



FCC PART 15.407

MEASUREMENT AND TEST REPORT

For

IXIA

26601 W. Agoura Road
Calabasas, CA 91302

FCC ID: RCXGC617644

Report Type:	Product Type:
<input checked="" type="checkbox"/> Supplemental Test Report	802.11 a/b/g Multi AP Emulator (client device)
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Report Number:	R0706045-407
Report Date:	2007-08-06
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TABLE OF CONTENTS

GENERAL INFORMATION.....	5
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	5
EUT PHOTO	5
MECHANICAL DESCRIPTION.....	6
OBJECTIVE	6
RELATED SUBMITTAL(S)/GRANT(S).....	6
TEST METHODOLOGY	6
MEASUREMENT UNCERTAINTY.....	6
TEST FACILITY	7
SYSTEM TEST CONFIGURATION.....	8
JUSTIFICATION	8
EUT EXERCISE SOFTWARE	8
SPECIAL ACCESSORIES.....	8
EQUIPMENT MODIFICATIONS	8
LOCAL SUPPORT EQUIPMENT LIST AND DETAILS	8
POWER SUPPLY INFORMATION.....	8
EXTERNAL I/O CABLING LIST AND DETAILS.....	9
SUMMARY OF TEST RESULTS	10
§ 15.407(F) AND § 2.1091 - RF EXPOSURE	11
§15.203 - ANTENNA REQUIREMENT.....	13
APPLICABLE STANDARD	13
§15.107 - CONDUCTED EMISSIONS	14
SECTION 15.107 CONDUCTED LIMITS:.....	14
TEST SETUP.....	14
TEST EQUIPMENT LIST AND DETAILS.....	14
TEST PROCEDURE	14
TEST SETUP BLOCK DIAGRAM.....	15
ENVIRONMENTAL CONDITIONS	16
SUMMARY OF TEST RESULTS	16
§2.1051 & §15.407(B) (1) & (B) (2) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS	19
APPLICABLE STANDARD	19
TEST EQUIPMENT	19
TEST SETUP DIAGRAM	19
ENVIRONMENTAL CONDITIONS	19
MEASUREMENT RESULTS.....	19
EQUIPMENT LISTS	20
TEST SETUP DIAGRAM	20
§15.407 – 26 DB & 99% BANDWIDTH.....	24
APPLICABLE STANDARD	24
TEST EQUIPMENT	24
TEST SETUP DIAGRAM	24
ENVIRONMENTAL CONDITIONS	24
MEASUREMENT RESULTS.....	24
EQUIPMENT LISTS	25
TEST SETUP DIAGRAM	25

§15.205 & §15.109 & §15.407(B) - RADIATED SPURIOUS EMISSIONS.....	28
APPLICABLE STANDARD	28
TEST SETUP.....	29
TEST EQUIPMENT LIST AND DETAILS.....	29
TEST PROCEDURE	30
CORRECTED AMPLITUDE & MARGIN CALCULATION	30
TEST SETUP BLOCK DIAGRAM.....	31
SUMMARY OF TEST RESULTS	32
RADIATED EMISSIONS TEST PLOT & DATA:.....	33
§15.407 (A) (1) & (A) (2) - MAXIMUM POWER.....	46
APPLICABLE STANDARD	46
TEST EQUIPMENT	46
TEST SETUP DIAGRAM	46
ENVIRONMENTAL CONDITIONS.....	46
MEASUREMENT RESULTS.....	46
EQUIPMENT LISTS	47
TEST SETUP DIAGRAM	47
§15.407 (A) (1) & (A) (3) (5) – PEAK POWER SPECTRAL DENSITY	50
APPLICABLE STANDARD	50
TEST EQUIPMENT	50
TEST SETUP DIAGRAM	50
ENVIRONMENTAL CONDITIONS	51
MEASUREMENT RESULTS.....	51
EQUIPMENT LISTS	51
TEST SETUP DIAGRAM	51
§15.407(A) (6) – PEAK EXCURSION	54
APPLICABLE STANDARD	54
TEST EQUIPMENT	54
TEST SETUP DIAGRAM	54
ENVIRONMENTAL CONDITIONS	54
MEASUREMENT RESULTS.....	54
EQUIPMENT LISTS	55
TEST SETUP DIAGRAM	55
EXHIBIT A - FCC ID LABEL INFORMATION	58
FCC § 2.925 IDENTIFICATION OF EQUIPMENT.....	58
FCC ID LABEL REQUIREMENTS AS PER FCC § 15.19	58
PROPOSED FCC ID LABEL	58
PROPOSED LABEL LOCATION ON EUT	59
EXHIBIT B - TEST SETUP PHOTOGRAPHS	60
CONDUCTED EMISSIONS –FRONT VIEW	60
CONDUCTED EMISSIONS – REAR VIEW	60
RADIATED EMISSIONS - FRONT VIEW	61
RADIATED EMISSIONS - REAR VIEW	61
EXHIBIT C - EUT PHOTOGRAPHS.....	62
EUT – TOP VIEW	62
EUT – BOTTOM VIEW.....	62
EUT – FRONT VIEW WITH ANTENNAE	63
EUT – FRONT VIEW W/O ANTENNAE	63
EUT – REAR VIEW	64
EUT – CHASSIS COVER OFF.....	65
EUT- MAIN BOARD (CPU) COMPONENT VIEW.....	65
EUT-MAIN BOARD (CPU) SOLDER VIEW	66
EUT - ENCRYPTION BOARD 1 COMPONENT VIEW	66

EUT-ENCRYPTION BOARD 1 SOLDER VIEW.....	67
RF MODULE – COMPONENT VIEW WITH FCC LABEL.....	67
EUT - RF MODULE COMPONENT VIEW WITH RF SHIELD INSTALLED	68
EUT - RF MODULE COMPONENT VIEW WITH RF SHIELDING REMOVED	68
EUT - RF MODULE SOLDER VIEW	69
EUT- FLASH DISK DRIVE SUB CIRCUIT 1 COMPONENT VIEW	69
EUT- FLASH DISK DRIVE SUB CIRCUIT 1 SOLDER VIEW	70
EUT-TRANSMITTER BOARD WITH NETWORK BOARD COMPONENT VIEW INSTALLED ON CARRIER BOARD	71
EUT- ENCRYPTION BOARD WITH NETWORK BOARD SOLDER VIEW INSTALLED ON CARRIER BOARD.....	72
EUT- POWER SUPPLY SUB CIRCUIT 3 COMPONENT VIEW	72
EUT- POWER SUPPLY SUB CIRCUIT 3 SOLDER VIEW.....	73
EUT- POWER SUPPLY SUB CIRCUIT 3 COVER OFF VIEW.....	73
EUT – ANTENNAE VIEW	74

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

This BACL measurement and test report has been compiled on behalf of *Ixia* and their product *FCC ID: RCXGC617644*, or the EUT as referred to in the rest of this report which is an AP device station emulator (client device) platform designed for testing Wi-Fi devices and networks. The model *IxWLAN SED-MR+*, capable of simulating multiple, concurrent virtual stations, also features roaming and multiple SSID testing capabilities. The EUT is an 802.11 a/b/g wireless AP device that operates on 2412-2462 MHz, 5150-5350 MHz, 5470-5725 MHz and 5725-5825 MHz bands. The EUT is programmed at the point of manufacture for client device operation only and does not have autonomous transmitting ability.

** The test data gathered in this report were from a production sample provided by the manufacturer with the serial number: B1218*

Antenna Information: The three identical antennae, *Nearson* model: Swivel Antenna 614 utilized by this device are external antennae with SMA (reverse polarity plug, female) connectors and maximum gain of 4.0 dBi (2.4~2.5 GHz), 5dBi (5.15~5.35 GHz) and 4.5dBi (5.75~5.85 GHz).

Swivel Multi-band Wireless LAN Antennae			
Frequency (MHz)	Main Antenna Gain (dBi)	Polarization	Radiation
2450	4.0	Vertical	Omni
5250	5.0	Vertical	Omni
5750	4.5	Vertical	Omni

EUT Photo



Additional EUT photos in Exhibit C

Mechanical Description

The EUT is of metallic construction and measures approximately 203 mm (L) x 330 mm (W) x 53 mm (H) and weighs approximately 2.24 kg.

Objective

This type approval report is prepared on behalf of *Ixia* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for the following test items: Conducted Output Power, Antenna Requirements, AC Line Conducted Emission and Radiated Emissions in Restricted Bands.

As declared by *Ixia* the three identical transmitter modules used in the model: IxWLAN SED-MR+, are all identical (FCC ID: NKRCM9, Model: CM9), and share the same radio frequency characteristics with the exception being the antennae used. The antenna used in IxWLAN SED-MR+ model has same gain of the original antenna certified for use with the CM9 module.

Related Submittal(s)/Grant(s)

This submittal is related to certified transmitter module manufactured by Winstron NeWeb (FCC ID: NKRCM9, Model CM9 tested by International Standards Laboratory in report: ISL-04LR018FC). Only those tests pertaining to the module's (FCC ID: NKRCM9) implementation in host device (*Ixia* model: IxWLAN SED-MR+) have been performed and recorded herein. For all testing and results pertaining to the original modular approval please refer to International Standards Laboratory report: ISL-04LR018FC.

Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from ± 2.0 for Conducted Emissions tests and ± 4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at it's facility in Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

SYSTEM TEST CONFIGURATION

Justification

The host system was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the testing mode to represent *worst-case* results during the final qualification test.

EUT Exercise Software

The EUT is programmed with the following data rate settings that were used during testing:

Channel	Mode	Frequency (MHz)	Date Rate (Mbps)
36	802.11a	5180	6 - 54
52	802.11a	5260	6 - 54
64	802.11a	5320	6 - 54
100	802.11a	5500	6 - 54
120	802.11a	5600	6 - 54
140	802.11a	5700	6 - 54

Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

Equipment Modifications

No modifications were made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Dell	Laptop PC	PP04S	OF926A02

Power Supply Information

Manufacturer	Description	Model	Serial Number	FCC ID
CUI Inc.	AC Adapter	A1-15S05	R00042200434	None

External I/O Cabling List and Details

Cable Description	Length (M)	Cable Type	From	To
RJ45	2	Shielded	EUT	Laptop PC
Serial Cable	1.7	Shielded	EUT	Laptop PC

SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC Rules	Description of Test	Result	Notes
§15.407 (f) §2.1091	RF Exposure	Compliant	/
§15.203	Antenna Requirement	Compliant	/
§ 15.207 (a)	Conducted Emissions	Compliant	/
§ 15.407 (b)(1) & (b)(2)	Spurious Emissions at Antenna Port	Compliant	Please refer to ISL Report: ISL-04LR018FC
§15.205	Restricted Band	Compliant	/
§15.209 (a) & §15.407(a)(1) & (a)(2)	Spurious Radiated Emissions	Compliant	/
§15.247 (a)(5)	99% & 26 dB Bandwidth	NA	/
§15.407 (a)(1) & (a)(2)	Maximum Peak Output Power	Compliant	Please refer to ISL Report: ISL-04LR018FC
§ 15.407 (a)(6)	Peak Excursion	Compliant	Please refer to ISL Report: ISL-04LR018FC
§15.407 (a)(1) & (a)(2)	Power Spectral Density	Compliant	Please refer to ISL Report: ISL-04LR018FC
§15.407 (h)	DFS	Compliant	Please see DFS report: R0706045-DFS

§ 15.407(f) and § 2.1091 - RF EXPOSURE

According to §15.407(f) and §1.1307(b)(1), §2.1091 and §2.1093, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
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
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

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

For 5150 – 5350 MHz: 802.11a

Maximum peak output power at antenna input terminal:

18.387 (dBm)

Maximum peak output power at antenna input terminal:

68.976 (mW)

Prediction distance:

20 (cm)

Predication frequency:

5260(MHz)

Antenna Gain (typical):

5 (dBi)

antenna gain:

3.16 (numeric)

Power density at predication frequency at 20 cm:

0.043 (mW/cm²)

MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm²)

For 5470 – 5725 MHz: **802.11a**

MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm²)

Result: Compliant.

§15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Result: Compliant, the three identical antennae, *Nearson* model: Swivel Antenna 614 utilized by this device are external antenna with SMA (reverse polarity plug, female) connectors and a maximum gain of 4.0 dBi (2.4~2.5 GHz), 5dBi (5.15~5.35 GHz) and 4.5dBi (5.75~5.85 GHz).

Swivel Multi-band Wireless LAN Antennae			
Frequency (MHz)	Main Antenna Gain (dBi)	Polarization	Radiation
2450	4.0	Vertical	Omni
5250	5.0	Vertical	Omni
5750	4.5	Vertical	Omni



§15.107 - CONDUCTED EMISSIONS

Section 15.107 Conducted limits:

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 Setup

The measurement was performed at shielded room, using the setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was plugged into LISN 1 which provided 120V/ 60 Hz AC

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2007-03-08
Solar Electronics	LISN	9252-R-24-BNC	511205	2006-07-07

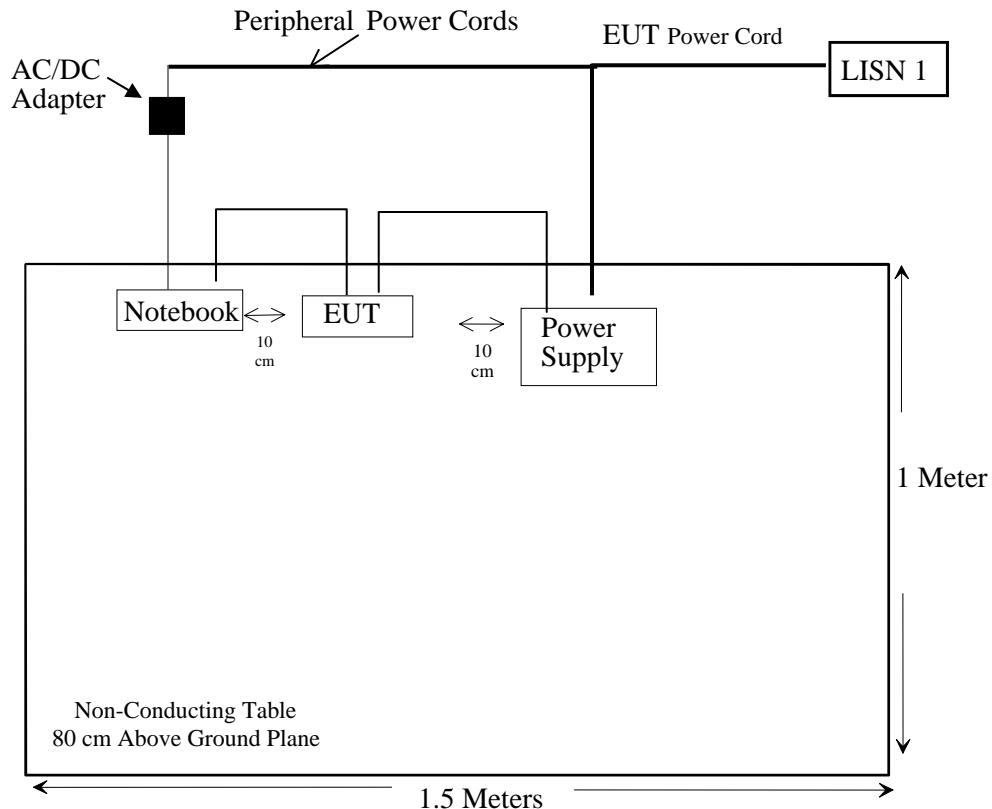
* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Procedure

During the conducted emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a “QP”. Average readings are distinguished with an “Ave”.

Test Setup Block Diagram**Conducted Emissions**

Environmental Conditions

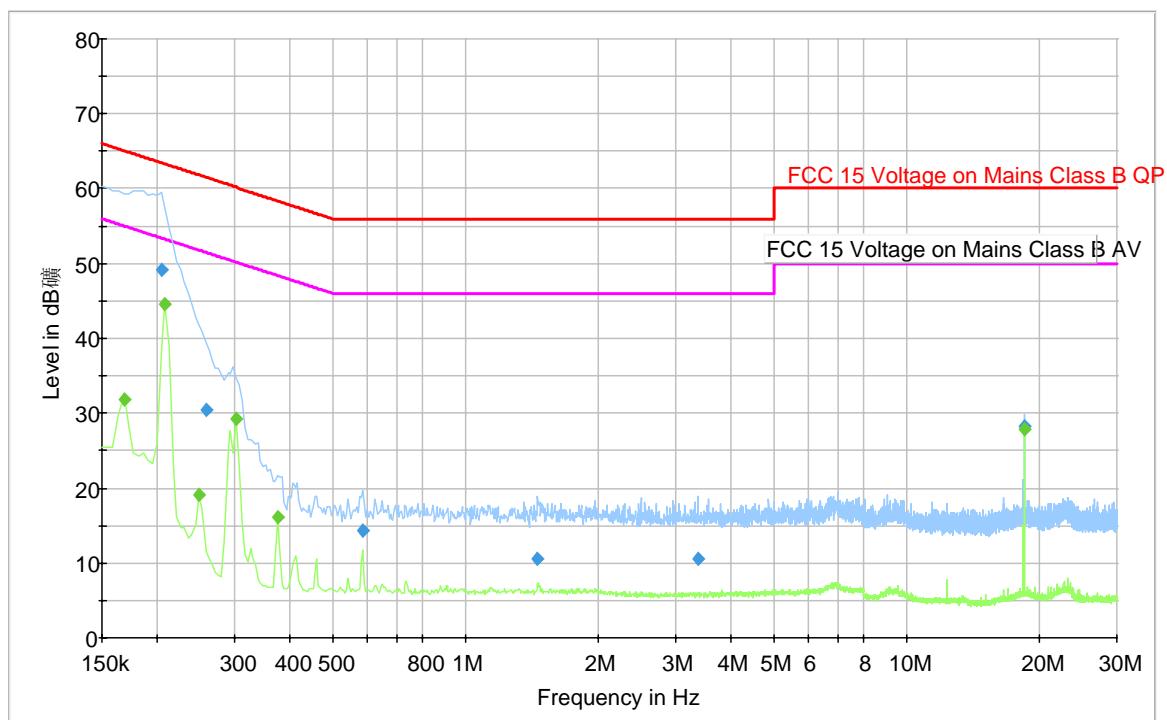
Temperature:	20° C -23° C
Relative Humidity:	30% - 63%
ATM Pressure:	101.1 – 101.9 kPa

* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15

Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC rules for conducted emissions for Class B devices, with the following margin reading closest to the limit:

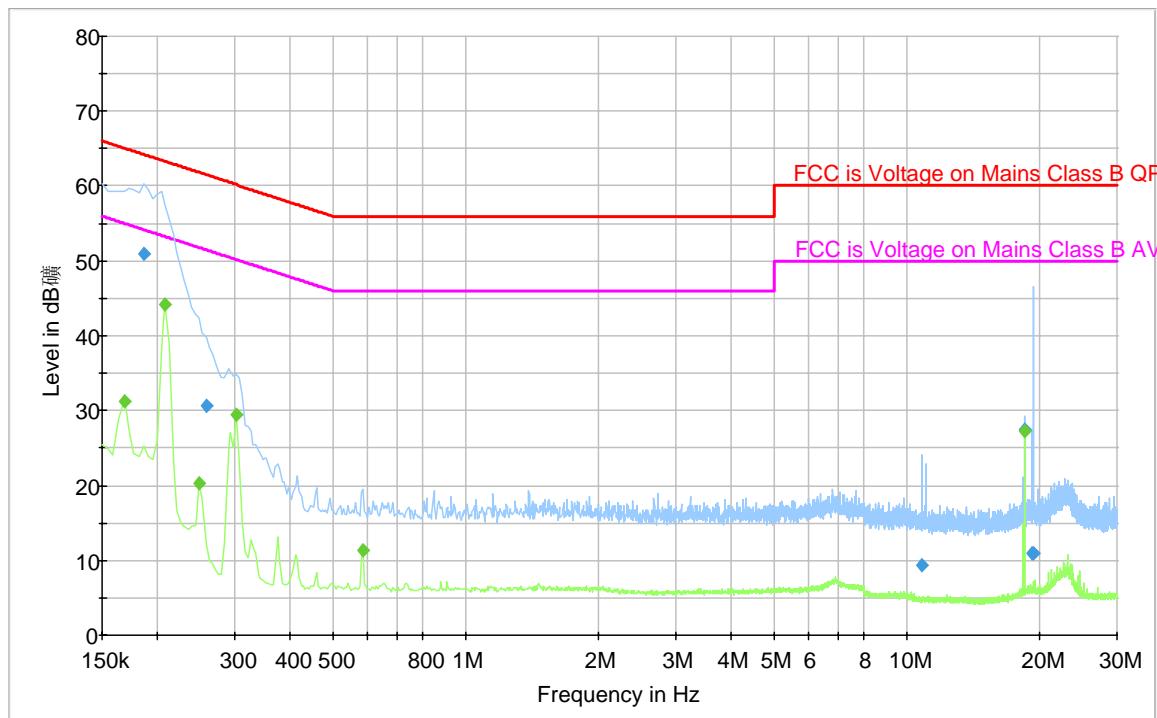
Connection: 120 V/60 Hz AC			
Margin (dB)	Frequency (MHz)	Conductor Mode (Hot/Neutral)	Range (MHz)
-8.8	0.208500	Hot	0.150 MHz to 30 MHz

120 V/ 60 Hz Hot:**Quasi-Peak**

Frequency (MHz)	Quasi -Peak (dB μ V)	Hot/Neutral	Correction Factor (dB)	Limit (dB μ V)	Margin (dB)
0.204000	49.2	Hot	12.1	63.4	-14.2
0.258000	30.5	Hot	12.3	61.5	-31.0
18.487500	28.2	Hot	12.5	60.0	-31.8
0.586500	14.4	Hot	12.5	56.0	-41.6
1.459500	10.5	Hot	12.5	56.0	-45.5
3.372000	10.5	Hot	12.4	56.0	-45.5

Average

Frequency (MHz)	Average (dB μ V)	Hot/Neutral	Correction Factor (dB)	Limit (dB μ V)	Margin (dB)
0.208500	44.5	Hot	12.2	53.3	-8.8
0.303000	29.2	Hot	12.3	50.2	-20.9
18.487500	27.9	Hot	12.3	50.0	-22.1
0.168000	31.9	Hot	12.3	55.1	-23.1
0.375000	16.1	Hot	12.3	48.4	-32.3
0.249000	19.1	Hot	12.3	51.8	-32.7

120 V/ 60 Hz Neutral:**Quasi-Peak**

Frequency (MHz)	Quasi-Peak (dB μ V)	Hot/Neutral	Correction Factor (dB)	Limit (dB μ V)	Margin (dB)
0.186000	50.8	Neutral	12.3	64.2	-13.4
0.258000	30.6	Neutral	12.3	61.5	-30.9
18.487500	27.5	Neutral	12.3	60.0	-32.5
19.297500	11.0	Neutral	12.3	60.0	-49.0
19.356000	10.9	Neutral	12.3	60.0	-49.1
10.828500	9.4	Neutral	12.3	60.0	-50.6

Average

Frequency (MHz)	Average (dB μ V)	Hot/Neutral	Correction Factor (dB)	Limit (dB μ V)	Margin (dB)
0.208500	44.2	Neutral	12.4	53.3	-9.1
0.303000	29.4	Neutral	12.5	50.2	-20.8
0.168000	31.3	Neutral	12.1	55.1	-23.8
18.487500	27.4	Neutral	12.6	50.0	-22.6
0.249000	20.3	Neutral	12.5	51.8	-31.5
0.586500	11.3	Neutral	12.3	46.0	-34.7

§2.1051 & §15.407(b) (1) & (b) (2) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

For §15.407 (b)(1), (b)(2) & (b)(3), transmitters operating in the 5.15-5.35 GHz band: all emissions outside 5.15 – 5.35 and 5.47 – 5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

For 5150 – 5350 MHz: 802.11a

Measurement Procedure

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Equipment

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Setup Diagram

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Environmental Conditions

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Measurement Results

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

For 5470 – 5725 MHz: 802.11a

Measurement Procedure

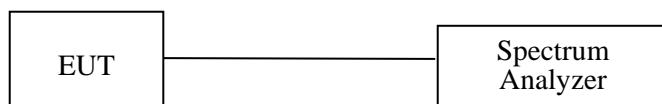
1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

Temperature:	22 °C
Relative Humidity:	56 %
ATM Pressure:	104.1 kPa

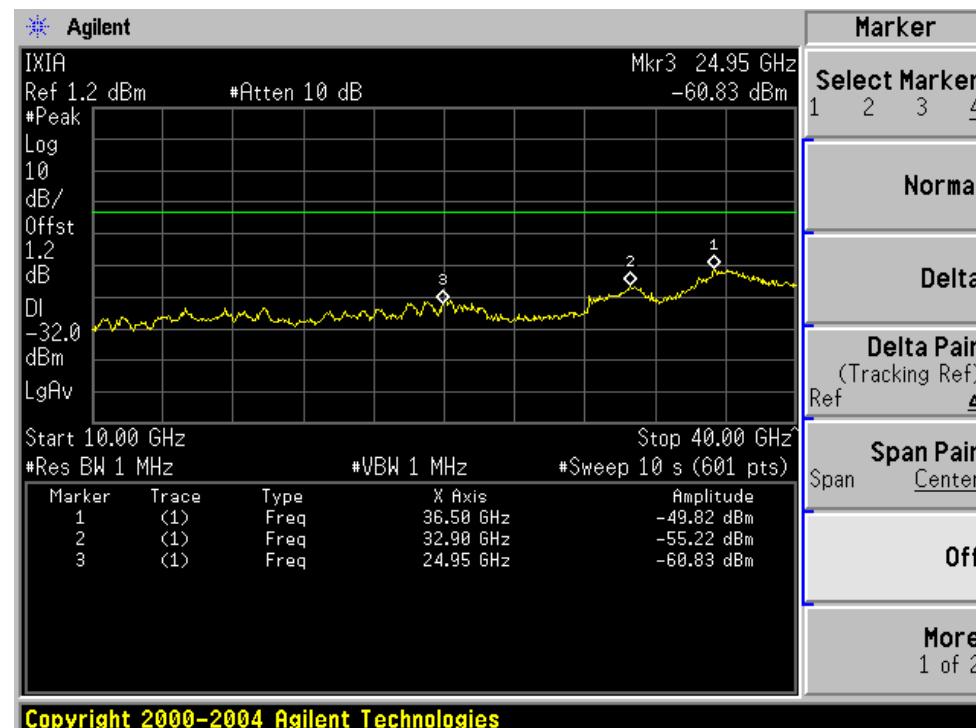
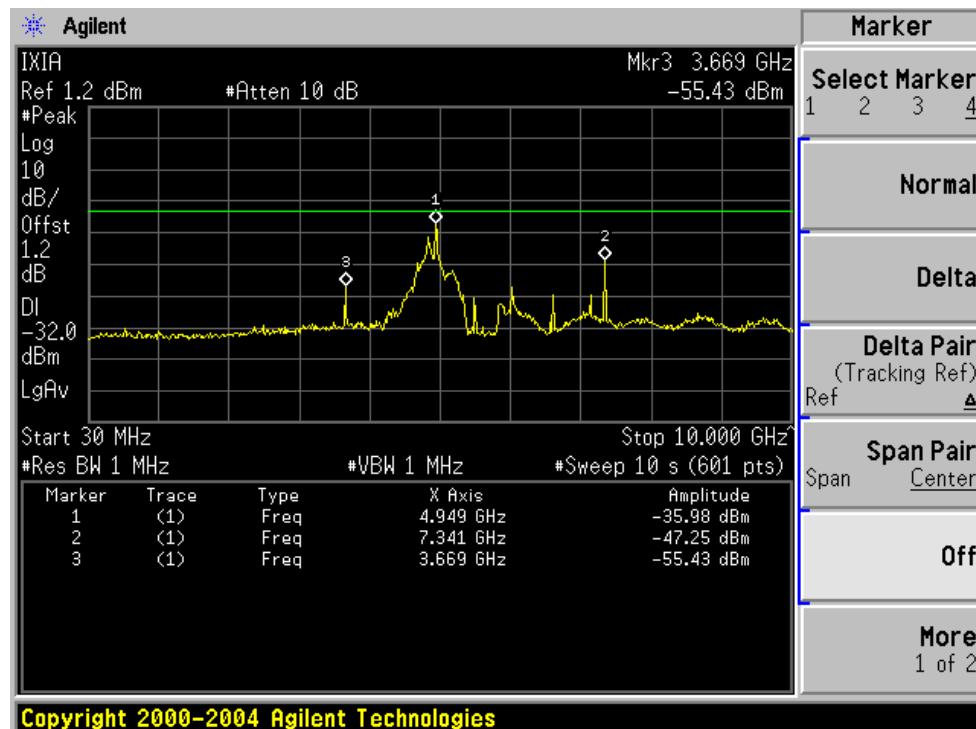
* The testing was performed by Dan Coronia from 2007-06-11 to 2007-06-15

Test Result

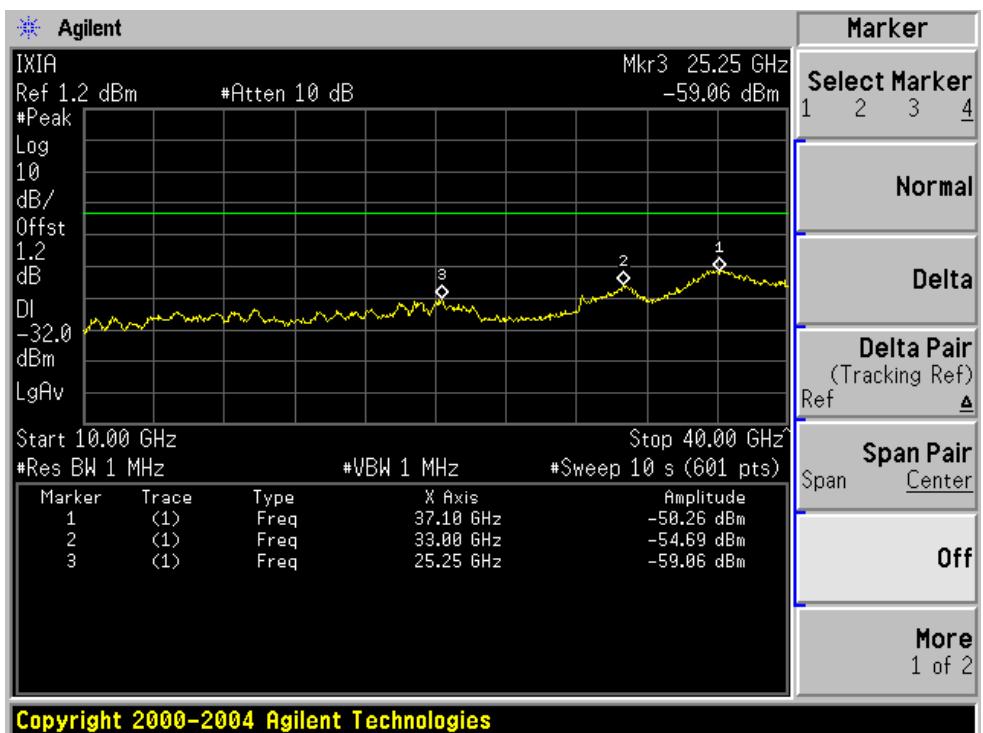
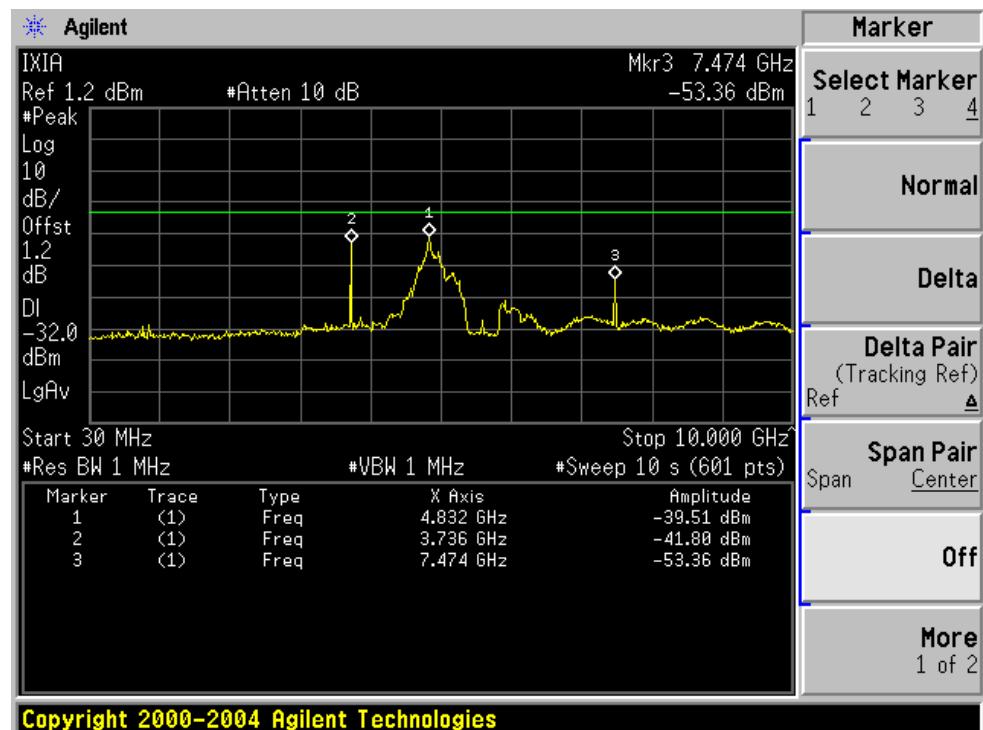
Please refer to following pages for plots of spurious emissions.

For 5470 – 5725 MHz: 802.11a

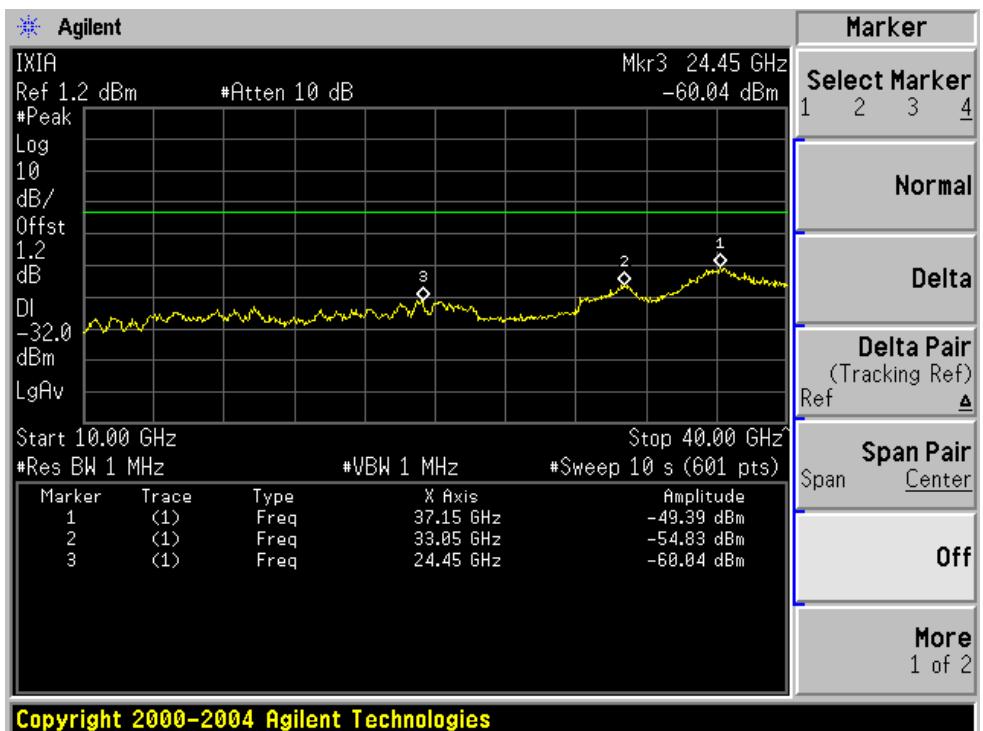
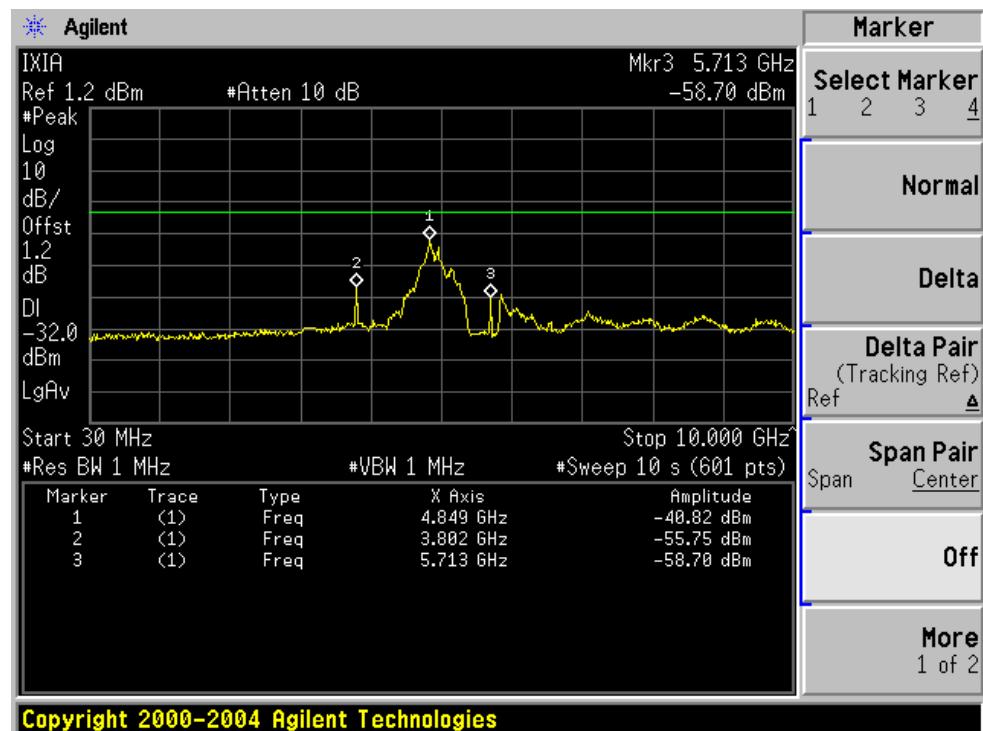
Channel: 100 (5500MHz)



Channel: 120 (5600MHz)



Channel: 140 (5700MHz)



§15.407 – 26 dB & 99% BANDWIDTH

Applicable Standard

No limit, for reporting purpose only.

For 5150 – 5350 MHz: 802.11a

Measurement Procedure

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Equipment

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Setup Diagram

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Environmental Conditions

Please refer to the following test report:

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For 5470 – 5725 MHz: 802.11a

Measurement Procedure

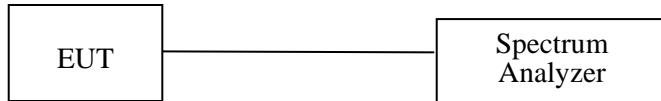
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 26 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

Temperature:	22 °C
Relative Humidity:	56 %
ATM Pressure:	104.1 kPa

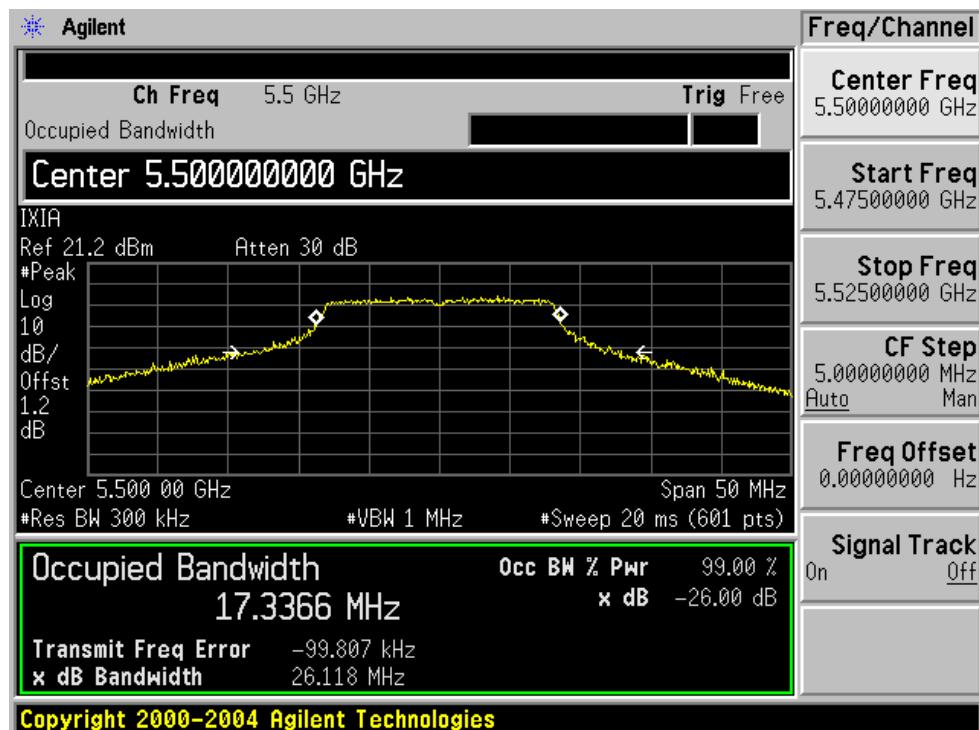
* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15

Test Result

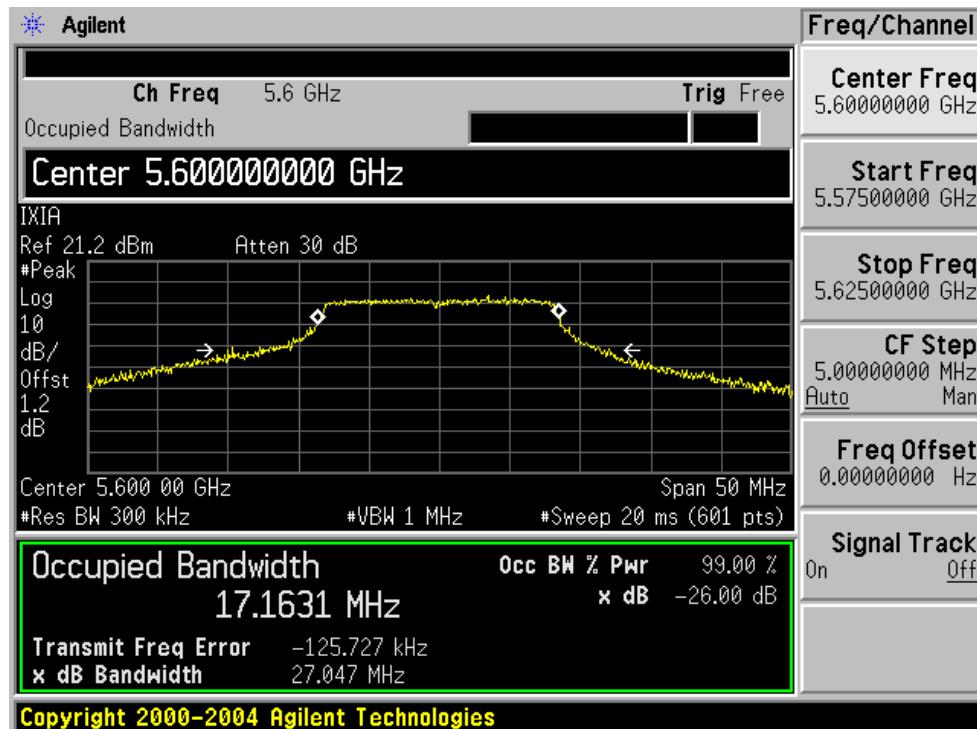
Please refer to following pages for plots of spurious emissions.

For 5470 – 5725 MHz: 802.11a

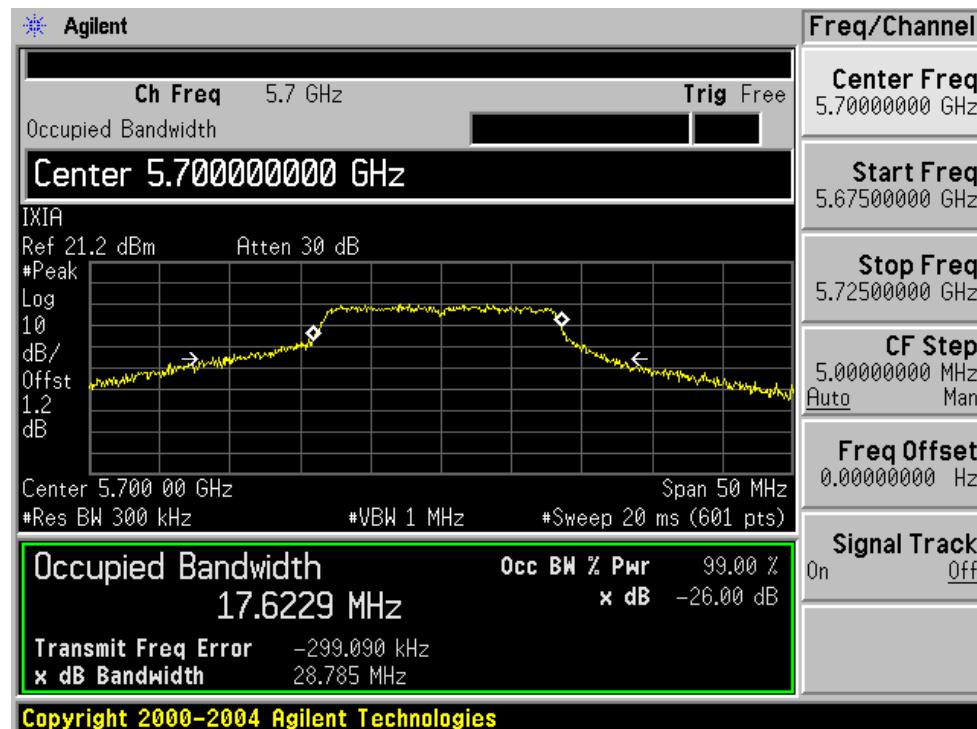
Channel: 100 (5500MHz)



Channel: 120 (5600MHz)



Channel: 140 (5700MHz)



§15.205 & §15.109 & §15.407(b) - RADIATED SPURIOUS EMISSIONS

Applicable Standard

As per 15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per 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)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
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.

As Per 15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3332 – 3339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3345.8 – 3358	23.6 – 24.0
12.29 – 12.293	240 – 285	3600 – 4400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per 15.407(b): Undesirable emission limits: Except as shown in paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.
- (3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47 – 5.725 GHz band shall exceed an EIRP of –27 dBm/MHz.
- (5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart E limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Sonoma	Amplifier, Pre	317	260406	2007-04-30
Agilent	Pre amplifier	8449B	3008A01978	2006-08-10
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100337	2007-03-08
Sunol Science Corp	System Controller	S9V	113005-1	NR
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-02-23
A.R.A	Antenna Horn	DRG-118/A	1132	2006-08-17
Agilent	Spectrum Analyzer	8565EC	3946A00131	2007-01-24

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000MHz:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000MHz:

- (1) Peak: $\text{RBW} = 1\text{MHz} / \text{VBW} = 1\text{MHz} / \text{Sweep} = \text{Auto}$
- (2) Average: $\text{RBW} = 1\text{MHz} / \text{VBW} = 10\text{Hz} / \text{Sweep} = \text{Auto}$

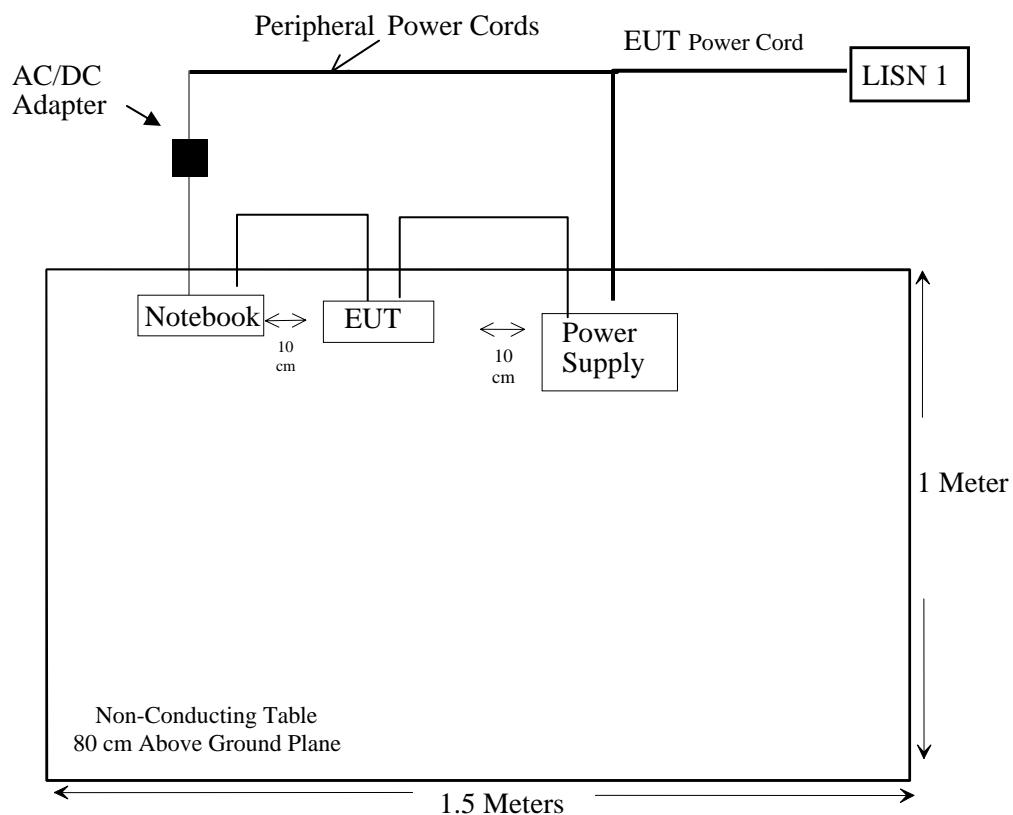
Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{FCC Limit}$$

Test Setup Block Diagram

Environmental Conditions

Temperature:	22° C
Relative Humidity:	56 %
ATM Pressure:	104.1 kPa

* The testing was performed by Dan Corona from 2007-06-11 to 2007-06-15

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart E, section 15.205, 15.209 and 15.407, and had the worst margin of:

Unintentional Emissions:

Mode: Receiver			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel
-4.1	666.643750	Horizontal	NA, 30 MHz to 1000 MHz

Intentional Emissions:

Mode: 802.11 a (5150 – 5250)			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel
-4.19	15540.00	Vertical	Low, 1 GHz – 40GHz
-3.43	15780.00	Vertical	Middle, 1 GHz – 40GHz
-2.45	15960.00	Vertical	High, 1 GHz – 40GHz

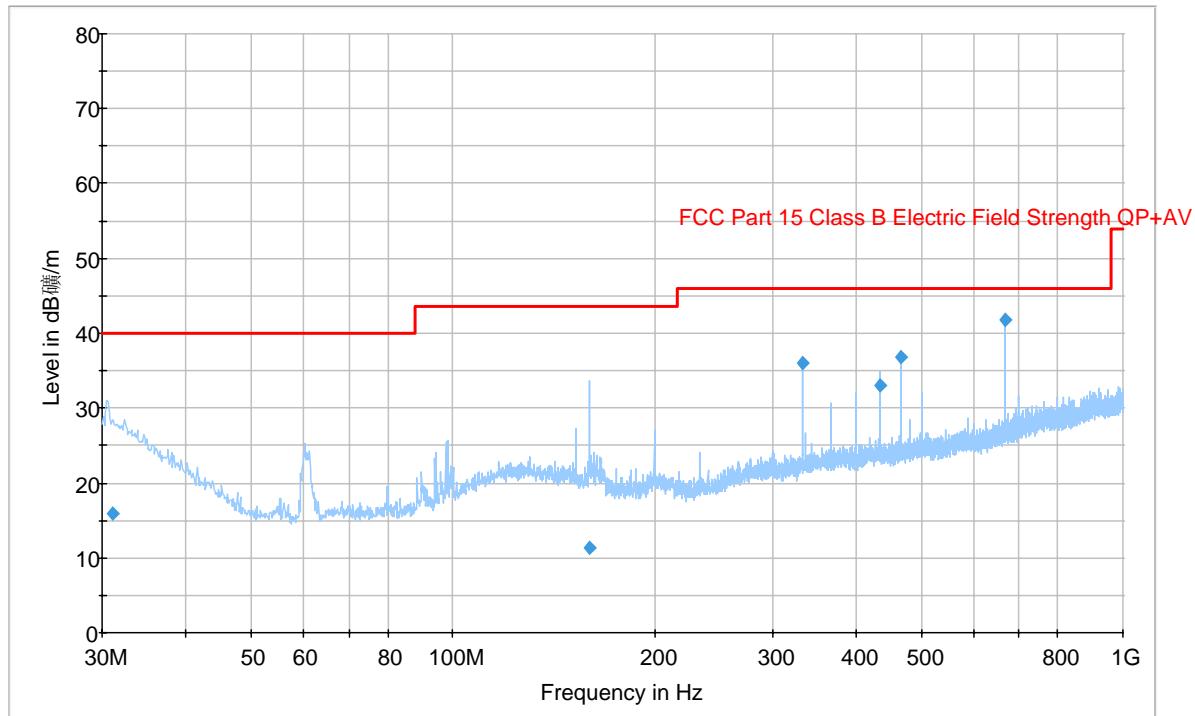
Intentional Emissions:

Mode: 802.11 a (5470 – 5725)			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Channel
-3.66	16500.00	Vertical	Low, 1 GHz – 40GHz
-4.72	16800.00	Vertical	Middle, 1 GHz – 40GHz
-3.9	17100.00	Vertical	High, 1 GHz – 40GHz

Please see the following plots and tables for full test result details

Radiated Emissions Test plot & data:

Primary scan 30MHz -1GHz



Frequency (MHz)	Quasi-Peak (dB μ V/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (degrees)	Limit (dB μ V/m)	Margin (dB)
666.643750	41.9	99.0	H	141.0	46.0	-4.1
466.662500	36.9	99.0	V	6.0	46.0	-9.1
333.327500	36.1	99.0	H	124.0	46.0	-9.9
433.318750	33.0	99.0	V	149.0	46.0	-13.0
31.085000	16.0	383.0	V	152.0	40.0	-24.0
160.300000	11.4	325.0	H	263.0	43.5	-32.1

802.11a 5150 – 5350 MHz band:

Channel: 36 (5180)

Frequency (MHz)	Reading (dBuV)	Direction Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier (dB)	Corrected Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
5180.0000	99.2	256	1.0	V	34.0	3.9	34.9	102.2			Fund/Peak
5180.0000	89.0	274	1.1	H	34.0	3.9	34.9	92.0			Fund/Peak
5180.0000	90.5	256	1.0	V	34.0	3.9	34.9	93.5			Ave
5180.0000	80.2	274	1.1	H	34.0	3.9	34.9	83.2			Ave
15540.0000	35.4	294	1.4	V	40.4	7.3	33.2	49.8	54	-4.19	Ave
15540.0000	34.6	278	1.6	H	40.4	7.3	33.2	49.0	54	-4.99	Ave
10360.0000	32.8	290	1.1	V	38.0	5.7	36.8	39.7	54	-14.27	Ave
10360.0000	30.1	251	1.4	H	38.0	5.7	36.8	37.0	54	-16.97	Ave
15540.0000	48.3	294	1.4	V	40.4	7.3	33.2	62.7	74	-11.26	Peak
15540.0000	47.5	278	1.6	H	40.4	7.3	33.2	61.9	74	-12.09	Peak
10360.0000	43.3	290	1.1	V	38.0	5.7	36.8	50.2	74	-23.82	Peak
10360.0000	41.5	251	1.4	H	38.0	5.7	36.8	48.4	74	-25.57	Peak

Channel: 52 (5260)

Frequency (MHz)	Reading (dBuV)	Direction Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier (dB)	Corrected Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
5260.0000	102.5	310	1.0	V	34.0	4.0	34.4	106.1			Fund/Peak
5260.0000	89.8	301	1.8	H	34.0	4.0	34.4	93.4			Fund/Peak
5260.0000	93.5	310	1.0	V	34.0	4.0	34.4	97.1			Ave
5260.0000	80.5	301	1.8	H	34.0	4.0	34.4	84.1			Ave
15780.0000	36.2	247	1.1	V	40.4	7.3	33.2	50.6	54	-3.43	Ave
15780.0000	36.0	292	1.3	H	40.4	7.3	33.2	50.4	54	-3.60	Ave
10520.0000	34.6	274	1.0	V	38.7	5.8	39.0	40.2	54	-13.81	Ave
10520.0000	34.5	317	1.6	H	38.7	5.8	39.0	40.1	54	-13.91	Ave
15780.0000	46.7	247	1.1	V	40.4	7.3	33.2	61.1	74	-12.93	Peak
15780.0000	46.5	292	1.3	H	40.4	7.3	33.2	60.9	74	-13.10	Peak
10520.0000	45.3	274	1.0	V	38.7	5.8	39.0	50.9	74	-23.08	Peak
10520.0000	44.7	317	1.6	H	38.7	5.8	39.0	50.3	74	-23.74	Peak

Channel: 64 (5320)

Frequency (MHz)	Reading (dBuV)	Direction Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier (dB)	Corrected Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
5320.0000	104.7	290	1.0	V	34.0	4.0	33.9	108.7			Fund/Peak
5320.0000	92.0	254	1.2	H	34.0	4.0	33.9	96.1			Fund/Peak
5320.0000	95.0	290	1.0	V	34.0	4.0	33.9	99.1			Ave
5320.0000	81.8	254	1.2	H	34.0	4.0	33.9	85.9			Ave
15960.0000	36.8	215	1.2	V	40.4	7.6	33.2	51.5	54	-2.45	Ave
15960.0000	36.5	325	1.6	H	40.4	7.6	33.2	51.2	54	-2.75	Ave
10640.0000	32.5	312	1.1	V	38.7	5.9	39.0	38.2	54	-15.90	Ave
10640.0000	32.3	294	1.5	H	38.7	5.9	39.0	38.0	54	-16.10	Ave
15960.0000	48.2	215	1.2	V	40.4	7.6	33.2	62.9	74	-11.05	Peak
15960.0000	47.1	325	1.6	H	40.4	7.6	33.2	61.8	74	-12.15	Peak
10640.0000	43.3	312	1.1	V	38.7	5.9	39.0	49.0	74	-25.10	Peak
10640.0000	42.5	294	1.5	H	38.7	5.9	39.0	48.2	74	-25.90	Peak

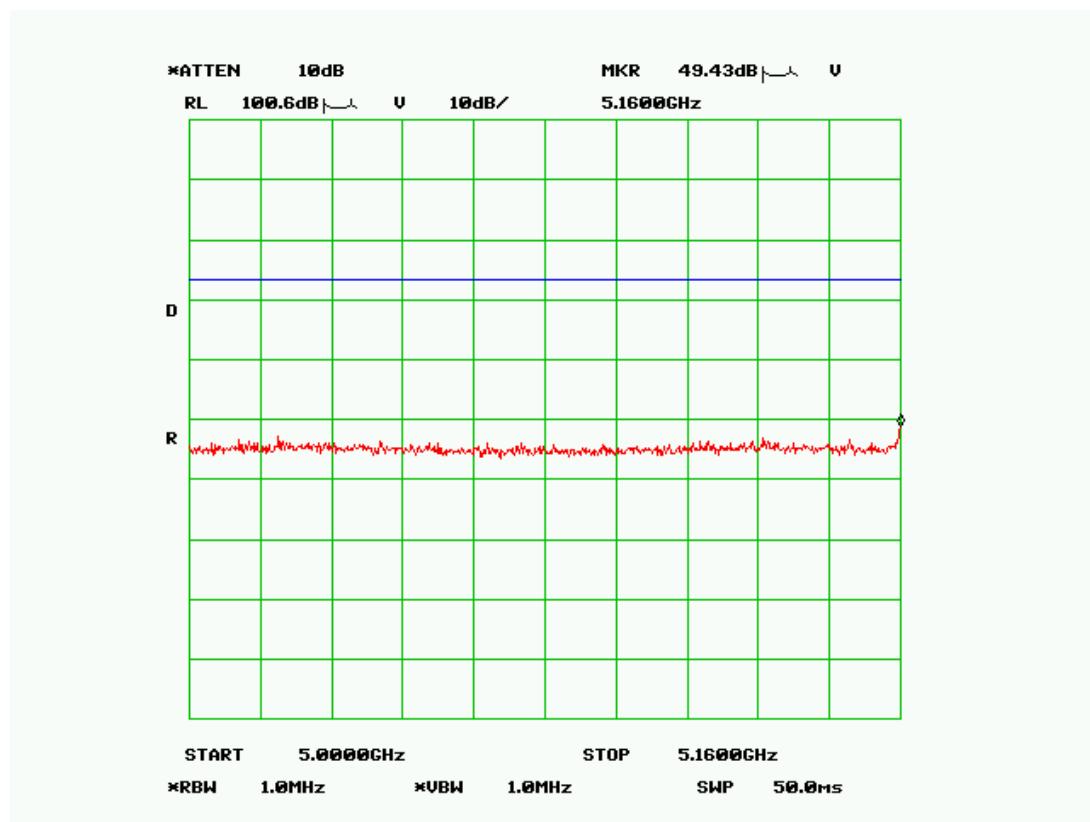
*Note: All frequencies from 1GHz to 40 GHz have been investigated.

The restricted band limit is 54 dB μ V/m, the out of band limit is 68.3 dB μ V/m.

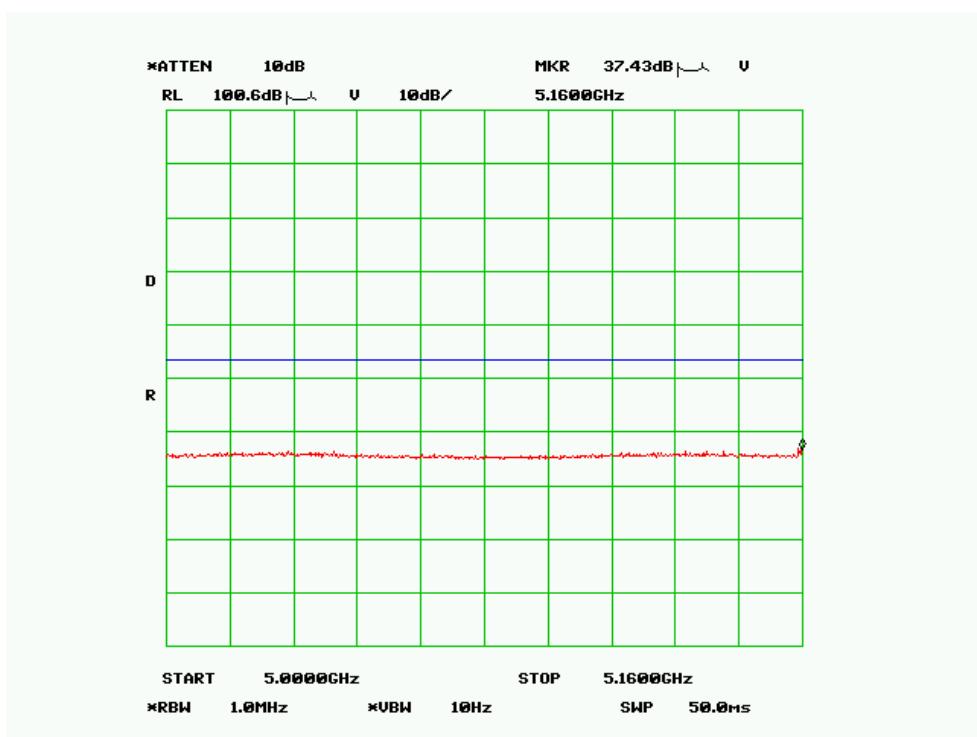
Restricted band edge

Low channel

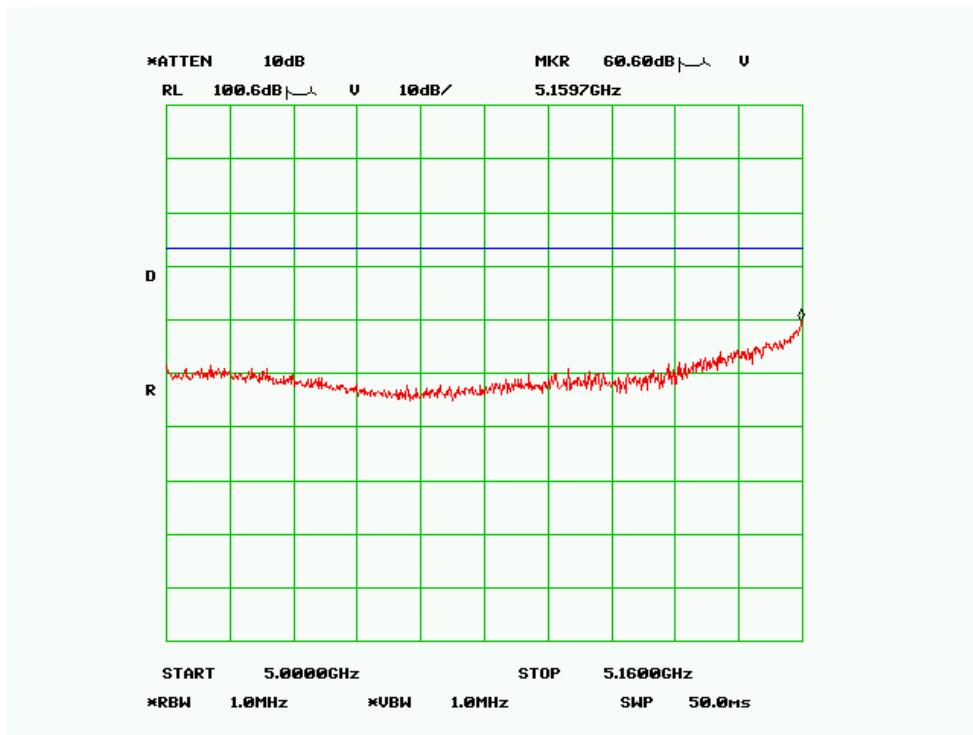
Peak, Horizontal



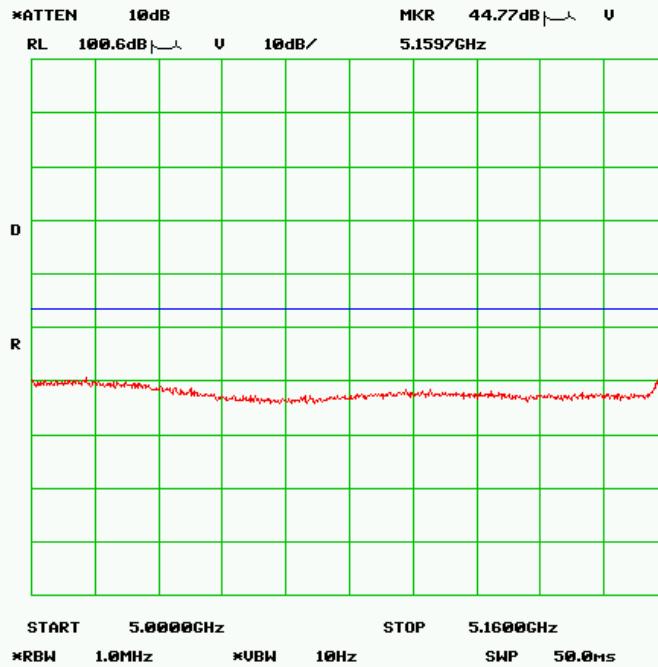
Average, Horizontal



Peak, Vertical

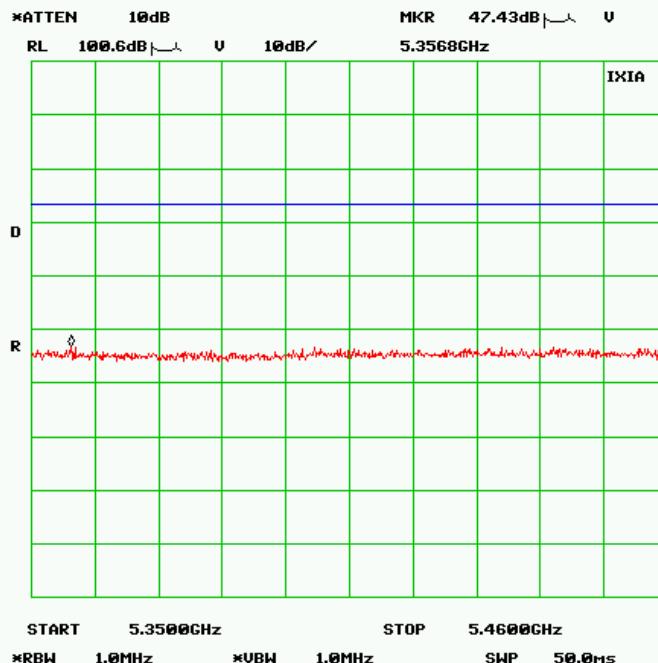


Average, Vertical

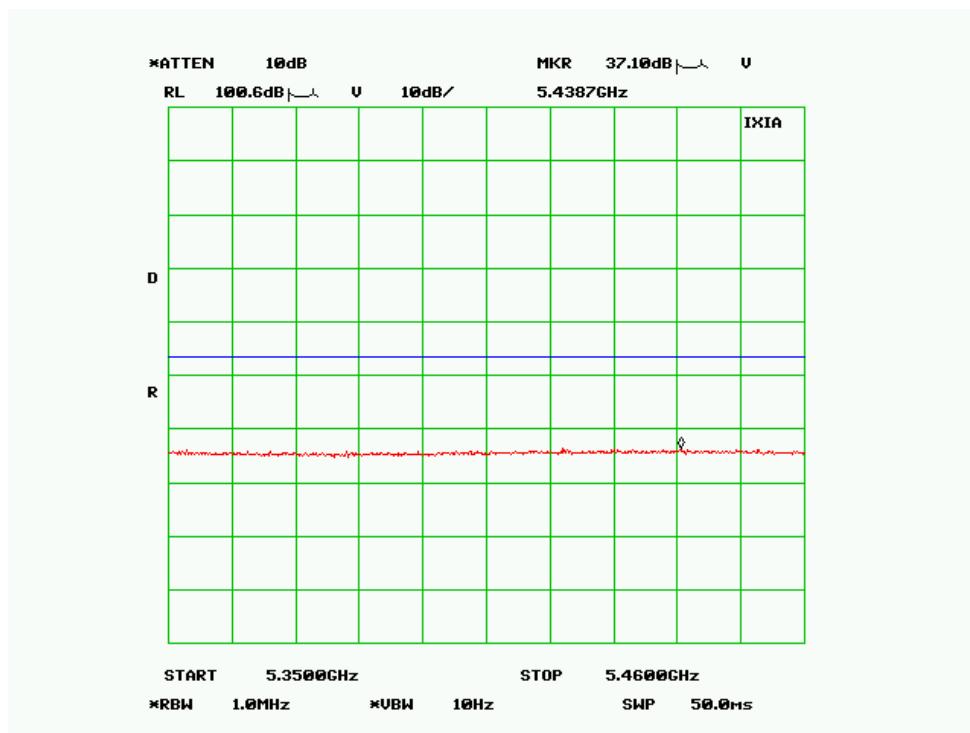


High channel

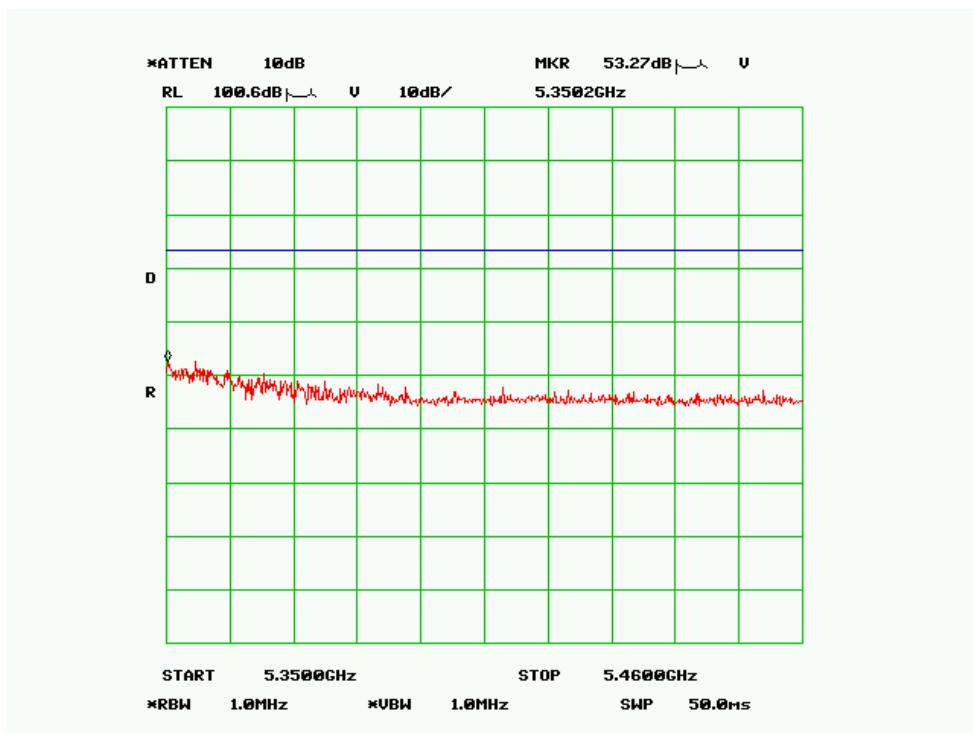
Peak, Horizontal



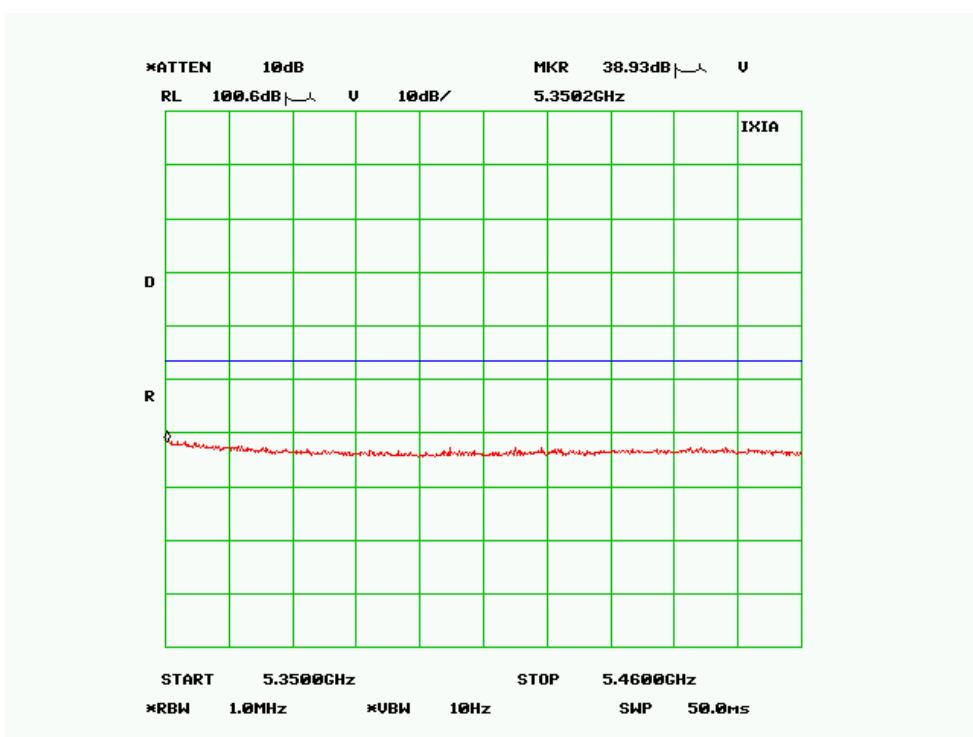
Average, Horizontal



Peak, Vertical



Average, Vertical



802.11a 5470 – 5725 MHz band:

Channel: 100 (5500)

Frequency (MHz)	Reading (dBuV)	Direction Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier (dB)	Corrected Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
5500.0000	102.7	248	1.1	V	34.1	4.1	34.1	106.8			Fund/Peak
5500.0000	92.8	329	1.5	H	34.1	4.1	34.1	96.9			Fund/Peak
5500.0000	93.5	248	1.1	V	34.1	4.1	34.1	97.6			Ave
5500.0000	83.3	329	1.5	H	34.1	4.1	34.1	87.4			Ave
16500.0000	31.8	322	1.1	V	42.6	7.5	31.6	50.3	54	-3.66	Ave
16500.0000	30.5	269	1.3	H	42.6	7.5	31.6	49.0	54	-4.96	Ave
11000.0000	36.3	277	1.0	V	39.3	6.0	39.5	42.2	54	-11.84	Ave
11000.0000	35.7	287	1.5	H	39.3	6.0	39.5	41.5	54	-12.50	Ave
16500.0000	45.5	322	1.1	V	42.6	7.5	31.6	64.0	74	-9.96	Peak
16500.0000	44.8	269	1.3	H	42.6	7.5	31.6	63.3	74	-10.66	Peak
11000.0000	45.8	277	1.0	V	39.3	6.0	39.5	51.6	74	-22.37	Peak
11000.0000	44.5	287	1.5	H	39.3	6.0	39.5	50.3	74	-23.67	Peak

Channel: 120 (5600)

Frequency (MHz)	Reading (dBuV)	Direction Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier (dB)	Corrected Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
5600.0000	104.3	308	1.1	V	34.1	4.2	34.3	108.3			Fund/Peak
5600.0000	95.7	292	1.7	H	34.1	4.2	34.3	99.6			Fund/Peak
5600.0000	93.8	308	1.1	V	34.1	4.2	34.3	97.8			Ave
5600.0000	85.2	292	1.7	H	34.1	4.2	34.3	89.1			Ave
16800.0000	30.8	301	1.0	V	42.6	7.5	31.6	49.3	54	-4.72	Ave
16800.0000	30.1	320	1.2	H	42.6	7.5	31.6	48.6	54	-5.40	Ave
11200.0000	34.7	323	1.0	V	39.3	6.0	39.5	40.5	54	-13.49	Ave
11200.0000	34.7	308	1.3	H	39.3	6.0	39.5	40.5	54	-13.49	Ave
16800.0000	45.2	301	1.0	V	42.6	7.5	31.6	63.6	74	-10.35	Peak
16800.0000	44.8	320	1.2	H	42.6	7.5	31.6	63.3	74	-10.72	Peak
11200.0000	46.7	323	1.0	V	39.3	6.0	39.5	52.5	74	-21.49	Peak
11200.0000	45.3	308	1.3	H	39.3	6.0	39.5	51.2	74	-22.83	Peak

Channel: 140 (5700)

Frequency (MHz)	Reading (dBuV)	Direction Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier (dB)	Corrected Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
5700.0000	101.2	300	1.2	V	34.1	4.2	34.4	105.0			Fund/Peak
5700.0000	95.2	329	1.4	H	34.1	4.2	34.4	99.0			Fund/Peak
5700.0000	91.8	300	1.2	V	34.1	4.2	34.4	95.7			Ave
5700.0000	86.7	329	1.4	H	34.1	4.2	34.4	90.5			Ave
17100.0000	30.5	300	1.3	V	43.6	7.6	31.6	50.1	54	-3.9	Ave
17100.0000	30.3	320	1.2	H	43.6	7.6	31.6	49.9	54	-4.1	Ave
11400.0000	35.6	245	1.1	V	39.3	6.1	39.5	41.5	54	-12.5	Ave
11400.0000	34.8	230	1.4	H	39.3	6.1	39.5	40.7	54	-13.3	Ave
17100.0000	43.7	300	1.3	V	43.6	7.6	31.6	63.3	74	-10.7	Peak
17100.0000	43.2	320	1.2	H	43.6	7.6	31.6	62.8	74	-11.2	Peak
11400.0000	44.7	245	1.1	V	39.3	6.1	39.5	50.6	74	-23.4	Peak
11400.0000	43.9	230	1.3	H	39.3	6.1	39.5	49.8	74	-24.2	Peak

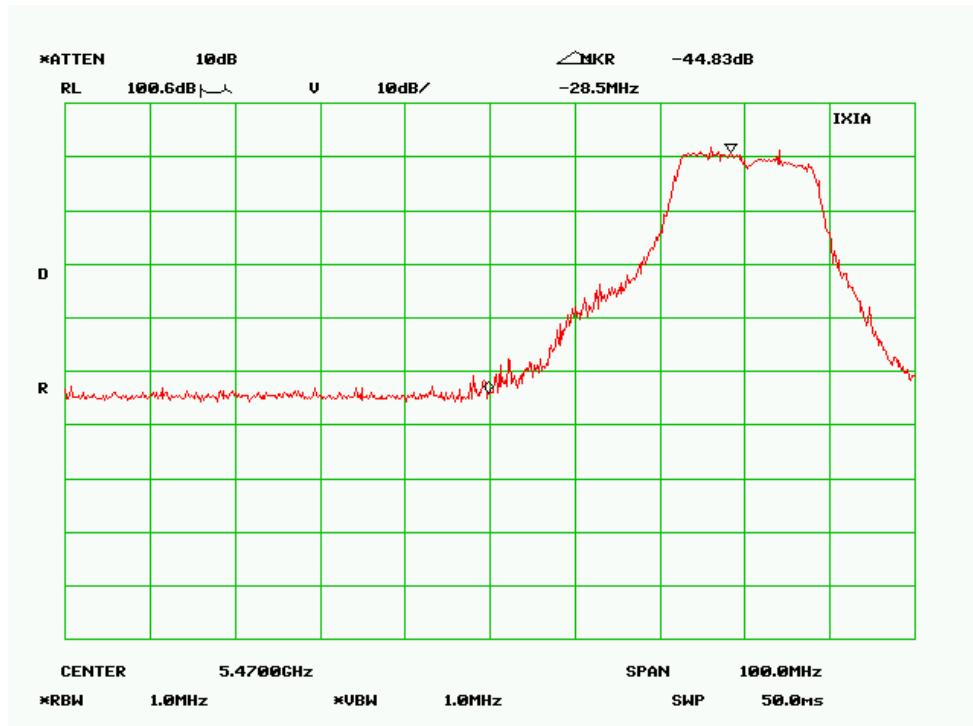
*Note: All frequencies from 1GHz to 40 GHz have been investigated.

The restricted band limit is 54 dB μ V/m, the out of band limit is 68.3 dB μ V/m.

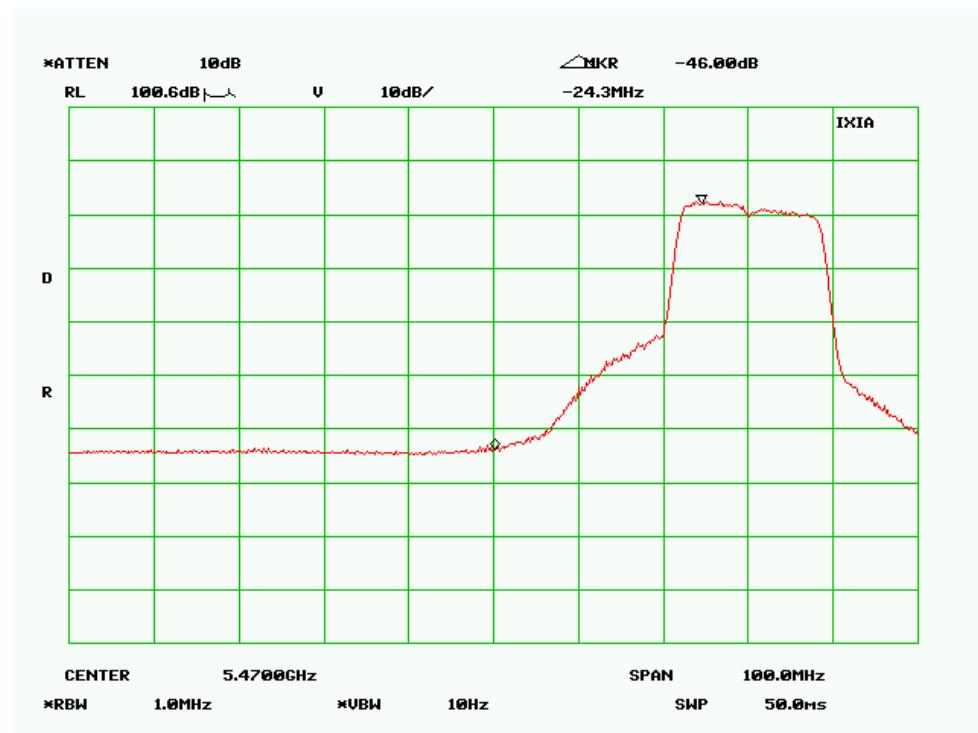
Restricted band edge

Low channel

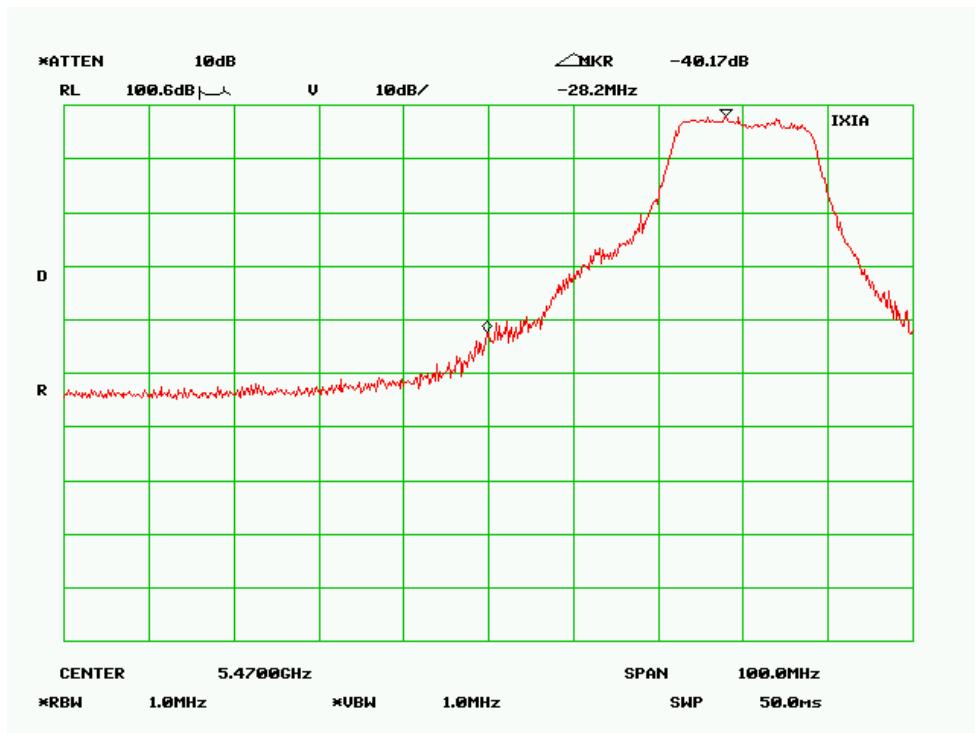
Peak, Horizontal



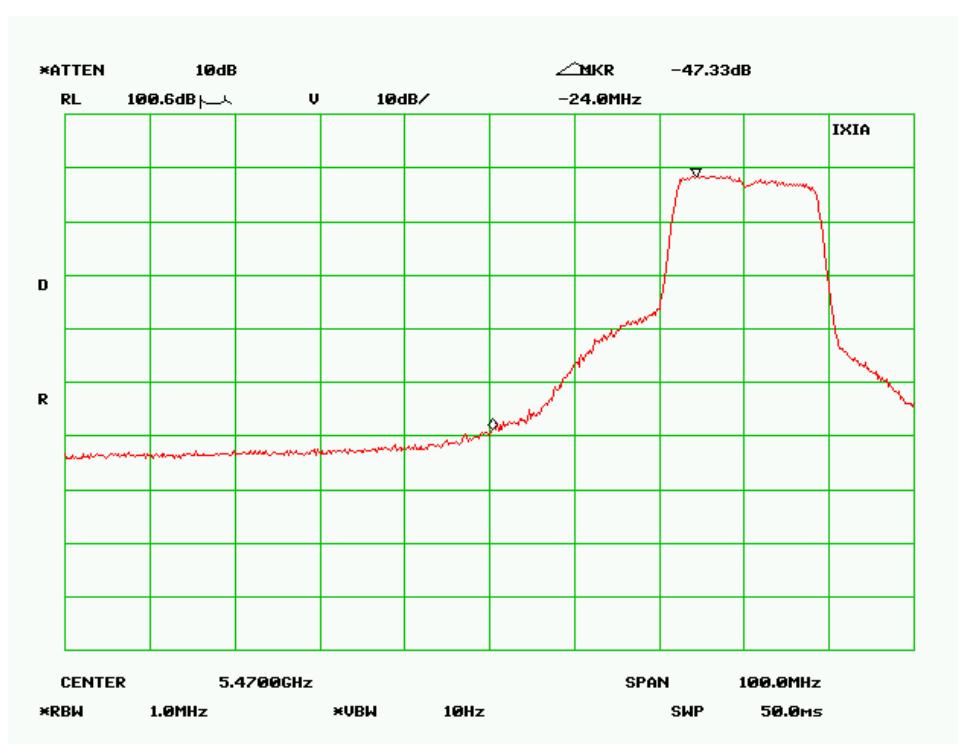
Average, Horizontal



Peak, Vertical

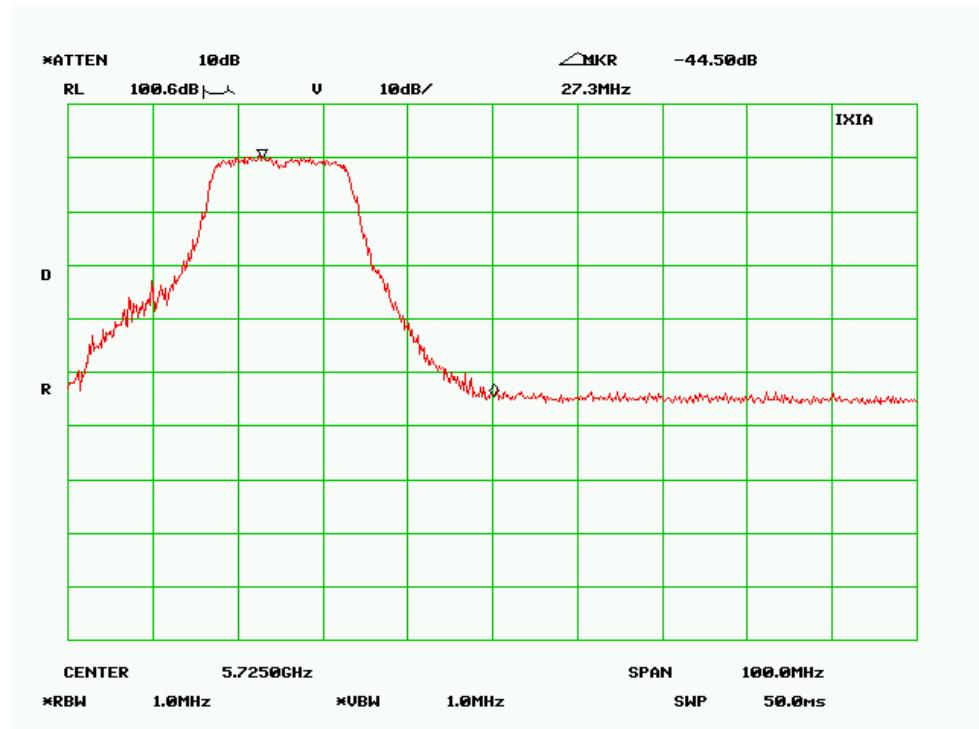


Average, Vertical

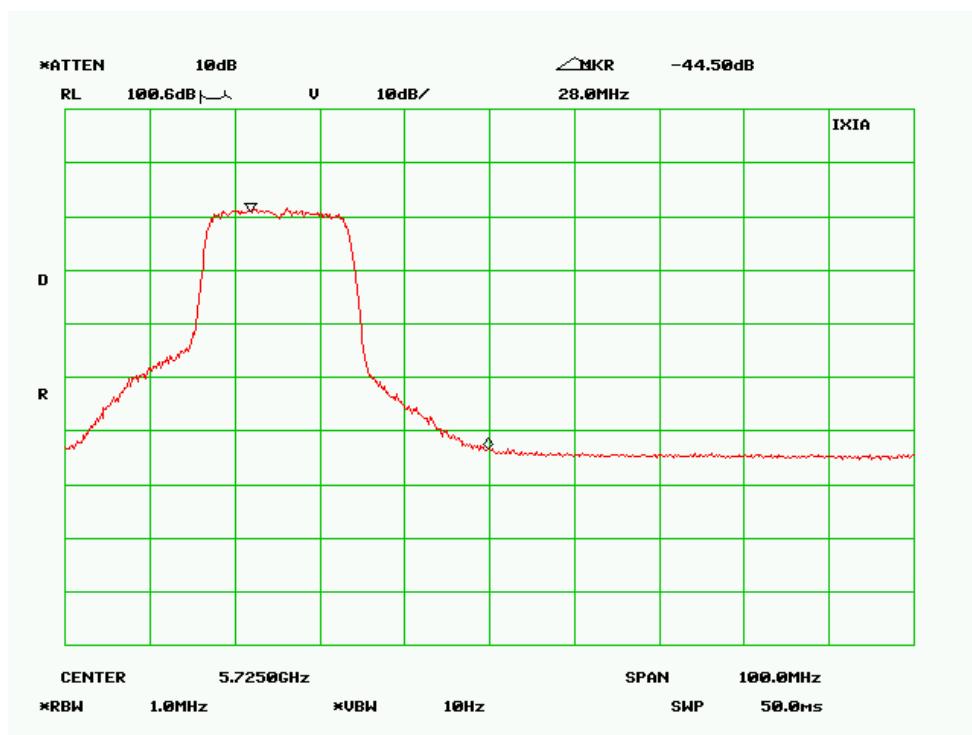


High channel

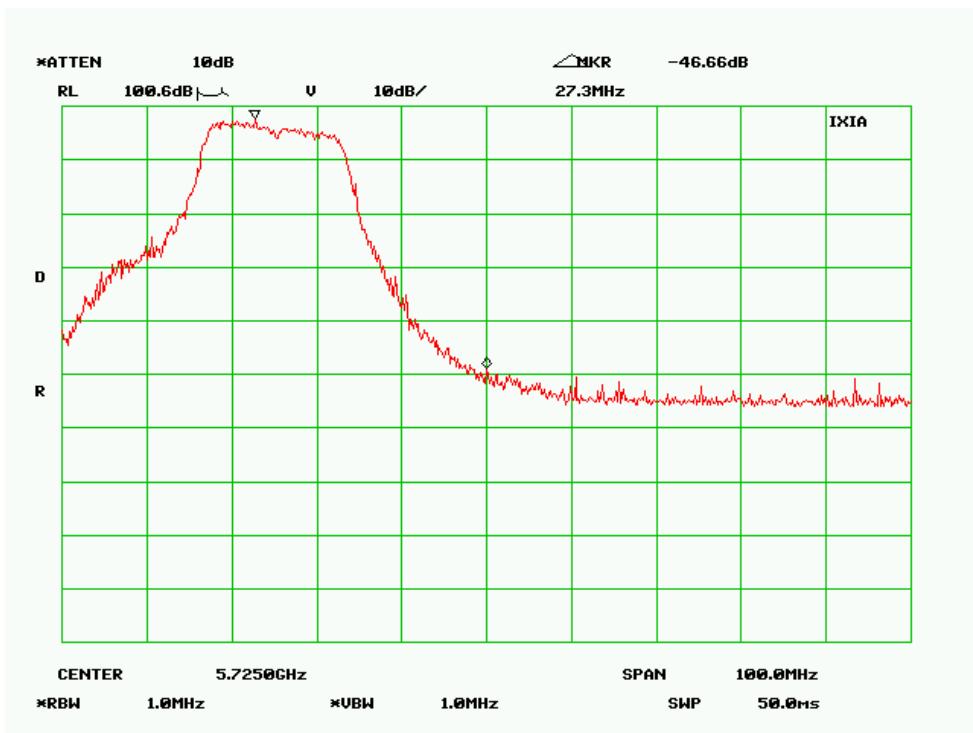
Peak, Horizontal



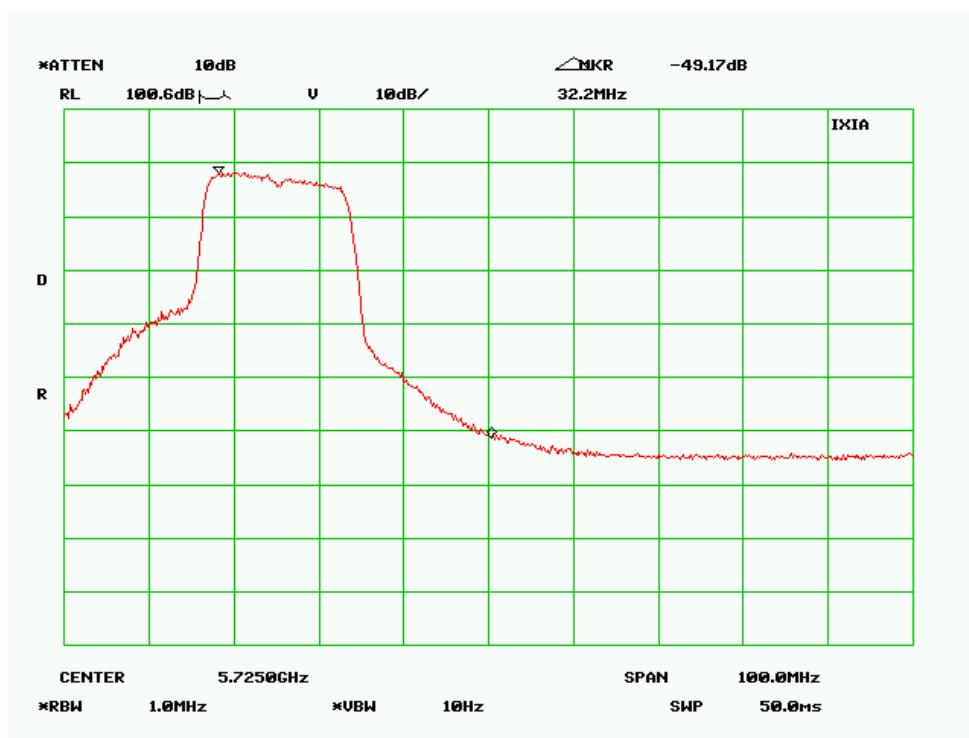
Average, Horizontal



Peak, Vertical



Average, Vertical



§15.407 (a) (1) & (a) (2) - MAXIMUM POWER

Applicable Standard

§15.407 (a)(1) For the band 5.15 – 5.25 GHz, the maximum conducted output 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, the conducted output 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)(2) For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands 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 megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output 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.

For 5150 – 5350 MHz: 802.11a

Measurement Procedure

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Equipment

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Setup Diagram

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Environmental Conditions

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Measurement Results

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

For 5470 – 5725 MHz: 802.11a

Measurement Procedure

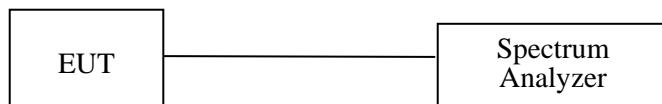
4. Place the EUT on a bench and set it in transmitting mode.
5. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
6. Add a correction factor to the display.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

Temperature:	22 °C
Relative Humidity:	56 %
ATM Pressure:	104.1 kPa

* The testing was performed by Dan Coronia from 2007-06-11 to 2007-06-15

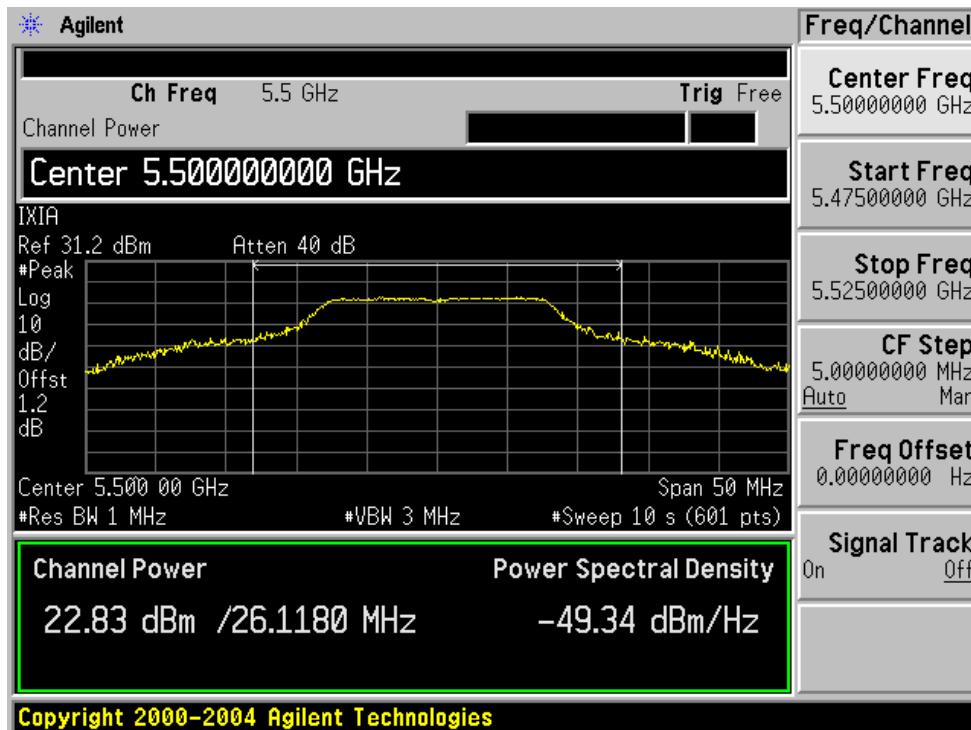
Test Result

For 5470 – 5725 MHz: 802.11a

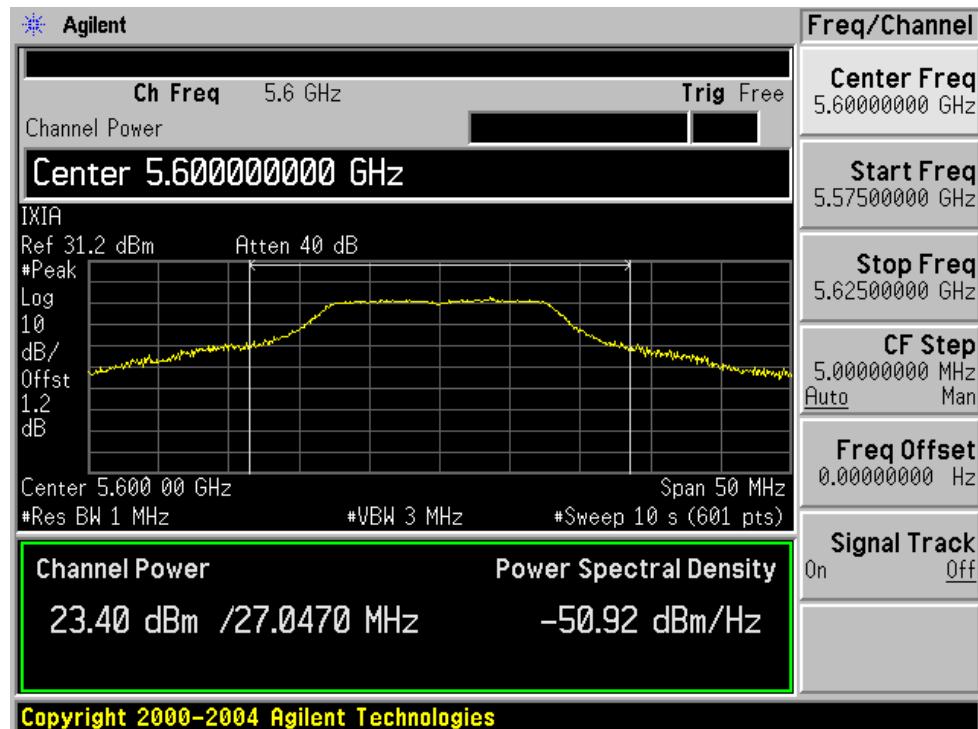
Channel	Frequency (MHz)	Peak Power Output (dBm)	Lesser Limit (dBm)	11 + Log B Limit (dBm)	Magin (dB)	Result
100	5500	22.83	24	25.17	-1.17	Compliant
120	5600	23.40	24	25.32	-0.6	Compliant
140	5700	20.65	24	25.59	-3.35	Compliant

For 5470 – 5725 MHz: 802.11a

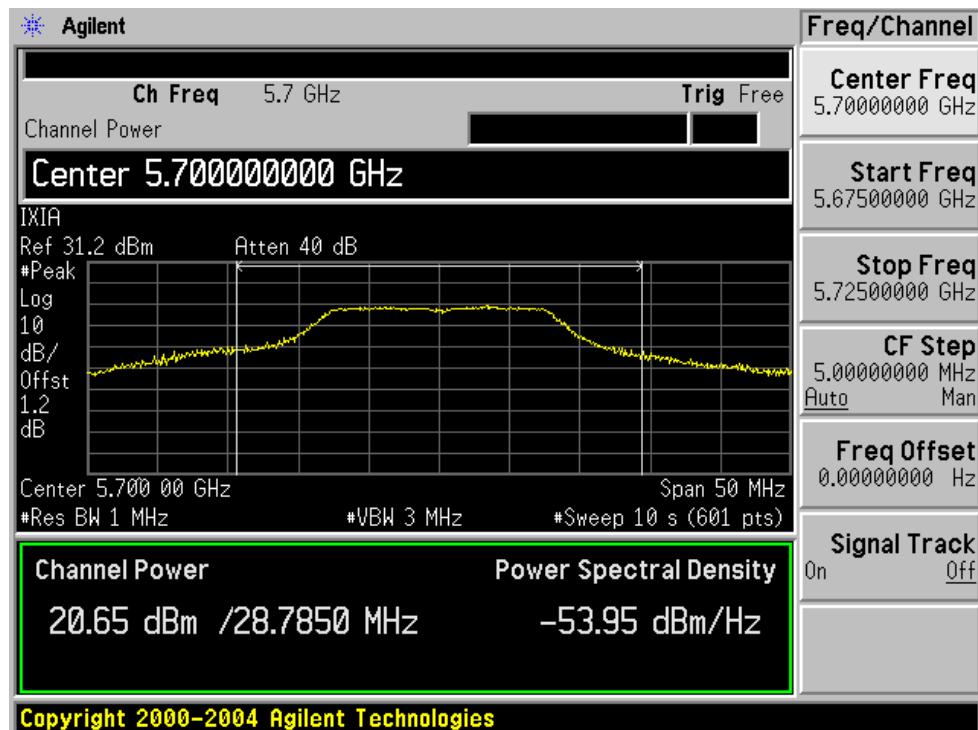
Channel: 100 (5500MHz)



Channel: 120 (5600MHz)



Channel: 140 (5700MHz)



§15.407 (a) (1) & (a) (3) (5) – PEAK POWER SPECTRAL DENSITY

Applicable Standard

§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, the conducted output 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)(2) 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, the conducted output 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)(2) For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands 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 megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output 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)(5) The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

For 5150 – 5350 MHz: 802.11a

Measurement Procedure

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Equipment

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Setup Diagram

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Environmental Conditions

Please refer to the following test report:
(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Measurement Results

Please refer to the following test report:
(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

For 5470 – 5725 MHz: 802.11a

Measurement Procedure

7. Place the EUT on a bench and set it in transmitting mode.
8. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
9. Add a correction factor to the display.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



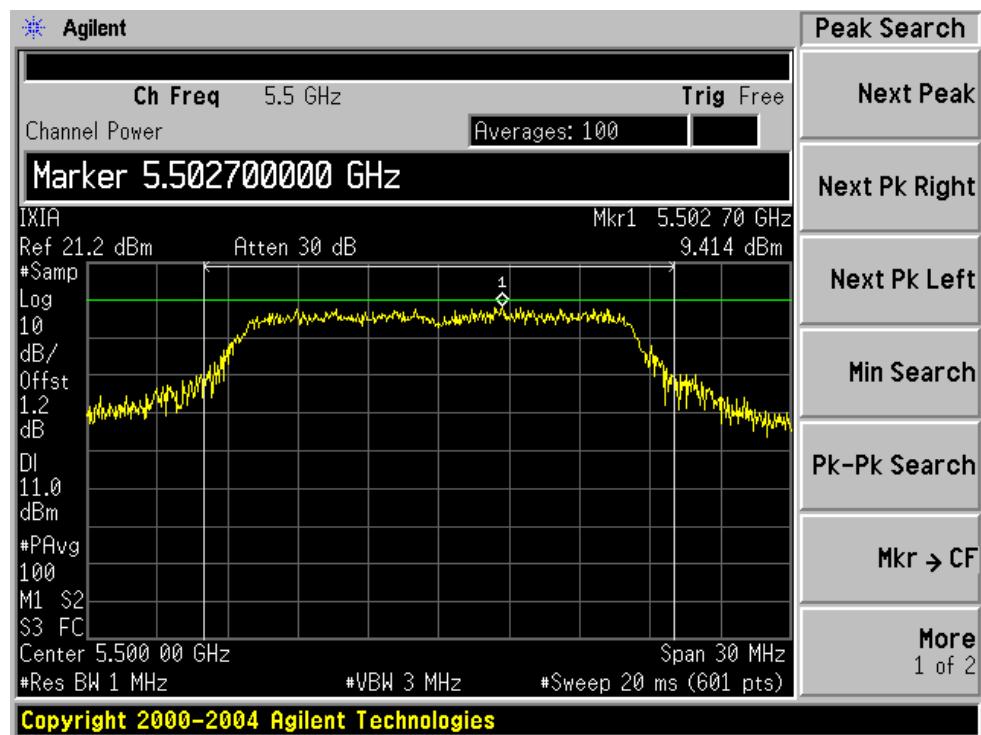
Environmental Conditions

Temperature:	22° C
Relative Humidity:	56 %
ATM Pressure:	104.1 kPa

* The testing was performed by Dan Coronia from 2007-06-11 to 2007-06-15

Test ResultFor 5470 – 5725 MHz: 802.11a

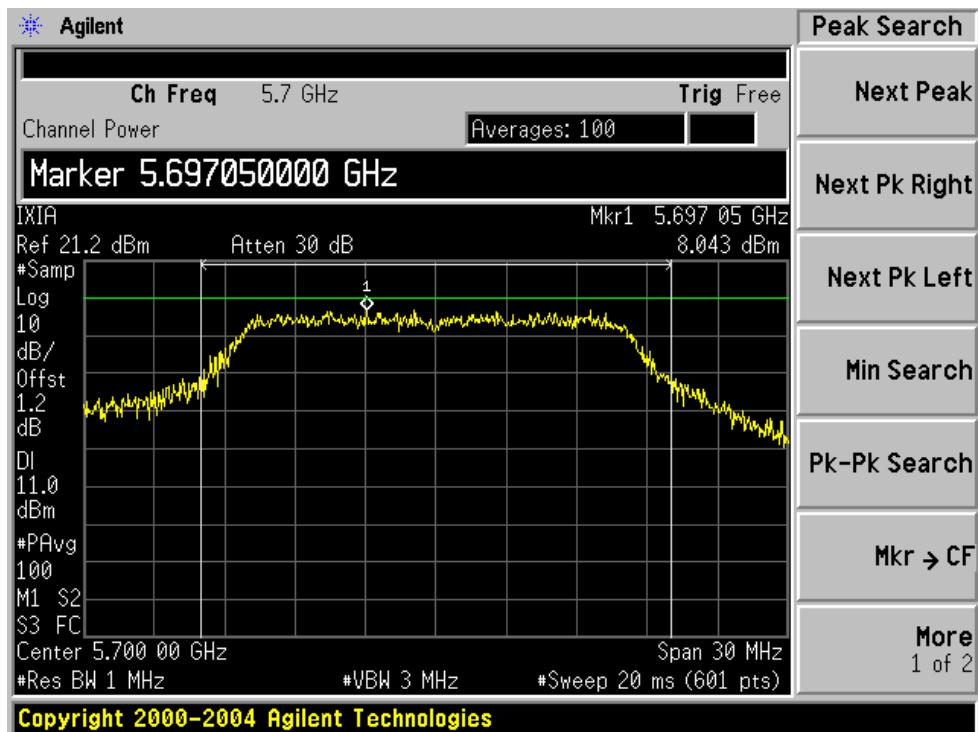
Channel: 100 (5500MHz)



Channel: 120 (5600MHz)



Channel: 140 (5700MHz)



§15.407(a) (6) – Peak Excursion

Applicable Standard

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

For 5150 – 5350 MHz: 802.11a

Measurement Procedure

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Equipment

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Test Setup Diagram

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Environmental Conditions

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

Measurement Results

Please refer to the following test report:

(FCC ID: NKRCM9 tested by International Standards Laboratory in report: ISL-04LR018FC).

For 5470 – 5725 MHz: 802.11a

Measurement Procedure

10. Place the EUT on a bench and set it in transmitting mode.
11. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
12. Add a correction factor to the display.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-02-23

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

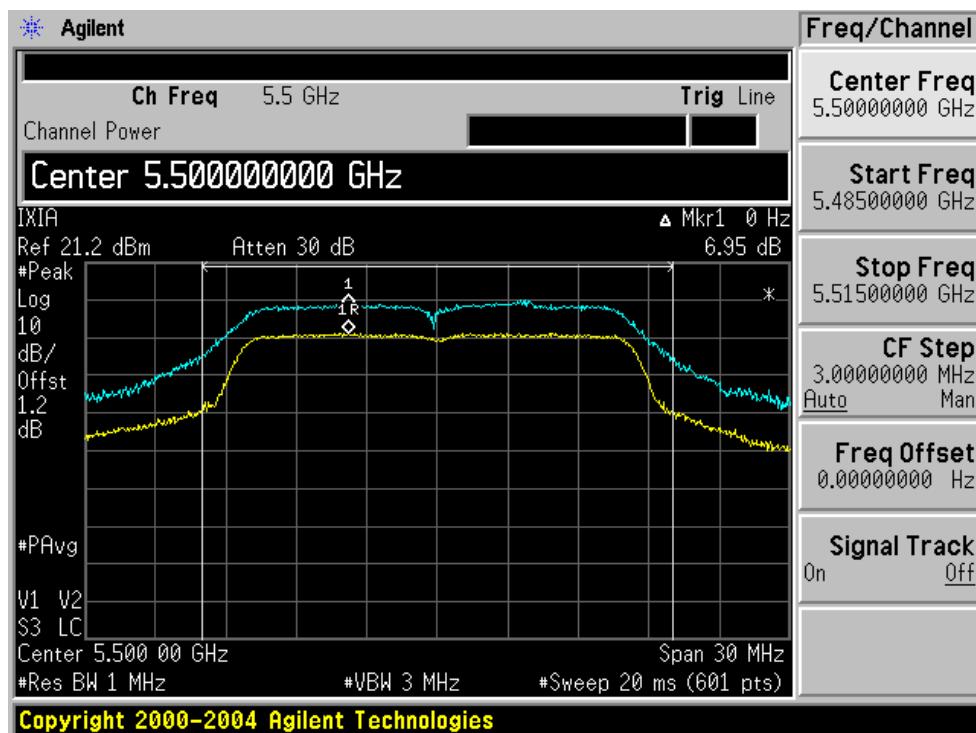
Temperature:	22 °C
Relative Humidity:	56 %
ATM Pressure:	104.1 kPa

* The testing was performed by Dan Coronia from 2007-06-11 to 2007-06-15

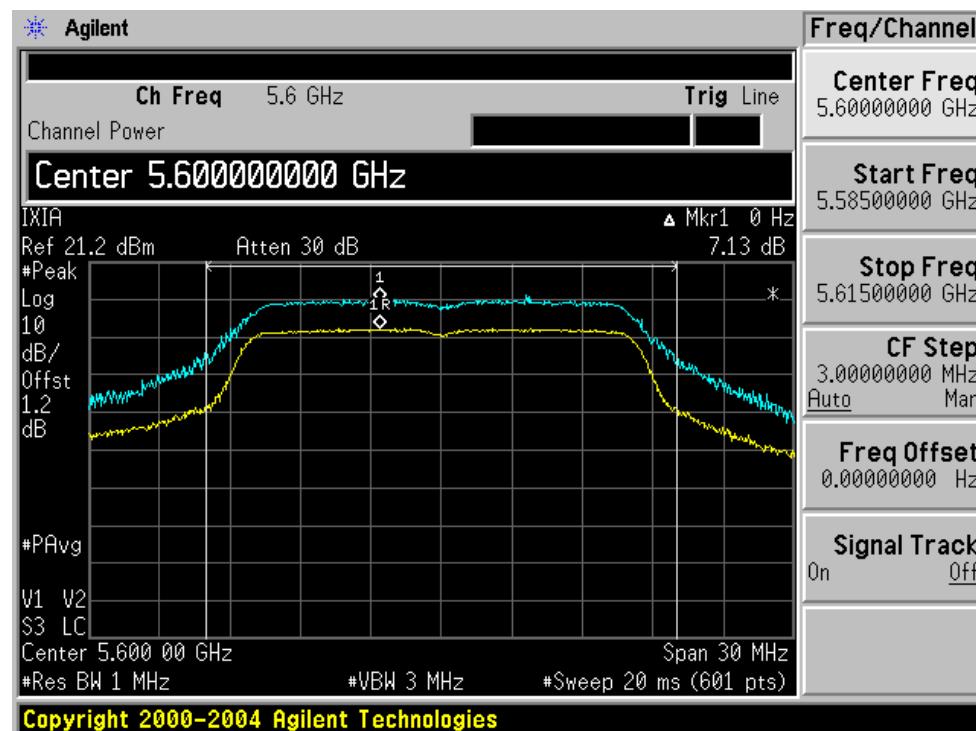
Test Result

For 5470 – 5725 MHz: 802.11a

Channel: 100 (5500MHz)



Channel: 120 (5500MHz)



Channel: 140 (5700MHz)

