



**FCC CFR47 PART 15 SUBPART C
CERTIFICATION**

TEST REPORT

FOR

WIRELESS 802.11 a MESH NETWORKED ETHERNET SERVICE POINT

MODEL NUMBER: 1500S-0101

FCC ID: REP-1500S-1

REPORT NUMBER: 04U3062-2

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Prepared for
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Revision History

<u>Rev.</u>	<u>Revisions</u>	<u>Revised By</u>
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1. TEST RESULT DECLARATION

COMPANY NAME: FIRETIDE, INC.
16795 LARK AVE. SUITE 100
LOS GATOS, CALIFORNIA 95032, USA.

EUT DESCRIPTION: Wireless 802.11 a Mesh Networked Ethernet Service Point

MODEL: 1500S-0101

DATE TESTED: OCTOBER 29, 2004 to DECEMBER 9, 2004

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART E	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.

Approved & Released For CCS By:

Tested By:



YAN ZHENG
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

HITESH H. SOLANKI
EMC ENGINEER
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2. EUT DESCRIPTION

The EUT is an 802.11a/b/g MESH NETWORKED SERVICE POINT

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

5150 to 5250 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5250	802.11a	14.26	26.67

5250 to 5350 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5250 - 5320	802.11a	15.71	37.24

5725 to 5825 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5805	802.11a	12.42	17.46

The radio utilizes two Omni (indoor) antennas for diversity, each with a maximum gain of 5 dBi in the 5.2 GHz band and 4.5 dBi in the 5.8 GHz band.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

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



No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

5. CALIBRATION AND UNCERTAINTY

5.1. 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.

5.2. 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%.

5.3. 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
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	4/23/1900	08/30/05
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/13/05
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/05
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/21/04
RF Filter Section	HP	85420E	3705A00256	11/21/04
30MHz---- 2Ghz	Sunol Sciences	JB1 Antenna	A121003	12/22/04
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	2/4/05
Antenna, Horn, 18 ~ 26 GHz	ARA	MWH-1826/B	1013	9/12/05
Amplifier 1-26GHz	MITEQ	NSP2600-SP	924342	4/25/05
Spectrum Analyzer 20 Hz ~ 44 GHz	Agilent	E4446A	US42070220	4/1/05
1.5 GHz High Pass Filter	Micro-Tronics	HPM13193	2	N/A
5.15 - 5.35GHz Band Reject Filter	Micro-Tronics	BRC13190	1	N/A
5.725 - 5.825GHz Band Reject Filter	Micro-Tronics	BRC13192	1	N/A

6. SETUP OF EQUIPMENT UNDER TEST

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
LAPTOP	IBM	THINKPAD 600E	78-PCX37	4U6JPN-32476-DT-E
AC ADAPTER	IBM	02K6557	N/A	N/A
AC ADAPTER	SINO-AMERICAN	SAL115A	N/A	N/A

SUPPORT EQUIPMENT

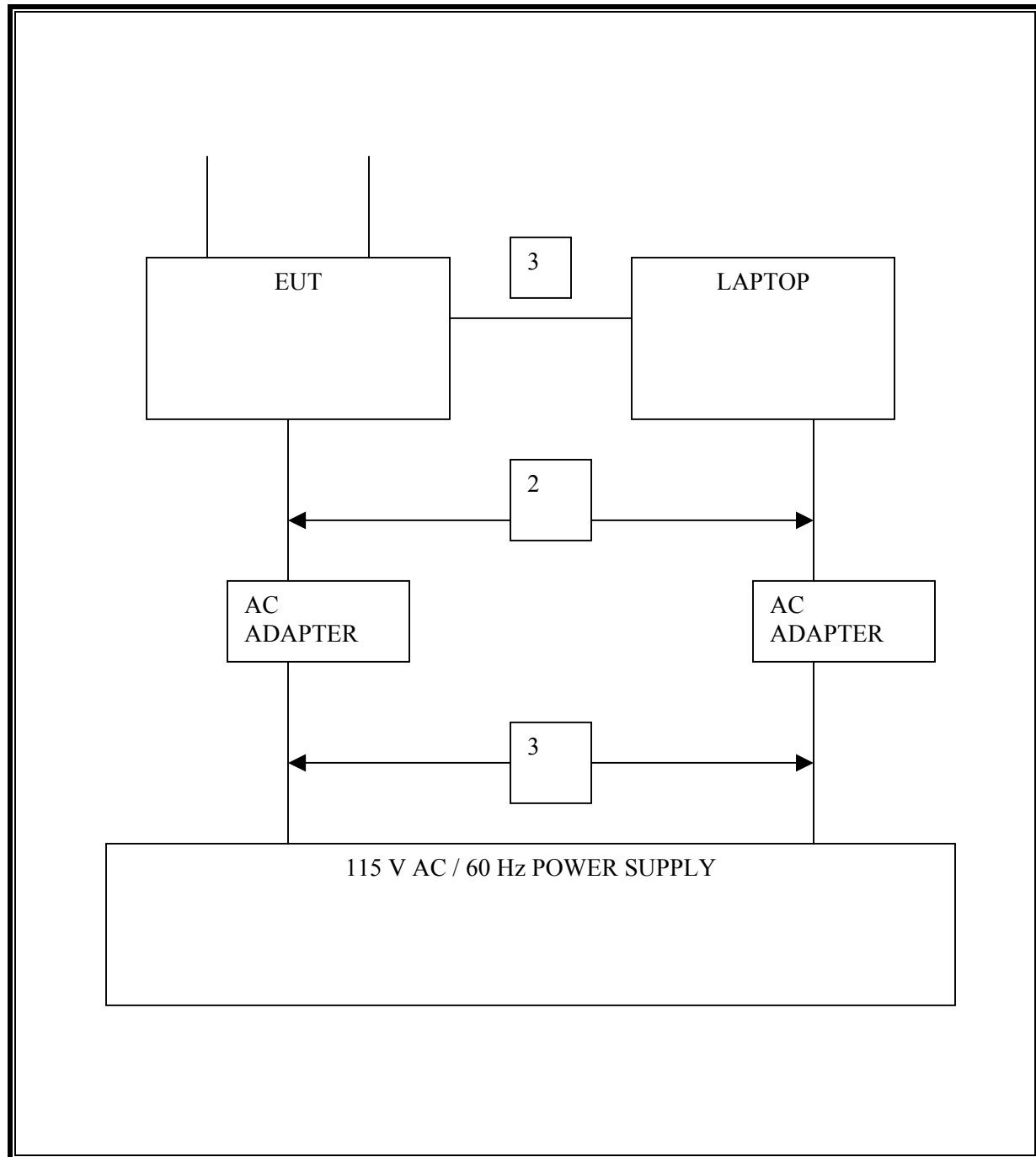
I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	AC	Un-Shielded	1m	N/A
2	DC	2	DC	Un-Shielded	1m	N/A
3	SERIAL	1	RS - 232	Un-Shielded	2m	N/A

TEST SETUP

For configuration purposes it was connected to a support Laptop via the serial port.
To operate the EUT in desired band and on desired channel with specific output power, the Atheros Radio Test (ART) software was used.

SETUP DIAGRAM FOR TESTS



SETUP OF EQUIPMENT UNDER TEST (DIGITAL)

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
LAPTOP	IBM	THINKPAD 600E	78-PCX37	4U6JPN-32476-DT-E
AC ADAPTER	IBM	02K6557	N/A	N/A
AC ADAPTER	SINO-AMERICAN	SAL115A	N/A	N/A

SUPPORT EQUIPMENT

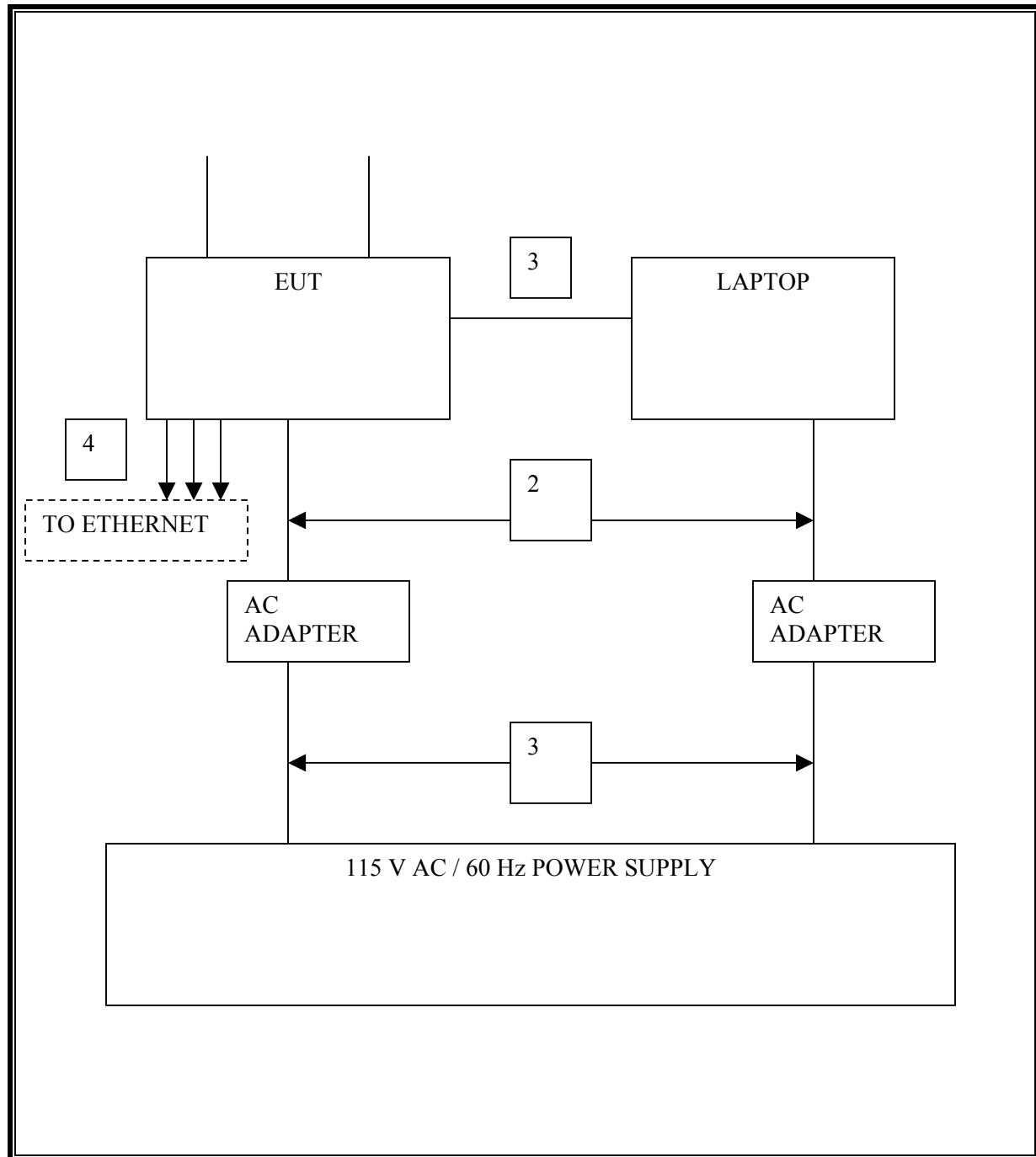
I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	AC	Un-Shielded	1m	N/A
2	DC	2	DC	Un-Shielded	1m	N/A
3	SERIAL	1	RS - 232	Un-Shielded	2m	N/A
4	ETHERNET	3	RJ 45	Un-Shielded	3m	N/A

TEST SETUP

For configuration purposes it was connected to a support Laptop via the serial port.
To operate the EUT in desired band and on desired channel with specific output power, the Atheros Radio Test (ART) software was used.

SETUP DIAGRAM FOR TESTS (DIGITAL)



7. APPLICABLE LIMITS AND TEST RESULTS

7.1. CHANNEL TESTS FOR THE 5150 TO 5350 MHz BAND

7.1.1. EMISSION BANDWIDTH

LIMIT

§15.403 (i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a sample detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 26 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

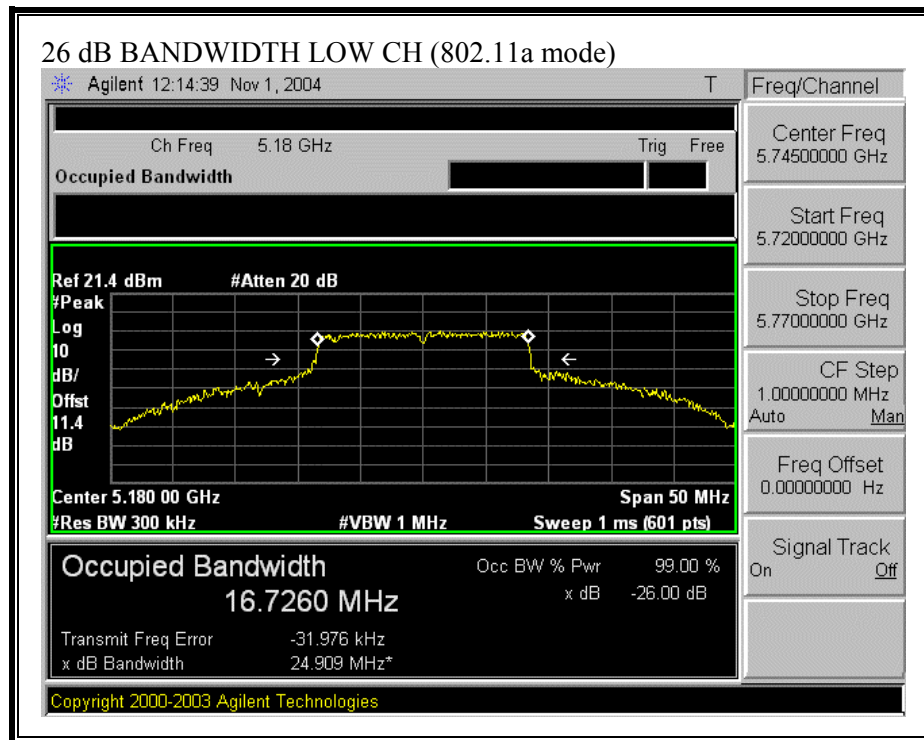
RESULTS

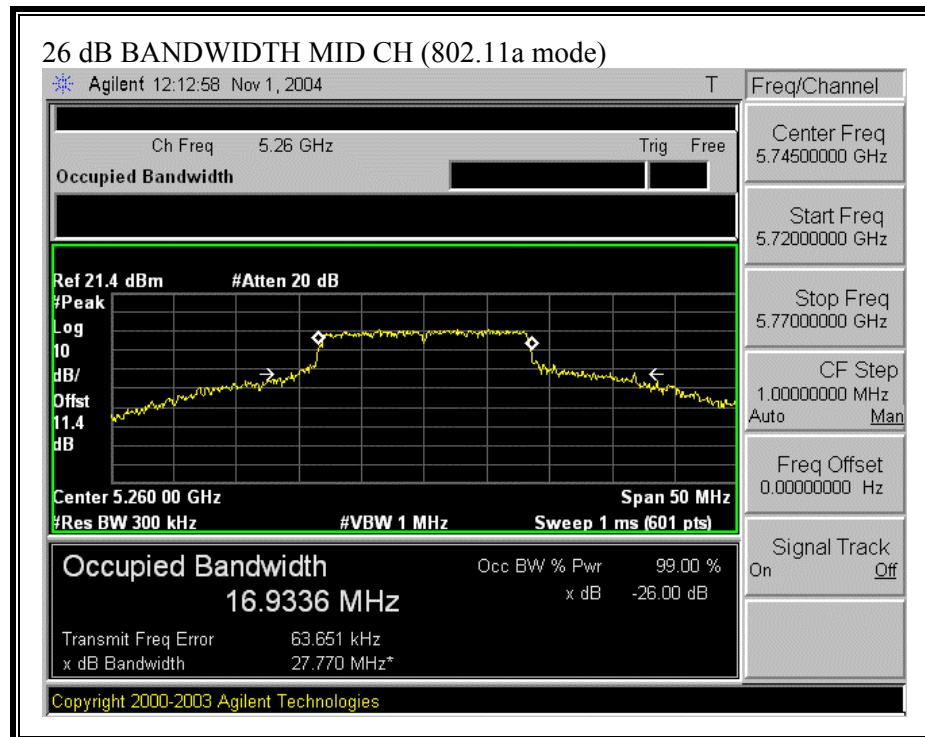
No non-compliance noted:

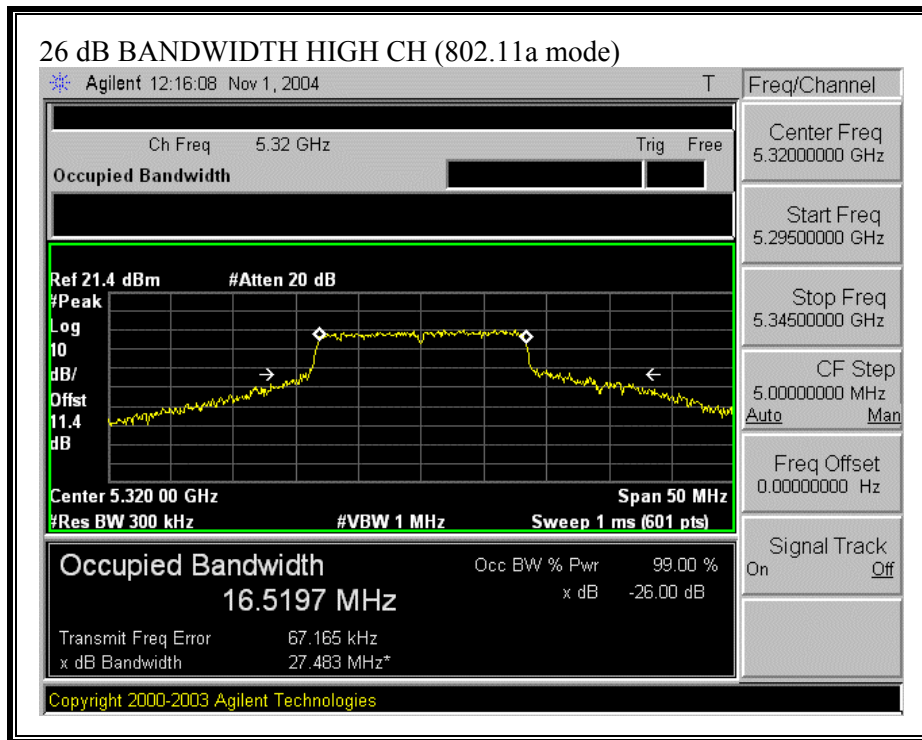
802.11a Mode

Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5180	24.91	13.96
Middle	5260	27.77	14.44
High	5320	27.48	14.39

26 dB EMISSION BANDWIDTH (802.11a MODE)







7.1.2. PEAK POWER

LIMIT

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, 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.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, 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.

LIMITS AND RESULTS

No non-compliance noted:

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	17	24.909	17.96	5.00	17.00

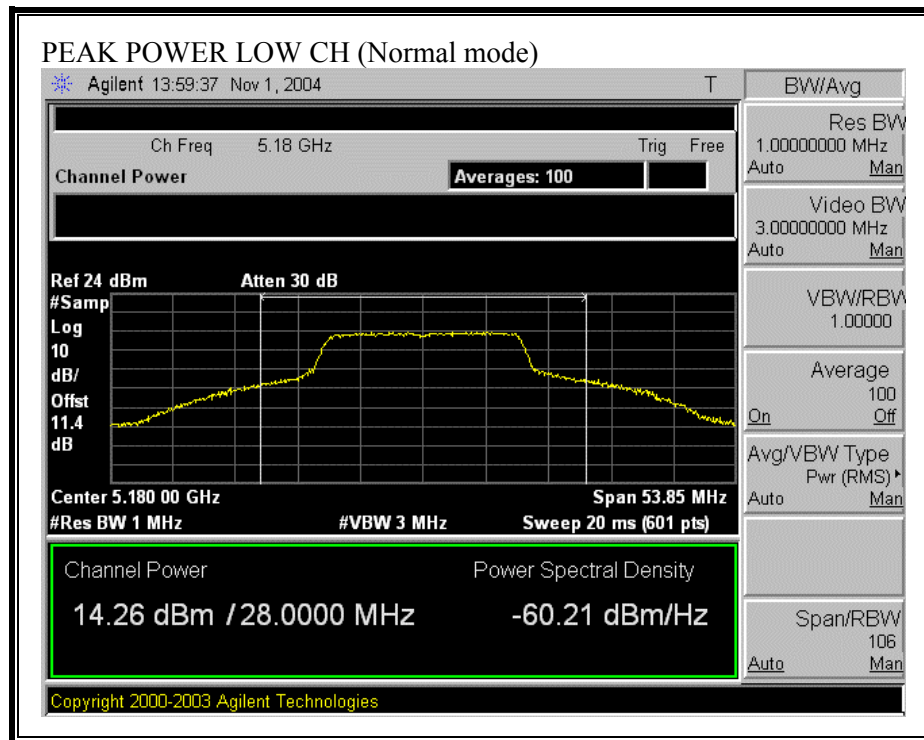
Limit in 5250 to 5350 MHz Band

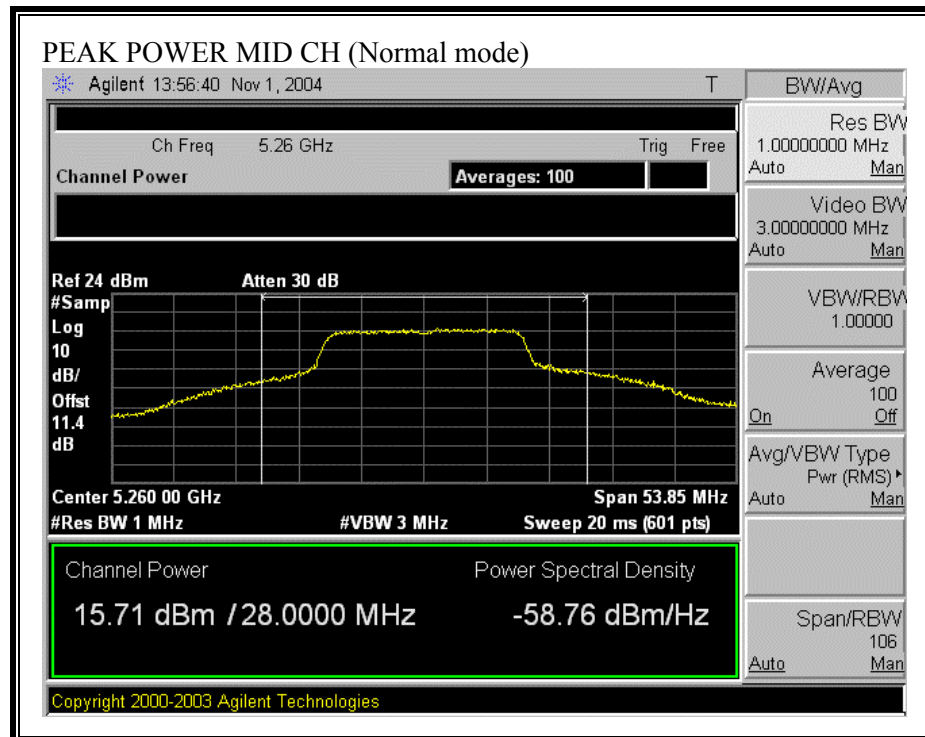
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5260	24	27.77	25.44	5.00	24.00
High	5320	24	27.483	25.39	5.00	24.00

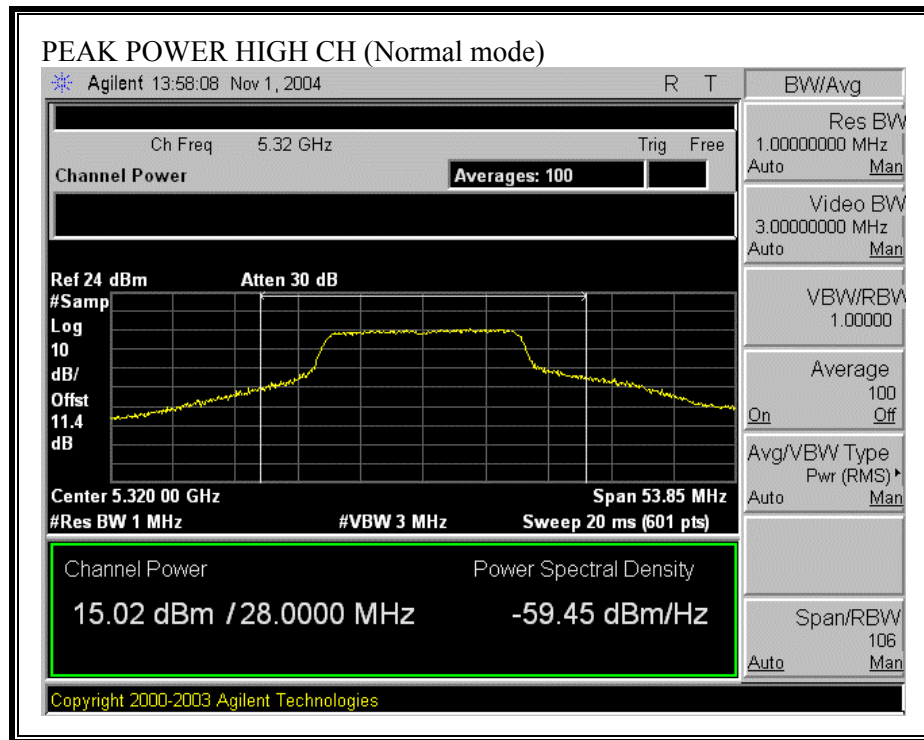
Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	14.26	17.00	-2.74
Mid	5260	15.71	24.00	-8.29
High	5320	15.02	24.00	-8.98

PEAK POWER (NORMAL MODE)







7.1.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§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.

CALCULATIONS

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S} \quad \text{Equation (1)}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

Equation (1) and the measured peak power is used to calculate the MPE distance.

LIMITS

From §1.1310 Table 1 (B), $S = 1.0 \text{ mW/cm}^2$

RESULTS

No non-compliance noted:

Mode	Power Density Limit (mW/cm²)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11a	1.0	15.71	5.00	3.06

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

7.1.4. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted:

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5180	13.90
Middle	5260	15.30
High	5320	14.30

7.1.5. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.407 (a) (1) For the band 5.15-5.25 GHz, 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.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain = 5 dBi, therefore there is no reduction due to antenna gain.

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.

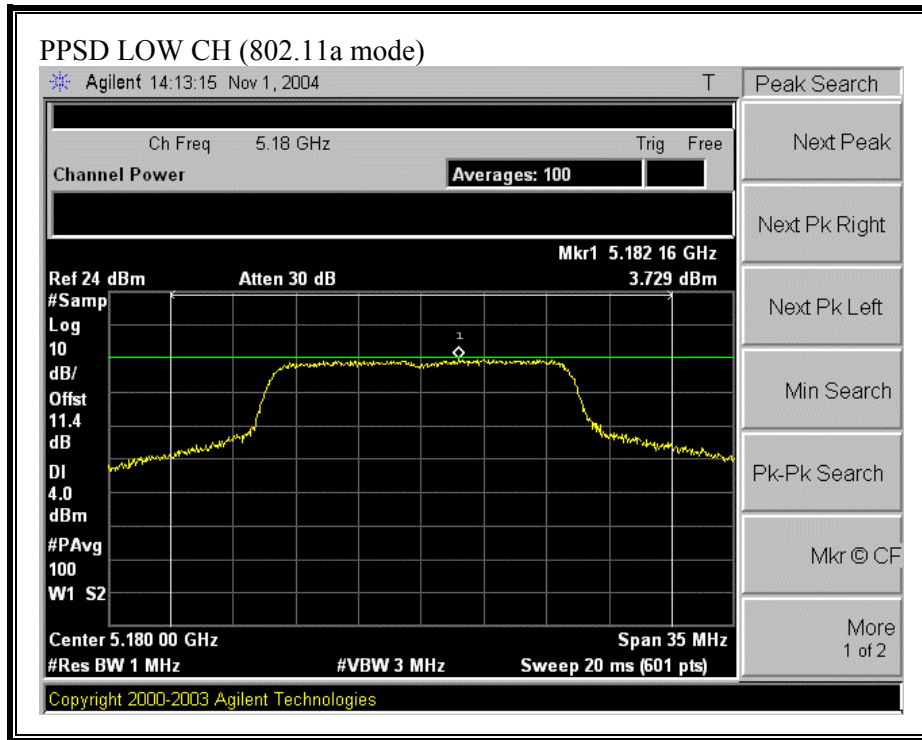
RESULTS

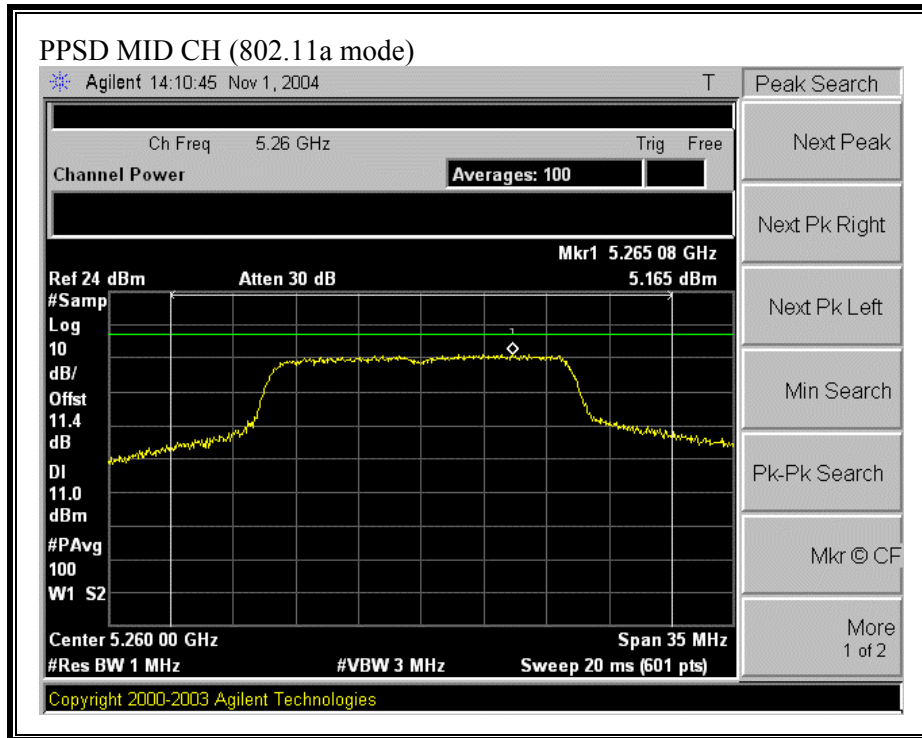
No non-compliance noted:

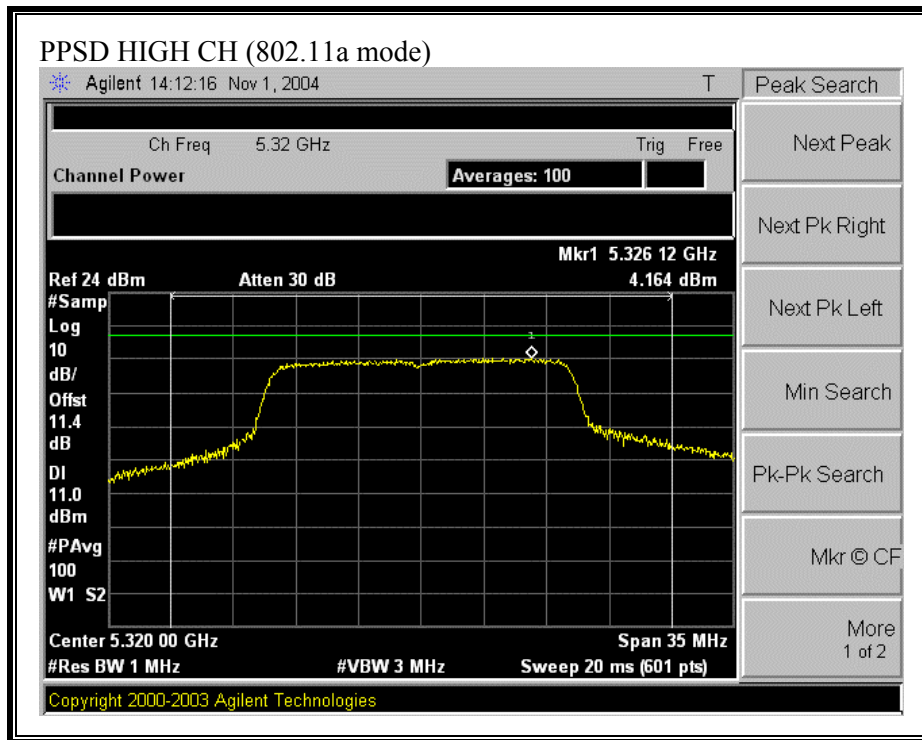
802.11a Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	3.73	4.00	-0.27
Mid	5260	5.17	11.00	-5.84
High	5320	4.16	11.00	-6.84

PEAK POWER SPECTRAL DENSITY (802.11a MODE)







7.1.6. PEAK EXCURSION

LIMIT

§15.407 (a) (6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

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

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

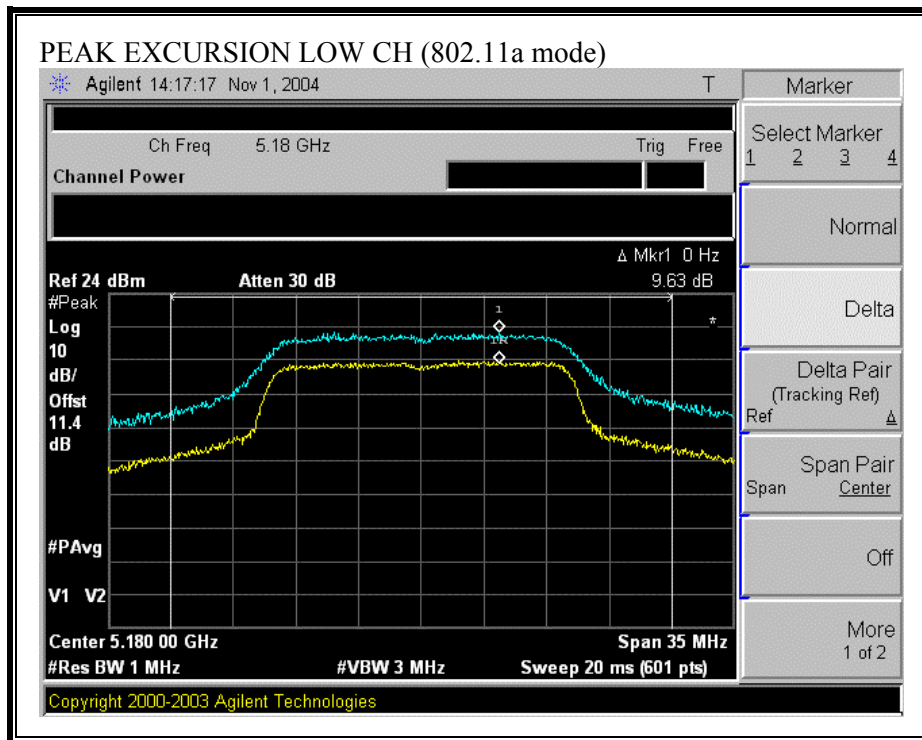
RESULTS

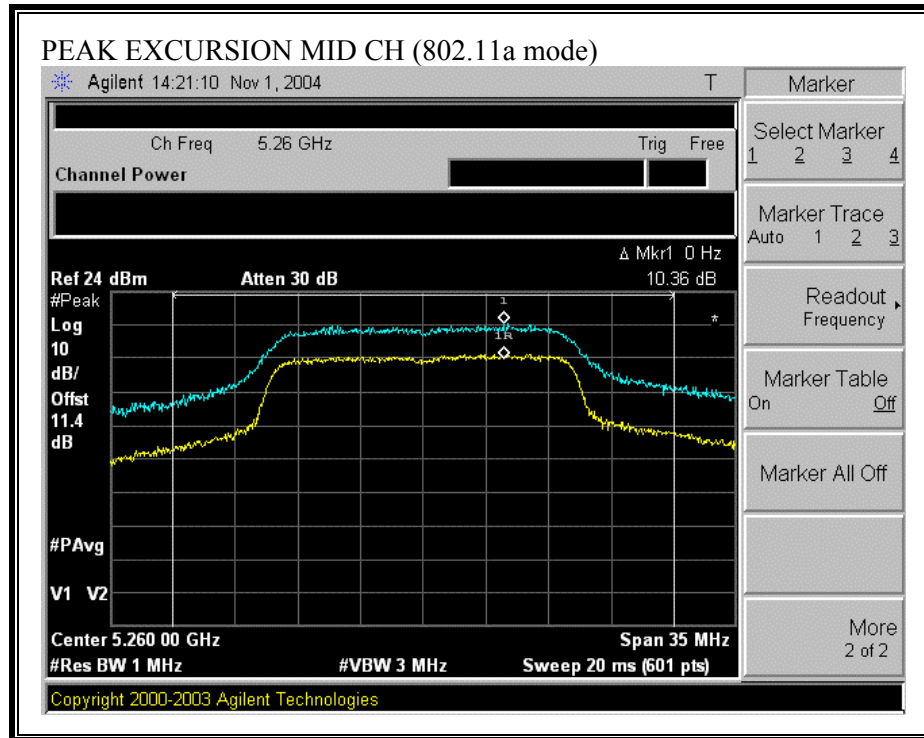
No non-compliance noted:

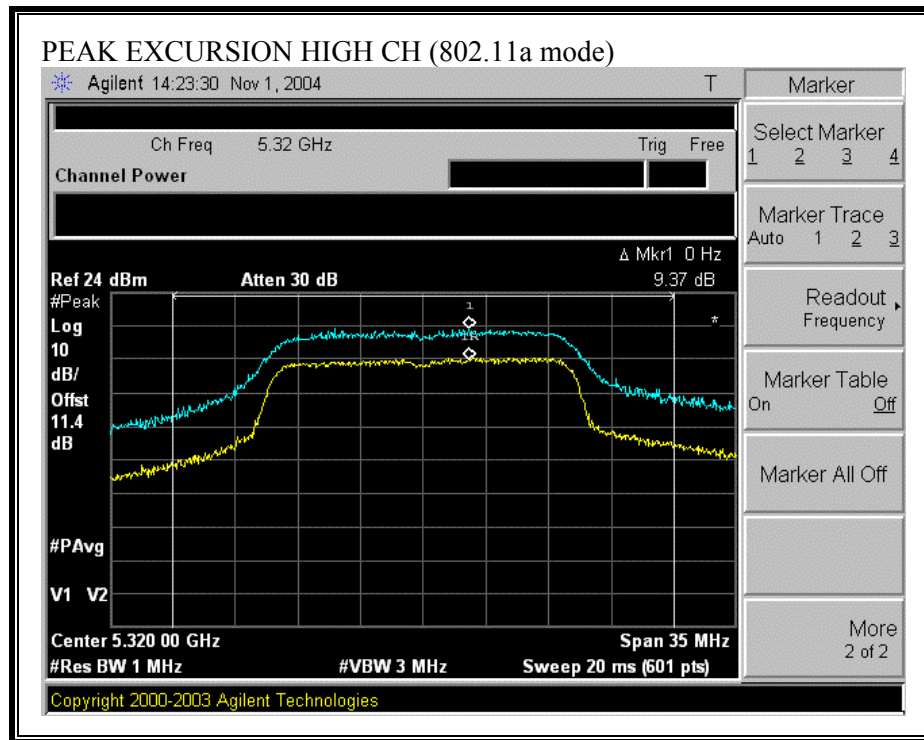
802.11a Mode

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	9.63	13	-3.37
Middle	5260	10.36	13	-2.64
High	5320	9.37	13	-3.63

PEAK EXCURSION (802.11a MODE)







7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.407 (b) (1 & 2) For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm / 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.

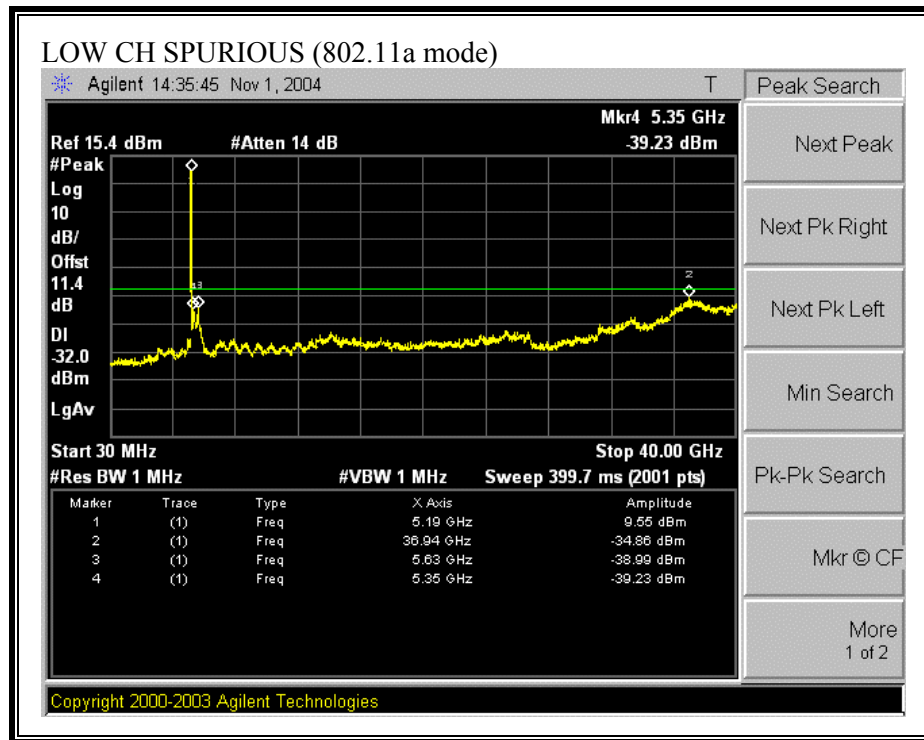
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

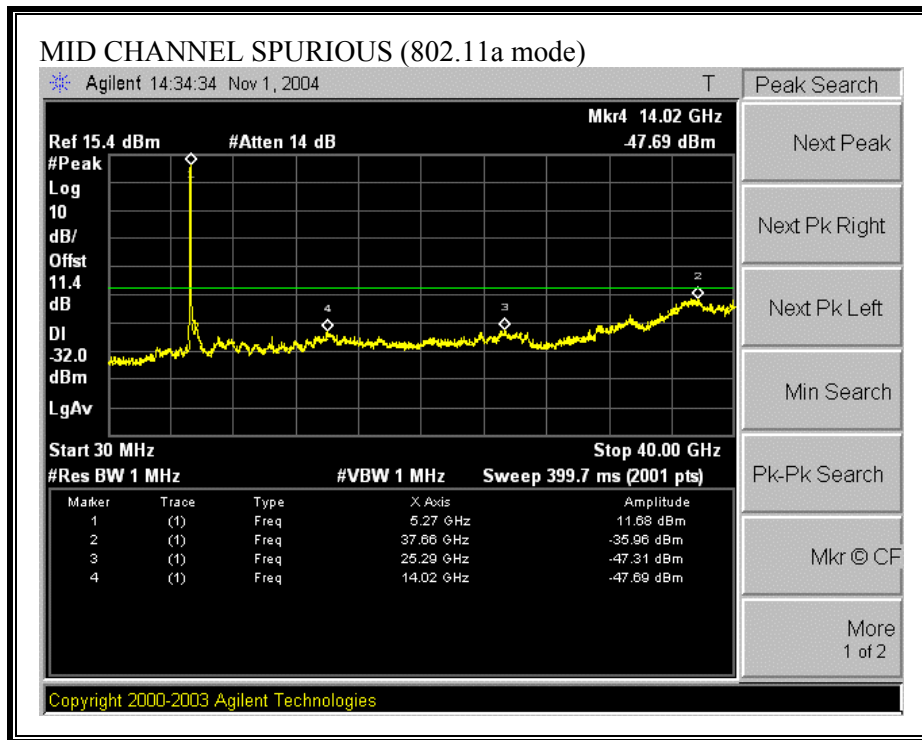
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

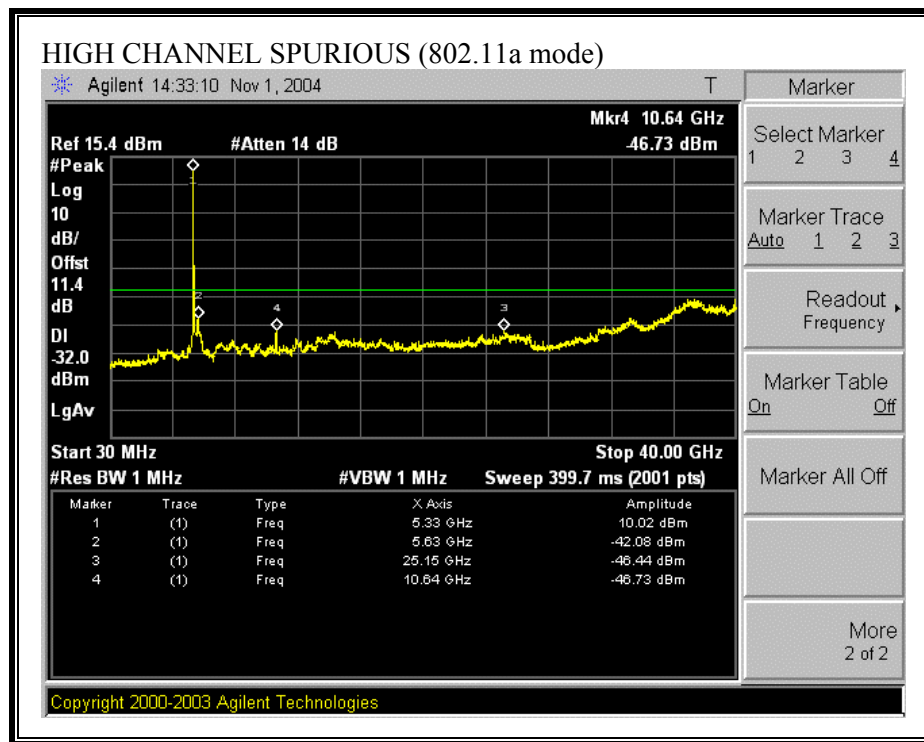
RESULTS

No non-compliance noted:

SPURIOUS EMISSIONS (802.11a MODE)







7.2. CHANNEL TESTS FOR THE 5725 TO 5825 MHz BAND

7.2.1. EMISSION BANDWIDTH

LIMIT

§15.403 (i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 26 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

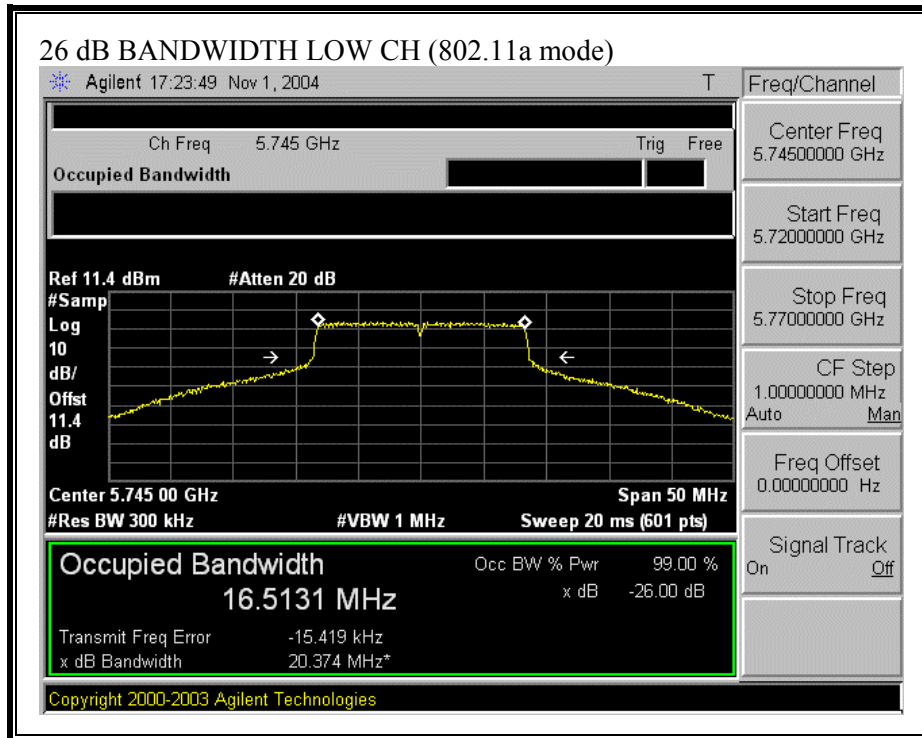
RESULTS

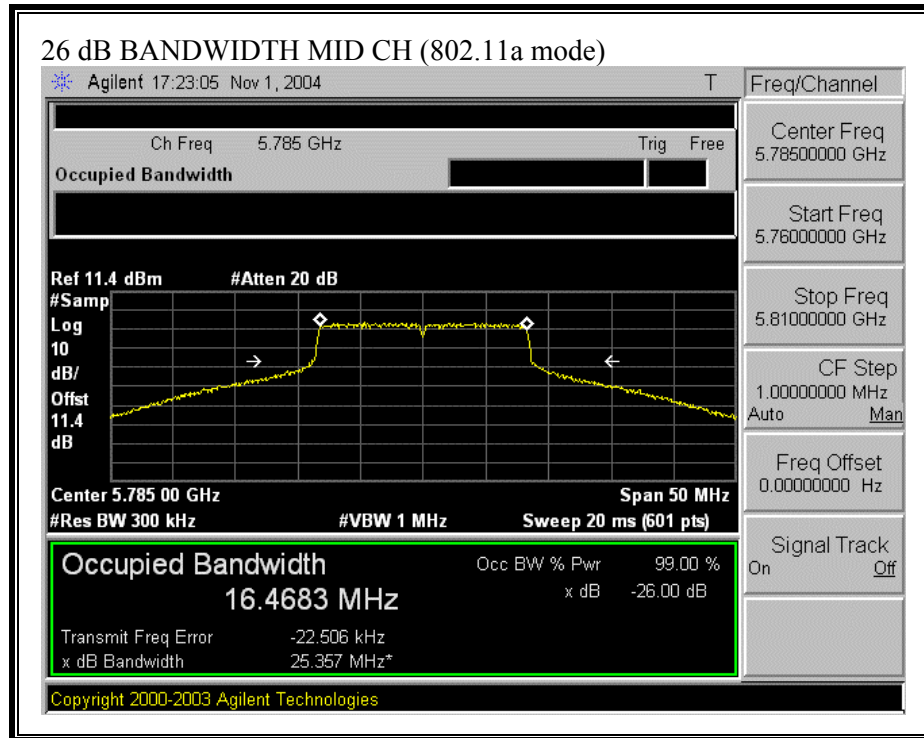
No non-compliance noted:

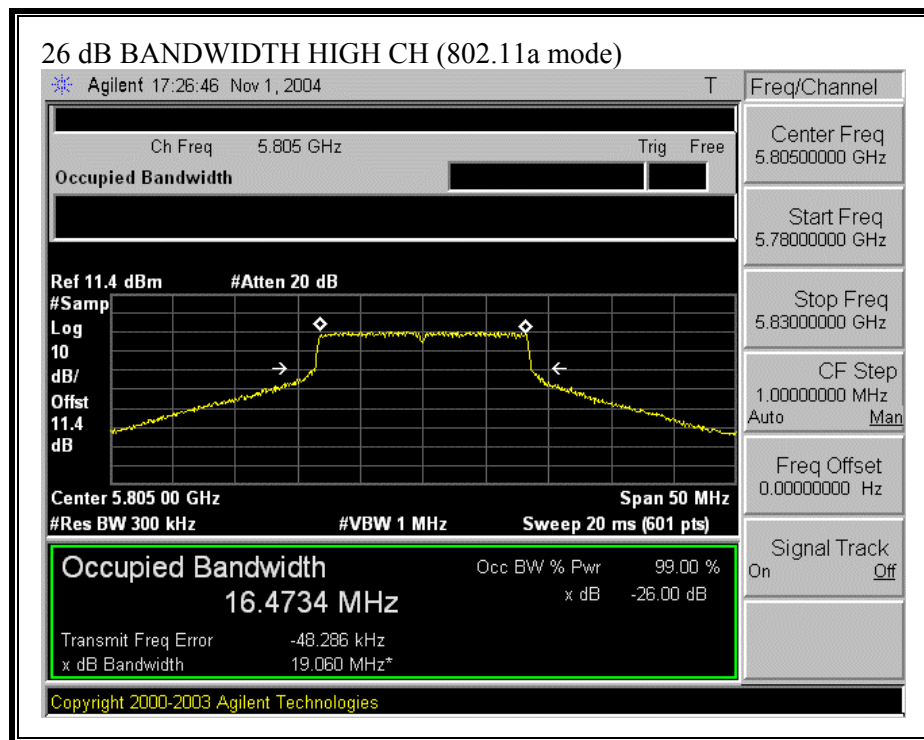
802.11a Mode

Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5745	20.34	13.08
Middle	5785	25.35	14.04
High	5805	19.06	12.80

26 dB EMISSION BANDWIDTH (802.11a MODE)







7.2.2. PEAK POWER

LIMIT

§15.407 (a) (3) For the 5.725–5.825 GHz band, the peak transmit power over the frequency band of operation shall not exceed the lesser of 1 W or $17 \text{ dBm} + 10 \log B$, 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. However, fixed point-to-point U–NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U–NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omni directional applications, and multiple collocated transmitters transmitting the same information. The operator of the U–NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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.

LIMITS AND RESULTS

No non-compliance noted:

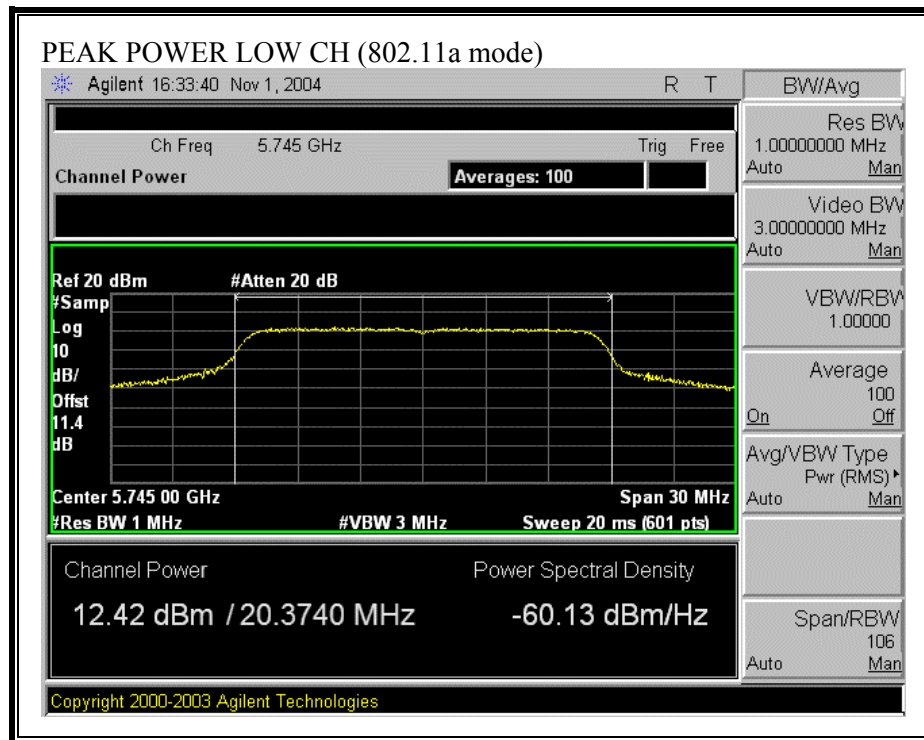
Limit

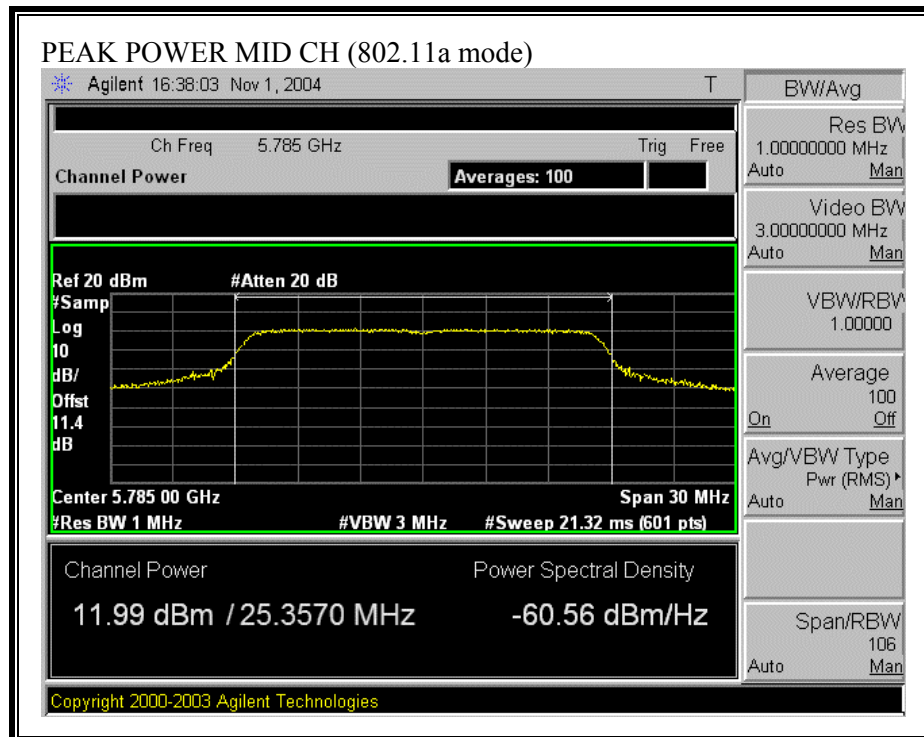
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	17 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5745	30	20.37	30.09	4.5	30.00
Mid	5785	30	25.35	31.04	4.5	30.00
High	5805	30	19.06	29.80	4.5	29.80

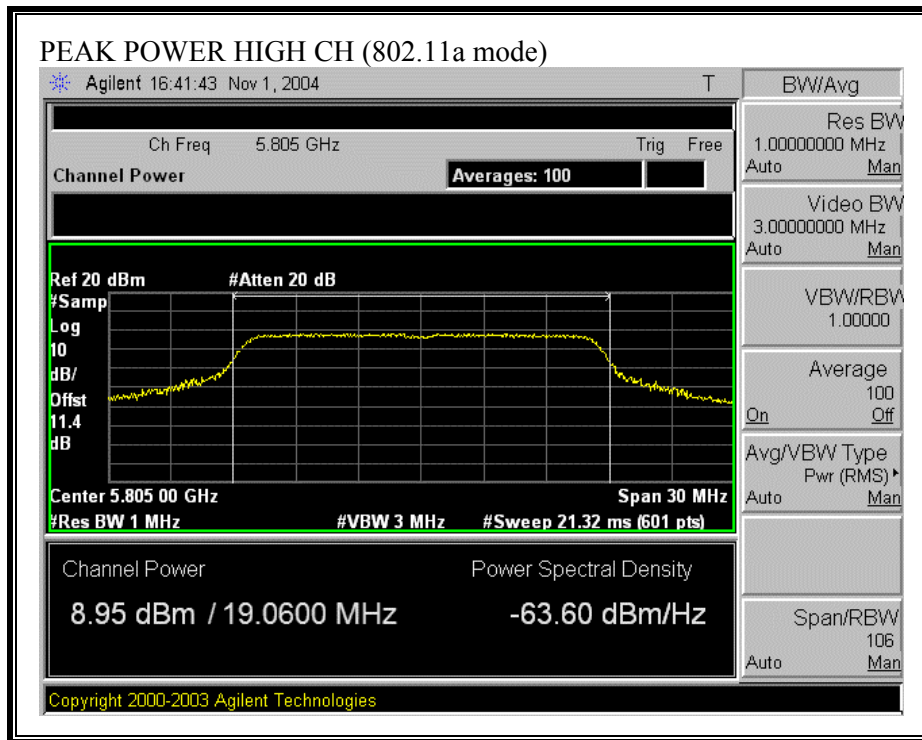
Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	12.42	30.00	-17.58
Middle	5785	11.99	30.00	-18.01
High	5805	8.95	29.80	-20.85

PEAK POWER (802.11a MODE)







7.2.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§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.

CALCULATIONS

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S} \quad \text{Equation (1)}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

Equation (1) and the measured peak power is used to calculate the MPE distance.

LIMITS

From §1.1310 Table 1 (B), $S = 1.0 \text{ mW/cm}^2$

RESULTS

No non-compliance noted:

Mode	Power Density Limit (mW/cm²)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11a	1.0	12.42	4.50	1.98

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

7.2.4. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted:

The cable assembly insertion loss of 11.4 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5745	12.00
Middle	5785	11.00
High	5805	8.70

7.2.5. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.407 (a) (3) For the 5.725–5.825 GHz band, the peak power spectral density shall not exceed 17 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. However, fixed point-to-point U–NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U–NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omni directional applications, and multiple collocated transmitters transmitting the same information. The operator of the U–NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

The maximum antenna gain = 4.5 dBi, therefore there is no reduction due to antenna gain.

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.

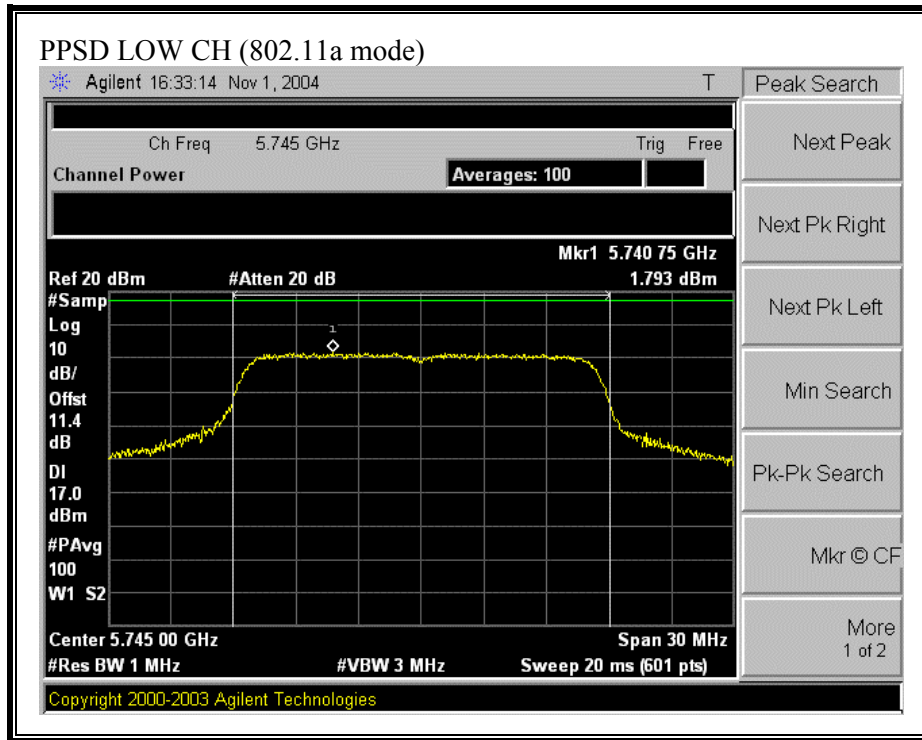
RESULTS

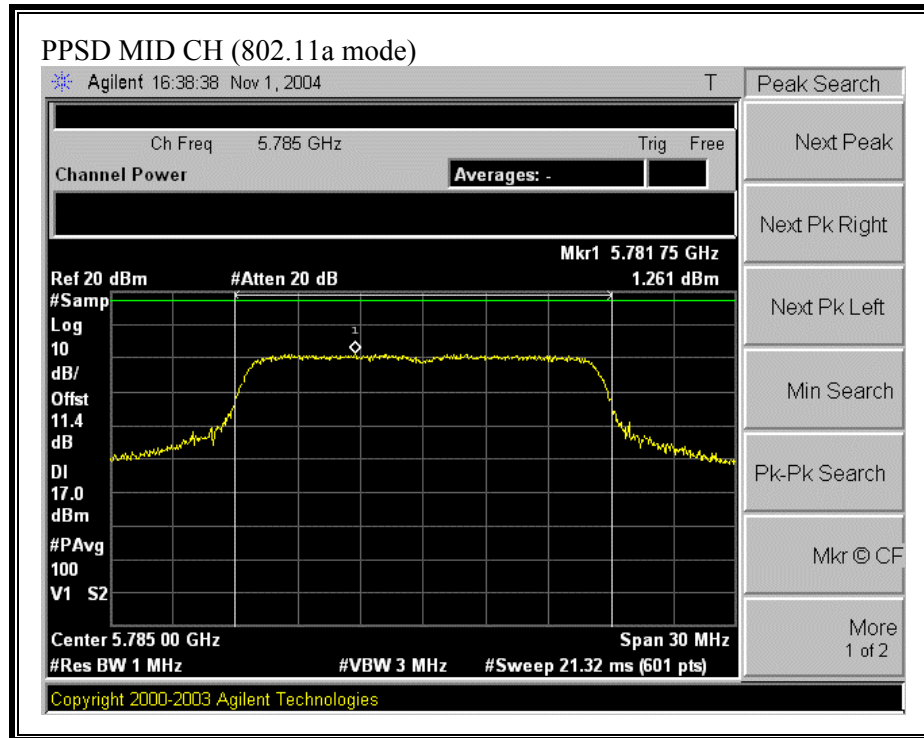
No non-compliance noted:

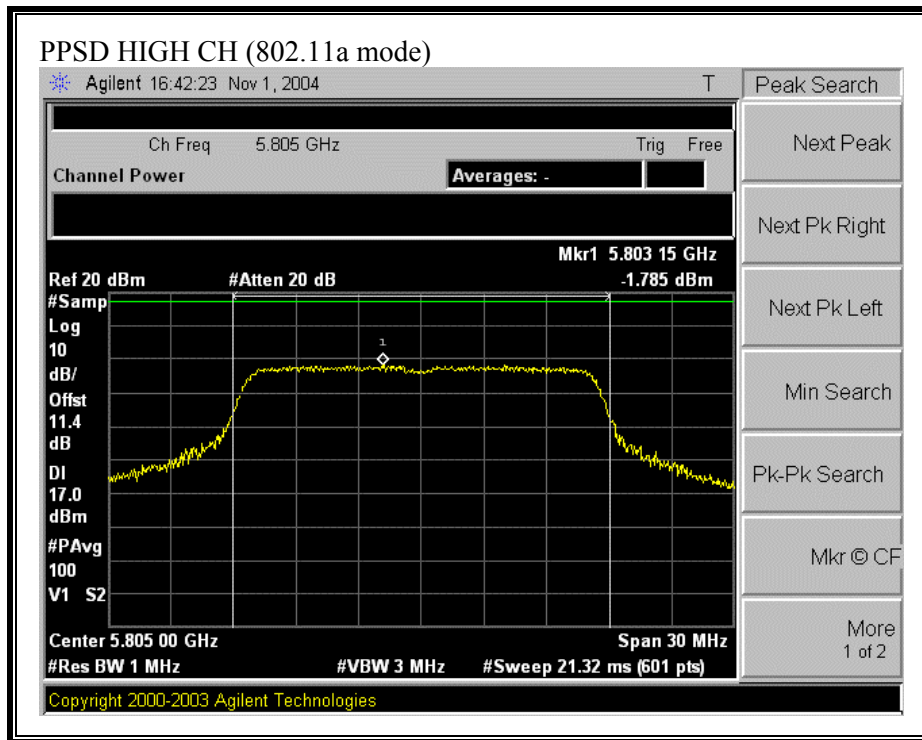
802.11a Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	1.79	17.00	-15.21
Middle	5785	1.26	17.00	-15.74
High	5805	-1.79	17.00	-18.79

PEAK POWER SPECTRAL DENSITY (802.11a MODE)







7.2.6. PEAK EXCURSION

LIMIT

§15.407 (a) (6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

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

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

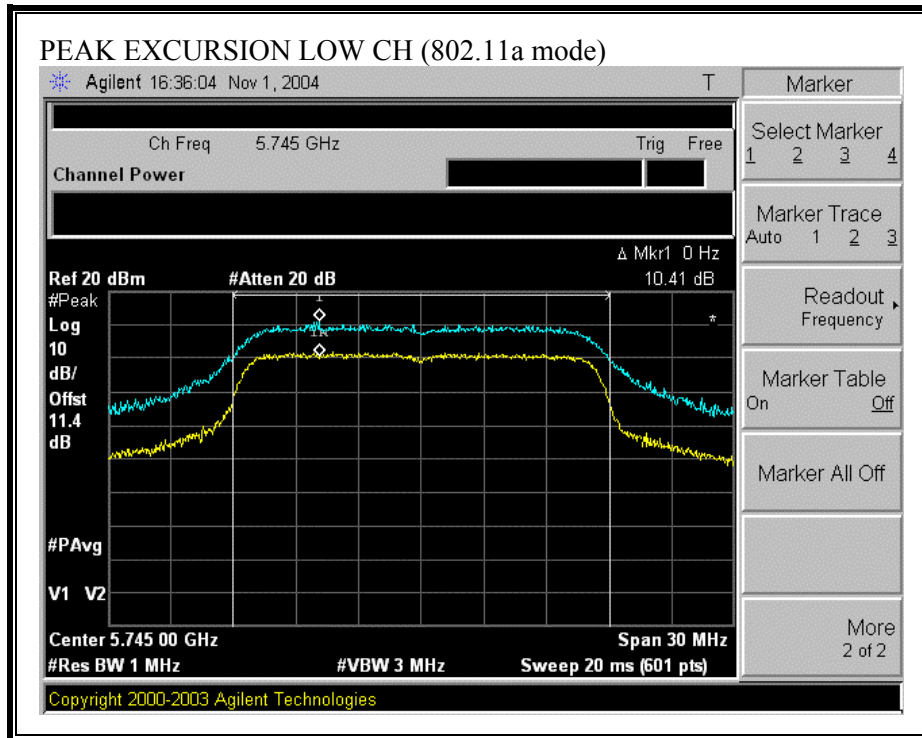
RESULTS

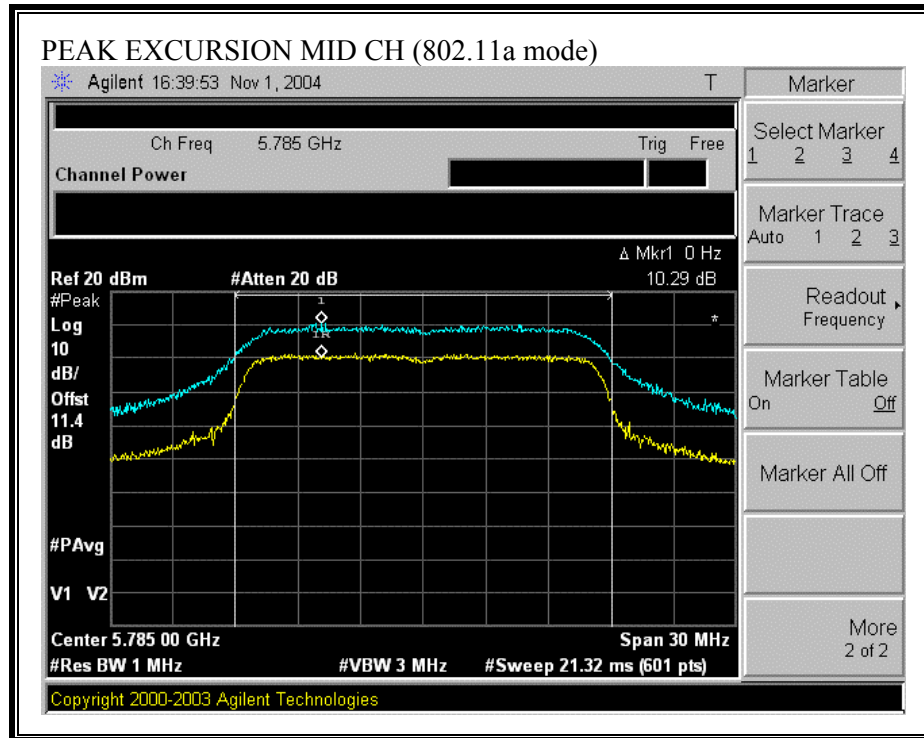
No non-compliance noted:

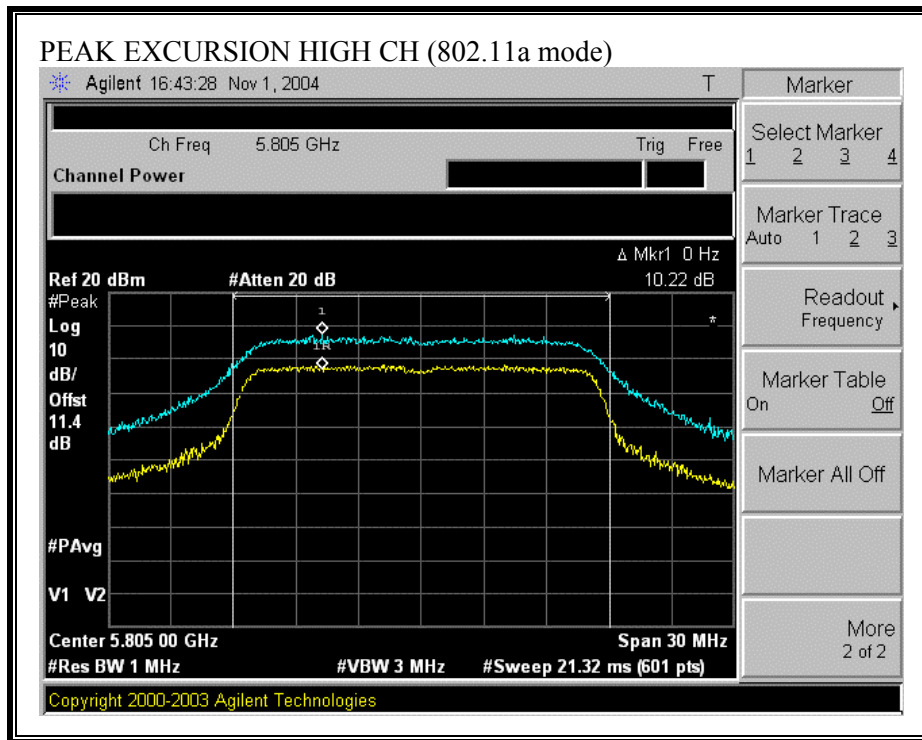
802.11a Mode

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5745	10.41	13	-2.59
Middle	5785	10.29	13	-2.71
High	5805	10.22	13	-2.78

PEAK EXCURSION (802.11a MODE)







7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.407 (b) (4) For transmitters operating in the 5.725–5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions 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.

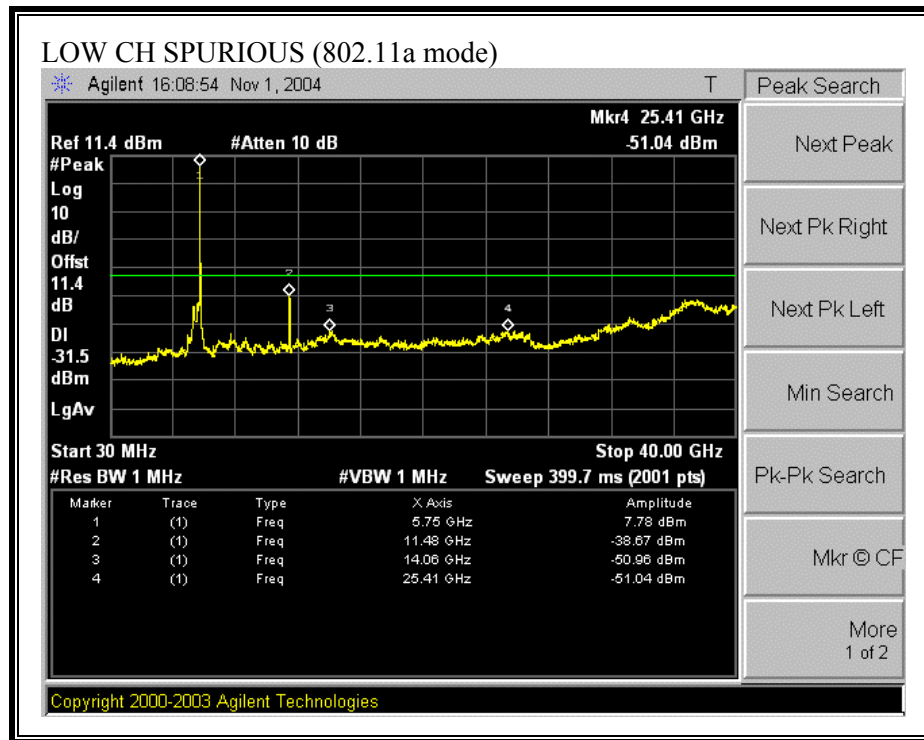
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

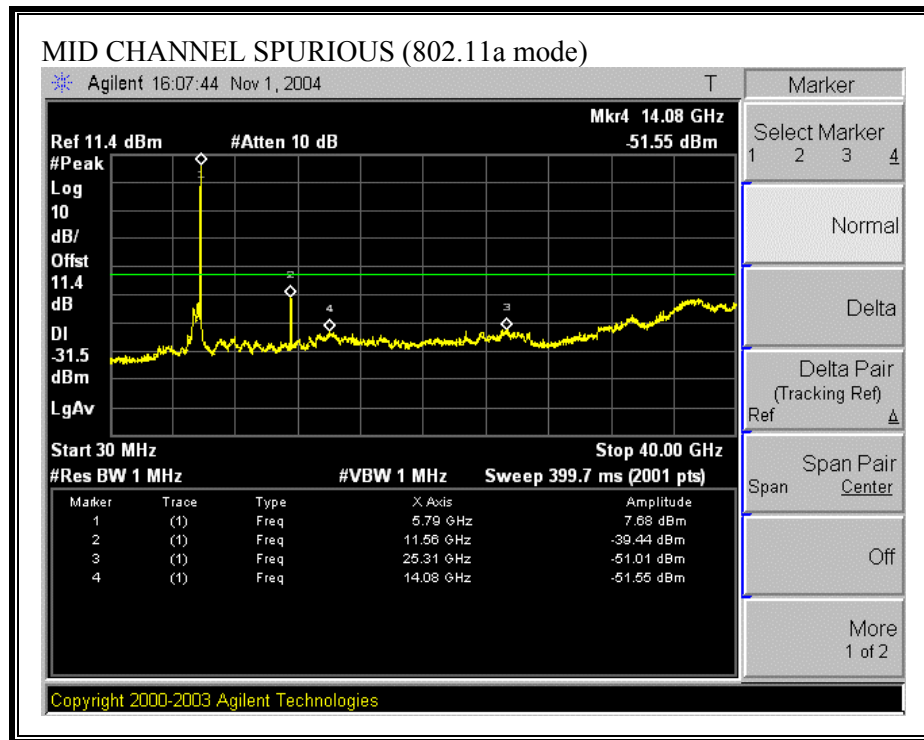
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

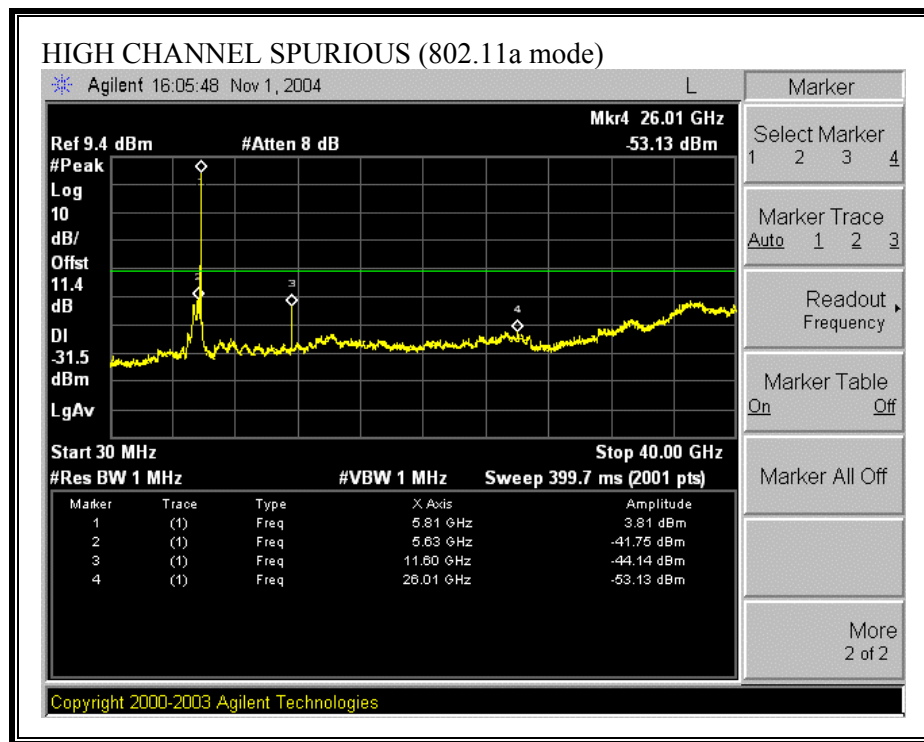
RESULTS

No non-compliance noted:

SPURIOUS EMISSIONS (802.11a MODE)







7.3. RADIATED EMISSIONS

7.3.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

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.

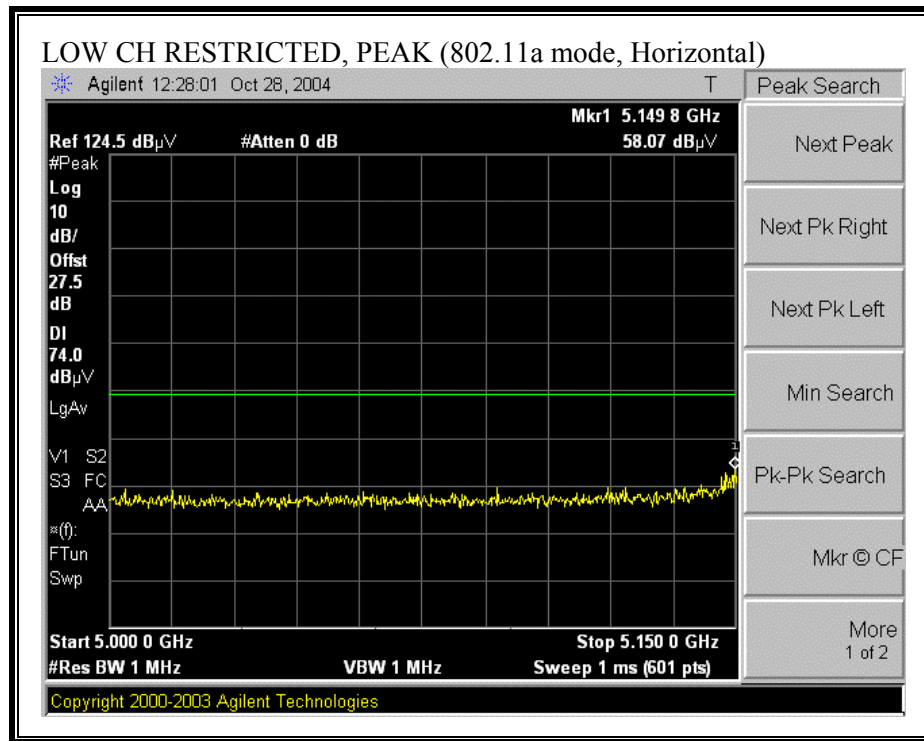
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

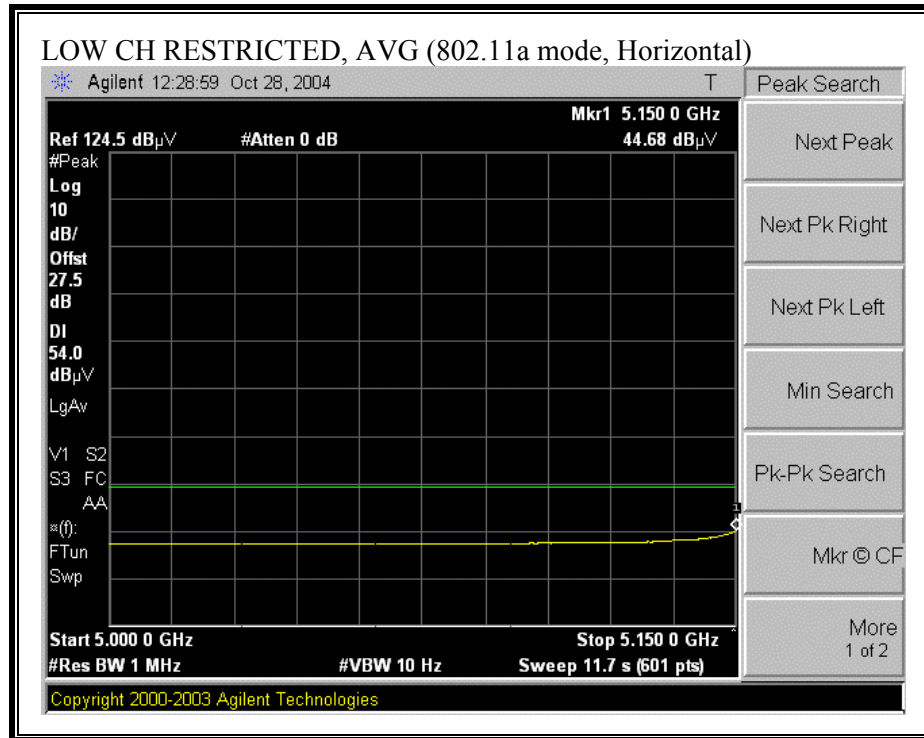
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each band.

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.

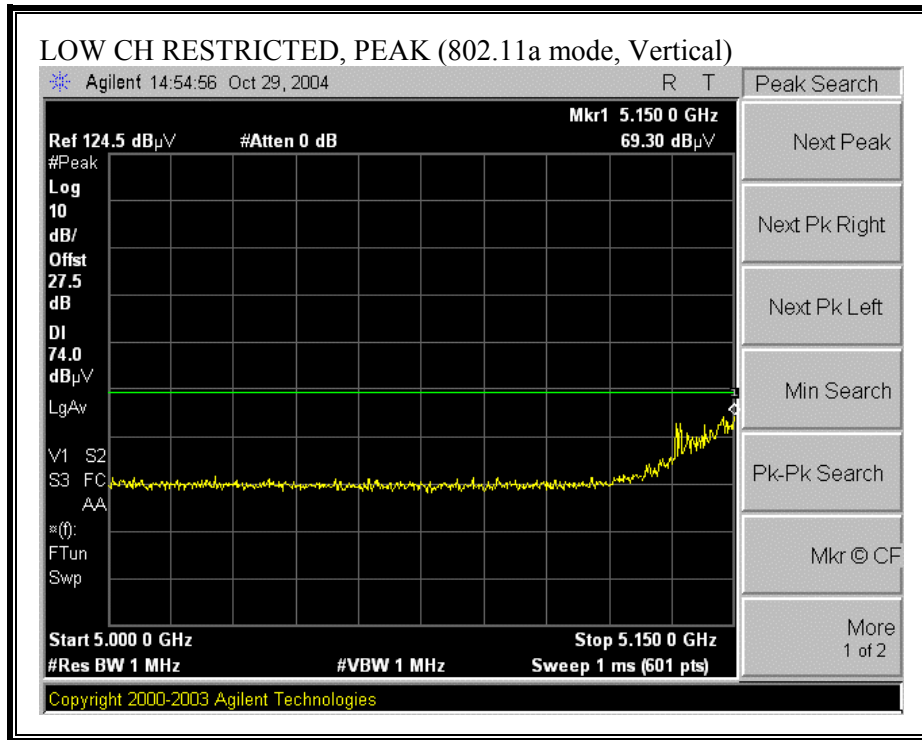
7.3.2. TRANSMITTER ABOVE 1 GHZ FOR 5150 TO 5350 MHz BAND

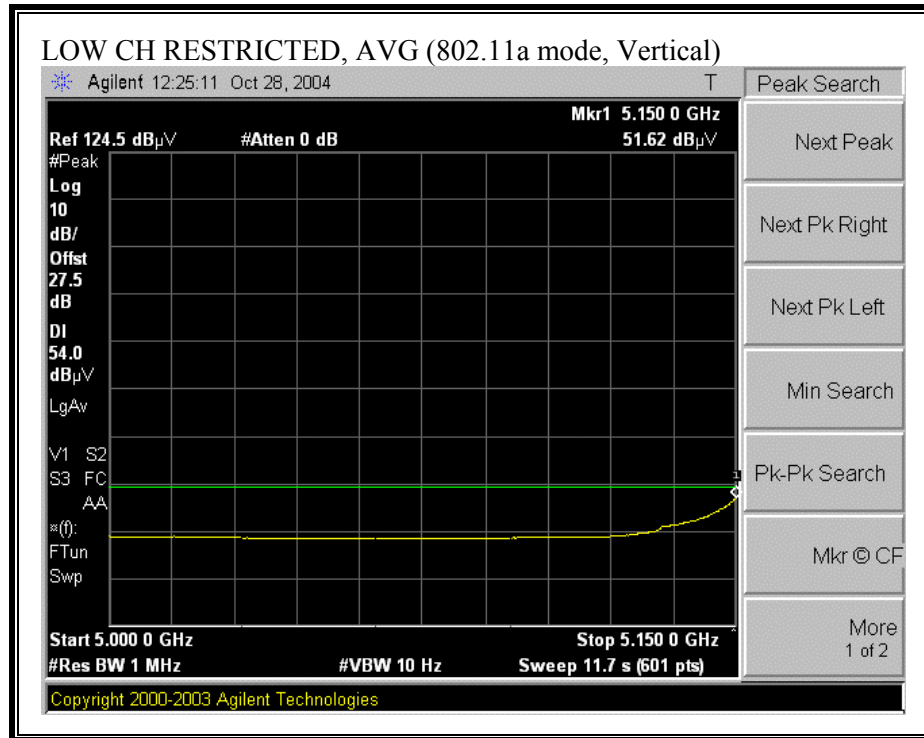
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)

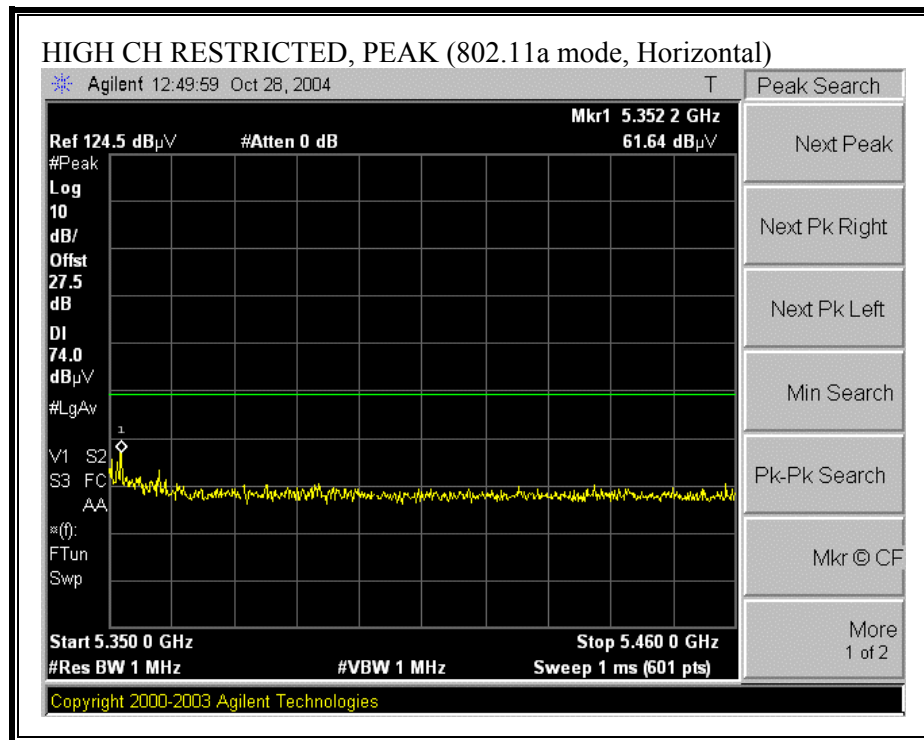


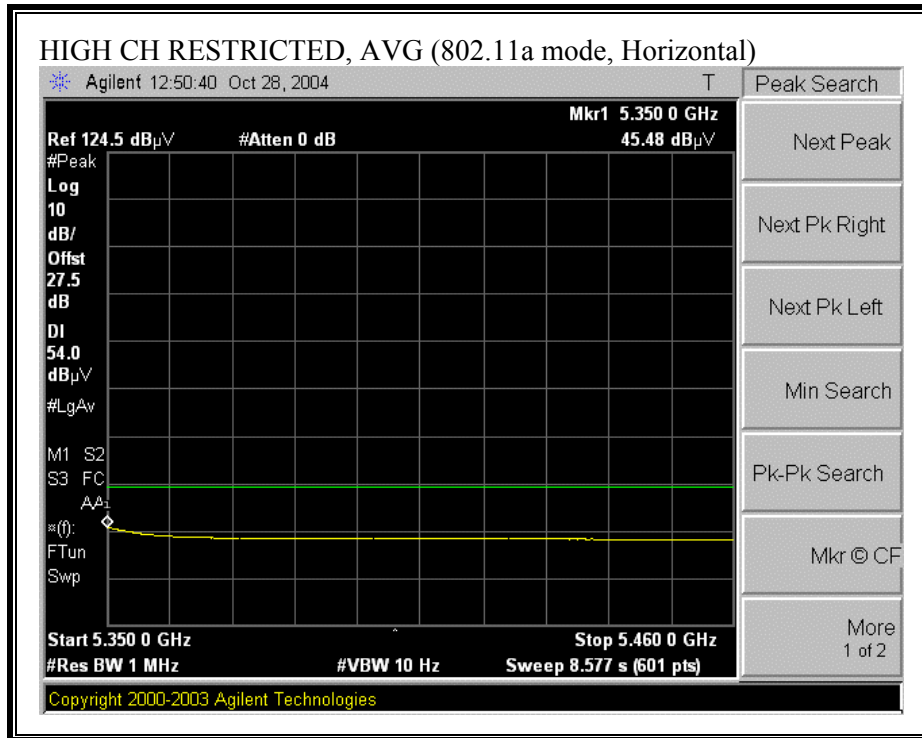


RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)

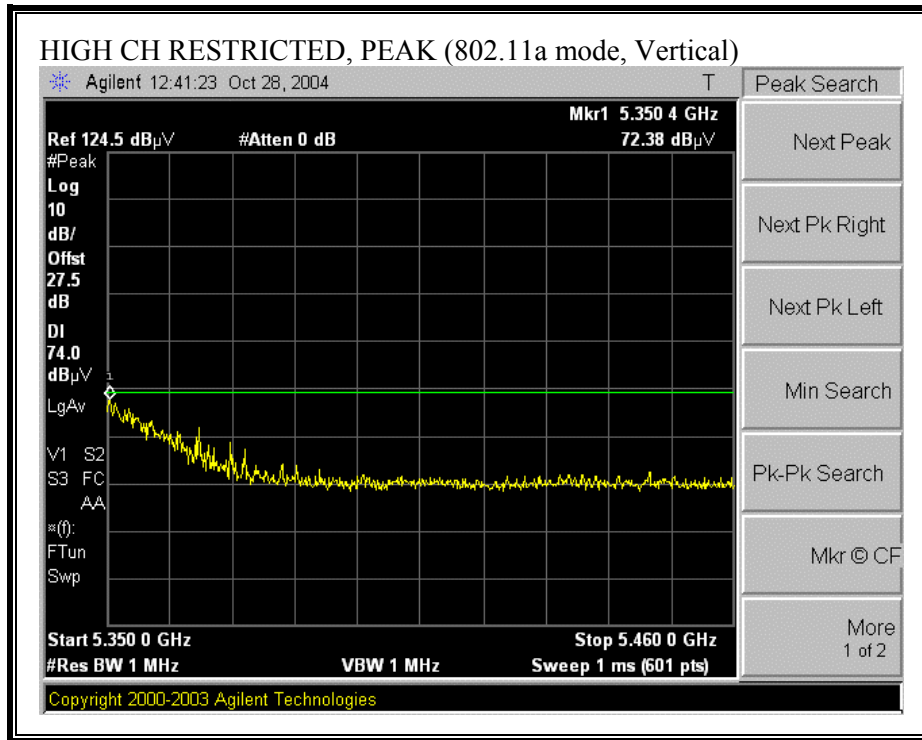


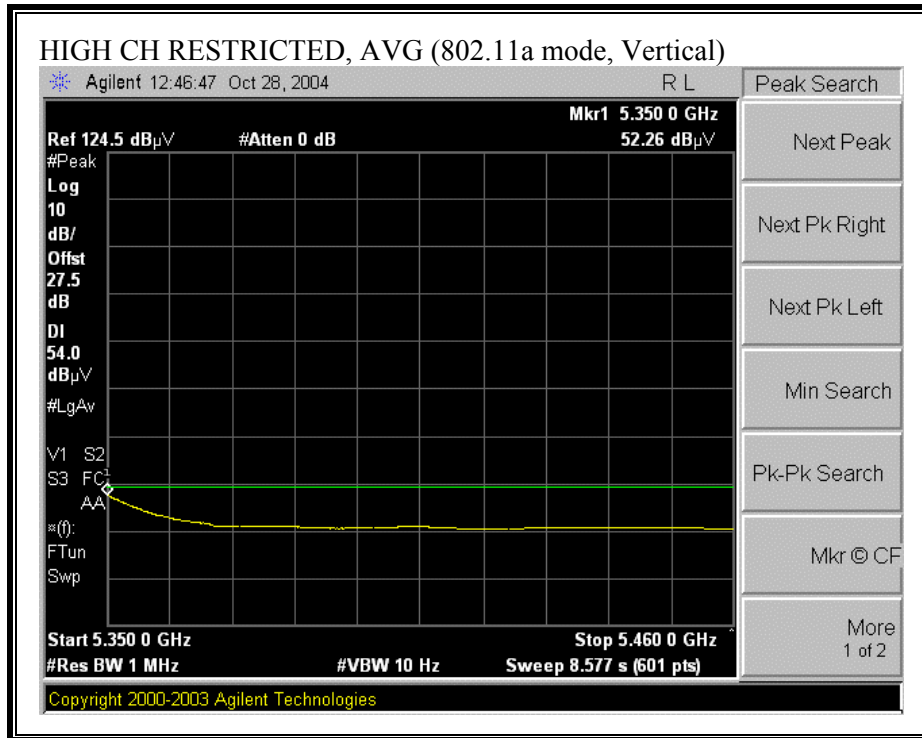


RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, VERTICAL)





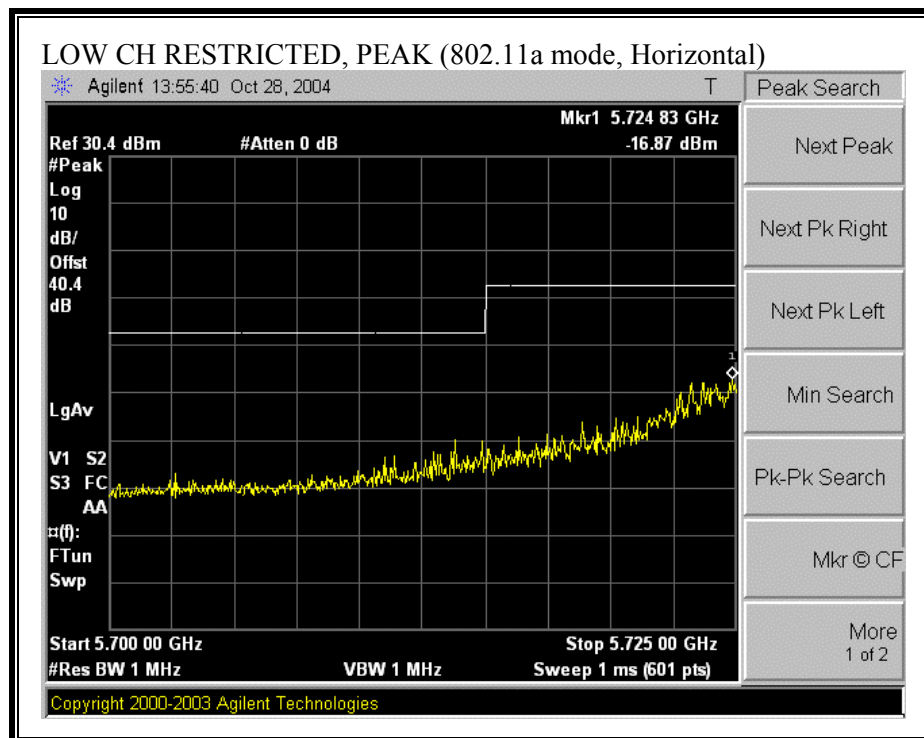
7.3.3. TRANSMITTER ABOVE 1 GHZ FOR 5725 TO 5825 MHz BAND

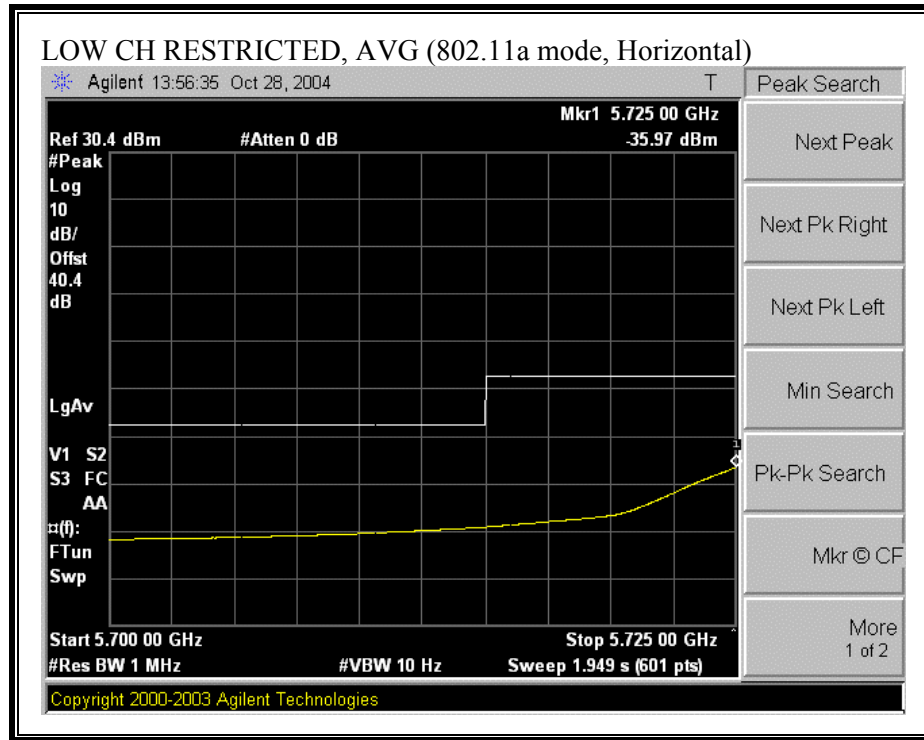
REPORTING NOTES

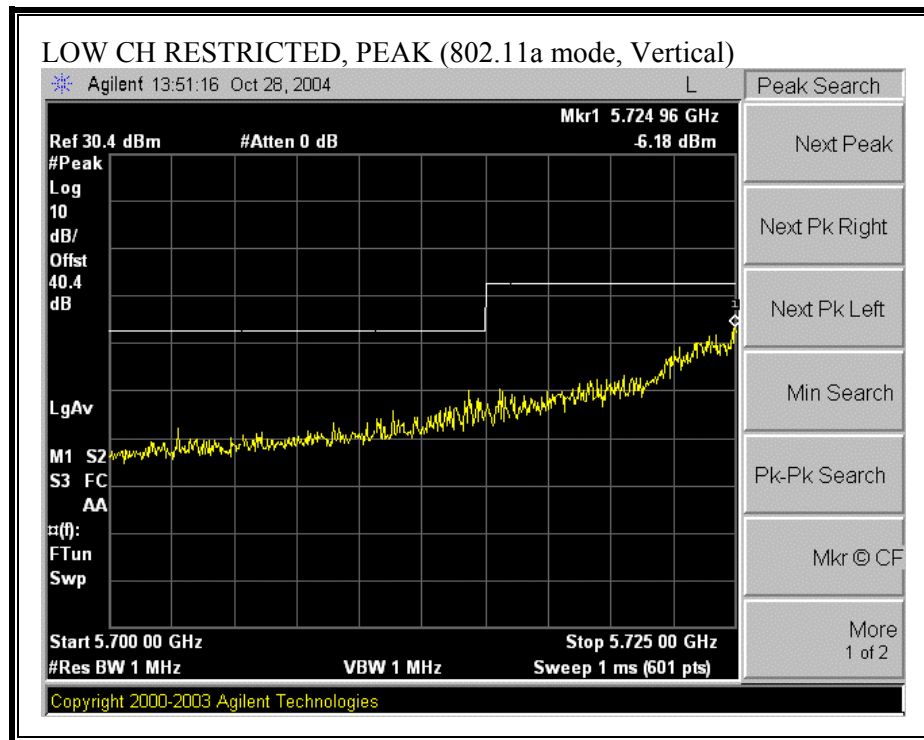
The nearby restricted band stops 10 MHz below the authorized band. A single plot is taken to show both restricted band emission levels and out-of-band radiated spurious emission levels at and near the lower authorized bandedge. The out-of-band spurious limits of -7 dBm Peak EIRP and -27 dBm Average EIRP are converted to the equivalent 3 meter field strengths of 88.2 dBuV/m Peak and 68.2 dBuV/m Average, respectively, for reporting purposes.

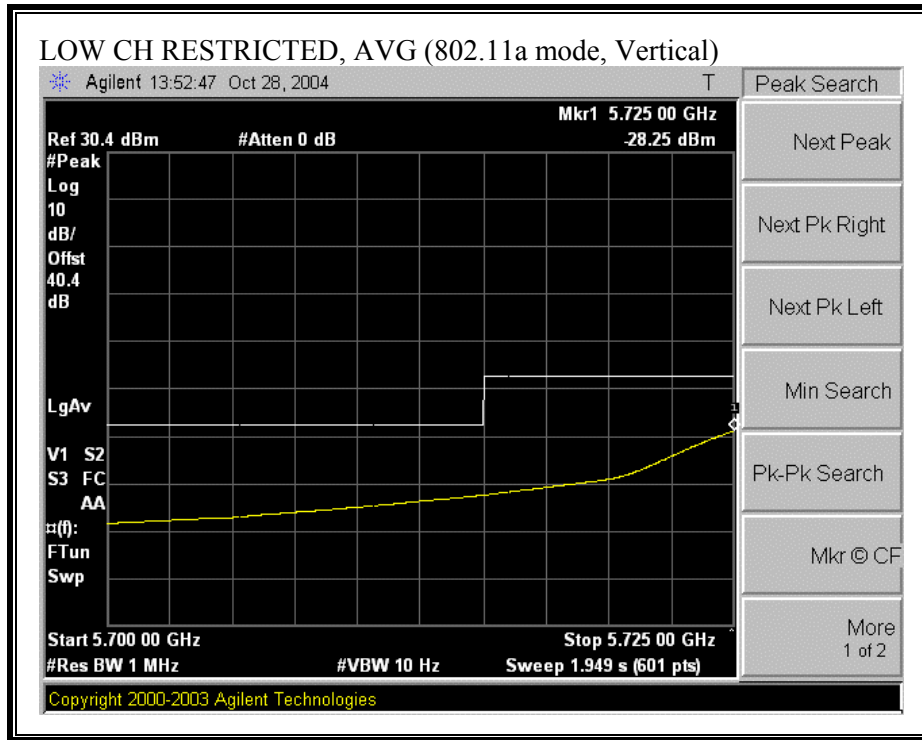
The out-of- band radiated spurious emission levels at and near the upper authorized bandedge are reported as EIRP values.

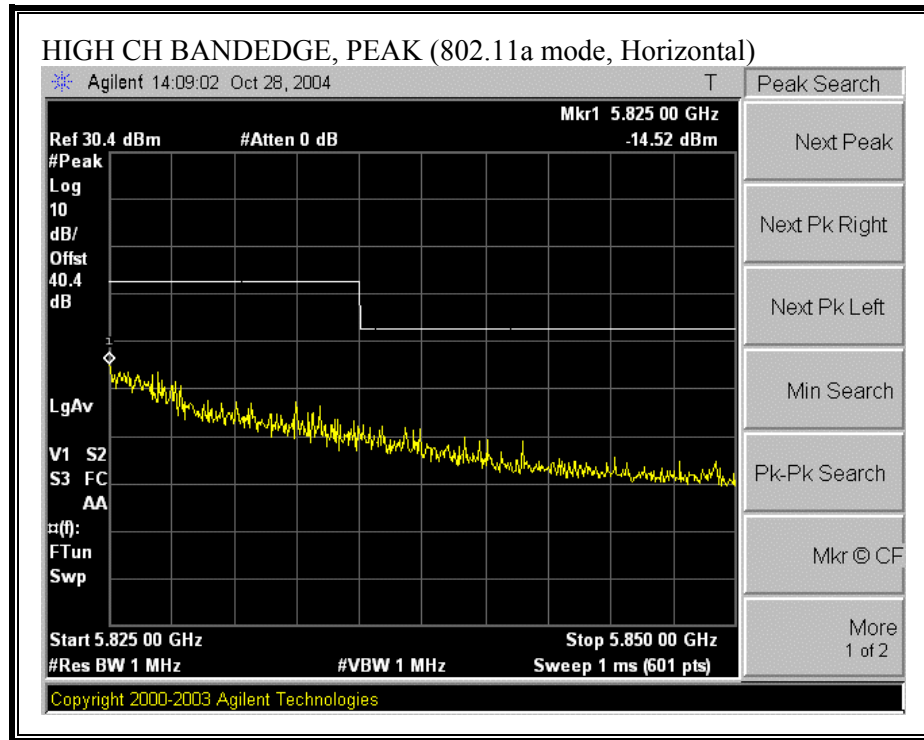
RESTRICTED BAND & BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)

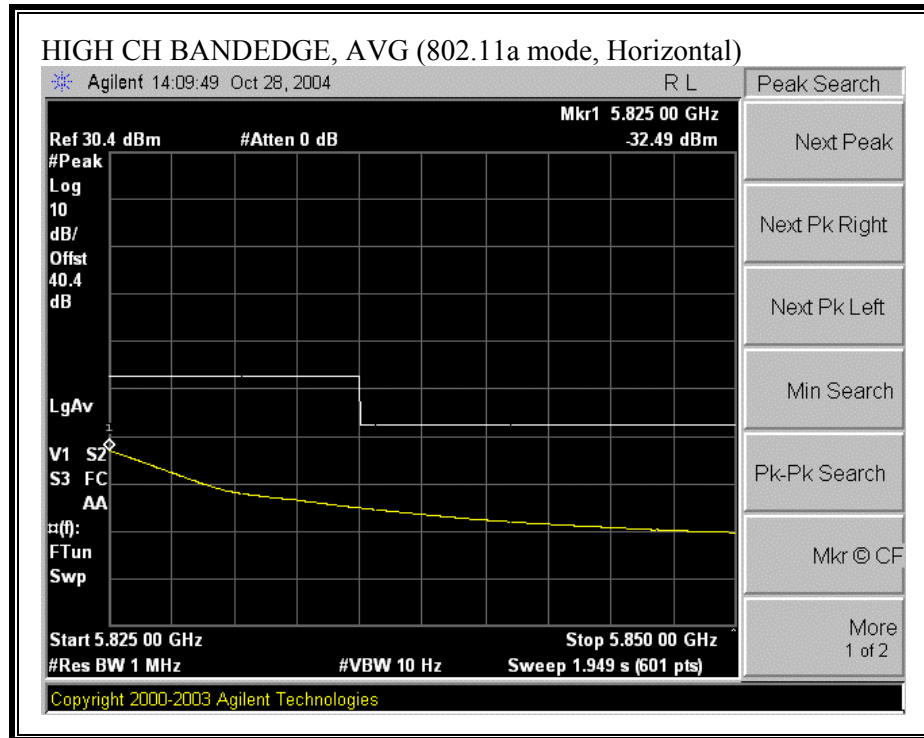




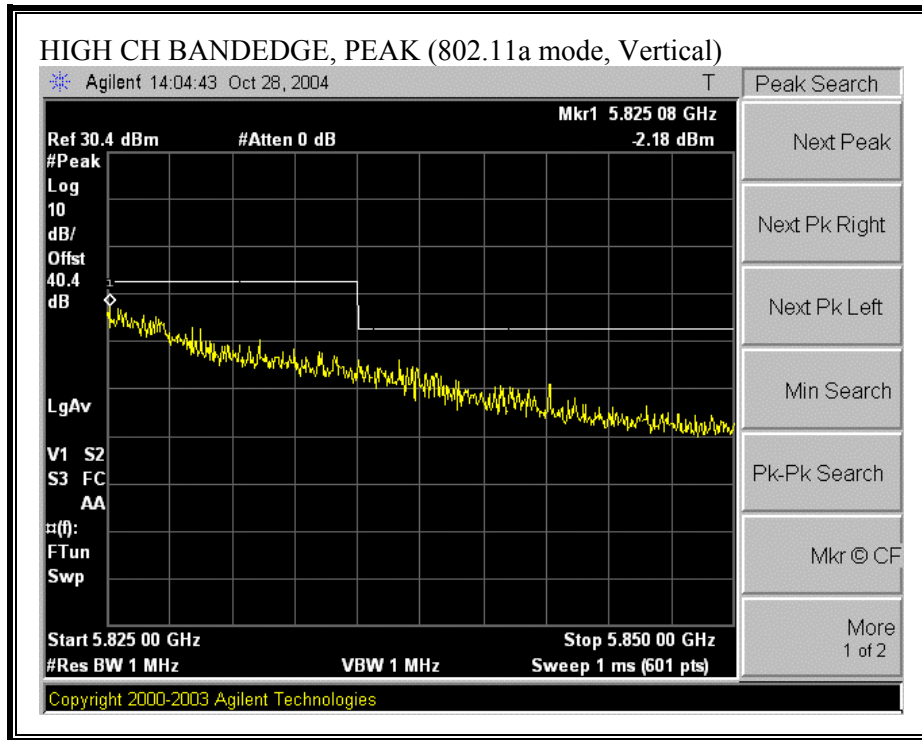
RESTRICTED BAND & BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)

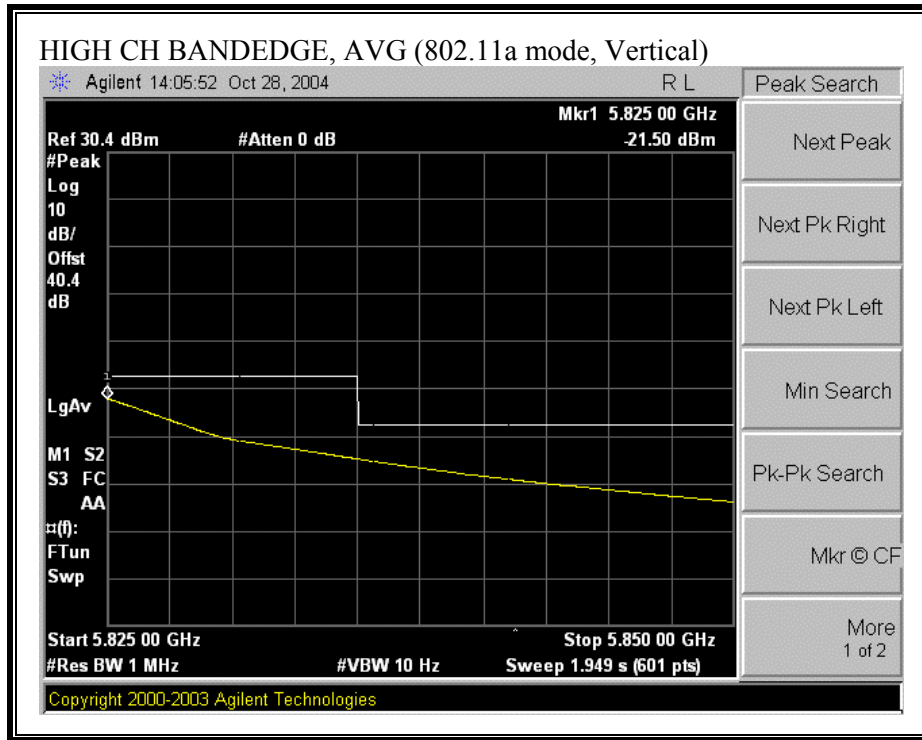


BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)



BANDEDGE (802.11a MODE, HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

10/31/04 High Frequency Measurement Compliance Certification Services, Morgan Hill Open Field Site																
Test Engr:		Hitesh H. Solanki														
Project #:		04U3062-1														
Company:		FIRETIDE INC.														
EUT Descrip.:		802.11 a/b/g MESH NETWORKED SERVICE POINT														
EUT M/N:		HOTPOINT 1500-S														
Test Target:		FCC PART 15.247														
Mode Oper:		TX CONTINUOUSLY AT SPECIFIC CHANNELS, a mode 5.8 band														
Test Equipment:																
EMCO Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz										
T73; S/N: 6717 @3m		T63 Miteq 646456														
Hi Frequency Cables				HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz								
2 foot cable				3 foot cable		4 foot cable		12 foot cable		HPF 1.5GHz		R 002		Average Measurements RBW=1MHz ; VBW=10Hz		
4_Hitesh				12_Hitesh												
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr 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 CHANNEL																
11.483	3.0	48.3	36.9	38.3	8.4	-34.3	0.0	0.8	61.4	50.0	74	54	-12.6	-4.0	H	
1.666	3.0	53.1	44.9	25.9	2.3	-36.7	0.0	0.3	44.9	36.7	74	54	-29.1	-17.3	H	
															H	
MIDDLE CHANNEL																
11.570	3.0	53.1	40.1	38.3	8.4	-34.4	0.0	0.8	66.2	53.2	74	54	-7.8	-0.8	H	
1.667	3.0	47.3	36.1	25.9	2.3	-36.7	0.0	0.3	39.1	27.9	74	54	-34.9	-26.1	H	
															H	
HIGH CHANNEL																
11.610	3.0	52.2	38.8	38.4	8.4	-34.4	0.0	0.8	65.3	51.9	74	54	-8.7	-2.1	H	
1.667	3.0	50.1	39.3	25.9	2.3	-36.7	0.0	0.3	41.9	31.1	74	54	-32.1	-22.9	H	
5.572	3.0	46.6	34.6	34.2	5.0	-35.7	0.0	0.5	50.6	38.6	74	54	-23.4	-15.4		
LOW CHANNEL																
11.489	3.0	52.6	40.4	38.3	8.4	-34.3	0.0	0.8	65.7	53.5	74	54	-8.3	-0.5	V	
1.666	3.0	51.1	41.7	25.9	2.3	-36.7	0.0	0.3	42.9	33.5	74	54	-31.1	-20.5	V	
5.550	3.0	52.8	43.1	34.2	5.0	-35.7	0.0	0.5	56.8	47.1	74	54	-17.2	-6.9	V	
MIDDLE CHANNEL																
11.572	3.0	55.2	40.7	38.3	8.4	-34.4	0.0	0.8	68.3	53.8	74	54	-5.7	-0.2	V	
1.666	3.0	51.1	40.8	25.9	2.3	-36.7	0.0	0.3	42.9	32.6	74	54	-31.1	-21.4	V	
5.576	3.0	53.0	41.5	34.2	5.0	-35.7	0.0	0.5	57.0	45.5	74	54	-17.0	-8.5	V	
HIGH CHANNEL																
11.613	3.0	52.2	39.7	38.4	8.4	-34.4	0.0	0.8	65.3	52.8	74	54	-8.7	-1.2	V	
1.666	3.0	46.1	38.6	25.9	2.3	-36.7	0.0	0.3	37.9	30.4	74	54	-36.1	-23.6	V	
5.579	3.0	53.0	42.0	34.2	5.0	-35.7	0.0	0.5	57.0	46.0	74	54	-17.0	-8.0	V	
															V	
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									

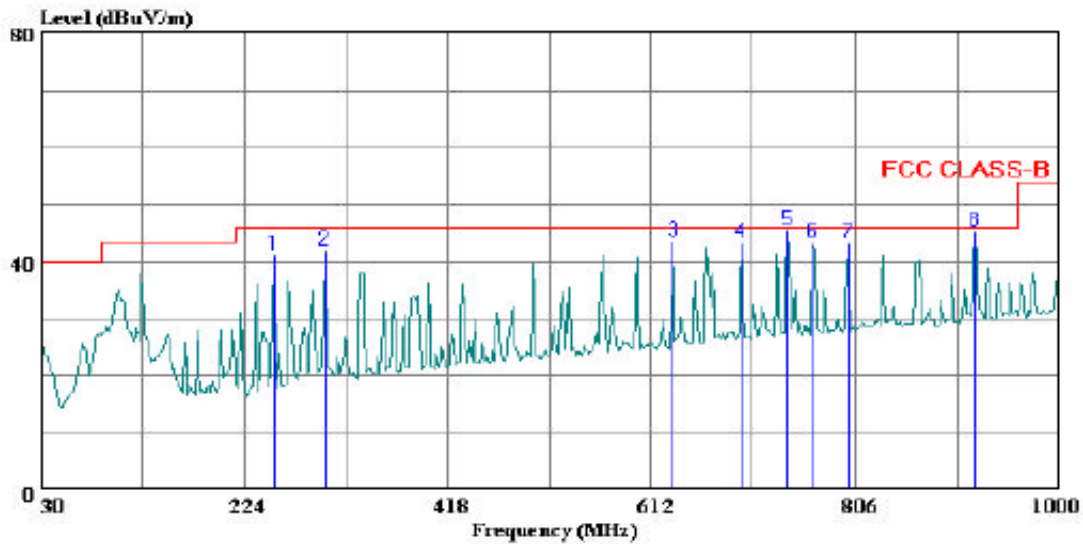
7.3.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)**

HORIZONTAL PLOT



561F Monterey Road
 Morgan Hill, CA 95037
 Tel: (408) 463-0888
 Fax: (408) 463-0885

Data#: 46 File#: 04u3062.EMI Date: 12-08-2004 Time: 11:31:24



(Auxiliary)

Trace: 45

Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
 Test Operator: : William Zhuang
 Project #: : 04U3062-2
 Company: : FIRETIDE
 EUT: : 802.11 a/b/g MESH NETWORKED
 : SERVICE POINT
 Model No: : HOTPOINT 1500-S
 Configuration: : EUT Only
 Target of Test: : FCC CLASS B
 Mode of Operation: Tx, the worst-case
 : Power cord without ferrite

HORIZONTAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	252.130	53.16	-12.08	41.08	46.00	-4.92	Peak
2	300.630	52.24	-10.30	41.94	46.00	-4.06	Peak
3	633.340	48.88	-5.27	43.61	46.00	-2.39	Peak
4	698.330	47.07	-3.98	43.09	46.00	-2.91	Peak
5	741.980	48.53	-3.14	45.39	46.00	-0.61	Peak
6	764.290	46.15	-3.03	43.12	46.00	-2.88	Peak
7	798.240	45.53	-2.38	43.15	46.00	-2.85	Peak
8	919.490	45.41	-0.30	45.11	46.00	-0.89	Peak

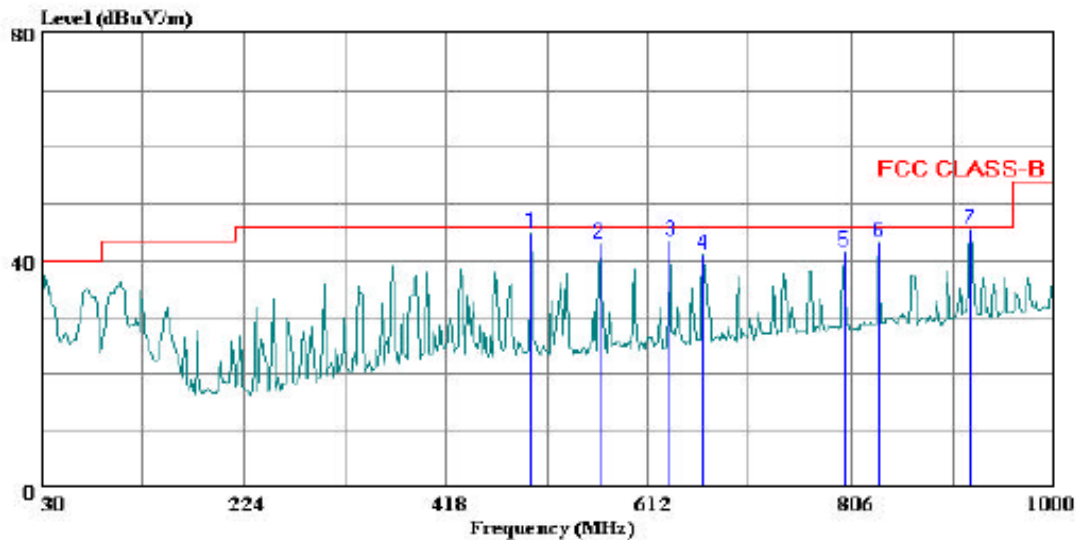
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 48 File#: 04u3062.EMI Date: 12-08-2004 Time: 11:38:21



(Auxiliary ATC)

Trace: 47

Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : William Zhuang
Project #: : 04U3062-2
Company: : FIRETIDE
EUT: : 802.11 a/b/g MESH NETWORKED
: SERVICE POINT
Model No: : HOTPOINT 1500-S
Configuration: : EUT Only
Target of Test: : FCC CLASS B
Mode of Operation: Tx, the worst-case
: Power cord without ferrite

VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	499.480	51.84	-6.89	44.95	46.00	-1.05	Peak
2	565.440	48.87	-6.05	42.82	46.00	-3.18	Peak
3	633.340	48.86	-5.27	43.59	46.00	-2.41	Peak
4	664.380	45.45	-4.48	40.97	46.00	-5.03	Peak
5	798.240	43.98	-2.38	41.60	46.00	-4.40	Peak
6	832.190	44.99	-1.79	43.20	46.00	-2.80	Peak
7	919.490	45.81	-0.30	45.52	46.00	-0.49	Peak

7.4. POWERLINE CONDUCTED EMISSIONS

LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

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.

TEST PROCEDURE

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

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

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

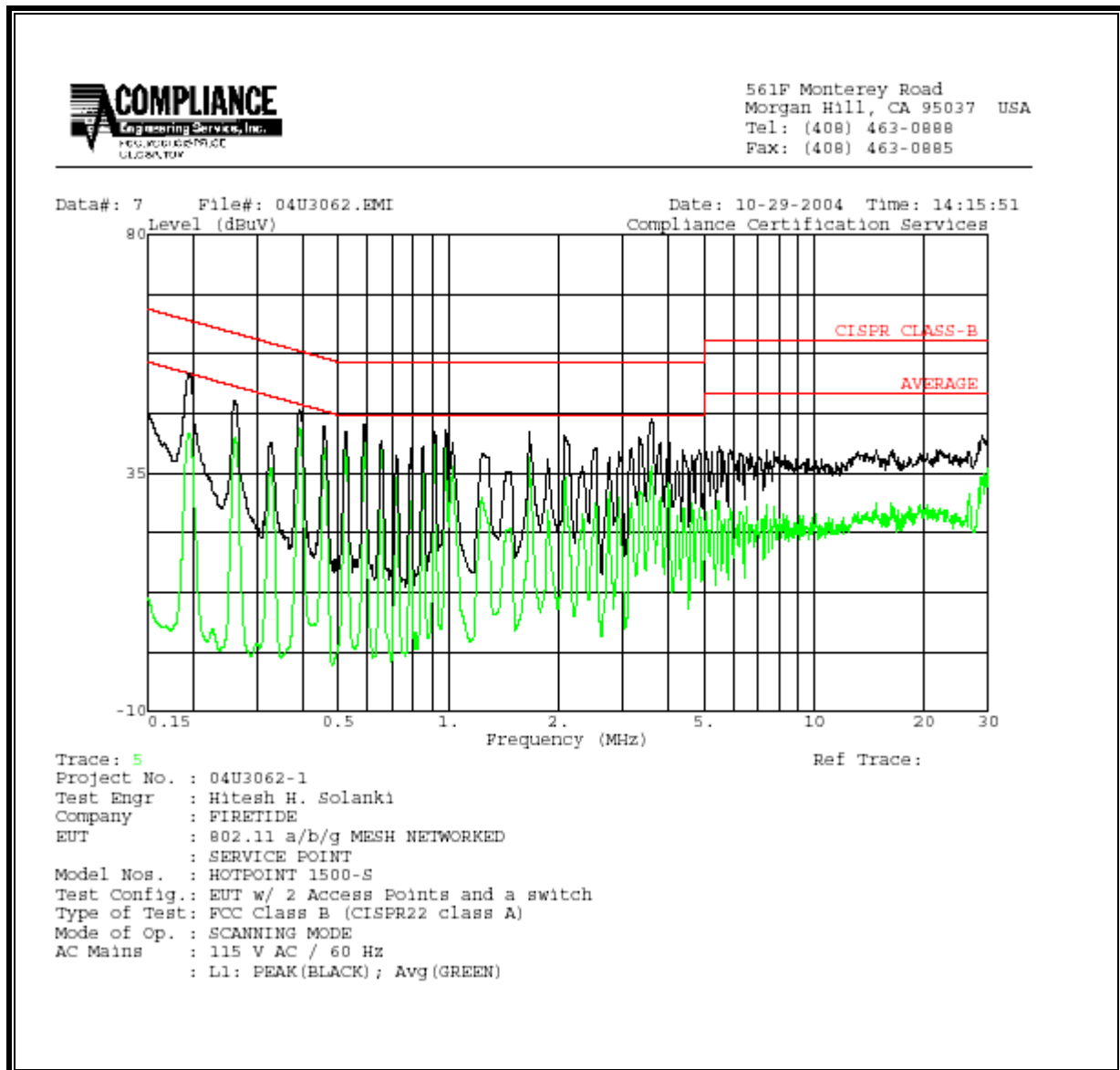
RESULTS

No non-compliance noted:

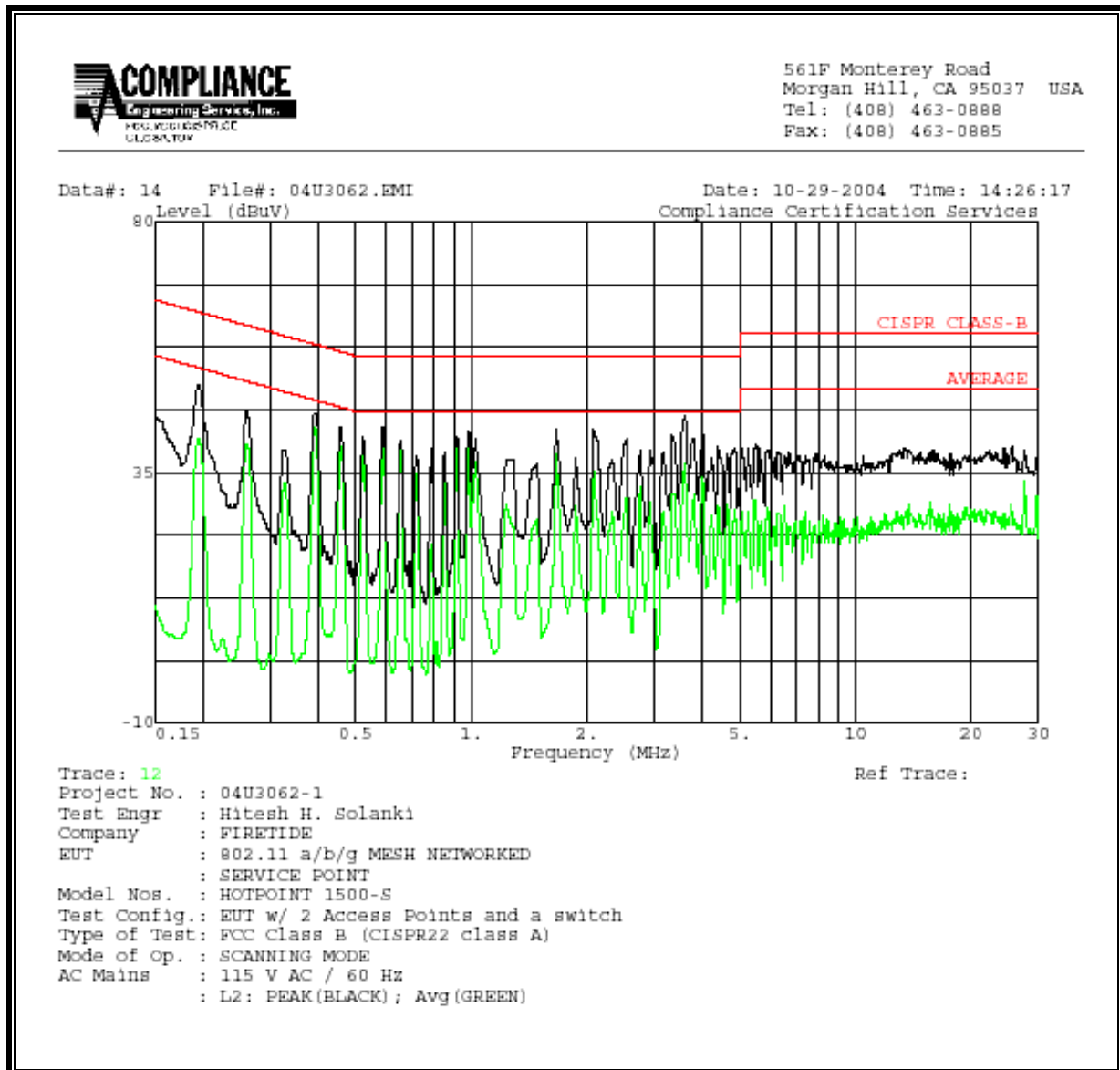
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.20	53.76	--	42.47	0.00	64.71	54.71	-10.95	-12.24	L1
3.58	45.26	--	36.32	0.00	56.00	46.00	-10.74	-9.68	L1
28.75	42.24	--	35.04	0.00	60.00	50.00	-17.76	-14.96	L1
0.20	50.72	--	41.07	0.00	64.71	54.71	-13.99	-13.64	L2
3.58	45.28	--	36.52	0.00	56.00	46.00	-10.72	-9.48	L2
5.53	39.96	--	33.52	0.00	60.00	50.00	-20.04	-16.48	L2
6 Worst Data									

LINE 1 RESULTS

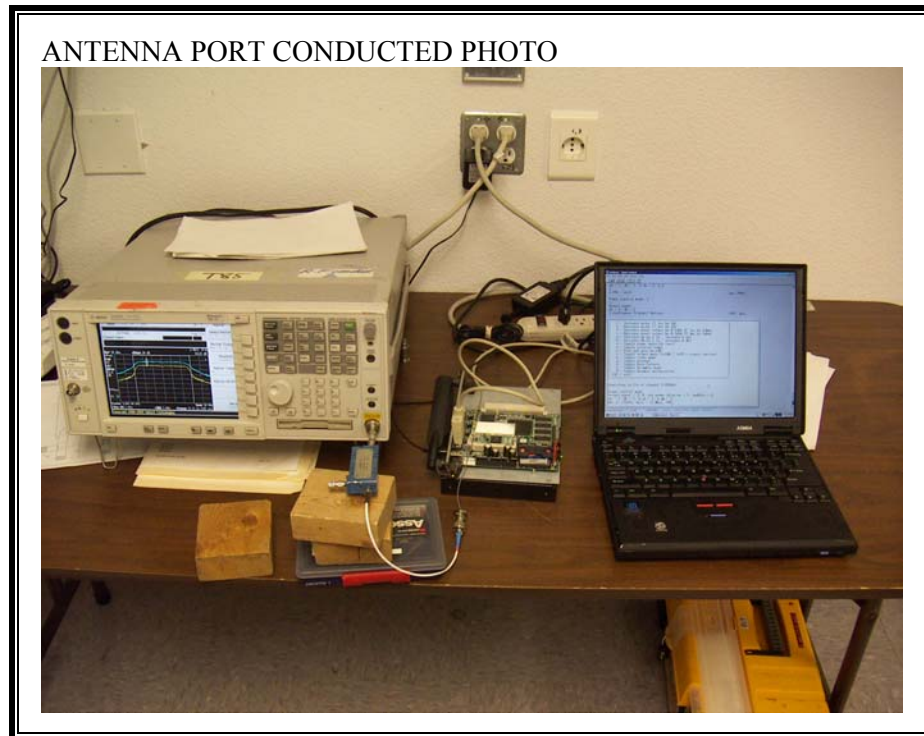


LINE 2 RESULTS



8. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



RADIATED RF MEASUREMENT SETUP

RADIATED FRONT PHOTO

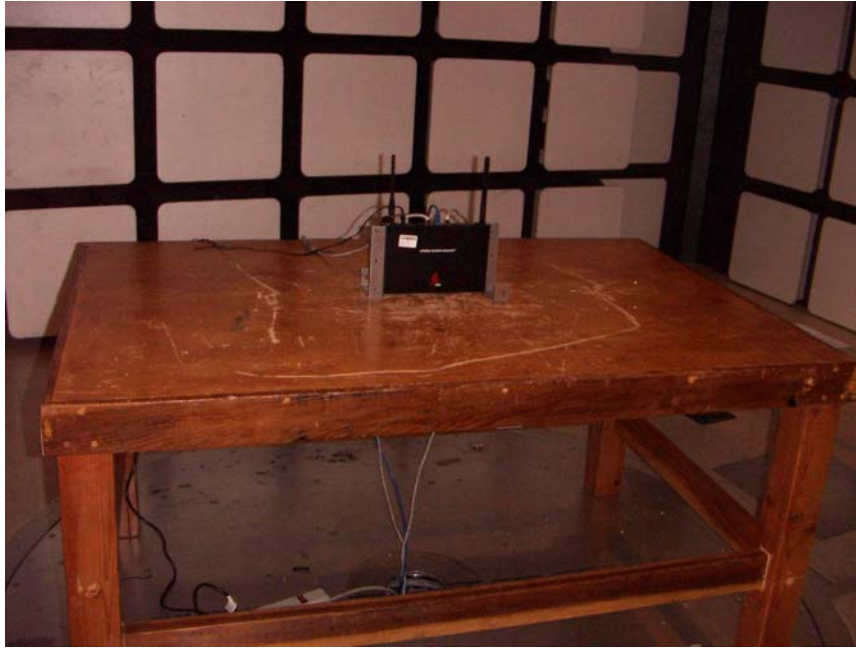


RADIATED BACK PHOTO

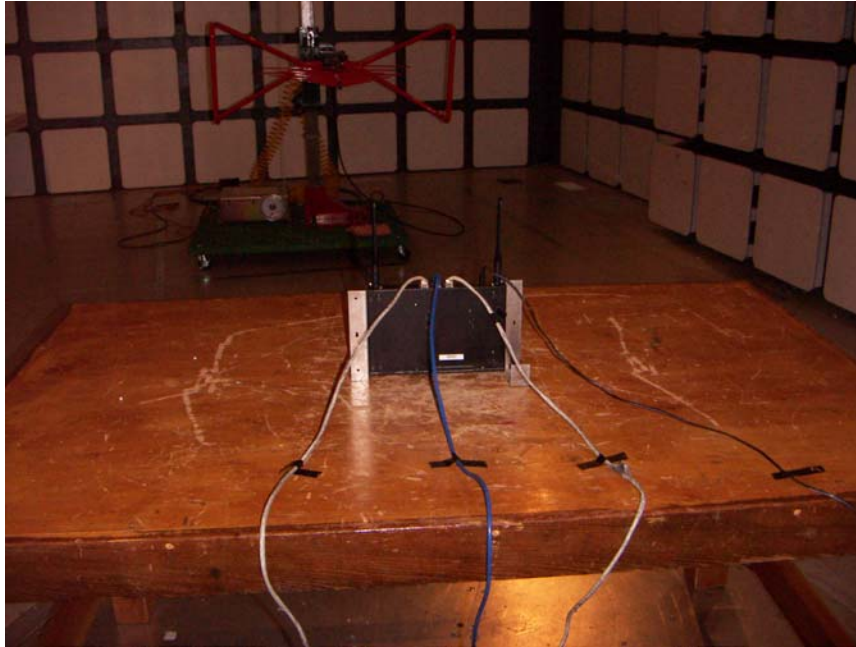


DIGITAL DEVICE RADIATED EMISSIONS SETUP

DIGITAL DEVICE FRONT PHOTO



DIGITAL DEVICE BACK PHOTO



POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP



LINE CONDUCTED BACK PHOTO



END OF REPORT