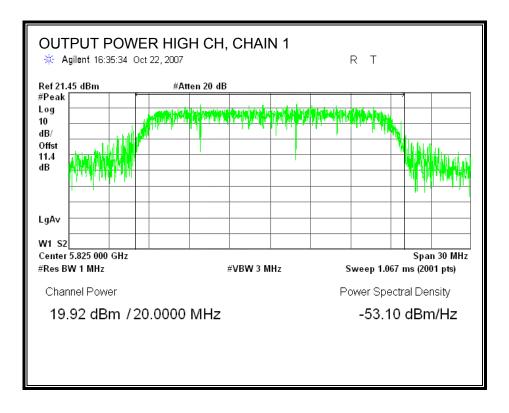
Channel	Frequency	Chain 0	Chain 1	Chain 2	Total	Limit	Margin
		Power	Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5745	19.85	20.40	19.73	24.77	30.00	-5.23
Mid	5785	19.59	19.96	19.82	24.56	30.00	-5.44
High	5825	19.89	19.92	20.23	24.79	30.00	-5.21

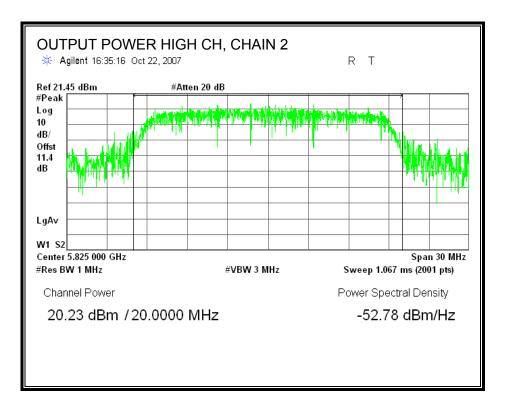
High channel plots are included hereafter.

Page 114 of 114

# **OUTPUT POWER**







Page 116 of 116

# 7.6.4. AVERAGE POWER FOR HT20 MODES (5.8GHz)

# <u>LIMITS</u>

None; for reporting purposes only.

# TEST PROCEDURE

The transmitter output is connected to a power meter.

## RESULTS

The cable assembly insertion loss of 11.45 dB (including 10 dB pad and 1.45 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Chain 0	Chain 1	Chain 2	Total Power
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5745	17.41	17.50	17.50	22.24
Middle	5785	17.46	17.86	17.72	22.45
High	5825	17.70	17.93	18.32	22.76

Page 117 of 117

# 7.6.5. POWER SPECTRAL DENSITY

# <u>LIMITS</u>

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

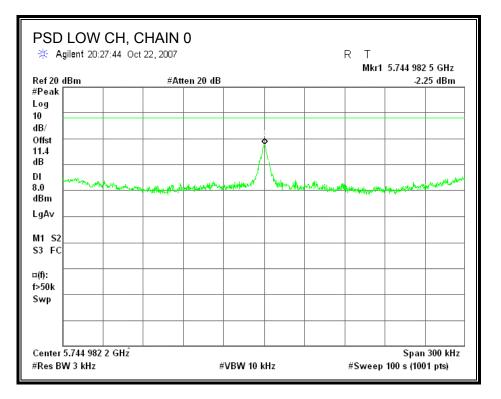
# RESULTS:

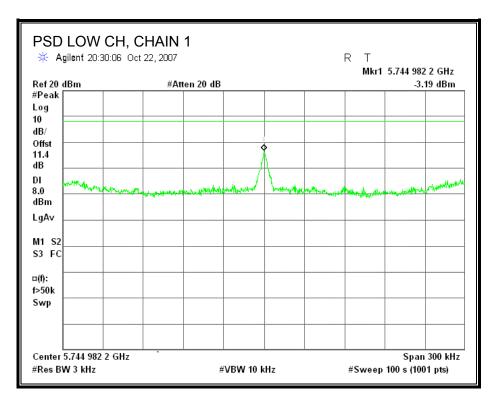
Channel	Frequency	Chain 0	Chain 1	Chain 2	Limit
		PSD	PSD	PSD	
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5745	-2.25	-3.19	-6.13	8
Middle	5785	-3.36	-4.43	-7.40	8
High	5825	-3.77	-3.98	-5.12	8

Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5745	5.51	8	-2.49
Middle	5785	6.36	8	-1.64
High	5825	5.37	8	-2.63

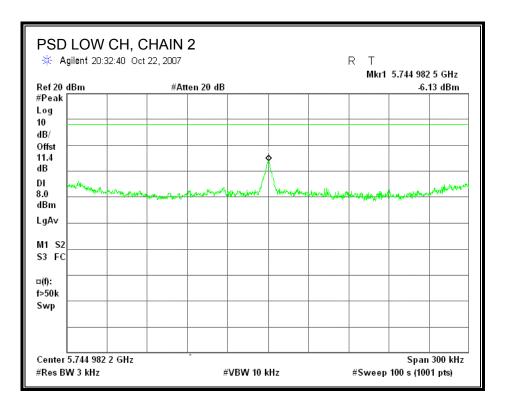
For individual chains Low channel plots are included hereafter. For combined chains Middle channel plots are included hereafter.

# POWER SPECTRAL DENSITY



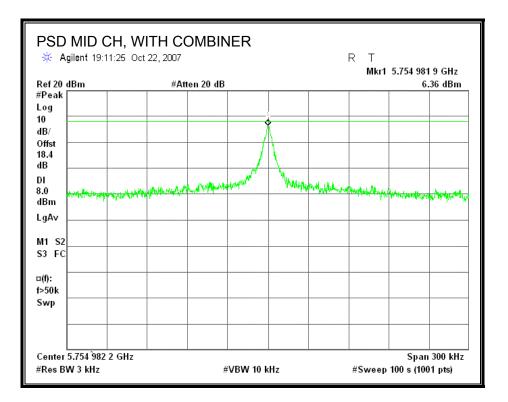


Page 119 of 119



Page 120 of 120

## POWER SPECTRAL DENSITY, WITH COMBINER



Page 121 of 121

# 7.6.6. CONDUCTED SPURIOUS EMISSIONS

## <u>LIMITS</u>

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

#### TEST PROCEDURE

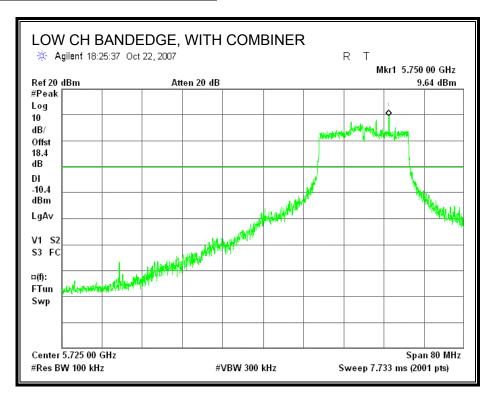
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

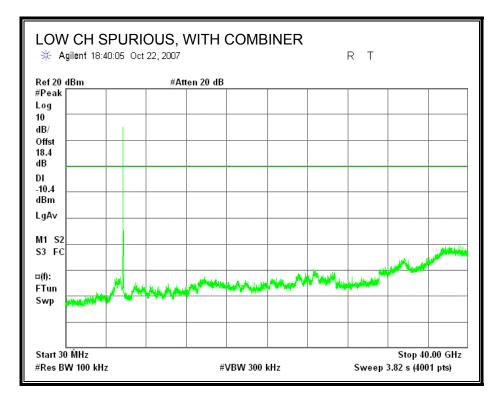
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

#### **RESULTS**

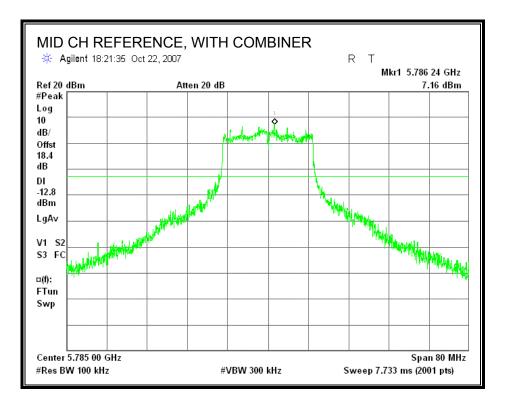
Page 122 of 122

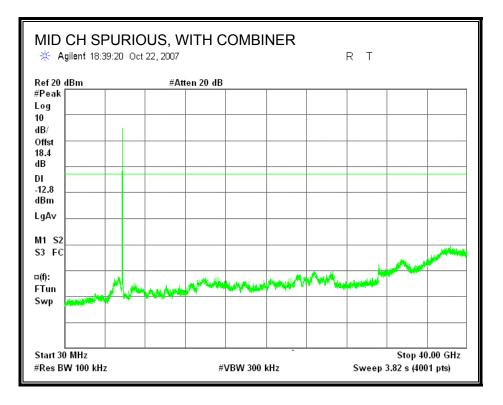
#### SPURIOUS EMISSIONS WITH COMBINER



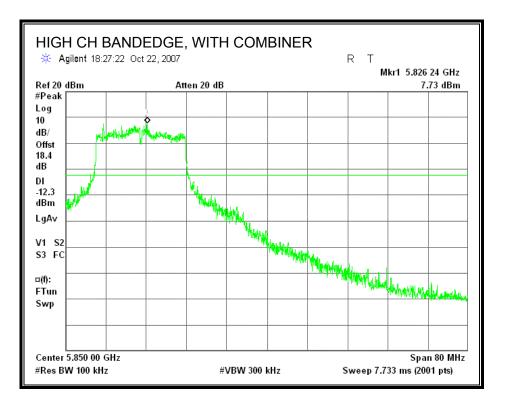


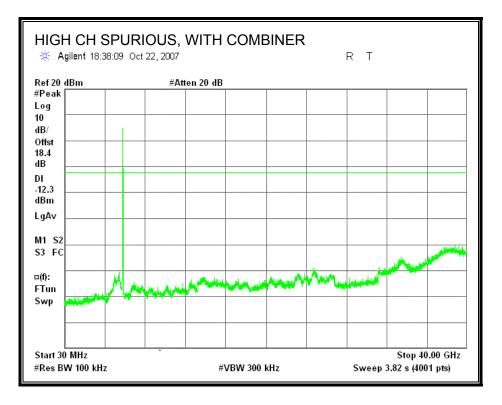
Page 123 of 123





Page 124 of 124





Page 125 of 125

# 7.7. 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND

# 7.7.1. 6 dB BANDWIDTH

# <u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

## TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

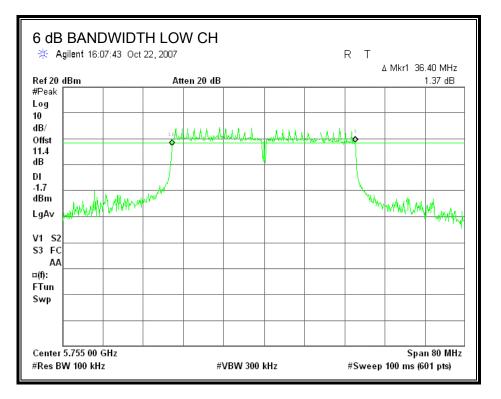
## **RESULTS**

Channel	Frequency	6 dB BW	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	5755	36.4	0.5
High	5795	36.4	0.5

Low channel plot is included hereafter.

Page 126 of 126

#### 6 dB BANDWIDTH



Page 127 of 127

# 7.7.2. 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 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

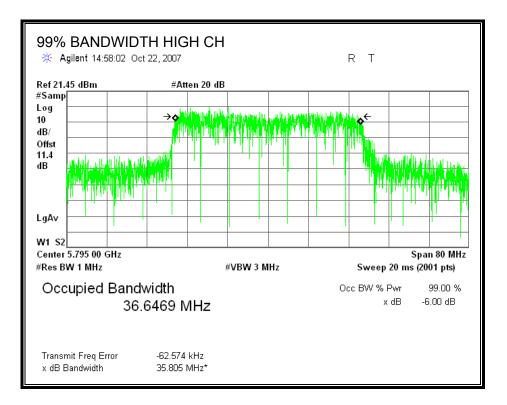
#### RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5755	36.5837
High	5795	36.6469

High channel plot is included hereafter.

Page 128 of 128

# 99% BANDWIDTH



Page 129 of 129

# 7.7.3. OUTPUT POWER

# <u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is 5 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

## TEST PROCEDURE

Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

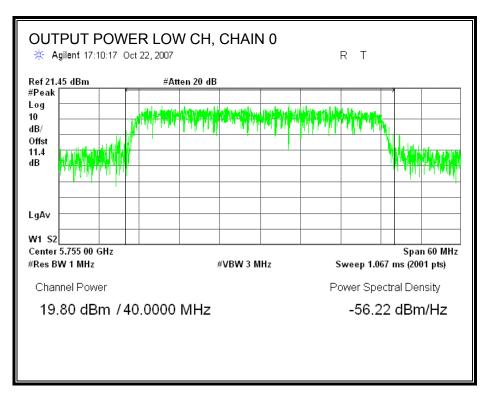
## **RESULTS**

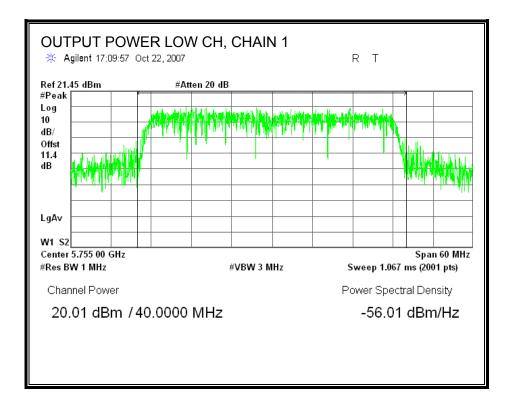
Channel	Frequency	Chain 0	Chain 1	Chain 2	Total	Limit	Margin
		Power	Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5755	19.80	20.01	20.09	24.74	30.00	-5.26
High	5795	19.76	20.15	19.77	24.67	30.00	-5.33

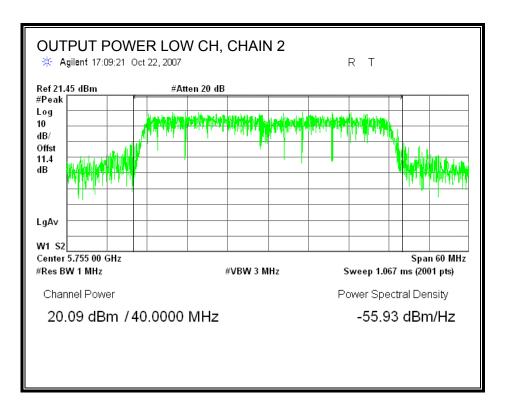
Low channel plots are included hereafter.

Page 130 of 130

# **OUTPUT POWER**







Page 132 of 132

# 7.7.4. AVERAGE POWER FOR HT40 MODES (5.8GHz)

# LIMITS

None; for reporting purposes only.

# TEST PROCEDURE

The transmitter output is connected to a power meter.

## RESULTS

The cable assembly insertion loss of 11.45 dB (including 10 dB pad and 1.45 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Chain 0	Chain 1	Chain 2	Total Power
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5755	17.44	17.67	17.63	22.35
High	5795	17.48	17.92	17.80	22.51

Page 133 of 133

# 7.7.5. POWER SPECTRAL DENSITY

# <u>LIMITS</u>

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

# TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

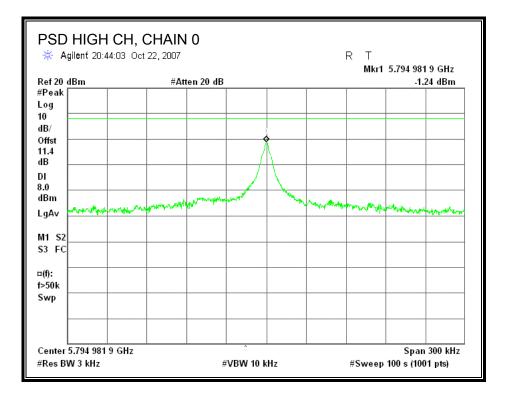
# RESULTS:

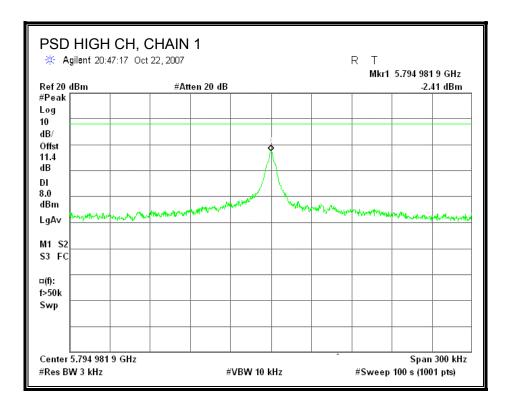
Channel	Frequency	Chain 0	Chain 1	Chain 2	Limit
		PSD	PSD	PSD	
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5755	-1.89	-3.26	-3.86	8
High	5795	-1.24	-2.41	-4.82	8

Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5755	6.36	8	-1.64
High	5795	5.37	8	-2.63

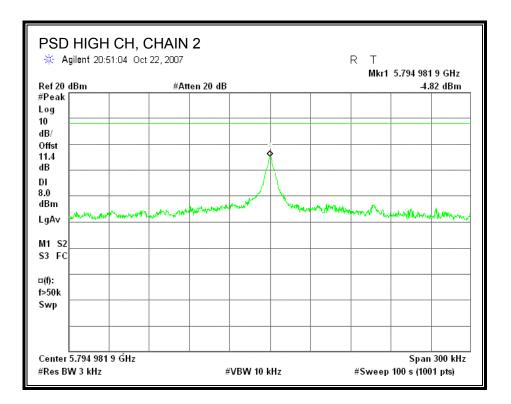
For individual chains High channel plots are included hereafter. For combined chains Low channel plots are included hereafter.

# **POWER SPECTRAL DENSITY**



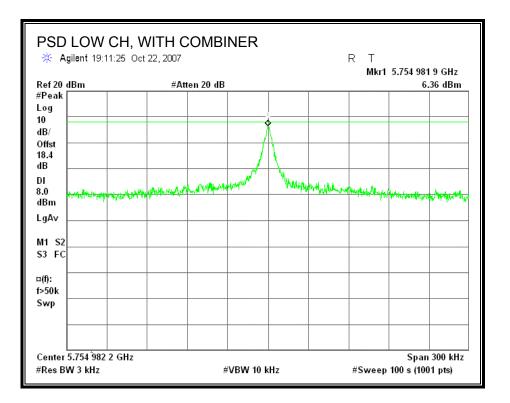


Page 135 of 135



Page 136 of 136

## POWER SPECTRAL DENSITY, WITH COMBINER



Page 137 of 137

# 7.7.6. CONDUCTED SPURIOUS EMISSIONS

## <u>LIMITS</u>

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

#### TEST PROCEDURE

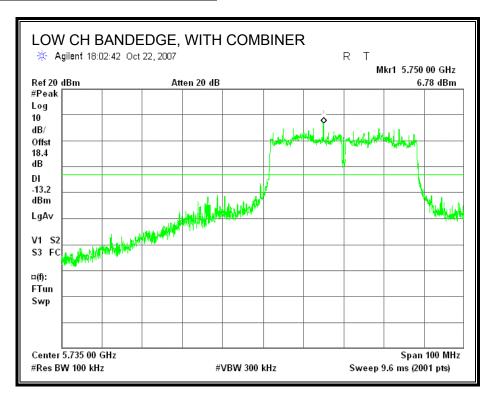
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

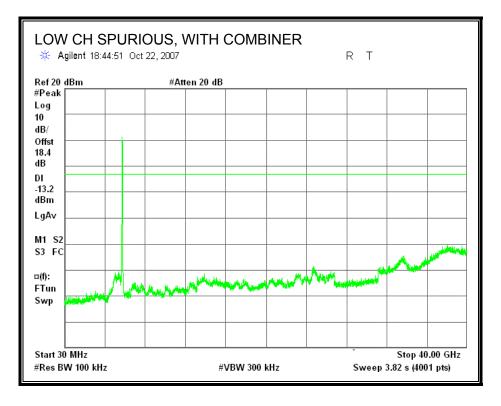
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

#### **RESULTS**

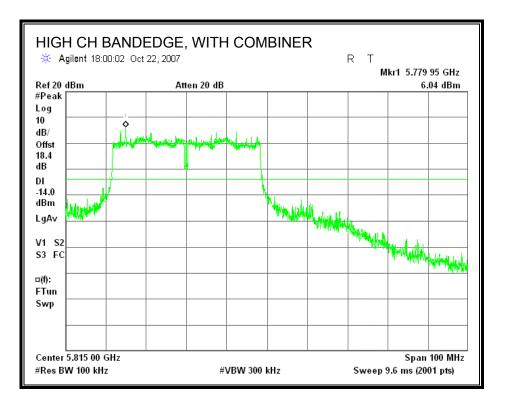
Page 138 of 138

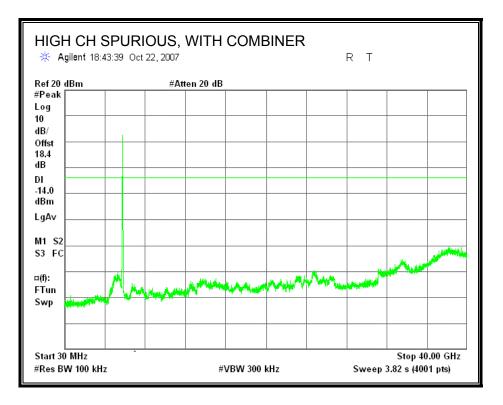
#### SPURIOUS EMISSIONS WITH COMBINER





Page 139 of 139





Page 140 of 140

# 8. RADIATED TEST RESULTS

# 8.1. LIMITS AND PROCEDURE

# <u>LIMITS</u>

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

# TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

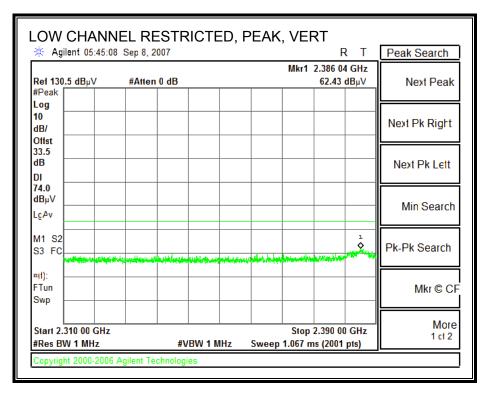
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

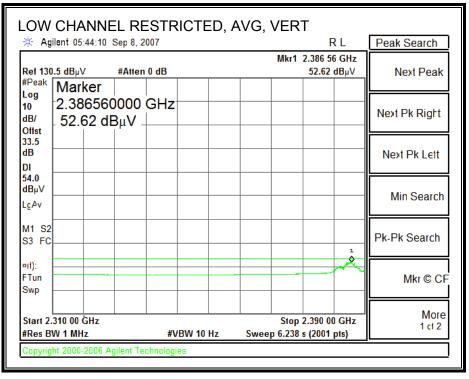
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

# 8.2. TRANSMITTER ABOVE 1 GHz

# 8.2.1. TX ABOVE 1 GHz, 802.11b THREE CHAINS LEGACY MODE, 2.4 GHz

# **RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

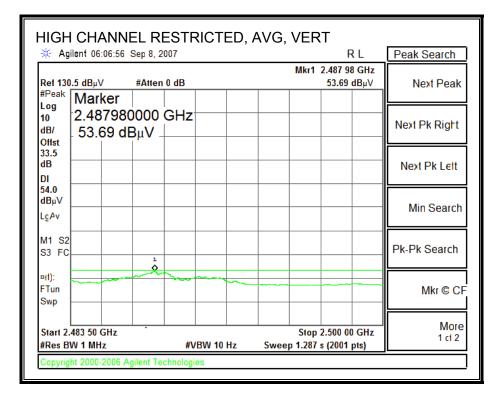




Page 142 of 142

# **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

HIGH			EL RI Sep 8, 2		RICT	ED, I	PEAK	K, VE	RT	₹Т	Peak Search
Ref 130			#Atten					Mkr1	2.487 7	6 GHz	Next Peak
#Peak Log 10 dB/ Offst											Next Pk Right
33.5 dB DI											Next Pk Lett
74.0 dBµV LgAv											Min Search
M1 S2 S3 FC	Ydraradhajili j	marcherer		atteraturi anterio	ana	Anthropodic, a	(Palosterding	امیرید. اماریک	han da an		Pk-Pk Search
¤(1): FTun Swp											Mkr © CF
Start 2. #Res Bl				#V	/BW 1 N	IHz	Sweep		2.500 00 Is (2001		More 1 ct 2
Copyrig	ht 2000-	2006 A	gilent Te	chnologi	es						



Page 143 of 143

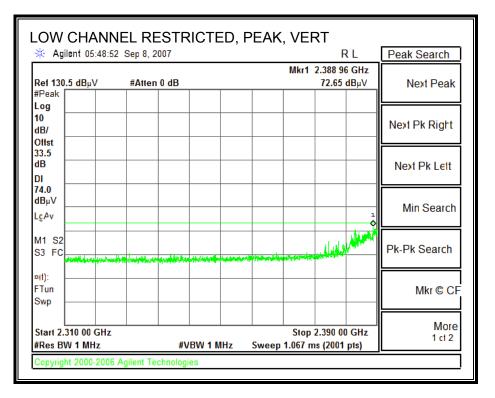
# HARMONICS AND SPURIOUS EMISSIONS

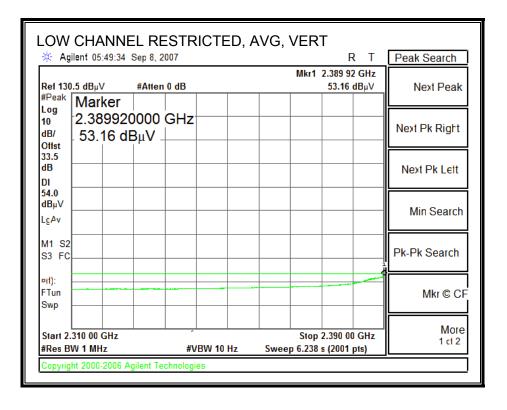
	orn 1- 5/N: 671	18GHz 7@3m		nplifer Aiteq 30			Pre-am T88 Mit	·	26-40GH: 0GHz		Ho ARA 18-26	orn > 180 GHz; S/N:1		-	Limit FCC 15.209
	ii Frequency Cables 3 foot cable					121	foot c	able	HPF Reject Filter					<u>Peak Measurements</u> RBW=VBW=1MHz	
						•	Gordon	a 20313	4001 🗸			•			ge Measurements IMHz ; VBW=10Hz
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m			Pk Mar dB	Avg Mar dB	Notes (V/H)
v CH 24	3.0	48.6	46.4	33.3	6.9	-36.5	0.0	0.0	52.4	50.1	74	54	-21.6	-39	v
36	3.0	38.6	25.9	34.9	8.4	-36.2	0.0	0.0	45.7	33.0	74	54	- <b>28.3</b>	-21.0	Noise floor
24 36	3.0 3.0	43.8 37.3	41.2 25.2	33.3 34.9	6.9 8.4	-36.5 -36.2	0.0 0.0	0.0 0.0	47.6 44.4	44.9 32.3	74 74	54 54	-26.4 -29.6	-9.1 -21.7	H Noise floor
Ch	3.0	3/3	23.2	343	0.4	-30.2	0.0	0.0	44.4	32.5	/4	54	-2930	-21./	THOISE HOUT
74	3.0	48.9	44,4	33.4	6.9	-36.5	0.0	0.0	52.7	48.2	74	54	-21.3	-5.8	<u>v</u>
11 74	3.0 3.0	37.6 39.2	26.3 37.5	35.0 33.4	8.4 6.9	-36.2 -36.5	0.0 0.0	0.0 0.0	44.8 43.0	33.5	74 74	54 54	-29.2 -31.0	-20.5 -12.7	Noise floor H
11	3.0	38.6	26.7	35.0	8.4	-36.2	0.0	0.0	45.7	33.8	74	54	-28.3	-20.2	Noise floor
h CH	20	49.9	45.0	33.4	70	-36.5	0.0	0.0	<u>61</u> 4	49.2				4.0	v
24 86	3.0 3.0	47.7 38.6	45.3 26.1	33.4 35.0	7.0 8.4	-36.2	0.0 0.0	0.0 0.0	51.6 45.8	33.4	74 74	54 54	-22.4 -28.2	-4.8 -20.6	Noise floor
24	3.0	43.7	39 <i>5</i>	33.4	7.0	-36.5	0.0	0.0	47.6	43.4	74	54	- <b>26.4</b>	-10.6	Н
86	3.0	39.2	25.9	35.0	8.4	-36.2	0.0	0.0	46.5	33.1	74	54	-27.5	- <b>20.9</b>	Noise floor
other	mission	s were detect	ed above noise :	floor.											
															<b>.</b>
	f Dist Read AF	Measurem Distance to Analyzer R Antenna Fa	eading	7		Amp D Corr Avg Peak	Average	Correc Field S	ot to 3 mete Strength @ a Field Stre	3 m		Pk Lim Avg Mar	Peak Field Margin vs.	Vield Strength I Strength Lis . Average Lis . Peak Limit	mit
	CL	Cable Loss				HPF	High Pas			ugui		F K. IVIdi	iviaigii vs.	. Feak Laint	

Page 144 of 144

## 8.2.2. TX ABOVE 1 GHz, 802.11g THREE CHAINS LEGACY MODE, 2.4 GHz

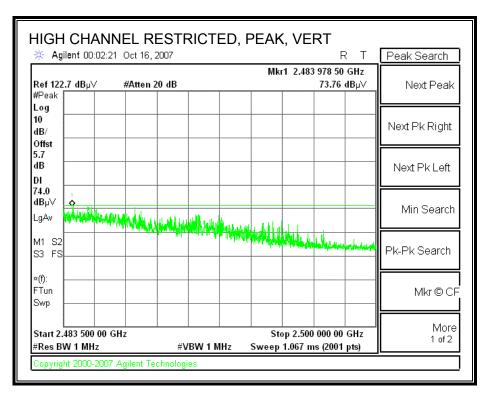
## **RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

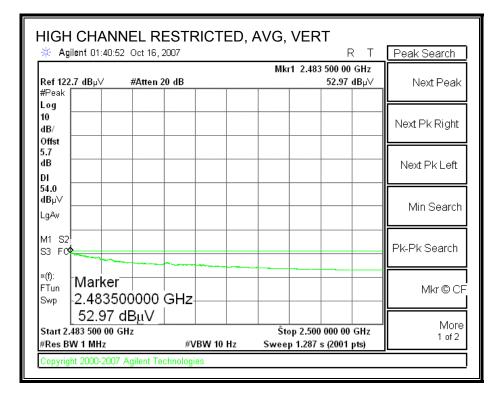




Page 145 of 145

## **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





Page 146 of 146

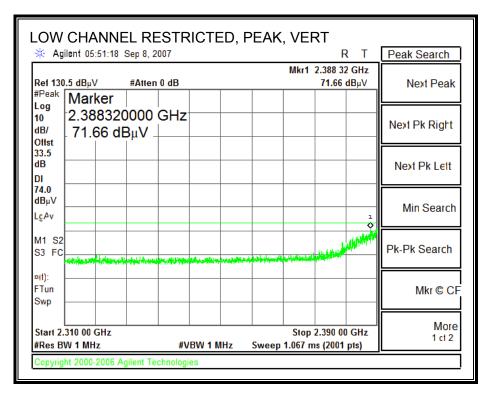
## HARMONICS AND SPURIOUS EMISSIONS

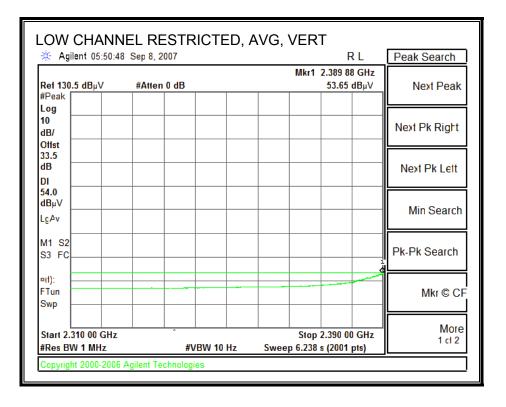
ompli	~	• ·	' Measurem Services, Fr		5m Ch	amber									
ompai	ıy:	Atheros													
roject	#:	07U11326													
ate: oct En		10/16/2007 Mengistu M	alamia												
		EUT With Di													
lode:		2.4GHz, g m													
est Eq	uipmen	t: MB82-03	1-\$0263												
		18GHz	Pre-ar	nplifer	1.260	GH7	Pre-am	plifer	26-40GH	7	н	orn > 180	3H7		Limit
	S/N: 671			Aiteq 30				pinor		-				•	FCC 15.209
- Hi Fre	quency Ca	bles —													
	2 foot	cable	3	footo	able		121	foot c	able		HPF	Re	ject Filte		<u>x Measurements</u> W=VBW=1MHz
			•			·	A-5m C	hamb	er 🗸			• R_	002	Avera	<u>ge Measurements</u> 1MHz ; VBW=10Hz
f	Dist		Read Avg.	AF	CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim	Avg Lim		Avg Mar	Notes
GHz	(m) 2412 MF	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)
w Сн. ( 396	2412 MF 3.0	55.2	36.0	25.2	35	-38.9	0.0	0.0	45.1	25.9	74	54	-28.9	-28.1	v
595	3.0	54.8	37.7	26.0	3.8	-38.6	0.0	0.0	45.9	28.8	74	54	- <b>28.1</b>	-25.2	v
990 800	3.0 3.0	53.7 43.6	36.1 31.5	27.4 33.3	4.3 6.9	-38.1 -36.5	0.0 0.0	0.0 0.0	47.3 47.3	29.7 35.2	74 74	54 54	-26.7 -26.7	-24.3 -18.8	v
822 396	3.0	43.0 54.2	31.5	25.2	35	-30.5	0.0	0.0 0.0	4/.3	35.2 24.6	74	54 54	-20.7 -29.9	-18.8 -29.4	¥ Н
595	3.0	56.7	39.0	26.0	3.8	-38.6	0.0	0.0	47.8	30.1	74	54	- <b>26.2</b>	-23.9	Н
990 822	3.0 3.0	51.3 41.0	34.5 28.4	27.4 33.3	4.3 6.9	-38.1 -36.5	0.0 0.0	0.0 0.0	44.9 44.7	28.1 32.1	74 74	54 54	-29.1	-25.9 -21.9	H H
022	3.0	41.0	20,4	333	0.9	-30.5	0.0	0.0	44.)	32.1	/4	54	-29.3	-21.9	n
	2437 MH														
876 876	3.0 3.0	43.2 41.3	31.2 28.3	33.4 33.4	69 69	-36.5 -36.5	0.0 0.0	0.0 0.0	47.0 45.1	35.0 32.1	74 74	54 54	-27.0 -28.9	-19.0 -21.9	V н
0/0	5.0	415	205	557	0.5	-302	0.0	0.0	42.1		· · ·		-205		
	462 MHz														
917 917	3.0 3.0	41.6 40.5	29.8 28.3	33.4 33.4	7.0 7.0	-36.5 -36.5	0.0 0.0	0.0 0.0	45 <i>5</i> 44,4	33.7 32.2	74 74	54 54	-28.5 -29.6	-20.3 -21.8	V H
ev. 4.12.	7														
	f	Measureme	ent Frequenc <sup>,</sup>	4		Amp	Preamp (	Gain				Avg Lim	Average H	Field Strengt	h Limit
	Dist	Distance to				D Corr	-		ct to 3 mete	rs		-	-	d Strength Li	
	Read	Analyzer R	-			Avg	-		Strength @			-	-	. Average Li	
	AF	Antenna Fa				Peak			c Field Stre	ngth		Pk Mar	Margin vs	. Peak Limit	
	CL	Cable Loss				HPF	High Pas	s Filter							

Page 147 of 147

## 8.2.3. TX ABOVE 1 GHz, 802.11n HT20 MODE, 2.4 GHz

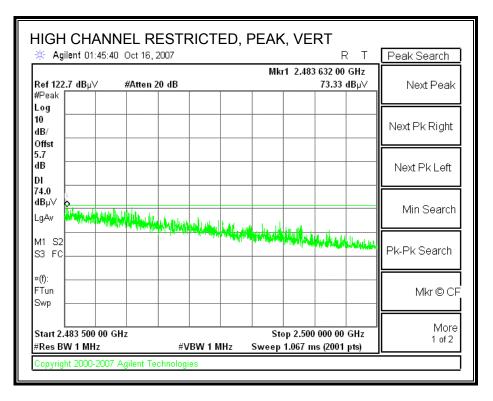
## **RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

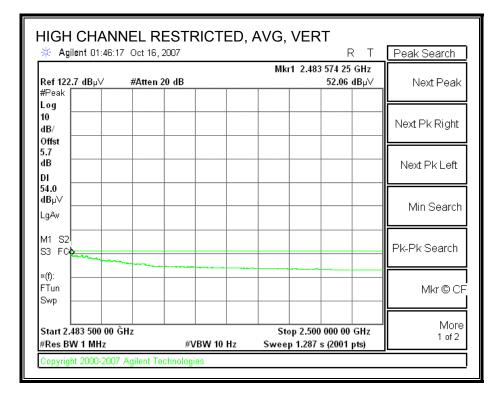




Page 148 of 148

## **RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





Page 149 of 149

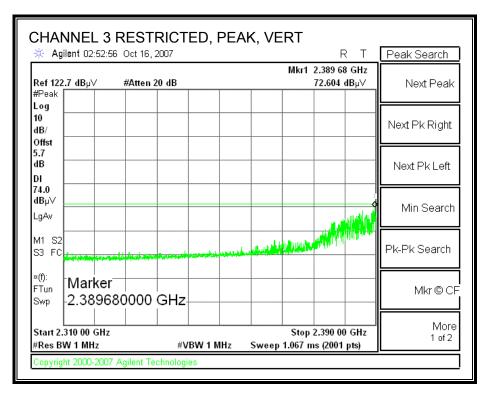
## HARMONICS AND SPURIOUS EMISSIONS

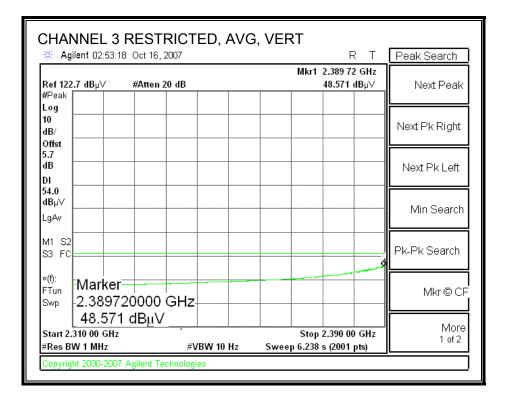
H 173; 9	orn 1- 5/N: 6717		Pre-ar	nplifer liteq 30			Pre-am	plifer	26-40GH			orn > 18( 6GHz; S/N:1		•	Limit FCC 15.209
	uency Cal 2 foot		3	foot c	able	•	12 1 A-5m C	foot c hambe			HPF		eject Filte 002	RB	<u>k Measurements</u> W=VBW=1MHz age Measurements =1MHz ; VBW=10Hz
f	Dist		Read Avg.	AF	CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim	Avg Lim	1	Avg Mar	Notes
GHz ow Ch. (	(m) 2412 MH		dBuV	dB/m	dB	dB	dB	dB	dBuV/m		dBuV/m		dB	dB	(V/H)
822 822	3.D 3.D	44.1 41.3	31.2 28.5	33.3 33.3	69 69	-36.5 -36.5	0.0 0.0	0.0 0.0	47.8 45.0	34.9 32.2	74 74	54 54	-26.2 -29.0	-19.1 -21.8	V H
	2437 MH	•													
351	3.0	42.8	30.5	33 <i>.</i> 3	69	-36.5	0.0	0.0	46.6	34.2	74	54	-27 <i>A</i>	-19.8	v
851	3.0	40 <i>.</i> 9	28.4	33.3	69	-36.5	0.0	0.0	44.7	32.2	74	54	-29.3	-21.8	H
i Ch. (24 932	462 MHz 3.0	42.2	29.8	33.4	7.0	-36.5	0.0	0.0	46.1	33.7	74	54	-27.9	-20.3	v
932 932	3.0 3.0	41.3	28.3	33.4 33.4	7.0	-36.5	0.0	0.0	45.2	32.2	74	54 54	-27.5	-20.5	H H
		Measurem Distance to Analyzer R Antenna F: Cable Los:	eading actor	7		Amp D Corr Avg Peak HPF	Average	Corre Field S ed Peal	ct to 3 mete Strength @ c Field Stre:	3 m		Pk Lim	Peak Fiel Margin vs	Field Strengt d Strength L 5. Average L 5. Peak Limit	imit imit

Page 150 of 150

## 8.2.4. TX ABOVE 1 GHz, 802.11n HT40 MODE, 2.4 GHz

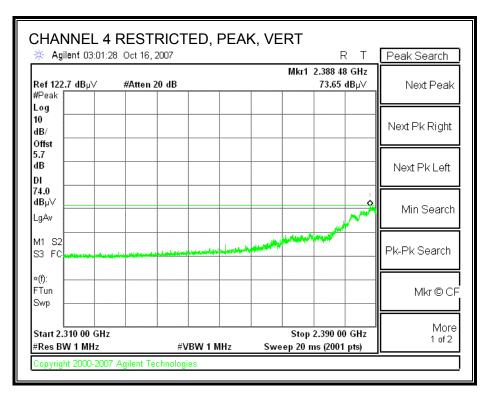
## **RESTRICTED LOW BANDEDGE (CHANNEL 3, VERTICAL)**

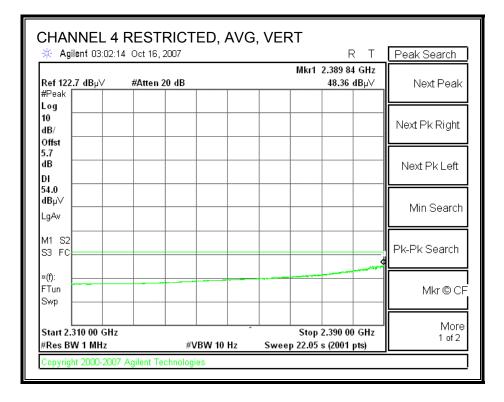




Page 151 of 151

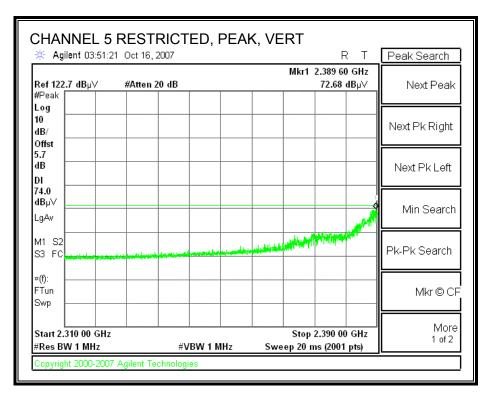
## **RESTRICTED LOW BANDEDGE (CHANNEL 4, VERTICAL)**

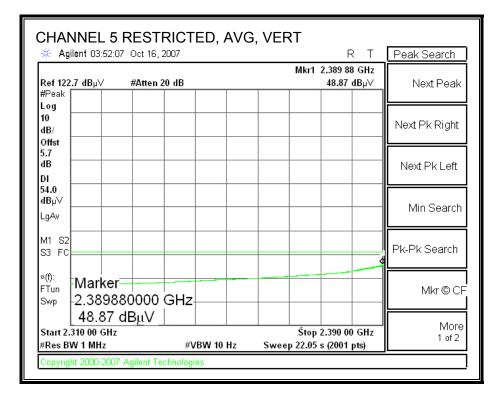




Page 152 of 152

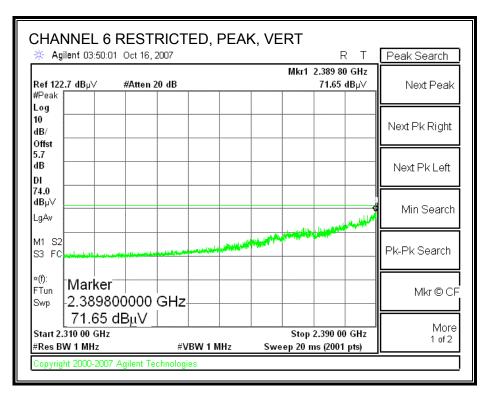
## **RESTRICTED LOW BANDEDGE (CHANNEL 5, VERTICAL)**

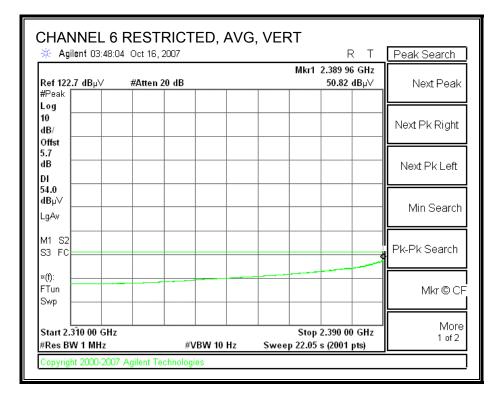




Page 153 of 153

## **RESTRICTED LOW BANDEDGE (CHANNEL 6, VERTICAL)**

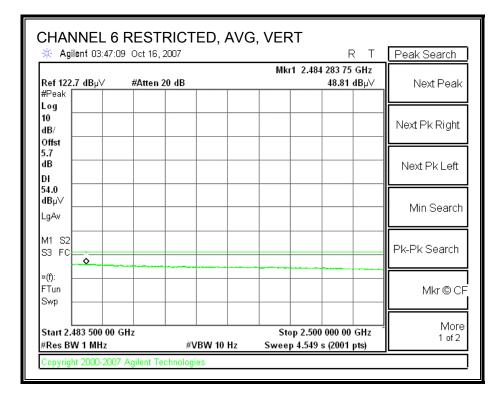




Page 154 of 154

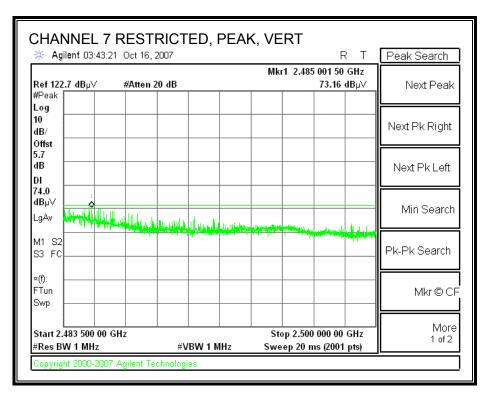
## **RESTRICTED HIGH BANDEDGE (CHANNEL 6, VERTICAL)**

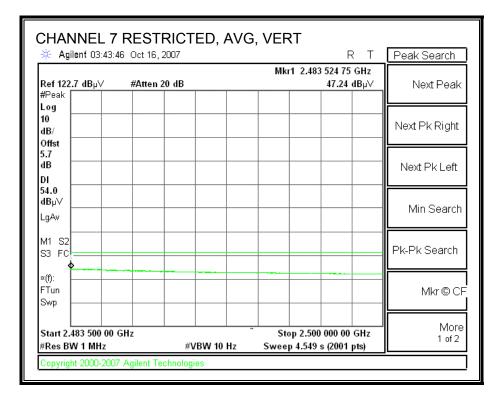
Ag	jilent 03:46:44	Oct 16,3	2007					F	х Т	Peak Search
f 122	2.7 dBµ∨	#Atten 2	20 dB			Mki	1 2.483	500 00 73.83		Next Pea
eak										
g :/										Next Pk Righ
fst										Next Pk Left
.0										
.0 μ∨ ∢ Αγ		to fill and all	la helter fild	r la		Legipe at la de la	e all al al II.	وروار الماليا	ert hie de	Min Searc
S2 FC										Pk-Pk Search
i: Un Ip	Marker 2.483500	0000	GHz							Mkr © (
	73.83 dE	BμV_								Mor
	.483 500 00 GH: W 1 MHz	Z	#V	BW 1 I	MHz		op 2.500 ep 20 m			1 of 2



Page 155 of 155

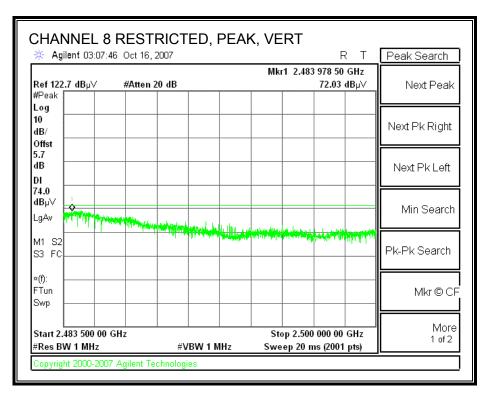
## **RESTRICTED HIGH BANDEDGE (CHANNEL 7, VERTICAL)**

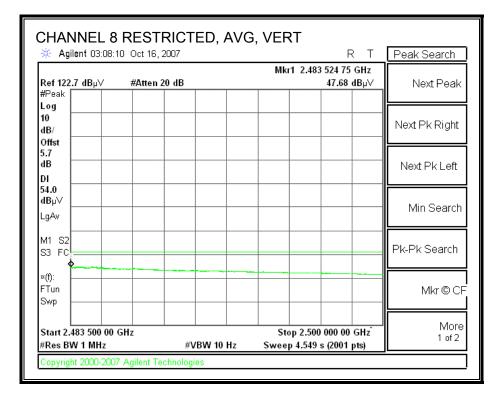




Page 156 of 156

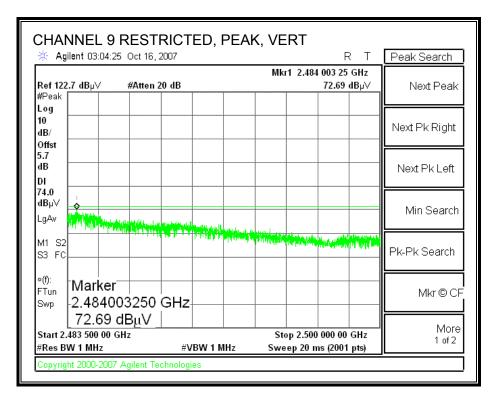
## **RESTRICTED HIGH BANDEDGE (CHANNEL 8, VERTICAL)**

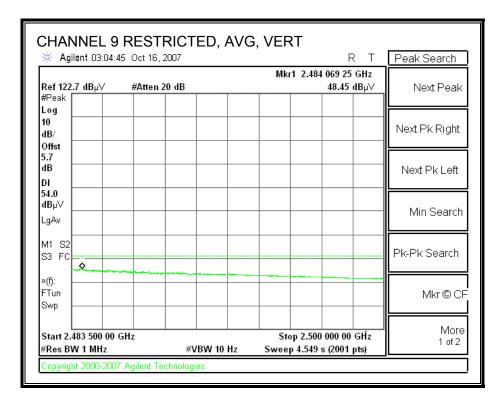




Page 157 of 157

## **RESTRICTED HIGH BANDEDGE (CHANNEL 9, VERTICAL)**





Page 158 of 158

## HARMONICS AND SPURIOUS EMISSIONS

T73; S/	orn 1- /N: 6717		Pre-ar	nplifer liteq 30			Pre-am	plifer	26-40GH:			orn > 180 GHz; S/N:1		•	Limit FCC 15.209
- Hi Frequ	iency Cal 2 foot		3	foot c	able	•	12 1 A-5m C	foot c hambe			HPF		ject Filte 002	RB Avera	<u>x Measurements</u> W=VBW=1MHz ge Measurements 1MHz ; VBW=10Hz
f	Dist		Read Avg.	AF	CL	Amp	D Corr	Fltr	Peak JBV/	Avg	Pk Lim	Avg Lim		Avg Mar	Notes
GHz ow Ch. (24	(m) 422 MH		dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m		dB	dB	(V/H)
322 322	3.0 3.0	41.5 41.4	29.3 28.4	33.3 33.3	6.9 6.9	-36.5 -36.5	0.0 0.0	0.0 0.0	45.2 45.1	33.0 32.1	74 74	54 54	-28.8 -28.9	-21.0 -21.9	<u></u> н
d Ch. (24 351	3.0	42.4	28.4	33.3	6.9	-36.5	0.0	0.0	46.1	32.1	74	54	- <b>27 9</b>	-21.9	v
851	3.0	40.8	28,4	33 <i>.</i> 3	6.9	-36.5	0.0	0.0	44.6	32.2	74	54	-29.4	-21.8	H
Ch. (245															
883 883	3.0 3.0	41.6 41.5	28.5 28.3	33.4 33.4	69 69	-36.5 -36.5	0.0 0.0	0.0 0.0	45.4 45.4	32.4 32.1	74 74	54 54	-28.6 -28.6	-21.6 -21.9	V H
	Dist	Measurem Distance to Analyzer R Antenna Fa	eading actor	7		Amp D Corr Avg Peak HPF	Average	Correc Field S d Peak	et to 3 mete Strength @ 5 Field Stre	3 m		Pk Lim Avg Mar	Peak Fiel Margin vs	Field Strengt d Strength L . Average L . Peak Limit	imit imit

Page 159 of 159

## 8.2.5. TX ABOVE 1 GHz, 802.11a THREE CHAINS LEGACY MODE, 5.8 GHz

## HARMONICS AND SPURIOUS EMISSIONS

	orn 1-		Pre-ar	· ·				·	26-40GH		H	orn > 180			Limit
	5/N: 6717 Juency Cat	•	▼   1144 N	liteq 30	08A00	931	T88 Mit	eq 26-4	IUGHZ	-   139	; AKA 10-20	GHZ; S/N:	013	•	FCC 15.209
	2 foot	cable	3	foot c	able			foot c			HPF	Re	ject Filte	RB	<u>k Measurements</u> W=VBW=1MHz
			•			•	B-5m C	hambe	er 🔽		F_7.6GHz	•			<b>ge <u>Measurements</u></b> 1MHz ; VBW=10Hz
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
	5745 MH 3.0		27.7	37.6	12.2	-35.5	0.0	0.7	56.0	42.7	74	54	-18.0	-11.3	v
1.870	3.0	41.6	29.3	37.6	12.2	-35.5	0.0	0.7	56.6	44.3	74	54	-17.4	- <b>9.</b> 7	Н
.584	5785 MH 3.0	41.5	27.8	37.5	11.9	-35.8	0.0	0.7	55.9	42.2	74	54	- <b>18.1</b>	-11.8	v
1.584	3.0	41.4	28.0	37.5	11.9	-35.8	0.0	0.7	55.8	42.4	74	54	-18.2	-11.6	H
1.645	325 MHz) 3.0	41.9	28.5	37.5	12.0	-35.7	0.0	0.7	56.4	43.0	74	54	-17.6	-11.0	v
1.645	3.0	41.8	28.9	37.5	12.0	-35.7	0.0	0.7	56.3	43.4	74	54	-17.7	-10.6	H
ev. 4.12.1	7														
	f	Measurem	ent Frequency	,		Amp	Preamp (	Tain				Avalim	Average	Field Strengt	h Timit
	Dist	Distance to	Antenna	,		*	Distance	Correc	ct to 3 mete			Pk Lim	Peak Fiel	d Strength L	imit
	Read AF	Analyzer R Antenna F:	-			Avg Peak	-		Strength @ c Field Stre			-	-	: Average L : Peak Limit	
	CL	Cable Los:				HPF	High Pas			ngui		I IC IVIOI	TATAL BIT #2		,

Page 160 of 160

## 8.2.6. TX ABOVE 1 GHz, 802.11n HT20 MODE, 5.8 GHz

## HARMONICS AND SPURIOUS EMISSIONS

		10/17/2007 Mengistu M EUT With D													
lode:		5.8GHz, a mo													
		t:MB82-03	<u>1-80263</u> Pre-ar	un life u	4.064		Dra ana	n life v	26-40GH			orn > 180	211-		Limit
	6/N: 671	18GHz 7 @3m		liteq 30			T88 Mit	·				GHz; S/N:1		-	FCC 15.209
- Hi Fred	juency Cal	bles —				_				 					
	2 foot	cable	3	foot o	able		12 1 B-5m C	foot c		НР	HPF F_7.6GHz	Re	ject Filte	RB	<u>k Measurements</u> W=VBW=1MHz age Measurements
	-					•								RBW=	1MHz ; VBW=10Hz
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.493	5745 MH 3.0	41.0	27.7	37.5	11.8	-35.9	0.0	0.7	55.1	41.9	74	54	-18.9	-12.1	V
.493	3.0	42.0	29.2	37.5	11.8	-35.9	0.0	0.7	56.2	43,4	74	54	-17.8	-10.6	H
.569	5785 MH 3.0	40.8	27.8	37.5	11.9	-35.8	0.0	0.7	55.1	42.1	74	54	- <b>18.9</b>	-11.9	v
.569	3.0	40.9	27.9	37.5	11.9	-35.8	0.0	0.7	55.3	42.3	74	54	-18.7	-11.7	Н
i Ch. (58 1.653	325 MHz 3.0	41.2	28.5	37.5	12.0	-35.7	0.0	0.7	55.8	43.0	74	54	-18.2	-11.0	v
1.653	3.0	41.2	28.9	37.5	12.0	-35.7	0.0	0.7	55.8	43.4	74	54	-18.2	-10.6	H
ev. 4.12.	7				L	1		I			4			1	
	f Dist		ent Frequency	7		Amp	Preamp (					-	-	Field Strengt d Strength L	
		Distance to Analyzer R				Avg			ct to 3 mete Strength @					a Strengtn L 1. Average L	
	AF	Antenna Fa	actor			Peak	Calculate	d Peal	c Field Stre			-	-	. Peak Limi	
	CL	Cable Loss				HPF	High Pas	s Filter							

Page 161 of 161

## 8.2.7. TX ABOVE 1 GHz, 802.11n HT40 MODE, 5.8 GHz

## HARMONICS AND SPURIOUS EMISSIONS

onfigu Iode:	ration:	Mengistu M EUT With D 5.8GHz, a m t: MB82-03	ELL Laptop ode, TH40												
н	orn 1-	18GHz	Pre-ar	- C.				·	26-40GH			orn > 18			Limit
	5/N: 671	•	▼   T144 N	liteq 30	08A009	931 🗸	T88 Mit	eq 26⊿	l0GHz	- T39	; ARA 18-20	GHz; S/N:	1013	•	FCC 15.209
	2 foot		3	footo	able			foot c			HPF	Re	ject Filte	RB	<u>k Measurements</u> W=VBW=1MHz
			-			•	B-5m C	namb	er 📕		F_7.6GHz	•			ege Measurements 1MHz ; VBW=10Hz
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
w Ch. (* 494 494	5755 ME 3.0 3.0	z) 41.2 41.0	27.6 27.7	375 375	119 119	-35.9 -35.9	0.0 0.0	0.7 0.7	55.3 55.1	41.8 41.9	74 74	54 54	-18.7 -18.9	-12.2 -12.1	V H
Ch. (57 598 598	795 MHz 3.0 3.0	) 41.3 41.0	27.8 27.8	375 375	12.0 12.0	-35.8 -35.8	0.0 0.0	0.7 0.7	55.7 55.4	42.2 42.2	74 74	54 54	-18.3 -18.6	-11.8 -11.8	V H
v. 4.12.5	f Dist	Measurem Distance to Analyzer R Antenna Fa	eading	7		Amp D Corr Avg Peak	Average	Corre Field S	ct to 3 mete Strength @ c Field Stre	3 m		Pk Lim Avg Mar	Peak Fiel Margin vs	Field Strengt d Strength L :. Average L :. Peak Limit	imit imit
	CL					HPF	High Pas								

Page 162 of 162

## 8.3. RECEIVER ABOVE 1 GHz

## 8.3.1. RX ABOVE 1 GHz, 20 MHz BANDWIDTH, 2.4 GHz

Configu			ELL Laptop												
lode: est Eq	nipmen	2.4GHz, Rx :													
		18GHz		nplifer	1-26	GHz	Pre-am	plifer	26-40GH	z	H	orn > 18(	GHz		Limit
T73; S	S/N: 671	7 @3m	▼ T144 N	Aiteq 30	08A00	931 🗸	T88 Mit	eq 26⊿	40GHz	▼ T39	; ARA 18-26	GHz; S/N:1	013	•	RX RSS 210 🗸
- Hi Fre	quency Cal 2 foot		3	foot c	able		12	foot c	able		HPF	Re	ject Filte		<u>k Measurements</u> 3W=VBW=1MHz
			•			•	B-5m C	:hamb	er 🗸			•		Aver	a <u>ge Measurements</u> =1MHz ; VBW=10Hz
f GHz	Dist	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
000	(m) 3.0	dBuV 53.0	dBu V 39.4	dB/m 23.8	dB 3.2	-39.5	0.0	0.0 aB	40.5	dBuV/m 27.0	dBuV/m 74	dBuV/m 54	-33.5	ав -27.0	(V/H) V
600	3.0	50.7	35.4	26.0	4.0	-38.6	0.0	0.0	42.0	26.8	74	54	-32.0	-27.2	v
000	3.0	49.1	34.6	27.4	4.5	-38.1	0.0	0.0	42.9	28.5	74	54	-31.1	-25.5	v
.000	3.0 3.0	51.9 57.6	35.6 41.5	23.8 26.0	3.2 4.0	-39.5 -38.6	0.0 0.0	0.0 0.0	39.4 49.0	23.1 32.8	74 74	54 54	-34.6 -25.0	-30.9 -21.2	H
		50.2	33.9	20.0	4.5	-38.1	0.0	0.0	44.1	27.8	74	54 54	-29.9	-26.2	Н
	3.0														
	3.0														
.600 .000	3.0														

Page 163 of 163

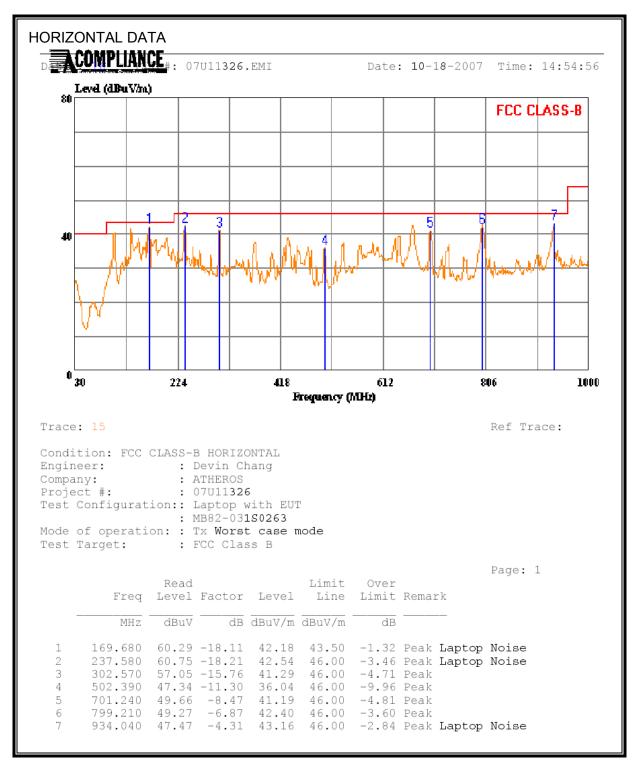
## 8.3.2. RX ABOVE 1 GHz, 20 MHz BANDWIDTH, 5.8 GHz

		Mengistu M EUT With D 5.8GHz, Rx 1	ELL Laptop												
est Ec	nipmen	t:MB82-03	<u>31-\$0263</u>												
н	lorn 1-	18GHz	Pre-ar	nplifer	1-260	SHz	Pre-am	plifer	26-40GH	z	н	orn > 18(	GHz		Limit
	S/N: 6717	·	▼ T144 M	Aiteq 30	08A009	31 🗸	T88 Mit	eq 26-4	10GHz	▼ T39	; ARA 18-26	GHz; S/N:1	1013	•	RX RSS 210
- Hi Fre	quency Cal 2 foot		3	foot c	able		12	foot c	able		HPF	Re	ject Filte		<u>k Measurements</u> 3W=VBW=1MHz
			•			•	B-5m C	hambe	er 🗸			•		Aver	a <u>ge Measurements</u> =1MHz ; VBW=10Hz
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m		Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
000 600	3.0	55.1	39.8	23.8	3.2	-39.5	0.0	0.0 0.0	42.6	27.3	74	54	-31.4	-26.7	v
6UU 000	3.0 3.0	54.3 50.2	35.8 34.2	26.0 27.4	4.0 4.5	-38.6 -38.1	0.0 0.0	0.0 0.0	45.6 44.1	27.2 28.1	74 74	54 54	-28.4 -29.9	-26.8 -25.9	v v
000	3.0	56.0	41.0	23.8	3.2	-39.5	0.0	0.0	43.5	28.5	74	54	-30.5	-25.5	Н
600 000	3.0 3.0	52.8 49.9	36.2 34.2	26.0 27.4	4.0 4.5	-38.6 -38.1	0.0 0.0	0.0 0.0	44.1 43.8	27.6 28.0	74 74	54 54	-29.9 -30.2	-26.4 -26.0	H H
lev. 4.12	.7														
	f		ent Frequenc	у		Amp	Preamp (					-	-	Field Streng	
		Distance to Analyzer R				D Corr Avg			ct to 3 mete Strength @					d Strength I : Average I	
	AF	Antenna F	-			Peak	-		c Field Stre			-	-	: Peak Limi	
	CL	Cable Los				HPF	High Pas			0					

Page 164 of 164

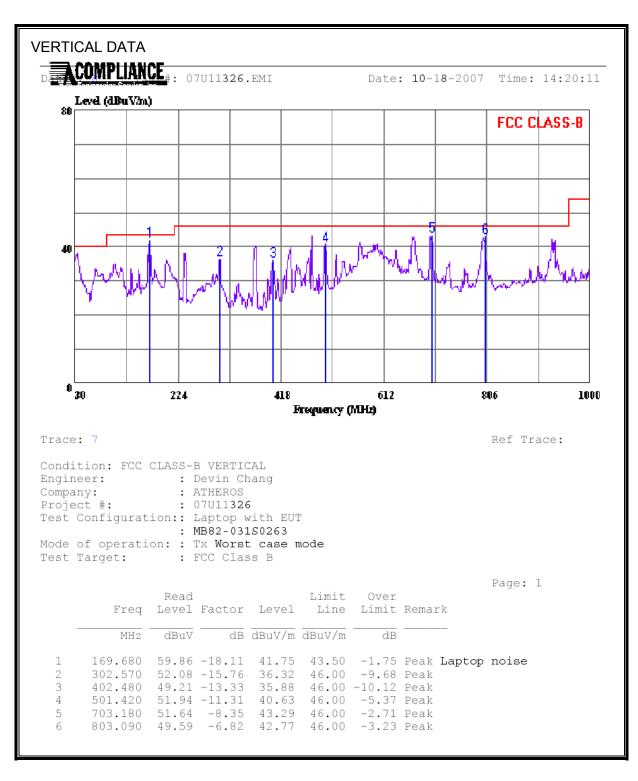
# 8.4. WORST-CASE BELOW 1 GHz

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



Page 165 of 165

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



Page 166 of 166

# 9. AC POWER LINE CONDUCTED EMISSIONS

## <u>LIMITS</u>

FCC §15.207 (a)

RSS-Gen 7.2.2

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

\* Decreases with the logarithm of the frequency.

## TEST PROCEDURE

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

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

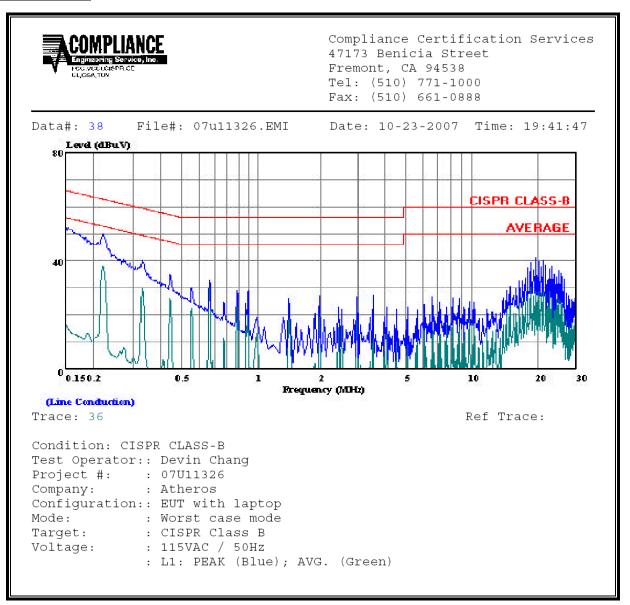
Line conducted data is recorded for both NEUTRAL and HOT lines.

## RESULTS

## 6 WORST EMISSIONS

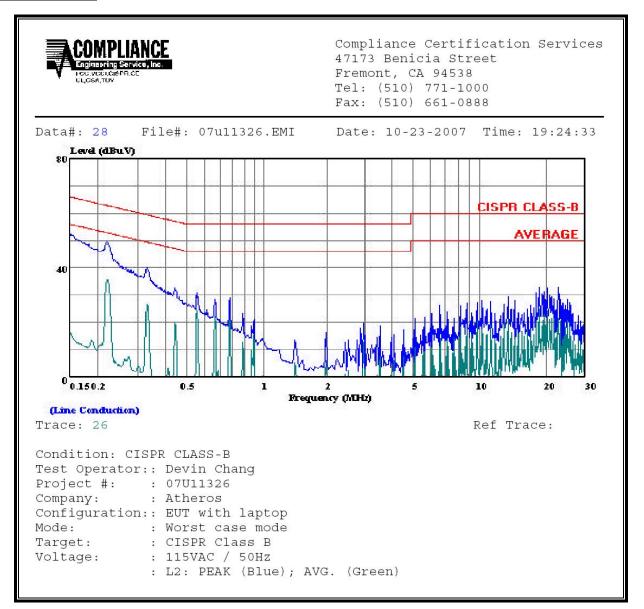
Freq.		Reading		Closs	Limit	FCC_B	Marg	in	Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1/L2
0.22	49.82		37.57	0.00	62.86	52.86	-13.04	-15.29	L1
0.33	40.04		29.63	0.00	59.45	49.45	-19.41	-19.82	L1
19.74	41.16		32.82	0.00	60.00	50.00	-18.84	-17.18	L1
0.22	49.40		35.52	0.00	62.78	52.78	-13.38	-17.26	L2
0.33	39.29		26.82	0.00	59.38	49.38	-20.09	-22.56	L2
18.72	32.84		24.81	0.00	60.00	50.00	-27.16	-25.19	L2
6 Worst I	Data								

## LINE 1 RESULTS



Page 168 of 168

## LINE 2 RESULTS



Page 169 of 169

#### 10. MAXIMUM PERMISSIBLE EXPOSURE

#### FCC RULES

§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) Lin	its for Occupational	I/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	ion/Uncontrolled Exp	posure	
0.3–1.34 1.34–30	614 824 <i>/</i> f	1.63 2.19/f	*(100) *(180/f²)	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/cm <sup>2</sup> )	Averaging time (minutes)
30-300	27.5	0.073	0.2	30
300–1500 1500–100,000			f/1500 1.0	30 30

f = frequency in MHz

t = 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 occupational/controlled limits apply provided the 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 exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure.

exposure or can not exercise control over their exposure.

Page 170 of 170

## IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

## Table 5

Exposure Limits for Persons Not Classed As RF and Microwave Ex-
posed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/f	2.19/ <i>f</i>		6
10–30	28	2.19/f		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042f <sup>0.5</sup>	f/150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 /f <sup>1.2</sup>
150 000–300 000	0.158f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616 000 /f <sup>1.2</sup>

\* Power density limit is applicable at frequencies greater than 100 MHz.

**Notes:** 1. Frequency, *f*, is in MHz.

- A power density of 10 W/m<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.
   A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

Page 171 of 171

## 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, rearranging the terms to express the distance as a function of the remaining variables, changing to units of Power to mW and Distance to cm, and substituting the logarithmic form of power and gain 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

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

The power density in units of mW/cm<sup>2</sup> is converted to units of W/m<sup>2</sup> by multiplying by a factor of 10.

Page 172 of 172

## LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm<sup>2</sup>

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m<sup>2</sup>

## **RESULTS**

(MPE distance equals 20 cm)

Mode	Band	MPE	Output	Antenna	FCC Power	IC Power
		Distance	Power	Gain	Density	Density
		(cm)	(dBm)	(dBi)	(mW/cm^2)	(W/m^2)
802.11b	2.4 GHz	20.0	27.75	7.77	0.71	7.08
802.11g	2.4 GHz	20.0	26.78	7.77	0.57	5.67
802.11n H20	2.4 GHz	20.0	26.63	3.00	0.18	1.83
802.11n H40	2.4 GHz	20.0	27.32	3.00	0.21	2.14

Mode	Band	MPE	Output	Antenna	FCC Power	IC Power
		Distance	Power	Gain	Density	Density
		(cm)	(dBm)	(dBi)	(mW/cm^2)	(W/m^2)
802.11a	5.8 GHz	20.0	24.89	9.77	0.58	5.81
802.11n H20	5.8 GHz	20.0	24.79	5.00	0.19	1.89
802.11n H40	5.8 GHz	20.0	24.74	5.00	0.19	1.87

The power level used for MPE calculations is the sum of the power of all transmitter chains. Since the antennas are identical for each transmitter this is equivalent to summing the power density of all transmitters. All three antennas are assumed to be at the same location to give a worst-case estimate of the total power density at a distance of 20 cm from this point. For 802.11abg transmissions the effective legacy mode antenna gain is used (this effective gain assumes that the legacy signals are coherent thus add in voltage). For 802.11n transmissions the signals are not coherent therefore they add in power and the normal antenna gain is applicable.