



**FCC CFR47 PART 15 SUBPART E
CLASS II PERMISSIVE CHANGE TEST REPORT
FOR**

802.11A/G PCI ADAPTER

MODEL NUMBER: AIR-PI21AG-A-K9

FCC ID: LDK102051

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TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS.....	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY.....	6
4.1. MEASURING INSTRUMENT CALIBRATION.....	6
4.2. MEASUREMENT UNCERTAINTY.....	6
5. EQUIPMENT UNDER TEST.....	7
5.1. DESCRIPTION OF EUT	7
5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE.....	7
5.3. MAXIMUM OUTPUT POWER	7
5.4. DESCRIPTION OF AVAILABLE ANTENNAS.....	7
5.5. SOFTWARE AND FIRMWARE	7
5.6. WORST-CASE CONFIGURATION AND MODE.....	7
5.7. DESCRIPTION OF TEST SETUP	8
6. TEST AND MEASUREMENT EQUIPMENT	10
7. LIMITS AND RESULTS	11
7.1. CHANNEL TESTS FOR THE 5470 TO 5725 MHz BAND	11
7.1.1. EMISSION BANDWIDTH.....	11
7.1.2. PEAK POWER	15
7.1.3. MAXIMUM PERMISSIBLE EXPOSURE.....	20
7.1.4. AVERAGE POWER.....	23
7.1.5. PEAK POWER SPECTRAL DENSITY	24
7.1.6. PEAK EXCURSION	28
7.1.7. CONDUCTED SPURIOUS EMISSIONS.....	32
7.2. DYNAMIC FREQUENCY SELECTION.....	36
7.2.1. LIMITS	36
7.2.2. DESCRIPTION OF EUT.....	39
7.2.3. TEST AND MEASUREMENT SYSTEM	40
7.2.4. TEST AND MEASUREMENT EQUIPMENT	43
7.2.5. SETUP OF EUT AND SUPPORT EQUIPMENT	44
7.2.6. PLOTS OF RADAR WAVEFORMS AND WLAN SIGNALS	45
7.2.7. TEST CHANNEL AND METHOD	47
7.2.8. CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME.....	47
7.3. RADIATED EMISSIONS.....	50
7.3.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS	50
7.3.2. TRANSMITTER ABOVE 1 GHZ FOR 5470 TO 5725 MHz BAND	53

7.3.3.	WORST-CASE RADIATED EMISSIONS BELOW 1 GHz.....	62
7.4.	<i>POWERLINE CONDUCTED EMISSIONS</i>	66
8.	SETUP PHOTOS	70

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 802.11A/G PCI ADAPTER

MODEL: AIR-PI21AG-A-K9

DATE TESTED: OCTOBER 02 – 09, 2006

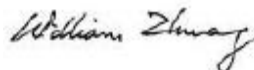
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART E	NO NON-COMPLIANCE NOTED

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.

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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>.

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 an 802.11a/g PCI adapter.

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The purpose of the change is to add the 5470 to 5725 MHz band.

5.3. MAXIMUM OUTPUT POWER

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

5470 to 5725 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5500 - 5700	802.11a	15.19	33.04

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a single flying lead straight antenna, with a maximum assembly (including cable) gain of 0.93 dBi in the 5.5GHz band.

5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was AR5002, ANWI Diagnostic Kernel Drive.

The test utility software used during testing was Art_V5_3_b11_xb6x.

5.6. WORST-CASE CONFIGURATION AND MODE

In our opinion the worst-case data rate is determined to be 6 Mb/s, based on previous experience with this device operating in the 802.11a mode in other frequency bands.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Monitor	LG	L1750S	512MXWED0A753	DoC
Keyboard	Dell	SK-8110	NA	DoC
Mouse	Dell	M-SAW34	LZA30519730	DZL211029
PC	HP	VECTRA	US82209954	DoC

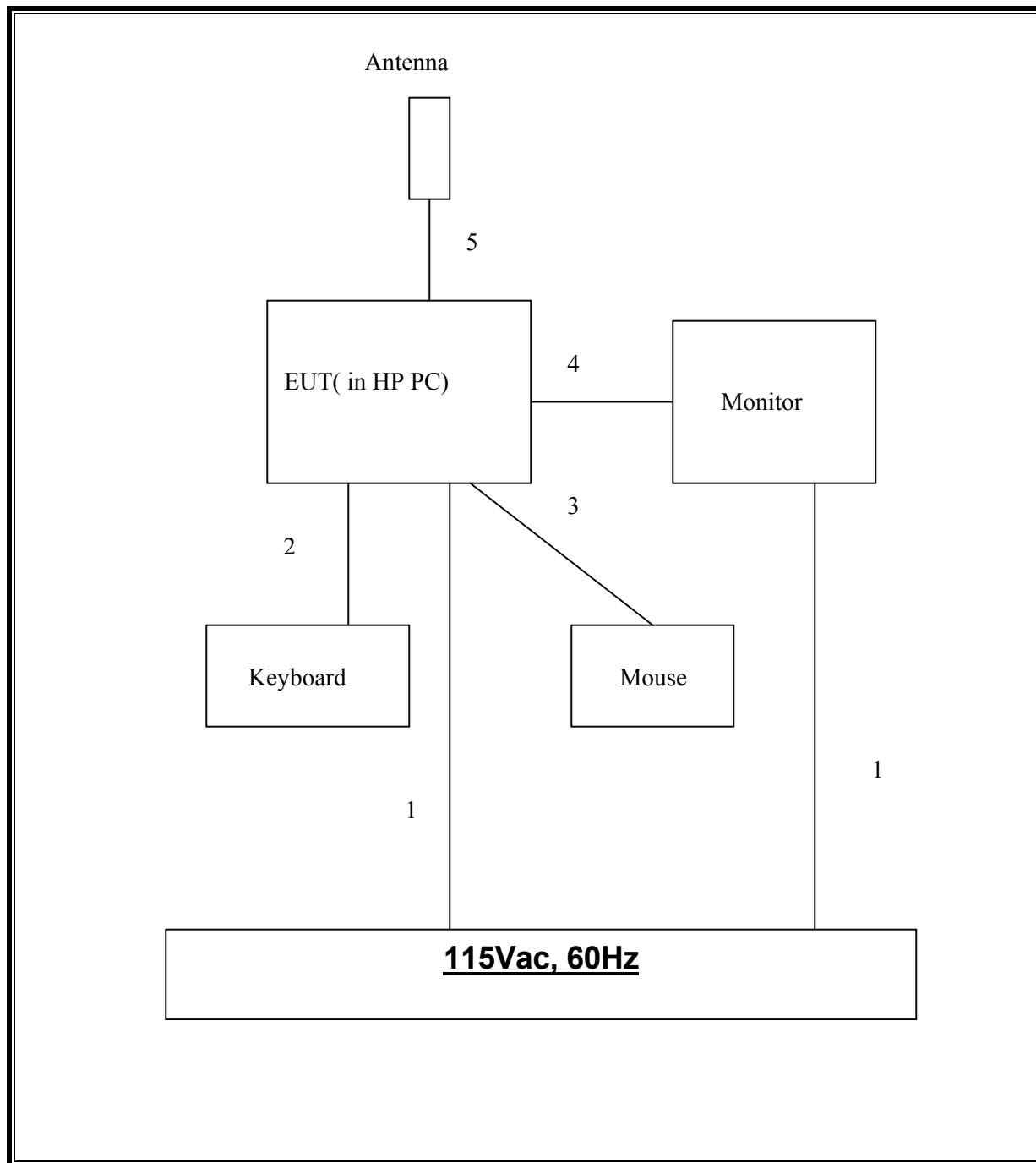
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	2	AC	Un-Shielded	2m	Bundled cable for LC test
2	KB	1	PS/2	Un-Shielded	2m	NA
3	Mouse	1	PS/2	Un-Shielded	2m	NA
4	Video	1	DB15	Shielded	1m	One Torroid on each end
5	Antenna	1	Antenna	Un-Shielded	2.5m	NA

TEST SETUP

The EUT is installed in a host Desktop 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
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-2	7/15/1905	8/30/2007
EMI Test Receiver	R & S	ESHS 20	827129/006	6/3/07
Antenna, Horn 1 ~ 18 GHz	ETS	3117	29301	4/22/07
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00561	10/3/07
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	5/3/07
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	2/4/07
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	9/3/07
RF Filter Section	Agilent / HP	85420E	3705A00256	2/4/07

7. LIMITS AND 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.

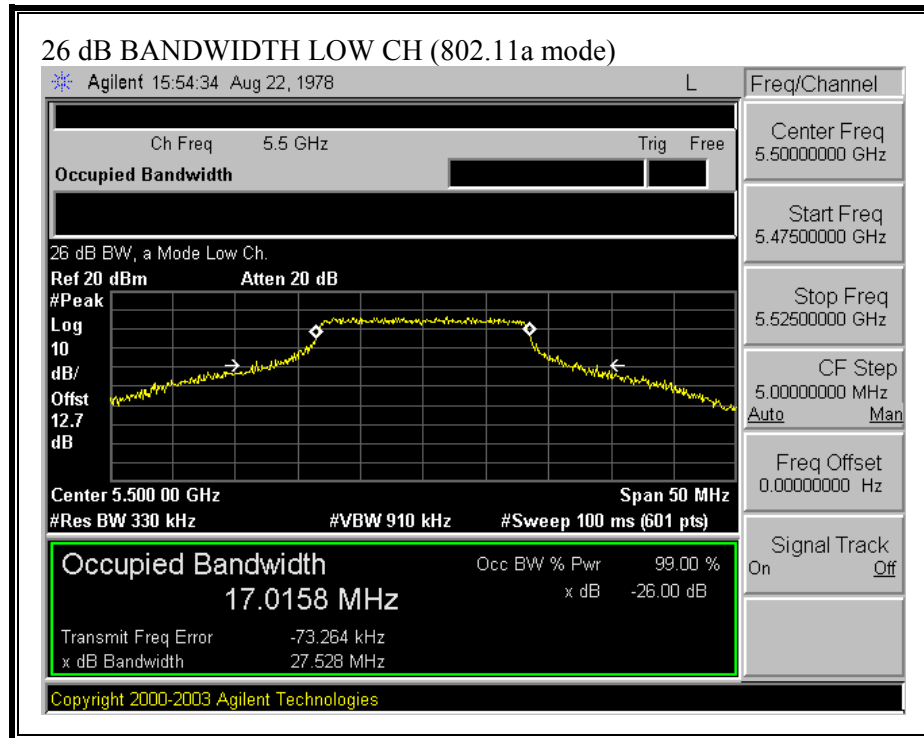
RESULTS

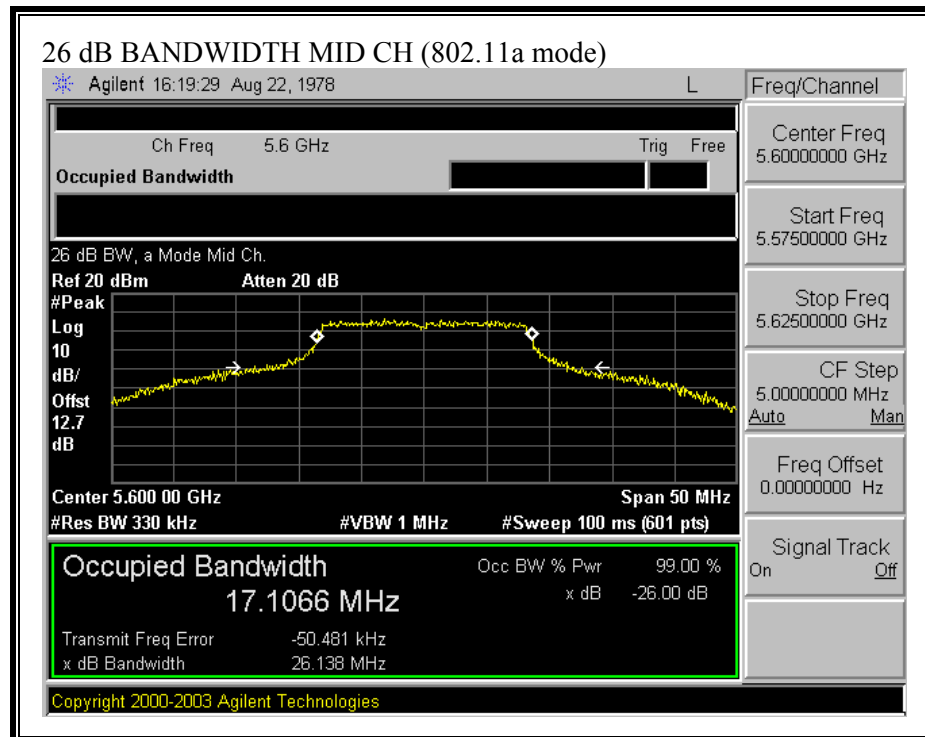
No non-compliance noted:

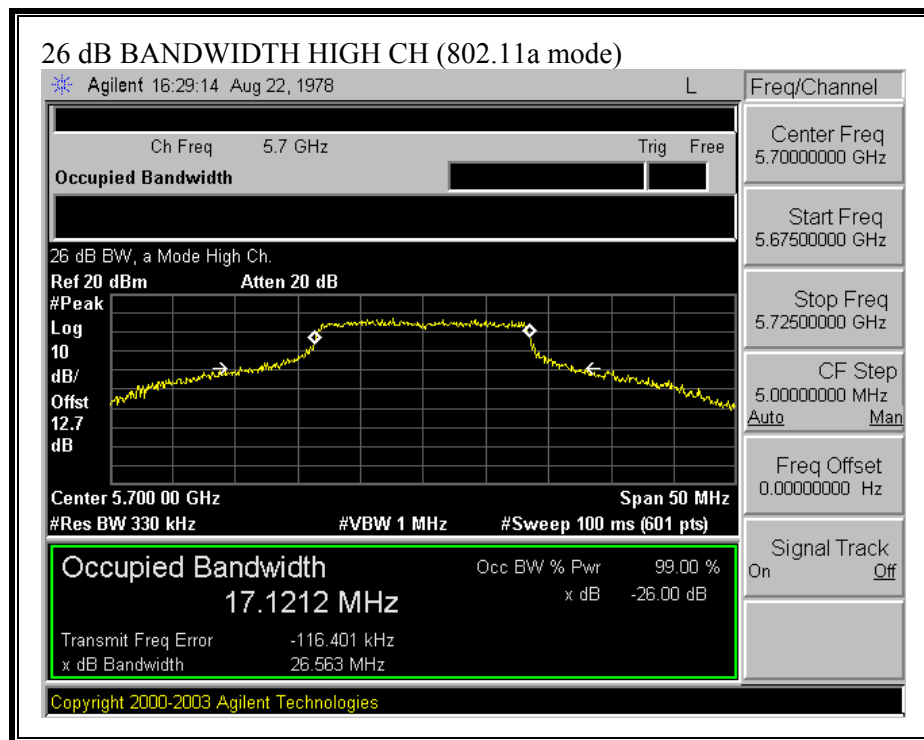
802.11a Mode

Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5500	27.53	14.40
Mid	5600	26.14	14.17
High	5700	26.56	14.24

26 dB EMISSION BANDWIDTH (802.11a MODE)







7.1.2. PEAK POWER

LIMIT

§15.407 (a) (2) For the 5.47–5.725 GHz band, 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:

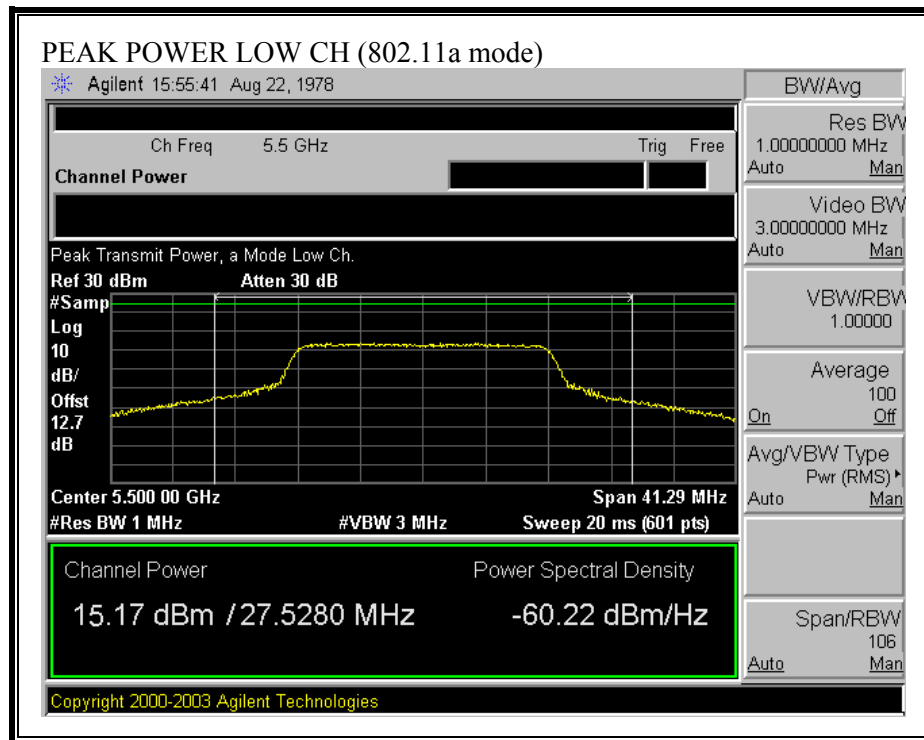
Limit

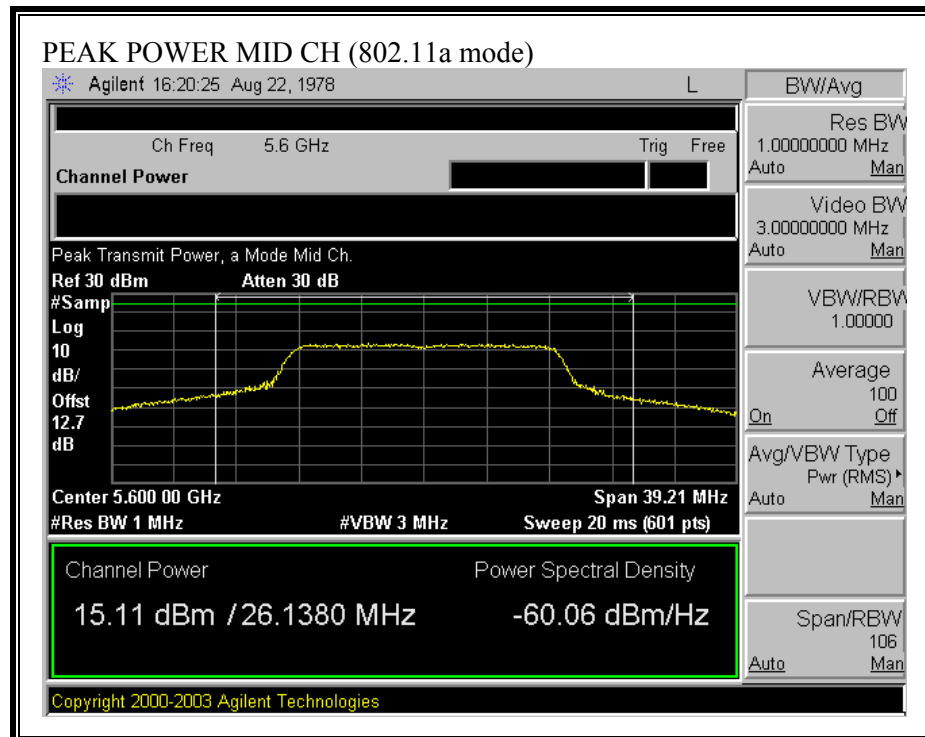
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5500	24	27.528	25.40	0.00	24.00
Mid	5600	24	26.138	25.17	0.00	24.00
High	5700	24	26.563	25.24	0.00	24.00

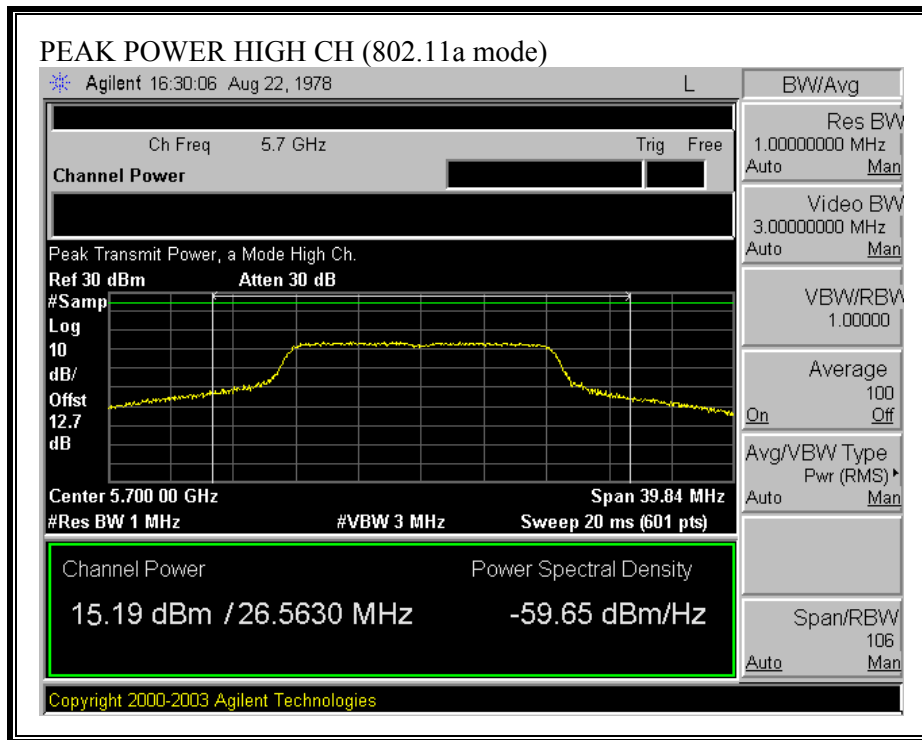
Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5500	15.17	24.00	-8.83
Mid	5600	15.11	24.00	-8.89
High	5700	15.19	24.00	-8.81

PEAK POWER (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:

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

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

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

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

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

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 $S = 1.0 \text{ mW/cm}^2$

RESULTS

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

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm²)
802.11a	20.0	15.19	0.93	0.01

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 12.7 dB (including 10 dB pad and 2.7 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	15.03
Mid	5600	15.01
High	5700	15.07

7.1.5. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.407 (a) (2) For the 5.47–5.725 GHz band, 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 = 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.

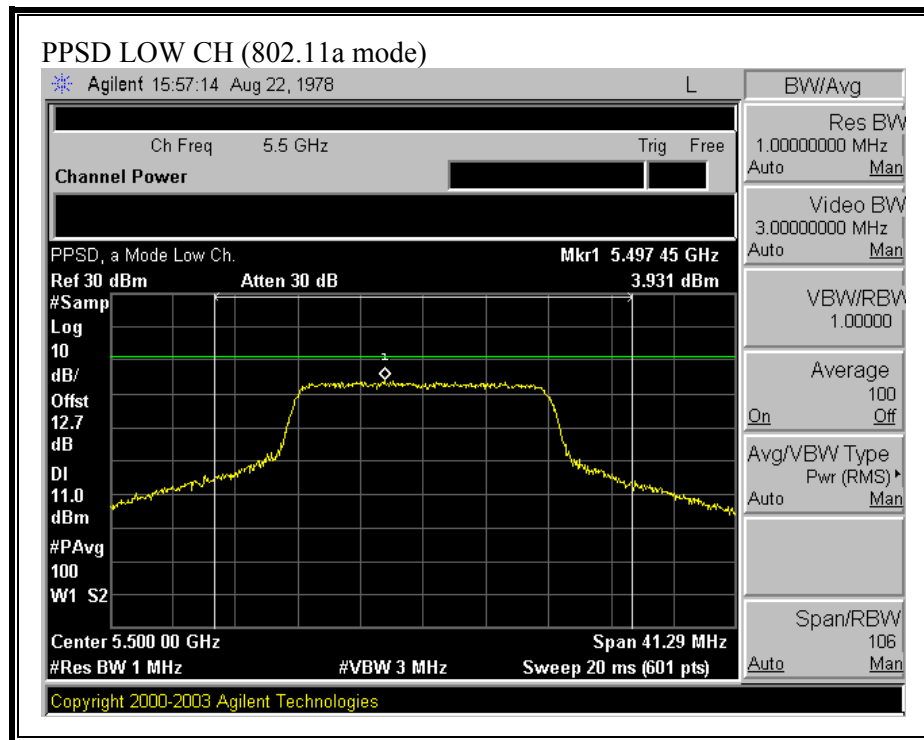
RESULTS

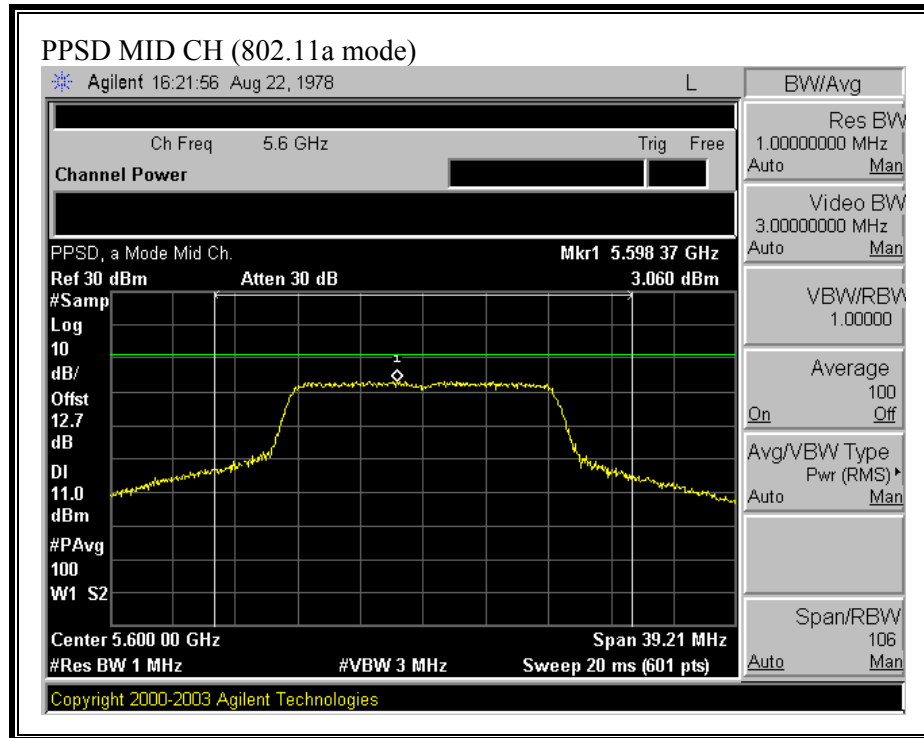
No non-compliance noted:

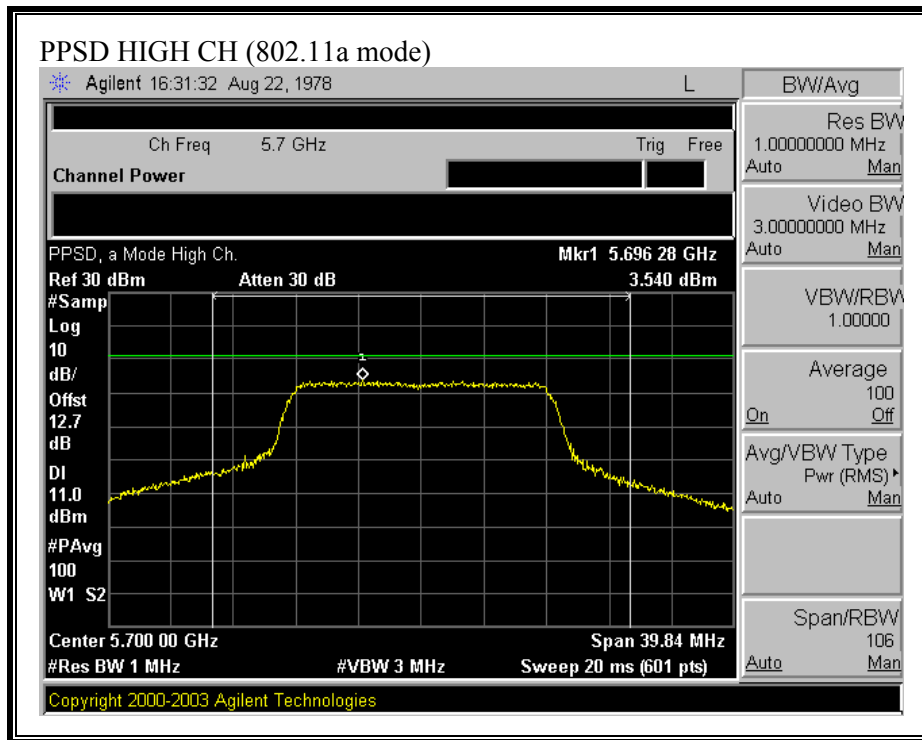
802.11a Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5500	3.93	11.00	-7.07
Mid	5600	3.06	11.00	-7.94
High	5700	3.54	11.00	-7.46

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.

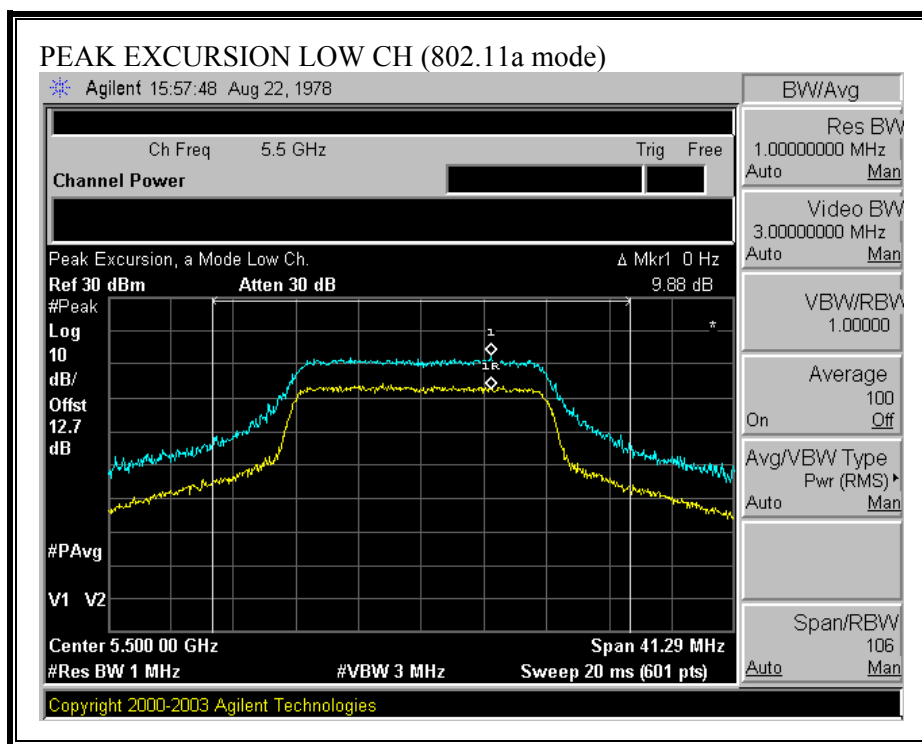
RESULTS

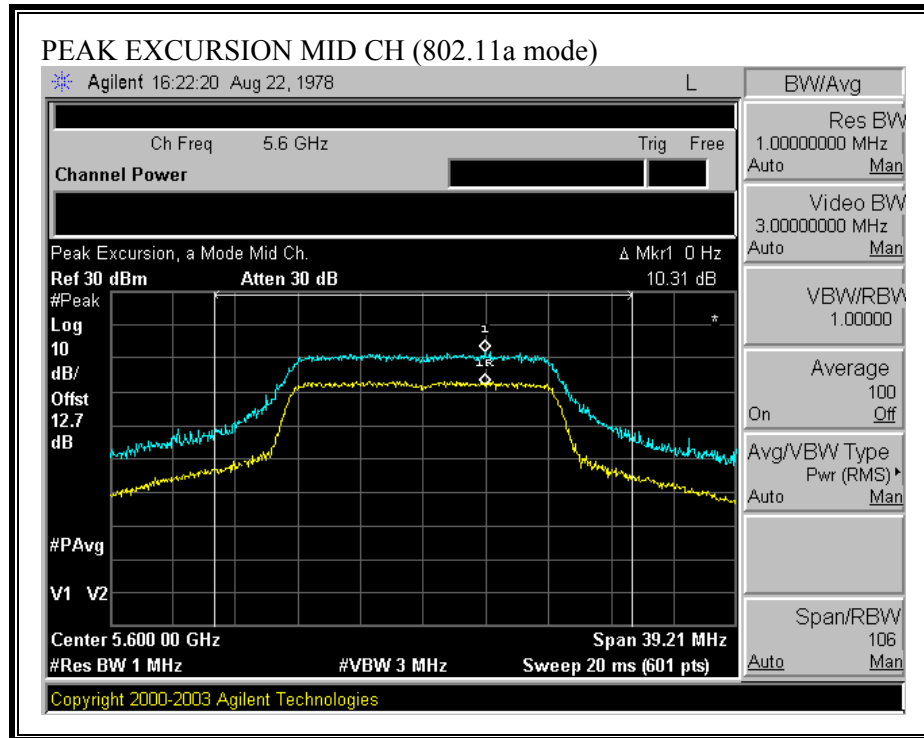
No non-compliance noted:

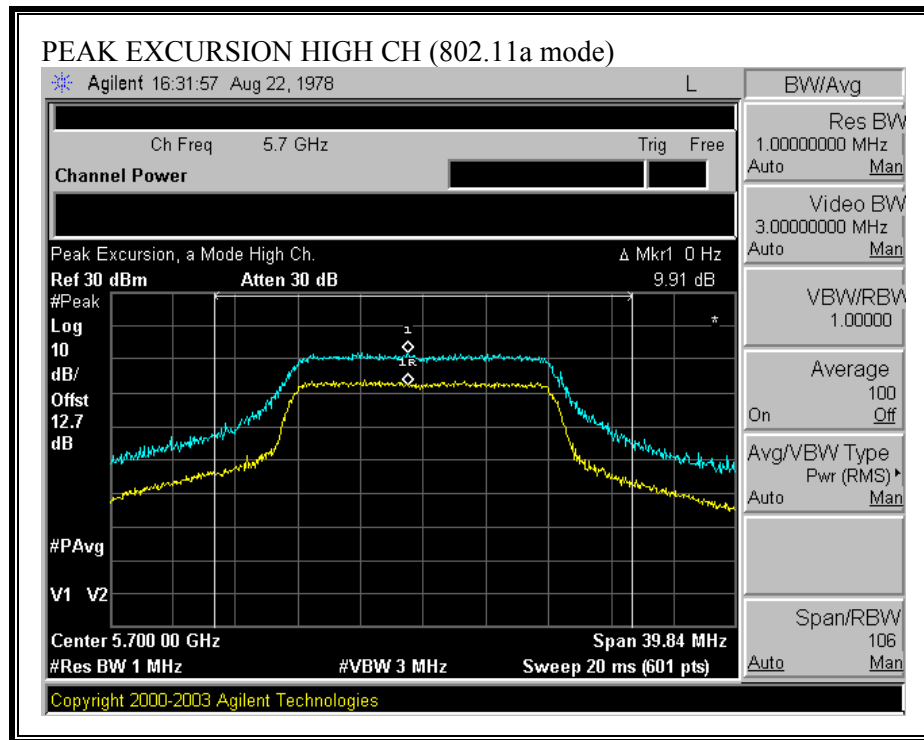
802.11a Mode

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	9.88	13	-3.12
Mid	5600	10.31	13	-2.69
High	5700	9.91	13	-3.09

PEAK EXCURSION (802.11a MODE)







7.1.7. 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.

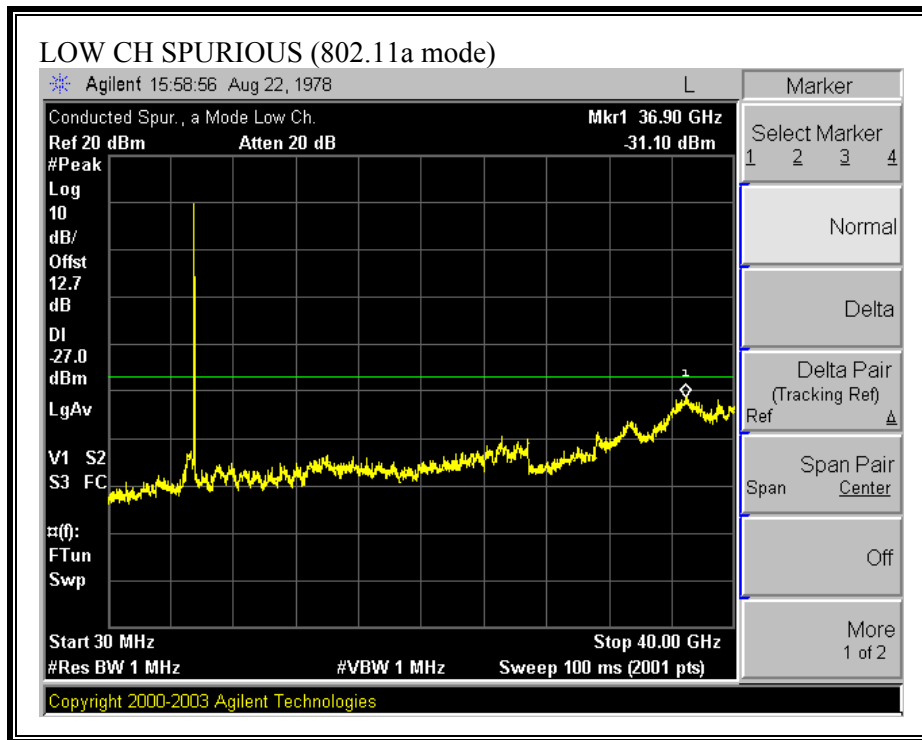
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements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

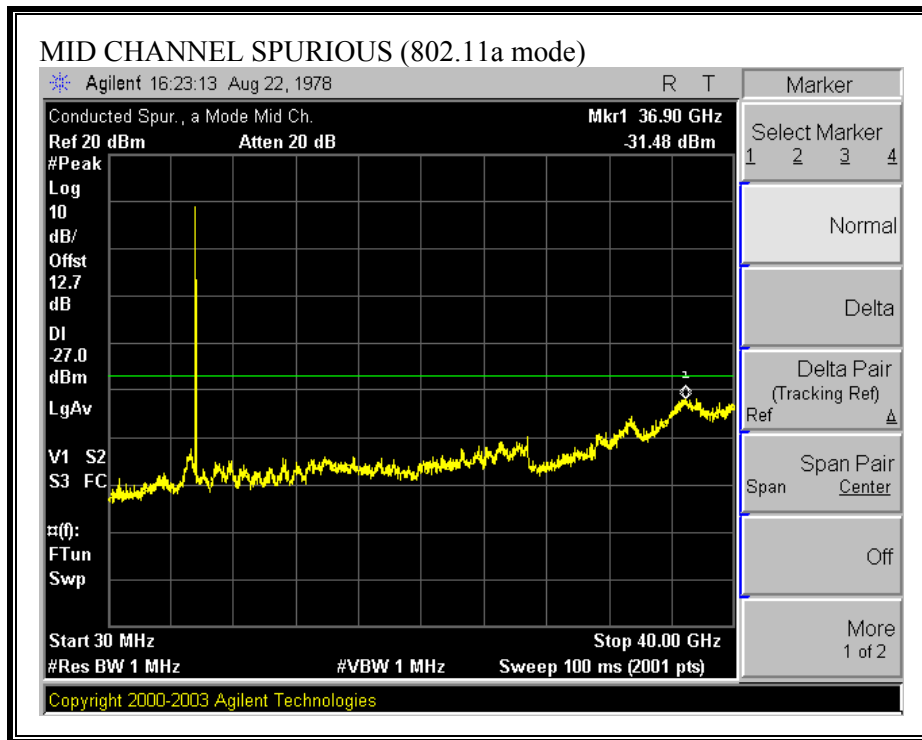
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

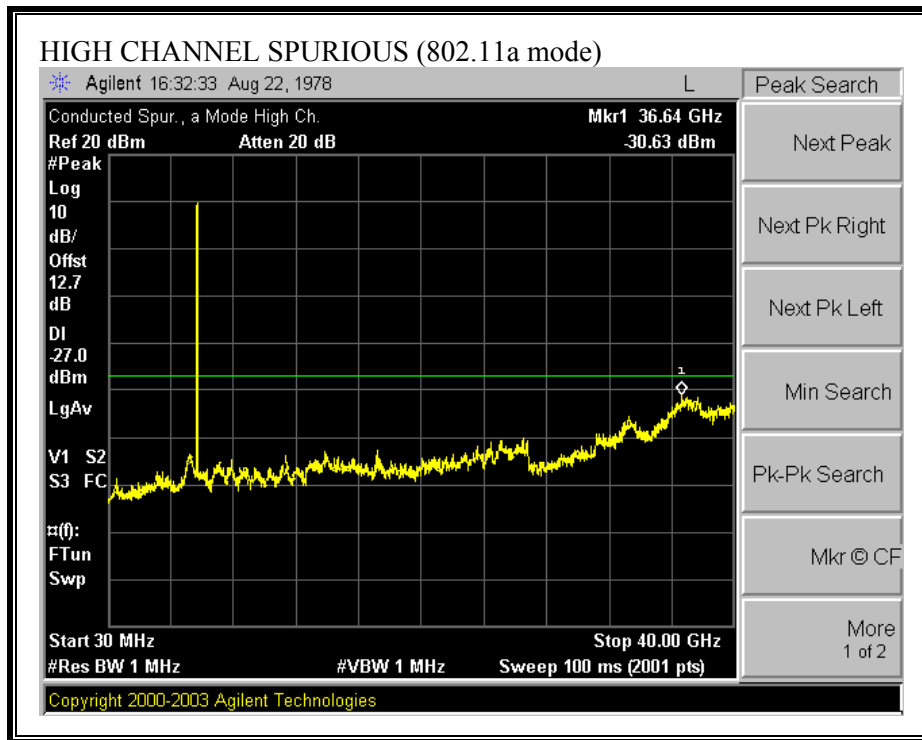
RESULTS

No non-compliance noted:

SPURIOUS EMISSIONS (802.11a MODE)







7.2. DYNAMIC FREQUENCY SELECTION

7.2.1. LIMITS

§15.407 (h) and FCC 06-96 APPENDIX “COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION”.

Table 1: Applicability of DFS requirements prior to use of a channel

Requirement	Operational Mode		
	Master	Client (without radar detection)	Client (with radar detection)
<i>Non-Occupancy Period</i>	Yes	Not required	Yes
<i>DFS Detection Threshold</i>	Yes	Not required	Yes
<i>Channel Availability Check Time</i>	Yes	Not required	Not required
<i>Uniform Spreading</i>	Yes	Not required	Not required

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client (without DFS)	Client (with DFS)
<i>DFS Detection Threshold</i>	Yes	Not required	Yes
<i>Channel Closing Transmission Time</i>	Yes	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes	Yes

Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.	

Table 4: DFS Response requirement values

Parameter	Value
<i>Non-occupancy period</i>	30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds
<i>Channel Closing Transmission Time</i>	200 milliseconds + approx. 60 milliseconds over remaining 10 second period
The instant that the <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> begins is as follows: - For the Short pulse radar Test Signals this instant is the end of the <i>Burst</i>. - For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated. - For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.	

Table 5 – Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Table 6 – Long Pulse Radar Test Signal

Radar Waveform	Bursts	Pulses per Burst	Pulse Width (μsec)	Chirp Width (MHz)	PRI (μsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	1000- 2000	80%	30

Table 7 – Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (μsec)	PRI (μsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	.333	70%	30

7.2.2. DESCRIPTION OF EUT

OVERVIEW OF EUT WITH RESPECT TO §15.407 (h) REQUIREMENTS

The EUT operates over the 5250-5350 MHz and 5470-5725 MHz ranges.

The EUT is a Client Device that does not have radar detection capability.

The EUT utilizes one transmitter/receiver and a single antenna.

The antenna assembly utilized with the EUT has a gain of 0.93 dBi in the 5250-5350 MHz band and the 5470-5725 MHz band.

The highest power level within these bands is 15.98 dBm EIRP in the 5250-5350 MHz band and 16.12 dBm EIRP in the 5470-5725 MHz band.

The 50-ohm Tx/Rx antenna port is connected to the test system to perform conducted tests.

WLAN traffic is generated by streaming the video file TestFile.mp2 “6 ½ Magic Hours” from the Master to the Slave in full motion video mode using the media player with the V2.61 Codec package.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes an 802.11a IP based architecture. One nominal channel bandwidth, 20 MHz, is implemented.

OVERVIEW OF MASTER DEVICE WITH RESPECT TO §15.407 (h) REQUIREMENTS

The Master Device is a Cisco Access Point, FCC ID: LDK102056. The DFS software installed in the Master Device is revision 6.00.1. The minimum antenna gain for the Master Device is 3.5 dBi.

The rated output power of the Master unit is $> 23\text{dBm}$ (EIRP). Therefore the required interference threshold level is -64 dBm . After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is $-64 + 3.5 + 1 = -59.5\text{ dBm}$.

The calibrated conducted DFS Detection Threshold level is set to -64 dBm . The tested level is lower than the required level hence it provides margin to the limit.

7.2.3. TEST AND MEASUREMENT SYSTEM

SYSTEM OVERVIEW

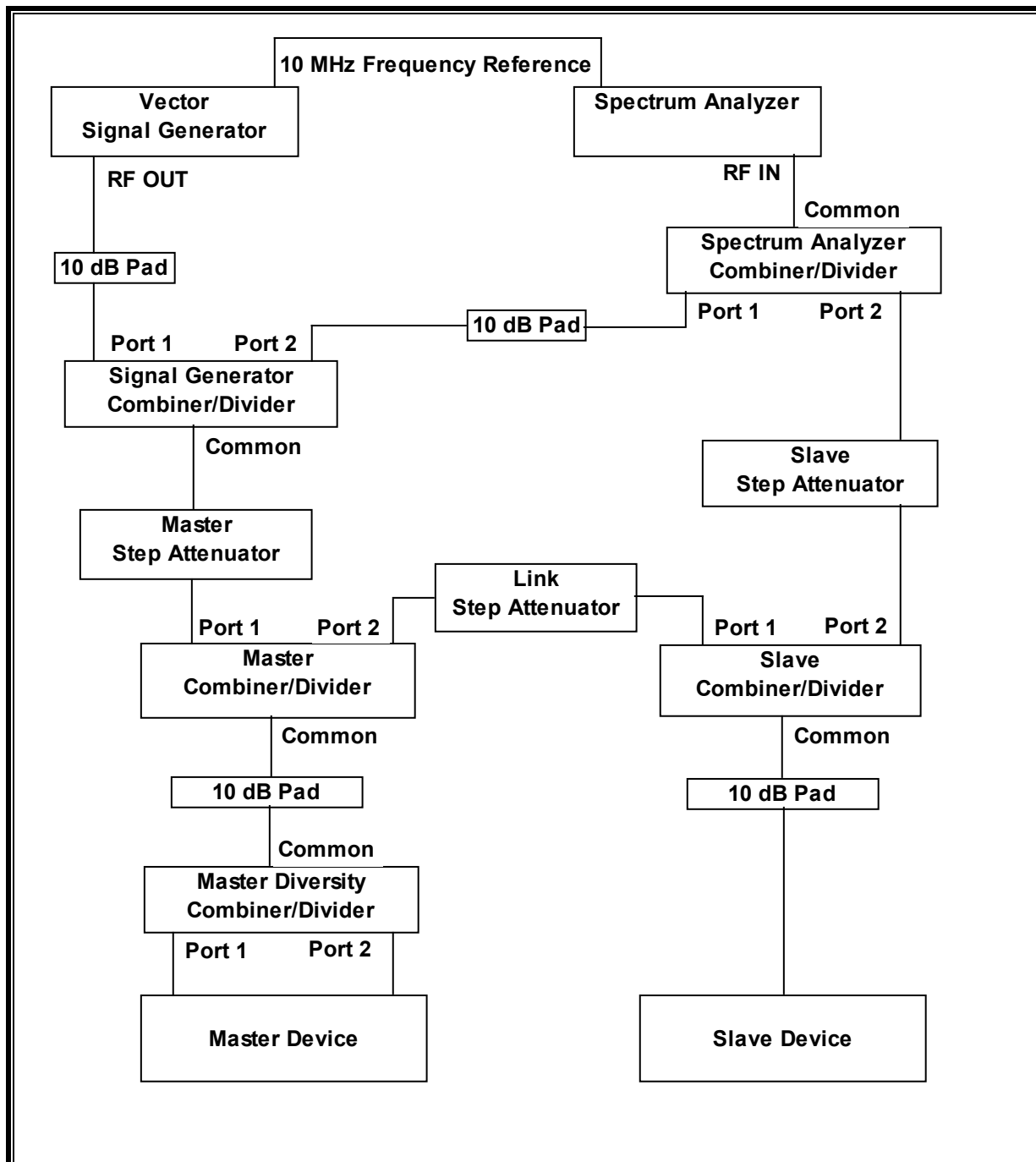
The measurement system is based on a conducted test method.

The short pulse and long pulse signal generating system utilizes the NTIA software and the same manufacturer / model Vector Signal Generator as the NTIA. The hopping signal generating system utilizes the simulated hopping method.

The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution. The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time. The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List, with the initial starting point randomized at run-time.

The signal monitoring equipment consists of a spectrum analyzer with the capacity to display 8192 bins on the horizontal axis. A time-domain resolution of 2 msec / bin is achievable with a 16 second sweep time, meeting the 10 second short pulse reporting criteria. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold. A time-domain resolution of 3 msec / bin is achievable with a 24 second sweep time, meeting the 22 second long pulse reporting criteria and allowing a minimum of 10 seconds after the end of the long pulse waveform.

CONDUCTED METHOD SYSTEM BLOCK DIAGRAM



MEASUREMENT SYSTEM FREQUENCY REFERENCE

Lock the signal generator and the spectrum analyzer to the same reference source as follows: Connect the 10 MHz OUT (SWITCHED) on the spectrum analyzer to the 10 MHz IN on the signal generator and set the spectrum analyzer 10 MHz Out to On.

SYSTEM CALIBRATION

Disconnect the spectrum analyzer, Master Device, and Slave Device from the test system. Terminate the Common port of the Spectrum Analyzer Combiner/Divider, Port 2 of the Master Diversity Combiner/Divider, and Ports 1 and 2 of the Slave Diversity Combiner/Divider. Connect, the appropriate cable to Port 1 of the Master Diversity Combiner/Divider and connect the free end (Master Device end) of this cable to the spectrum analyzer.

Adjust the signal generator and spectrum analyzer to the center frequency of the channel to be measured. Set the signal generator to CW mode. Set the RBW of the spectrum analyzer to 10 kHz and the span to 100 kHz. Adjust the amplitude of the signal generator to yield a measured level of -64 dBm on the spectrum analyzer.

Without changing any of the instrument settings, reconnect the spectrum analyzer to the Common port of the Spectrum Analyzer Combiner/Divider, then remove the cable from Port 1 of the Master Diversity Combiner/Divider and replace this cable with a termination. Measure the amplitude and calculate the difference from -64 dBm. Adjust the Reference Level Offset of the spectrum analyzer to this difference. Confirm that the signal is displayed at -64 dBm. Readjust the RBW and VBW to 3 MHz, set the span to 10 MHz, and confirm that the signal is still displayed at -64 dBm.

This Reference Level Offset setting is used for all tests for which the Master Step Attenuator is set to the current value. The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of -64 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

The Link Step Attenuator and Slave Step Attenuator settings may be changed without affecting the System Calibration. The System Calibration process must be repeated for different settings of the Master Step Attenuator to determine the Reference Level Offset associated with each Master Step Attenuator setting.

INTERFERENCE DETECTION THRESHOLD ADJUSTMENT

Set the signal generator to produce the specified radar waveform, trigger a burst manually and measure the amplitude on the spectrum analyzer. Readjust the amplitude of the signal generator as required so that the peak level of the waveform is at a displayed level equal to the required or desired interference detection threshold.

ADJUSTMENT OF DISPLAYED TRAFFIC LEVEL

Establish a link between the Master and Slave, adjusting the Link Step Attenuator as needed to provide an adequate RSS level at the Master and Slave devices. Stream the video test file to generate WLAN traffic. Adjust the Slave Step Attenuator so that the WLAN traffic level from the Slave, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold.

Confirm that the displayed traffic is from the Slave Device by changing the setting of the Slave Step Attenuator and verifying that the displayed traffic level changes accordingly. Confirm that the displayed traffic does not include Master Device traffic by changing the setting of the Master Step Attenuator and the Link Step Attenuator and verifying that the displayed traffic level does not change. Reset all Step Attenuators to their previous settings.

If the above conditions cannot be met, use a different setting of the Master Step Attenuator, performing a new System Calibration and Interference Detection Threshold Adjustment as required for the new Master Step Attenuator setting.

7.2.4. TEST AND MEASUREMENT EQUIPMENT

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

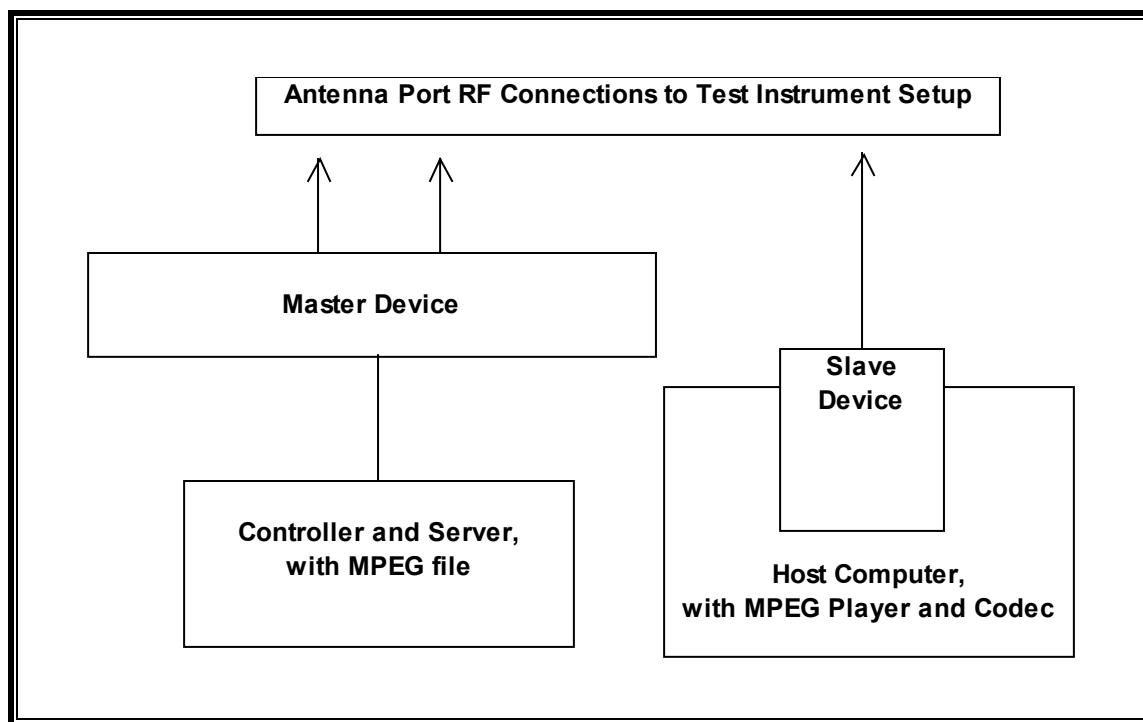
TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Cal Due
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	US42070220	11/26/2007
Vector Signal Generator 250kHz-20GHz	Agilent / HP	E8267C	US43320336	11/2/2007

7.2.5. SETUP OF EUT AND SUPPORT EQUIPMENT

SUPPORT EQUIPMENT

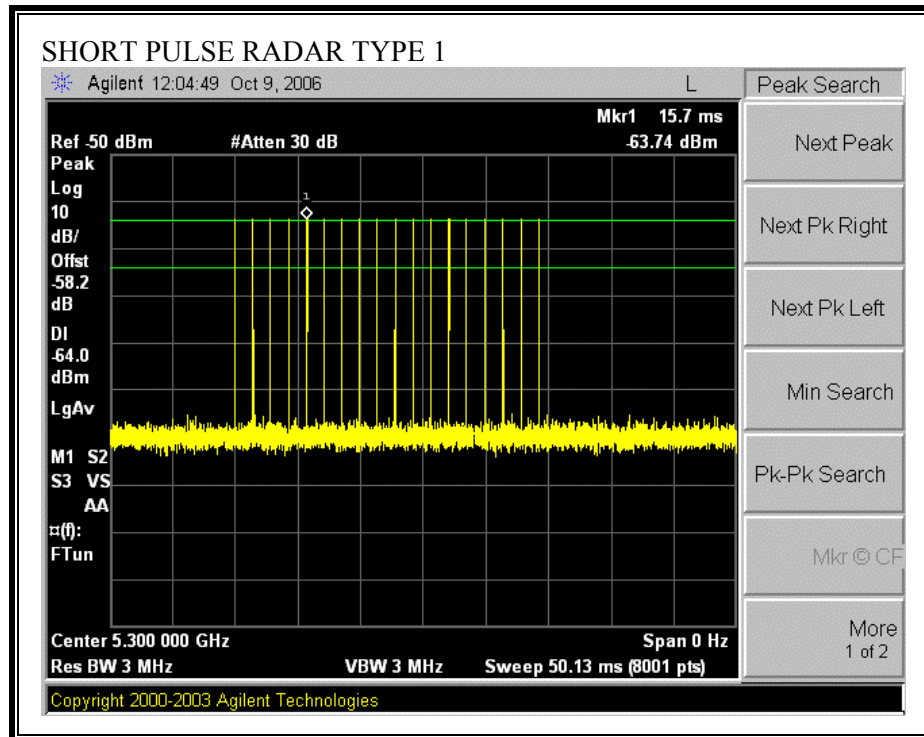
PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Monitor	LG	L1750S	512MXWED0A753	DoC
Keyboard	Dell	SK-8110	NA	DoC
Mouse	Dell	M-SAW34	LZA30519730	DZL211029
PC	HP	VECTRA	US82209954	DoC
Access Point	Cisco	AIR-AP1242AG-A-k	FHK09434008	LDK102056
AC Adapter (AP)	Delta Electronics	ADP-18PB	PZT0628359656	none
Laptop	Dell	Inspiron 600m	CN-0D2125-48643-514-4749	none
AC Adapter (laptop)	Dell	PA-1650-05D	CN-05U092-71615-4BK-1809	none

TEST SETUP

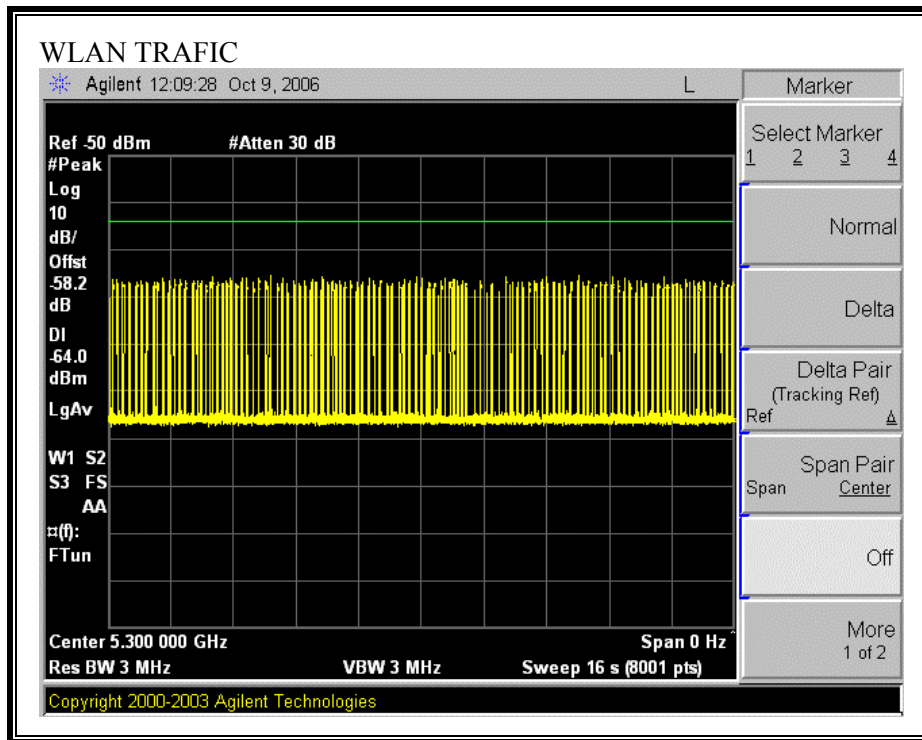


7.2.6. PLOTS OF RADAR WAVEFORMS AND WLAN SIGNALS

PLOTS OF RADAR WAVEFORM



PLOT OF WLAN TRAFFIC FROM SLAVE



7.2.7. TEST CHANNEL AND METHOD

All tests were performed at a channel center frequency of 5300 MHz utilizing a conducted test method.

7.2.8. CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME

GENERAL REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

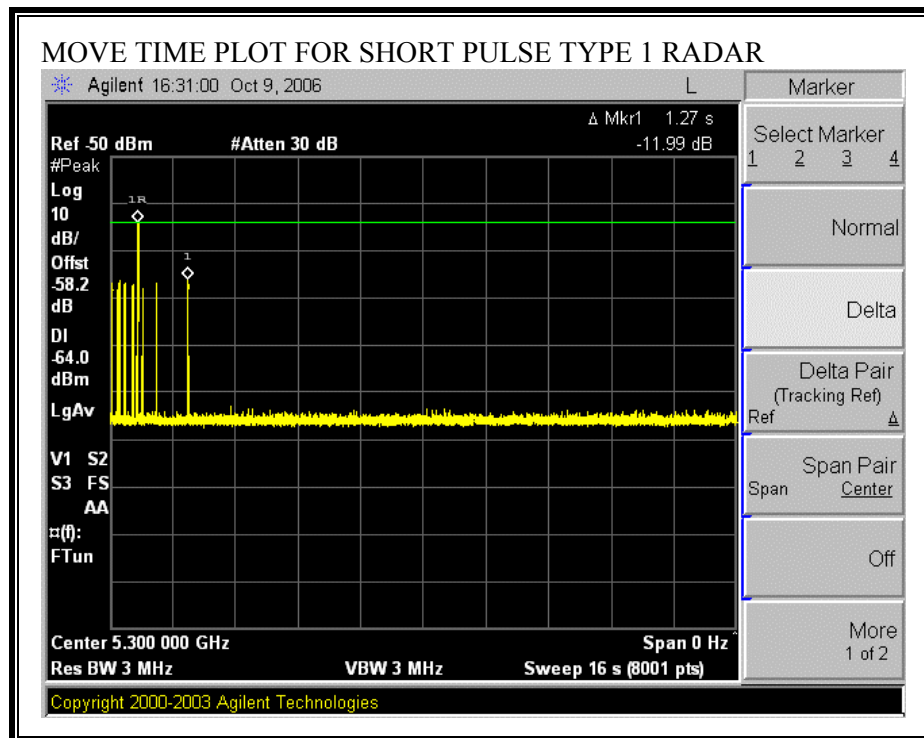
Aggregate Transmission Time =
(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the aggregate time is calculated
Begins no later than (Reference Marker + 200 msec)
and
Ends no earlier than (Reference Marker + 10 sec).

TYPE 1 CHANNEL MOVE TIME RESULTS

No non-compliance noted:

Channel Move Time (s)	Limit (s)
1.270	10

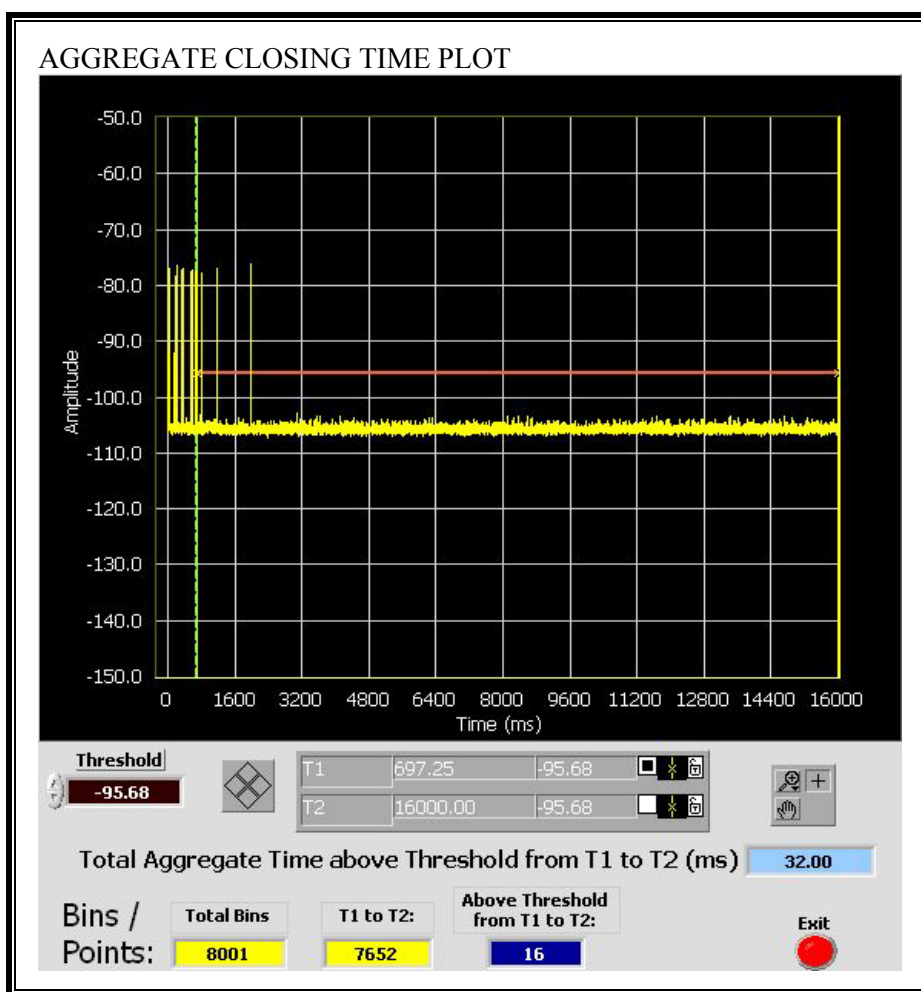


TYPE 1 CHANNEL CLOSING TRANSMISSION TIME RESULTS

No non-compliance noted:

Aggregate Transmission Time (ms)	Limit (ms)	Margin (ms)
32.00	60	28.00

Only intermittent transmissions are observed during the aggregate monitoring period.



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.

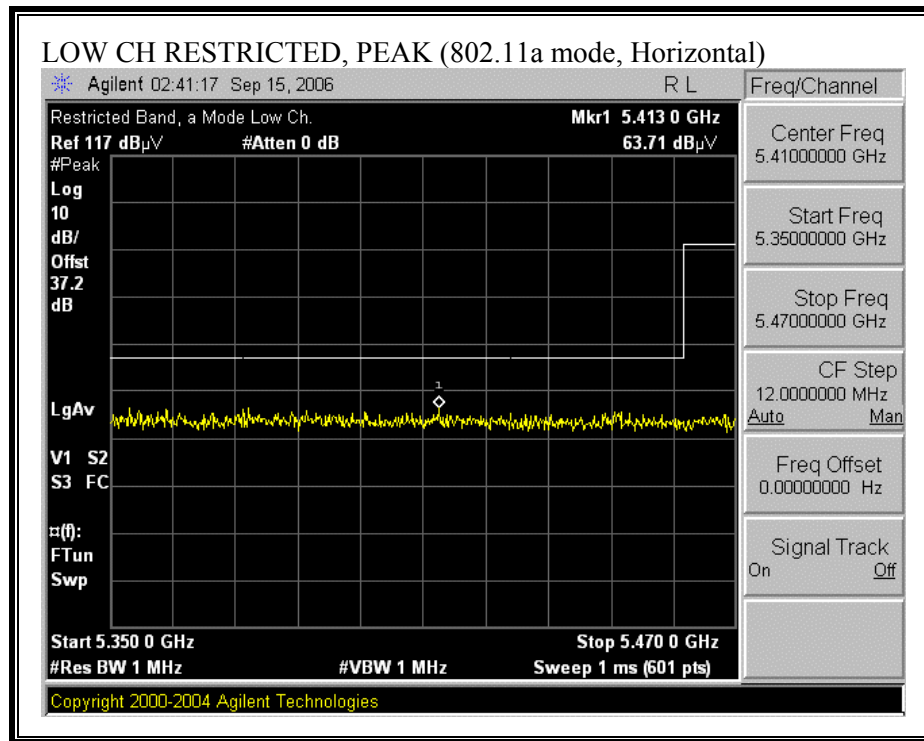
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

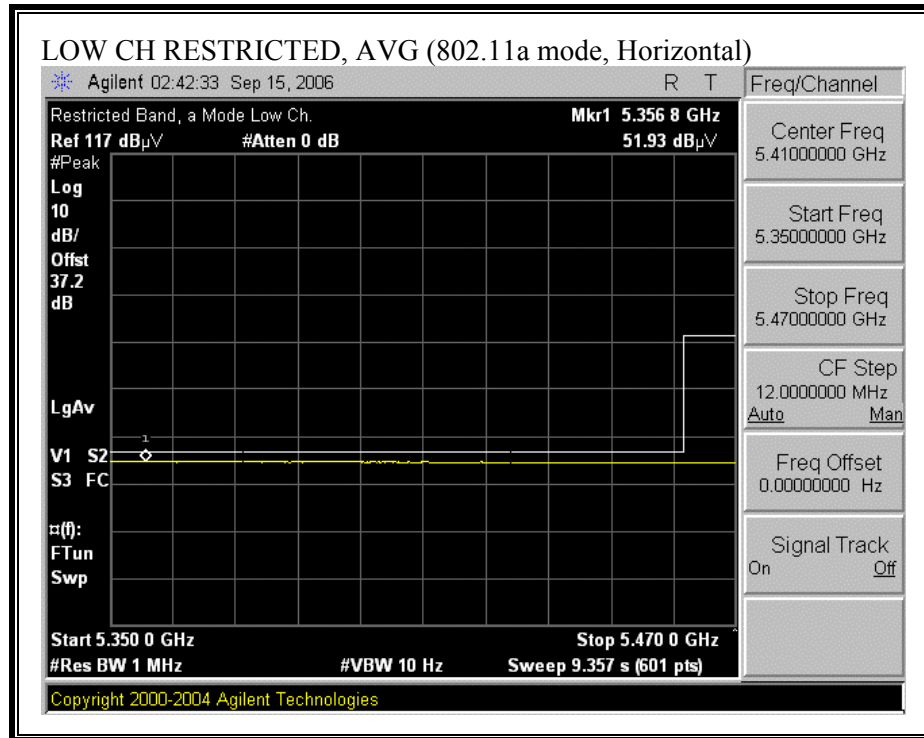
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each band.

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.

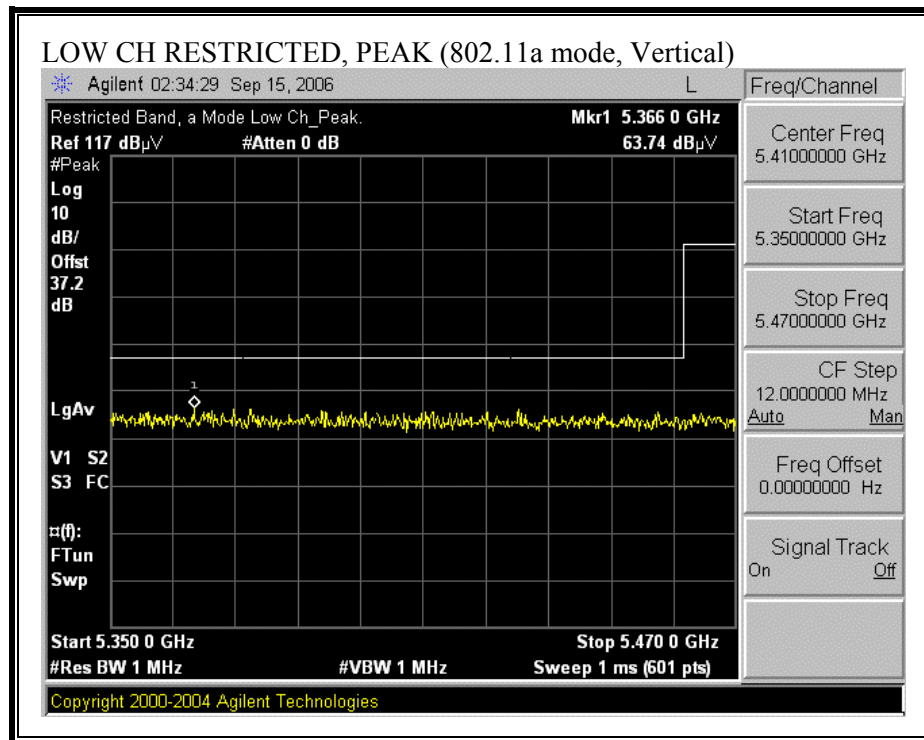
7.3.2. TRANSMITTER ABOVE 1 GHZ FOR 5470 TO 5725 MHz BAND

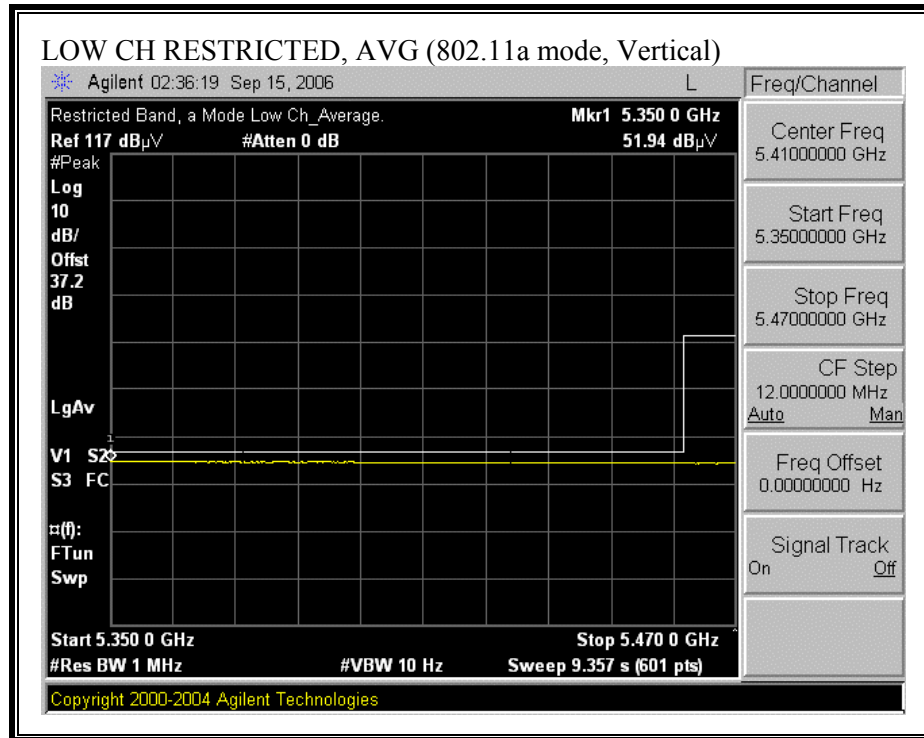
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)



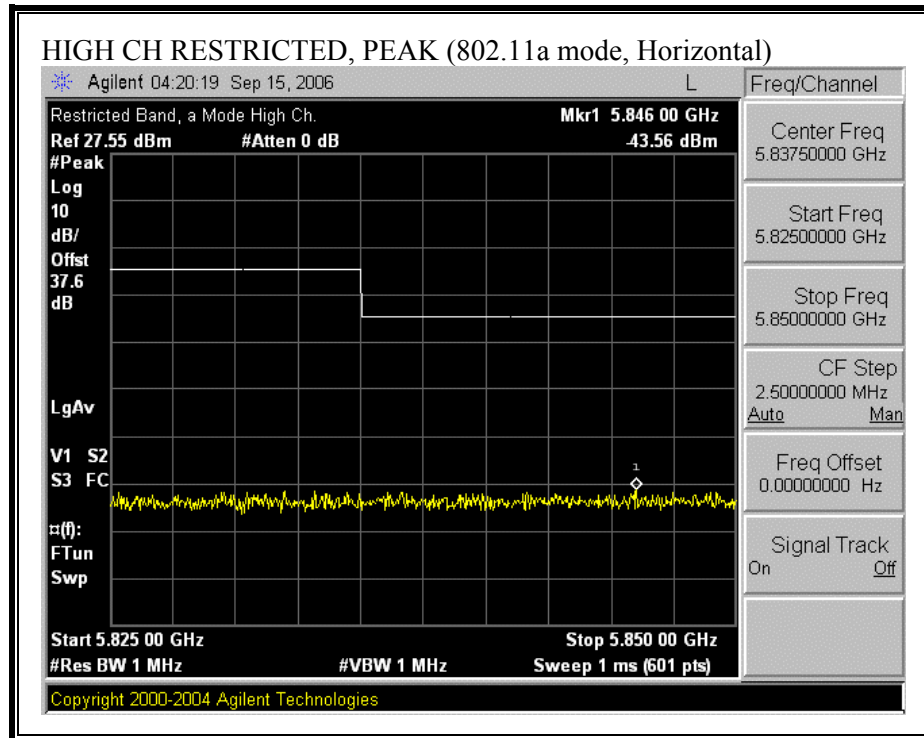


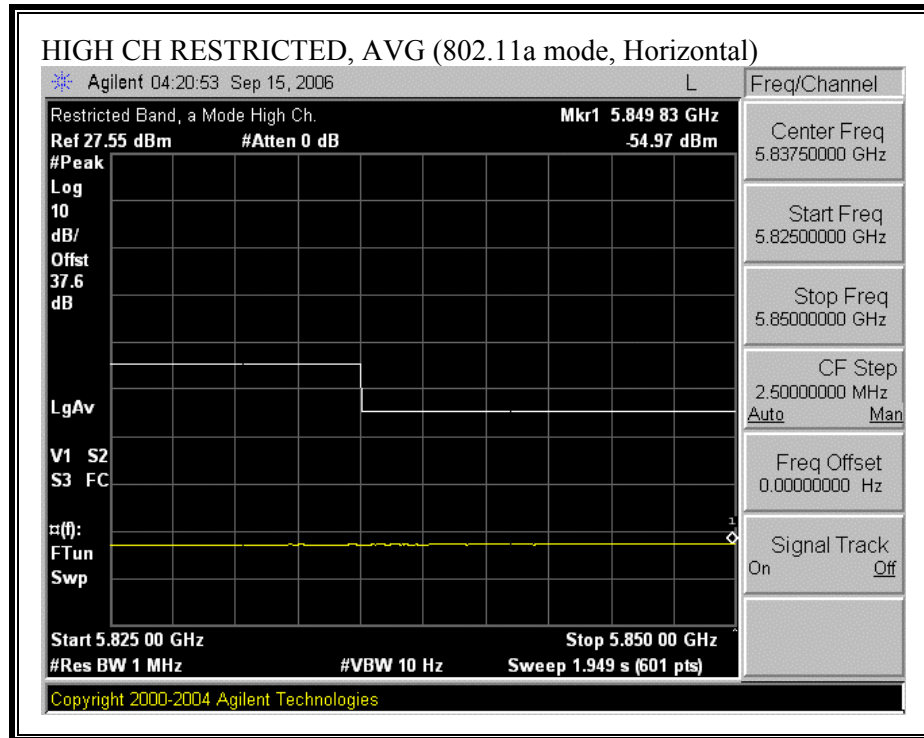
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)



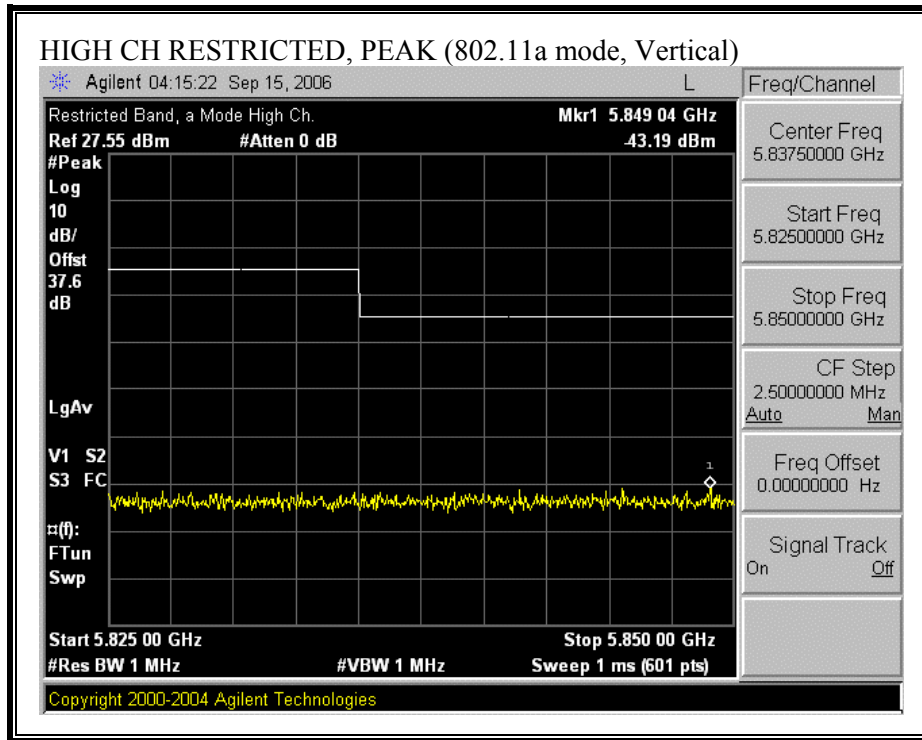


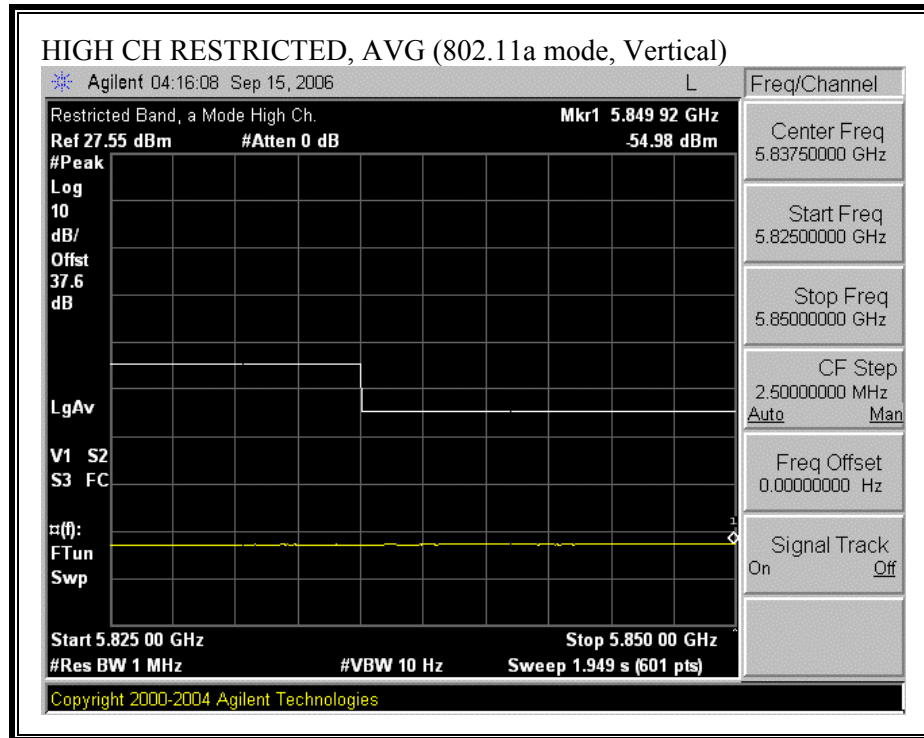
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)





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





HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

High Frequency Measurement																
Compliance Certification Services, Morgan Hill Open Field Site																
Company: Cisco Project #: 06U10593 Date: 9/29/2006 Test Engineer: Mengistu Mekuria Configuration: EUT with Patch Antenna Mode: TX Mode																
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T136; MIN: 3117 @3m			T145 Agilent 3008A0056									FCC 15.209				
2 foot cable 3 foot cable 12 foot cable HPF Reject Filter Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz																
Hi Frequency Cables Gordon 177080004 Chin 200354001																
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dBm	CL dB	Amp dB	D Corr dB	Fitr dB	Peak dBuV/m	Avg dBuV/m	Pk Lin dBuV/m	Avg Lin dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
High Ch																
11.404	3.0	46.5	33.3	37.3	5.0	-33.2	0.0	0.7	56.3	43.1	74	54	-17.7	-10.9	H	
17.099	3.0	46.3	33.6	40.0	6.7	-32.0	0.0	0.7	61.6	48.9	74	54	-12.4	-5.1	H	
11.417	3.0	43.7	31.5	37.3	5.0	-33.2	0.0	0.7	53.5	41.3	74	54	-20.5	-12.7	V	
17.103	3.0	44.9	33.4	40.0	6.7	-32.0	0.0	0.7	60.2	48.8	74	54	-13.8	-5.2	V	
Mid Ch																
11.199	3.0	44.7	32.3	37.3	4.9	-33.5	0.0	0.7	54.1	41.7	74	54	-19.9	-12.3	H	
16.797	3.0	44.6	32.2	39.8	6.6	-32.0	0.0	0.7	59.6	47.2	74	54	-14.4	-6.8	H	
11.192	3.0	44.5	31.6	37.3	4.9	-33.5	0.0	0.7	53.9	41.0	74	54	-20.1	-13.0	V	
16.790	3.0	44.8	31.9	39.8	6.6	-32.1	0.0	0.7	59.8	46.9	74	54	-14.2	-7.1	V	
Low																
10.990	3.0	44.6	31.5	37.2	4.8	-33.8	0.0	0.7	53.6	40.5	74	54	-20.4	-13.5	H	
16.523	3.0	45.0	32.3	39.6	6.5	-32.1	0.0	0.7	59.6	46.9	74	54	-14.4	-7.1	H	
10.986	3.0	43.9	31.4	37.2	4.8	-33.8	0.0	0.7	52.9	40.4	74	54	-21.1	-13.6	V	
16.476	3.0	45.4	32.3	39.5	6.5	-32.1	0.0	0.7	60.0	46.8	74	54	-14.0	-7.2	V	

7.3.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

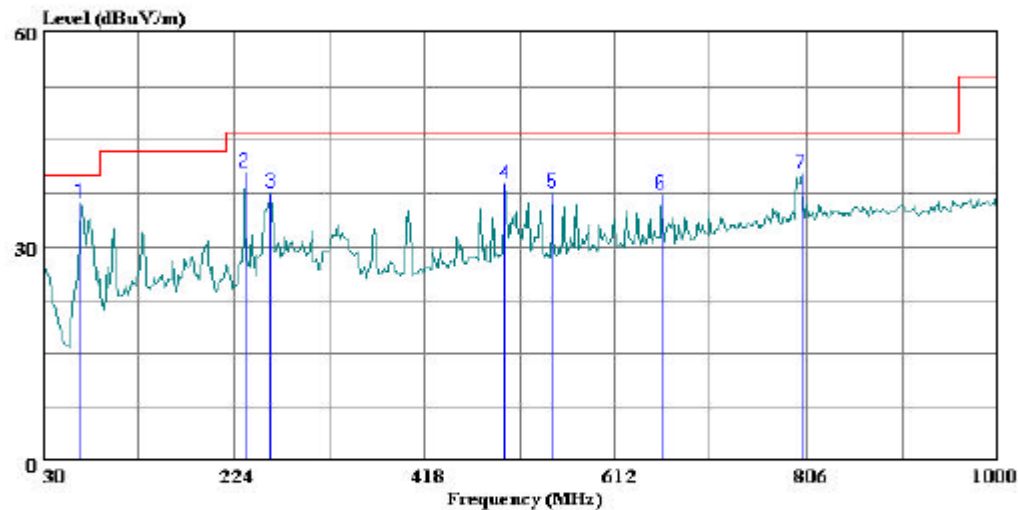
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

Data#: 4 File#: EMI593 Date: 10-04-2006 Time: 14:23:44



(Auxiliary ATC)

Trace: 3

Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator:: Thanh Nguyen
Company: : CISCO
Project #: : 06U10593
Configuration:: BUT inside the PC, basic peripheral.
Mode of Oper.: Transmit worst Case
Target: : FCC Class B

HORIZONTAL DATA

		Read			Limit	Over	
	Freq	Level	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	67.830	26.88	9.20	36.08	40.00	-3.92	Peak
2	235.640	27.26	13.30	40.56	46.00	-5.44	Peak
3	261.830	23.32	14.35	37.67	46.00	-8.33	Peak
4	499.480	18.65	20.22	38.87	46.00	-7.13	Peak
5	547.980	16.69	20.86	37.55	46.00	-8.45	Peak
6	659.530	14.84	22.49	37.33	46.00	-8.67	Peak
7	800.180	15.78	24.58	40.36	46.00	-5.64	Peak

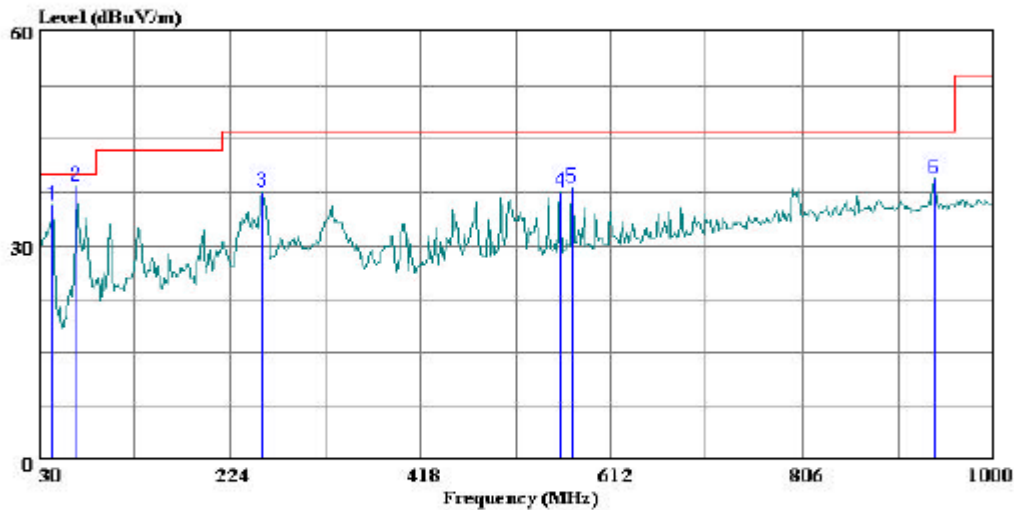
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



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

Data#: 2 File#: EMI593 Date: 10-04-2006 Time: 14:19:38



(Auxiliary ATC)

Trace: 1

Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator:: Thanh Nguyen
Company: : CISCO
Project #: : 06U10593
Configuration:: BUT inside the PC, basic peripheral.
Mode of Oper.: Transmit worst Case
Target: : FCC Class B

VERTICAL DATA

		Read			Limit	Over	
	Freq	Level	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	43.580	22.61	13.02	35.63	40.00	-4.37	Peak
2	67.830	29.27	9.20	38.47	40.00	-1.53	Peak
3	256.980	23.41	14.21	37.62	46.00	-8.38	Peak
4	560.590	16.69	20.98	37.67	46.00	-8.33	Peak
5	572.230	17.07	21.14	38.21	46.00	-7.79	Peak
6	938.890	13.03	26.43	39.46	46.00	-6.54	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.

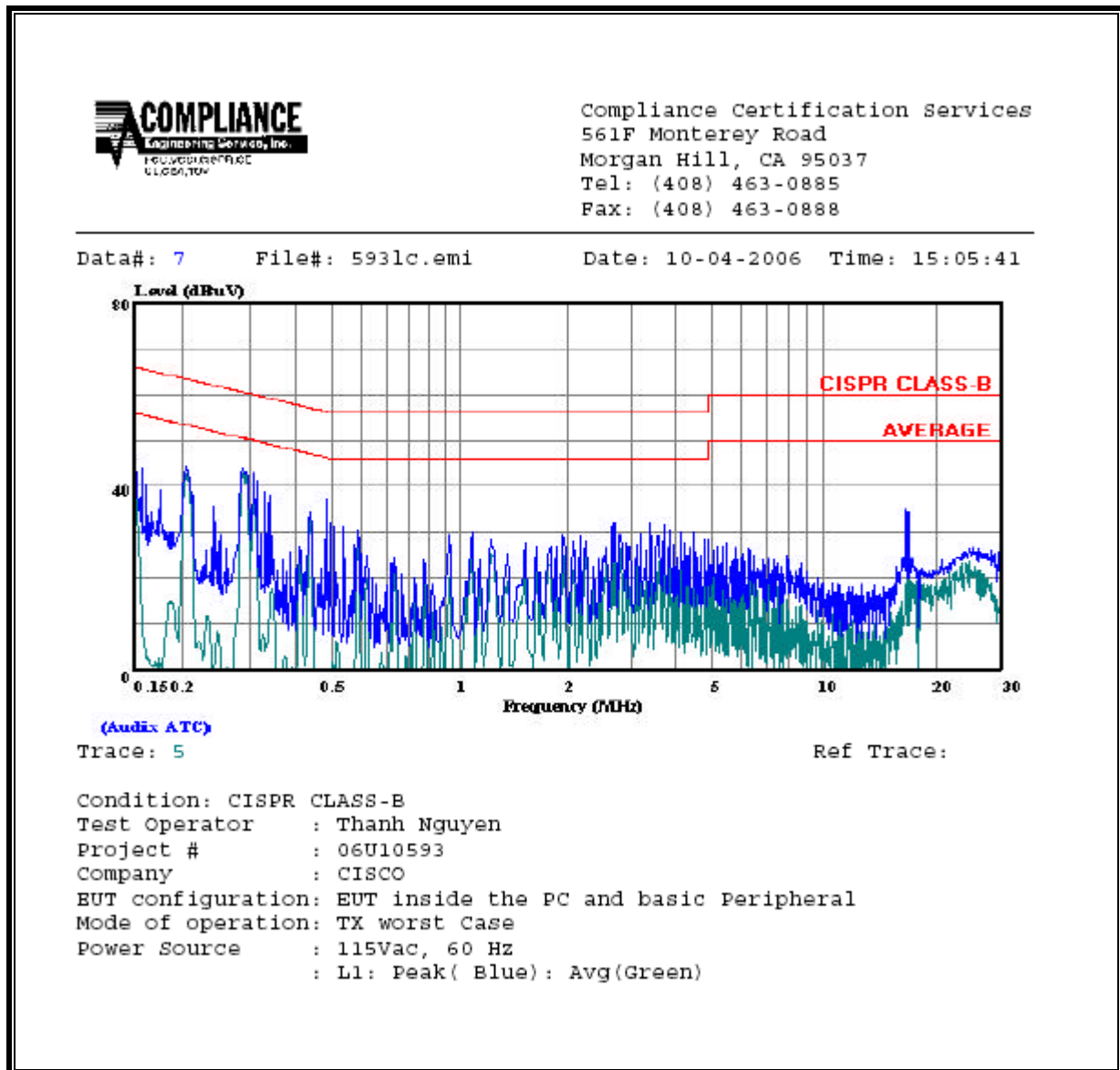
RESULTS

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
0.29	44.10	--	--	0.00	60.47	50.47	-16.37	-6.37	L1
2.81	32.00	--	--	0.00	56.00	46.00	-24.00	-14.00	L1
16.94	34.44	--	--	0.00	60.00	50.00	-25.56	-15.56	L1
0.29	41.38	--	--	0.00	60.50	50.50	-19.12	-9.12	L2
2.81	30.32	--	--	0.00	56.00	46.00	-25.68	-15.68	L2
16.93	34.32	--	--	0.00	60.00	50.00	-25.68	-15.68	L2
6 Worst Data									

LINE 1 RESULTS

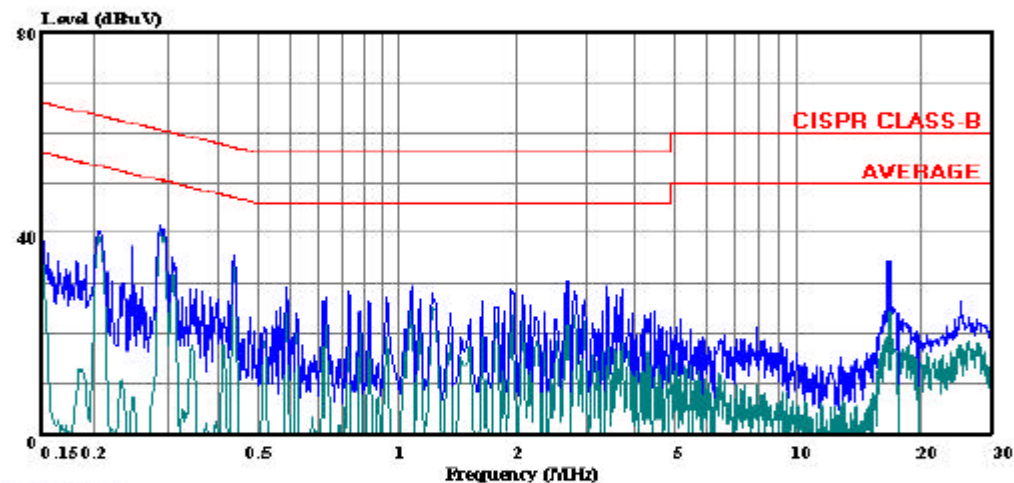


LINE 2 RESULTS



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

Data#: 14 File#: 5931c.emi Date: 10-04-2006 Time: 15:31:58



(Audix ATC)

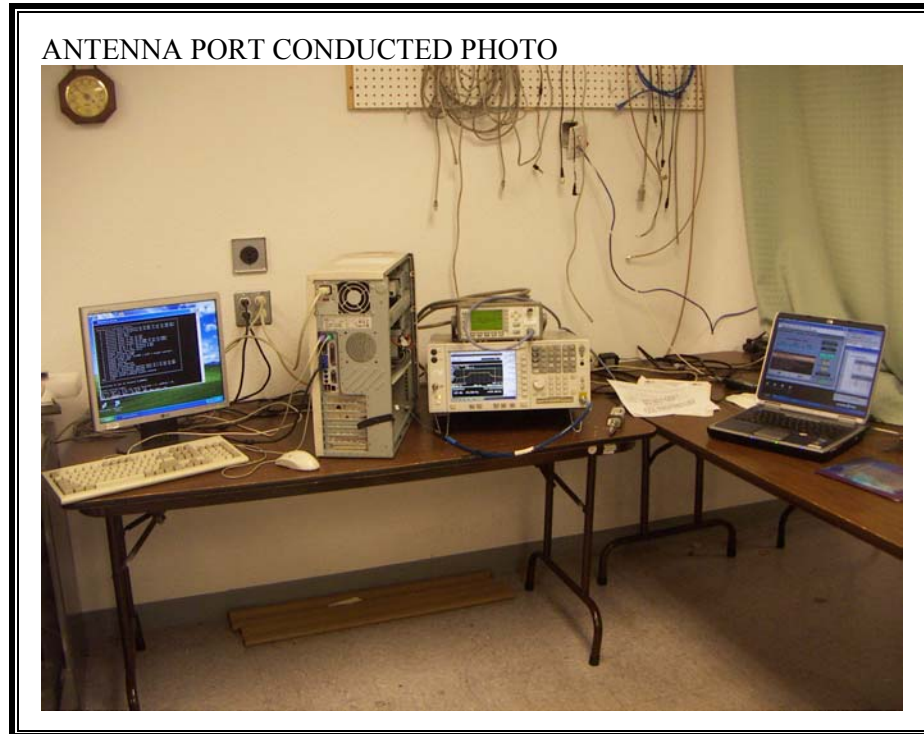
Trace: 12

Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Thanh Nguyen
Project # : 06U10593
Company : CISCO
EUT configuration: EUT inside the PC and basic Peripheral
Mode of operation: TX worst Case
Power Source : 115Vac, 60 Hz
L2: Peak(Blue): Avg(Green)

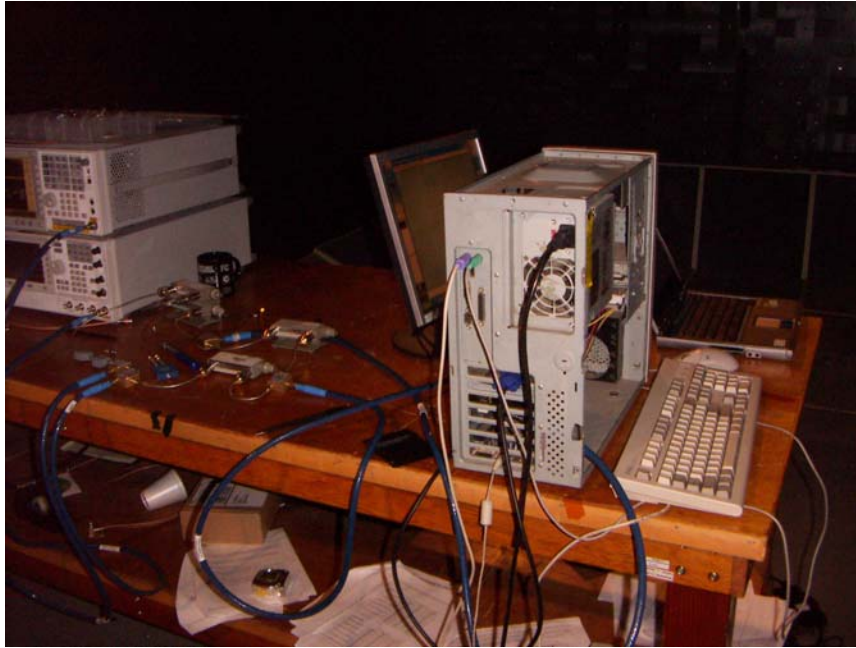
8. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



DFS MEASUREMENT SETUP

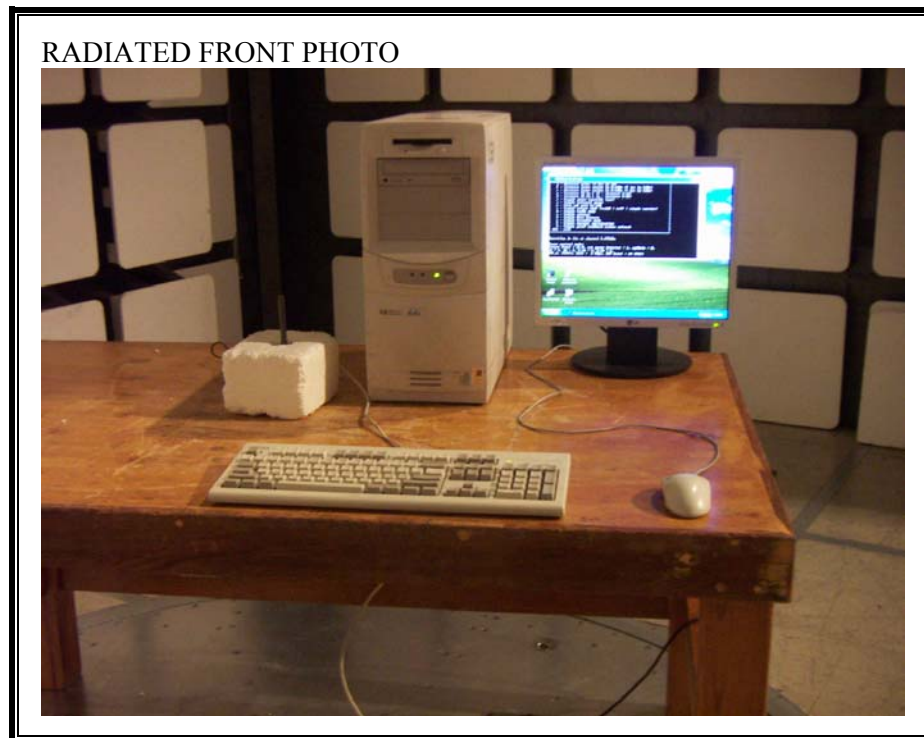
DFS FRONT PHOTO



DFS BACK PHOTO



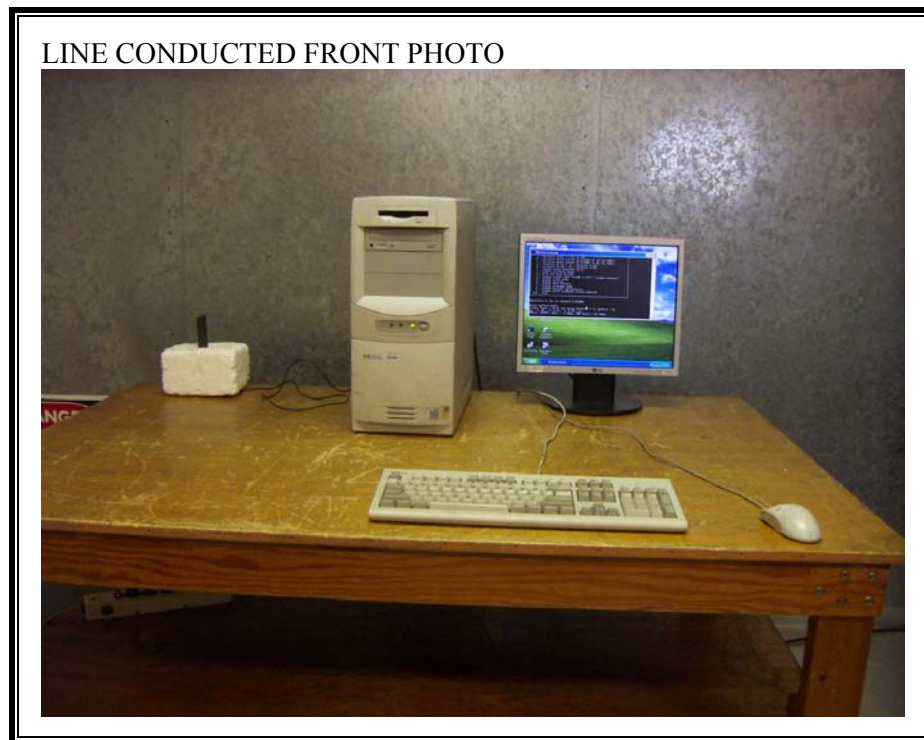
RADIATED RF MEASUREMENT SETUP



RADIATED BACK PHOTO



POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP



LINE CONDUCTED BACK PHOTO



END OF REPORT