

FCC CFR47 PART 15 SUBPART C INDUSTRY CANADA RSS 210 ISSUE 7 SUPPLEMENTAL CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n PCI Module

MODEL: AR5BMB82

FCC ID: PPD-AR5BMB82

IC: 4104A-AR5BMB82

REPORT NUMBER: 08U11627-2

ISSUE DATE: MARCH 06, 2008

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



Revision History

Rev.	lssue Date	Revisions	Revised By
	3/06/08	Initial Issue	T. Chan

Page 2 of 95

TABLE OF CONTENTS

1. A	TTESTATION OF TEST RESULTS	5
2. T	EST METHODOLOGY	6
3. F.	ACILITIES AND ACCREDITATION	6
4. C	ALIBRATION AND UNCERTAINTY	6
4.1.	MEASURING INSTRUMENT CALIBRATION	6
4.2.	MEASUREMENT UNCERTAINTY	6
5. E	QUIPMENT UNDER TEST	7
5.1.	DESCRIPTION OF EUT	7
5.2.	DESCRIPTION OF CHANGES	7
5.3.	DESCRIPTION OF SUPPLEMENTAL MEASUREMENTS	7
5.4.	MAXIMUM OUTPUT POWER	8
5.5.	DESCRIPTION OF AVAILABLE ANTENNAS	8
5.6.	SOFTWARE AND FIRMWARE	8
5.7.	WORST-CASE CONFIGURATION AND MODE	9
5.8.	DESCRIPTION OF TEST SETUP	10
6. T	EST AND MEASUREMENT EQUIPMENT	12
•••••••••••••••••••••••••••••••••••••••		
7. A	NTENNA PORT TEST RESULTS	13
7. A 7.1.	NTENNA PORT TEST RESULTS	13 13
7. A 7.1. 7.	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND .1.1. 6 dB BANDWIDTH	13 13 13
7. A 7.1. 7. 7. 7.	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND .1.1. 6 dB BANDWIDTH .1.2. 99% BANDWIDTH .1.3. OUTPUT POWER	13 13 13 17 21
7. A 7.1. 7. 7. 7. 7.	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND .1.1. 6 dB BANDWIDTH .1.2. 99% BANDWIDTH .1.3. OUTPUT POWER .1.4. AVERAGE POWER FOR LEGACY MODES (5.8GHz)	13 13 13 17 21 31
7. A 7.1. 7. 7. 7. 7. 7. 7. 7.	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND 1.1. 6 dB BANDWIDTH 1.2. 99% BANDWIDTH 1.3. OUTPUT POWER 1.4. AVERAGE POWER FOR LEGACY MODES (5.8GHz) 1.5. POWER SPECTRAL DENSITY 1.6. CONDUCTED SPUPIOUS EMISSIONS	13 13 13 17 21 31 32 32
7. A 7.1. 7. 7. 7. 7. 7. 7. 7. 7.	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND .1.1 6 dB BANDWIDTH .1.2 99% BANDWIDTH .1.3 OUTPUT POWER .1.4 AVERAGE POWER FOR LEGACY MODES (5.8GHz) .1.5 POWER SPECTRAL DENSITY .1.6 CONDUCTED SPURIOUS EMISSIONS	13 13 13 17 21 31 32 36
7. A 7.1. 7. 7. 7. 7. 7. 7. 7. 7. 2. 7. 2.	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND .1.1. 6 dB BANDWIDTH .1.2. 99% BANDWIDTH .1.3. OUTPUT POWER .1.4. AVERAGE POWER FOR LEGACY MODES (5.8GHz) .1.5. POWER SPECTRAL DENSITY .1.6. CONDUCTED SPURIOUS EMISSIONS .802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND .2.1. 6 dB BANDWIDTH	13 13 13 17 21 31 32 36 39 39
7. A 7.1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7.	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND 1.1. 6 dB BANDWIDTH 1.2. 99% BANDWIDTH 1.3. OUTPUT POWER 1.4. AVERAGE POWER FOR LEGACY MODES (5.8GHz) 1.5. POWER SPECTRAL DENSITY 1.6. CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND 2.1. 6 dB BANDWIDTH	13 13 13 13 17 17 21 31 32 36 39 39 39 43
7. A 7. 1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND .1.1 6 dB BANDWIDTH .1.2 99% BANDWIDTH .1.3 OUTPUT POWER .1.4 AVERAGE POWER FOR LEGACY MODES (5.8GHz) .1.5 POWER SPECTRAL DENSITY .1.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND .2.1 6 dB BANDWIDTH .2.2 99% BANDWIDTH .2.3 OUTPUT POWER .2.4 AVERAGE POWER FOR HT20 MODES (5.8GHz)	13 13 13 17 21 31 32 36 39 39 43 43 47 57
7. A 7. 1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	NTENNA PORT TEST RESULTS802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND1.1.6 dB BANDWIDTH1.2.99% BANDWIDTH1.3.OUTPUT POWER1.4.AVERAGE POWER FOR LEGACY MODES (5.8GHz)1.5.POWER SPECTRAL DENSITY1.6.CONDUCTED SPURIOUS EMISSIONS802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND2.1.6 dB BANDWIDTH2.2.99% BANDWIDTH2.3.OUTPUT POWER2.4.AVERAGE POWER FOR HT20 MODES (5.8GHz)2.5.POWER SPECTRAL DENSITY	13 13 13 13 17 21 31 32 36 39 39 43 47 57 58
7. A 7. 1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND 1.1. 6 dB BANDWIDTH 1.2. 99% BANDWIDTH 1.3. OUTPUT POWER 1.4. AVERAGE POWER FOR LEGACY MODES (5.8GHz) 1.5. POWER SPECTRAL DENSITY 1.6. CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND 2.1. 6 dB BANDWIDTH 2.2. 99% BANDWIDTH 2.3. OUTPUT POWER 2.4. AVERAGE POWER FOR HT20 MODES (5.8GHz) 2.5. POWER SPECTRAL DENSITY 2.6. CONDUCTED SPURIOUS EMISSIONS	13 13 13 13 17 21 31 32 36 39 39 39 43 43 47 57 58 62
7. A 7. 1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND 1.1 6 dB BANDWIDTH 1.2 99% BANDWIDTH 1.3 OUTPUT POWER 1.4 AVERAGE POWER FOR LEGACY MODES (5.8GHz) 1.5 POWER SPECTRAL DENSITY 1.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND 2.1 6 dB BANDWIDTH 2.2 99% BANDWIDTH 2.3 OUTPUT POWER 2.4 AVERAGE POWER FOR HT20 MODES (5.8GHz) 2.5 POWER SPECTRAL DENSITY 2.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND 2.1 6 dB DANDWIDTH	13 13 13 13 17 21 31 32 36 39 39 43 43 47 57 58 62 65
7. A 7. 1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND 1.1 6 dB BANDWIDTH 1.2 99% BANDWIDTH 1.3 OUTPUT POWER 1.4 AVERAGE POWER FOR LEGACY MODES (5.8GHz) 1.5 POWER SPECTRAL DENSITY 1.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND 2.1 6 dB BANDWIDTH 2.2 99% BANDWIDTH 2.3 OUTPUT POWER 2.4 AVERAGE POWER FOR HT20 MODES (5.8GHz) 2.5 POWER SPECTRAL DENSITY 2.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND 3.1 6 dB BANDWIDTH 3.2 99% BANDWIDTH	13 13 13 13 17 17 21 31 32 36 39 39 39 43 43 47 57 58 62 65 65 65 65
7. A 7. 1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND 1.1 6 dB BANDWIDTH 1.2 99% BANDWIDTH 1.3 OUTPUT POWER 1.4 AVERAGE POWER FOR LEGACY MODES (5.8GHz) 1.5 POWER SPECTRAL DENSITY 1.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND 2.1 6 dB BANDWIDTH 2.2 99% BANDWIDTH 2.3 OUTPUT POWER 2.4 AVERAGE POWER FOR HT20 MODES (5.8GHz) 2.5 POWER SPECTRAL DENSITY 2.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND 3.1 6 dB BANDWIDTH 3.2 99% BANDWIDTH 3.3 OUTPUT POWER	13 13 13 13 17 21 31 32 36 39 39 39 43 47 57 58 62 65 65 65 65 68 71
7. A 7. 1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND 1.1 6 dB BANDWIDTH 1.2 99% BANDWIDTH 1.3 OUTPUT POWER 1.4 AVERAGE POWER FOR LEGACY MODES (5.8GHz) 1.5 POWER SPECTRAL DENSITY 1.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND 2.1 6 dB BANDWIDTH 2.2 99% BANDWIDTH 2.3 OUTPUT POWER 2.4 AVERAGE POWER FOR HT20 MODES (5.8GHz) 2.5 POWER SPECTRAL DENSITY 2.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND 3.1 6 dB BANDWIDTH 3.2 99% BANDWIDTH 3.3 OUTPUT POWER 3.4 AVERAGE POWER FOR HT40 MODES (5.8GHz) 3.4 AVERAGE POWER FOR HT40 MODES (5.8GHz)	13 13 13 17 21 31 32 36 39 43 47 57 58 62 65 65 65 65 71 78
7. A 7. 1. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7	NTENNA PORT TEST RESULTS 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND 1.1 6 dB BANDWIDTH 1.2 99% BANDWIDTH 1.3 OUTPUT POWER 1.4 AVERAGE POWER FOR LEGACY MODES (5.8GHz) 1.5 POWER SPECTRAL DENSITY 1.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND 2.1 6 dB BANDWIDTH 2.2 99% BANDWIDTH 2.2 99% BANDWIDTH 2.3 OUTPUT POWER 2.4 AVERAGE POWER FOR HT20 MODES (5.8GHz) 2.5 POWER SPECTRAL DENSITY 2.6 CONDUCTED SPURIOUS EMISSIONS 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND 3.1 6 dB BANDWIDTH 3.2 99% BANDWIDTH 3.3 OUTPUT POWER 3.4 AVERAGE POWER FOR HT40 MODES (5.8GHz) 3.5 POWER SPECTRAL DENSITY 3.6 CONDUCTED SPURIOUS EMISSIONS 3.6 CONDUCTED SPURIOUS EMISSIONS	13 13 13 13 17 21 31 32 36 39 39 39 43 47 57 58 62 65 65 65 65 65 65 65 67 71 78 79 82

REP FCC	PORT NO: 08U11627-2 C ID: PPD-AR5BMB82	DATE: MARCH 06, 2008 IC: 4104A-AR5BMB82
8.	RADIATED TEST RESULTS	85
8.	.1. LIMITS AND PROCEDURE	85
8.	 <i>TRANSMITTER ABOVE 1 GHz FOR 802.11a MODE IN THE</i> 8.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT20 MOD BAND 87 8.2.2. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT40 MOD BAND 88 	5.8 GHz BAND 86 E IN THE 5.8 GHz E IN THE 5.8 GHz
8.	.3. RECEIVER ABOVE 1 GHz 8.3.1. RX ABOVE 1 GHz40 MHz BANDWIDTH, 5.8 GHz	
9.	MAXIMUM PERMISSIBLE EXPOSURE	90
10.	SETUP PHOTOS	

Page 4 of 95

1. ATTESTATION OF TEST RESULTS

	STANDARD	TEST
	APPLICABLE STANDARDS	
DATE TESTED: MARCH 05, 2008		
SERIAL NUMBER:	MB82-031-S0263	
MODEL:	AR5BMB82	
EUT DESCRIPTION:	802.11a/b/g/n PCI Module	
COMPANY NAME:	ATHEROS COMMUNICATIONS, IN 5480 GREAT AMERICA PARKWAY SANTA CLARA, CA 95054, U.S.A.	IC. (

STANDARD	IESI RESULIS
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:

Tested By:

Chin Pany

THU CHAN EMC SUPERVISOR COMPLIANCE CERTIFICATION SERVICES

CHIN PANG EMC ENGINEER COMPLIANCE CERTIFICATION SERVICES

Page 5 of 95

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. DESCRIPTION OF CHANGES

The following changes have been made to the product as originally tested:

A) The Baseband chip AR9160 has been updated from version 1.0 to version 1.1

Changes implemented in the 1.0 version Baseband chip:

1) Corrected various digital logic bugs related to IEEE protocol functions

2) Corrected digital logic bug that sometimes caused baseband to hang during radar detection

Version 1.1 chip has the same pinout and hardware specifications as originally tested chip (1.0).

The product's capabilities, features, RF modulations and power are unchanged from the originally tested product.

B) The board has undergone minor layout change and some component changes

Changes to board & Schematic:

1) Added extra filtering in 5GHz Tx Path to improve EVM

2) Added and optimized decoupling caps to improve linearity of transmitter in each chain

3) Reduced clock voltage swing

4) Minor layout change to accommodate above changes

5.3. DESCRIPTION OF SUPPLEMENTAL MEASUREMENTS

The following supplemental measurements were made on the product with the Version 1.1 baseband chip installed: Bandwidth, Power and PPSD tests were performed on the low, middle, and high channels of each 5 GHz band. Conducted and Radiated Spurious tests were performed on the middle channel of each 5 GHz band.

Page 7 of 95

5.4. MAXIMUM OUTPUT POWER

Frequency Range	Mode	Output Power	Output Power
(MHz)		(dBm)	(mW)
5745 - 5825	802.11a	24.94	311.89
5745 - 5825	802.11n HT20	24.90	309.03
5755 - 5795	802.11n HT40	25.00	316.23

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

5.5. DESCRIPTION OF AVAILABLE ANTENNAS

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

5.6. 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.

Page 8 of 95

5.7. 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:

802.11a 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

For 6 dB and 99% BW measurement preliminary testing showed that Chain 2 is worst-case chain, so final measurement was performed on chain 2 for all modes and channels.

For conducted and PSD measurements preliminary testing showed that combiner is worst-case compared to individual chains; therefore, final measurement was performed using combiner for each mode.

For conducted and radiated spurious, the test was performed on worst channel for each mode of each frequency band.

For radiated receiver spurious, the test was performed on worst channel for each frequency band.

Page 9 of 95

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST							
Description Manufacturer Model Serial Number FCC ID							
Laptop PC	ThinkPad	R50	99-C4812	DOC			
AC/DC Adapter	IBM	9P1020	11S92P1020Z1Z	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	Туре	Туре	Length			
		Ports						
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 10 of 95

SETUP DIAGRAM FOR TESTS



Page 11 of 95

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	4/22/08				
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, Horn, 18 GHz	EMCO	3115	C00945	04/15/08				
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	08/03/08				
EMI Test Receiver, 30 MHz	R&S	ESHS 20	N02396	01/27/08				
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02677	CNR				
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02681	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 12 of 95

7. ANTENNA PORT TEST RESULTS

7.1. 802.11a THREE CHAINS MODE IN THE 5.8 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	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

Page 13 of 95

6 dB BANDWIDTH



Page 14 of 95

6 dB BANDWI		СН) т	b devilse y
Ref 20 dBm	Atten 20 dB			∆ Mk	r1 16.3(0.(XI 3 MHz D0 dB	Select Marker
#Peak Log 10							1 2 3 4
dB/ Offst	hentrathan	norman prov	Mulmin	hendress	Anento	¢	Normal
11.4 dB DI						the	Delta
1.4 dBm							Delta Pair (Tracking Ref)
V1 S2							Ref <u>∆</u> Span Pair
S3 FC AA ⊏(f):							Span <u>Center</u>
FTun Swp							Off
Center 5.785 00 GHz #Res BW 100 kHz	 #VE	3W 300 kHz	#Swe	ep 1.856	Span 2 5 s (601	20 MHz [°] pts)	More 1 of 2
Copyright 2000-2007 A	gilent Technolog	ies		•	1	• *	

Page 15 of 95



Page 16 of 95

7.1.2. 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	16.4835
Middle	5785	16.4809
High	5825	16.7315

Page 17 of 95

99% BANDWIDTH



Page 18 of 95

99% BANDWIDTH			RL	Sween
Ch Freq 5.78 Occupied Bandwidth	5 GHz		Trig Free	Sweep Time 20.00 ms <u>Auto Man</u>
	L			Sweep <u>Single Cont</u>
Ref 20 dBm Atten 2 #Samp Log 10 dB/ Offst 11.4 dB		March March	Jr.Mayee	Auto Sweep Time Norm <u>Accy</u>
Center 5.785 00 GHz #Res BW 300 kHz	#VBW 1 MHz	Sweep 20	Span 50 MHz ms (601 pts)	
Occupied Bandwid 16.48	th 09 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Points 601
Transmit Freq Error - x dB Bandwidth 2	34.184 kHz 22.593 MHz*			
Copyright 2000-2007 Agilent Te	chnologies			

Page 19 of 95

99% BANDWIDTH HIG * Agilent 14:26:00 Mar 5, 2008	GH CH		RТ	Sweep
Ch Freq 5.825 GHz Occupied Bandwidth	<u>.</u> Г		Trig Free	Sweep Time 20.00 ms <u>Auto Man</u>
				Sweep <u>Single Cont</u>
Ref 20 dBm Atten 20 dB #Samp Log 10 dB/ Offst	and the second second	here and the second sec	The second se	Auto Sweep Time <u>Norm Accy</u>
dB Center 5.825 00 GHz #Res BW 300 kHz	#VBW 1 MHz	Sweep 20	Span 50 MHz ms (601 pts)	
Occupied Bandwidth 16.7315	MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Points 601
Transmit Freq Error -134.5 x dB Bandwidth 22.725 Copyright 2000-2007 Agilent Technol	90 kHz 5 MHz* ogies			

Page 20 of 95

7.1.3. 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	19.88	19.80	20.03	24.68	26.23	-1.55
Mid	5785	19.41	20.19	20.00	24.65	26.23	-1.58
High	5825	19.90	20.35	20.24	24.94	26.23	-1.29

Page 21 of 95

OUTPUT POWER

CH 0



Page 22 of 95

OUTPUT POWER MID CH	Sweep			
Ch Freq 5.785 GHz Trig Free Channel Power	Sweep Time 1.067 ms <u>Auto Man</u>			
	Sweep <u>Single Cont</u>			
Ref 30 dBm Atten 30 dB #Peak Log 10 dB/ offst	Auto Sweep Time <u>Norm Accy</u>			
II.4 dB II.4 dB II.4 dB Center 5.785 000 GHz Span 30 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (2001 pts)				
Channel Power Power Spectral Density Points 19.41 dBm / 20.0000 MHz -53.60 dBm/Hz				
Copyright 2000-2007 Agilent Technologies				

Page 23 of 95

OUTPUT POWER	HIGH CH		RТ	Sweep
Ch Freq 5.82 Channel Power	5 GHz		Trig Free	Sweep Time 1.067 ms <u>Auto Man</u>
Ref 30 dBm Atten 3	30 dB			Sweep Single Cont
HPeak Log 10 dB/ Offst				Auto Sweep Time <u>Norm Accy</u>
11.4 dB Center 5.825 000 GHz #Res BW 1 MHz	#VBW 8 MHz	Sweep 1.067 ms	Span 30 MHz (2001 pts)	
Channel Power Power Spectral Density 2001 19.90 dBm / 20.0000 MHz -53.11 dBm/Hz				
Copyright 2000-2007 Agilent Te	chnologies			

Page 24 of 95

OUTPUT POWER

CH 1



Page 25 of 95

OUTPUT POWER MID CH	R L Sweep
Ch Freq 5.785 GHz Ti Channel Power	rig Free Sweep Time Auto Ma
	Sweep Single Con
Ref 30 dBm Atten 30 dB #Peak Log 10 dB/ Offst 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4	Auto Sweep Tim Norm <u>Acc</u>
Center 5.785 000 GHz Spa #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (20	an 30 MHz D01 pts)
Channel Power Power Spectral De 20.19 dBm / 20.0000 MHz -52.82 dBm	n/Hz

Page 26 of 95

OUTPUT POWER HIGH CH	Sweep
Ch Freq 5.825 GHz Trig Free Channel Power	Sweep Time 1.067 ms <u>Auto Man</u>
	Sweep <u>Single Cont</u>
Ref 30 dBm Aften 30 dB #Peak Log 10 dB/ offst best and a state of the	Auto Sweep Time <u>Norm Accy</u>
Center 5.825 000 GHz Span 30 MHz	
Channel Power Power Spectral Density 20.35 dBm / 20.0000 MHz -52.66 dBm/Hz	Points 2001
Copyright 2000-2007 Agilent Technologies	

Page 27 of 95

OUTPUT POWER

CH 2



Page 28 of 95

Agilent 18:18:38 Mar 5, 2008 R	T Sweep
Ch Freq 5.785 GHz Trig F Channel Power	Free Sweep Time 1.067 ms Auto Mar
	Sweep Single Cont
Ref 30 dBm Atten 30 dB #Peak Log db db/ Offst 11.4	Auto Sweep Time <u>Norm Accy</u>
dB	MHz s)
Channel Power Power Spectral Density 20.00 dBm / 20.0000 MHz -53.01 dBm/Hz	Z Points

Page 29 of 95

OUTPUT POWER HIGH CH <u># Agilent 15:36:35 Mar 5, 2008 R 1 </u>	Sweep			
Ch Freq 5.825 GHz Trig Fre Channel Power	Sweep Time 1.067 ms <u>Auto Man</u>			
	Sweep Single Cont			
Ref 30 dBm Atten 30 dB #Peak	Auto Sweep Time <u>Norm Accy</u>			
11.4 Image: Content of the second secon	1z			
Channel Power Power Spectral Density Points 2001 20.24 dBm / 20.0000 MHz -52.77 dBm/Hz				
Copyright 2000-2007 Agilent Technologies				

Page 30 of 95

7.1.4. AVERAGE POWER FOR LEGACY 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	5745	17.63	17.58	17.33	22.29
Middle	5785	17.40	17.79	17.54	22.35
High	5825	17.67	18.20	18.10	22.77

Page 31 of 95

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.

RESULTS:

Channel Frequency		PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5745	2.54	8	-5.46
Middle	5785	2.53	8	-5.47
High	5825	4.41	8	-3.59

Page 32 of 95

POWER SPECTRAL DENSITY WITH COMBINER



Page 33 of 95

Aylient 10.4t	5.25 TVTat 0,2							<u> </u>	Feak Search
ef 20 dBm	Atten	Atten 20 dB			Mkr1 5.784 749 10 GHz 2.53 dBm				Next Pea
og									
3/	h-forfithuffeter			>					Next Pk Righ
ffst ^{runn} ormann 1.9		A	(And the second	a high star	Window .	W. Line	and the second		
3							- Printed	A NUMBER OF STREET	Next Pk Lef
0									
3m 1Av									Min Searc
I M2 3 FC									Pk-Pk Search
AA									
n: 50k									Mkr©(
wp									
optor 5 784 750	00 CH7						Snan 3	00 1/11-7	Mo
enter 5.764750 Res BW 3 kHz	00 0112	#VE	W 10 k	Hz	#Swe	en 100	span 5 « /2001	nts)	1 of 1

Page 34 of 95



Page 35 of 95

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 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

Page 36 of 95
SPURIOUS EMISSIONS MID CHANNEL WITH COMBINER



Page 37 of 95



Page 38 of 95

7.2. 802.11n THREE CHAINS HT20 MODE IN THE 5.8 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	6 dB BW	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	5745	17.53	0.5
Middle	5785	17.57	0.5
High	5825	17.53	0.5

Page 39 of 95

6 dB BANDWIDTH



Page 40 of 95

6 dB BANDW		СН		рт	Morker
Ref 20 dBm	Atten 20 dB		∆ MI	kr1 17.57 MHz 0.12 dB	Select Marker
Log 10 18 dB/ <u>& Mula</u>	handrakan	alany por low	Munhandra	Magalug 2	Normal
Offst 11.4 dB					Delta
1.2 dBm LgAv					Delta Pair (Tracking Ref)
V1 S2 S3 FC					Span Pair Span <u>Center</u>
¤(f): FTun Swp					Off
Center 5.785 00 GHz #Res BW 100 kHz	#VB\	W 300 kHz	#Sweep 1.85	Span 20 MHz [°] i6 s (601 pts)	More 1 of 2
Copyright 2000-2007 /	Agilent Technologie	S	•	• • •	

Page 41 of 95



Page 42 of 95

7.2.2. 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	17.6050
Middle	5785	17.4316
High	5825	17.6785

Page 43 of 95

99% BANDWIDTH,

🔆 Agilent 14:28:04 Mar 5	, 2008		RТ	Sw	еер
Ch Freq 5. Occupied Bandwidth	745 GHz		Trig Free	Swe <u>Auto</u>	ep Time 20.00 ms <u>Mar</u>
				<u>Single</u>	Sweep <u>Cont</u>
Ref 20 dBm Atte \$ samp			to-ulay-files-uph structures	Auto Norm	Sweep Time <u>Accy</u>
Center 5.745 00 GHz #Res BW 300 kHz	#VBW 1 MHz	Sweep 20	Span 50 MHz ms (601 pts)		
Occupied Bandw 17.6	/idth 6050 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB		Points 601
Transmit Freq Error x dB Bandwidth	-7.369 kHz 23.301 MHz*				

Page 44 of 95

99% BANDWIDTH	MID CH		RТ	Sweep
Ch Freq 5.7 Occupied Bandwidth	B5 GHz		Trig Free	Sweep Time 20.00 ms <u>Auto Man</u>
				Sweep <u>Single Cont</u>
Ref 20 dBm Atten #Samp Log 10	20 dB			Auto Sweep Time Norm <u>Accy</u>
dB/ Zanata department of the second department		"http://www.ukity.org	hard a start provider	
Center 5.785 00 GHz #Res BW 300 kHz	#VBW 1 MHz	Sp Sweep 20 ms	an 50 MHz (601 pts)	
Occupied Bandwi 17.4	dth 316 MHz	Occ BW % Pwr x dB -2	99.00 % 26.00 dB	Points 601
Transmit Freq Error x dB Bandwidth	54.074 kHz 23.378 MHz*			
Copyright 2000-2007 Agilent T	echnologies			

Page 45 of 95

99% BANDWIDTH H	HIGH CH		RТ	Sweep
Ch Freq 5.825 Occupied Bandwidth	GHz		Trig Free	Sweep Time 20.00 ms <u>Auto Man</u>
				Sweep <u>Single Cont</u>
Ref 20 dBm Atten 20 #Samp Log 10 dB/		manufactures		Auto Sweep Time Norm <u>Accy</u>
Offst 11.4 dB			Wing Mary Marine	
Center 5.825 00 GHz #Res BW 300 kHz	#VBW 1 MHz	Sweep 20	Span 50 MHz ms (601 pts)	
Occupied Bandwid 17.678	th 35 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Points 601
Transmit Freq Error -5 x dB Bandwidth 23	14.668 Hz 3.875 MHz*			
Copyright 2000-2007 Agilent Tec	hnologies			

Page 46 of 95

7.2.3. OUTPUT POWER

LIMITS

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.

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	19.97	20.47	19.94	24.90	30.00	-5.10
Mid	5785	19.62	19.90	19.82	24.55	30.00	-5.45
High	5825	19.90	19.83	20.27	24.78	30.00	-5.22

Page 47 of 95

CHAIN 0 OUTPUT POWER



Page 48 of 95

OUTPUT POWER MID CH, CHAIN 0	Sweep
Ch Freq 5.785 GHz Trig Free Channel Power	Sweep Time 1.067 ms <u>Auto Man</u>
	Sweep <u>Single Cont</u>
Ref 30 dBm Atten 30 dB #Peak	Auto Sweep Time <u>Norm Accy</u>
Center 5.785 000 GHz Span 30 MHz #Res BW 1 MHz #VBW 8 MHz Sweep 1.067 ms (2001 pts)	
Channel Power Power Spectral Density 19.62 dBm / 20.0000 MHz -53.39 dBm/Hz	Points 2001
Copyright 2000-2007 Agilent Technologies	

Page 49 of 95

OUTPUT POWER HIGH CH, CHAIN 0 * Agilent 14:39:34 Mar 5, 2008 R T	Sweep
Ch Freq 5.825 GHz Trig Free Channel Power	Sweep Time 1.067 ms <u>Auto Man</u>
Ref 30 dBm Atten 30 dB	Sweep Single Cont
#Peak	Norm Accy
Center 5.825 000 GHz Span 30 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (2001 pts)	
Channel Power Power Spectral Density 19.90 dBm / 20.0000 MHz -53.11 dBm/Hz	2001
Copyright 2000-2007 Agilent Technologies	

Page 50 of 95

CHAIN 1 OUTPUT POWER



Page 51 of 95

OUTPUT POWER MID CH, CHAIN 1 Agilent 15:31:15 Mar 5, 2008 R T	Sweep
Ch Freq 5.785 GHz Trig Free Channel Power	Sweep Time 1.067 ms <u>Auto Man</u> Sweep
Ref 30 dBm Atten 30 dB #Peak Log 10 dB/ dB/ Offst 11.4 dB	<u>Single Cont</u> Auto Sweep Time <u>Norm Accy</u>
Center 5.785 000 GHz Span 30 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (2001 pts) Channel Power Power Spectral Density 19.90 dBm / 20.0000 MHz -53.11 dBm/Hz	Points 2001
Copyright 2000-2007 Agilent Technologies	

Page 52 of 95

OUTPUT POWER HIGH CH, CHAIN 1 * Agilent 15:29:08 Mar 5, 2008 R T	System
Ch Freq 5.825 GHz Trig Free	Show Errors
	Power On/ Preset
Ref 30 dBm Atten 30 dB #Peak	Time/Date ▸
10 dB/ offst 11.4	Alignments •
dB Center 5.825 000 GHz Span 30 MHz	Config I/O 🔸
#Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (2001 pts) Channel Power Power Spectral Density	Reference 🔸
19.83 dBm / 20.0000 MHz -53.18 dBm/Hz	More 1 of 3
Copyright 2000-2007 Agilent Technologies	

Page 53 of 95

CHAIN 2 OUTPUT POWER



Page 54 of 95

OUTPUT POWER MID CH CHAIN 2 Agilent 15:32:24 Mar 5, 2008	RL	Sweep
Ch Freq 5.785 GHz Trig Channel Power	g Free	Sweep Time 1.067 ms <u>Auto Man</u>
		Sweep <u>Single Cont</u>
Ref 30 dBM Aften 30 dB #Peak Log 10 dB/ Offst		Auto Sweep Time <u>Norm Accy</u>
11.4 dB Center 5.785 000 GHz Span #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (200 Sweep 1.067 ms (200	30 MHz 1 pts)	
Channel Power Power Spectral Den 19.82 dBm / 20.0000 MHz -53.19 dBm	sity I /Hz	Points 2001
Copyright 2000-2007 Agilent Technologies		

Page 55 of 95

OUTPUT POWER HIGH CH, CHAIN 2	Sweep
Ch Freq 5.825 GHz Trig Free Channel Power	Sweep Time 1.067 ms <u>Auto Man</u>
	Sweep <u>Single Cont</u>
Ref 30 dBm Atten 30 dB #Peak	Auto Sweep Time <u>Norm Accy</u>
Center 5.825 000 GHz Span 30 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (2001 pts)	
Channel Power Power Spectral Density 20.27 dBm / 20.0000 MHz -52.74 dBm/Hz	Points 2001
Copyright 2000-2007 Agilent Technologies	

Page 56 of 95

7.2.4. AVERAGE POWER FOR HT20 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	5745	17.75	17.52	17.75	22.45
Middle	5785	17.35	17.73	17.83	22.41
High	5825	17.80	17.65	18.20	22.66

Page 57 of 95

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.

RESULTS:

Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5745	2.87	8	-5.13
Middle	5785	3.48	8	-4.52
High	5825	5.68	8	-2.32

Page 58 of 95

POWER SPECTRAL DENSITY, WITH COMBINER

is rightin 10.	01.01							· ·	
Ref 20 dBm		Atten 2	20 dB	 	Mkr	1 5.743	487 80	GHz dBm	Next Peak
Peak .og									
0 B/				\$					Next Pk Right
ffst	11	- And and	ALC: TUBLE						
B		1				. 1.01	<u> 11 i</u>	P	Next Pk Left
Bm				 					Min Search
gA∨									
1 M2									Dk Dk Soarch
3 FC									FK-FK Sedicii
(f):									Murac
wp									MKIUC
									More
enter 5.743 50	00 00 G	Hz		 			Span 3	00 kHz	1 of 2

Page 59 of 95

						Mk	1 5./84	998 79	GHZ	
lef 20 dBm Peak		Atten Z	0 dB	1	1	1		3.40	dBm	Next Peak
oa										
0										
B/					}					Next Pk Right
ffst				3	1					
3.9	and the state of	الم الله عال	and a statistic	14.11	Mar Her	-			A distant	
	A Discould be		phillippine and	and the first	Lan aller	Log Contract	Indexe Strate		1000	Next Pk Left
Bm										
αAv										Min Search
J										
1 M2										DL DL O
3 FC										PK-PK Search
AA										
(f):										Nu.
>JUK										MKr@C
										L
E 705 [°] 04										Mor
enter 5./85 00	00 00 GH	z						Span 3	00 kHz	1 of 2

Page 60 of 95

<u>y</u>		.40.00	viai 0, Zi	500					<u>г</u>		Feak Search
ef 20	dBm		Atten 2	0 dB			Mki	1 5.824	998 64 5.68	GHz dBm	Next Peak
'eak)g											
3/					1	}					Next Pk Right
Hist 1.9 3		la Marilanda Marina			And	Land the		hter ber ber			Novt Dk Loft
		1	1.4.48 1.6.2	· · · ·				1. 1. ala. 4 4 .	. 16.21		INEXLEKLEIL
0 3m											Min Search
JA∨											
1 M2 3 FC											Pk-Pk Search
_ AA											
f): 50k											Mkr © C
мþ											
enter Des B	5.825 0 W3kH	00 00 G	Hz	#VI	BW 10 1	kH7	#Swa	en 100 -	Span 30 s /2001	00 kHz	More 1 of 2

Page 61 of 95

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 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

Page 62 of 95



Page 63 of 95



Page 64 of 95

7.3. 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND

7.3.1. 6 dB BANDWIDTH

LIMITS

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	35.75	0.5
High	5795	36.08	0.5

Page 65 of 95

6 dB BANDWIDTH,



Page 66 of 95



Page 67 of 95

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	99% Bandwidth
	(MHz)	(MHz)
Low	5755	36.4406
High	5795	36.3774

Page 68 of 95

99% BANDWIDTH,

99% BANDWIDTH I			RT	Sweep
Ch Freq 5.755 Occupied Bandwidth	i GHz		Trig Free	Sweep Time 20.00 ms <u>Auto Man</u>
				Sweep <u>Single Cont</u>
Ref 20 dBm Atten 2 #Samp Log 10 dB/ Offst 11.4	0 dB		Variation of the second s	Auto Sweep Time Norm <u>Accy</u>
Center 5.755 00 GHz #Res BW 510 kHz	#VBW 1.5 MHz	sweep 20	Span 80 MHz ms (601 pts)	
Occupied Bandwid 36.44	lth 06 MHz	Occ BW % Pwr x dB	99.00 % -26.00 dB	Points 601
Transmit Freq Error -7 x dB Bandwidth 4	74.374 kHz 1.082 MHz*			
Copyright 2000-2007 Agilent Teo	chnologies			

Page 69 of 95

99% BANDWIDTH	HIGH CH			RТ	Sweep	
Ch Freq 5.7 Occupied Bandwidth	795 GHz			Trig Free	Sweep 1 20.0 <u>Auto</u>	Fime O ms <u>Man</u>
					Sw <u>Single</u>	/eep <u>Cont</u>
Ref 20 dBm Atte	n 20 dB	-peritor parapapar	₩ \$		Auto Swy	eep Time <u>Accy</u>
offst WMM The second se						
Center 5.795 00 GHz #Res BW 510 kHz	#VBW 1.5 M	AHz Sv	veep 20 n	Span 80 MHz 1s (601 pts)		
Occupied Bandw 36.3	idth 774 MHz	Occ BW	′% Pwr xdB	99.00 % -26.00 dB	Po	oints 601
Transmit Freq Error x dB Bandwidth	31.048 kHz 44.133 MHz*					
oopyngni 2000-2007 Agilent	recimologies					

Page 70 of 95

7.3.3. 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	20.08	20.12	20.37	24.96	30.00	-5.04
High	5795	19.96	20.57	20.12	25.00	30.00	-5.00

Page 71 of 95

CHAIN 0 OUTPUT POWER



Page 72 of 95
OUTPUT POWER HIGH CH, CHAIN 0	Sweep
Ch Freq 5.795 GHz Trig Free Channel Power	Sweep Time 1.067 ms <u>Auto Man</u>
Ref 30 dBm Atten 30 dB	Sweep Single Cont
Altern So ublin Altern So ublin #Peak	Auto Sweep Time <u>Norm Accy</u>
Center 5.795 00 GHz Span 60 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (2001 pts)	
Channel Power Power Spectral Density 19.96 dBm / 40.0000 MHz -56.06 dBm/Hz	Points 2001
Copyright 2000-2007 Agilent Technologies	

Page 73 of 95

CHAIN 1 OUTPUT POWER



Page 74 of 95

OUTPUT POWER HIGH CH, CHAIN 1 * Agilent 14:47:28 Mar 5, 2008 R T	Sweep
Ch Freq 5.795 GHz Trig Fre Channel Power	Sweep Time e 1.067 ms <u>Auto Man</u>
Ref 30 dBm Atten 30 dB #Peak Log 10 dB/ Offst 11.4 dB	Sweep Single Cont Auto Sweep Time Norm Accy
Center 5.795 00 GHz Span 60 MH #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (2001 pts) Channel Power Power Spectral Density 20.57 dBm / 40.0000 MHz -55.45 dBm/Hz Copyright 2000-2007 Agilent Technologies	Iz Points 2001

Page 75 of 95

CHAIN 2 OUTPUT POWER



Page 76 of 95

OUTPUT POWER HIGH CH, CHAIN 2	Sweep
Ch Freq 5.795 GHz Trig Free Channel Power	Sweep Time 1.067 ms <u>Auto Man</u>
Ref 30 dBm Atten 30 dB #Peak Log 10 dB/ Offst	Sweep Single Cont Auto Sweep Time <u>Norm Accy</u>
dB Span 60 MHz Center 5.795 00 GHz Span 60 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 1.067 ms (2001 pts) Channel Power Power Spectral Density 20.12 dBm / 40.0000 MHz -55.90 dBm/Hz	Points 2001
Copyright 2000-2007 Agilent Technologies	

Page 77 of 95

7.3.4. 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	17.52	17.63	17.67	22.38
High	5795	17.64	18.01	17.97	22.65

Page 78 of 95

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.

RESULTS:

Channel	Frequency	PSD with Combiner	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	5755	5.84	8	-2.16
High	5795	2.99	8	-5.01

Page 79 of 95

POWER SPECTRAL DENSITY, WITH COMBINER



Page 80 of 95



Page 81 of 95

7.3.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

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 82 of 95



Page 83 of 95



Page 84 of 95

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	Field Strength Limit	Field Strength Limit
(IVI⊓Z)	(uv/m) at 3 m	(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 FOR 802.11a MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

Horn 1-18GHz Pre-amplifer 1-26GHz Pre-amplifer 26-40GHz Horn > 18GHz Limit T120; S.N: 29310 @3m T145 Agilent 3008A005(T88 Miteq 26-40GHz T89; ARA 18-26GHz; S.N:1049 FCC 15-205 H Frequency Cables 3 foot cable 12 foot cable HPF Reject Filter Peak Measurements RBW=VBW=1MHz M Frequency Cables 12 foot cable 12 foot cable Pre-amplifer 1/2 foot cable Pre-amplifer 1/2 foot cable Peak Measurements f Dist Read Avg AF CL Amp D C ont Flt Peak Avg IN Avg Lim Avg Mar Notes SHz (m) dBuV dBu dB dB dB dB Avg Pk Lim Avg Lim Pk Mar Avg Mar Notes SHz (m) dBuV dBu dB dB dBuV/m dBuV/m dB U/V/m V/H CLA 5768Mite - <t< th=""><th>st Eq</th><th>uipmen</th><th><u>t:</u></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<>	st Eq	uipmen	<u>t:</u>													
H Frequency Cables Iso mineq 20-dusity How mineq 20-dusity </th <th>H</th> <th>lorn 1-</th> <th>18GHz</th> <th>Pre-ar</th> <th>nplifer</th> <th>1-26</th> <th>GHZ</th> <th>Pre-am</th> <th>plifer</th> <th>26-40GH</th> <th>Z</th> <th>H</th> <th>orn > 180</th> <th>GHz</th> <th></th> <th>Limit</th>	H	lorn 1-	18GHz	Pre-ar	nplifer	1-26	GHZ	Pre-am	plifer	26-40GH	Z	H	orn > 180	GHz		Limit
Integrative cases 3 foot cable 12 foot cable HPF Reject Filter Peak Measurements RBW=VBW=1MHz Image: Construction of the const	Hi Eree	S/N: 29	310 @3m	▼ 1145 A	igilent 3	008A0	05(188 Mit	eq 26-4	IOGHZ	- 189	; AKA 18-20	GRZ; S/N:	1049	•	FCC 15.205
Chin 177079003 C.5m Chamber HPF_7.6GHz Average Measurements RBW=1MHz, VBW=10Hz f Dist Read Pk Read Avg. AF CL Amp D Corr Flt Peak Avg Pk Lin Avg Lin Pk Mar Avg Mar Notes f Dist Read Pk Read Avg. AF CL Amp D Corr Flt Peak Avg Pk Lin Avg Lin Avg Lin Pk Mar Avg Mar Notes f MBNV dBuV dB dB dB dB dB dB dB dW (VH) ich 570 3.0 40.6 30.0 36.4 4.6 -33.0 0.0 0.7 51.7 40.7 74 54 -22.3 -13.3 V store at 0.6 30.0 36.4 4.6 -33.0 0.0 0.7 49.3 38.7 74 54 -24.7 -15.3 H e: No other emissions were detected above the system noise Boor. E Preamp Gain Avg Lin Average Field Strength Limit Pk Lim Peak Field Strength Limit		2 foot	cable	3	foot c	able		12	foot c	able		HPF	Re	ject Filte	r Peal	<u>Measurements</u>
f Dist Read Pk Read Avg. AF CL Amp D Corr Fltr Peak Avg Pk Lim Avg Lim Pk Mar Avg Mar Notes GH2 (m) dBuV dB/m dB dB dB dB dB dB dB V(H) dBuV/m dBuV/m dB dB V(H) V(H) C16.5785MHz	Chi	in 177079	9003	•			T	C-5m C	hambe	er 🛓	HP	F_7.6GHz	•		Avera RBW=	ge Measurements 1MHz ; VBW=10Hz
1 Ch 5785MHz Image: Character of the system system system of the system of the system of the sys	f 3Hz	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)
570 3.0 40.6 30.0 36.4 4.6 -33.0 0.0 0.7 49.3 38.7 74 54 -24.7 -15.3 H r. 412.7	d Ch 5 570	785MHz 3.0	43.0	32.0	36.4	4.6	-33.0	0.0	0.7	51.7	40.7	74	54	-22.3	-13.3	v
r. 412.7 e: No other emissions were detected above the system noise floor. f Measurement Frequency Amp Preamp Gain Avg Lim Average Field Strength Limit Dist Distance to Antenna D Corr Distance Correct to 3 meters Pk Lim Peak Field Strength Limit Read Analyzer Reading Avg Average Field Strength @ 3 m Avg Mar Margin vs. Average Limit AF Antenna Factor Peak Calculated Peak Field Strength Pk Mar Margin vs. Peak Limit CL Cable Loss HPF High Pass Filter	570	3.0	40.6	30.0	36.4	4.6	-33.0	0.0	0.7	49.3	38.7	74	54	-24.7	-15.3	H
CL Cable Loss nFF nigh Pass Filter		Dist Read AF	Distance to Analyzer R Antenna Fa	Antenna eading .ctor	,		D Corr Avg Peak	Distance Average Calculate	Correc Field S d Peak	ct to 3 mete Strength @ c Field Stre	ers 3 m ngth		Pk Lim Avg Mar Pk Mar	Peak Fiel Margin vs Margin vs	d Strength L: . Average L: . Peak Limit	imit imit

Page 86 of 95

8.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

ompan oject : ate: 3/ est En onfigu iode: 1	y: Athe #: 08U 4/2008 gineer: ration: 1 FX, 5.80	ros Comm 11627 Chin Pang EUT/3 Ant 3Hz Band.	unication ennas/Laj HT20	top											
est Eq	uipmen	<u>t</u>													
н	orn 1-	18GHz	Pre	amplife	1-26	GHz	Pre-am	plifer	26-40GH	z	н	orn > 180	GHz		Limit
T120;	S/N: 293	10 @3m	▼ T14	5 Agilent	3008A0	05(🖵	T88 Mit	eq 26-4	10GHz	▼ T89;	; ARA 18-20	6GHz; S/N:1	1049	•	FCC 15.205 🗸
Hi Fred	uency Cat	les —						-		_					
	2 foot	cable		3 foot o	able		121	foot c	able		HPF	Re	iect Filte	er Pea	k Measurements
Chi	n 177079	003	1				C 5m C	hamha	AT.		F 7 6GHz		jootrint	RE	BW=VBW=1MHz
	1111013	.005				•	Com C	namby	•		1_7.00112	-		RBW:	=1MHz; VBW=10Hz
f	Dist	Read Pk	Read Av	g. AF	CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim	Avg Lim	Pk Mar	Avg Mar	Notes
GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)
d Ch 5 570	785MHz 3.0	45.D	32.0	36.4	4.6	-33.0	0.0	0.7	53.7	40.7	74	54	-20.3	-13.3	v
570	3.0	43.5	31.0	36.4	4.6	-33.0	0.0	0.7	52.2	39.7	74	54	-21.8	-14.3	Н
	f Dist Read AF	Measureme Distance to Analyzer R Antenna Fa	ent Freque Antenna eading actor	ncy		Amp D Corr Avg Peak	Preamp (Distance Average Calculate	Gain Corre Field S d Peal	ct to 3 mete Strength @ c Field Stre	ers 3 m ngth		Avg Lim Pk Lim Avg Mar Pk Mar	Average I Peak Fiel Margin vs Margin vs	Field Streng d Strength I Average I Peak Lim	th Limit Limit Limit it
	CL.														

Page 87 of 95

8.2.2. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

Compli Compai Project Date: 3: Cest En Configu Aode: 7	High ance Ce ny: Athe #: 08U (4/2008 agineer: ration: TX, 5.8(Frequency ertification f eros Commu 11627 Chin Pang EUT/3 Ante GHz Band, 1	Measurem Services, Fr unications ennas/Lapto HT40	ent emont : P	5m Ch	amber											
est Eq	uipmen	<u>ıt:</u>															
н	orn 1-	18GHz	Pre-ar	nplifer	1-260	GHz	Pre-am	plifer	26-40GH	z		H	orn >	180	Hz		Limit
T120;	S/N: 29	310 @3m	▼ T145 A	gilent 3	008A0	05(🖵	T88 Mit	eq 26⊿	40GHz	•	T89;	ARA 18-26	GHz; S	S/N:1	049	-	FCC 15.205
Hi Fre	quency Ca	bles								 ה							
	2 foot	cable	3	foot c	able		12	foot c	able			HPF		Re	ject Filte	r Peal RB	<u>k Measurements</u> W=VBW=1MHz
Chi	n 17707:	9003	•			•	C-5m C	hambo	er 🛓	Í	HP	7.6GHz	•			 Avera RBW= 	ge Measurements 1MHz ; VBW=10Hz
f	Dist	Read Pk	Read Avg.	AF	CL	Amp	D Corr	Fltr	Peak	А	vg	Pk Lim	Avg	Lim	Pk Mar	Avg Mar	Notes
GHz oh Chi	(m) 5795MH	dBuV 7	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBu	V/m	dBuV/m	dBu	//m	dB	dB	(V/H)
.590	3.0	43.6	31.5	36.4	4.6	-33.0	0.0	0.7	52.3	41).2	74	54		-21.7	-13.8	V
.590	3.0	42.3	30.6	36.4	4.0	-33.U	ບມ	0.7	51.0	3	,3	74	54		-23,IJ	-14.7	H
v. 4.12. 1 te: No	7 other em f Dist Read AF	issions were d Measureme Distance to Analyzer R Antenna Fa	letected above ent Frequency Antenna eading actor	the syste: 7	m noise	floor. Amp D Corr Avg Peak	Preamp (Distance Average Calculate	Gain Corre Field S d Peal	ct to 3 mete Strength @ c Field Stre	ers 3 m ngth			Avg L Pk Lit Avg N Pk M	im n Aar ar	Average F Peak Field Margin vs Margin vs	ield Strengt I Strength L Average L Peak Limit	h Limit imit imit
	CL	Cable Loss				HPF	High Pas	s Filter									

Page 88 of 95

8.3. RECEIVER ABOVE 1 GHz

8.3.1. RX ABOVE 1 GHz40 MHz BANDWIDTH, 5.8 GHz

<u>st Eq</u>	orp. 1	1904-	Pro	mnlifer	1.260	247	Pre am	nlifer	26-400-	-	ц	orn > 19/	247		Limit
H T119:	S/N: 293	301 @3m	T145	Agilent 3	008A00	05(i-re-am	pmer	20-40GH	- -		011 > 181	582		FCC 15.209
Hi Fred	quency Cal	oles —													
	2 foot	cable	:	3 foot c	able		121	foot c	able		HPF	Re	ject Filte	er <u>Peal</u> RB	<u>k Measurements</u> 3W=VBW=1MHz
Chi	n 177079	0003	•			•	C-5m C	hambe	er 🗸			•		Avera RBW=	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	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
;h Ch, 93	5795MH 3.0	z 55.6	34.0	28.3	1.7	-36.1	0.0	0.0	49.5	27.9	74	54	-24.5	-26.1	v
58	3.0	52.7	32.8	29.5	1.9	-35.8	0.0	0.0	48.3	28.4	74	54	-25.7	-25.6	<u>v</u>
73 58	3.0	54.6 50.5	33.2 30.8	28.3 29.5	1.7 1.9	-36.1 -35.8	0.0 0.0	0.0 0.0	48 <i>5</i> 46.1	27.1 26.4	74 74	54 54	-25.5 -27.9	-26.9 -27.6	H
				-											
7. 4.12. te: No o	7 other emi Dist Read AF CL	Measurem Distance to Analyzer F Antenna F Cable Los	detected above ent Frequence Antenna teading actor s	the syste Y	m noise	floor. Amp D Corr Avg Peak HPF	Preamp (Distance Average Calculate High Pas	Gain Correc Field S d Peak s Filter	ct to 3 mete Strength @ c Field Stre	rs 3 m ngth		Avg Lim Pk Lim Avg Mar Pk Mar	Average l Peak Fiel Margin vs Margin vs	Field Strengt d Strength L :. Average L :. Peak Limi	th Limit .imit .imit t

Page 89 of 95

9. 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) Lim	nits 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 8
(B) Limits	for General Populati	ion/Uncontrolled Exp	posure	
0.3–1.34 1.34–30	614 824/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 ²)	Averaging time (minutes)
30–300 300–1500 1500–100,000	27.5	0.073	0.2 f/1500 1.0	30 30 30

f = frequency in MHz

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

exposure or can not exercise control over their exposure.

Page 90 of 95

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 ²)	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/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> ^{0.5}	0.0042f ^{0.5}	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000-150 000	61.4	0.163	10	616 000 /f ^{1.2}
150 000-300 000	0.158f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616 000 /f ^{1.2}

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

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

- A power density of 10 W/m² is equivalent to 1 mW/cm².
 A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

Page 91 of 95

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/cm² is converted to units of W/m² by multiplying by a factor of 10.

Page 92 of 95

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm²

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

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)
802.11a	5.8 GHz	20.0	24.94	9.77	0.59	5.88
802.11n H20	5.8 GHz	20.0	24.90	5.00	0.19	1.94
802.11n H40	5.8 GHz	20.0	25.00	5.00	0.20	1.99

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.

Page 93 of 95