FCC CFR47 PART 15 SUBPART E CERTIFICATION

TEST REPORT

FOR

802.11 a/b/g ACCESS POINT

MODEL NUMBER: AIR-AP1131AG-A-K9

FCC ID: LDK102054E

REPORT NUMBER: 06U10108-1, Revision C

ISSUE DATE: MARCH 2, 2006

Prepared for
CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
SAN JOSE, CA 95134

Prepared by
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Revision History

Rev.	Revisions	Revised By
A	Initial Issue	DG
B	Corrected typo in model number	DG
C	Corrected FCC ID per customer request	DG

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1. TEST RESULT CERTIFICATION

COMPANY NAME: CISCO SYSTEMS, INC.
170 WEST TASMAN DRIVE
SAN JOSE, CA 95134

EUT DESCRIPTION: 802.11 a/b/g Access Point

MODEL: AIR-AP1131AG-A-K9

DATE TESTED: JUNE 30 – JULY 29, 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. 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:

DAVID GARCIA
ENGINEERING MANAGER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

YAN ZHENG
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 and FCC CFR 47 Part 15.

3. 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.

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4. EUT DESCRIPTION

The EUT is an 802.11a/b/g access point. There are two radios, one for the 2.4 GHz band and the other for the 5 GHz bands. These two radio transmitters may operate simultaneously.

The 5 GHz transmitter has a maximum peak conducted output power as follows:

Frequency Band (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5500 - 5700	802.11a	16.44	44.06

The5 GHz radio utilizes two identical internal inverted F antennas for diversity, each with a maximum gain of 4 dBi.

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
EMI Test Receiver	R & S	ESIB40	4/24/2174	11/21/2004
Power Meter	Agilent	E4416A	GB41291160	11/7/04
Peak / Average Power Sensor	Agilent	E9327A	US40440755	11/7/04
30MHz---- 2Ghz	Sunol Sciences	JB1 Antenna	A121003	12/22/04
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/21/04
RF Filter Section	HP	85420E	3705A00256	11/21/04
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	9001-3245	2/4/05
Antenna, Horn, 18 ~ 26 GHz	ARA	MWH-1826/B	1013	2/4/05
Antenna, Horn 26 ~ 40 GHz	ARA	MWH-2640/B	1029	12/3/04
Amplifier 1-26GHz	MITEQ	NSP2600-SP	924342	4/25/05
PreAmplifier 26-40 GHz	Miteq	NSP4000-SP2	924343	6/1/05
Spectrum Analyzer	Agilent	E4446A	MY43360112	1/13/05

The following test and measurement equipment was utilized for the radiated emissions below 1GHz and AC line conducted tests documented in this report:

Equip#	Manufacturer/ Model	Description	Last Cal	Next Due	Test Number(s)
005678	Hewlett Packard/ E7401A	Spectrum Analyzer	18-AUG-2003	18-AUG-2004	[11186], [11189], [11193], [11216]
005680	Hewlett Packard/ E7405A	Spectrum Analyzer	11-SEP-2003	11-SEP-2004	[11173], [11174], [11217]
005682	Hewlett Packard/ 85460A	RF Filter Section	11-JUL-2003	11-JUL-2004	[11173], [11174], [11217]
005684	Hewlett Packard/ 85462A	EMI Receiver RF Section	11-JUL-2003	11-JUL-2004	[11173], [11174], [11217]
007056	Schaffner-Chase/ CBL6112B	Bilog Antenna	23-OCT-2003	23-OCT-2004	[11173], [11174], [11217]
007705	Fischer Custom Communications/ FCC-LISN-50/250-50-2-01	LISN	26-AUG-2003	26-AUG-2004	[11186], [11189], [11216]
007893	EMC Test Systems/ 3144	Log Periodic Antenna	Cal Not Required	N/A	[11176]
008111	Unifield 5m Chamber/ Unifield 5m Chamber	Unifield 5m Chamber	12-MAR-2004	12-MAR-2005	[11176], [11207]
008136	Huber + Suhner/ SF106A	7m Sucoflex cable	16-JAN-2004	16-JAN-2005	[11176], [11207]
018313	Heweltt Packard/ 8447D	RF Preamplifier	30-DEC-2003	30-DEC-2004	[11173]
018719	Rohde & Schwarz/ ESCS30	EMI Test Receiver, 9kHz-2.75GHz	28-AUG-2003	28-AUG-2004	[11186], [11189], [11193], [11216]
020646	Microwave Associates/ 7524-PND	N Type Line Coax Switch	17-AUG-2003	17-AUG-2004	[11186], [11189], [11193], [11216]
021676	Amplifier Research/ DC7144	Directional Coupler, 0.8-4.2GHz, 40dB Coupling	15-MAR-2004	15-MAR-2005	[11207]

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
Laptop PC	IBM	T20	78-F2737
AC Adapter	IBM	AA21131	N/A
AC Adapter	Cisco	PSA18U-480C	N/A

I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	AC	Unshielded	1.8	N/A
2	DC	1	DC	Unshielded	1.5	N/A
3	Serial	1	dB9 to RJ45	Unshielded	1.5	N/A
4	DC	1	DC	Unshielded	1.5	N/A
5	AC	1	AC	Unshielded	1.8	N/A

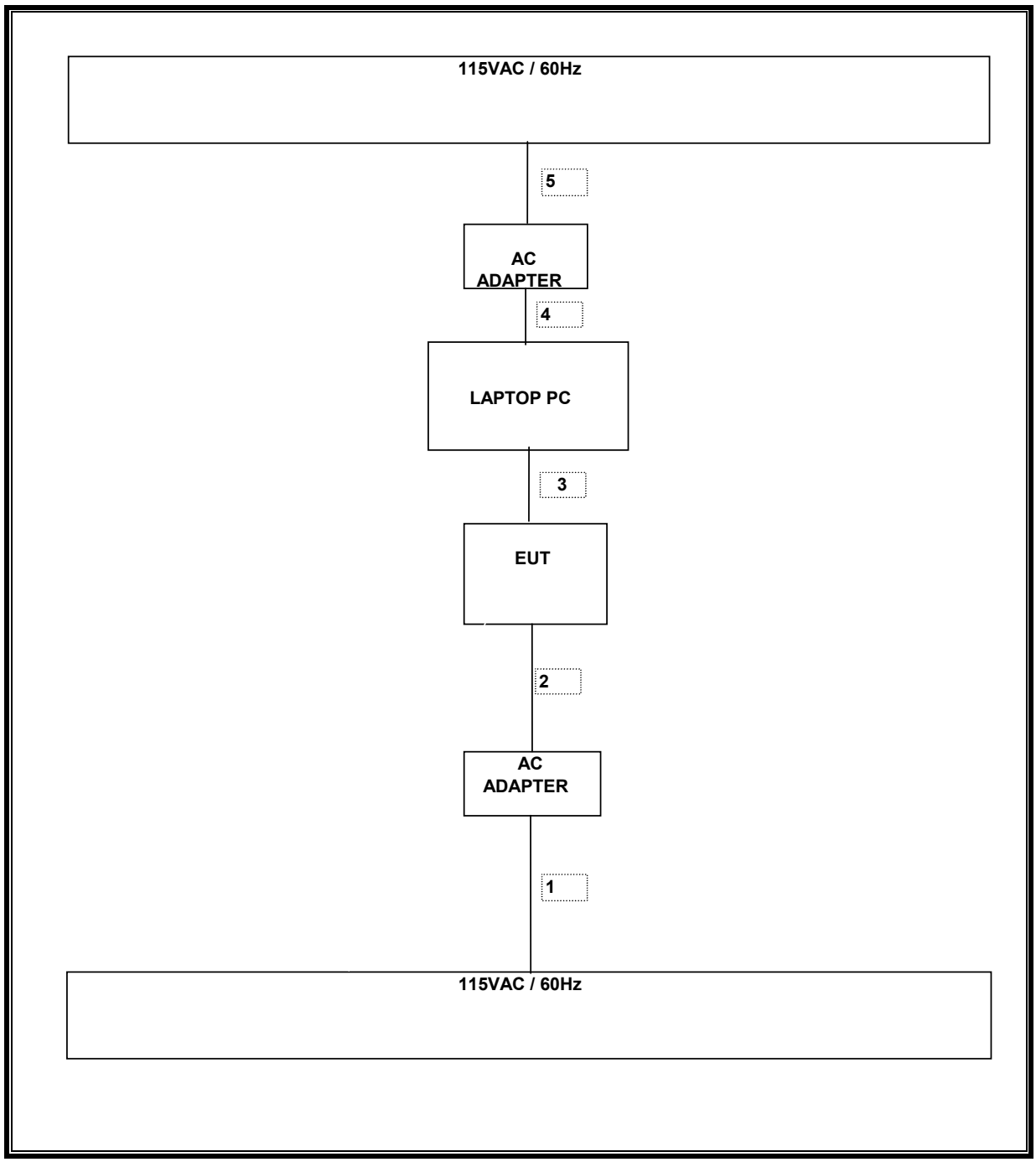
The following support equipment was utilized for the radiated emissions below 1GHz and AC line conducted tests documented in this report:

Sample Number	Equipment Details	Serial Number	Part Number
S01	AIR-AP1131G-x-K9	FHH08202078	
S02	AIR-PWRINJ3	FOC0750M0PK	
S03	AC Adapter	PHI07390EL8	34-1977-03
S04	IBM T20 Laptop	78-F2668	
S05	TBM T20 with AIR-CB21AG		
S06	IBM T20 with AIR-CB21AG		

TEST SETUP

The EUT is a stand-alone access point. It was connected to a laptop PC and test software was used to exercise the radio.

SETUP DIAGRAM FOR TESTS



7. APPLICABLE LIMITS AND TEST RESULTS

7.1. CHANNEL TESTS FOR THE 5470 TO 5725 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 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

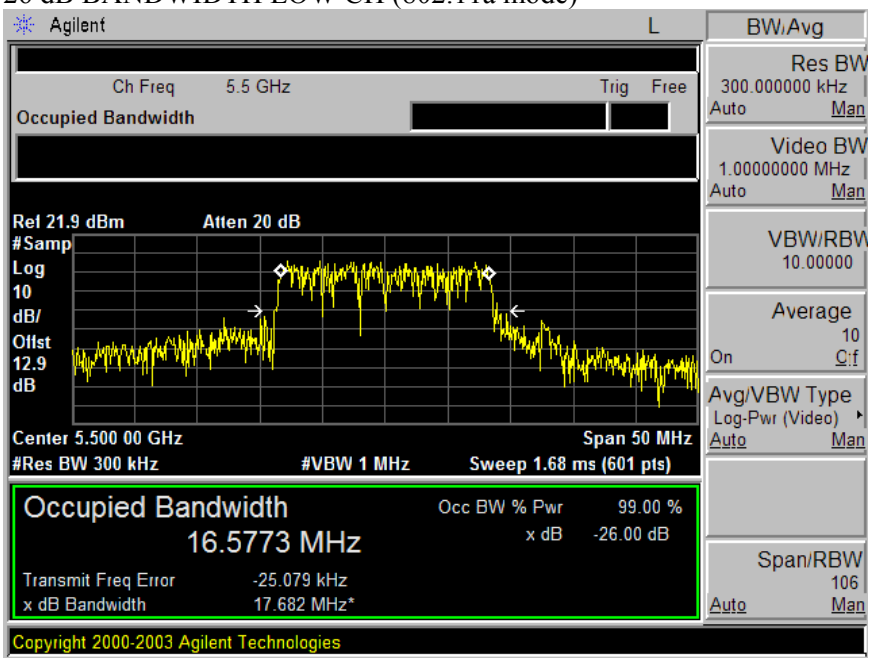
No non-compliance noted:

802.11a Mode

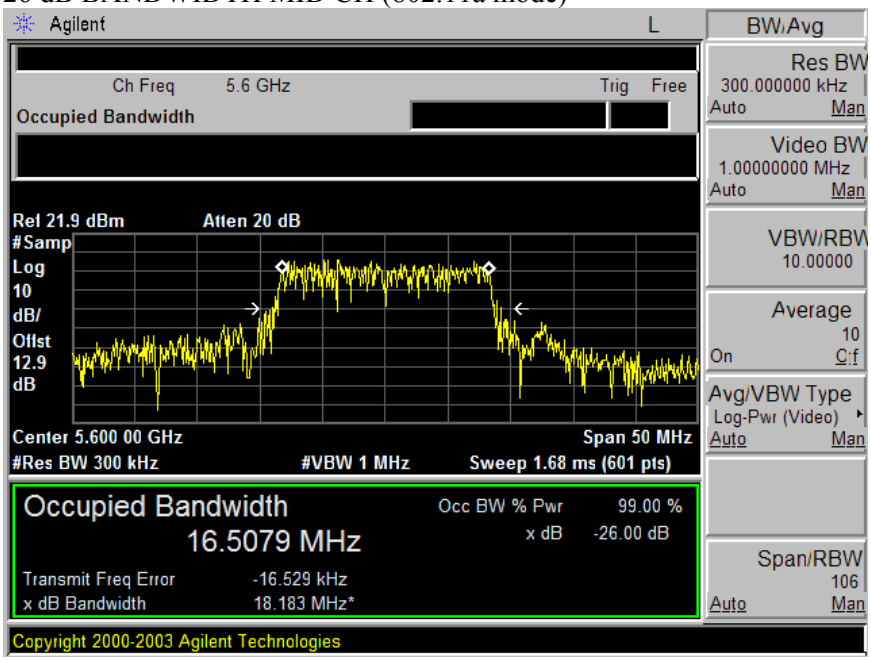
Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5500	17.68	12.48
Middle	5600	18.18	12.60
High	5700	18.87	12.76

26 dB EMISSION BANDWIDTH (802.11a MODE)

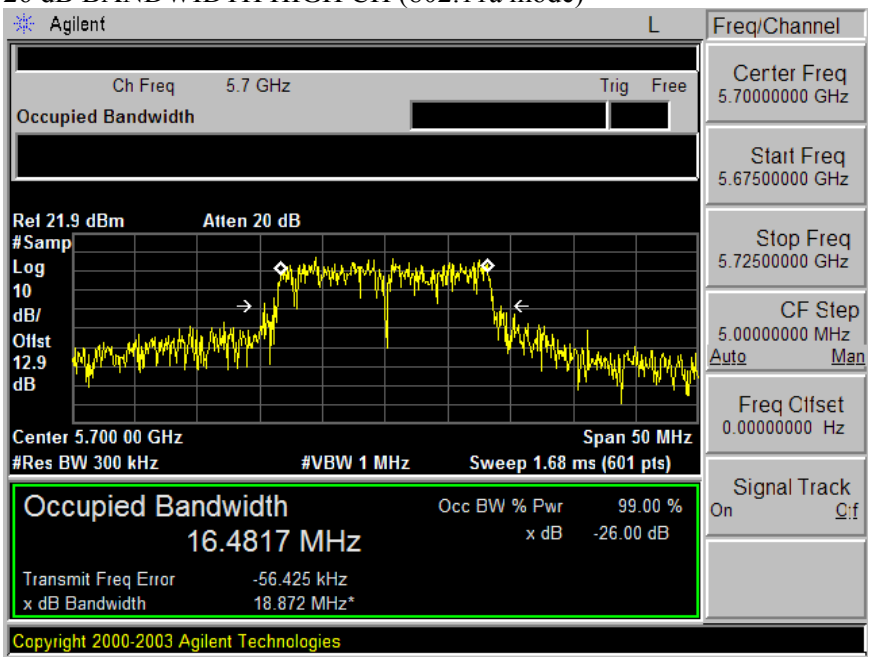
26 dB BANDWIDTH LOW CH (802.11a mode)



26 dB BANDWIDTH MID CH (802.11a mode)



26 dB BANDWIDTH HIGH CH (802.11a mode)



7.1.2. PEAK POWER

LIMIT

§15.407 (a) (2) For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 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.

EIRP LIMIT

None; for reporting purposes only.

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)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5500	24	17.682	23.48	4.00	23.48
Mid	5600	24	18.183	23.60	4.00	23.60
High	5700	24	18.872	23.76	4.00	23.76

802.11a mode Results

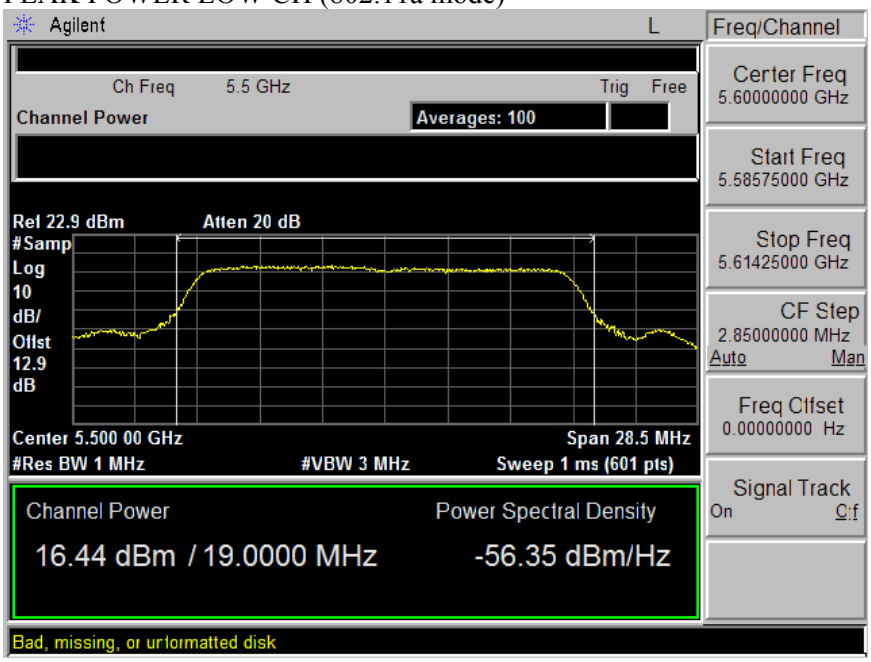
Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5500	16.44	23.48	-7.04
Middle	5600	15.90	23.60	-7.70
High	5700	16.00	23.76	-7.76

802.11a mode Maximum EIRP Results

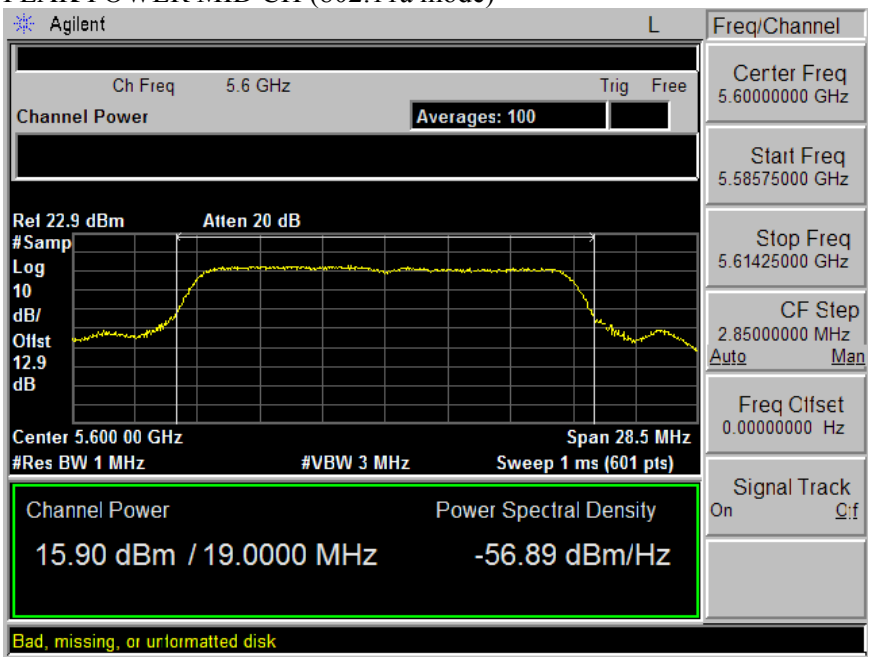
Channel	Frequency (MHz)	Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)
Low	5500	16.44	4.00	20.44
Middle	5600	15.90	4.00	19.90
High	5700	16.00	4.00	20.00

PEAK POWER (802.11a MODE)

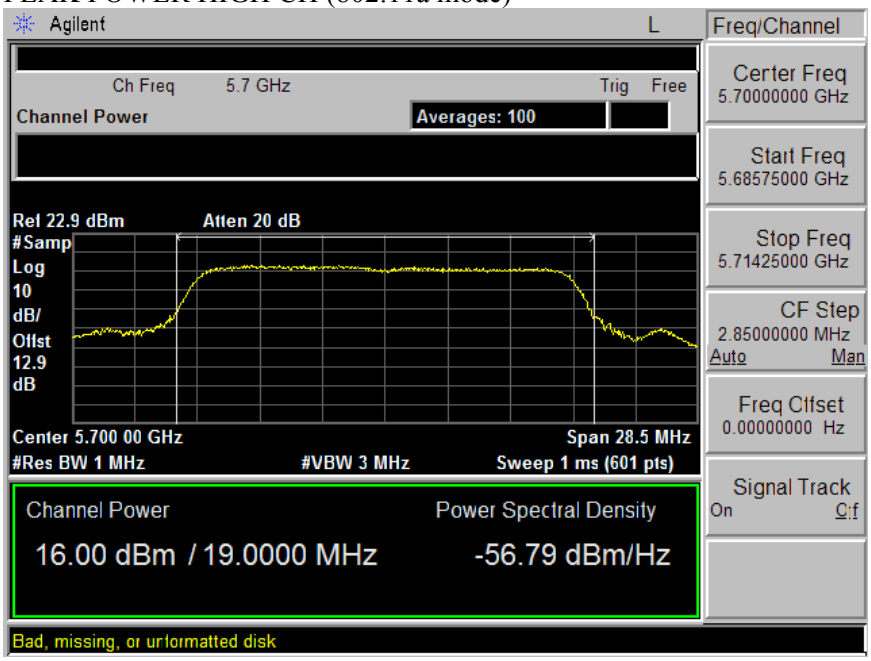
PEAK POWER LOW CH (802.11a mode)



PEAK POWER MID CH (802.11a mode)



PEAK POWER HIGH CH (802.11a 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 (mW) = P (W) / 1000 and
d (cm) =100 * d (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/cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

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

where

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

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

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

LIMITS

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

RESULTS

No non-compliance noted: (MPE distance equals 20 cm)

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)
802.11a	20.0	16.44	4.00	0.02

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. CO-LOCATED 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 (mW) = P (W) / 1000 and
d (cm) =100 * d (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/cm^2

For multiple colocated transmitters operating simultaneously the total power density can be calculated by summing the Power * Gain product of each transmitter.

yields

$d = 0.282 * \sqrt{((P1 * G1) + (P2 * G2) + ... + (Pn * Gn)) / S)}$

where

d = distance in cm
Pk = Power in mW of the kth transmitter
Gk = Numeric antenna gain of the kth transmitter
S = Power Density in mW/cm^2

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

$S = 0.0795 * 10 ^ (((P1 * G1) + (P2 * G2) + ... + (Pn * Gn)) / 10) / (d^2)$

In the table below, Power and Gain are entered in units of dBm and dBi respectively, then these are converted to their linear forms prior to the summation function.

LIMITS

From §1.1310 Table 1 (B), S = 1.0 mW/cm^2

RESULTS

No non-compliance noted: (MPE distance equals 20 cm)

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)
802.11g		25.64	4.00	
802.11a		17.31	4.00	
Combined	20.0			0.21

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.

NOTE: The highest 802.11a output power was measured at 5260 MHz and is represented in the above table.

7.1.5. 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 12.9 dB (including 10 dB pad and 2.9 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	5500	17.10
Middle	5600	17.00
High	5700	16.90

7.1.6. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.407 (a) (2) For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, 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 = 4.0 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

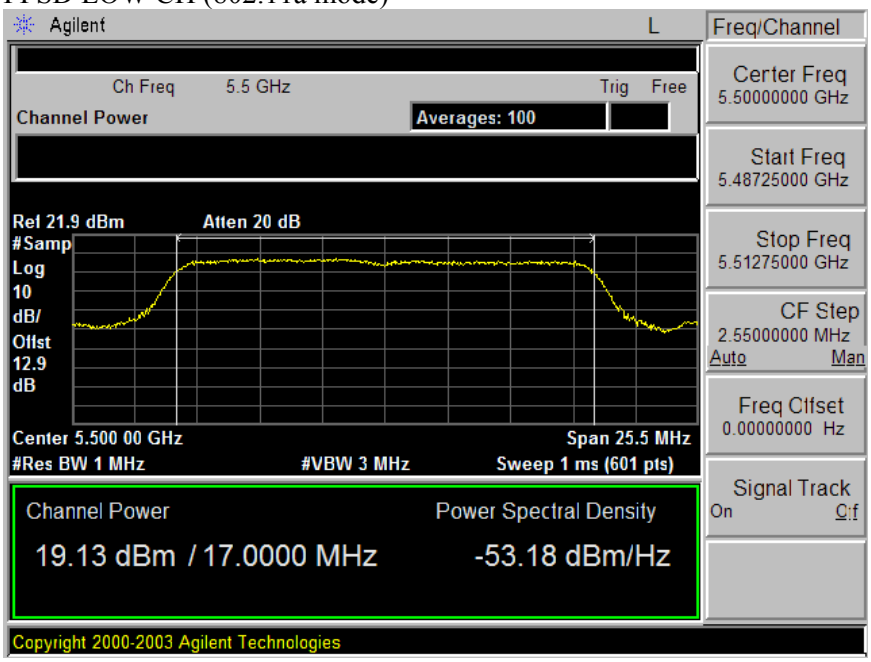
No non-compliance noted:

802.11a Mode

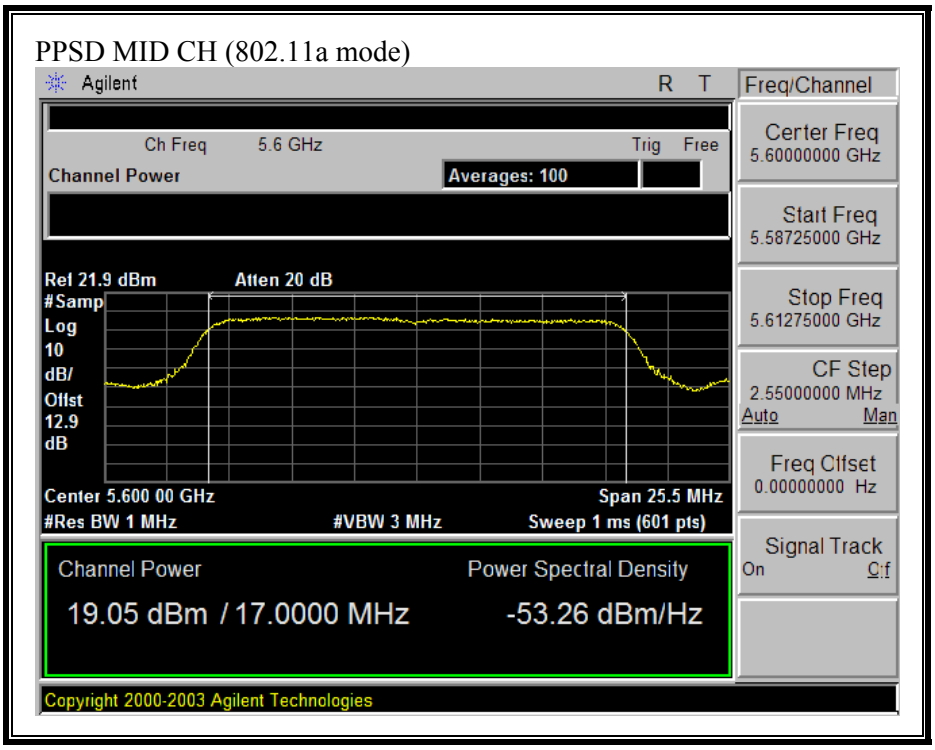
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5500	6.76	11.00	-4.24
Middle	5600	7.37	11.00	-3.64
High	5700	6.83	11.00	-4.17

PEAK POWER SPECTRAL DENSITY (802.11a MODE)

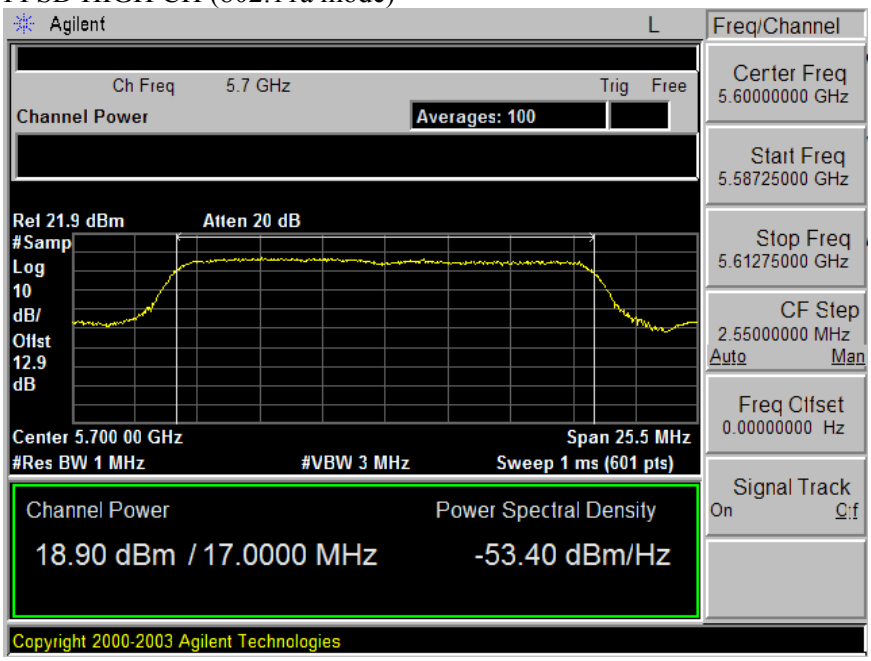
PPSD LOW CH (802.11a mode)



PPSD MID CH (802.11a mode)



PPSD HIGH CH (802.11a mode)



7.1.7. 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

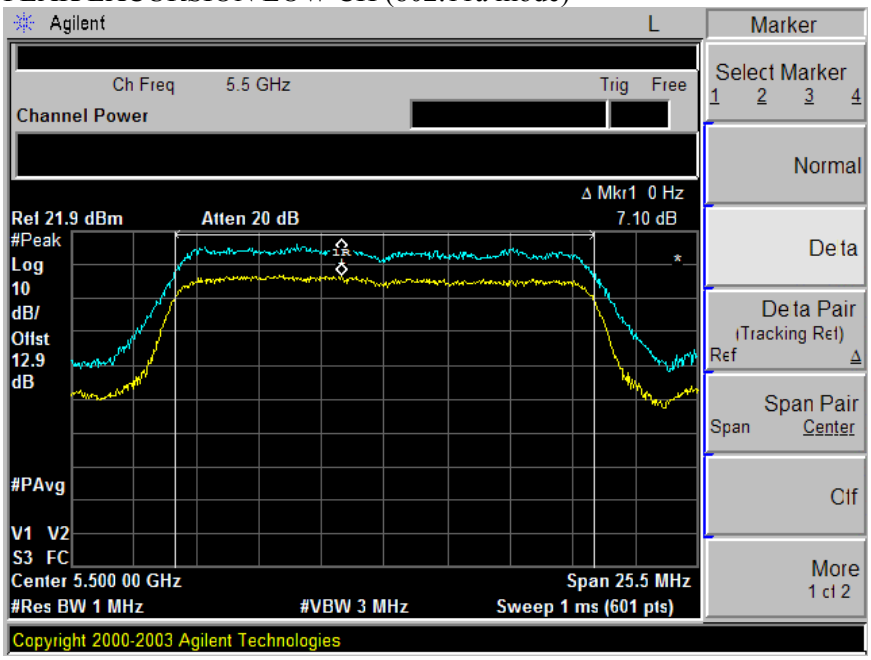
No non-compliance noted:

802.11a Mode

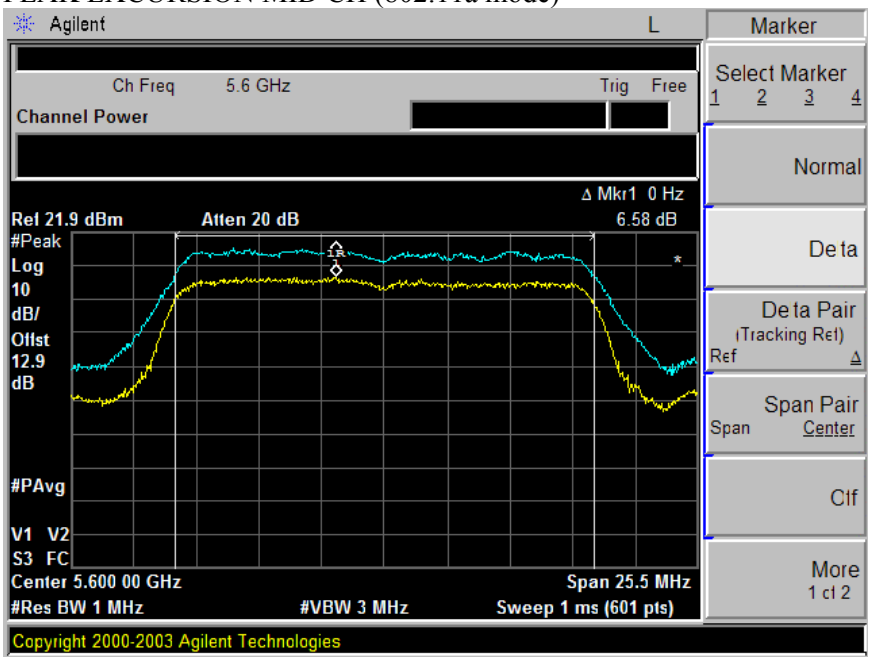
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	7.10	13	-5.90
Middle	5600	6.58	13	-6.42
High	5700	6.93	13	-6.07

PEAK EXCURSION (802.11a MODE)

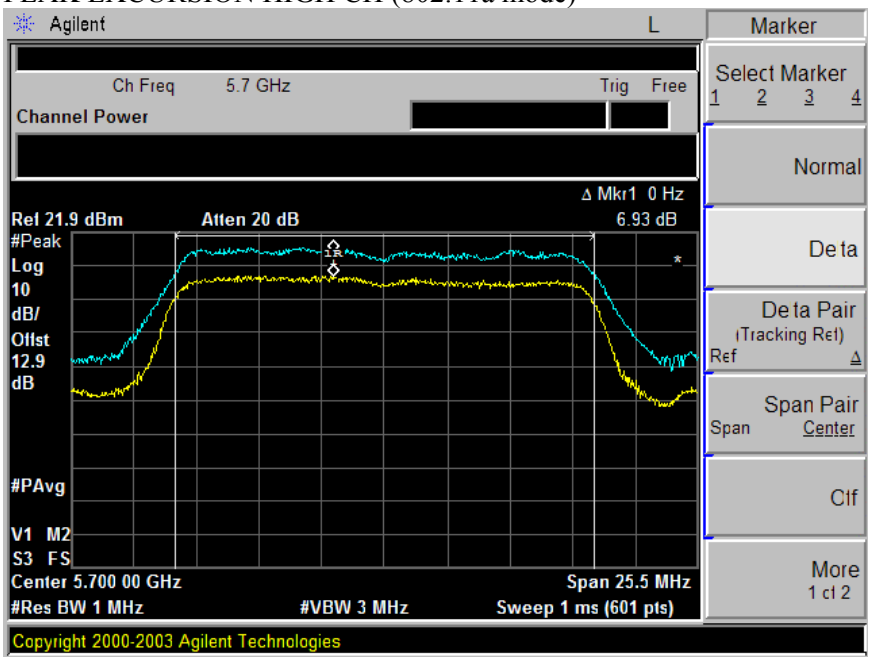
PEAK EXCURSION LOW CH (802.11a mode)



PEAK EXCURSION MID CH (802.11a mode)



PEAK EXCURSION HIGH CH (802.11a mode)



7.1.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.407 (b) (3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 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.

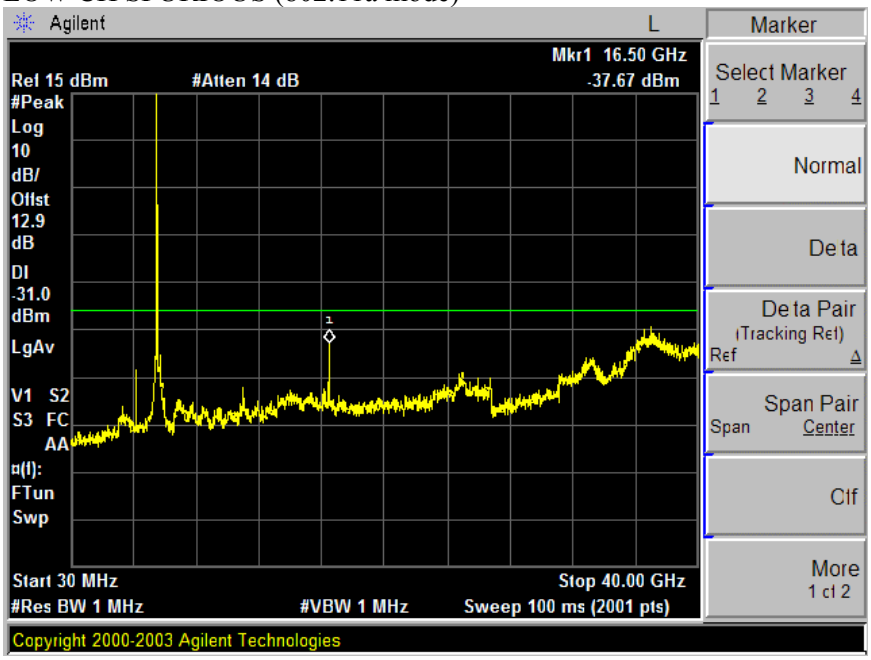
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

RESULTS

No non-compliance noted:

SPURIOUS EMISSIONS (802.11a MODE)

LOW CH SPURIOUS (802.11a mode)



MID CHANNEL SPURIOUS (802.11a mode)

HIGH CHANNEL SPURIOUS (802.11a mode)

7.2. RADIATED EMISSIONS

7.2.1. LIMITS AND PROCEDURES

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 of 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.

RESULTS

No non-compliance noted:

7.2.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ FOR 5470 MHz TO 5725 MHz

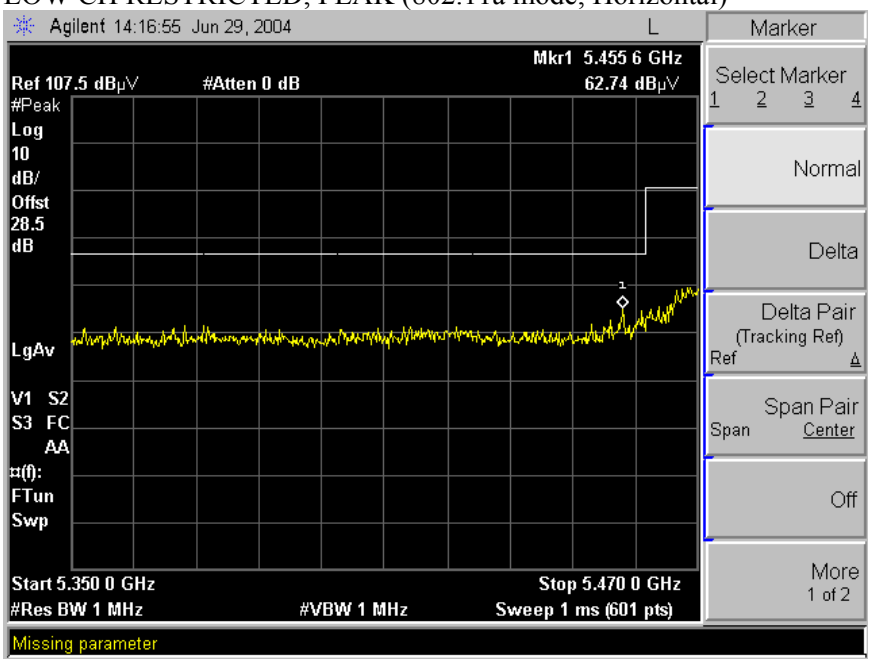
REPORTING NOTES

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.

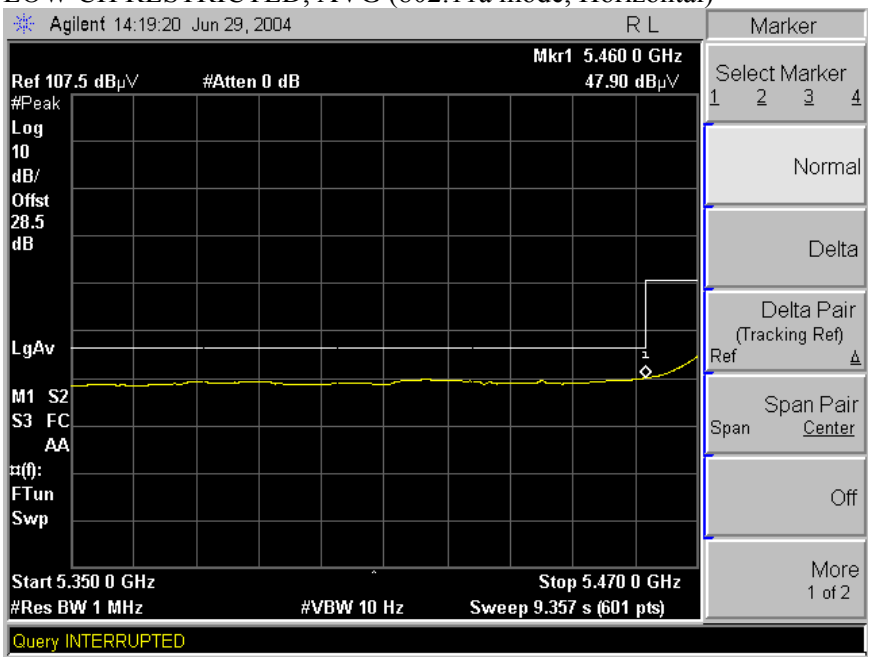
The out-of- band radiated spurious emission levels at and near the upper authorized bandedge are reported as EIRP values.

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

LOW CH RESTRICTED, PEAK (802.11a mode, Horizontal)

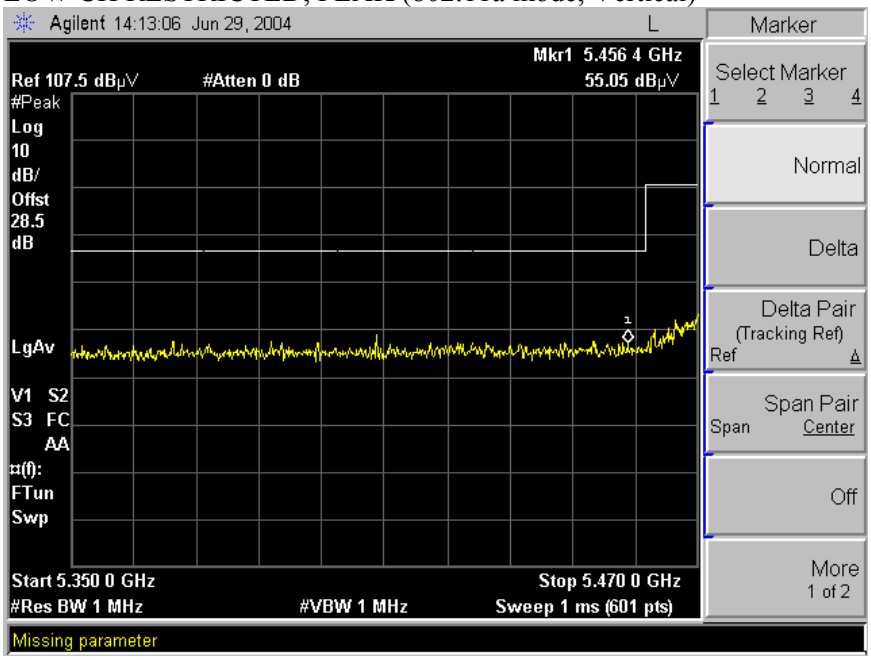


LOW CH RESTRICTED, AVG (802.11a mode, Horizontal)

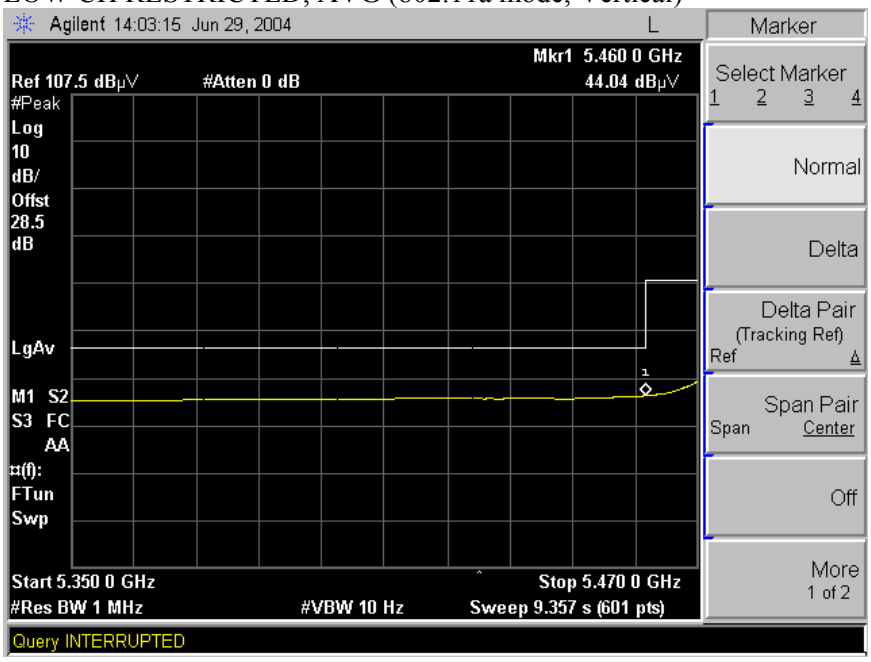


RESTRICTED BAND & BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)

LOW CH RESTRICTED, PEAK (802.11a mode, Vertical)

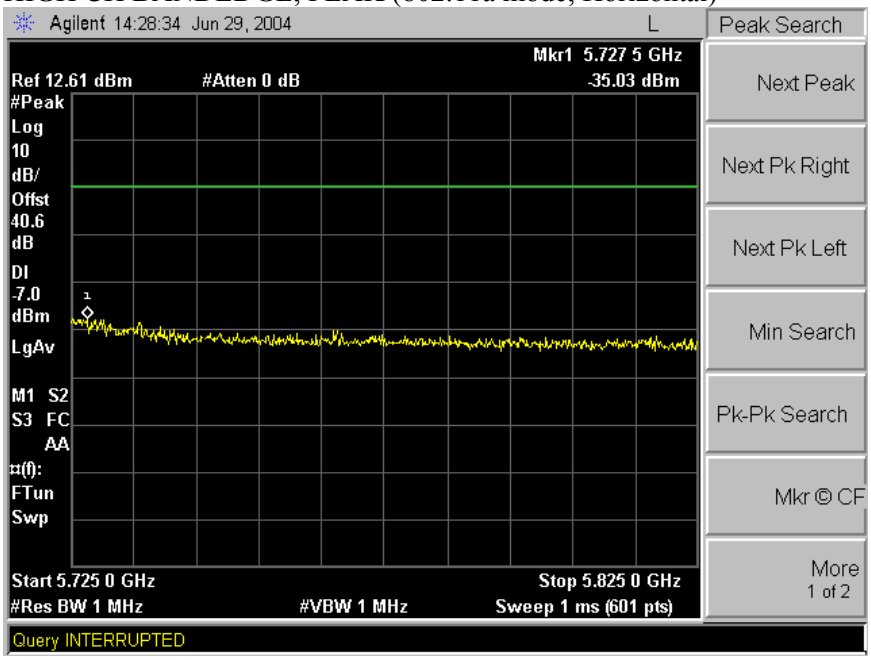


LOW CH RESTRICTED, AVG (802.11a mode, Vertical)

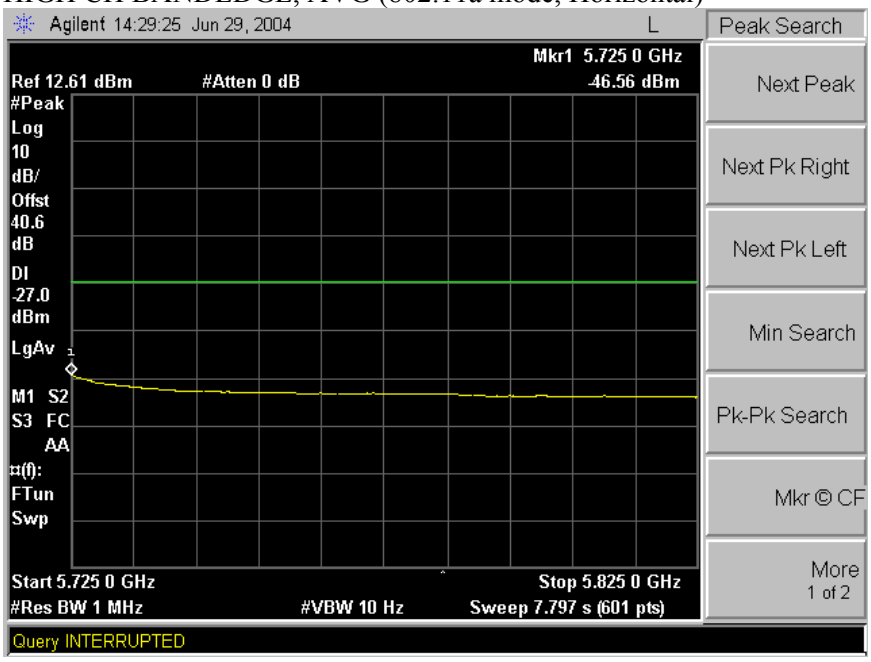


BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)

HIGH CH BANDEDGE, PEAK (802.11a mode, Horizontal)

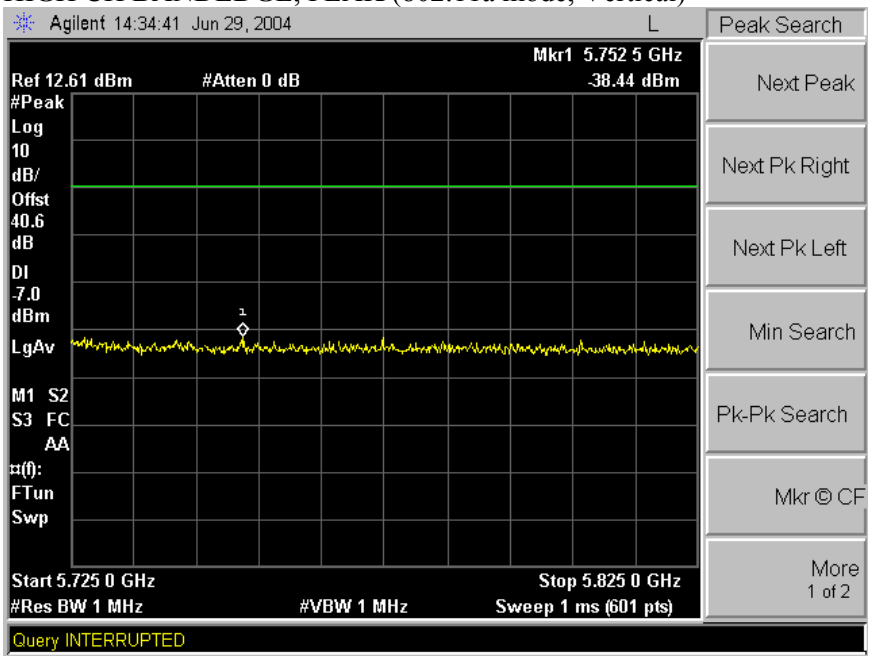


HIGH CH BANDEDGE, AVG (802.11a mode, Horizontal)

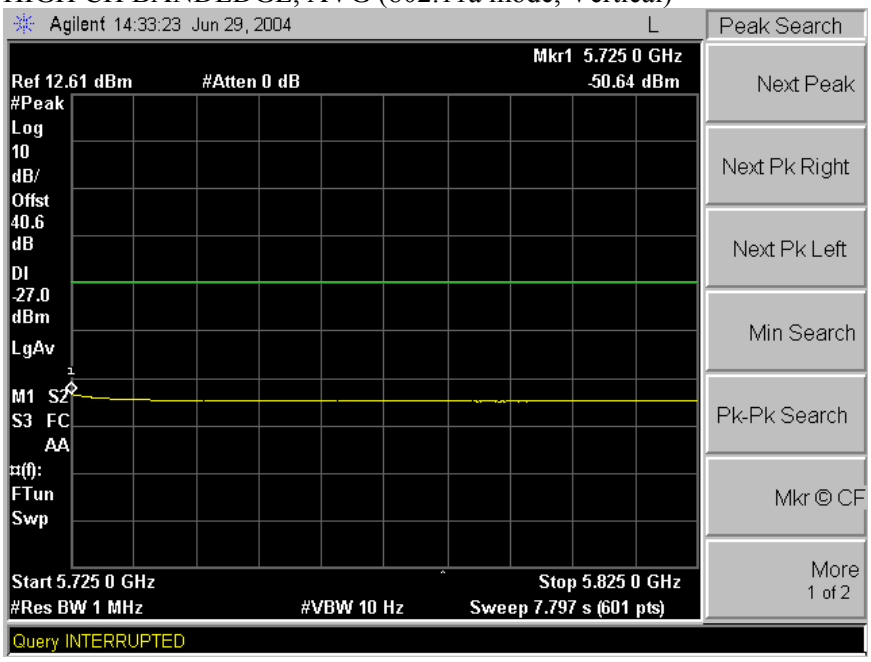


BANDEDGE (802.11a MODE, HIGH CHANNEL, VERTICAL)

HIGH CH BANDEDGE, PEAK (802.11a mode, Vertical)



HIGH CH BANDEDGE, AVG (802.11a mode, Vertical)



HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

07/01/04 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: Yan Zheng
Project #: 04U2603-1
Company: Cisco
EUT Descrip.: Dual Band 2.4 / 5 GHz Access Point
EUT M/N: AIR-AP1131AG-x-K9
Test Target: FCC CLASS B
Mode Oper: TX mode, 5.5 GHz Band

Test Equipment:

EMCO Horn 1-18GHz	Spectrum Analyzer	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz
T60; S/N: 2238 @3m	Agilent E4446A Analyzer	T87 Miteq 924342	T88 Miteq 16-40GHz	

Hi Frequency Cables: ☐ (2 ft) ☐ (2 ~ 3 ft) ☑ (4 ~ 6 ft) ☑ (12 ft)

Peak Measurements:
1 MHz Resolution Bandwidth
1MHz Video Bandwidth

Average Measurements:
1 MHz Resolution Bandwidth
10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
Channel 5500 MHz															
4.180	9.8	53.8	50.8	32.7	4.0	-44.1	0.0	1.5	47.9	44.9	74.0	54.0	-26.1	-9.1	V
4.180	9.8	54.8	52.2	32.7	4.0	-44.1	0.0	1.5	48.9	46.3	74.0	54.0	-25.1	-7.7	H
11.000	9.8	46.3	34.4	38.1	7.4	-40.9	0.0	1.5	52.4	40.5	74.0	54.0	-21.6	-13.5	V
11.000	9.8	46.4	35.8	38.1	7.4	-40.9	0.0	1.5	52.5	41.9	74.0	54.0	-21.5	-12.1	H
Channel 5600 MHz															
4.247	9.8	52.6	48.8	32.8	4.1	-44.2	0.0	1.5	46.7	42.9	74.0	54.0	-27.3	-11.1	V
4.247	9.8	56.1	54.0	32.8	4.1	-44.2	0.0	1.5	50.2	48.1	74.0	54.0	-23.8	-5.9	H
11.200	9.8	45.3	33.4	38.3	7.5	-41.1	0.0	1.5	51.5	39.6	74.0	54.0	-22.5	-14.4	V
11.200	9.8	45.6	34.8	38.3	7.5	-41.1	0.0	1.5	51.8	41.0	74.0	54.0	-22.2	-13.0	H
Channel 5700 MHz															
4.313	9.8	51.4	47.9	32.8	4.1	-44.3	0.0	1.5	45.5	42.0	74.0	54.0	-28.5	-12.0	V
4.313	9.8	56.4	54.4	32.8	4.1	-44.3	0.0	1.5	50.5	48.5	74.0	54.0	-23.5	-5.5	H
11.400	9.8	44.9	33.5	38.6	7.6	-41.4	0.0	1.5	51.1	39.7	74.0	54.0	-22.9	-14.3	V
11.400	9.8	45.5	33.9	38.6	7.6	-41.4	0.0	1.5	51.7	40.1	74.0	54.0	-22.3	-13.9	H

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		

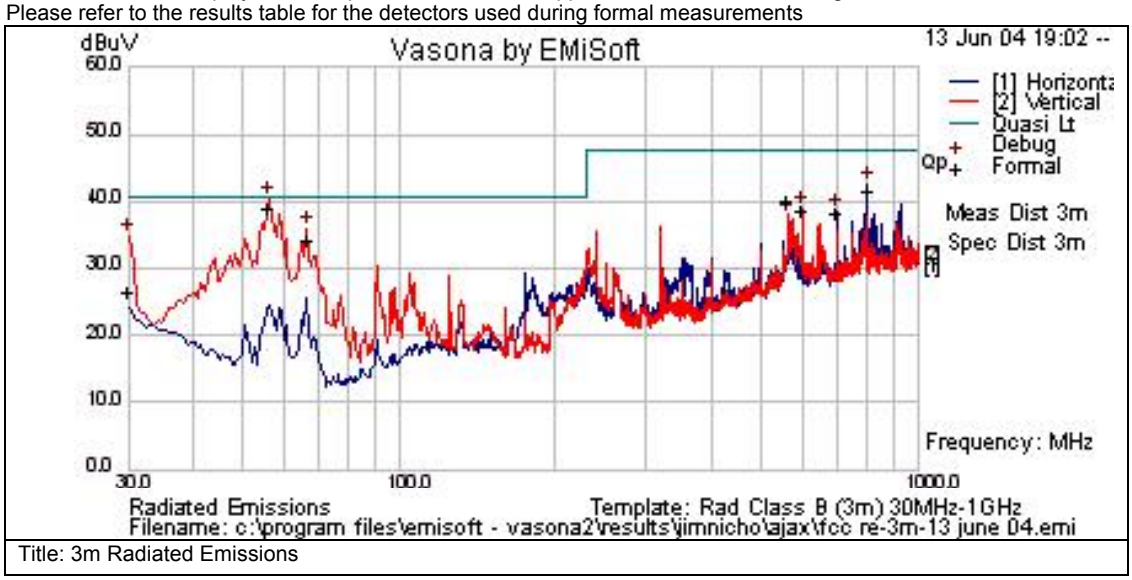
7.2.3. WORST-CASE BELOW 1 GHz

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

VERTICAL AND HORIZONTAL PLOT

Graphical Test Results

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'.
Please refer to the results table for the detectors used during formal measurements



Title: 3m Radiated Emissions

VERTICAL AND HORIZONTAL DATA

Test Results Table

Frequency MHz	Raw dBuV	Cable Loss dB	AF dB	Level dBuV	Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
30	5.3	0.6	18.6	24.6	Qp	V	98	359	40.5	-15.9	Pass	
56	29.5	0.8	7	37.4	Qp	V	123	204	40.5	-3.2	Pass	
66.272	24.8	0.9	6.6	32.4	Qp	V	163	86	40.5	-8.1	Pass	
560	16.5	2.5	19.2	38.2	Qp	V	98	66	47.5	-9.2	Pass	
600	15.2	2.6	19	36.8	Qp	V	104	96	47.5	-10.7	Pass	
700	14.4	2.8	19.3	36.4	Qp	H	307	62	47.5	-11	Pass	
800	16.5	3	20.1	39.6	Qp	H	198	220	47.5	-7.9	Pass	

7.3. 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 μH/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:

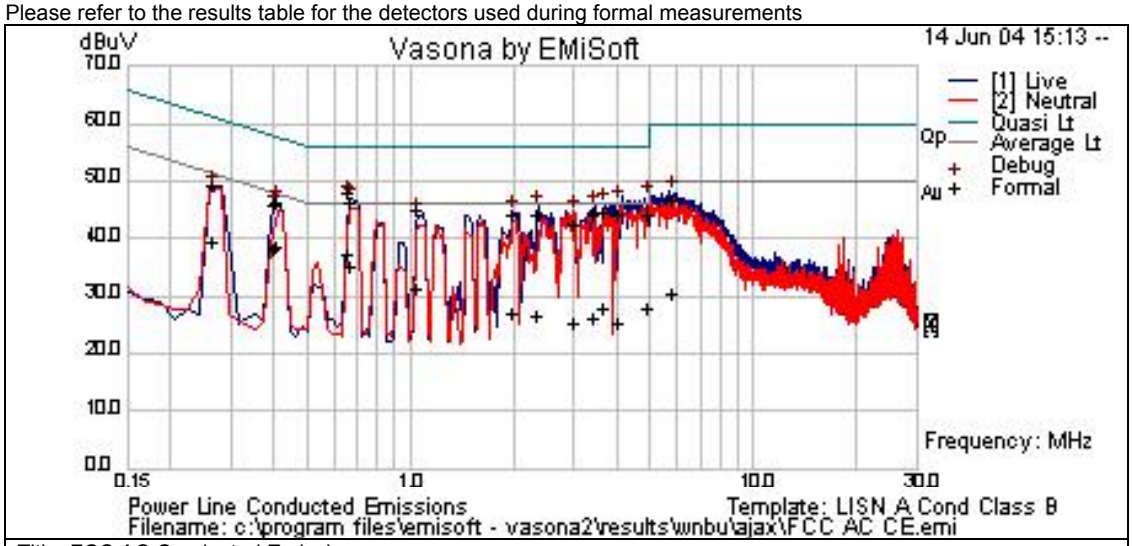
WORST EMISSIONS

Test Results Table

Frequency MHz	Raw dBuV	Cable Loss dB	Factors dB	Level dBuV	Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
0.266	17.2	20.2	0	37.5	Av	L	51.2	-13.8	Pass	
0.266	27.1	20.2	0	47.4	Qp	L	61.2	-13.8	Pass	
0.268	17.3	20.2	0	37.5	Av	N	51.2	-13.7	Pass	
0.268	26.9	20.2	0	47.2	Qp	N	61.2	-14	Pass	
0.406	23.5	20.1	0	43.6	Qp	N	57.7	-14.1	Pass	
0.406	15.8	20.1	0	35.9	Av	N	47.7	-11.8	Pass	
0.41	24	20.1	0	44.1	Qp	L	57.6	-13.5	Pass	
0.41	16.6	20.1	0	36.7	Av	L	47.6	-11	Pass	
0.662	15.3	20	0	35.4	Av	L	46	-10.6	Pass	
0.662	25.7	20	0	45.8	Qp	L	56	-10.2	Pass	
0.677	13.1	20	0	33.2	Av	N	46	-12.8	Pass	
0.677	24.3	20	0	44.4	Qp	N	56	-11.6	Pass	
1.06	22.8	20	0	42.9	Qp	L	56	-13.1	Pass	
1.06	9.1	20	0	29.1	Av	L	46	-16.9	Pass	
2.002	22	20	0	42.1	Qp	L	56	-13.9	Pass	
2.002	4.7	20	0	24.8	Av	L	46	-21.2	Pass	
2.362	22.1	20	0	42.2	Qp	L	56	-13.8	Pass	
2.362	4.4	20	0	24.5	Av	L	46	-21.5	Pass	
3.021	2.9	20.1	0	23	Av	N	46	-23	Pass	
3.021	20.1	20.1	0	40.2	Qp	N	56	-15.8	Pass	
3.436	3.8	20.1	0	24	Av	L	46	-22	Pass	
3.436	21.8	20.1	0	41.9	Qp	L	56	-14.1	Pass	
3.689	22.2	20.1	0	42.4	Qp	L	56	-13.6	Pass	
3.689	5.6	20.1	0	25.8	Av	L	46	-20.2	Pass	
4.059	21.9	20.1	0	42	Qp	N	56	-14	Pass	
4.059	3.3	20.1	0	23.4	Av	N	46	-22.6	Pass	
4.97	22	20.1	0.1	42.2	Qp	N	56	-13.8	Pass	
4.97	5.6	20.1	0.1	25.8	Av	N	46	-20.2	Pass	
5.89	24.3	20.2	0.1	44.5	Qp	L	60	-15.5	Pass	
5.89	8.3	20.2	0.1	28.5	Av	L	50	-21.5	Pass	

LINE 1 AND LINE 2 RESULTS

Graphical Test Results
Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'.
Please refer to the results table for the detectors used during formal measurements



Title: FCC AC Conducted Emissions

8. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

ANTENNA PORT CONDUCTED PHOTO

RADIATED RF MEASUREMENT SETUP, FRONT

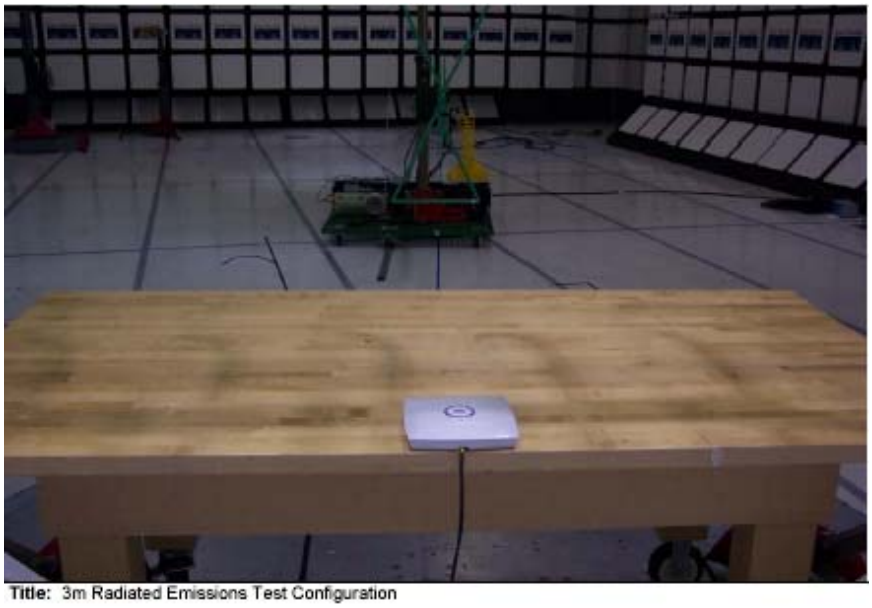
RADIATED PHOTO

RADIATED RF MEASUREMENT SETUP, BACK

RADIATED PHOTO

RADIATED RF MEASUREMENT SETUP, BELOW 1GHz

RADIATED PHOTO



Title: 3m Radiated Emissions Test Configuration

POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED PHOTO

END OF REPORT