

FCC CFR47 PART 15 SUBPART C INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

Wi-Fi b/g/n Expansion Card (CONTAINED IN MODEM: GX400, GX440)

FCC ID: N7NEC4501

IC ID: 2417C- EC4501

MODEL NUMBER: EC4501

REPORT NUMBER: 12U14203-1, Revision C

ISSUE DATE: MARCH 23, 2012

Prepared for SIERRA WIRELESS, INC. 13811 WIRELESS WAY RICHMOND, BC V6V 3A4, CANADA

Prepared by COMPLIANCE CERTIFICATION SERVICES (UL CCS) 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.	Issue Date	Revisions	Revised By
	02/06/12	Initial Issue	F. Ibrahim
A	03/02/12	 Revised report based on client's comments 1. Revised on page 7 the MC5728V module 2. Changed date of testing to Aug-26-Sept 6 on page 5. 3. Updated cover page to state "Certification Test Report" 	A. Zaffar
В	03/14/12	Removed the "x, y, z Statement from section 5.5	A. Zaffar
С	03/23/12	Added the worst-case orientation to section 5.5	F. Ibrahim

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1. ATTESTATION OF TEST RESULTS

	APPLICABLE STANDARDS
DATE TESTED:	AUGUST 26- SEPT 6, 2011, JANUARY 26 to FEBRUARY 3, 2012
SERIAL NUMBER:	353567040131022, and CA11981509810
MODEL:	EC4501
EUT DESCRIPTION:	Wi-Fi b/g/n Expansion Card (CONTAINED IN MODEM: GX400, GX440)
COMPANY NAME:	SIERRA WIRELESS, INC. 13811 WIRELESS WAY RICHMOND, BC V6V 3A4, CANADA

STANDARD	TEST RESULTS		
CFR 47 Part 15 Subpart C	Pass		
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass		
INDUSTRY CANADA RSS-GEN Issue 3	Pass		

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. 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 UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:

FRANK IBRAHIM EMC SUPERVISOR UL CCS

Tested By: William Shing

WILLIAM ZHUANG EMC ENGINEER UL CCS

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

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

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://www.ccsemc.com</u>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Wi-Fi b/g/n Expansion Card installed inside host Modems, m/n GX400 (co-located with MC8705 and MC5728V) or GX440 (co-located with MC7750).

The radio module is manufactured by Sierra Wireless, Inc.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	17.53	56.62
2412 - 2462	802.11g	17.75	59.57
2412 - 2462	802.11n HT20	17.84	60.81
2422 - 2452	802.11n HT40	16.13	41.02

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a detachable dipole antenna, with a maximum gain of 2 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 4.2.3.007

The test utility software used during testing was 4.2.3.007

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is the channel with the highest output power; therefore, radiated emissions below 1 GHz and power line conducted emissions were performed with the EUT set to transmit at the channel with highest output power.

EUT is investigated at X, Y and Z orientations; X position was the worst case, so all final emission testing was performed at X position.

Worst-case data rates provided by the client which were used for the testing are as follows: 802.11b Mode: 1 Mbps 802.11g Mode: 6 Mbps 802.11n HT20 Mode: MCS0 802.11n HT40 Mode: MCS15

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6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST					
Description	Manufacturer	Model	Serial Number	FCC ID	
AC Adapter 1	Sierra Wireless	S018EM1200150	02037	DoC	
Notebook PC	Toshiba	Tecra A11-S3511	7A105324H	DoC	
AC Adapter 2	Hipro Electronics	PA3755U-1ACA	Q71C000A5210	DoC	
USB Memory Dongle	National Semiconductor	Power Wise 512Mb	02039	DoC	

I/O CABLES

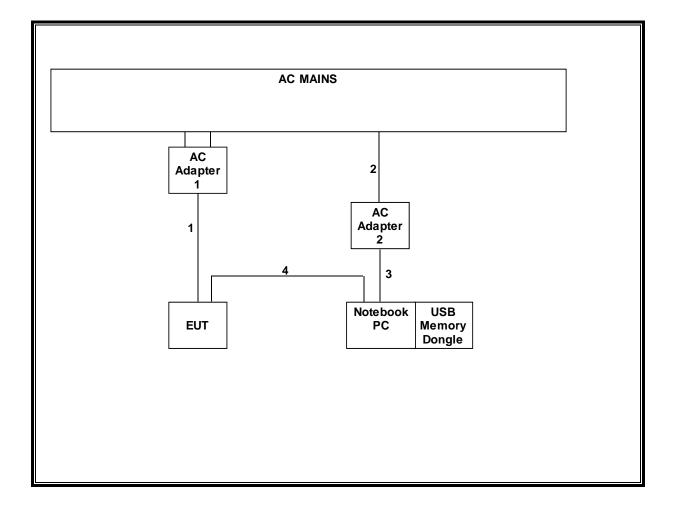
	I/O CABLE LIST					
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC Power	1	2x2	Un-Shielded	1.75m	N/A
2	AC Power	1	3-Prong	Un-Shielded	1.5m	N/A
3	DC Power	1	Mini-Jack	Un-Shielded	1.75m	N/A
4	LAN	1	RJ-45	Un-Shielded	1m	N/A

TEST SETUP

The EUT is connected to a laptop computer during the tests. Test software exercised the radio card.

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SETUP DIAGRAM FOR TESTS



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7. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	Asset	Cal Date	Cal Due
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	01/19/11	04/19/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/16/11	07/16/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/27/11	02/27/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/11	06/29/12
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	07/28/11	07/28/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/12/11	07/12/12
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR	CNR
EMI Test Receiver, 9 kHz-7 GHz	R&S	ESCI 7	1000741	07/06/11	07/06/12
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/10/10	11/10/12
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	11/10/10	11/10/12
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	04/29/10	10/29/12
Power Meter	Agilent / HP	437B	None	07/28/11	07/28/12
Power Sensor, 18 GHz	Agilent / HP	8481A	None	07/28/11	10/28/12

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8. ANTENNA PORT TEST RESULTS

8.1. 802.11b MODE IN THE 2.4 GHz BAND

8.1.1. 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

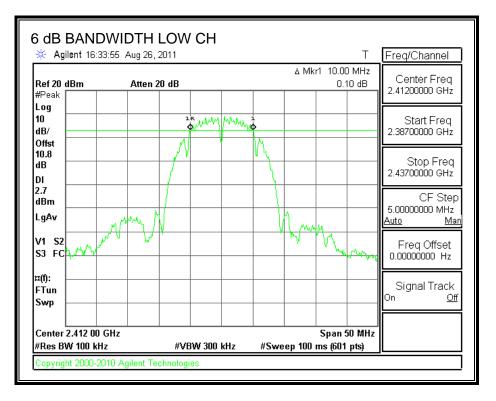
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency 6 dB Bandwidth Minimum Li		Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	2412	10	0.5
Middle	2437	10	0.5
High	2462	10	0.5

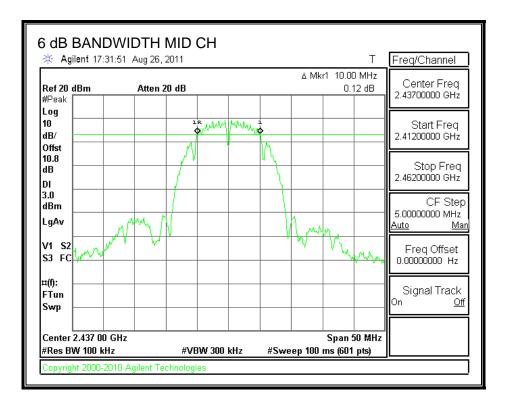
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6 dB BANDWIDTH



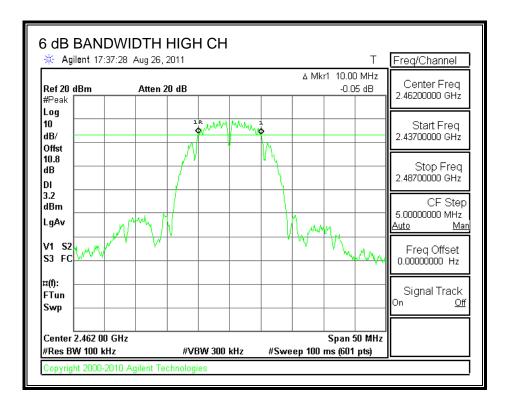
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8.1.2. 99% BANDWIDTH

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.

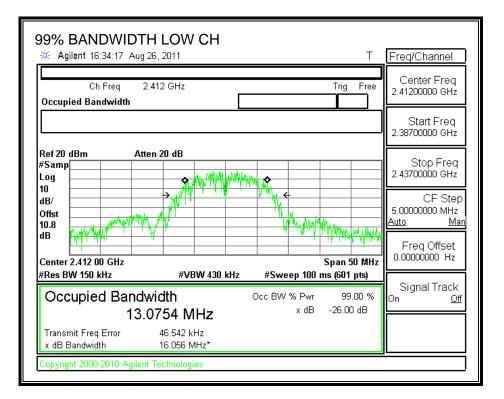
RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2412	13.0754
Middle	2437	13.1996
High	2462	13.2743

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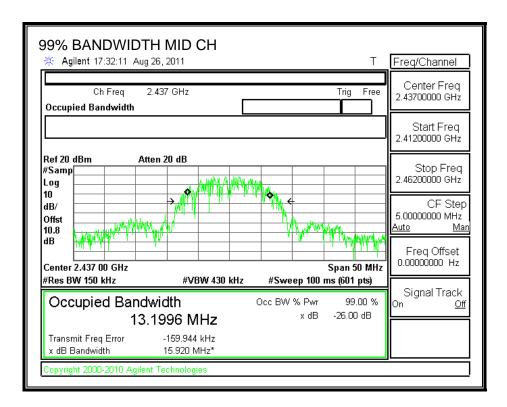
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99% BANDWIDTH

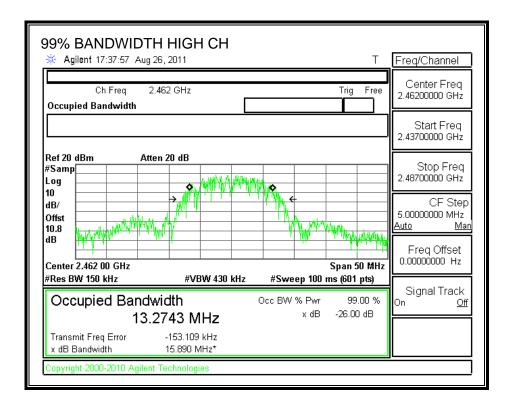


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8.1.3. OUTPUT POWER

<u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

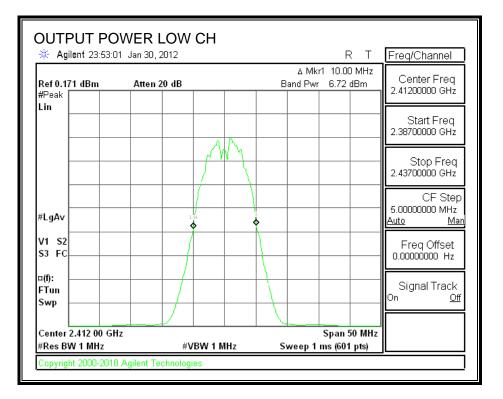
TEST PROCEDURE

Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

RESULTS

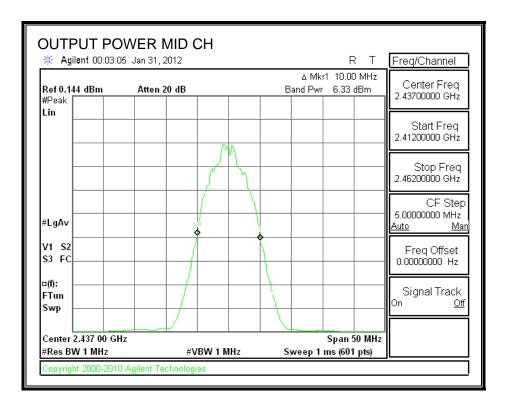
Channel	Frequency	Peak Power	Attenuator and	Output	Limit	Margin
		Reading	Cable Offset	Power		
	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
Low	2412	6.72	10.8	17.52	30	-12.48
Middle	2437	6.33	10.8	17.13	30	-12.87
High	2462	6.73	10.8	17.53	30	-12.47

OUTPUT POWER

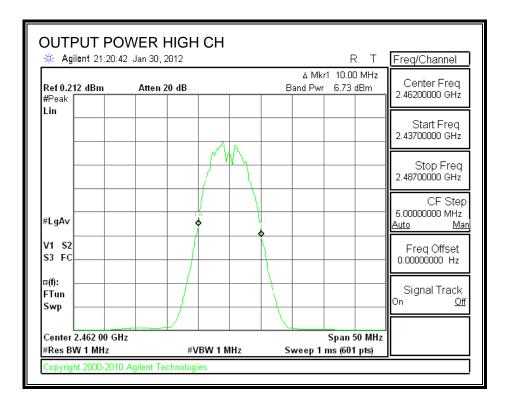


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8.1.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Power
	(MHz)	(dBm)
Low	2412	15.35
Middle	2437	15.40
High	2462	15.50

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8.1.5. POWER SPECTRAL DENSITY

LIMITS

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

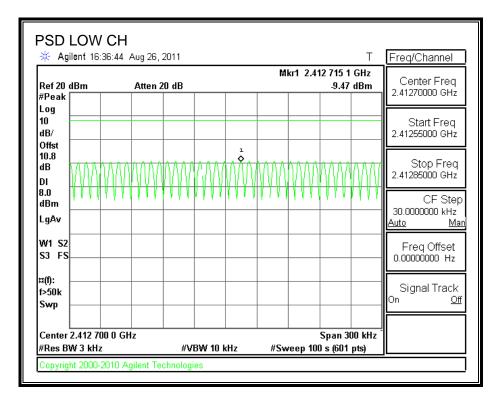
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2412	-9.47	8	-17.47
Middle	2437	-9.15	8	-17.15
High	2462	-9.00	8	-17.00

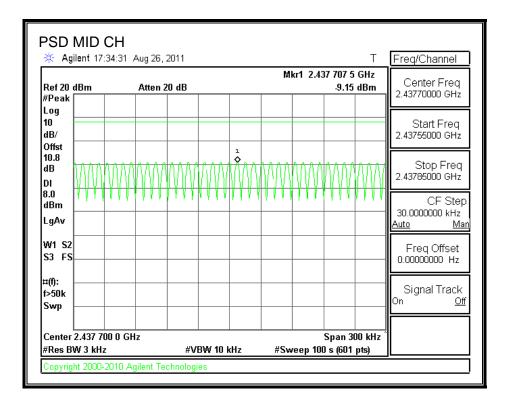
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POWER SPECTRAL DENSITY

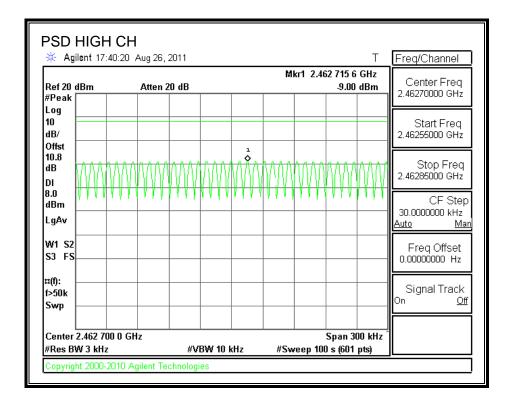


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8.1.6. CONDUCTED SPURIOUS EMISSIONS

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

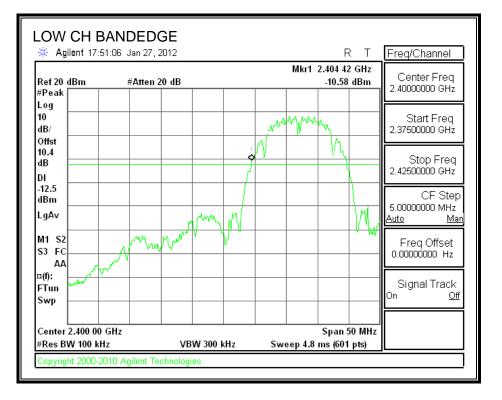
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

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RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



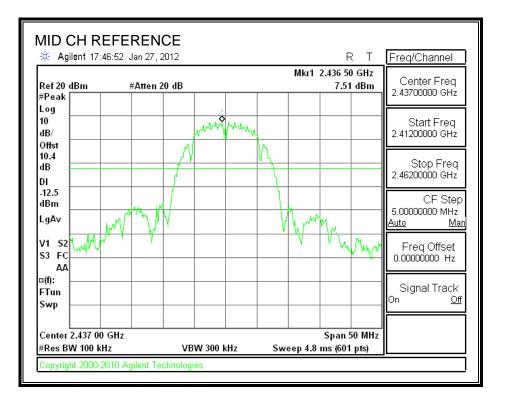
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🔆 Agilen		RIOUS Jan 27, 20					F	τ γ	Freq/Channel
Ref 20 dBı #Peak	n 1	#Atten 20	dB			M	4.8 40.69	33 GHz dBm	Center Freq 13.0150000 GHz
Log 10 dB/ Offst									Start Freq 30.000000 MHz
10.4 dB DI		2							Stop Freq 26.000000 GHz
-11.7 dBm LgAv ─	and the second							fignines, and	CF Step 2.59700000 GHz <u>Auto Man</u>
Start 30 M #Res BW 1			VBW 300	kHz	Swee	St ep 2.482	op 26.0 :s(601		Freq Offset
Marker 1 2	Trace (1) (1)	Type Freq Freq		X Axis 2.41 GHz 4.83 GHz		•	Ampliti 8.10 dE -40.69 dE	ude 9m	0.00000000 Hz Signal Track On <u>Off</u>

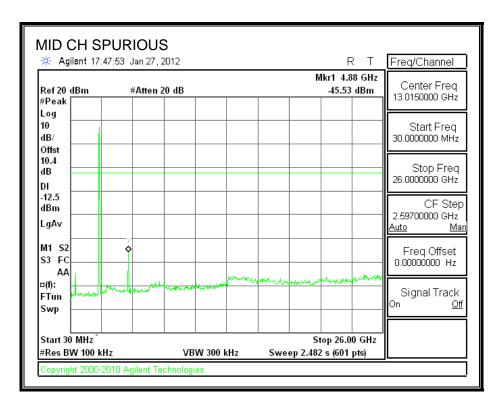
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SPURIOUS EMISSIONS, MID CHANNEL



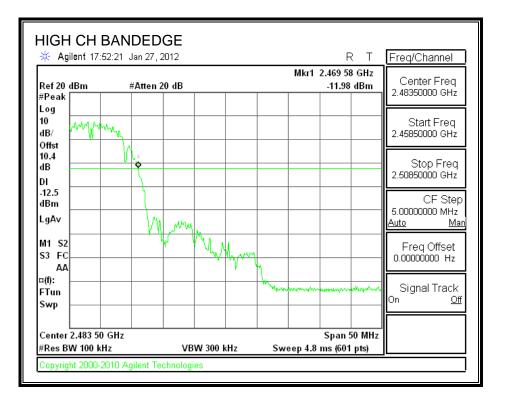
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SPURIOUS EMISSIONS, HIGH CHANNEL



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🔆 Agilent 17:53:	.17 Jan 27, 2012			R T	Freq/Channel
Ref 20 dBm #Peak	#Atten 20 dB			Mkr1 4.92 GH: -50.64 dBm	Center Freq
10 dB/					Start Freq 30.0000000 MHz
Offst 10.4 dB					Stop Freq
DI					26.000000 GHz
-12.5 dBm					CF Step 2.59700000 GHz
LgAv					<u>Auto Ma</u>
M1 S2 S3 FC	1				Freq Offset 0.00000000 Hz
AA ⊐(f):		- man	unan marine and	mound	~
FTun Swp	mallow and more the				Signal Track On <u>Of</u>
Start 30 MHz				Stop 26.00 GHz	!

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8.2. 802.11g MODE IN THE 2.4 GHz BAND

8.2.1. 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

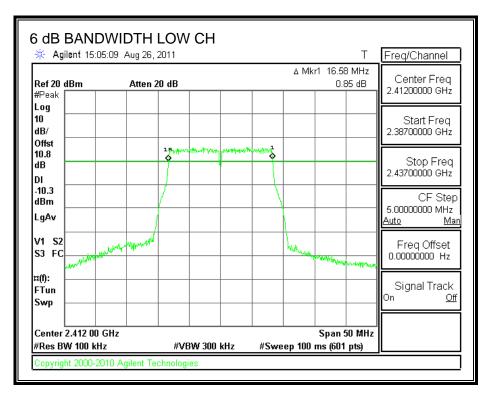
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency	6 dB Bandwidth	Minimum Limit	
	(MHz)	(MHz)	(MHz)	
Low	2412	16.58	0.5	
Middle	2437	16.58	0.5	
High	2462	16.58	0.5	

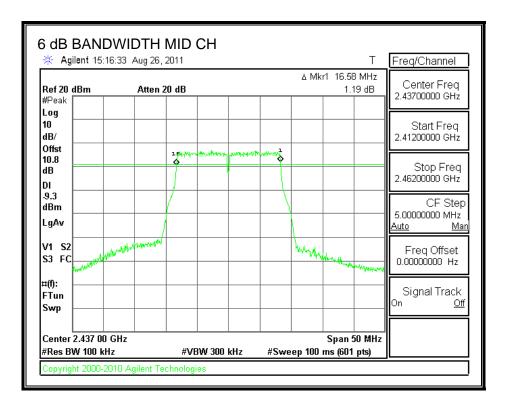
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6 dB BANDWIDTH

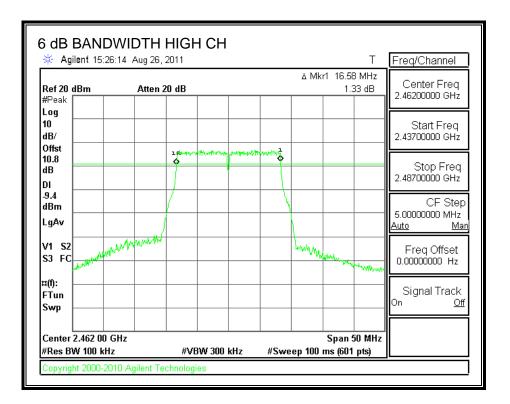


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8.2.2. 99% BANDWIDTH

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.

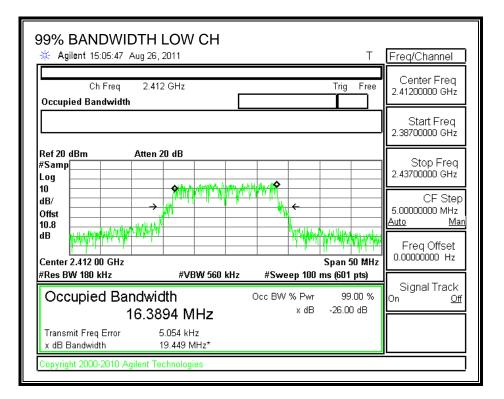
RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2412	16.3894
Middle	2437	16.4212
High	2462	16.4022

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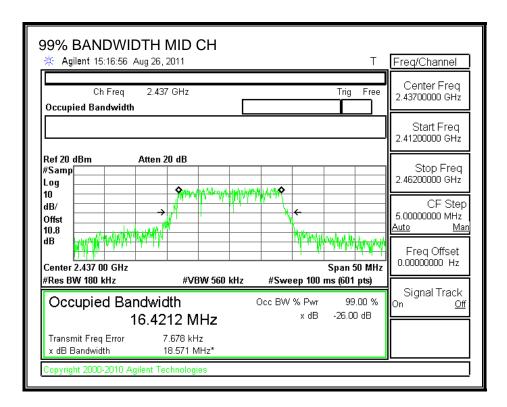
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99% BANDWIDTH

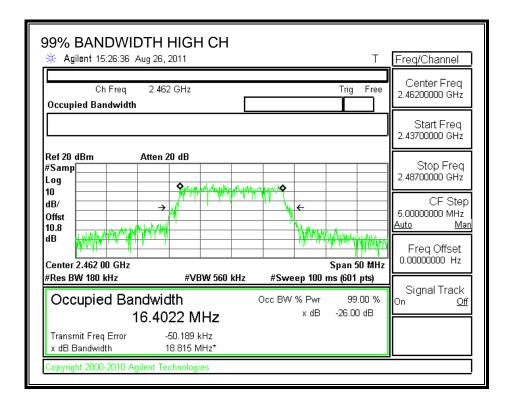


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8.2.3. OUTPUT POWER

<u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

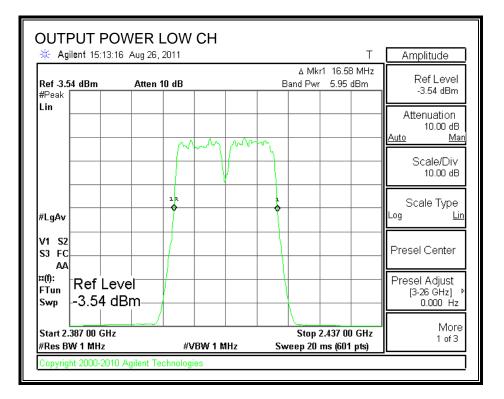
TEST PROCEDURE

Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

RESULTS

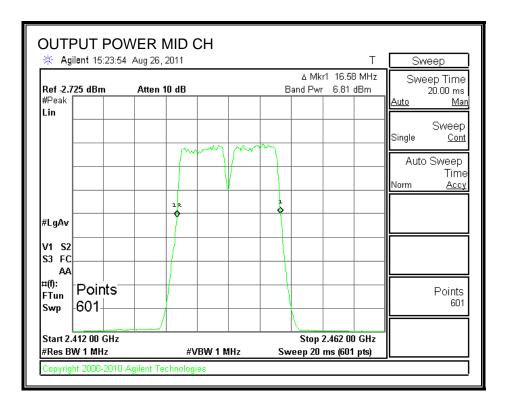
Channel	Frequency	Peak Power	Attenuator and	Output	Limit	Margin
		Reading	Cable Offset	Power		
	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
Low	2412	5.95	10.8	16.75	30	-13.25
Middle	2437	6.81	10.8	17.61	30	-12.39
High	2462	6.95	10.8	17.75	30	-12.25

OUTPUT POWER



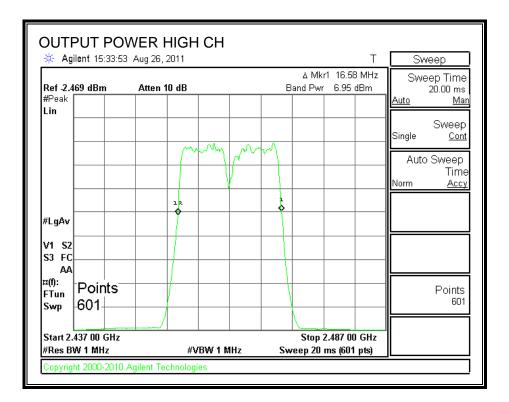
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8.2.4. AVERAGE POWER

<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 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Power
	(MHz)	(dBm)
Low	2412	14.58
Middle	2437	14.58
High	2462	14.25

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8.2.5. POWER SPECTRAL DENSITY

LIMITS

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

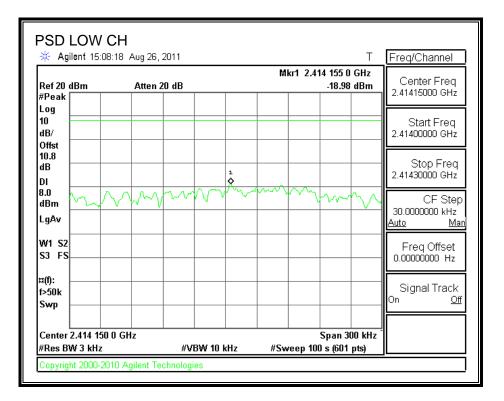
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

<u>RESULTS</u>

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2412	-18.98	8	-26.98
Middle	2437	-18.56	8	-26.56
High	2462	-17.81	8	-25.81

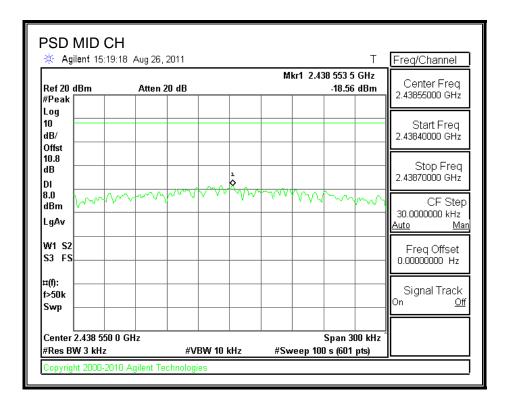
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POWER SPECTRAL DENSITY



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🔆 Agilent 15:29	•	Mkr1 2.464	154 5 GHz	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		-17.81 dBm	Center Freq 2.46415000 GHz
Log				Chart Eve a
dB/				Start Freq 2.46400000 GHz
Offst 10.8				
dB DI				Stop Freq 2.46430000 GHz
8.0 dBm	mm	www	\sim	CF Step 30.0000000 kHz
LgAv				Auto Ma
W1 S2 S3 FS				Freq Offset 0.00000000 Hz
¤(f):		 		
f>50k Swp				Signal Track On <u>Of</u>
Center 2.464 150 #Res BW 3 kHz	0 GHz #VBW	Sj #Sweep 100 s	pan 300 kHz	

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8.2.6. 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

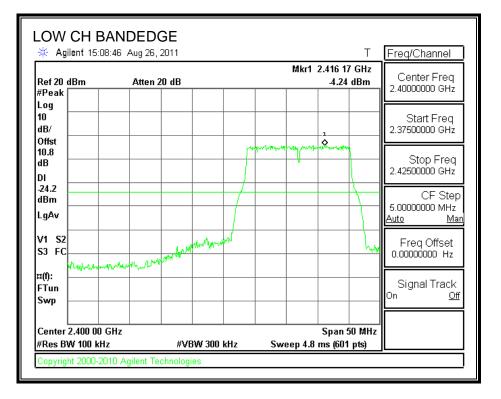
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

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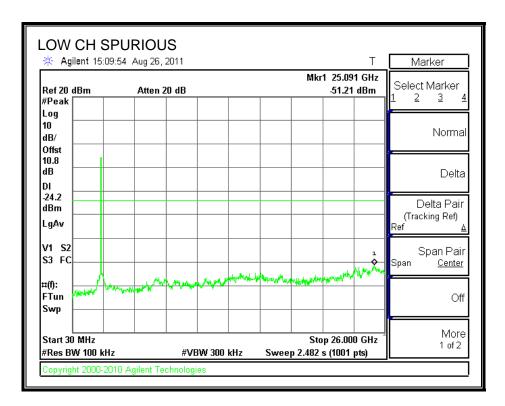
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



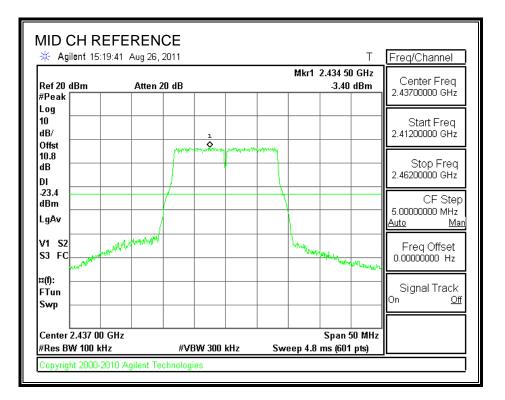
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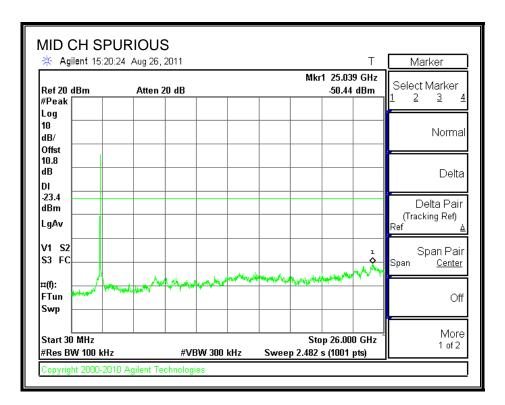
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SPURIOUS EMISSIONS, MID CHANNEL



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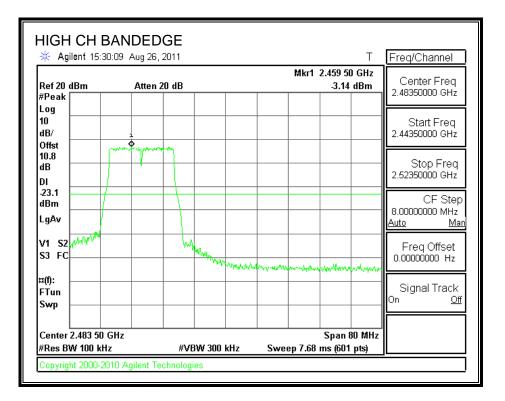
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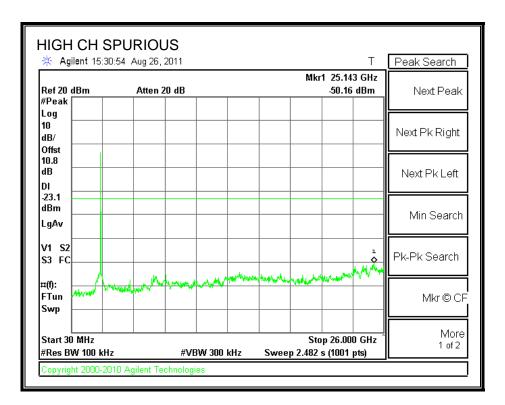
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SPURIOUS EMISSIONS, HIGH CHANNEL



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8.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

8.3.1. 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

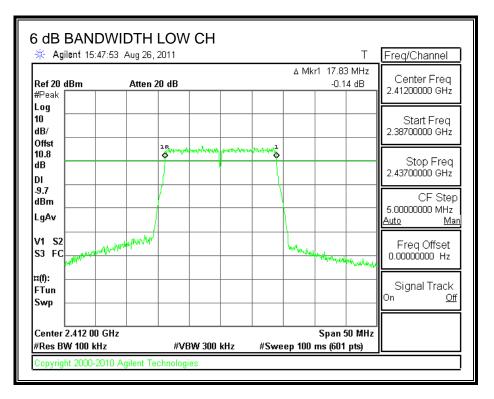
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	2412	17.83	0.5
Middle	2437	17.83	0.5
High	2462	17.83	0.5

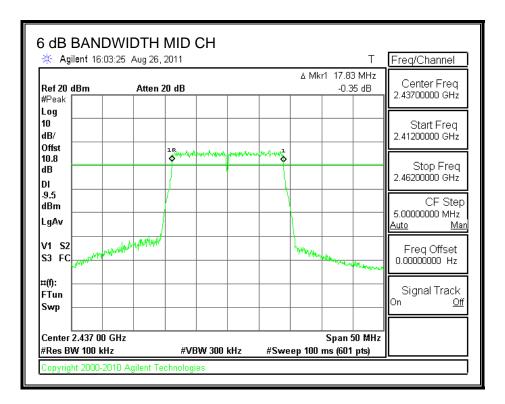
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6 dB BANDWIDTH

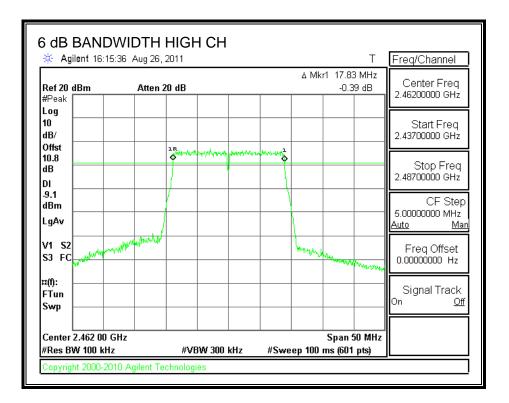


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8.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

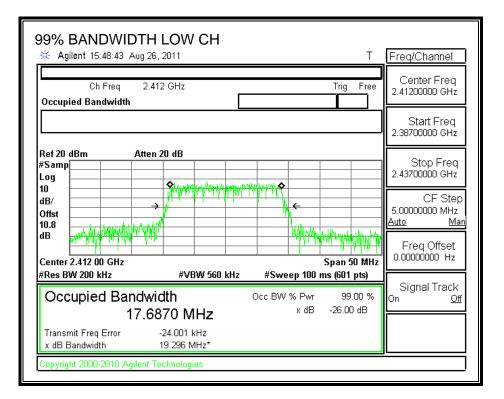
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2412	17.687
Middle	2437	17.6777
High	2462	17.6865

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99% BANDWIDTH

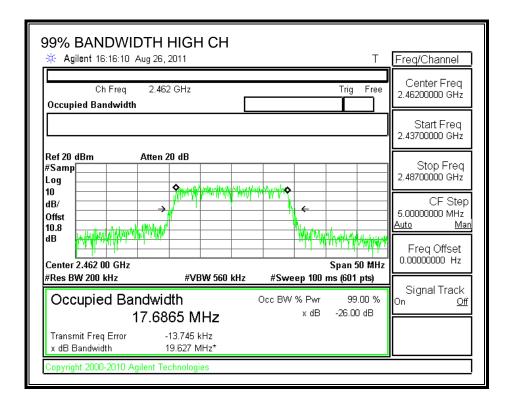


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99% BANDWIDTH			Т	Freq/Channel
Ch Freq 2.43 Occupied Bandwidth	7 GHz		Trig Free	Center Freq 2.43700000 GHz
				Start Freq 2.41200000 GHz
Ref 20 dBm Atten #Samp	20 dB	4m W/M/W		Stop Freq 2.46200000 GHz
dB/ Offst 10.8 dB		│	Addressed	CF Step 5.00000000 MHz <u>Auto Man</u>
Center 2.437 00 GHz #Res BW 200 kHz	#VBW 560 kHz	#Sweep 100 r	Span 50 MHz ns (601 pts)	Freq Offset 0.00000000 Hz
Occupied Bandwig 17.67	dth 77 MHz	Occ BW % Pwr x dB		Signal Track On <u>Off</u>
x dB Bandwidth	46.003 kHz 19.761 MHz*			
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8.3.3. OUTPUT POWER

<u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

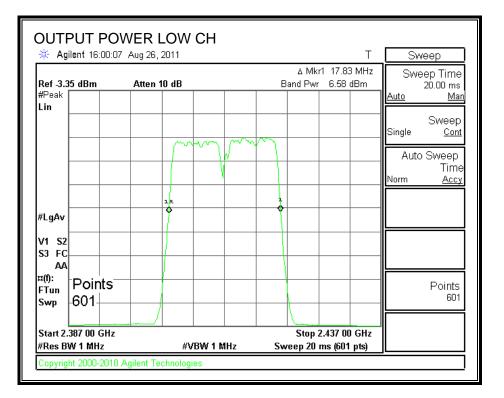
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

RESULTS

Channel	Frequency	Peak Power	Attenuator and	Output	Limit	Margin
		Reading	Cable Offset	Power		
	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
Low	2412	6.58	10.8	17.38	30	-12.62
Middle	2437	6.88	10.8	17.68	30	-12.32
High	2462	7.04	10.8	17.84	30	-12.16

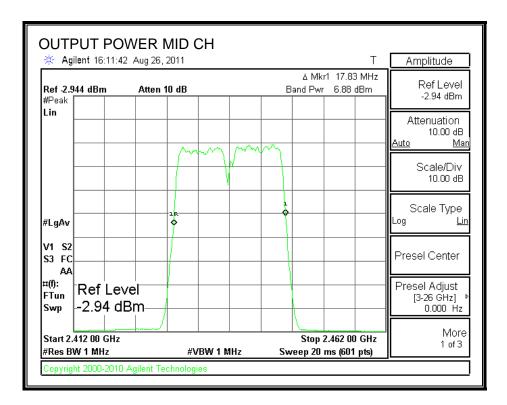
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OUTPUT POWER

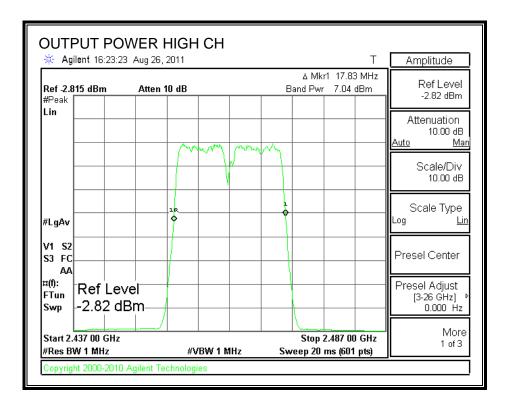


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8.3.4. AVERAGE POWER

<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 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Power
	(MHz)	(dBm)
Low	2412	14.23
Middle	2437	14.18
High	2462	13.85

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8.3.5. POWER SPECTRAL DENSITY

LIMITS

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

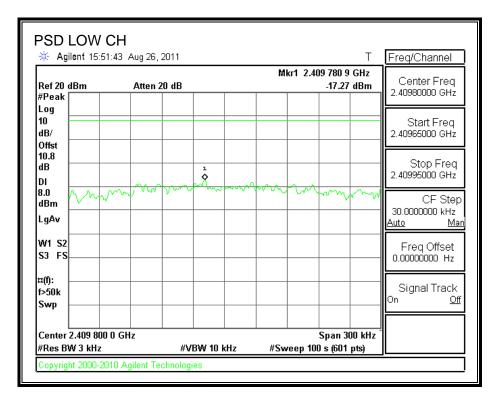
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

<u>RESULTS</u>

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2412	-17.27	8	-25.27
Middle	2437	-17.60	8	-25.60
High	2462	-17.59	8	-25.59

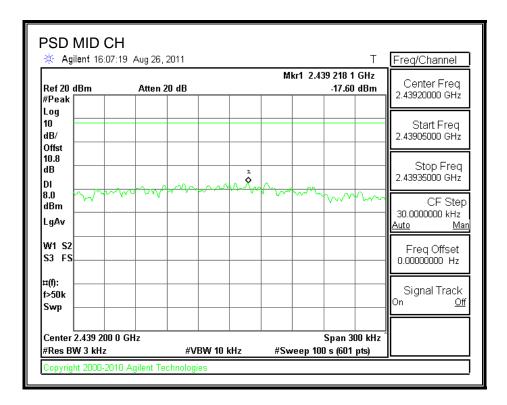
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POWER SPECTRAL DENSITY



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🔆 Agilent 16:18	.04 Aug 20, 2011			Τ	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB		MKr1 2.4	68 527 1 GHz -17.59 dBm	Center Freq 2.46860000 GHz
Log 10 dB/ Offst					Start Freq 2.46845000 GHz
10.8 dB					Stop Freq 2.46875000 GHz
8.0 48m LgAv	V			man	CF Step 30.0000000 kHz <u>Auto Ma</u>
W1 S2 S3 FS					Freq Offset 0.00000000 Hz
¤(f): f>50k Swp					Signal Track On <u>Off</u>
Center 2.468 600 #Res BW 3 kHz		VBW 10 kHz	#Sugar 10	Span 300 kHz 0 s (601 pts)	

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8.3.6. 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

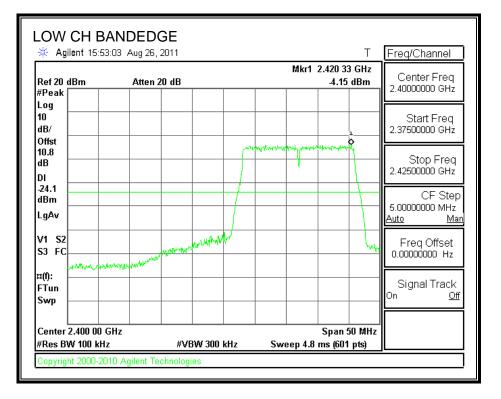
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

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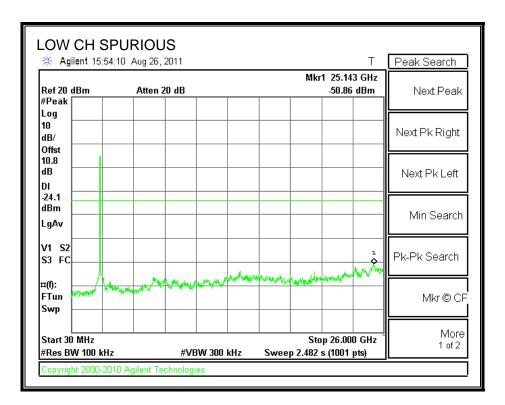
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



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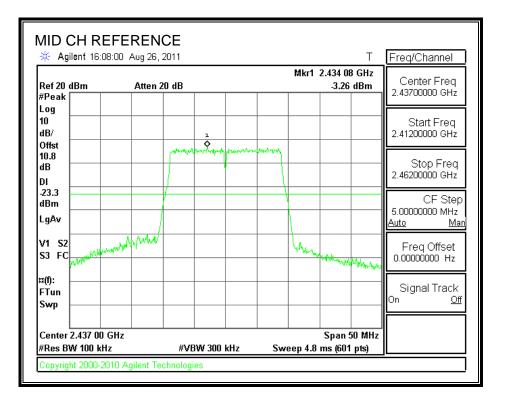
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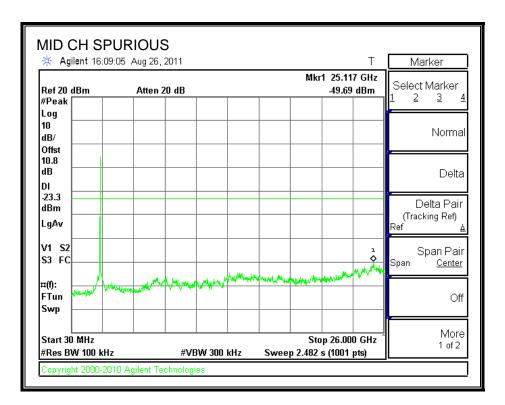
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SPURIOUS EMISSIONS, MID CHANNEL

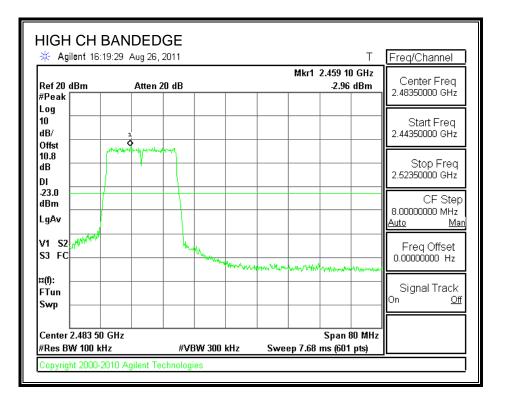


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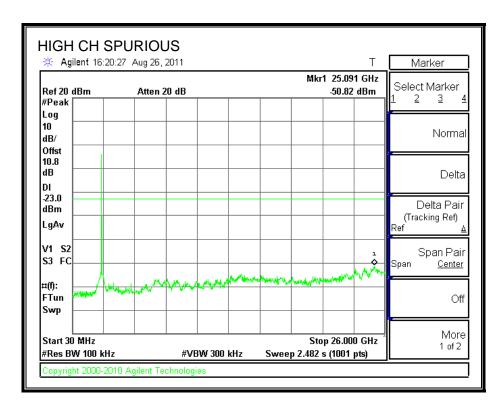
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SPURIOUS EMISSIONS, HIGH CHANNEL



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8.4. 802.11n HT40 MODE IN THE 2.4 GHz BAND

8.4.1.6 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

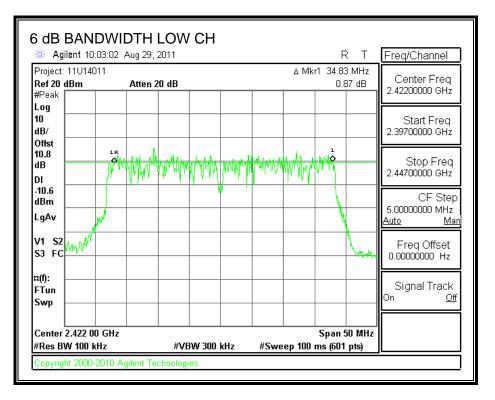
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	2422	34.83	0.5
Middle	2437	34.83	0.5
High	2452	34.5	0.5

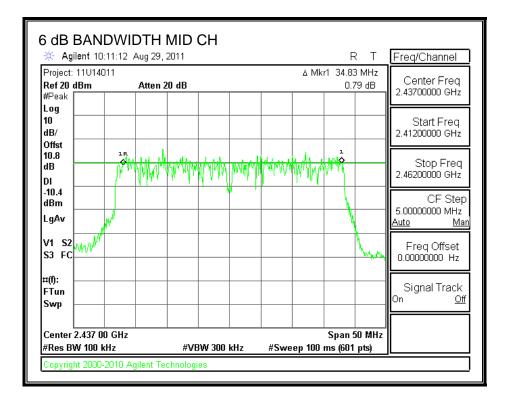
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6 dB BANDWIDTH

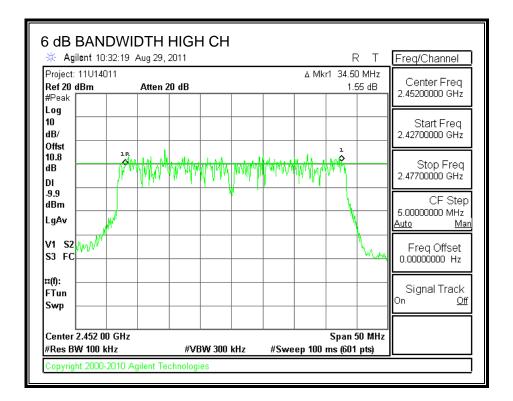


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8.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

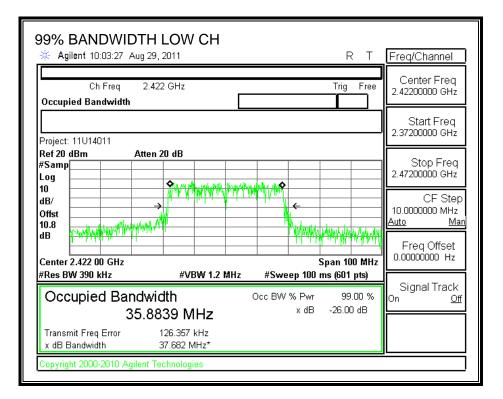
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2422	35.8839
Middle	2437	35.8673
High	2452	35.8181

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99% BANDWIDTH



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99% BANDWIDTH M * Agilent 10:11:43 Aug 29, 20			RТ	Freq/Channel	
Ch Freq 2.437 G Occupied Bandwidth	GHz		Trig Free	Center Freq 2.43700000 GHz	
Project: 11U14011 Ref 20 dBm Atten 20 #Samp	dB			Start Freq 2.38700000 GHz Stop Freq	
Log 10 dB/ Offst 10.8 dB dB dB dB dB dB dB dB/ dB/		←	Tink Willowshill W	2.48700000 GHz CF Step 10.000000 MHz <u>Auto Man</u>	
Center 2.437 00 GHz #Res BW 390 kHz	#VBW 1.2 MHz		Span 100 MHz	Freq Offset 0.00000000 Hz Signal Track	
Occupied Bandwidth Occ BW % Pwr 99.00 % On Off 35.8673 MHz x dB -26.00 dB 0n Off Transmit Freq Error 71.004 kHz 000 kHz 000 kHz 000 kHz					
· · ·	140 MHz*				

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Occupied Bandwidth 2 Project: 11U14011 2 Ref 20 dBm Atten 20 dB #Samp 2 Log 4 10 4 dB/ 4 Offst 4 10.8 4 dB 4 Offst 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 5 0.8 7 0.9 0 0.8 7 0.9 0 0.8 7 0.9 0 <th>Freq/Channel</th> <th>BANDWIDTH HIGH CH enf 10:32:54 Aug 29, 2011 R T</th>	Freq/Channel	BANDWIDTH HIGH CH enf 10:32:54 Aug 29, 2011 R T
Project: 11U14011 Ref 20 dBm Atten 20 dB #Samp	Center Freq 2.45200000 GHz	
#Samp	Start Freq 2.40200000 GHz	11U14011
Occupied Bandwidth Occ BW % Pwr 99.00 % 35.8181 MHz x dB -26.00 dB Transmit Freq Error 92.312 kHz	Stop Freq 2.5020000 GHz CF Step 10.000000 MHz <u>Auto Man</u> Freq Offset 0.0000000 Hz	
Transmit Freq Error 92.312 kHz	Signal Track ^{Dn <u>Off</u>}	upied Bandwidth Occ BW % Pwr 99.00 %
x dB Bandwidth 38.607 MHz*		it Freq Error 92.312 kHz andwidth 38.607 MHz*

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8.4.1. OUTPUT POWER

<u>LIMITS</u>

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

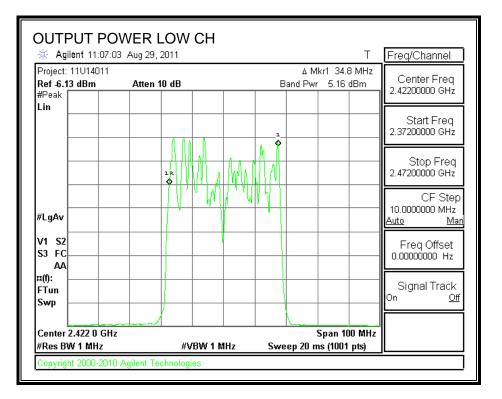
TEST PROCEDURE

Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

RESULTS

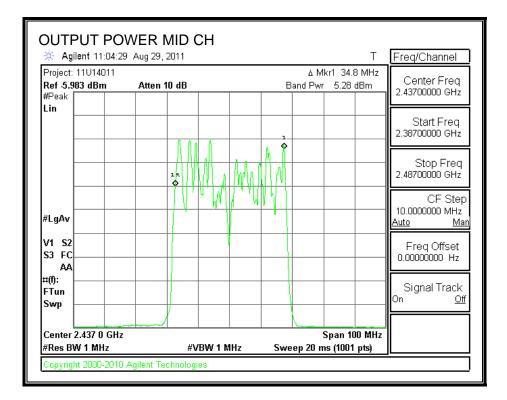
Channel	Frequency	Peak Power	Attenuator and	Output	Limit	Margin
		Reading	Cable Offset	Power		
	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)
Low	2422	5.16	10.8	15.96	30	-14.04
Middle	2437	5.28	10.8	16.08	30	-13.92
High	2452	5.33	10.8	16.13	30	-13.87

OUTPUT POWER



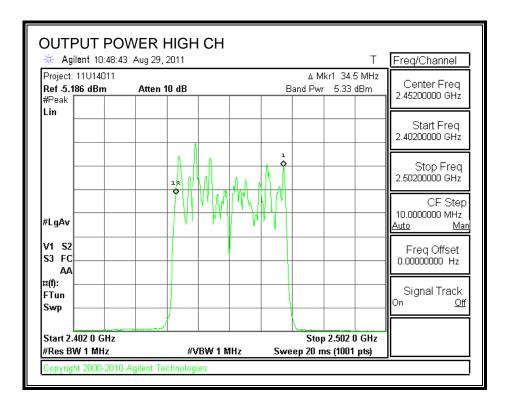
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8.4.2. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.80 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Power
	(MHz)	(dBm)
Low	2422	14.55
Middle	2437	14.80
High	2452	14.98

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8.4.3. POWER SPECTRAL DENSITY

LIMITS

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

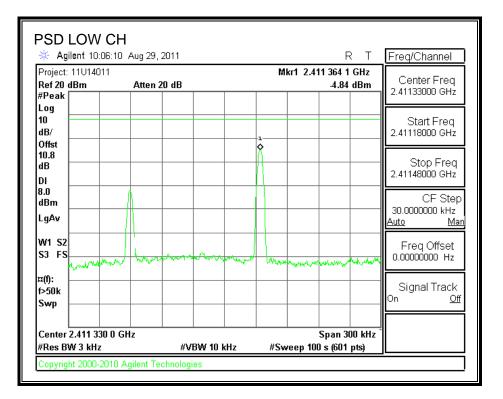
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

<u>RESULTS</u>

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2422	-4.84	8	-12.84
Middle	2437	-4.71	8	-12.71
High	2452	-4.40	8	-12.40

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POWER SPECTRAL DENSITY



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Agilent 10:15:44 . Project: 11U14011		R T Mkr1 2.426 363 6 GHz	Freq/Channel
Ref 20 dBm #Peak	Atten 20 dB	4.71 dBm	Center Freq 2.42633000 GHz
Log 10 dB/ Offst		1	Start Freq 2.42618000 GHz
dB			Stop Freq 2.42648000 GHz
8.0 dBm LgAv			CF Step 30.0000000 kHz <u>Auto Ma</u>
W1 S2 S3 FS	han har	Manager and the second se	Freq Offset
rr(f): f>50k Swp			Signal Track On <u>Ot</u>
Center 2.426 330 0 GH #Res BW 3 kHz	lz #VBW 10 kHz	Span 300 kHz #Sweep 100 s (601 pts)	

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Project: 11U14011			Mkr1 2	.441 363 2 GHz	
Ref 20 dBm #Peak	Atten 20 dB			-4.40 dBm	Center Freq 2.44133000 GHz
Log					Start Freq
dB/ Offst			1		2.44118000 GHz
10.8 dB					Stop Freq
DI					2.44148000 GHz
8.0 dBm					CF Step 30.0000000 kHz
LgAv					<u>Auto Ma</u>
W1 S2 S3 FS		Mar and a strate a	hanash	which we will be a first of the second of the	Freq Offset 0.00000000 Hz
¤(f): f>50k					Signal Track
Swp					

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8.4.4. 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

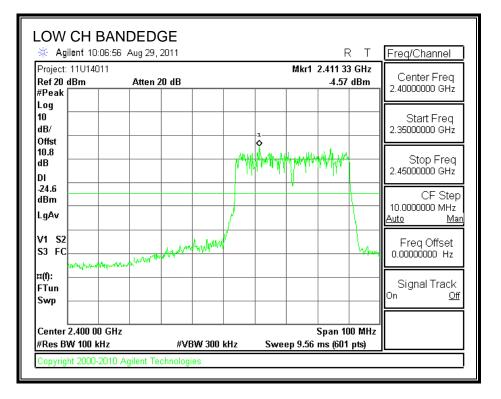
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

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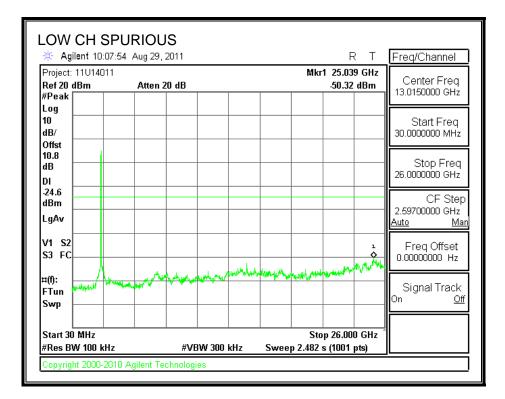
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL



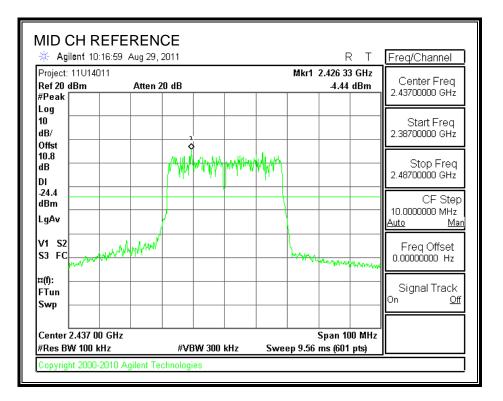
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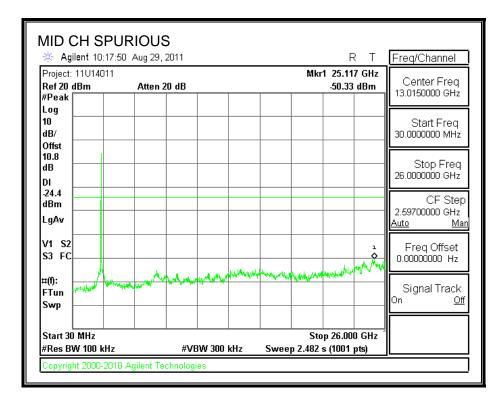
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SPURIOUS EMISSIONS, MID CHANNEL



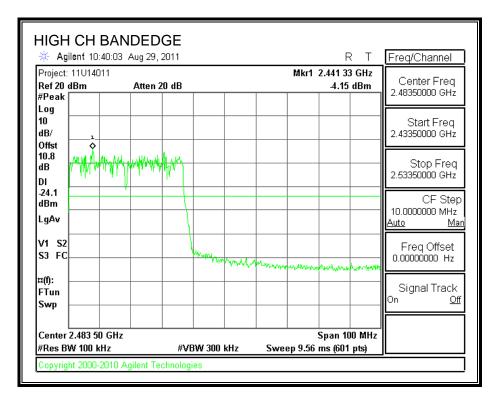
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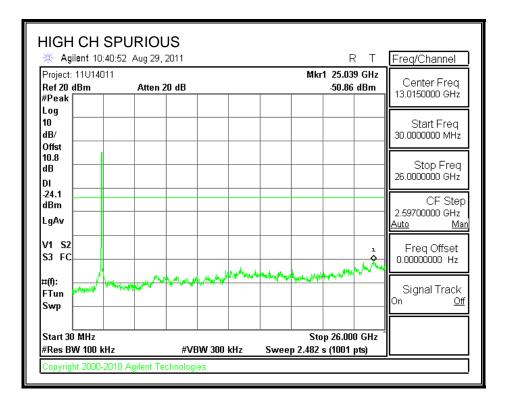
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SPURIOUS EMISSIONS, HIGH CHANNEL



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9. RADIATED TEST RESULTS

9.1. 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.

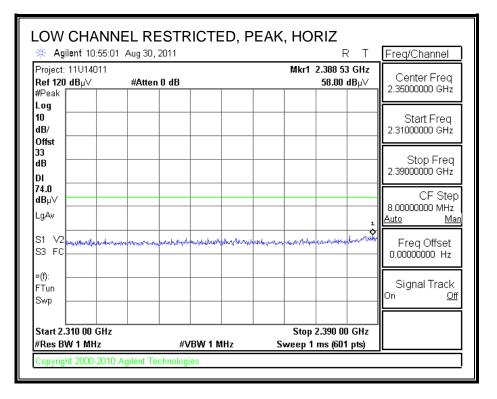
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

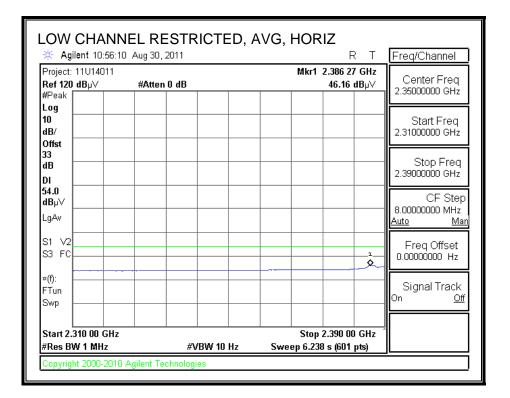
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. TX ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

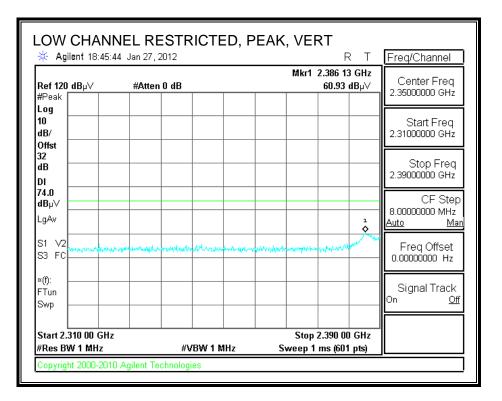


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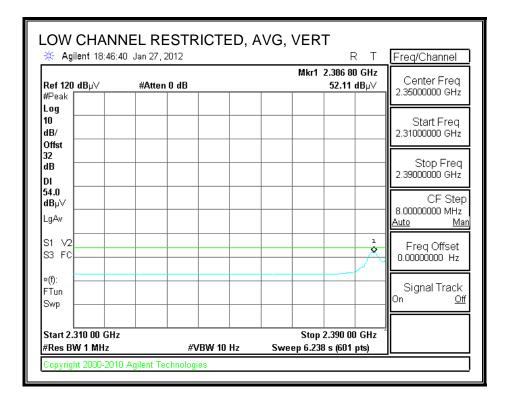
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RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



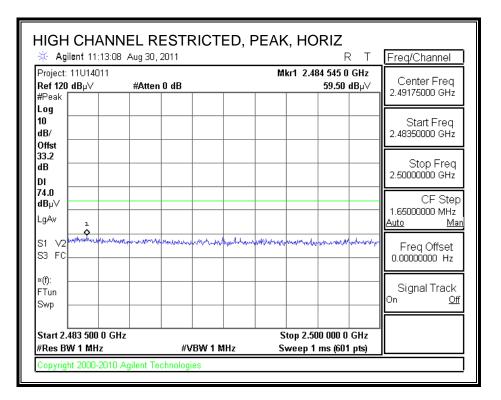
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RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



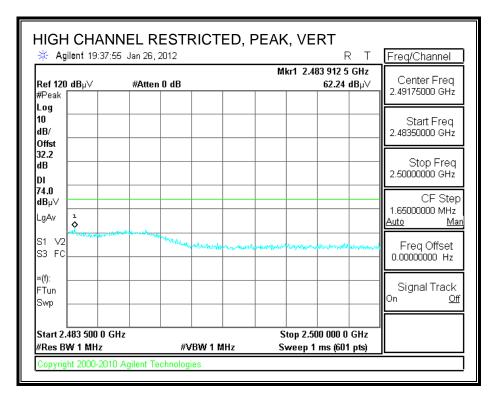
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We Aylient 11:15	:39 Aug 30, 2011	R	r regressamenter
Project: 11U14011 Ref 120 dB µ∨ #Peak	#Atten 0 dB	Mkr1 2.483 500 0 47.34 c	Contor Frod
Log			
10 dB/			Start Freq 2.48350000 GHz
Offst 33.2 dB			Stop Freq
DI			2.5000000 GHz
54.0 dBµ∨			CF Step
LgAv			Auto Man
S1 ∨2 S3 FC			Freq Offset
*(f):			Signal Track
FTun Swp			Signal Track On <u>Off</u>
Start 2.483 500 0	GHz	Stop 2.500 000 0	GHz

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RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



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🔆 Agilent 19:38:2	23 Jan 20, 2012			R T	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB		Mkr1 2.4	483 500 0 GHz 52.92 dBµ∨	Center Freq 2.49175000 GHz
Log 10 dB/ Offst					Start Freq 2.48350000 GHz
dB					- Stop Freq 2.5000000 GHz
54.0 dBµ∨ LgAv					CF Step 1.65000000 MHz Auto Mar
S1 V2 S3 FC					<u>Auto Mar</u> Freq Offset 0.00000000 Hz
×(f): FTun Swp					Signal Track On <u>Off</u>
Start 2.483 500 0 G #Res BW 1 MHz		W 10 Hz	•	500 000 0 GHz 87 s (601 pts)	

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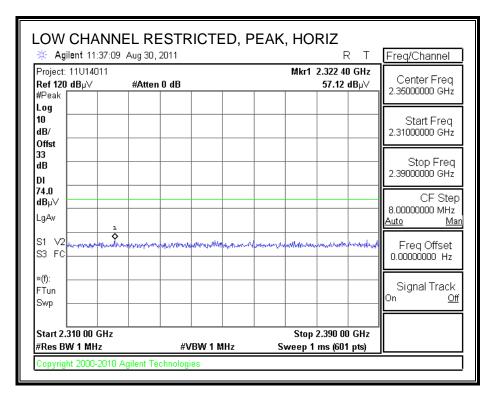
HARMONICS AND SPURIOUS EMISSIONS

	on: <u>nent:</u>	Thanh Nguye EUT and remo Transmit b m	ote suppor	rt laptop										
Horn														
	1-18GHz		mplifer			Pre-am	plifer	26-40GH	z	Ho	rn > 18G	Hz		Limit FCC 15.205
T59; S/N: 3 Hi Frequency	-	■ 1145 #	Agilent 3	008A00	^{)5t}								•	FCC 15.205
	le 22807700	12' o	cable 2	28076	00	20' ca	ble 22	807500		HPF	Re	ject Filte		k Measurements W=VBW=1MHz
3' cable	22807700	• 12' ca	able 228	07600	•	20' cab	le 2280	7500			•			age Measurements =1MHz ; VBW=10Hz
f Di GHz (n		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 824 3.		42.1	33.2	6.3	-34.8	0.0	0.0	50.4	46.8	74	54	-23.6	-7.2	(V/H) V
d ch 374 3.		42.1	33.2	6.3	-34.8	0.0	0.0	50.4	46.9	74	54 54	-23.0	-7.2	v
gh Ch 24 3.		37.6	33.3	6.3	-34.8	0.0	0.0	48.6	42.4	74	54	-25.4	-7.1	V V
f Dist Rea AF CL	t Distance t ad Analyzer I Antenna F	Reading Tactor	у		D Corr Avg Peak	Average	Correc Field S ed Peak	et to 3 mete Strength @ c Field Stre	3 m		Pk Lim Avg Mar	Peak Field Margin vs	Field Streng 1 Strength L . Average L . Peak Limi	.imit .imit

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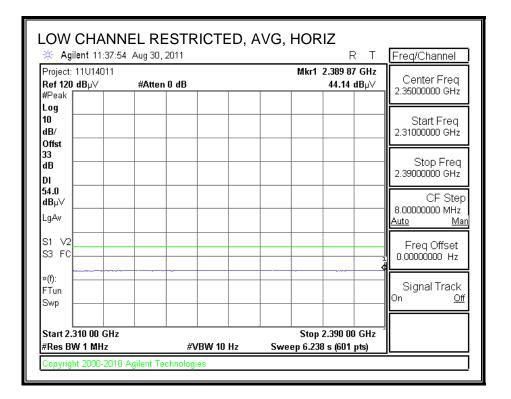
9.2.2. TX ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



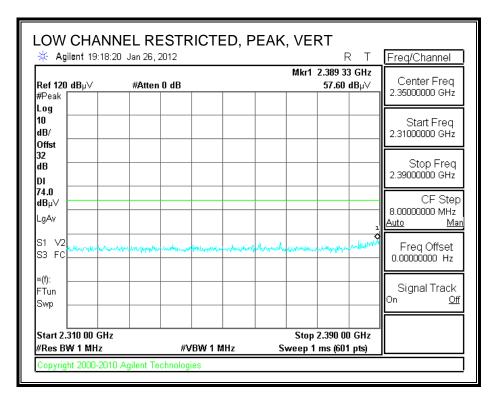
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RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



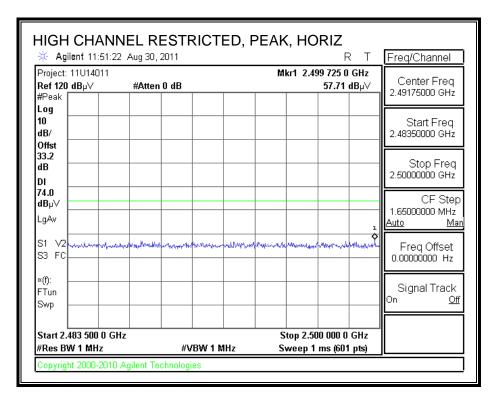
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we Aynem 19.1	9:01 Jan 26, 2012			R T	Freq/Channel
Ref 120 dB µ∨ #Peak	#Atten 0 dB		Mkr1 :	2.390 00 GHz 45.62 dBµ∨	Center Freq 2.35000000 GHz
Log 10 dB/ Offst					Start Freq 2.31000000 GHz
dB					Stop Freq 2.39000000 GHz
54.0 dBµ∀ LgAv					CF Step 8.0000000 MHz <u>Auto Mar</u>
S1 V2					Freq Offset
≈(f): FTun Swp					Signal Track On <u>Off</u>
Start 2.310 00 GI #Res BW 1 MHz		'BW 10 Hz	Stop 2 Sweep 6.238	2.390 00 GHz	

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RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



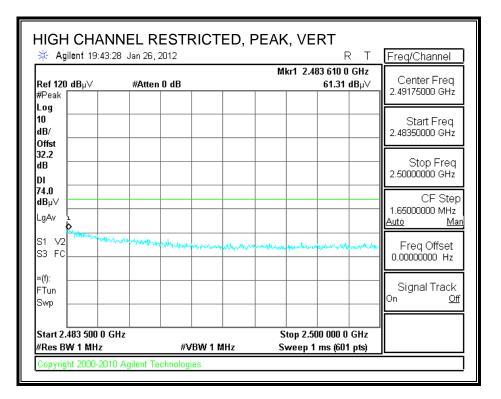
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🔆 Agilent 11:51:	44 Aug 50, 2011		R T	Freq/Channel
Project: 11U14011 Ref 120 dB µ∨ #Peak	#Atten 0 dB	Mkr1 2.48	B3 582 5 GHz 44.60 dBµ∨	Center Freq 2.49175000 GHz
#Peak Log				
10 dB/				Start Freq 2.48350000 GHz
Offst 33.2 dB				Stop Freq
DI				2.50000000 GHz
54.0 dBµ∨				CF Step
LgAv				Auto Mar
S1 V2 S3 FC				Freq Offset 0.00000000 Hz
×(f):				Signal Track
FTun Swp				On <u>Off</u>
Start 2.483 500 0 (GHz	Stop 2.50) Hz Sweep 1.28)0 000 0 GHz	

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RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



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🔆 Agilent 19:43:5	JZ JAH 20, 2012			R T	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB		Mkr1 2.4	483 500 0 GHz 48.19 dBµ∨	Center Freq 2.49175000 GHz
Log 10 dB/ Offst					Start Freq 2.48350000 GHz
dB					Stop Freq 2.5000000 GHz
54.0 dBµ∨					CF Step 1.6500000 MHz
LgAv S1 V2					Freq Offset
S3 FC					0.00000000 Hz
FTun Swp					Signal Track On <u>Off</u>
Start 2.483 500 0 G #Res BW 1 MHz		WV 10 Hz	•	500 000 0 GHz 87 s (601 pts)	,

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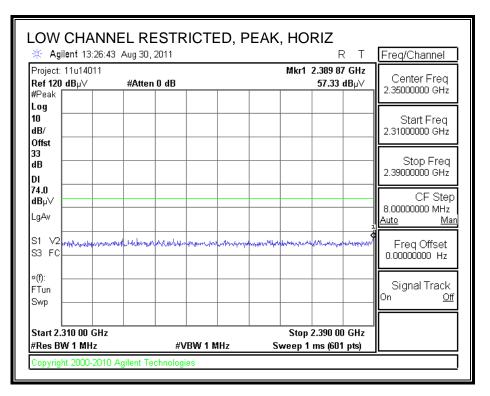
HARMONICS AND SPURIOUS EMISSIONS

omplia	_		· Measurem Services, Fr		5m Ch	amber-/	4								
roject ; ate: OS est En onfigw	#: 11U 8/31/11 gineer: ration: 1	a Wireless 14011 Doug And EUT with S ous Tx 11g	erson upport PC												
	uipmen					1	_								Limit
	orn 1- 5/N: 6717	18GHz 7 @3m	Pre-an	nplifer liteg 30			Pre-am	plifer	26-40GH		ARA 18-260	orn > 180 GHz; S/N:10		-	FCC 15.205
	juency Cal														
3' d	able 2	2807700	12' c	able 2	28076	00	20' cal	ble 22	807500		HPF	Re	ject Filte		<u>Measurements</u> W=VBW=1MHz
3' ca	able 228	,07700	12' ca	ble 228	07600	•	20' cab	le 2280)7500 🝷			• R	001	Avera	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 Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
		2 MHz): Vert	ical												
324	3.0	39.1	25.5	34.6	6.2	-35.5	0.0	0.0	44.4	30.8	74	54	-29.6	-23.2	V, Noise Floor
w Chan	mel (241)	2 MHz): Hori	<u>zontal</u>												
324	3.0	39.5	25.4	34.6	6.2	-35.5	QO	0.0	44.8	30.7	74	54	-29.2	-23.3	H, Noise Floor
d Chan	nel (243'	7 MHz): Vert	ical												
74	3.0	39.5	25.6	34.7	6.2	-35.5	0.0	0.0	45.0	31.1	74	54	- 29.0	-22.9	V, Noise Floor
d Chan	nel (243'	7 MHz): Hori	<u>zontal</u>												
74	3.0	37.8	24.8	34.7	6.2	-35.5	0.0	0.0	43.2	30.2	74	54	-30.8	-23.8	H, Noise Floor
<u>yh Cha</u>	nnel (246	52 MHz): Ver	tical												
24	3.0	39.8	27.6	34.8	63	-35.5	۵٥	0.0	45.3	33.2	74	54	-28.7	-20.8	V, Noise Floor
gh Cha	nnel (246	i2 MHz): Hor	<u>izontal</u>												
24	3.0	40.2	27.0	34.8	63	-35.5	0.0	0.0	45.8	32.5	74	54	-28.2	-21 <i>5</i>	H, Noise Floor
o Sign	ificant]	Emissions I	Found Abov	e the N	oise F	loor									
v. 07.08	.11													<u>.</u>	
	f Dist	Measureme Distance to	ent Frequency Antenna	7				Corre	ct to 3 mete					Field Strength d Strength Li	
	Read AF CL	Analyzer R Antenna Fa Cable Loss	actor			Avg Peak HPF		d Peal	Strength @ c Field Stre ·					. Average Li . Peak Limit	mit

Page 125 of 162 COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4701D 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

9.2.3. TX ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



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 COMPLIANCE CERTIFICATION SERVICES (UL CCS)
 FORM NO: CCSUP4701D

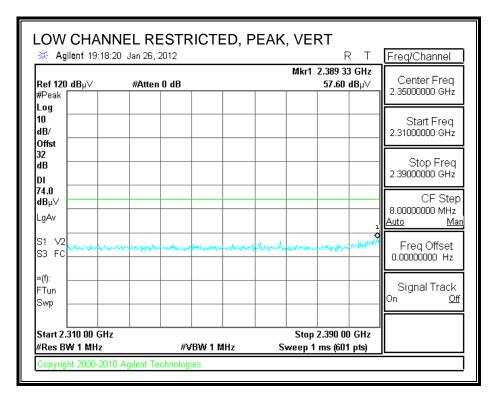
 47173 BENICIA STREET, FREMONT, CA 94538, USA
 TEL: (510) 771-1000
 FAX: (510) 661-0888

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🔆 Agilent 13:28	3:27 Aug 30, 2011			RT	Freq/Channel
Project: 11u14011 Ref 120 dB µ∨ #Peak □ □ □	#Atten 0 dB		390 00 GHz I4.76 dBµ∀	Center Freq 2.35000000 GHz	
Log					
10 dB/					Start Freq 2.31000000 GHz
Offst 33					Stop Frog
dB					Stop Freq 2.3900000 GHz
DI 54.0 dBµ∀					CF Step
LgAv					8.00000000 MHz <u>Auto Mar</u>
S1 V2 S3 FC					Freq Offset 0.00000000 Hz
×(f):					
FTun Swp					Signal Track On <u>Off</u>
Start 2.310 00 GH #Res BW 1 MHz		W 10 Hz	Stop 2.3 Sweep 6.238 s	390 00 GHz	<u></u>

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RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



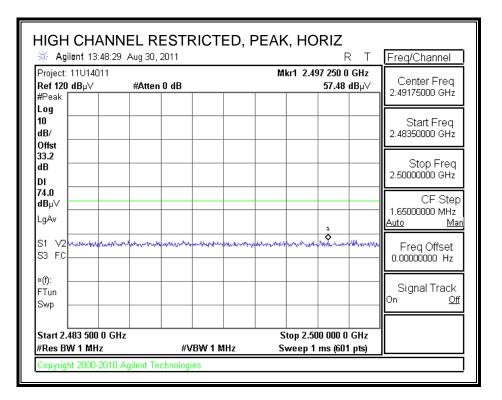
COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4701D 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL CCS.

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🔆 Agilent 19:19	9:01 Jan 26, 2012			RT	Freq/Channel
Ref 120 dB µ∨ #Peak	#Atten 0 dB			.390 00 GHz 45.62 dBµ∨	Center Freq 2.35000000 GHz
Log 10 dB/ Offst					Start Freq 2.31000000 GHz
dB					Stop Freq 2.39000000 GHz
54.0 dBµ∨ LgAv					CF Step 8.00000000 MHz
S1 V2					Auto Mar Freq Offset
×(f): FTun Swp					Signal Track On <u>Off</u>
Start 2.310 00 GH #Res BW 1 MHz	-	*VBW 10 Hz	Stop 2 Sweep 6.238	.390 00 GHz s (601 pts)	Ì

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RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



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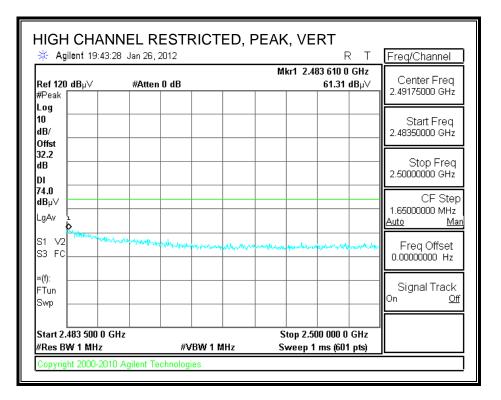
Page 130 of 162

Agilent 13:49:	00 Aug 30, 2011	R T	Freq/Channel					
Project: 11U14011 Ref 120 dBµ∨	#Atten 0 dB	Mkr1 2.483 527 5 GHz D dB 45.26 dBµ∨						
#Peak Log			2.49175000 GHz					
10 dB/			Start Freq 2.48350000 GHz					
Offst 33.2 dB			Stop Freq					
DI			2.50000000 GHz					
54.0 dBµ∨			CF Step					
LgAv			<u>Auto</u> <u>Mar</u>					
S1 V2 S3 FC			Freq Offset 0.00000000 Hz					
»(f):			Signal Track					
FTun Swp			On <u>Off</u>					
Start 2.483 500 0 (GHz	Stop 2.500 000 0 GHz	ļ					

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RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



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🔆 Agilent 19:43:5	JZ JAH 20, 2012			R T	Freq/Channel		
Ref 120 dBµ∨ #Peak	#Atten 0 dB		Mkr1 2.4	483 500 0 GHz 48.19 dBµ∀	Center Freq 2.49175000 GHz		
Log							
10 dB/					Start Freq 2.48350000 GHz		
Offst 32.2							
dB					Stop Freq		
DI					2.50000000 GHz		
54.0 dBµ∀					CF Step		
LgAv					1.65000000 MHz <u>Auto Mar</u>		
S1 V2							
S3 FC					Freq Offset		
×(f):		· · · · · ·			 		
FTun					Signal Track		
Swp					On <u>Off</u>		
Start 2.483 500 0 G	H7		Stop 2.5	500 000 0 GHz	Ĭ		
#Res BW 1 MHz		W 10 Hz	•	37 s (601 pts)			

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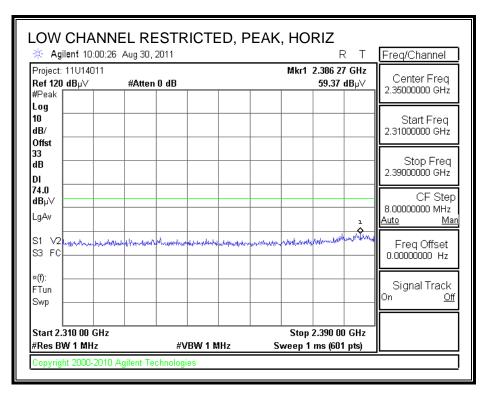
HARMONICS AND SPURIOUS EMISSIONS

Com		-		7 Measurem Services, Fr		5m Ch	amber-2	A								
Com Proj Date Test Cont	ipany: ect #: :: 08/3 : Engir figurat	Sierr 11UI 1/11 neer: ion: I	a Wireless 14011 Doug And	erson upport PC												
	Equip															
1030			 18GHz	Bro. et	nplifer	1.060		Bro. om	nlifor	26-40GH	-	L a	orn > 180	<u>чц</u> -		Limit
Π	'3; S/N				diteq 30			Fie-am	piner	20-4001		; ARA 18-260			-	FCC 15.205 -
ГНі	Frequer	ncy Cab	oles —								 					·
	3' cal	ble 2	2807700	12' c	able 2	28076	500	20' cal	ble 22	807500		HPF	Re	eject Filte		Measurements W=VBW=1MHz
Γ	3' cabl	le 228	07700	• 12' ca	ible 228	07600	•	20' cab	le 2280	7500 🗸	í 🗆		• R	_001	Avera	ge Measurements 1MHz ; VBW=10Hz
f				Read Avg.		CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim	Avg Lim	1	Avg Mar	Notes
GI	łz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)
Low ([hanne]	1(2412	2 MHz): Vert	tical												
4.824		3.0	40.7	27.0	34.6	6.2	-35.5	0.0	0.0	46.1	32.3	74	54	-27.9	-21.7	V, Noise Floor
Løw (Channe)	1 (2412	2 MHz): Heri	zontal												
4.824		3.0	40.4	27.0	34.6	6.2	-35.5	0.0	0.0	45.7	32.3	74	54	-28.3	-21.7	H, Noise Floor
Mid (hannel	1 (2437	' MHz): Vert	ical												
4.874		3.0	40.4	26.8	34.7	6.2	-35.5	0.0	0.0	45.9	32.3	74	54	-28.1	-21.7	V, Noise Floor
Mid (<u>[hanne]</u>	l (2437	' MHz): Heri	zontal												
4.874		3.0	40.2	26.6	34.7	6.2	-35.5	0.0	0.0	45.6	32.1	74	54	-28.4	-21.9	H, Noise Floor
High	Channe	el (246	2 MHz): Ver	rtical												
4.924		3.0	40.8	26.9	34.8	63	-35.5	0.0	0.0	46.4	32.5	74	54	-27.6	-21.5	V, Noise Floor
<u>High</u>	Channe	el (246	2 MHz): Hor	<u>izontal</u>												
4.924		3.0	40.1	26.9	34.8	63	-35.5	0.0	0.0	45.7	32.5	74	54	-28.3	-21.5	H, Noise Floor
No S	Signifi	cant]	Emissions	Found Abov	e the N	oise I	loor									
Rev. (07.08.11	J		L		I	i		I	l	I	L	1	J	il	
	R)ist lead	Measurem Distance to Analyzer R Antenna Fa	eading	у		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 Strengtl d Strength Li :. Average Li :. Peak Limit	mit mit
			Antenna Fa Cable Loss				Peak HPF	Calculate High Pas			agu		rk wiar	wargin vs	. reak Limit	

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9.2.4. TX ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



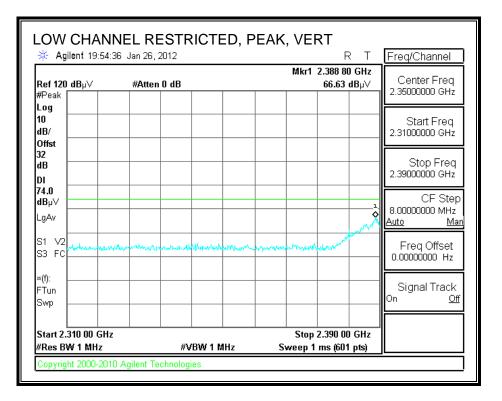
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	-				Freq/Channel
Project: 11U14011 Ref 120 dBµ∨	#Atten 0 dB		387 87 GHz 7.28 dBµ∨	Center Freq 2.3500000 GHz	
#Peak Log					2.00000000 0112
10 dB/					Start Freq 2.31000000 GHz
Offst 33 dB					Stop Freq
DI					2.39000000 GHz
LgAv					8.0000000 MHz <u>Auto Mar</u>
S1 V2				1	Freq Offset 0.00000000 Hz
»(f):					Signal Track
Swp					On <u>Off</u>
Start 2.310 00 GH;	•		Stop 2 3	190 00 GHz	

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RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



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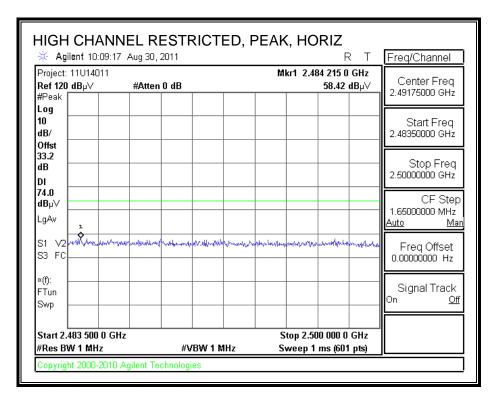
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🔆 Agilent 19:55	:16 Jan 26, 2012			RT	Freq/Channel
Ref 120 dB µ∨ #Peak	#Atten 0 dB		Mkr1 2.39 52.	0 00 GHz 58 dBµ∨	Center Freq 2.35000000 GHz
Log 10 dB/ Offst					Start Freq 2.31000000 GHz
dB					Stop Freq 2.39000000 GHz
54.0 dBµ∨ LgAv					CF Step 8.0000000 MHz Auto Mar
S1 V2					Auto Mar Freq Offset 0.00000000 Hz
×(f): FTun Swp					Signal Track On <u>Off</u>
Start 2.310 00 GH: #Res BW 1 MHz	-	/BW 10 Hz	Stop 2.390 Sweep 6.238 s (6		*

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RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



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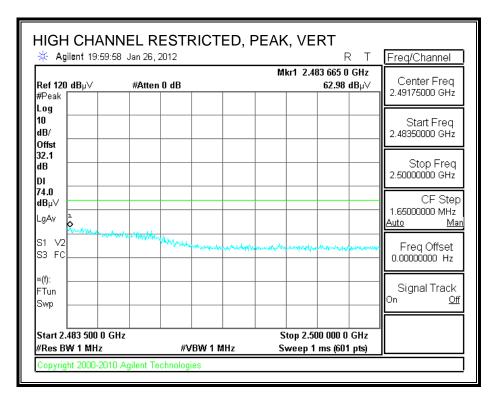
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🔆 Agilent 10:09	44 Aug 30, 2011			RT	Freq/Channel
Project: 11U14011 Ref 120 dB µ∀ #Peak	#Atten 0 dB		Mkr1 2.483 5	500 0 GHz 5.67 dBµ∀	Center Freq 2.49175000 GHz
Log 10 dB/					Start Freq 2.48350000 GHz
Offst 33.2 dB					Stop Freq
DI					2.50000000 GHz
LgAv					1.65000000 MHz <u>Auto Man</u>
S1 V2 S3 FC1					Freq Offset 0.00000000 Hz
»(f): FTun					Signal Track On <u>Off</u>
Swp	GHz		Stop 2.500 (100 0 GHz	
#Res BW 1 MHz		VBW 10 Hz	Sweep 1.287 s		

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RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



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🔆 Agilent 20:00:2	20 Jail 20, 2012		R T	Freq/Channel
Ref 120 dBµ∨ #Peak	#Atten 0 dB	Mkr1 2.4	83 500 0 GHz 50.65 dBµ∨	Center Freq 2.49175000 GHz
Log 10 dB/ Offst				Start Freq 2.48350000 GHz
dB				Stop Freq 2.50000000 GHz
54.0 dBμ∨ LgAv				CF Step 1.6500000 MHz
S1 V2				<u>Auto Mar</u> Freq Offset 0.0000000 Hz
»(f):				Signal Track
Swp				0n <u>Off</u>
Start 2.483 500 0 G #Res BW 1 MHz	Hz #VBW 1	•	00 000 0 GHz	<u>,</u>

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HARMONICS AND SPURIOUS EMISSIONS

Complia			7 Measurem Services, Fra		5m Ch	amber-2	A								
	ıy: Sierı #: 11U	a Wireless 14011													
ate: OS	3/31/11														
		Doug And FUT with S	erson Support PC												
		ous Tx HT													
est En	uipmen	t:													
		_			4.00	211-	D		00 40 00				NI		Limit
		18GHz	Pre-an	· · ·			Pre-am	pliter	26-40GH			orn > 180			FCC 15.205
	S/N: 671		- 1144 M	liteq 30	U8AUU	J31 <u>-</u>				_ 189;	ARA 18-260	5HZ; S/N:1U	49	-	FCC 13.203
	juency Cal														
3' (cable 2	2807700	12' c	able 2	28076	500	20' ca	ble 22	807500		HPF	Re	eject Filter		<u>Measurements</u> W=VBW=1MHz
3' c	able 228	07700	• 12' ca	ble 228	07600	-	20' cab	le 2280)7500 🗸			• R_	001 .		ge Measurements 1MHz ; VBW=10Hz
f	Dist	Deed Die	Read Avg.	AF	CL	Amp	D Corr	Fltr	Peak		Pk Lim	Arra Tim	Pk Mar		Notes
ı GHz	(m)	dBuV	dBuV	AF dB/m	dB	Amp dB	dB	dB		Avg dBuV/m	dBuV/m	Avg Lim dBuV/m	dB	dB	(V/H)
ow Char	mel (242	2 MHz): Vert	ical												
.844	3.0	41.2	27.1	34.7	6.2	-35.5	0.0	0.0	46.6	32.5	74	54	-27.4	-21.5	V, Noise Floor
				34.7	0.2	-355	0.0	0.0	40.0	343	/4		-27.4	-215	v, Nuise Fillor
		2 MHz): Høri													
.844	3.0	40.4	27.0	34.7	6.2	-35.5	0.0	0.0	45.8	32.4	74	54	-28.2	- 21.6	H, Noise Floor
/lid Chan	nel (243'	7 MHz): Vert	ical												
.874	3.0	40.0	26.6	34.7	6.2	-35.5	0.0	0.0	45.5	32.0	74	54	-28.5	-22.0	V, Noise Floor
	1	7 MHz): Heri													
.874	3.0	39.7	26.6	34.7	6.2	-35.5	0.0	0.0	45.2	32.0	74	54	-28.8	-22.0	H, Noise Floor
ligh Cha	nnel (24:	52 MHz): Ver	rtical												
.904	3.0	40.3	26.7	34.8	63	-35.5	0.0	0.0	45.8	32.3	74	54	-28.2	-21.7	V, Noise Floor
		52 MHz): Hor													
.904	3.0	40.3	26.7	34.8	63	-35.5	0.0	0.0	45.9	32.2	74	54	-28.1	-21.8	H, Noise Floor
							U.U	0.0	45.9	32.2	/4	54	-28.1	-21.8	H, Noise Floor
₹o Sign	ificant	Emissions	Found Abov	e the N	oise I	loor									
ev. 07.08	211				L		1	L							
	f		ent Frequency	7		Amp	Preamp (Average Fi		
		Distance to Analyzer R				D Corr Avg			ct to 3 mete Strength @				Peak Field Margin vs.	<u> </u>	
	AF	Antenna Fa				Peak			c Field Stre				Margin vs.		
	CL	Cable Loss	3			H₽F	High Pas	s Filter							

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9.3. RECEIVER ABOVE 1 GHz

9.3.1. RX ABOVE 1 GHz FOR 20 MHz BANDWIDTH IN THE 2.4 GHz BAND

	/31/11	14011													
		Doug Ande EUT with S													
			Support PC 3W Rx on We	orst Ca	se Chi	annel ar	ıd Mode								
st Equi	ipment	<u>t:</u>				_									
Но	rn 1-	18GHz	Pre-ar	nplifer	1-260	Hz	Pre-am	plifer	26-40GH	IZ	Ho	orn > 18G	Hz		Limit
173; S/				Aiteq 300				P							FCC 15.209
173; an	N: 07 17	/ (a ų am	- 1199 In	litteq ou	Jöauus	31								*	
Hi Freque	ency Cał	bles ——						_		n					
3' c;	able 2	2807700	12' c	able 22	28076	00	20' ca	ble 22	2807500		HPF	Re	ject Filte		<u>Measurements</u>
							- 221 h	2200					Jeest	RB\	W=VBW=1MHz
3. cai	ble 228	,07700	- 12' ca	ble 2280	J7600	-	20' cab	ie 2280	/7500	<u> _</u>		-			ge Measurements 1MHz ; VBW=10Hz
										<u> </u>					
f	Dist		Read Avg.	AF	CL	Amp	D Corr		Peak	Avg	Pk Lim			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)
rtical:			<u> </u>					1				-			
	1					ļ	<u> </u>	<u> </u>							
)00 150	3.0 3.0	56.3 54.4	52.1 49.0	27.9 25.7	39 33	-37.5 -38.2	0.0 0.0	0.0 0.0	50.5 45.2	46.4 39.8	74 74	54 54	-23.5 -28.8	-7.6 -14.2	v
96	3.0 3.0	54.4 62.6	49.0 50.2	25./ 24.8	3.3 3.0	-38.2 -38.5	0.0	0.0	45.2 51.7	39.8 39.3	74 74	54	-22.3	-14.7	v
67	3.0	50.1	44.3	26.6	35	-37.9	0.0	0.0	42.3	36.5	74	54	-31.7	-17.5	V
350)50	3.0 3.0	49.4 49.4	40.0 37.4	25.4 24.2	3.1 2.8	-38.3 -38.7	0.0 0.0	0.0 0.0	39.6 37.6	30.2 25.6	74 74	54 54	-34.4 -36.4	-23.8 -28.4	v
50	30	49.4	3/A	24.4	2.0	-38./	U.U	0.0	37.0	25.0	/4	24	-30 A	-28,4	
·1														-	
rizontal:	i														
	3.0	64.5	50 <i>.5</i>	27.7	3.8	-37.5	0.0	0.0	58.5	44.5	74	54	-15.5	-9.5	Н
·····ò-		54.4	48.0	25.7	33	-38.2	0.0	0.0	45.2	38.8	74	54	-28.8	-15.2	H
450	3.0	48.9	42.3 40.8	27.9 25.3	3.9 3.1	-37.5 -38.4	0.0 0.0	0.0 0.0	43.2 39.9	36.5 30.8	74 74	54 54	-30.8 -34.1	-17.5 -23.2	<u>н</u> н
960 450 000	3.0	40.0			بسعب			0.0		···	74	54 54	-34.1 -31.6	-23.2 -25.7	<u>н</u> Н
450		49.8 50.6	36.5	26.3	3.4	-38.0	0.0	. 0.0	42.4	28.3	/4				

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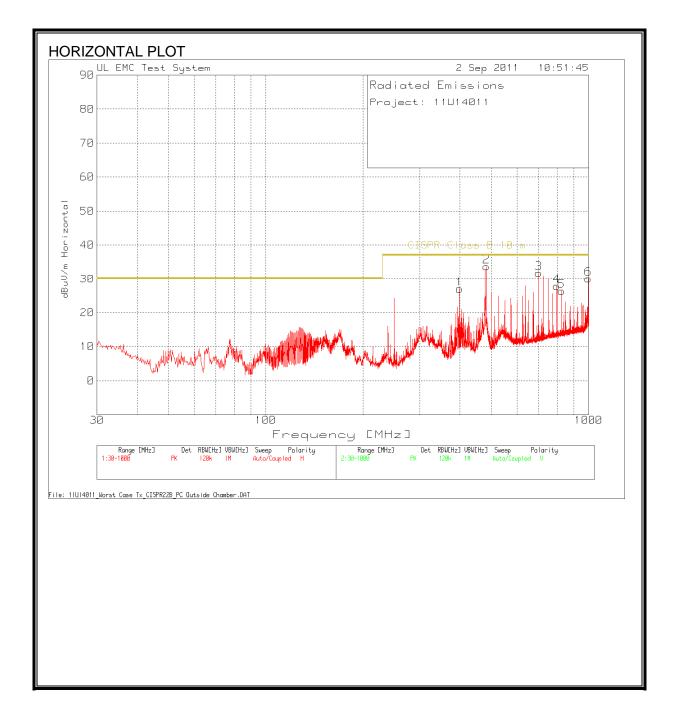
9.3.2. RX ABOVE 1 GHz FOR 40 MHz BANDWIDTH IN THE 2.4 GHz BAND

Project # Date: 08		14011													
		Doug And													
		EUT with S	upport PC W Rx on W	oret Co	co Ch		d Modo								
<u>'est Eq</u>			W ICX OIL W	0130 04	36 016	шега	lu mode								
H	orn 1	18GHz	Pre-ar	nplifer	1-260	GHz	Pre-am	plifer	26-40GH	z	Но	orn > 18G	iHz		Limit
T73; S	5/N: 671	7 @3m	- T144 h	Aiteq 30	08A009	31 🖵				-				-	FCC 15.209
	uency Ca		401 -		00076		20' cak	ale 22	807500		UDE			Peak	. Measurements
3.0	apre 2	22807700	12.0	able 2	28076	00	20 car	10 22			HPF	Re	ject Filte		W=VBW=1MHz
3' ca	able 22	807700	, 12' ca	ble 228	07600	•	20' cabl	e 2280)7500 🝷			•			ge Measurements 1MHz ; VBW=10Hz
f	Dist		Read Avg.	AF	CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim			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)
'ertical:															
.000	3.0	55.8	51.6	27.9	39	-37.5	0.0	0.0	50.1	45.9	74	54	-23.9	-8.1	v
.450	3.0	55.6	49.3	21.9	33	-37.5	0.0	0.0	45.7	45.5	74	54 54	-23.3	-139	v
.196	3.0	62.3	5 0.0	24.8	3.0	-38.5	0.0	0.0	51.5	39.2	74	54	-22.5	-14.8	v
.667	3.0	50.8	44.5	26.6	3.5	-37.9	0.0	0.0	43.0	36.7	74	54	-31.0	-17.3	V
.350 .050	3.0 3.0	49.1 50.6	39.8 38.1	25.4 24.2	3.1 2.8	-38.3 -38.7	0.0 0.0	0.0 0.0	39.3 38.8	30.0 26.3	74 74	54 54	-34.7 -35.2	-24.0 -27.7	v v
orizonta	1.														
960	3.0	63.4	49.3	27.7	3.8	-37.5	0.0	0.0	57.A	43.3	74	54	-16.6	-10.7	H
.450 .000	3.0 3.0	54.9 49.9	48.2	25.7 27.9	3.3 3.9	-38.2 -37.5	0.0 0.0	0.0 0.0	45.7 44.2	39.0 36.9	74 74	54 54	-28.3 -29.8	-15.0 -17.1	H H
333	3.0	49.9 50.3	40.9	25.3	3.9	-37.5	0.0	0.0	44.2	30.9	74	54 54	-29.8	-17.1	Н
.050	3.0	52.0	39.8	24.2	2.8	-38.7	0.0	0.0	40.2	28.0	74	54	-33.8	- 26.0	Н
.599	3.0	49.3	36.1	26.3	3.4	-38.0	0.0	0.0	41.1	27.9	74	54	- 32.9	-26.1	H
ev. 07.08	.11			A											
														2.110	
	f		ent Frequency	у		Amp	Preamp (-	-	Field Strength	
	Dist Dec 1	Distance to							ct to 3 mete					d Strength Li	
		Analyzer R				Avg	-		Strength @			-	-	Average Li	
AF Antenna Factor 1			ictor			Peak HPF	Calculated Peak Field Strength High Pass Filter					Pk Mar Margin vs. Peak Limit			

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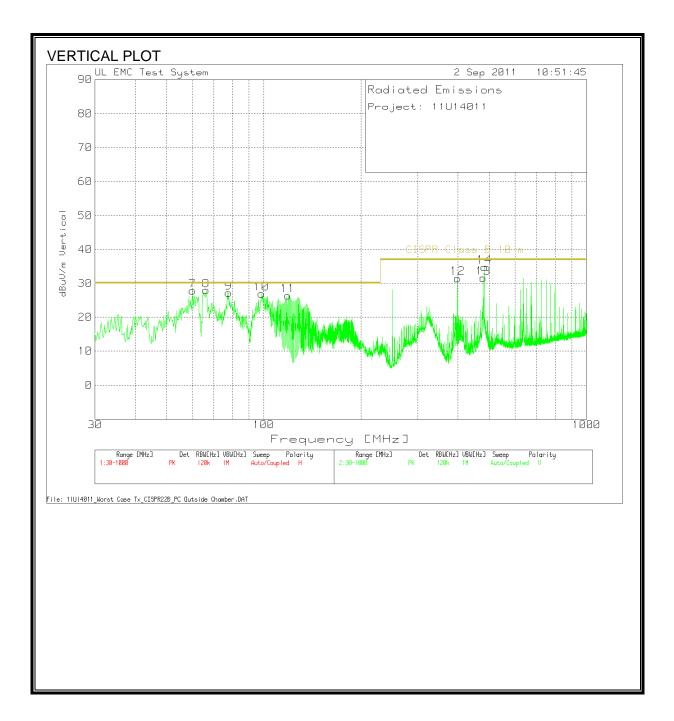
9.4. WORST-CASE BELOW 1 GHz

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



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



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HORIZONTAL AND VERTICAL DATA

Range 1 30 ·	1000MHz										
Test Freq. (MHz)	Meter Reading (dBuV)	Detector	Cable Loss [dB]	Pre-Amp Gain [dB]	Antenna Factor [dB]	10m to 3m Conversion [dB]	dBuV/m	CISPR22 Class B 10 m Limit	Margin	Height [cm]	Polarity
398.4992	48.21	PK	2.2	-27.8	14.9	-10.5	27.01	37	-9.99	200	Horz
482.6279	53.1	PK	2.4	-27.7	16.4	-10.5	33.7	37	-3.3	200	Horz
699.9281	46.72	PK	2.9	-27	19.6	-10.5	31.72	37	-5.28	100	Horz
797.2382	41.43	PK	3.2	-27.2	20.9	-10.5	27.83	37	-9.17	100	Horz
825.1519	39.73	PK	3.2	-27.3	21.2	-10.5	26.33	37	-10.67	100	Horz
996.7046	42.36	PK	3.5	-27.7	22.4	-10.5	30.06	37	-6.94	100	Horz
Range 2 30 ·	1000MHz										
Test Freq. (MHz)	Meter Reading (dBuV)	Detector	Cable Loss [dB]	Pre-Amp Gain [dB]	Antenna Factor [dB]	10m to 3m Conversion [dB]	dBuV/m	CISPR22 Class B 10 m Limit	Margin	Height [cm]	Polarit
60.2398	57.91	PK	0.8	-28.3	7.9	-10.5	27.81	30	-2.19	100	Vert
60.2398	55.15	QP	0.8	-28.3	7.9	-10.5	25.05	30	-4.95	100	Vert
66.249	57.69	PK	0.9	-28.2	8	-10.5	27.89	30	-2.11	100	Vert
66.249	55.22	QP	0.9	-28.2	8	-10.5	25.42	30	-4.58	100	Vert
77.8797	57.43	PK	0.9	-28.2	7.5	-10.5	27.13	30	-2.87	100	Vert
77.8797	54.38	QP	0.9	-28.2	7.5	-10.5	24.08	30	-5.92	100	Vert
98.4273	54.85	PK	1.1	-28.2	9.6	-10.5	26.85	30	-3.15	100	Vert
118.781	50.44	PK	1.2	-28.2	13.4	-10.5	26.34	30	-3.66	100	Vert
398.4992	52.75	PK	2.2	-27.8	14.9	-10.5	31.55	37	-5.45	200	Vert
478.5572	51.13	PK	2.4	-27.7	16.3	-10.5	31.63	37	-5.37	100	Vert
482.6279	54.27	PK	2.4	-27.7	16.4	-10.5	34.87	37	-2.13	100	Vert
482.6279	47.47	QP	2.4	-27.7	16.4	-10.5	28.07	37	-8.93	100	Vert
PK - Peak de											
QP - Quasi-P											
_nAv - Linear	•										
LgAv - Log Average detector											
Av - Average											
CAV - CISPI	0	letector									
RMS - RMS											
CRMS - CISE	R RMS de	tection									

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10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted I	Limit (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

ANSI C63.4

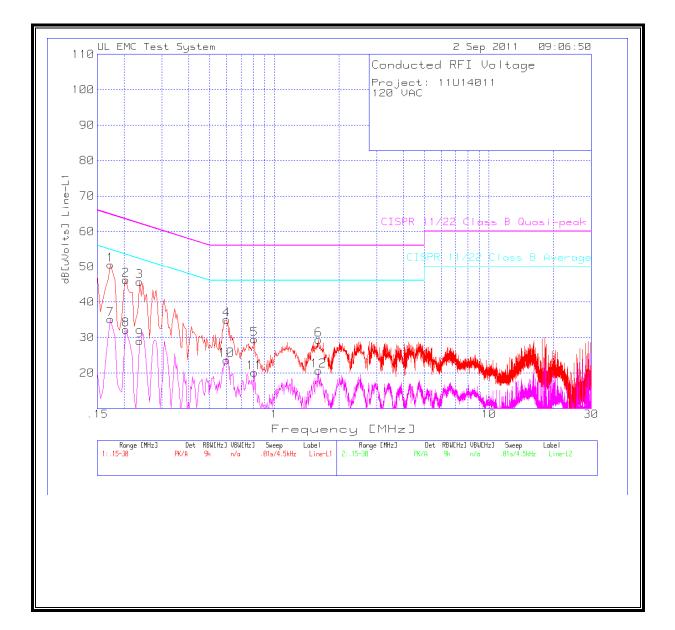
RESULTS

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<u>6 WORST EMISSIONS</u>

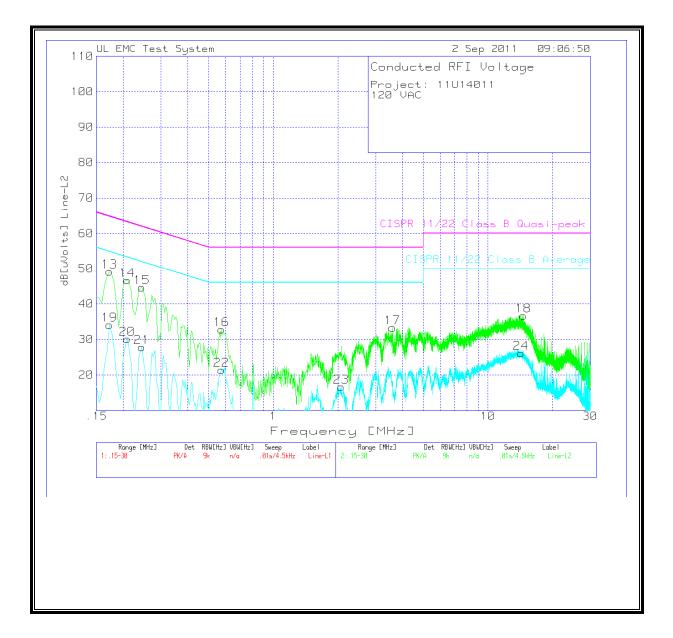
Project: 11	U14011								
120 VAC									
Line-L1 .15	- 30MHz								
Test Frequency	Meter Reading	Detector	LISN [dB]	Conducte d Emission Cable [dB]	dB[uVolts]	CISPR 11/22 Class B Quasi- peak	Margin	CISPR 11/22 Class B Average	Margin
0.1725	50.48	PK	0	0	50.48	64.8	-14.32	54.8	-4.32
0.204	46.18	PK	0	0	46.18	63.4	-17.22	53.4	-7.22
0.2355	45.72	PK	0	0	45.72	62.3	-16.58	52.3	-6.58
0.6	34.97	PK	0	0	34.97	56	-21.03	46	-11.03
0.807	29.47	PK	0	0	29.47	56	-26.53	46	-16.53
1.608	29.36	PK	0	0	29.36	56	-26.64	46	-16.64
0.1725	35.08	Av	0	0	35.08	64.8	-29.72	54.8	-19.72
0.204	32.13	Av	0	0	32.13	63.4	-31.27	53.4	-21.27
0.2355	29.02	Av	0	0	29.02	62.3	-33.28	52.3	-23.28
0.6	23.62	Av	0	0	23.62	56	-32.38	46	-22.38
0.807	20.04	Av	0	0	20.04	56	-35.96	46	-25.96
1.608	20.6	Av	0	0	20.6	56	-35.4	46	-25.4
Line-L2 .15	- 30MHz								
0.1725	49.08	PK	0	0.1	49.18	64.8	-15.62	54.8	-5.62
0.2085	46.58	PK	0	0.1	46.68	63.3	-16.62	53.3	-6.62
0.2445	44.5	PK	0	0.1	44.6	61.9	-17.3	51.9	-7.3
0.573	32.69	PK	0	0.1	32.79	56	-23.21	46	-13.21
3.5925	33.24	PK	0	0.1	33.34	56	-22.66	46	-12.66
14.604	36.39	PK	0	0.3	36.69	60	-23.31	50	-13.31
0.1725	34.02	Av	0	0.1	34.12	64.8	-30.68	54.8	-20.68
0.2085	29.99	Av	0	0.1	30.09	63.3	-33.21	53.3	-23.21
0.2445	27.66	Av	0	0.1	27.76	61.9	-34.14	51.9	-24.14
0.573	21.27	Av	0	0.1	21.37	56	-34.63	46	-24.63
2.076	16.57	Av	0	0.1	16.67	56	-39.33	46	-29.33
14.2755	25.83	Av	0	0.3	26.13	60	-33.87	50	-23.87
PK - Peak c	letector								
QP - Quasi-		tor							
LnAv - Linea	r Average o	detector							
LgAv - Log A									
Av - Averag	-								
CAV - CISF	R Average	detector							
RMS - RMS	detection								

LINE 1 RESULTS



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LINE 2 RESULTS



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11. 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	its for Occupational	/Controlled Exposu	res	
0.3-3.0 3.0-30 30-300 300-1500 1500-100,000	614 1842/f 61.4	1.63 4.89/f 0.163	*(100) *(900/f²) 1.0 f/300 5	6 6 6 8
(B) Limits	for General Populati	on/Uncontrolled Exp	posure	
0.3–1.34 1.34–30	614 824 <i>/</i> f	1.63 2.19/f	*(100) *(180/f ²)	30 30

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

f = frequency in MHz

* = Plane-wave equivalent power density NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occu-tions where a transient through a location where occu-

pational/controlled limits apply provided he or she is made aware of the potential for exposure. NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be ex-posed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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/f		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> ^{0.5}	0.0042f ^{0.5}	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 ^{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.

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

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2 EIRP = Equivalent Isotropic Radiated Power in W D = Separation distance in m

Power density in units of W/m² is converted to units of mWc/m² by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m EIRP = Equivalent Isotropic Radiated Power in W S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter xGx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

<u>LIMITS</u>

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

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

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RESULTS

Band	Mode	Separation	Output	Antenna	IC Power	FCC Power
		Distance	AV Power	Gain	Density	Density
		(m)	(dBm)	(dBi)	(W/m^2)	(mW/cm^2)
2.4 GHz	WLAN	0.20	15.50	2.00	0.11	0.011

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