FCC CFR47 PART 15 SUBPART E
INDUSTRY CANADA RSS-210 ISSUE 7
CERTIFICATION TEST REPORT

FOR

2X3 ACCESS POINT W/ 802.11a/b/g/n CARD

MODEL NUMBER: A1254

FCC ID: BCGA1254

IC: 579C-A1254

REPORT NUMBER: 07U11257-10

ISSUE DATE: NOVEMBER 2, 2007

Prepared for
APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, USA

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

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	11/2/07	Initial Issue	Hsin Fu Shih

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, USA

EUT DESCRIPTION: 2X3 ACCESS POINT w/ 802.11a/b/g/n CARD

MODEL: A1254

SERIAL NUMBER: 6F73002JYZV

DATE TESTED: September 11 - October 16, 2007

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C and Subpart E	No Non-Compliance Noted
RSS-210 Issue 7 Annex 8 and 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:

HSIN FU SHIH
ENGINEERING SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

WILLIAM ZHUANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

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 2X3 Access point w/ 802.11a/b/g/n Card.

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)
5150 to 5250	802.11a	13.19	20.84
5150 to 5250	802.11n HT20	14.72	29.65
5150 to 5250	802.11n HT40	15.62	36.48

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA Antenna, with a maximum gain of 3.99 dBi @ 2.4 GHz band; 3.27 dBi @ 5.15-5.25 GHz band; and 2.16 dBi @ 5.8 GHz band.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 7.3d1 Auto20070907T0400.

The EUT driver software installed during testing was DutApiClient_UDP.exe, ver.031607.

The test utility software used during testing was m4tool.exe, rev 083107

5.5. WORST-CASE CONFIGURATION AND MODE

The 2x3 configuration was used for all testing in this report.

The worst- case data rates are determined to be as follows for each mode based on investigation by measuring the average power, peak power and PPSD across all data rates, bandwidths, and modulations.

The worst-case data rates for the 5 GHz bands are: 9 Mbps for 802.11a 20MHz and 802.11a 40MHz; MCS0 for 802.11n HT20 and 802.11n HT40. These are based on baseline testing with this chipset.

All emissions tests were made with the worst-case data rates.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Apple	MacBook Pro	AOU257941	DoC
AC Adapter	Apple	A52	611-0394	DoC
Mouse	Apple	A1152	KY5350QD7U3MA	DoC

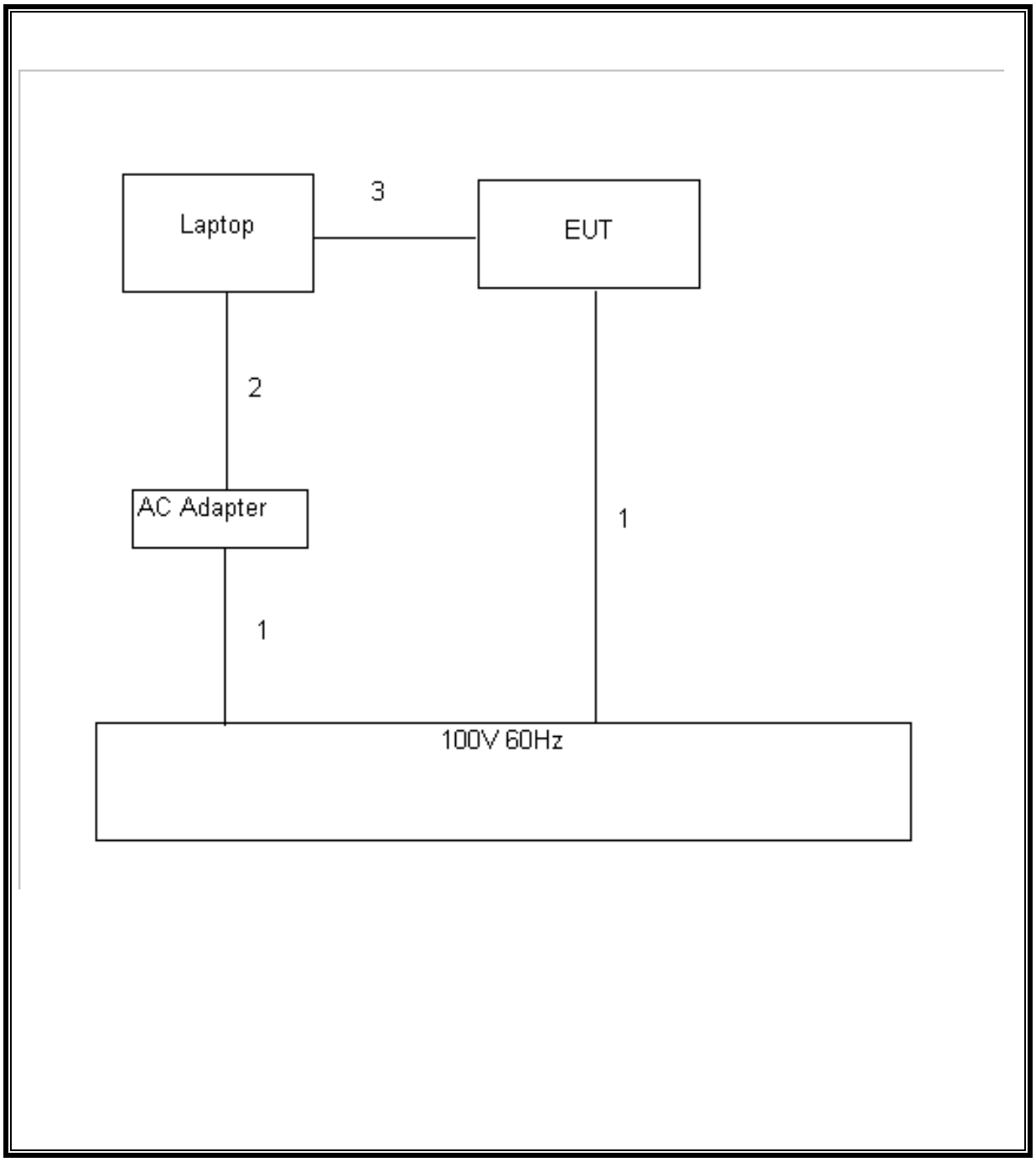
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identica Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	2	US 115V	Un-shielded	2m	N/A
2	DC	1	DC	Un-shielded	2m	N/A
3	Ethernet	1	RJ45	Un-shielded	3m	N/A

TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
Peak Power Meter	Agilent / HP	E4416A	GB41291160	12/02/08
Peak / Average Power Sensor	Agilent	E9327A	US40440755	12/02/08
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	08/07/08
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	04/15/08
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00931	08/03/08
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	10/15/08
EMI Test Receiver	R & S	ESHS 20	827129/006	01/27/08
SA Display Section 2	Agilent / HP	85662A	2816A16696	04/07/08
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	01/07/08
Quasi-Peak Adaptor	Agilent / HP	85650A	3145A01654	01/21/08
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	09/28/08
Preamp 30-1000MHz	Sonoma	310N	185623	01/20/08

7. ANTENNA PORT TEST RESULTS

7.1. 802.11a MODE IN THE 5.2 GHz BAND

7.1.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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

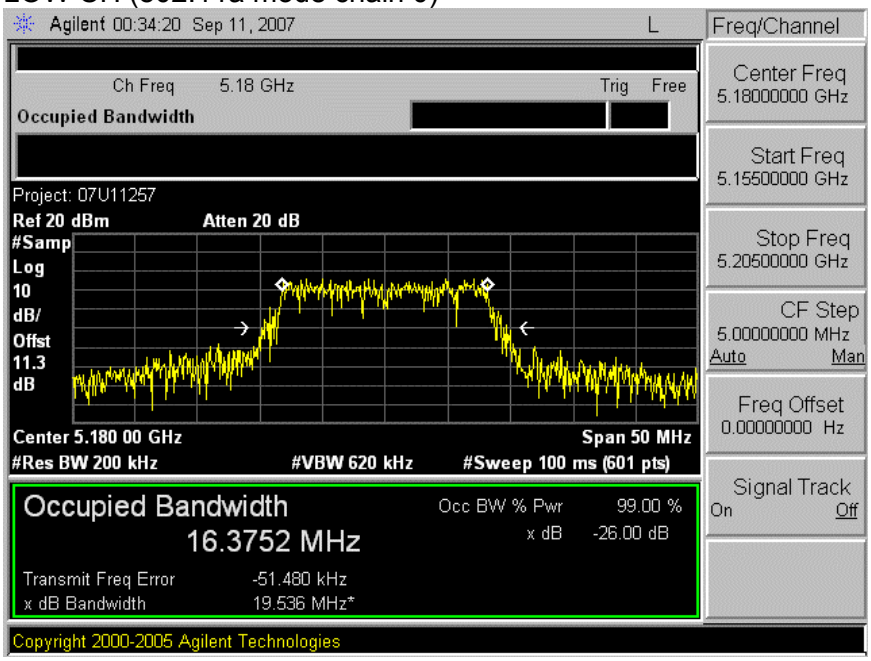
RESULTS

Mode Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 2 (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 2 (MHz)
802.11a Mode					
Low	5180	16.375	16.431	19.536	19.079
Middle	5220	16.439	16.459	19.231	19.388
High	5240	16.404	16.445	19.051	19.659
802.11n HT20 Mode					
Low	5180	17.642	17.76	20.063	19.393
Middle	5220	17.778	17.712	20.24	19.844
High	5240	17.765	17.716	19.832	20.208
802.11n HT40 Mode					
Low	5190	36.172	35.944	39.18	37.596
High	5230	36.047	36.127	39.733	39.693

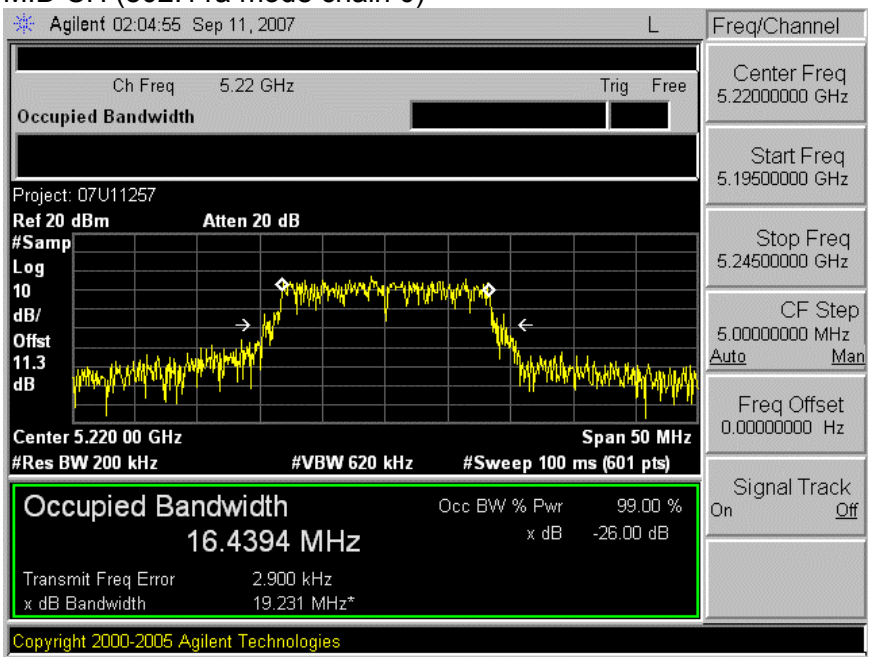
26 dB and 99% BANDWIDTH

(802.11a MODE CHAIN 0)

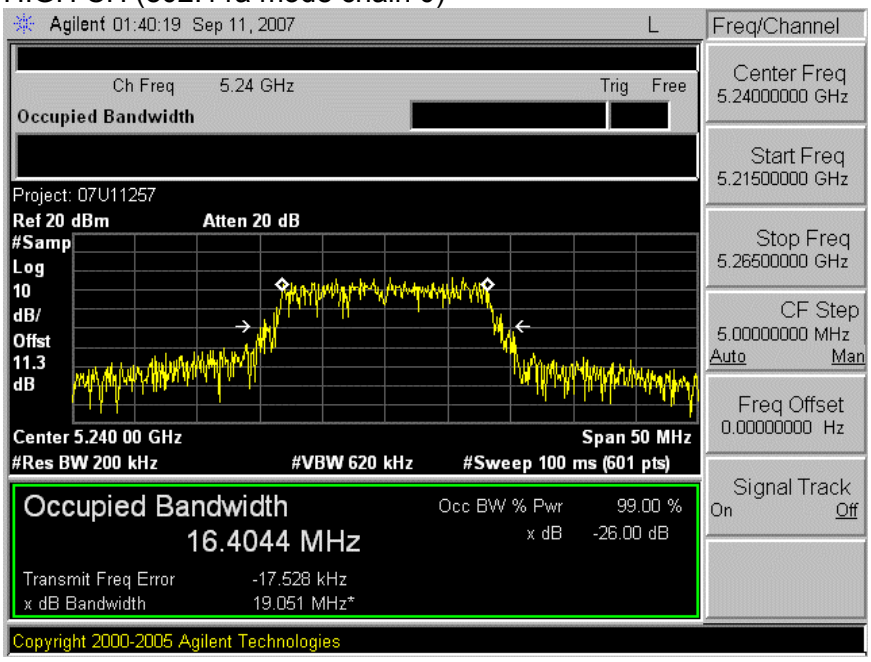
LOW CH (802.11a mode chain 0)



MID CH (802.11a mode chain 0)

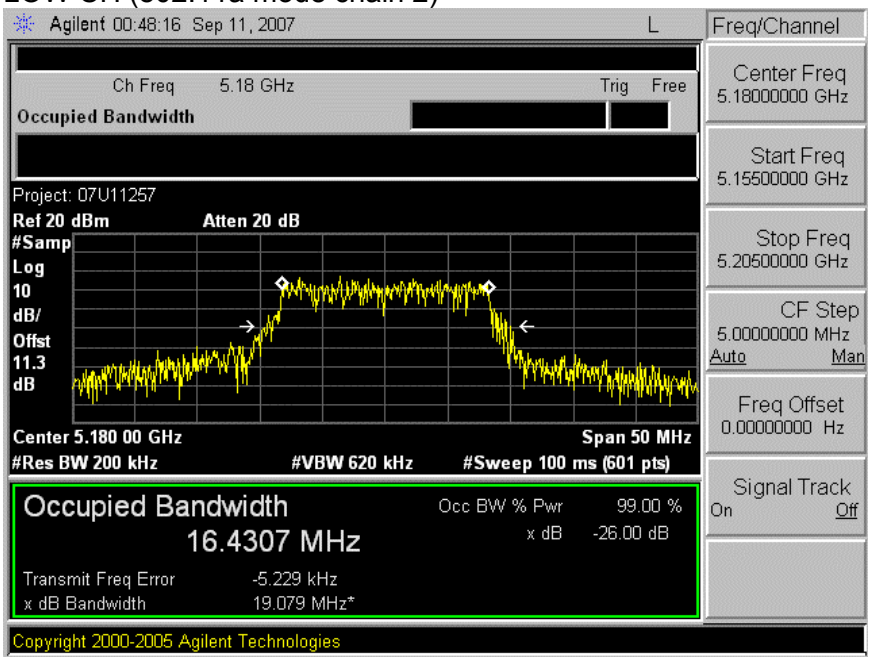


HIGH CH (802.11a mode chain 0)



(802.11a MODE CHAIN 2)

LOW CH (802.11a mode chain 2)



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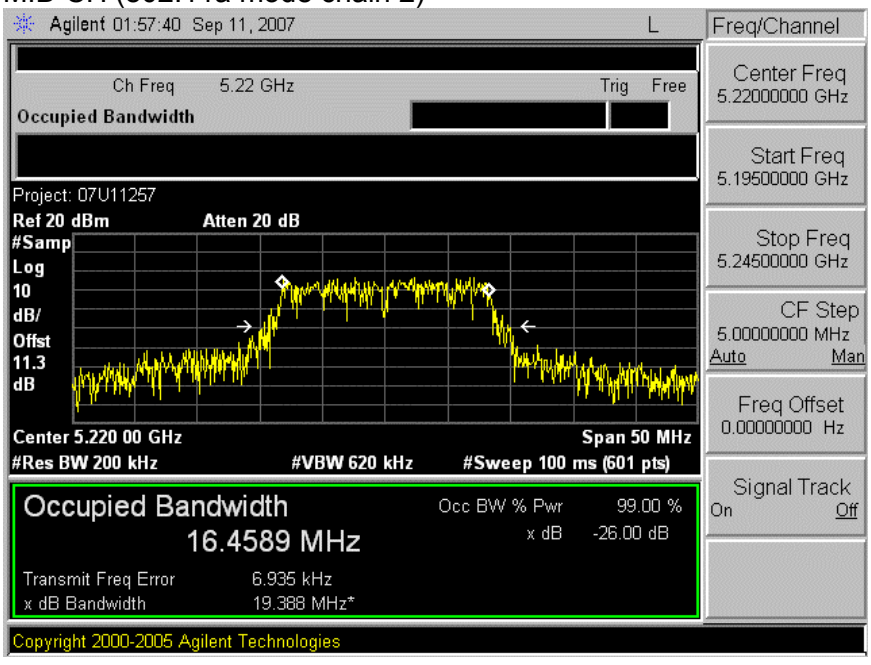
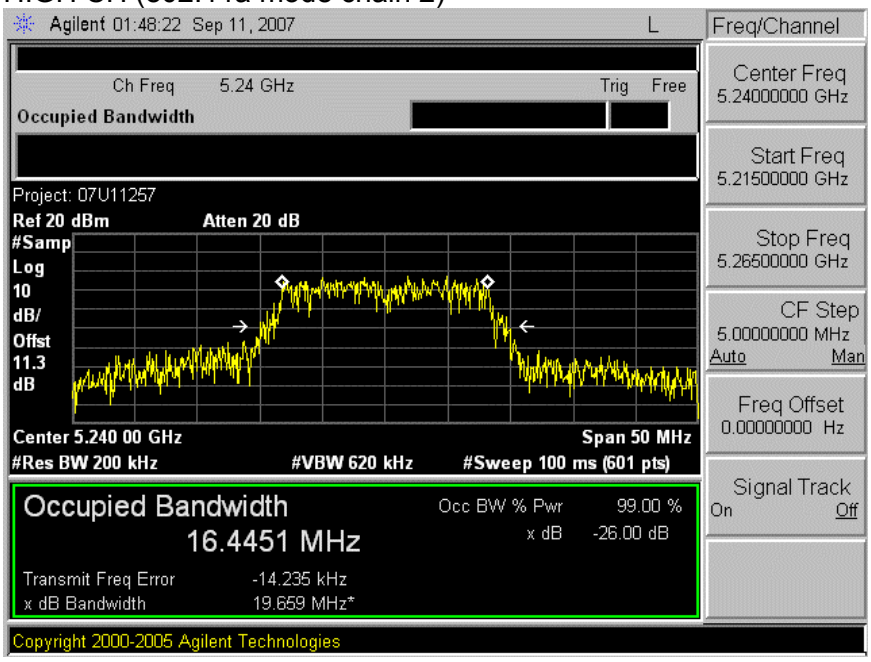
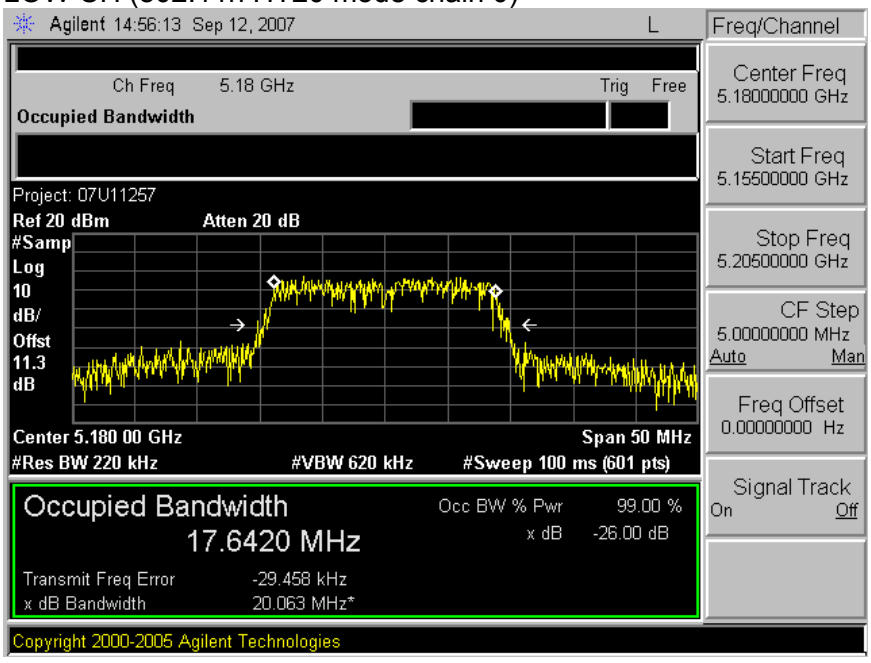


HIGH CH (802.11a mode chain 2)



(802.11n HT20 MODE CHAIN 0)

LOW CH (802.11n HT20 mode chain 0)



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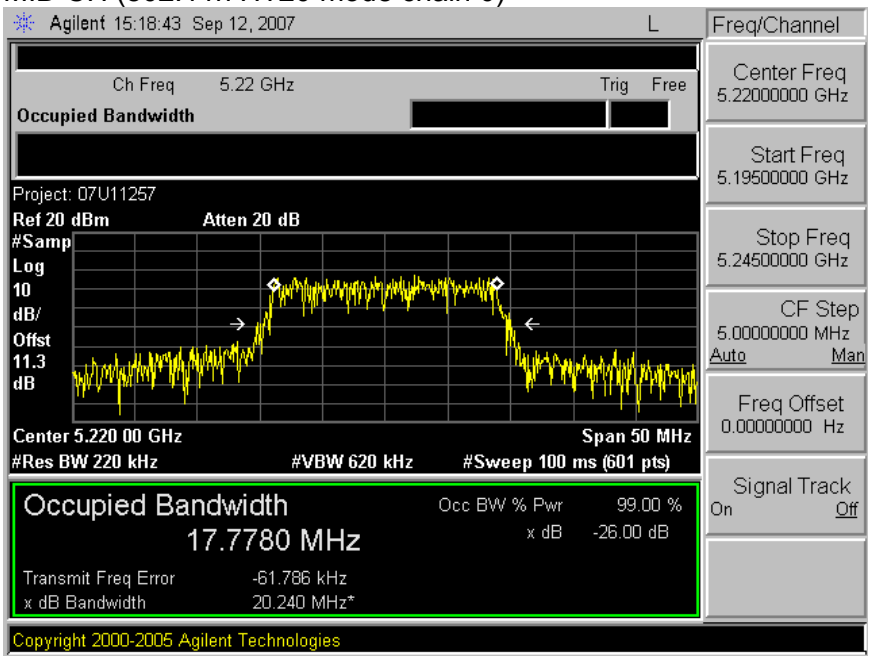
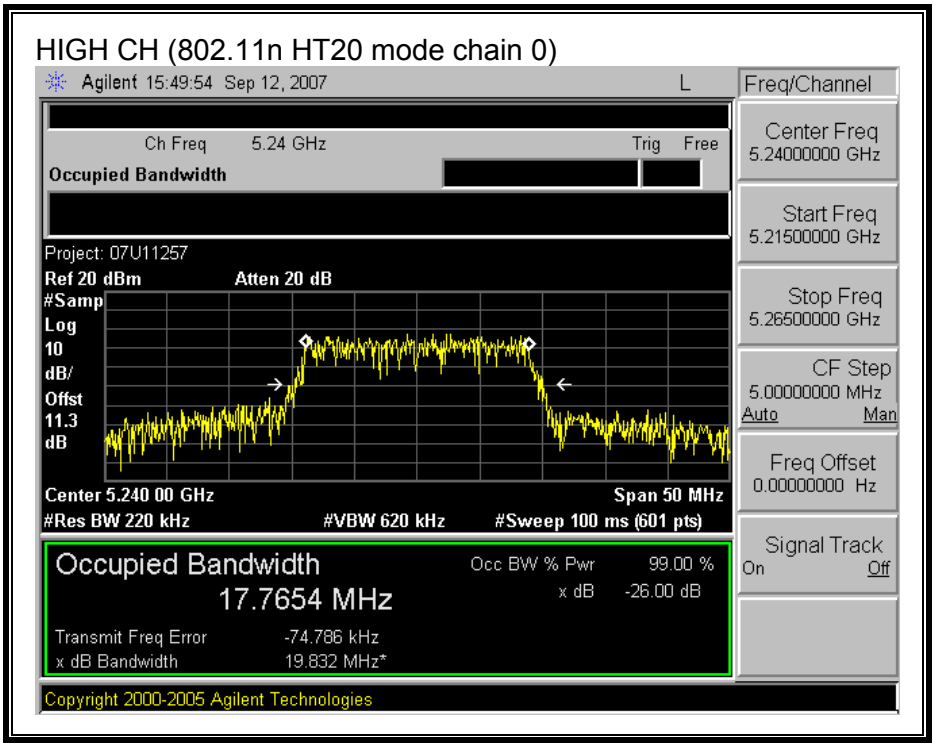
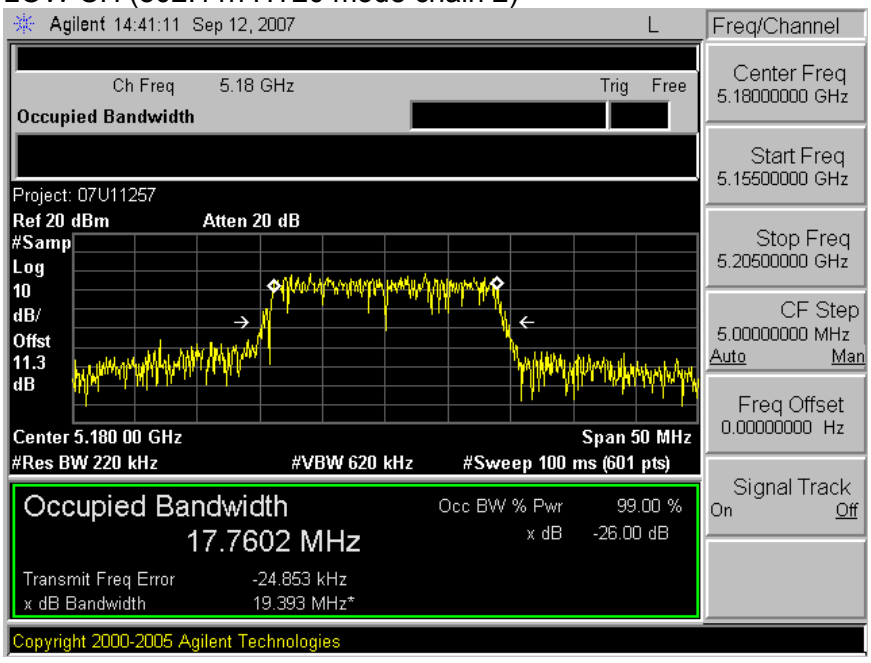


HIGH CH (802.11n HT20 mode chain 0)

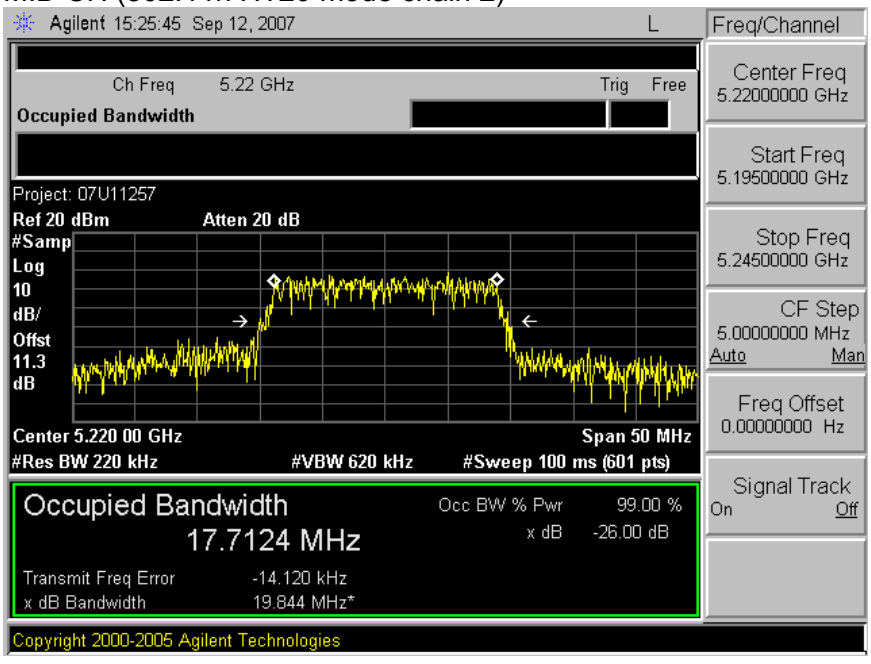


(802.11 HT20 MODE CHAIN 2)

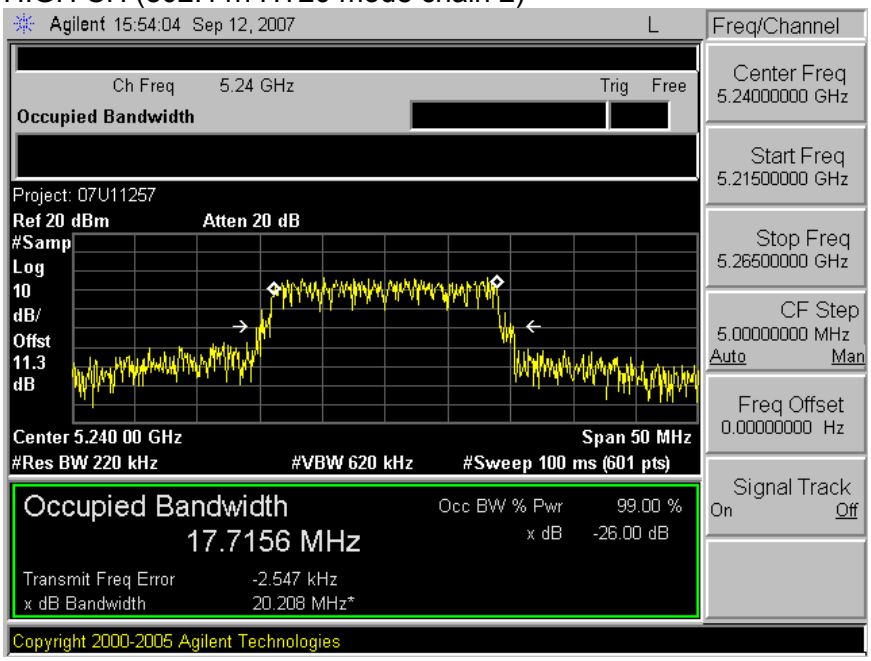
LOW CH (802.11n HT20 mode chain 2)



MID CH (802.11n HT20 mode chain 2)

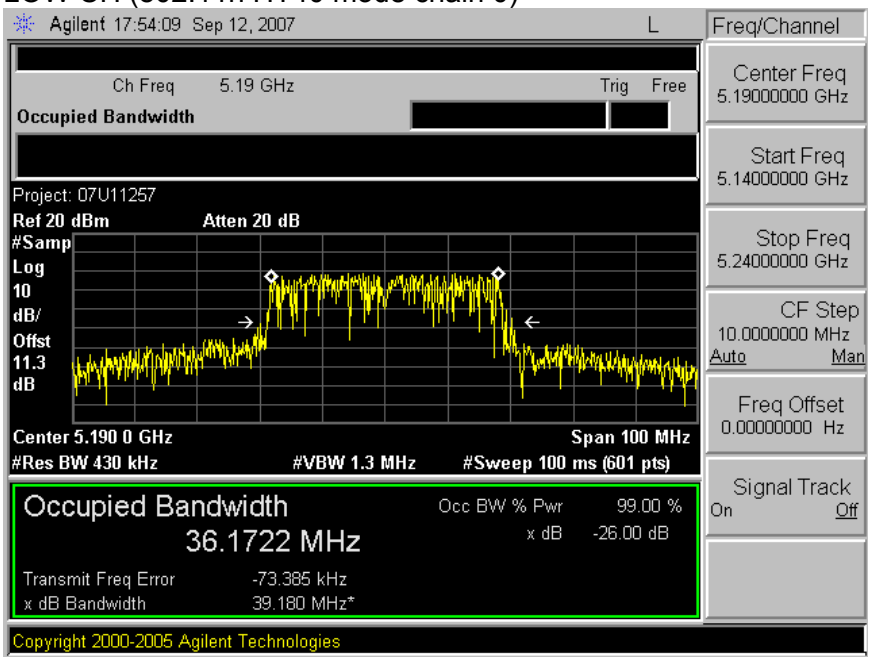


HIGH CH (802.11n HT20 mode chain 2)

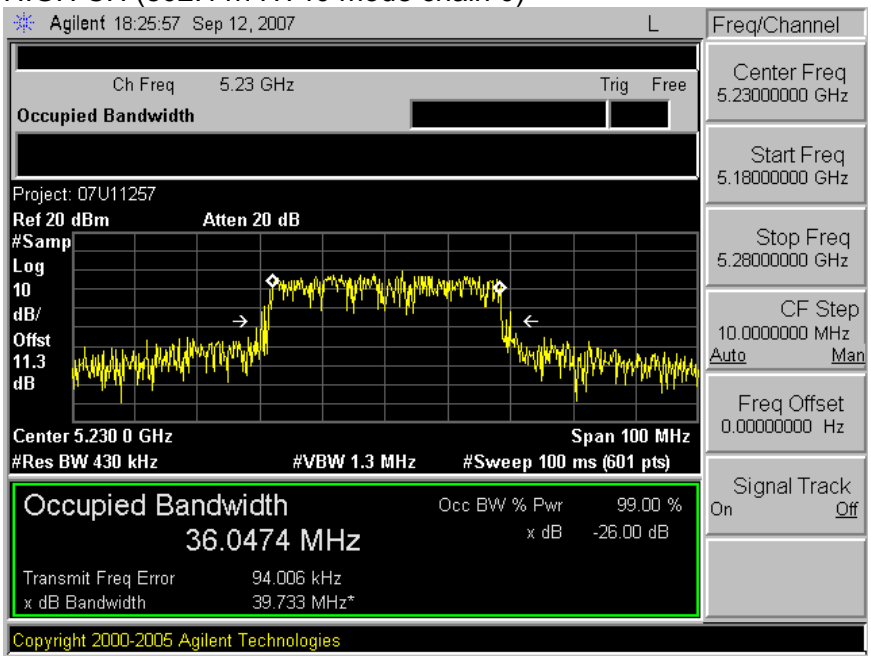


(802.11 HT40 MODE CHAIN 0)

LOW CH (802.11n HT40 mode chain 0)

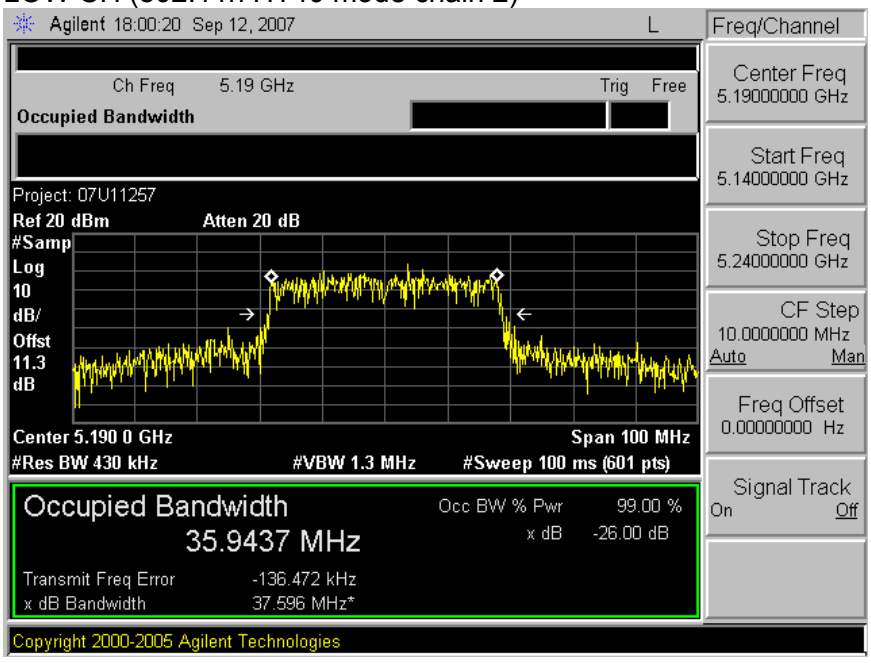


HIGH CH (802.11n HT40 mode chain 0)

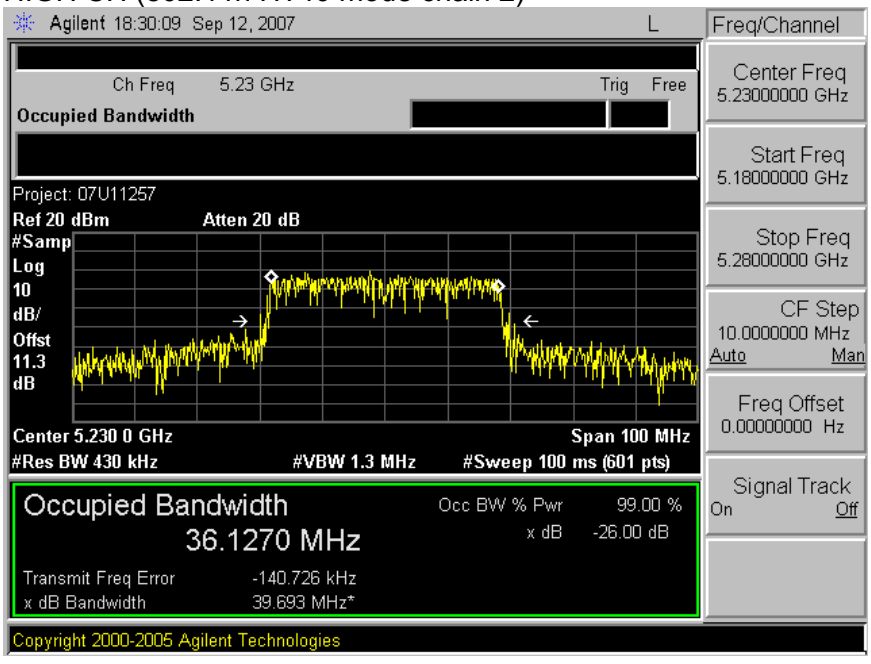


(802.11 HT40 MODE CHAIN 2)

LOW CH (802.11n HT40 mode chain 2)



HIGH CH (802.11n HT40 mode chain 2)



7.1.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

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

The transmitter output operates continuously therefore Method # 1 is used.

Each chain is measured separately and the total power is calculated using:

Total Power = 10 log (10^ (Chain 0 Power / 10) + 10^ (Chain 2 Power / 10))

RESULTS

5150 to 5250 MHz Band

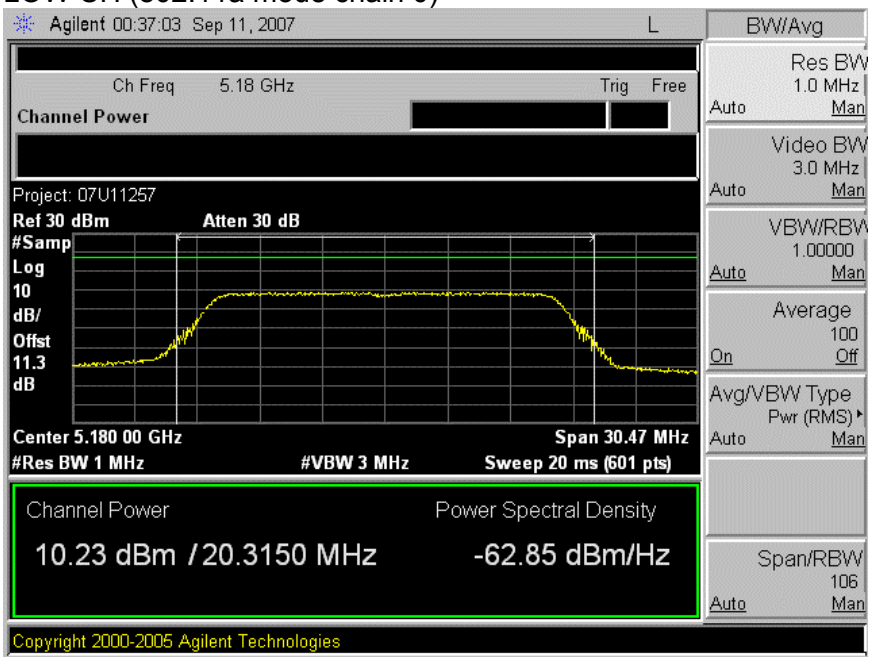
Fixed Limit (dBm)	17
Antenna Gain (dBi) # 0	1.93
Antenna Gain (dBi) # 2	3.27
Effective Legacy Gain	5.66

Mode Chan.	Freq (MHz)	10LogB (dBm)	4+10LogB Limit (dBm)	Limit (dBm)	Chain 0 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Margin (dB)
802.11a Mode								
Low	5180	13.07	17.07	17.00	10.23	10.12	13.19	-3.81
Mid	5220	13.06	17.06	17.00	9.39	9.70	12.56	-4.44
High	5240	13.07	17.07	17.00	9.34	10.43	12.93	-4.07
802.11n HT20 Mode								
Low	5180	13.1	17.10	17.00	11.13	12.22	14.72	-2.28
Mid	5220	13.09	17.09	17.00	9.79	10.83	13.35	-3.65
High	5240	13.09	17.09	17.00	10.13	10.46	13.31	-3.69
802.11n HT40 Mode								
Low	5190	15.58	19.58	17.00	12.38	12.77	15.59	-1.41
High	5230	15.57	19.57	17.00	12.12	13.05	15.62	-1.38

Low channel plots for a mode and HT20 mode, and high channel plots for HT40 mode, are included hereafter.

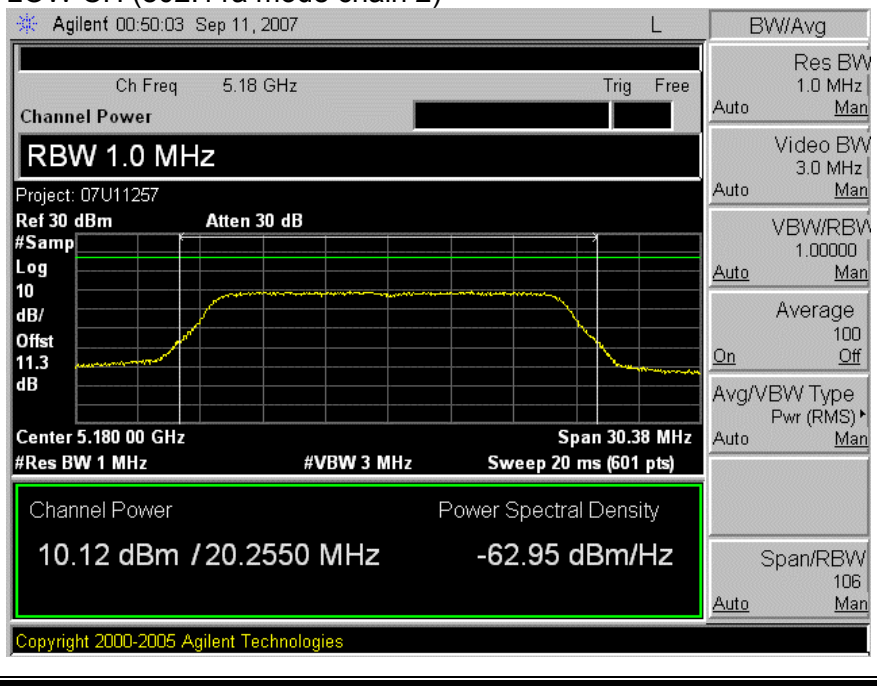
(802.11a MODE CHAIN 0)

LOW CH (802.11a mode chain 0)



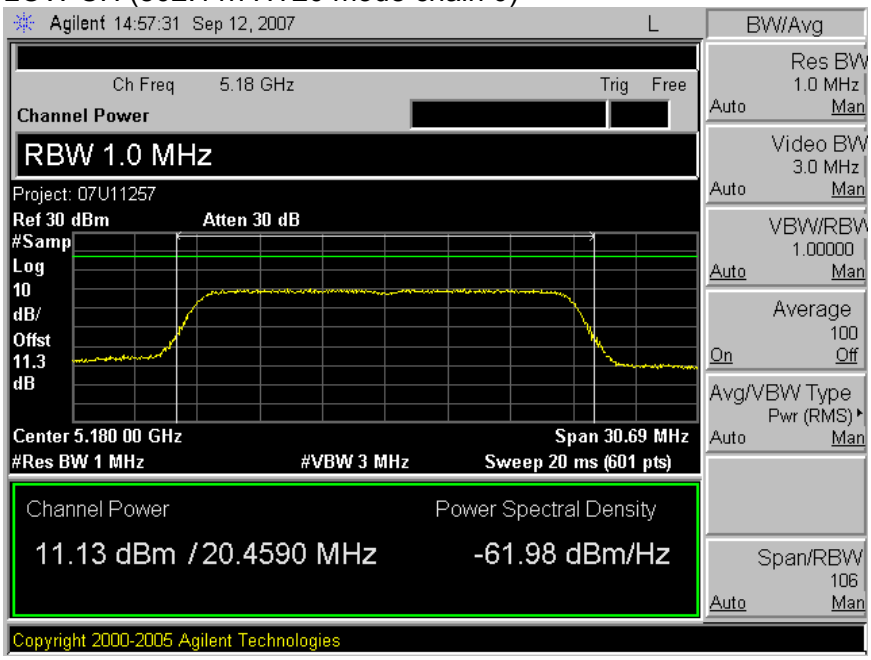
(802.11a MODE CHAIN 2)

LOW CH (802.11a mode chain 2)



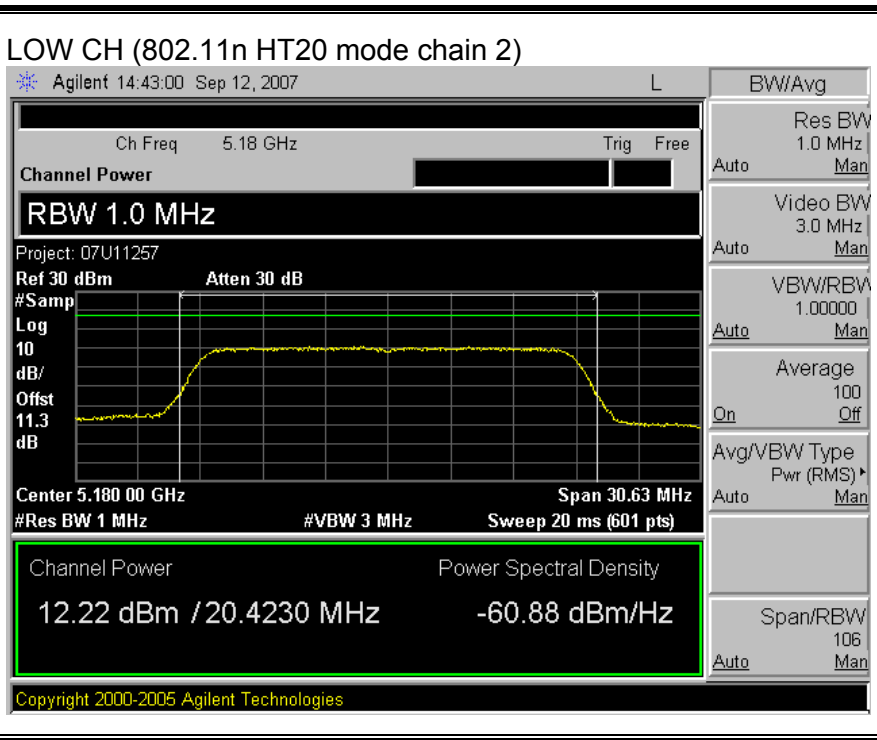
(802.11n HT20 MODE CHAIN 0)

LOW CH (802.11n HT20 mode chain 0)



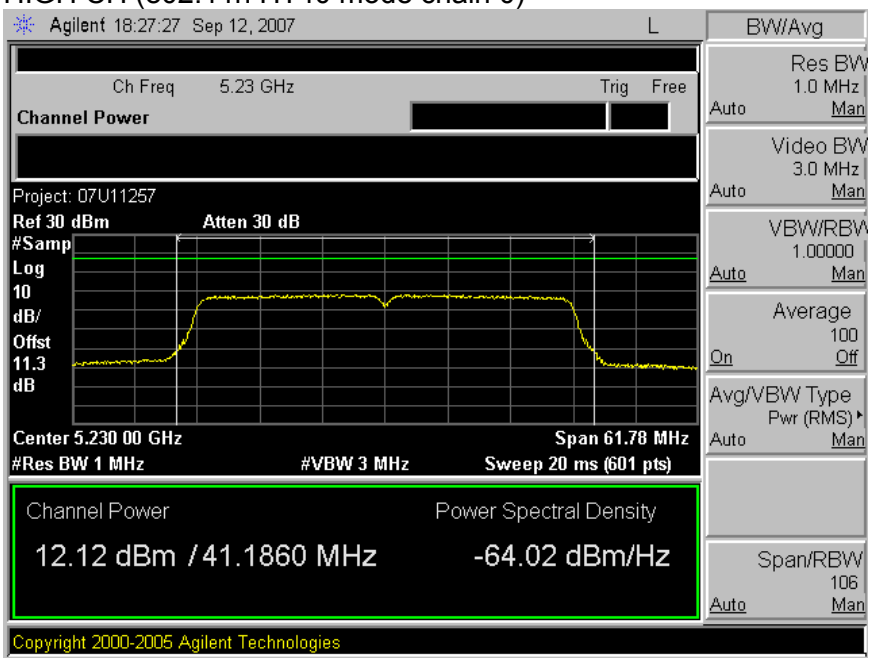
(802.11 HT20 MODE CHAIN 2)

LOW CH (802.11n HT20 mode chain 2)



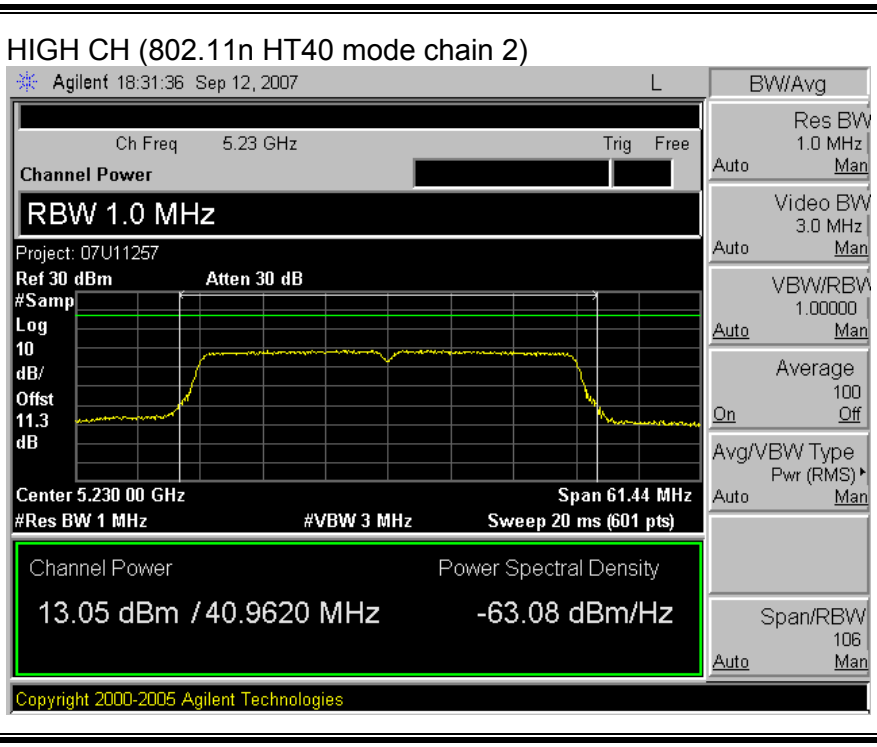
(802.11 HT40 MODE CHAIN 0)

HIGH CH (802.11n HT40 mode chain 0)



(802.11 HT40 MODE CHAIN 2)

HIGH CH (802.11n HT40 mode chain 2)



7.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

Each chain is measured separately and the total power is calculated using:

Total Power = 10 log (10^ (Chain 0 Power / 10) + 10^ (Chain 2 Power / 10))

RESULTS

The cable assembly insertion loss of 11.3 dB (including 10 dB pad and 1.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Mode Channel	Frequency (MHz)	Average Power Chain 0 (dBm)	Average Power Chain 2 (dBm)	Average Power Total (dBm)
802.11a Mode				
Low	5180	10.3	10.3	13.3
Middle	5220	10.2	10.3	13.3
High	5240	10.1	10.3	13.2
802.11n HT20 Mode				
Low	5180	11.7	12.0	14.8
Middle	5220	11.0	11.4	14.2
High	5240	10.9	10.8	13.9
802.11n HT40 Mode				
Low	5190	13.1	13.2	16.1
High	5230	12.9	13.2	16.1

7.1.4. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 4 dBm.

TEST PROCEDURE

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

RESULTS

POWER SPECTRAL DENSITY WITH COMBINER

5150 to 5250MHz Band

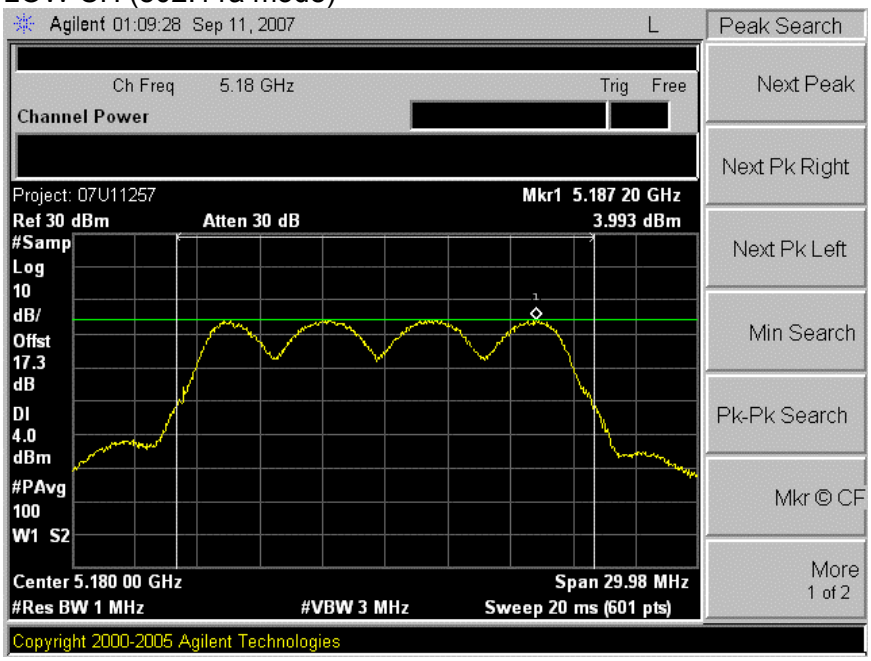
Antenna Gain (dBi) # 0	1.93
Antenna Gain (dBi) # 2	3.27
Effective Legacy Gain	5.66

Mode Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
802.11a Mode				
Low	5180	3.99	4.00	-0.01
Middle	5220	3.88	4.00	-0.12
High	5240	3.69	4.00	-0.31
802.11n HT20 Mode				
Low	5180	3.96	4.00	-0.04
Middle	5220	3.90	4.00	-0.10
High	5240	3.86	4.00	-0.14
802.11n HT40 Mode				
Low	5190	3.24	4.00	-0.76
High	5230	2.94	4.00	-1.06

Low channel plots are included hereafter.

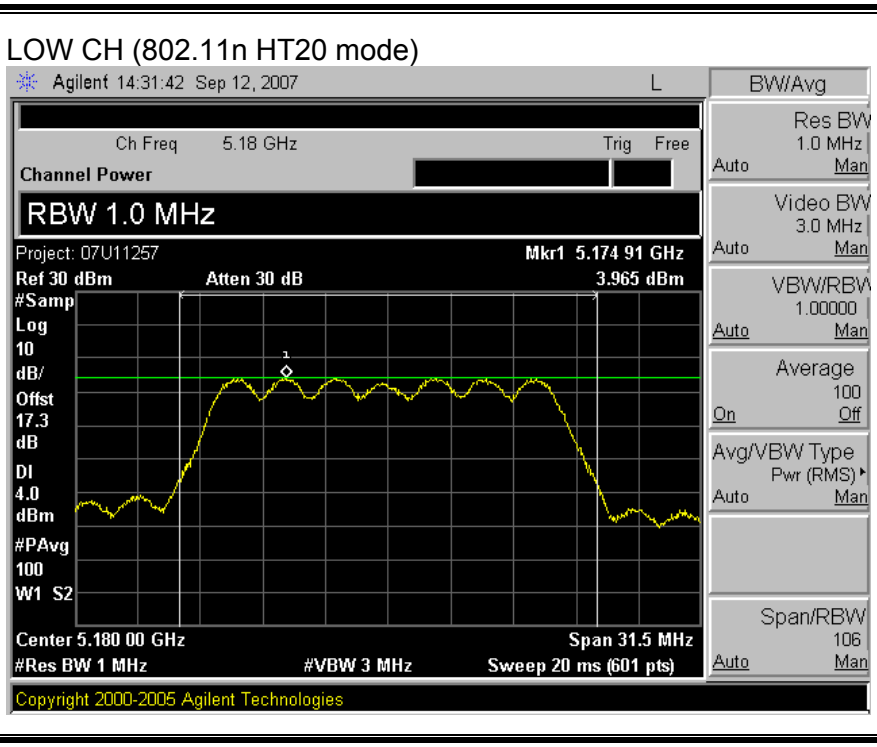
POWER SPECTRAL DENSITY WITH COMBINER
(802.11a MODE)

LOW CH (802.11a mode)



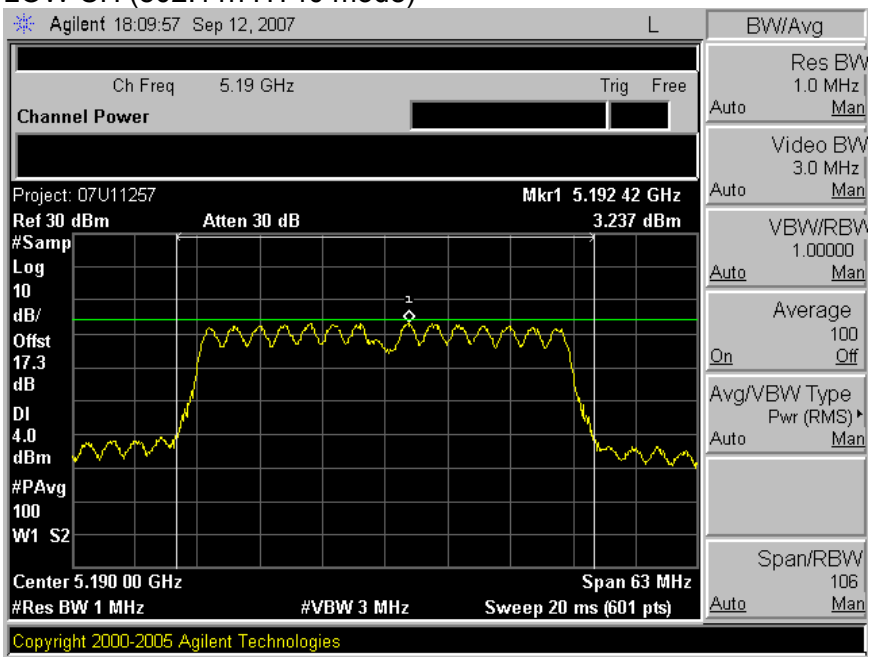
(802.11n HT20 MODE)

LOW CH (802.11n HT20 mode)



(802.11n HT40 MODE)

LOW CH (802.11n HT40 mode)



7.1.5. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

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

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

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

RESULTS

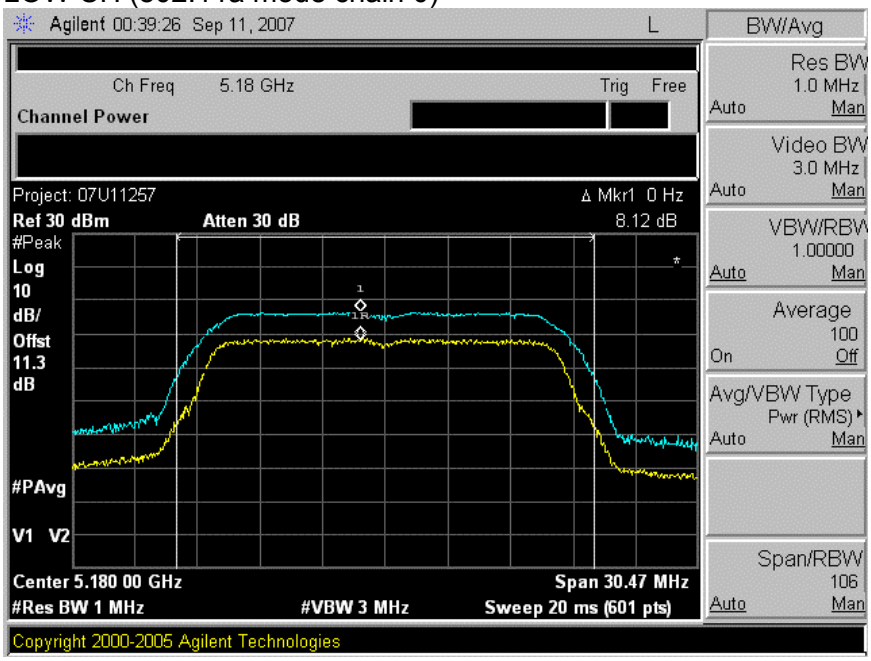
Mode Channel	Frequency (MHz)	Peak Excursion Chain 0 (dBm)	Peak Excursion Chain 2 (dBm)	Limit (dBm)	Worst Case Margin (dB)
802.11a Mode					
Low	5180	8.12	10.68	13	-2.32
Middle	5220	7.54	10.05	13	-2.95
High	5240	8.39	9.93	13	-3.07
802.11n HT20 Mode					
Low	5180	7.91	9.09	13	-3.91
Middle	5220	8.73	10.08	13	-2.92
High	5240	8.38	10.37	13	-2.63
802.11n HT40 Mode					
Low	5190	8.19	9.24	13	-3.76
High	5230	8.27	8.68	13	-4.32

Low channel plots for a mode and HT40 mode, and high channel plots for HT20 mode, are included hereafter.

PEAK EXCURSION

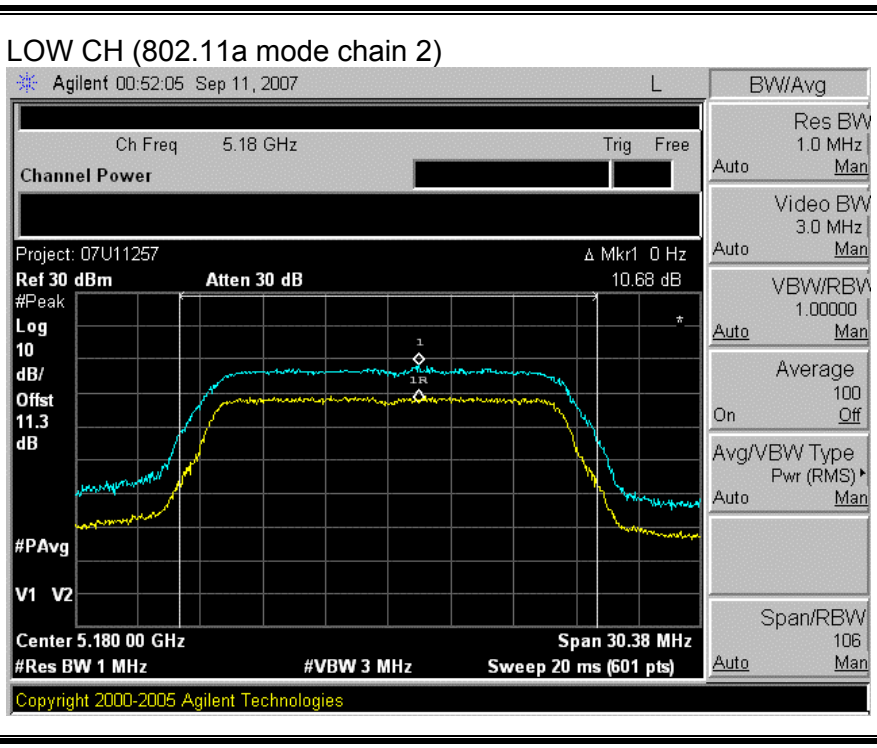
(802.11a MODE CHAIN 0)

LOW CH (802.11a mode chain 0)



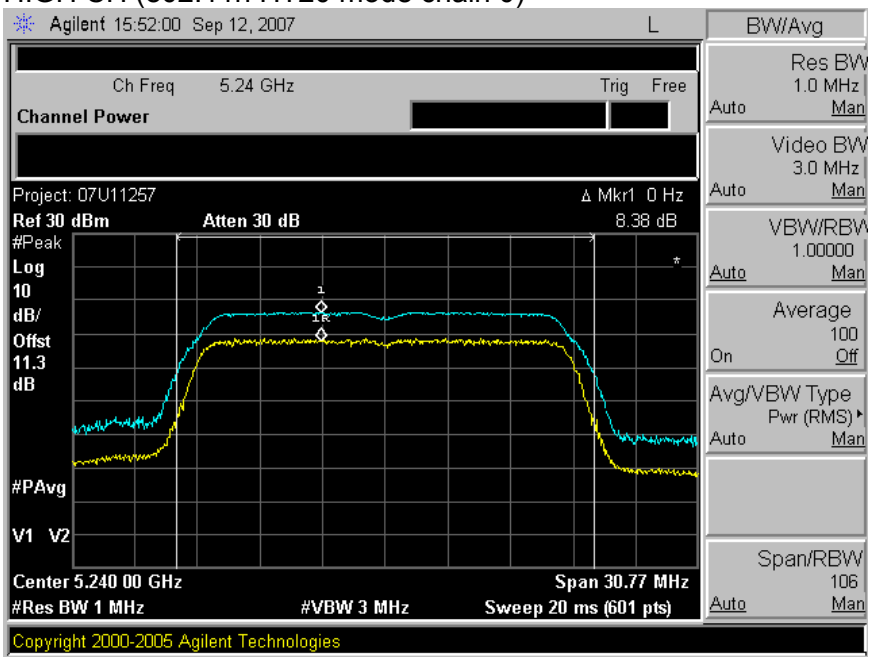
(802.11a MODE CHAIN 2)

LOW CH (802.11a mode chain 2)



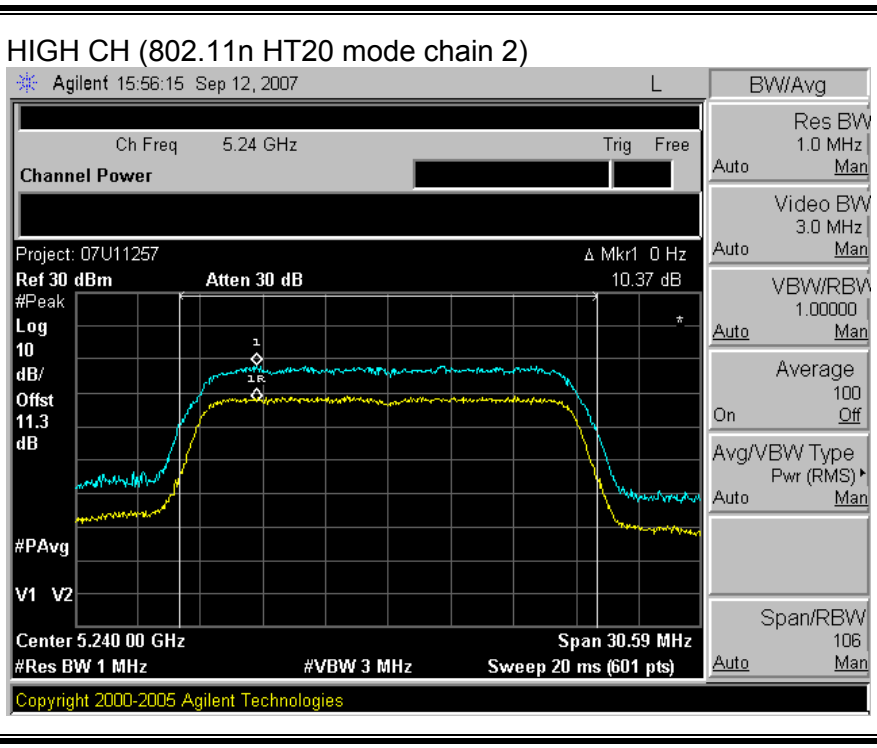
(802.11n HT20 MODE CHAIN 0)

HIGH CH (802.11n HT20 mode chain 0)



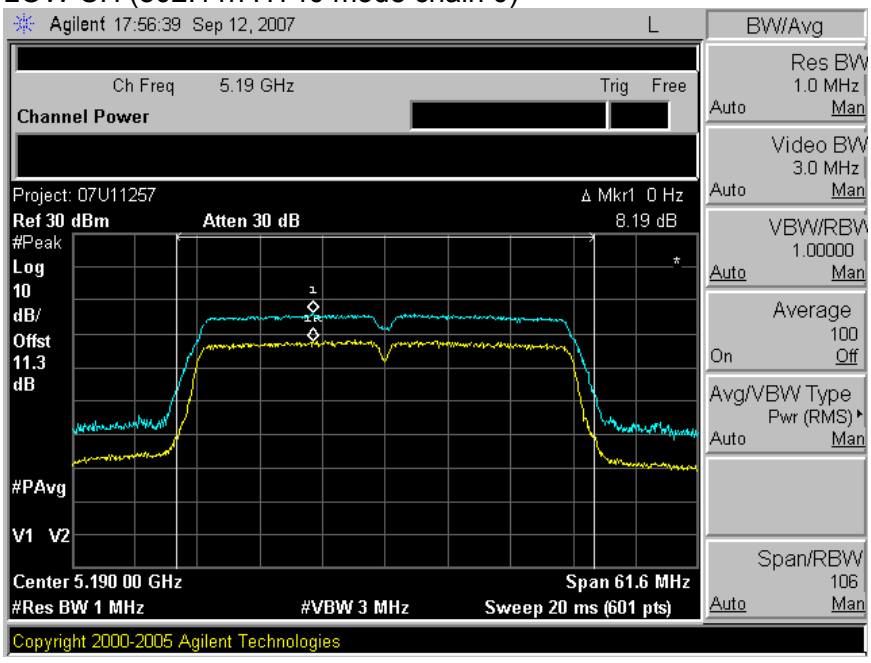
(802.11n HT20 MODE CHAIN 2)

HIGH CH (802.11n HT20 mode chain 2)



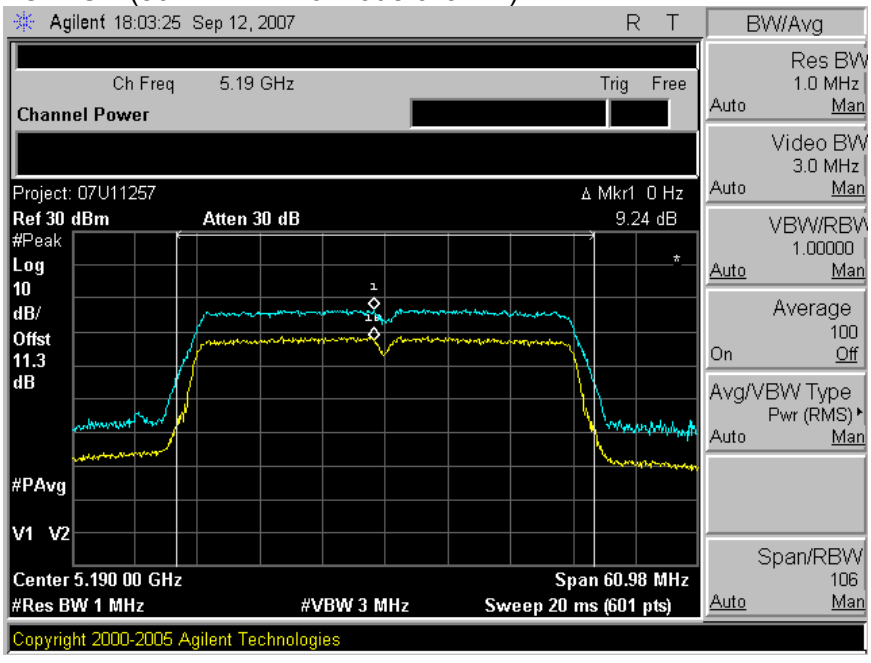
(802.11n HT40 MODE CHAIN 0)

LOW CH (802.11n HT40 mode chain 0)



(802.11n HT40 MODE CHAIN 2)

LOW CH (802.11n HT40 mode chain 2)



7.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

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

TEST PROCEDURE

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

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

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

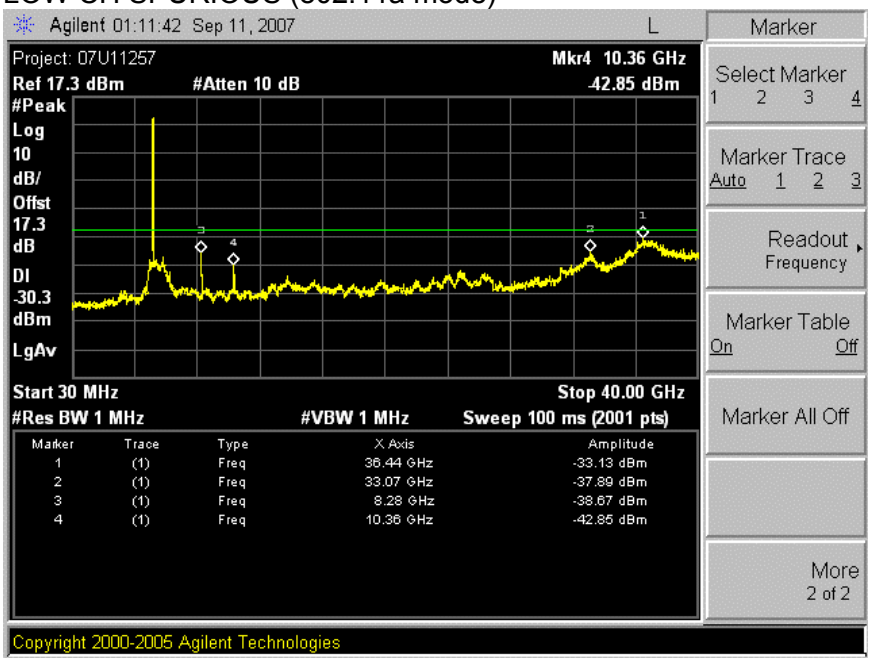
Offset Value = Cable Loss + Attenuation + Antenna Gain + Combiner Loss

RESULTS

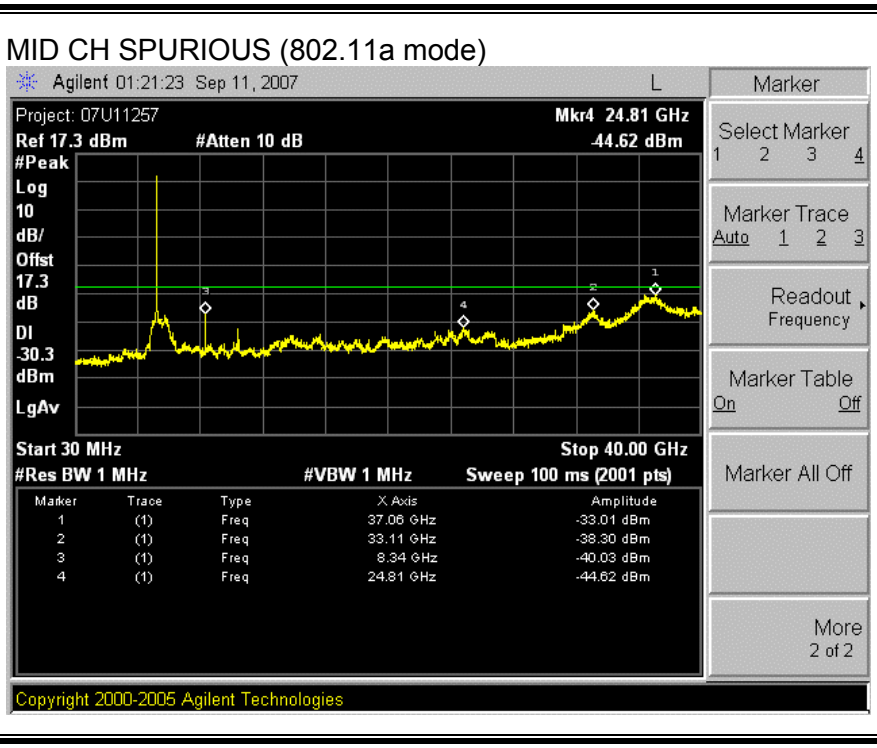
SPURIOUS EMISSIONS WITH COMBINER

(802.11a MODE)

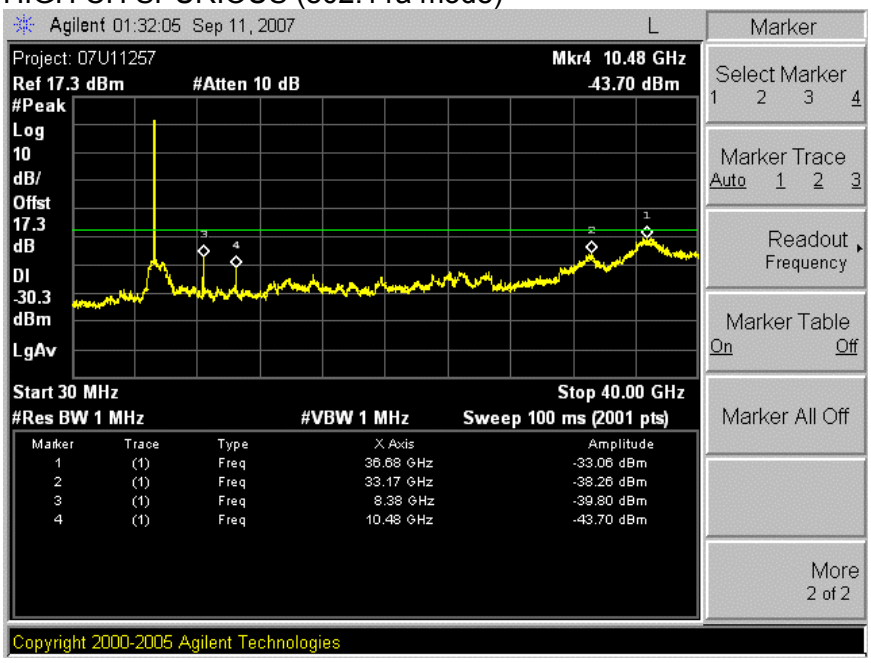
LOW CH SPURIOUS (802.11a mode)



MID CH SPURIOUS (802.11a mode)

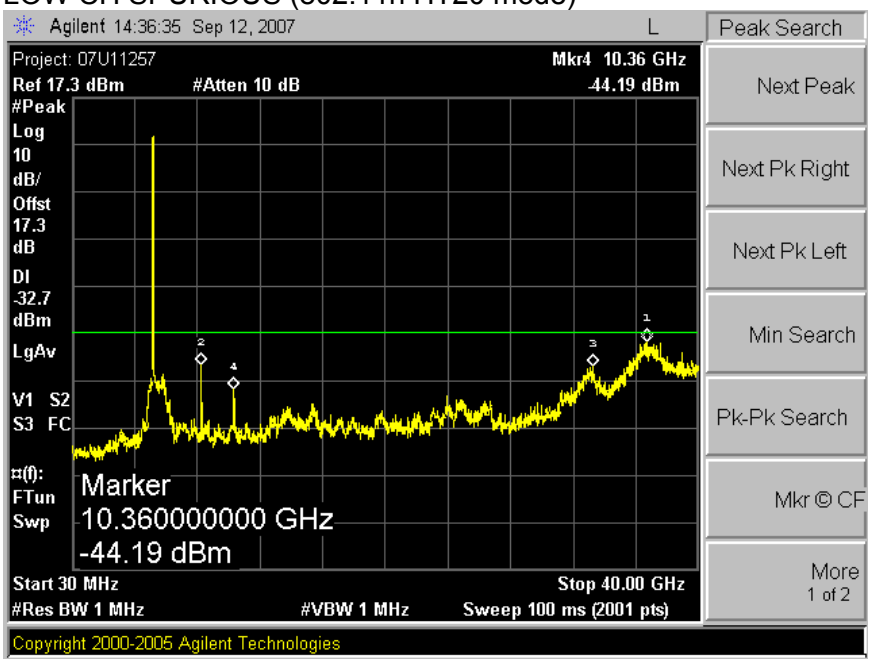


HIGH CH SPURIOUS (802.11a mode)

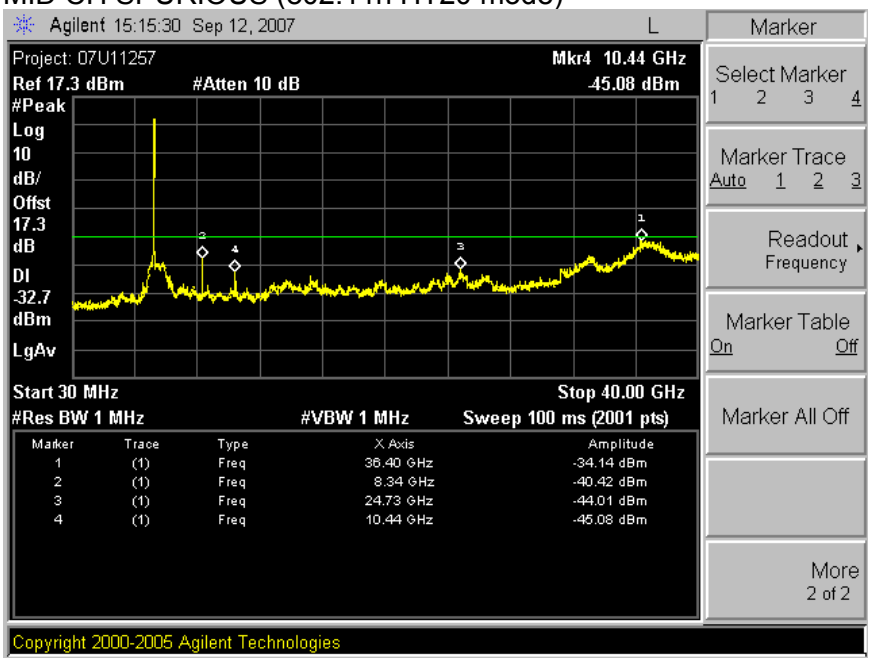


(802.11n HT20 MODE)

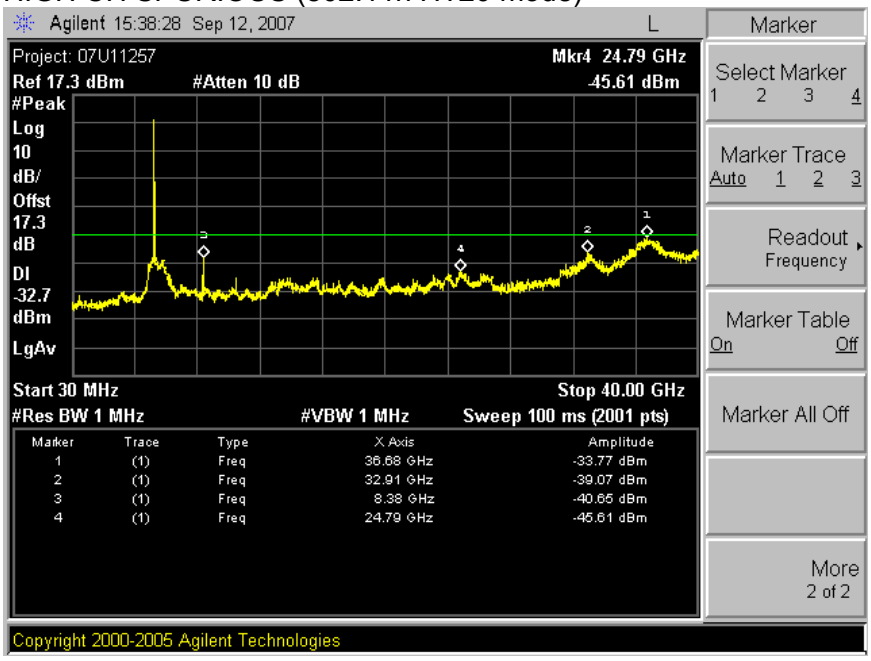
LOW CH SPURIOUS (802.11n HT20 mode)



MID CH SPURIOUS (802.11n HT20 mode)

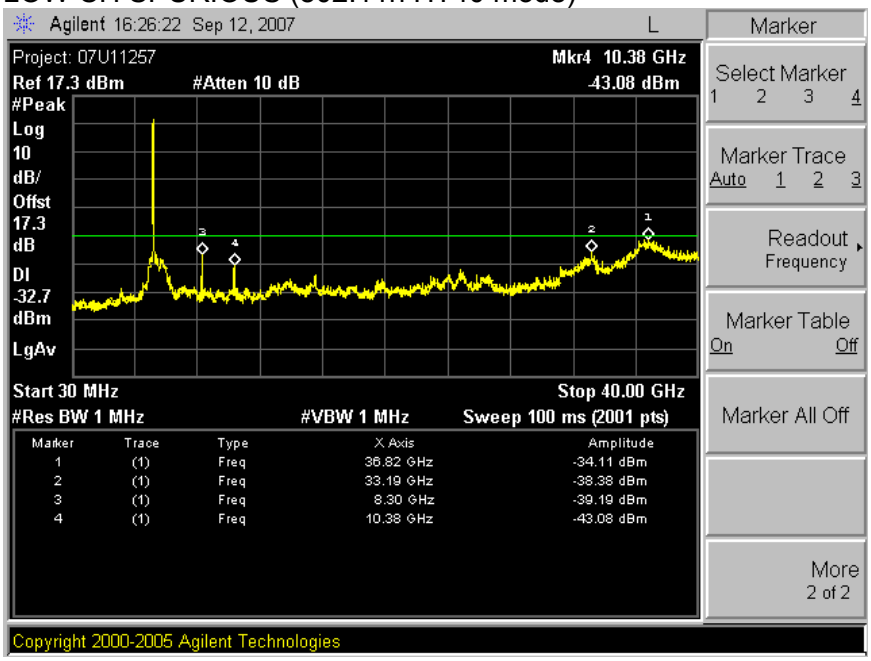


HIGH CH SPURIOUS (802.11n HT20 mode)

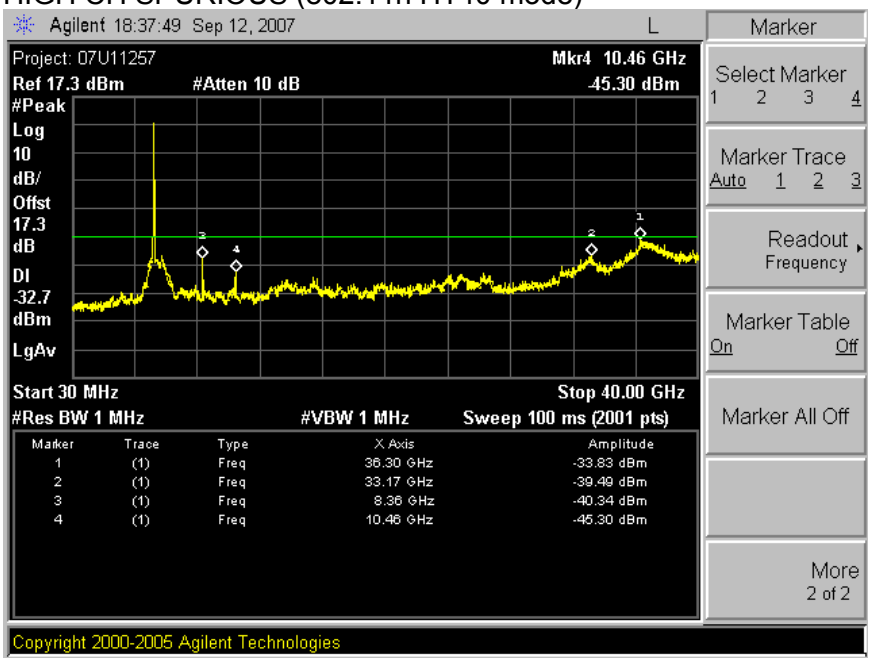


(802.11n HT40 MODE)

LOW CH SPURIOUS (802.11n HT40 mode)



HIGH CH SPURIOUS (802.11n HT40 mode)



8. RADIATED TEST RESULTS

8.1LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

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

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

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

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

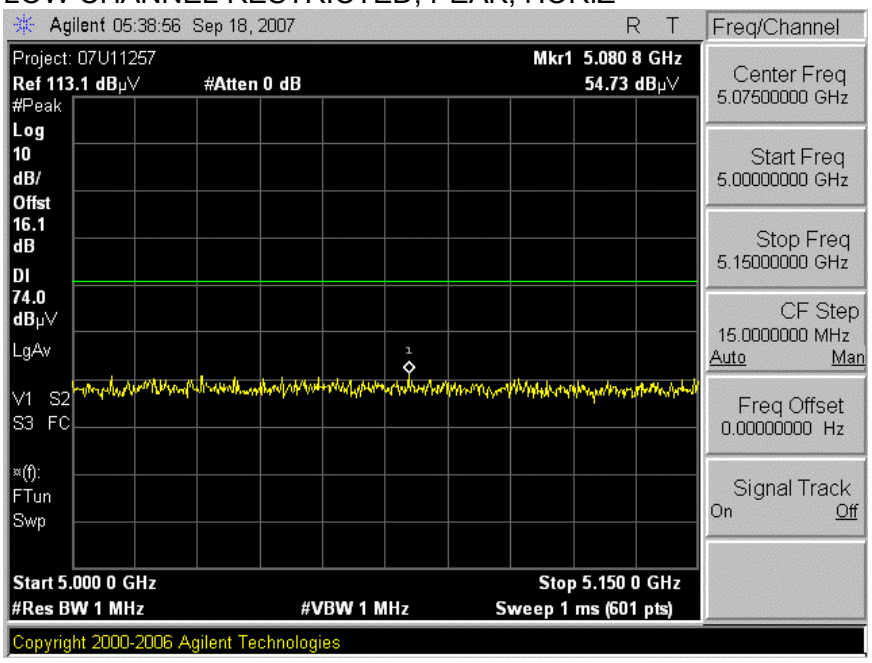
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.1. TRANSMITTER ABOVE 1 GHz IN THE 5.2 GHz BAND

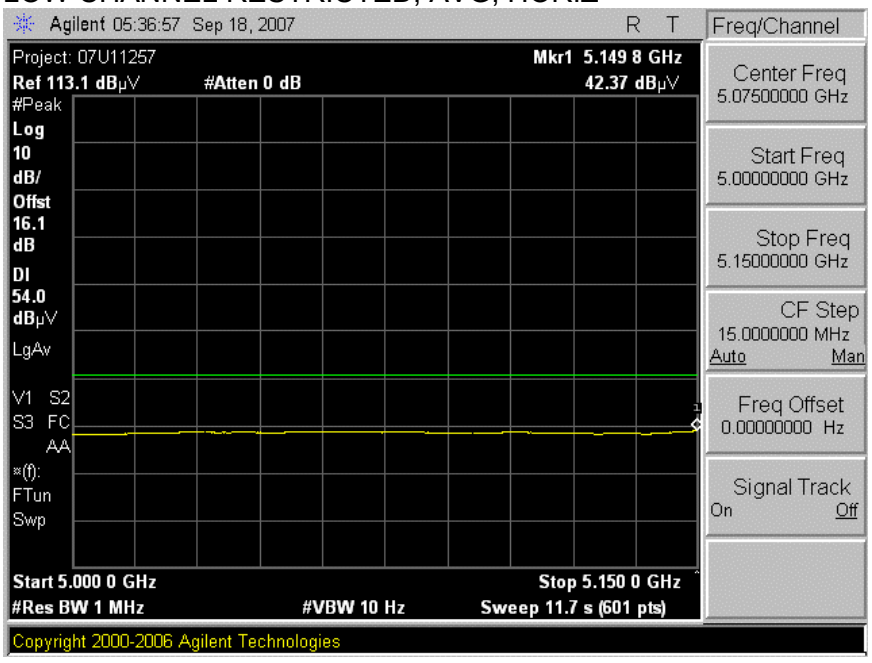
8.1.1. 802.11a MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

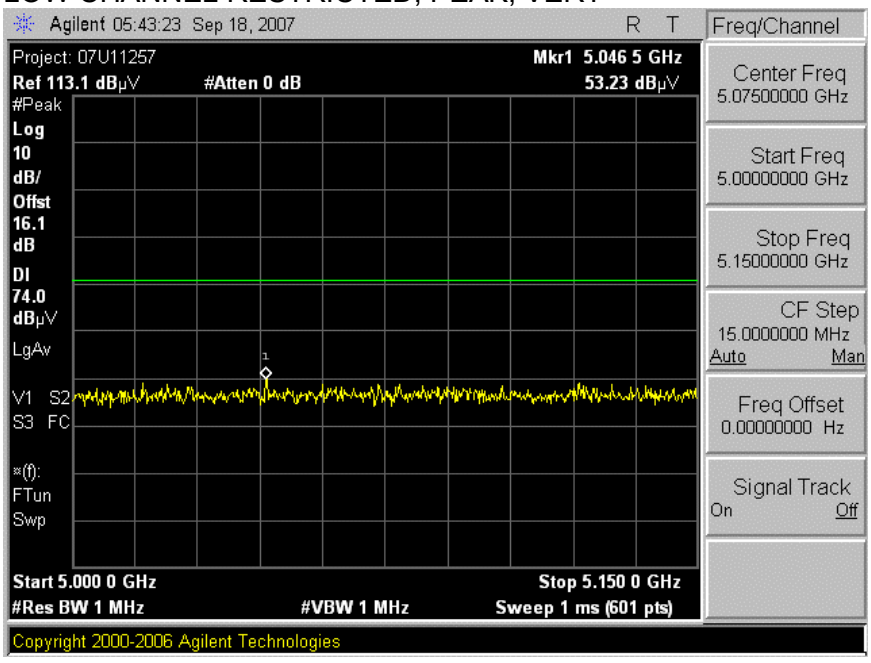


LOW CHANNEL RESTRICTED, AVG, HORIZ

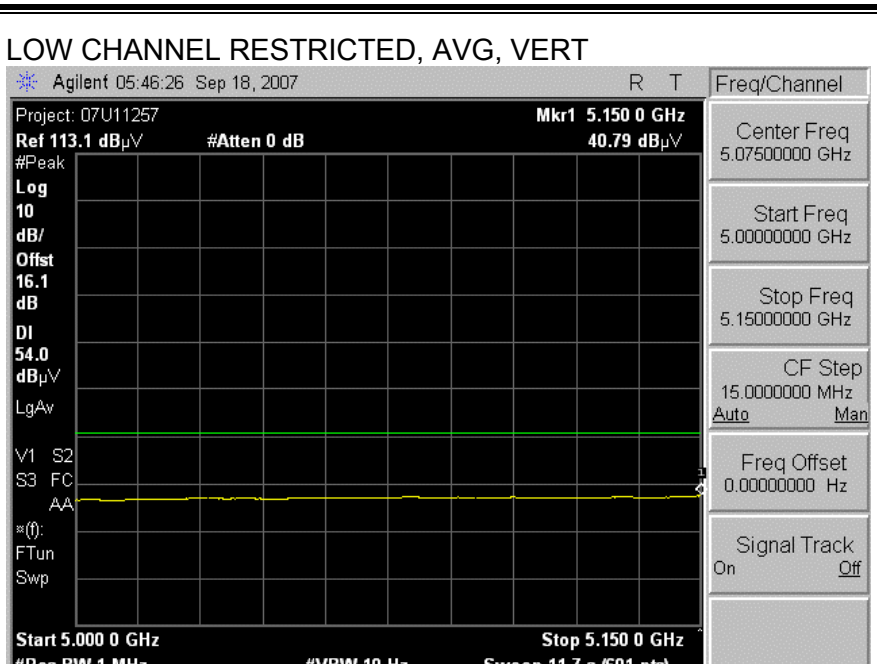


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

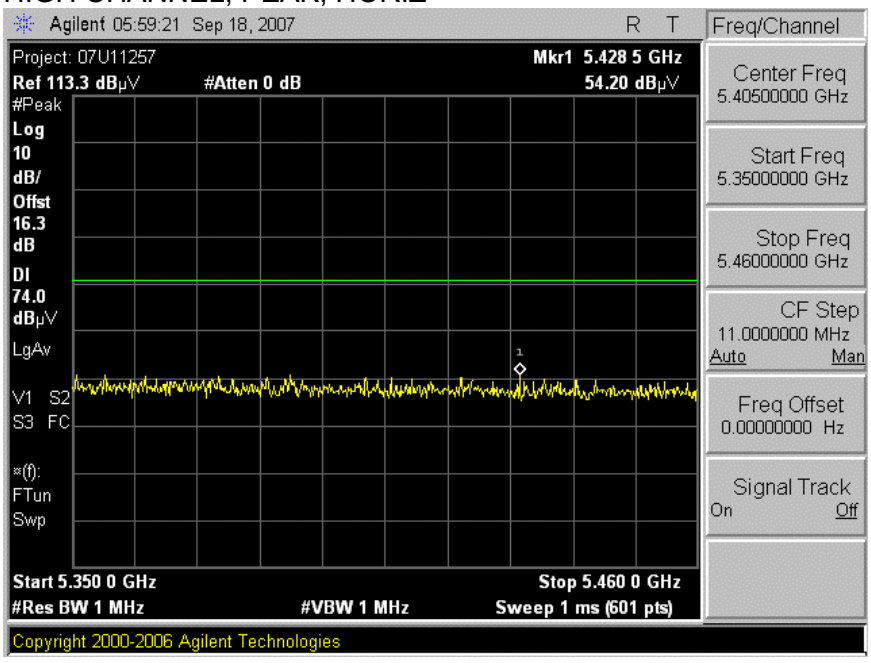


LOW CHANNEL RESTRICTED, AVG, VERT

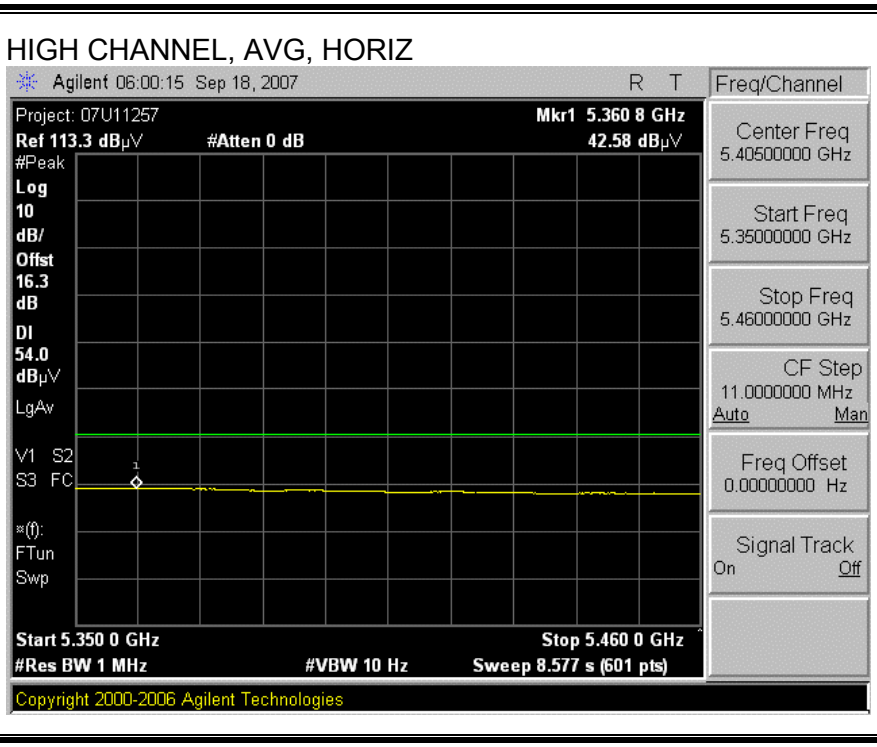


AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL, PEAK, HORIZ

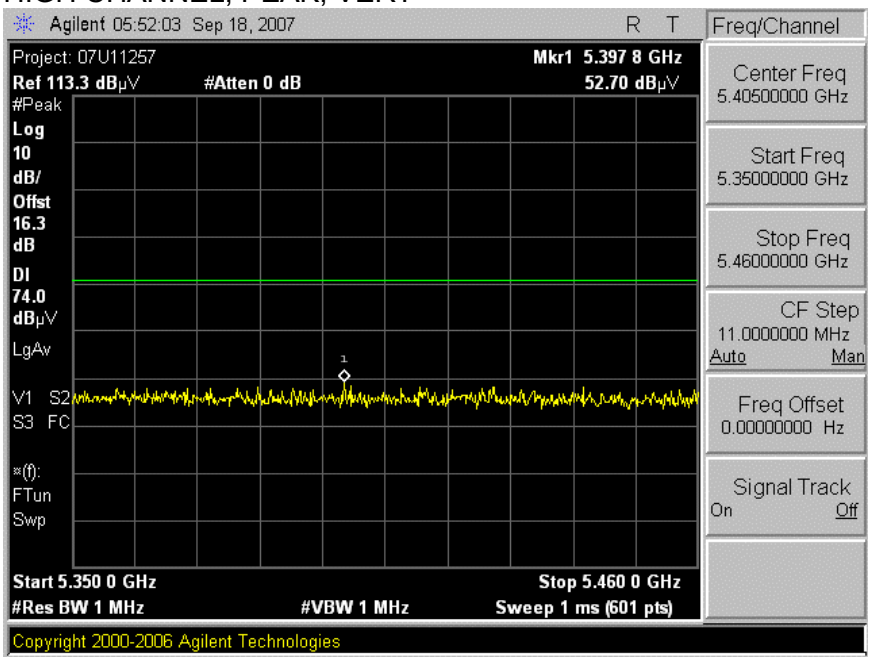


HIGH CHANNEL, AVG, HORIZ

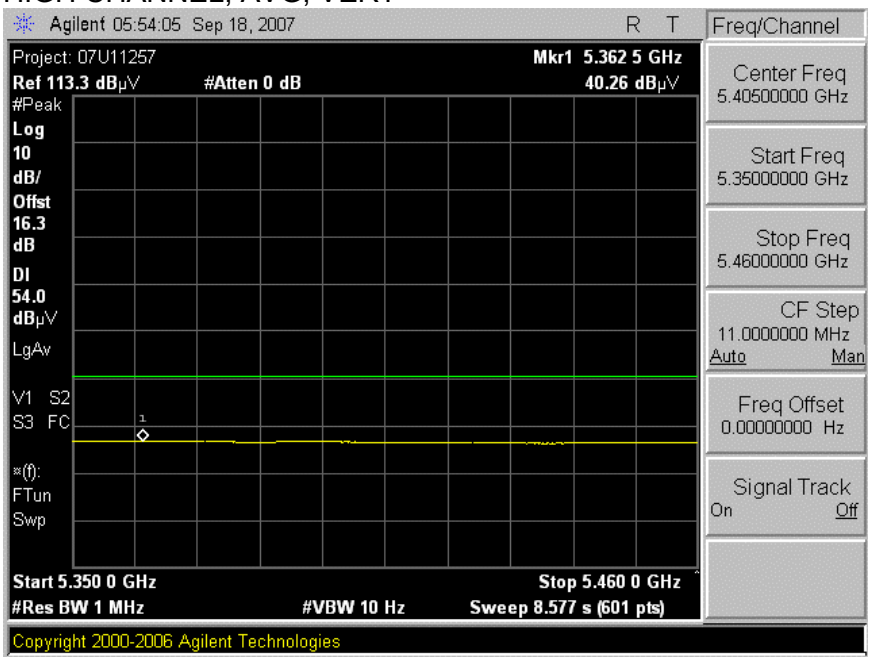


AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL, PEAK, VERT



HIGH CHANNEL, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Apple Computer Inc.
Project #: 07U11257
Date: Sept. 19, 2007
Test Engineer: William Zhuang
Configuration: EUT with support equipment
Mode: 5.2 GHz Band a Mode, Tx On

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
William 177079009		B-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch. 5180 MHz, setting: 55-55															
10.360	3.0	40.1	26.4	37.4	11.7	-32.6	0.0	0.8	57.3	43.6	74	54	-16.7	-10.4	V
15.540	3.0	35.3	22.6	38.0	14.1	-32.2	0.0	0.7	55.9	43.2	74	54	-18.1	-10.8	V
10.360	3.0	43.3	29.5	37.4	11.7	-32.6	0.0	0.8	60.5	46.7	74	54	-13.5	-7.3	H
15.540	3.0	34.9	21.8	38.0	14.1	-32.2	0.0	0.7	55.6	42.5	74	54	-18.4	-11.5	H
Mid Ch. 5220 MHz, setting: 55-55															
10.440	3.0	37.7	25.7	37.4	11.8	-32.6	0.0	0.8	55.0	42.9	74	54	-19.0	-11.1	V
15.660	3.0	37.2	23.6	37.9	14.2	-32.2	0.0	0.7	57.8	44.3	74	54	-16.2	-9.7	V
10.440	3.0	39.4	24.1	37.4	11.8	-32.6	0.0	0.8	56.7	41.4	74	54	-17.3	-12.6	H
15.660	3.0	35.5	22.0	37.9	14.2	-32.2	0.0	0.7	56.2	42.7	74	54	-17.8	-11.3	H
High Ch. 5240 MHz, setting: 55-55															
10.480	3.0	36.0	22.9	37.4	11.8	-32.6	0.0	0.8	53.4	40.2	74	54	-20.6	-13.8	V
15.720	3.0	35.5	22.4	37.9	14.2	-32.2	0.0	0.7	56.2	43.1	74	54	-17.8	-10.9	V
10.480	3.0	38.3	25.6	37.4	11.8	-32.6	0.0	0.8	55.6	43.0	74	54	-18.4	-11.0	H
15.720	3.0	34.8	22.1	37.9	14.2	-32.2	0.0	0.7	55.4	42.8	74	54	-18.6	-11.2	H
No more signal found															

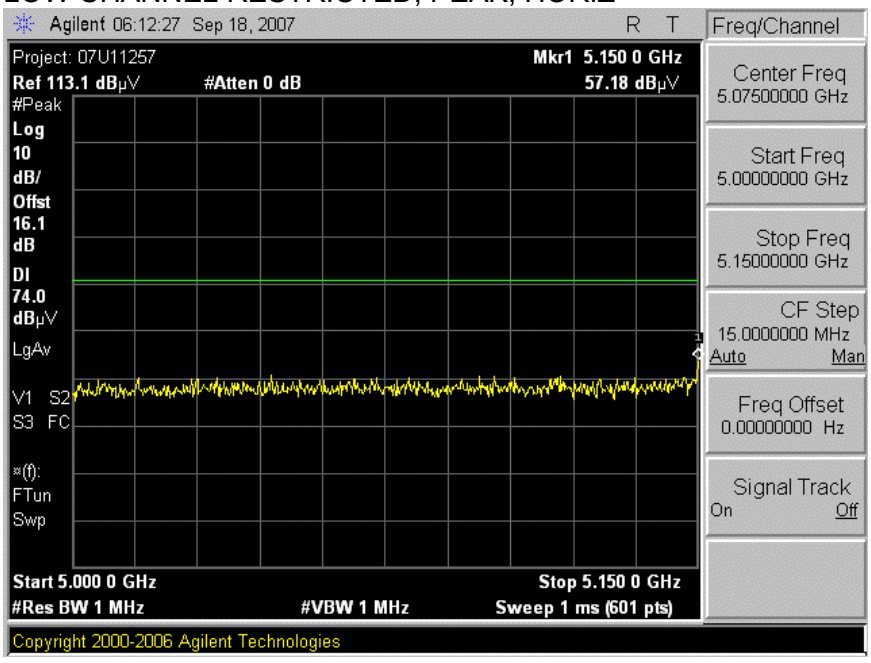
Rev. 4.12.7

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		

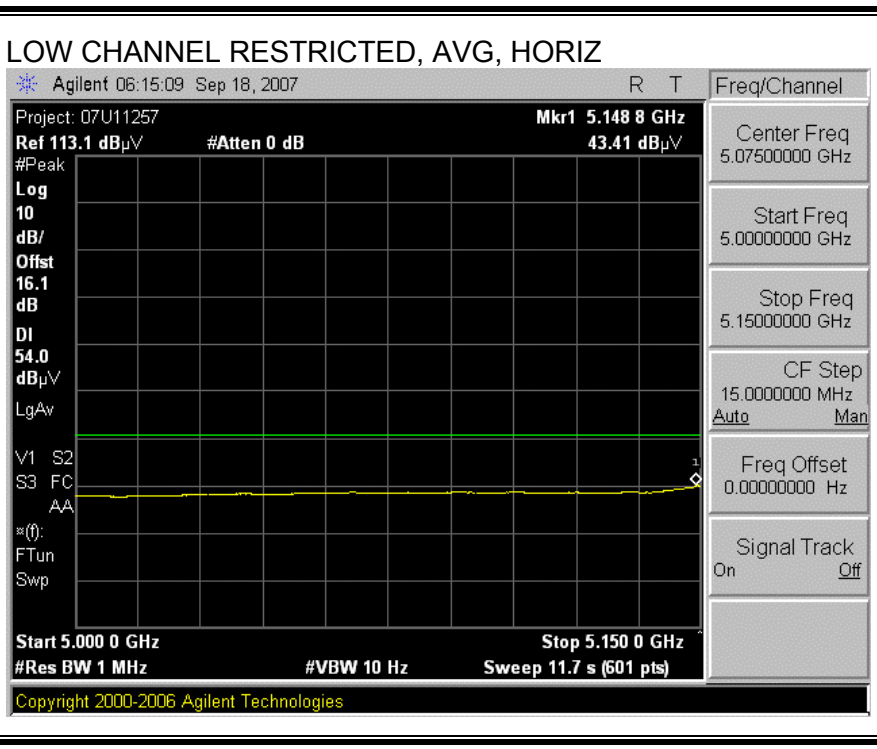
8.1.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

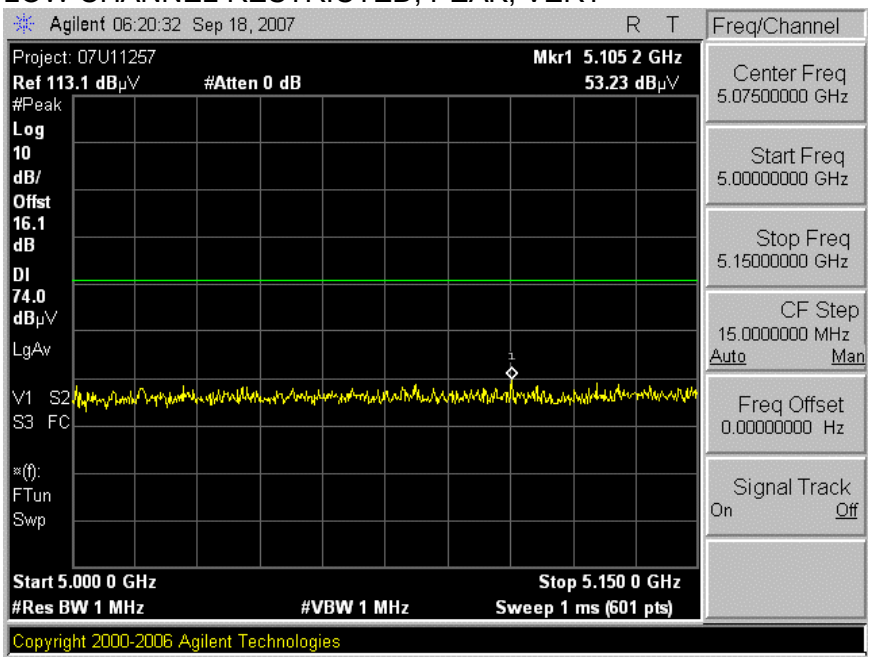


LOW CHANNEL RESTRICTED, AVG, HORIZ

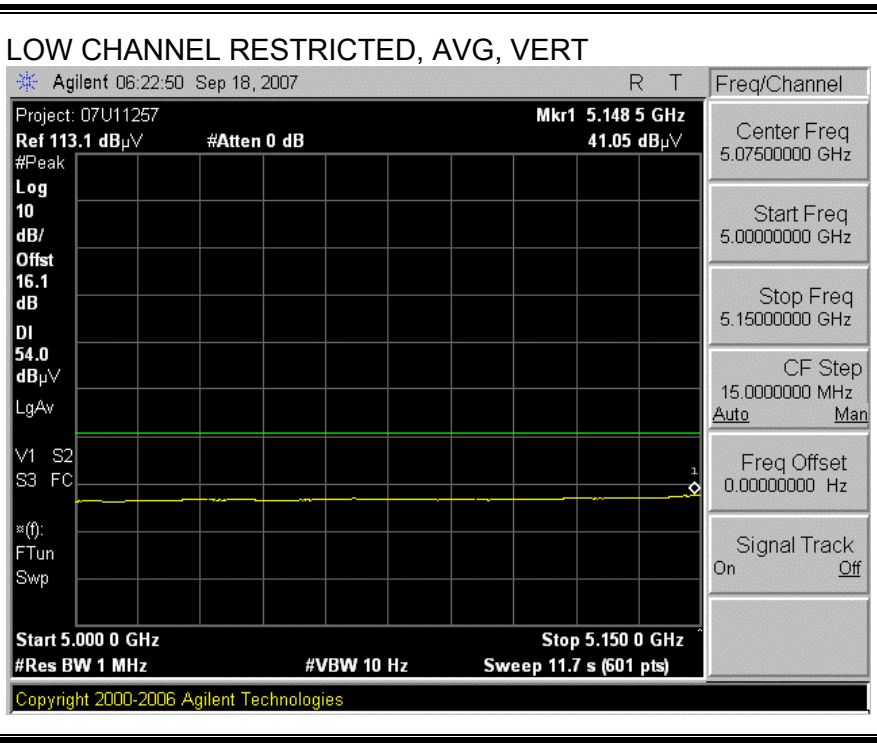


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

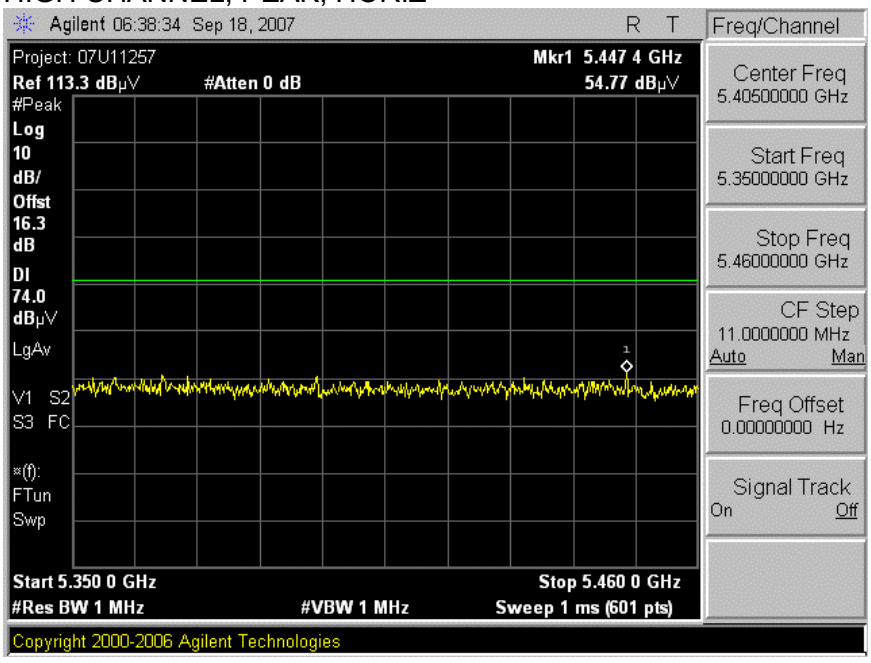


LOW CHANNEL RESTRICTED, AVG, VERT

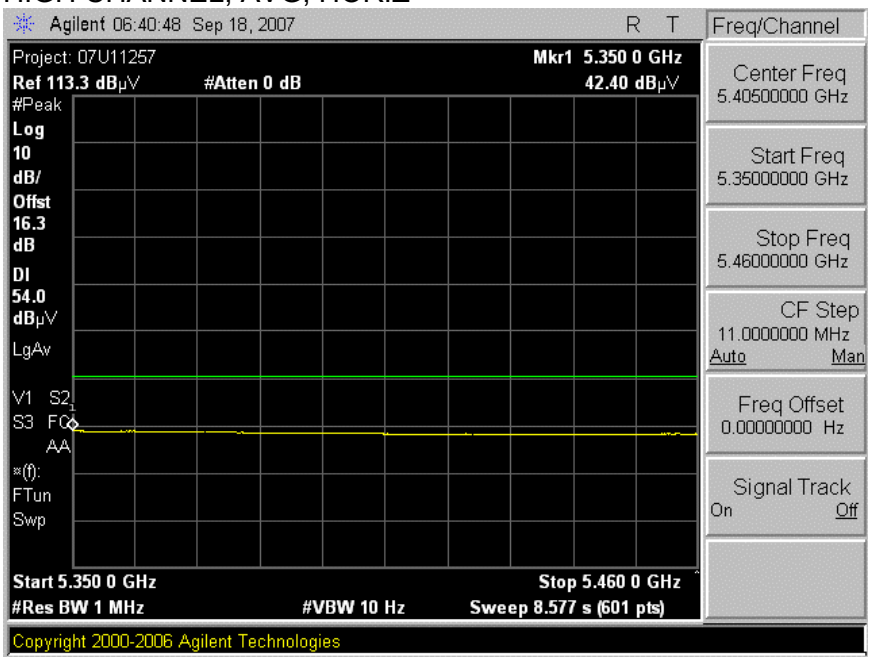


AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL, PEAK, HORIZ

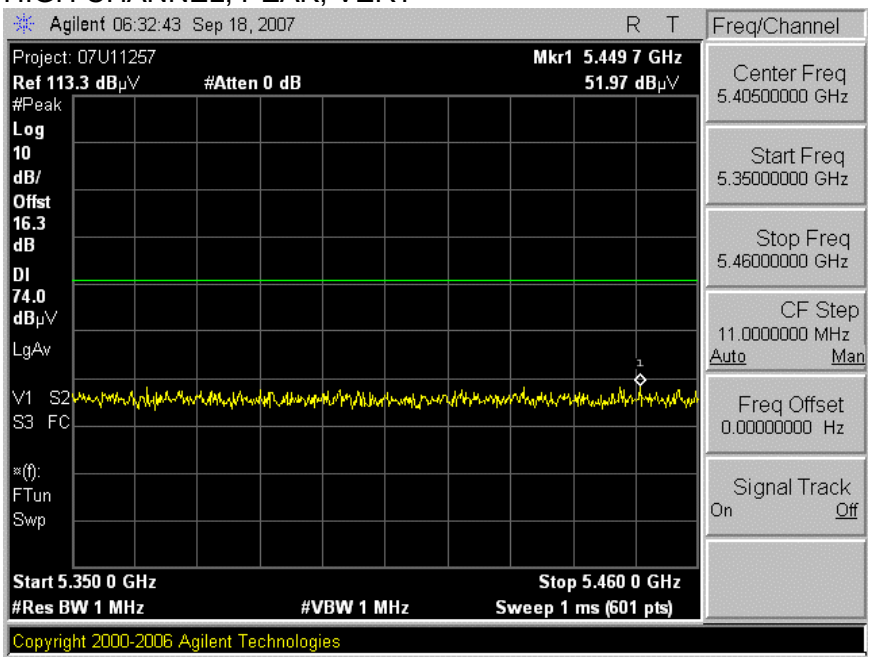


HIGH CHANNEL, AVG, HORIZ

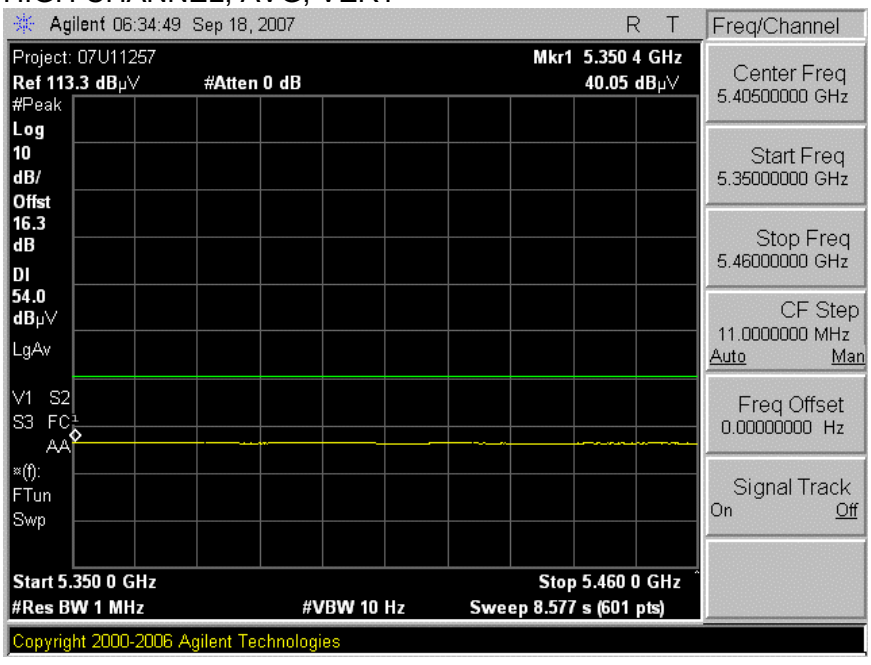


AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL, PEAK, VERT



HIGH CHANNEL, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Apple Computer Inc.
Project #: 07U11257
Date: Sept. 19, 2007
Test Engineer: William Zhuang
Configuration: EUT with support equipment
Mode: 5.2 GHz Band HT20 Mode, Tx On

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
William 177079009		B-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch. 5180 MHz, setting: 57-57															
10.360	3.0	44.5	30.2	37.4	11.7	-32.6	0.0	0.8	61.7	47.5	74	54	-12.3	-6.5	V
15.540	3.0	37.3	23.2	38.0	14.1	-32.2	0.0	0.7	57.9	43.8	74	54	-16.1	-10.2	V
10.360	3.0	43.7	30.6	37.4	11.7	-32.6	0.0	0.8	61.0	47.8	74	54	-13.0	-6.2	H
15.540	3.0	36.5	21.9	38.0	14.1	-32.2	0.0	0.7	57.2	42.6	74	54	-16.8	-11.4	H
Mid Ch. 5220 MHz, setting: 56-56															
10.440	3.0	38.4	24.7	37.4	11.8	-32.6	0.0	0.8	55.7	42.0	74	54	-18.3	-12.0	V
15.660	3.0	35.5	22.0	37.9	14.2	-32.2	0.0	0.7	56.1	42.7	74	54	-17.9	-11.3	V
10.440	3.0	36.0	23.2	37.4	11.8	-32.6	0.0	0.8	53.3	40.5	74	54	-20.7	-13.5	H
15.660	3.0	34.9	22.1	37.9	14.2	-32.2	0.0	0.7	55.6	42.7	74	54	-18.4	-11.3	H
High Ch. 5240 MHz, setting: 56-55															
10.480	3.0	37.8	25.0	37.4	11.8	-32.6	0.0	0.8	55.2	42.3	74	54	-18.8	-11.7	V
15.720	3.0	36.0	22.3	37.9	14.2	-32.2	0.0	0.7	56.7	43.0	74	54	-17.3	-11.0	V
10.480	3.0	38.0	25.1	37.4	11.8	-32.6	0.0	0.8	55.3	42.5	74	54	-18.7	-11.5	H
15.720	3.0	35.2	22.1	37.9	14.2	-32.2	0.0	0.7	55.8	42.8	74	54	-18.2	-11.2	H
No more signal found															

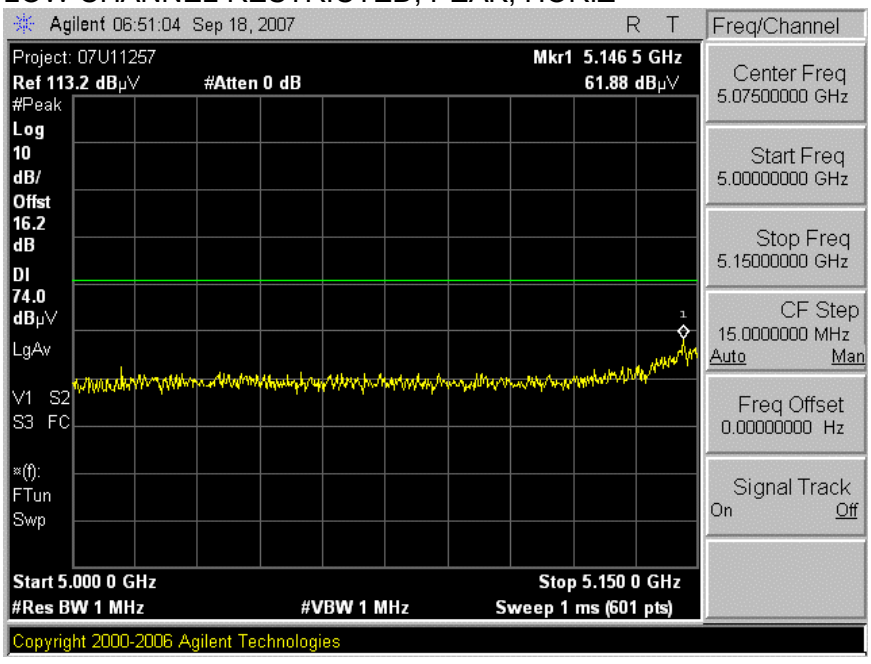
Rev. 4.12.7

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		

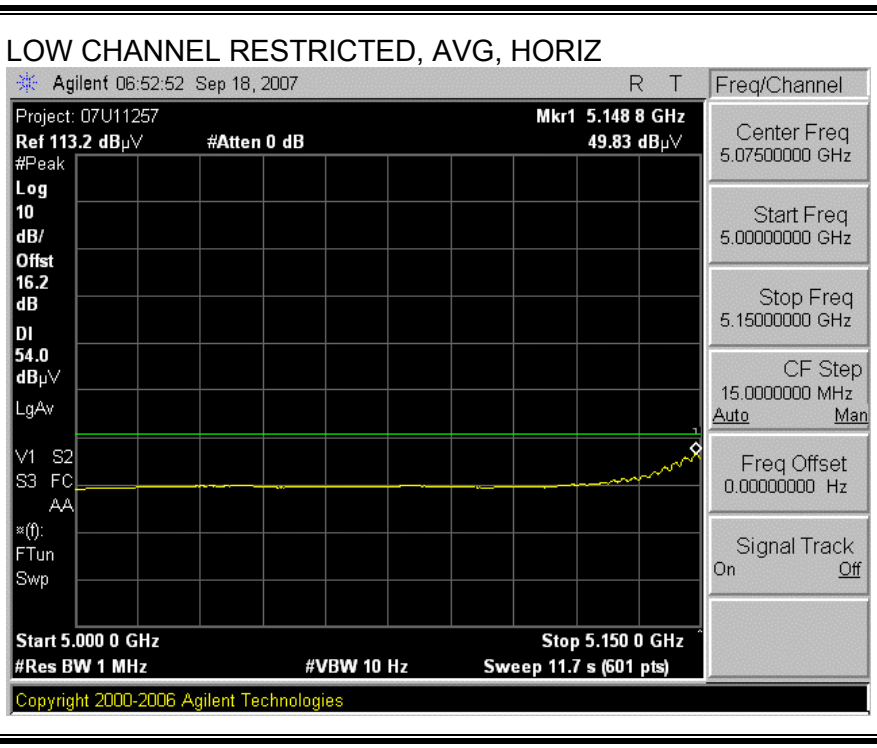
8.1.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

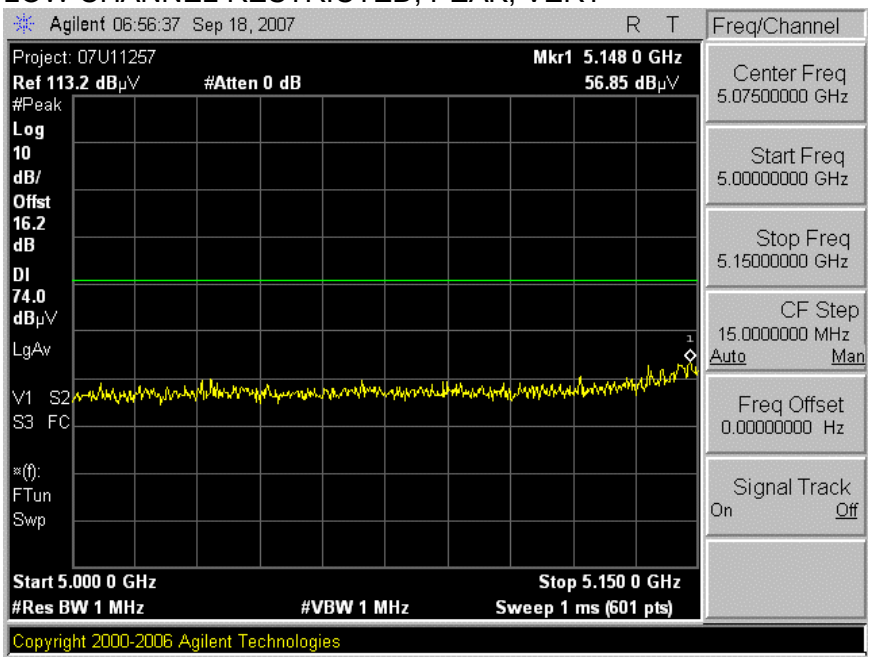


LOW CHANNEL RESTRICTED, AVG, HORIZ

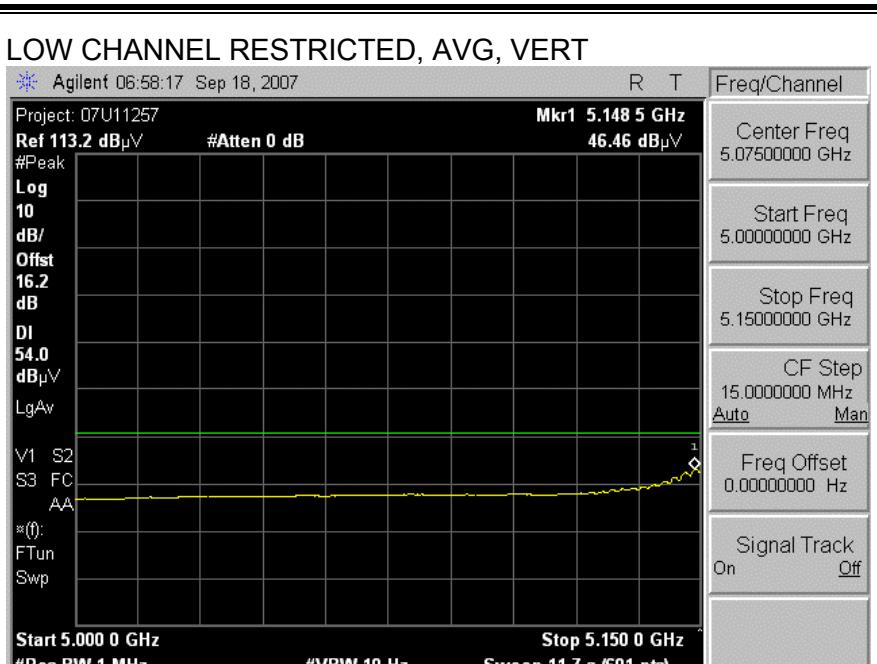


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

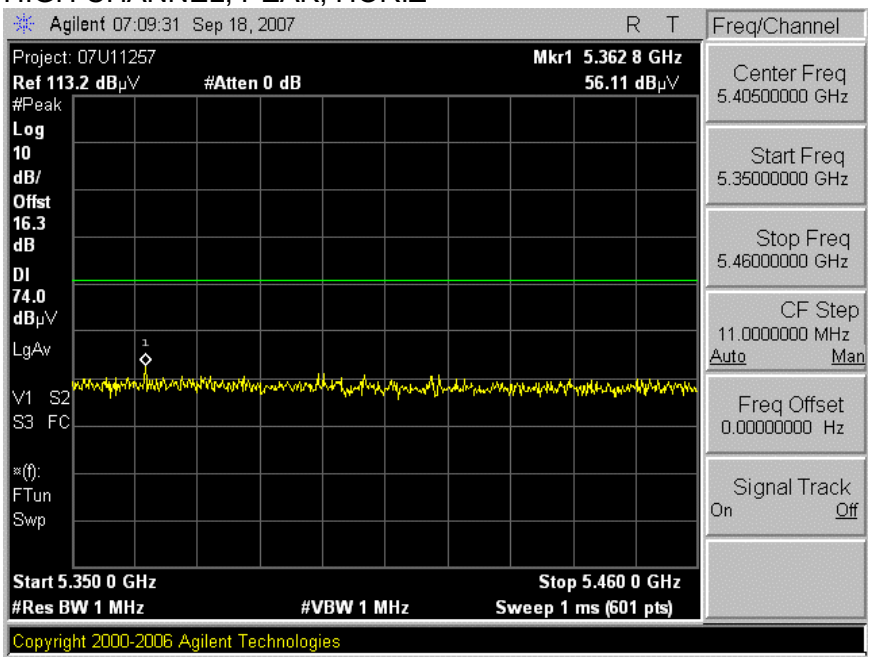


LOW CHANNEL RESTRICTED, AVG, VERT

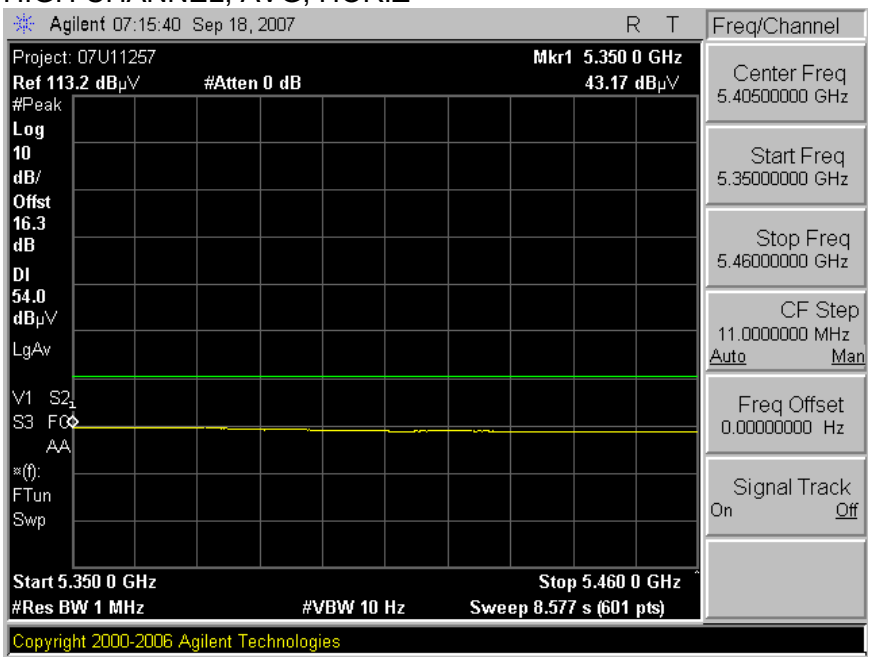


AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL, PEAK, HORIZ

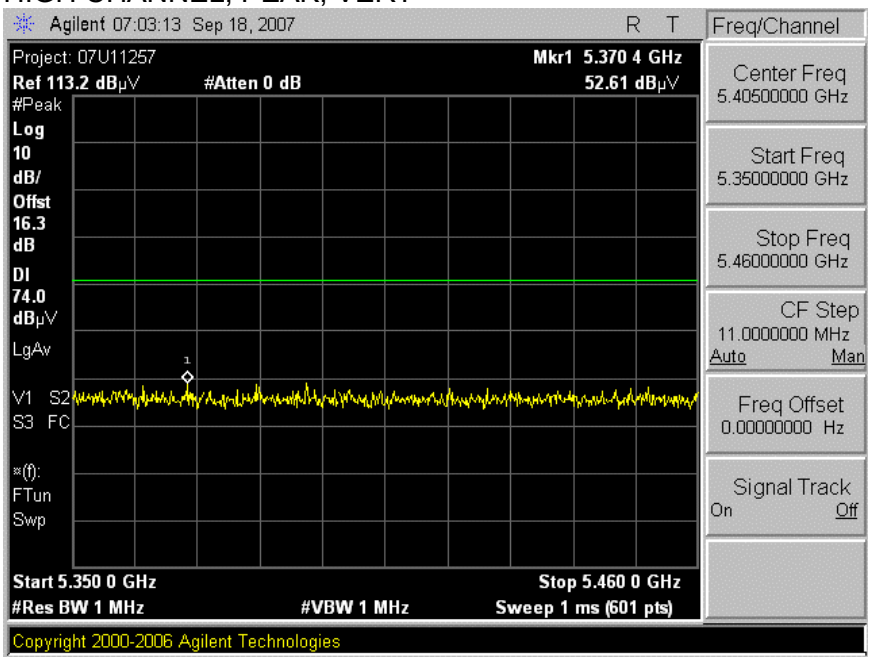


HIGH CHANNEL, AVG, HORIZ

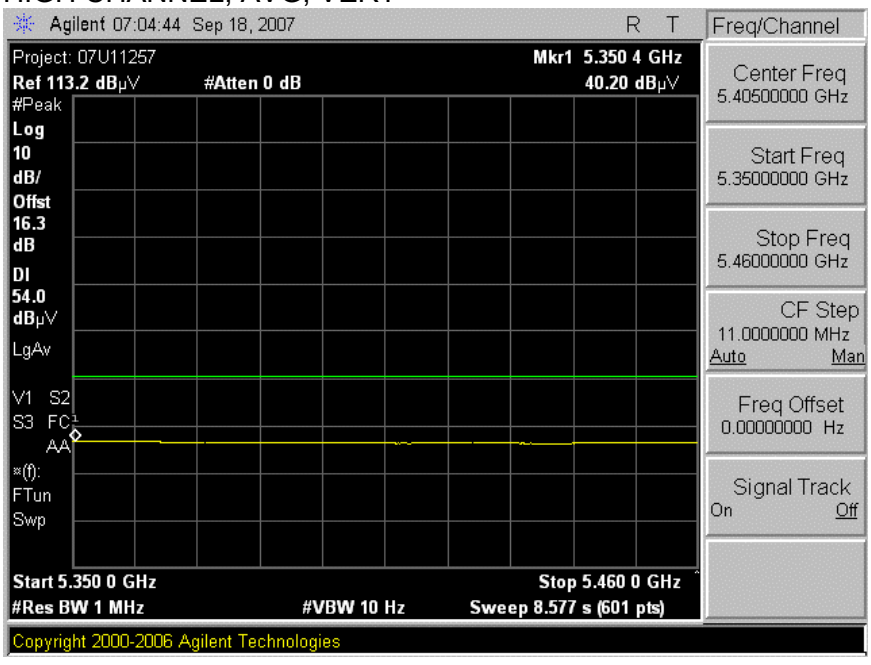


AUTHORIZED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL, PEAK, VERT



HIGH CHANNEL, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Apple Computer Inc.
Project #: 07U11257
Date: Sept. 20, 2007
Test Engineer: William Zhuang
Configuration: EUT with support equipment
Mode: 5.2 GHz Band HT40 Mode, Tx On

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
William 177079009		B-5m Chamber	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch. 5190 MHz, setting: 5B-5B															
10.380	3.0	39.3	27.2	37.4	11.7	-32.6	0.0	0.8	56.6	44.5	74	54	-17.4	-9.5	V
15.570	3.0	37.9	24.1	38.0	14.1	-32.2	0.0	0.7	58.6	44.7	74	54	-15.4	-9.3	V
10.380	3.0	40.7	28.4	37.4	11.7	-32.6	0.0	0.8	57.9	45.6	74	54	-16.1	-8.4	H
15.570	3.0	35.5	23.1	38.0	14.1	-32.2	0.0	0.7	56.1	43.7	74	54	-17.9	-10.3	H
High Ch. 5230 MHz, setting: 5B-5B															
10.460	3.0	38.6	27.9	37.4	11.8	-32.6	0.0	0.8	55.9	45.2	74	54	-18.1	-8.8	V
15.690	3.0	35.3	22.2	37.9	14.2	-32.2	0.0	0.7	56.0	42.8	74	54	-18.0	-11.2	V
10.460	3.0	34.9	22.7	37.4	11.8	-32.6	0.0	0.8	52.2	40.0	74	54	-21.8	-14.0	H
15.690	3.0	34.5	22.0	37.9	14.2	-32.2	0.0	0.7	55.2	42.7	74	54	-18.8	-11.3	H
No more signal found															V

Rev. 4.12.7

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		

8.2. RECEIVER ABOVE 1 GHz IN THE WORST CASE MODE

8.2.1. 802.11a MODE IN THE WORST CASE MODE

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Apple Computer Inc.
Project #: 07U11257
Date: Sept. 19, 2007
Test Engineer: William Zhuang
Configuration: EUT with support equipment
Mode: 5.2 GHz Band a Mode, Mid Ch. Rx On

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			RX RSS 210

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
William 177079009		B-5m Chamber		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.125	3.0	53.9	45.0	25.7	4.1	-38.1	0.0	0.0	45.6	36.8	74	54	-28.4	-17.2	H
1.560	3.0	53.1	40.7	26.8	4.7	-37.5	0.0	0.0	47.1	34.7	74	54	-26.9	-19.3	H
1.866	3.0	52.1	40.3	27.6	5.1	-37.1	0.0	0.0	47.7	36.0	74	54	-26.3	-18.0	H
2.000	3.0	51.7	39.8	27.9	5.3	-36.9	0.0	0.0	48.1	36.1	74	54	-25.9	-17.9	H
1.125	3.0	54.8	45.6	25.7	4.1	-38.1	0.0	0.0	46.6	37.3	74	54	-27.4	-16.7	V
1.560	3.0	54.2	41.1	26.8	4.7	-37.5	0.0	0.0	48.2	35.2	74	54	-25.8	-18.8	V
1.866	3.0	56.9	42.4	27.6	5.1	-37.1	0.0	0.0	52.5	38.0	74	54	-21.5	-16.0	V
2.000	3.0	53.8	41.4	27.9	5.3	-36.9	0.0	0.0	50.2	37.7	74	54	-23.8	-16.3	V
No more signal found															

Rev. 4.12.7

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		

8.2.2. 802.11n H20 MODE IN THE WORST CASE MODE

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Apple Computer Inc.
Project #: 07U11257
Date: Sept. 20, 2007
Test Engineer: William Zhuang
Configuration: EUT with support equipment
Mode: 5.2 GHz Band HT20 Mode, Mid Ch. Rx On

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			RX RSS 210

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
William 177079009		B-5m Chamber		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.166	3.0	53.3	44.3	25.8	4.1	-38.0	0.0	0.0	45.3	36.2	74	54	-28.7	-17.8	V
1.739	3.0	54.1	41.3	27.3	4.9	-37.2	0.0	0.0	49.1	36.2	74	54	-24.9	-17.8	V
1.166	3.0	49.7	36.9	25.8	4.1	-38.0	0.0	0.0	41.7	28.8	74	54	-32.3	-25.2	H
1.739	3.0	54.6	42.2	27.3	4.9	-37.2	0.0	0.0	49.6	37.2	74	54	-24.4	-16.8	H
No more signal found															

Rev. 4.12.7

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		

8.2.3. 802.11n H40 MODE IN THE WORST CASE MODE

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Apple Computer Inc.
Project #: 07U11257
Date: Sept. 20, 2007
Test Engineer: William Zhuang
Configuration: EUT with support equipment
Mode: 5.2 GHz Band HT40 Mode, High Ch. Rx On

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			RX RSS 210

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
William 177079009		B-5m Chamber		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.199	3.0	54.2	42.1	25.9	4.2	-38.0	0.0	0.0	46.4	34.3	74	54	-27.6	-19.7	V
1.823	3.0	58.2	45.3	27.5	5.0	-37.1	0.0	0.0	53.6	40.7	74	54	-20.4	-13.3	V
1.199	3.0	50.3	38.3	25.9	4.2	-38.0	0.0	0.0	42.5	30.4	74	54	-31.5	-23.6	H
1.823	3.0	53.8	41.4	27.5	5.0	-37.1	0.0	0.0	49.2	36.8	74	54	-24.8	-17.2	H
No more signal found															

Rev. 4.12.7

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		

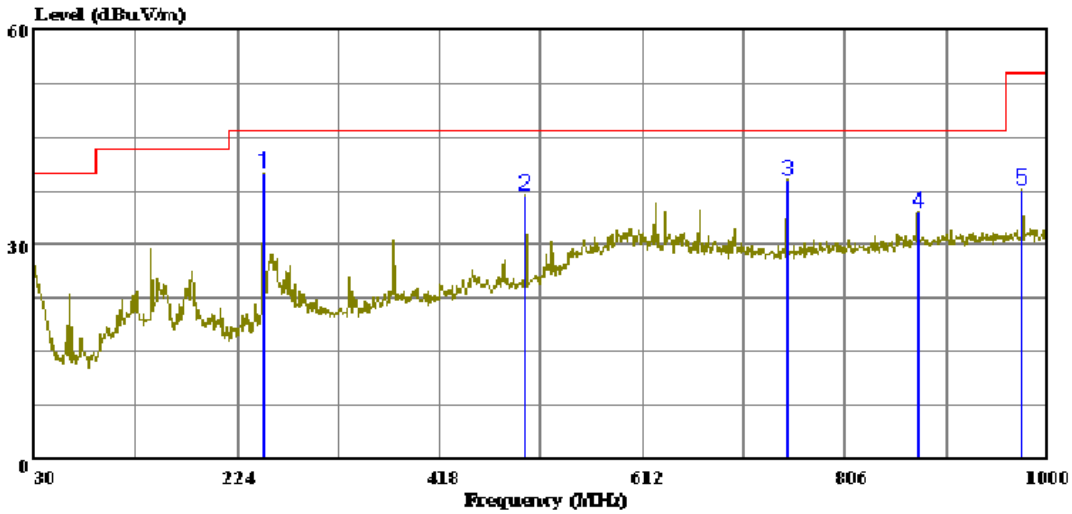
8.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL DATA

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 12 File#: 07u11257.emi Date: 10-12-2007 Time: 10:23:12



Trace: 11 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Engineer: : Thanh Nguyen
Company: : Apple Computer Inc.
Project #: : 07U11257
Test Configuration:: EUT with Support Equipment
Mode of operation: : Wireless link, play music and R/W to HD
Test Target: : FCC Class B

Page: 1

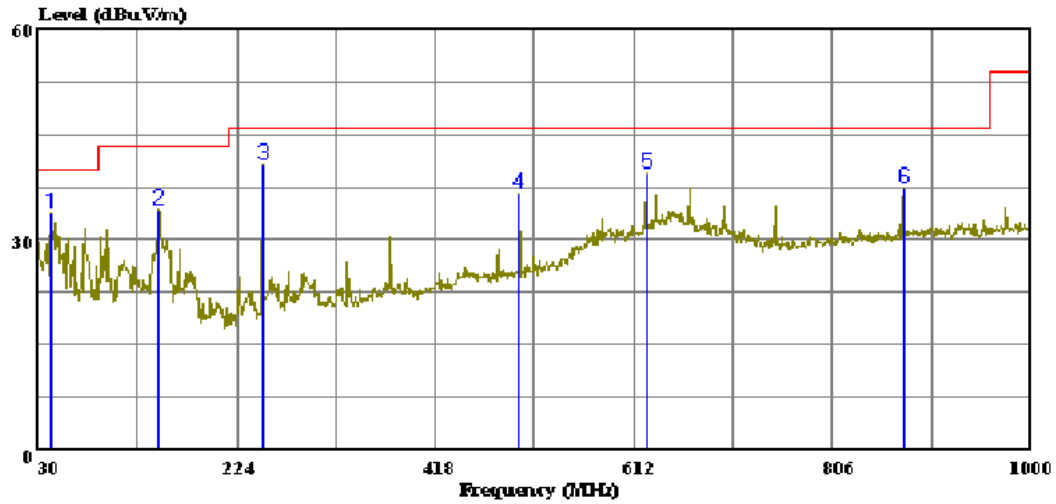
	Freq	Read Level	Level	Over Limit	Remark
	MHz	dBuV	dBuV/m	dB	
1	249.220	54.10	39.91	-6.09	Peak
2	499.480	44.30	36.90	-9.10	Peak
3	750.710	41.70	38.93	-7.07	Peak
4	875.840	35.80	34.48	-11.52	Peak
5	975.750	38.40	37.65	-16.35	Peak

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

VERTICAL DATA

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 10 File#: 07u11257.emi Date: 10-12-2007 Time: 10:11:37



Trace: 9 Ref Trace:

Condition: FCC CLASS-B 3m VERTICAL
Engineer: : Thanh Nguyen
Company: : Apple Computer Inc.
Project #: : 07U11257
Test Configuration:: EUT with Remote Support Laptop
Mode of operation: : Wireless link, play music and R/W to HD
Test Target: : FCC Class B

Page: 1

	Freq	Read Level	Level	Over Limit	Remark
	MHz	dBuV	dBuV/m	dB	
1	41.640	46.49	33.64	-6.36	Peak
2	148.340	47.93	34.19	-9.31	Peak
3	249.220	55.00	40.81	-5.19	Peak
4	499.480	44.00	36.60	-9.40	Peak
5	624.610	44.30	39.36	-6.64	Peak
6	875.840	38.60	37.28	-8.72	Peak

8.4. POWERLINE CONDUCTED EMISSIONS

LIMIT

RSS-Gen 7.2.2

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommnication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.

Table 2 – AC Power Lines Conducted Emission Limits

Frequency of Emission (MHz)	Conducted 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.

RESULTS

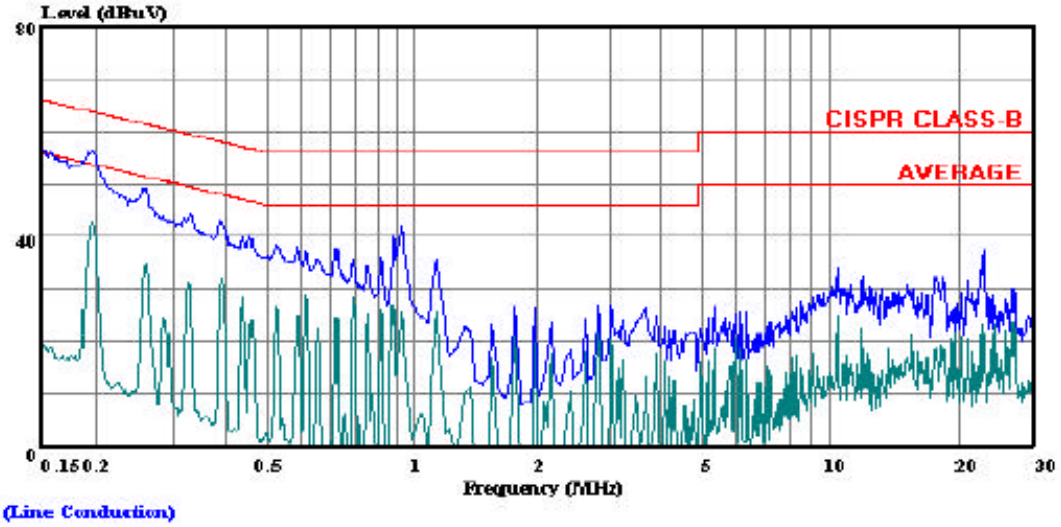
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit		Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.20	53.64	--	42.47	0.00	63.82	53.82	-10.18	-11.35	L1
1.03	41.90	--	25.71	0.00	56.00	46.00	-14.10	-20.29	L1
23.02	37.46	--	23.25	0.00	60.00	50.00	-22.54	-26.75	L1
0.20	54.88	--	41.58	0.00	63.82	53.82	-8.94	-12.24	L2
0.99	39.78	--	27.28	0.00	56.00	46.00	-16.22	-18.72	L2
23.02	33.60	--	22.22	0.00	60.00	50.00	-26.40	-27.78	L2
6 Worst Data									

LINE 1 RESULTS

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 7 File#: 07U111257LC.EMI Date: 10-16-2007 Time: 08:39:50



(Line Conduction)

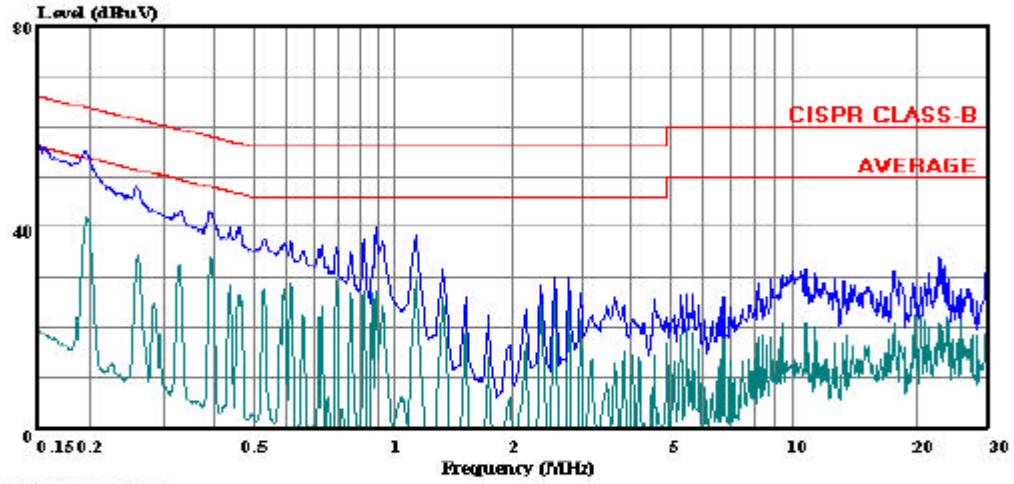
Trace: 5 Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Thanh Nguyen
Project #: : 07U11257
Company: : APPLE COMPUTER INC.
Configuration:: EUTand Support Equipment
Mode: : Transmit worst case 2.4GHz
Target: : FCC Class B
Voltage: : 115VAC/ 60Hz
: L1: PEAK (Blue); AVG. (Green)

LINE 2 RESULTS

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 14 File#: 07U111257LC.EMI Date: 10-16-2007 Time: 08:52:01



(Line Conduction)

Trace: 12 Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Thanh Nguyen
Project #: : 07U11257
Company: : APPLE COMPUTER INC.
Configuration:: EUTand Support Equipment
Mode: : Transmit worst case 2.4GHz
Target: : FCC Class B
Voltage: : 115VAC/ 60Hz
: L2: PEAK (Blue); AVG. (Green)

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.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

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	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	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 occupational/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 exposed, 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 Exposed 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	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	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	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* 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.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

CALCULATIONS

Given

E = √ (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) / √ S

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

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

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

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

LIMITS

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

RESULTS

(MPE distance is greater than 20 cm)

5150 - 5250 MHz Band

Mode	Band	FCC Limit (mW/cm^2)	IC Limit (W/m^2)	Output (dBm)	Antenna (dBi)	MPE Distance (cm)
802.11a	5.2 GHz	1.0	10.0	12.93	5.66	2.40
02.11n HT20	5.2 GHz	1.0	10.0	20.25	5.66	5.57
802.11n HT40	5.2 GHz	1.0	10.0	20.17	5.66	5.52