FCC PART 15 SUBPART C

EMI MEASUREMENT AND TEST REPORT

For

Actiontec Electronics, Inc.

760 N. Mary Ave.
Sunnyvale, CA 94086

FCC ID: LNQAU802C

2003-05-30

This Report Concerns:	**Equipment Type:**
☒ Original Report	802.11g Access Point

Test Engineer:	Ling Zhang /
Report No.:	R0305051
Test Date:	2003-05-09
Reviewed By:	Ming Jing /
Prepared By:	Bay Area Compliance Laboratory Corporation (BACL) 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Actiontec Electronics, Inc.'s*, model: *AU802C,* or the "EUT" as referred to in this report is an 802.11g Access Point which measures approximately 8"L x 5.3"W x 5.25"H. The EUT composed by a 802.11g wireless card and a mother board which can admit the wireless card inserted in. The mother board use Ubicom's programmable processor IP2022 and ASIX's AX88796L Ethernet controller. Wireless card use Intersil based Dullet design.

** The test data gathered is from typical production samples provided by the manufacturer.*

1.2 Objective

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

The objective of the manufacturer is to demonstrate compliance with FCC rules for Output Power, Antenna Requirements, 6 dB Bandwidth, power density, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Spurious Radiated Emission.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals.

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-1992, 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 and FCC97114 for Direct Sequence SS.

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.

1.5 Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, 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 C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 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 scope of the accreditation covers the FCC Method – 47 CFR Part – Digital Devices, CISPER 22: 1997: Electromagnetic Interference – Limits and Methods of Measurement of Information Technology Equipment test methods.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8568B	Panel 2408A00105 Display 2403A06544	2004-05-01
HP	Spectrum Analyzer	8564E	29190A00242	2003-12-06
HP	Amplifier	8447E	1937A01054	2004-05-01
HP	Quasi-Peak Adapter	85650A	2521A00718	2004-05-01
Com-Power	Biconical Antenna	AB-100	14012	2004-05-01
Com-Power	LISN	LI-200	12005	2004-03-28
Com-Power	LISN	LI-200	12008	2004-03-28
Com-Power	Log Periodic Antenna	AL-100	16091	2004-05-01
Com-Power	Log Periodic Antenna	AB-900	15049	2004-05-01
Rohde & Schwarz	EMI Test Receiver	ESPI	1147 8007 07	2003-12-03

*** Statement of Traceability: Bay Area Compliance Laboratory Corp.** certifies that all calibration has been performed using suitable standards traceable to the NIST.

1.7 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
IBM	Notebook	Iseries	N/A	DOC
Citizen	Printer	LSP-10	5047999-82	DLK66TLSP-10

1.8 External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Shielded Serial Cable	1.5	Serial Port/Notebook PC	EUT
Shielded Printer Cable	2.0	Parallel Port/Notebook PC	Citizen Printer

1.9 Power Supply Information

Manufacturer	Description	Model	Serial Number	FCC ID
HITRON	AC Power Adapter	HES09-050160-1(0)	119198	DOC

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing in a typical fashion (as normally used by a typical user).

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The test software, provided by the customer, is started the Windows 2000 terminal program under the Windows 2000 operating system. Once loaded, the program sequentially exercises each system component, and the Prism Test Utility icon appears in the PC screen. Select the channel to be tested, select the 11 Mbps, and click the "Continuous TX" button for transmitting the RF power.

Repeat above steps for other channel to be tested.

2.3 Special Accessories

As shown in section 2.7, all interface cables used for compliance testing are shielded. The host pc and the peripherals featured shielded metal connectors.

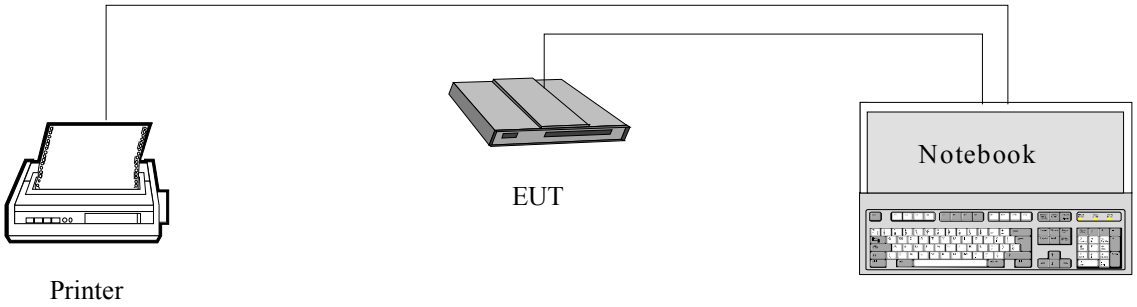
2.4 Schematics / Block Diagram

Please refer to Appendix A.

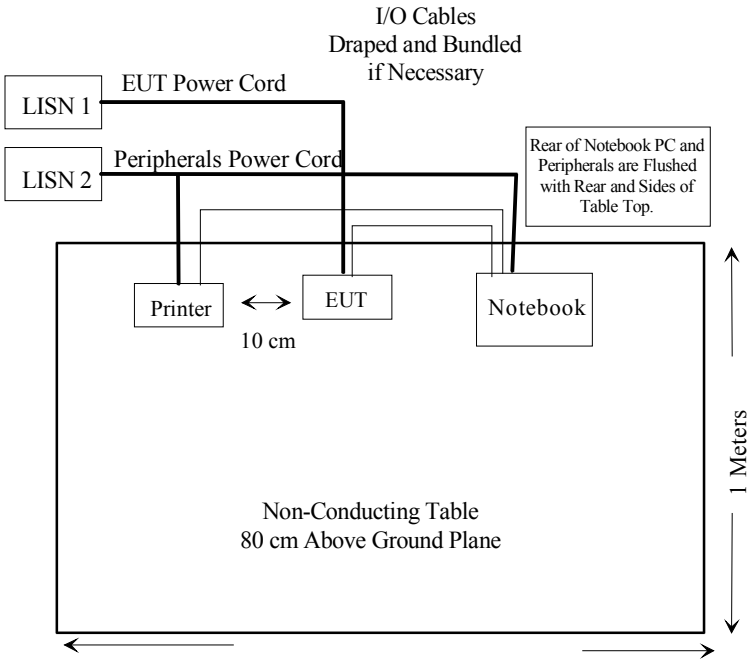
2.5 Equipment Modifications

No modifications were made by BACL to ensure the EUT to comply with the applicable limits and requirements.

2.6 Configuration of Test System



2.7 Test Setup Block Diagram



3 - SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT	REFERENCE
§15.203	Antenna Requirement	Compliant	Section 9
§ 15.205	Restricted Bands	Compliant	Section 10
§15.207 (a)	Conducted Emission	Compliant	Section 11
§15.209 (a)	Radiated Emission	Compliant	Section 10
§15.209 (a)	Spurious Emission	Compliant	Section 6
§15.247 (a) (2)	6 dB Bandwidth	Compliant	Section 5
§15.247 (b) (3)	Maximum Peak Output Power	Compliant	Section 4
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edge	Compliant	Section 8
§15.247 (d)	Peak Power Spectral Density	Compliant	Section 7

4 - CONDUCTED OUTPUT POWER MEASUREMENT

4.1 Standard Applicable

According to §15.247(b) (3), for systems using digital modulation in 2400-2483.5 MHz: 1 Watt

4.2 Measurement Procedure

1. Place the EUT on the turntable 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 the Spectrum Analyzer.
3. The peak power will be obtained by adding the bandwidth correction factor, 10log(BW 6dB / RBW) to the peak power reading at RBW = 2.0 MHz of the spectrum analyzer.

4.3 Test Equipment

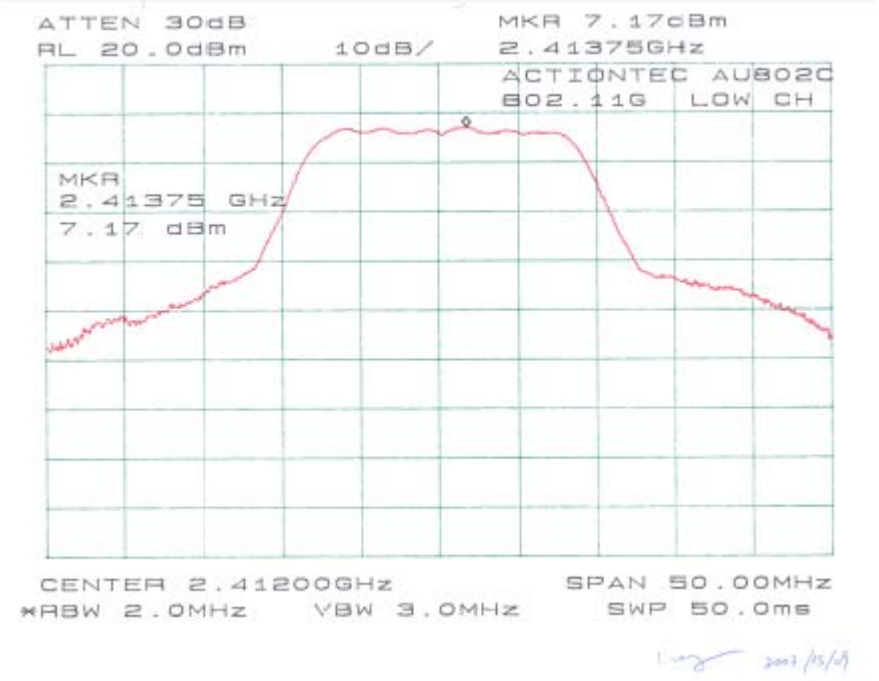
Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

4.4 Measurement Result

	Frequency (MHz)	Peak Output Power (dBm)	Correction Factor (dBm)	Corrected Factor (dBm)	Output Power (W)	Standard (W)	Result
802.11g	2412	7.17	9.2	16.37	0.043	≤ 1 W	Compliant
	2437	7.33	9.2	16.53	0.045	≤ 1 W	Compliant
	2462	7.17	9.2	16.37	0.043	≤ 1 W	Compliant
802.11b	2412	8.33	8.1	16.43	0.044	≤ 1 W	Compliant
	2437	9.00	8.1	17.10	0.051	≤ 1 W	Compliant
	2462	8.67	8.1	16.77	0.048	≤ 1 W	Compliant

Note:

802.11g: Correction Factor = 10 log (BW6dB/RBW) = 10 log (16.75/2.0) = 9.2 dBm
802.11b: Correction Factor = 10 log (BW6dB/RBW) = 10 log (12.88/2.0) = 8.1 dBm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MKR 7.17dBm
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MKR
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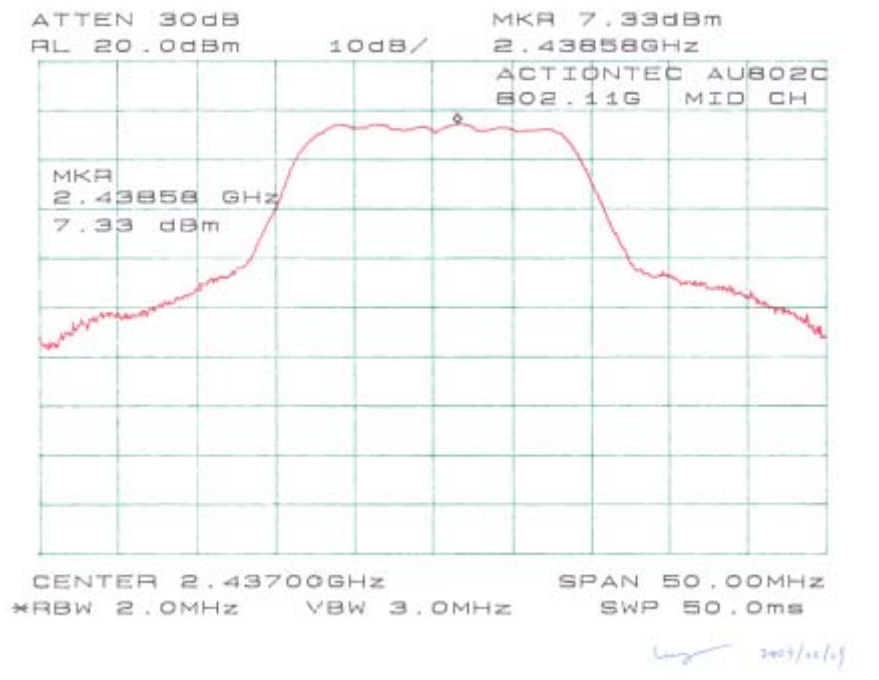
CENTER 2.41200GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms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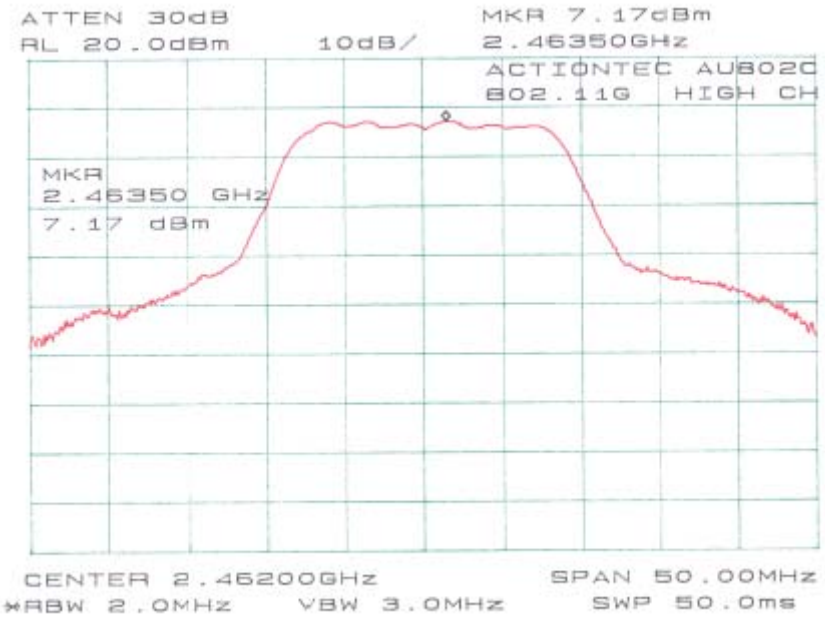
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms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MKR
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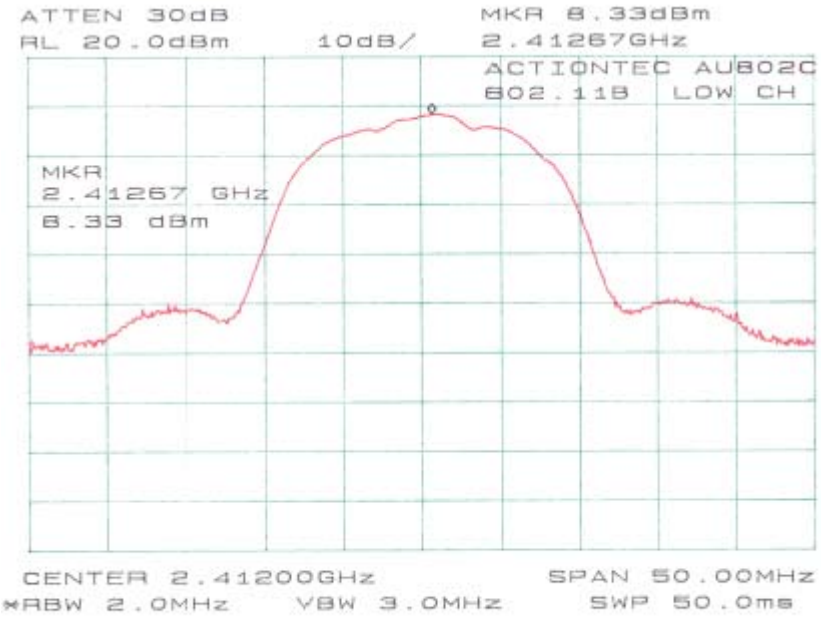
CENTER 2.46200GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms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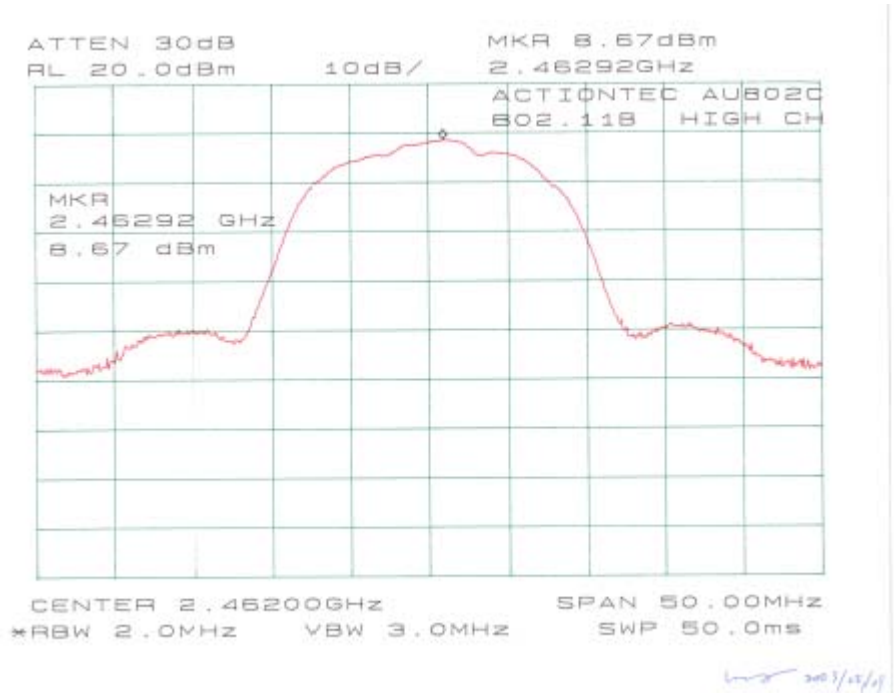
802.11B LOW CH
MKR
2.41267 GHz
8.33 dBm
CENTER 2.41200GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms


ATTEN 30dB
RL 20.0dBm
10dB/
MKR 9.00dBm
2.43808GHz
ACTIONTEC AU802C
802.11B MID CH
MKR
2.43808 GHz
9.00 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms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10dB/
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MKR
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8.67 dBm
CENTER 2.46200GHz
SPAN 50.00MHz
*RBW 2.0MHz
VBW 3.0MHz
SWP 50.0ms

5 – 6 DB BANDWIDTH

5.1 Standard Applicable

According to §15.247(a)(2), for systems using digital modulation techniques operate in 2400 – 2483.5MHz, the minimum 6dB bandwidth shall be at least 500 kHz.

5.2 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 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

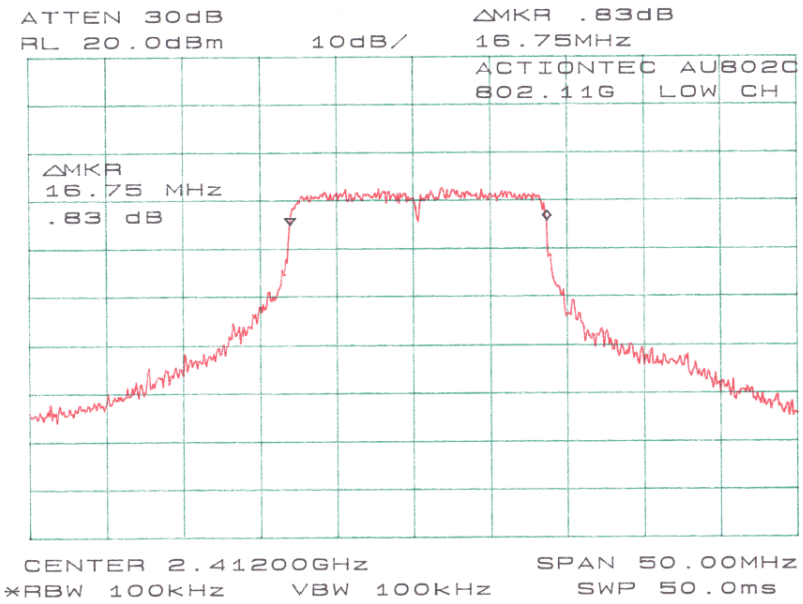
5.3 Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

5.4 Measurement Result

Please refer to following pages for plots of 6 dB Bandwidth.

	Frequency (MHz)	Measured (MHz)	Standard (kHz)	Result
802.11g	2412	16.75	≥ 500	Compliant
	2437	16.67	≥ 500	Compliant
	2462	16.67	≥ 500	Compliant
802.11b	2412	12.88	≥ 500	Compliant
	2437	12.83	≥ 500	Compliant
	2462	12.83	≥ 500	Compliant



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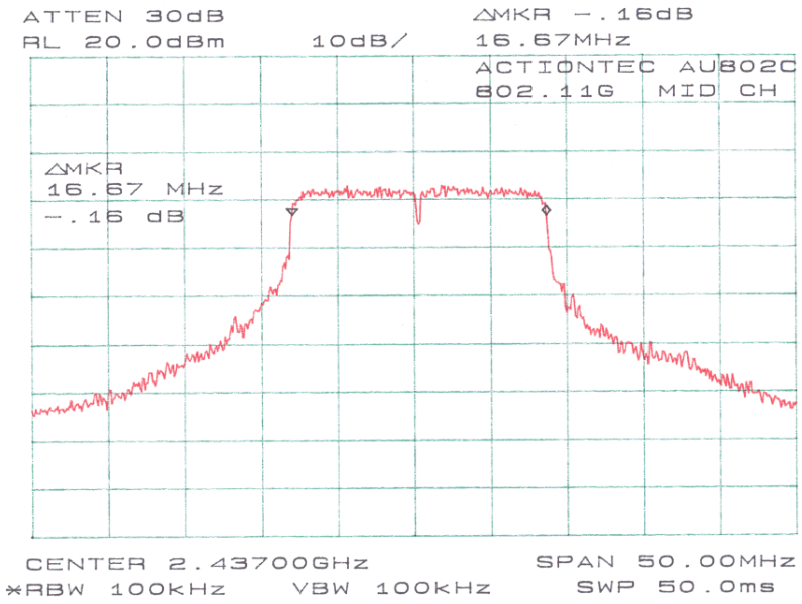

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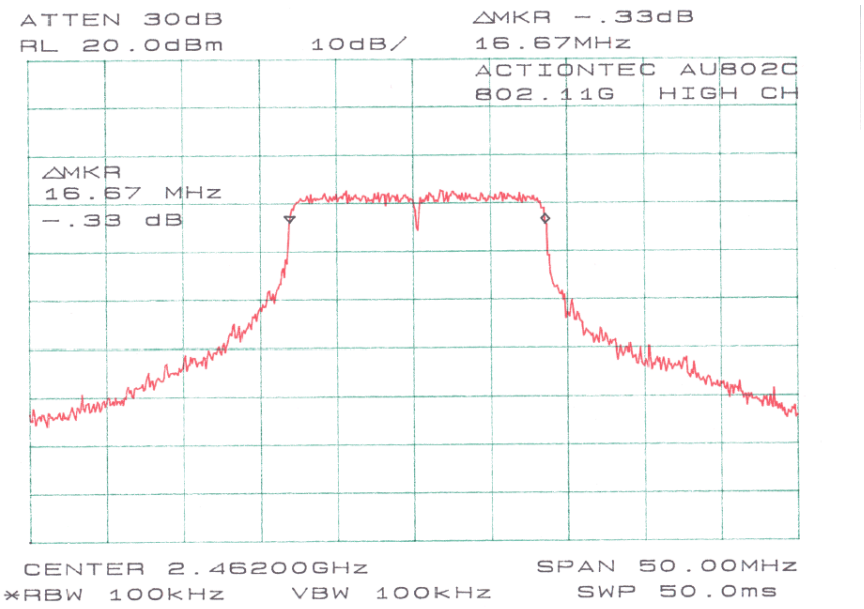

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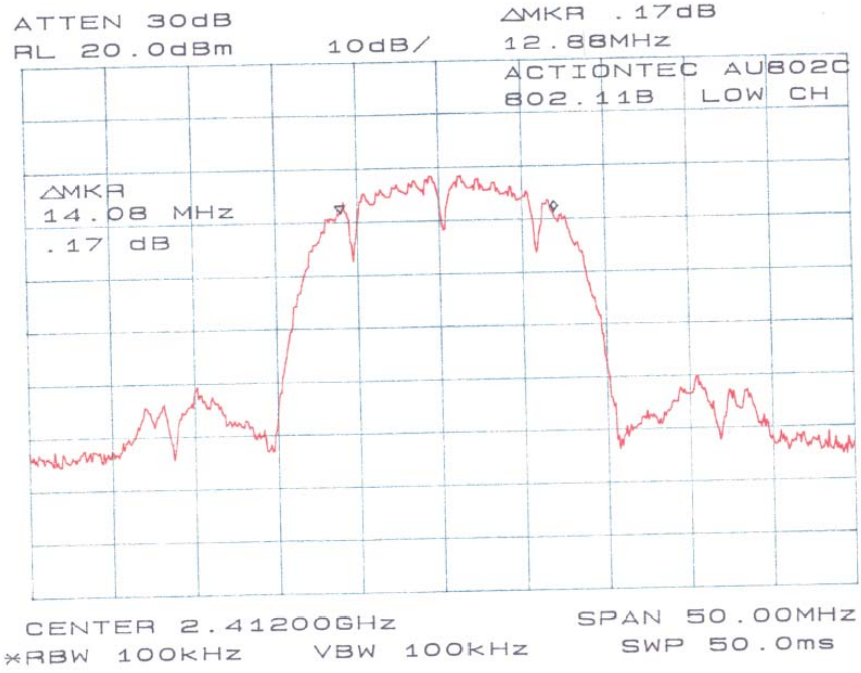

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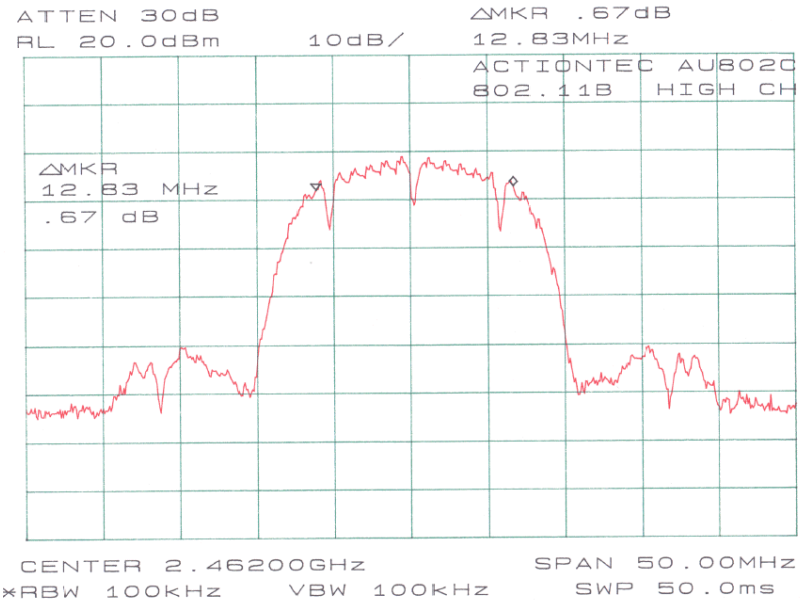

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6 - SPURIOUS EMISSION AT ANTENNA TERMINAL

6.1 Standard Applicable

According to §15.209 (a), except as provided elsewhere in the subpart of 15.209, 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., §§ 15.231 and 15.241.

6.2 Measurement Procedure

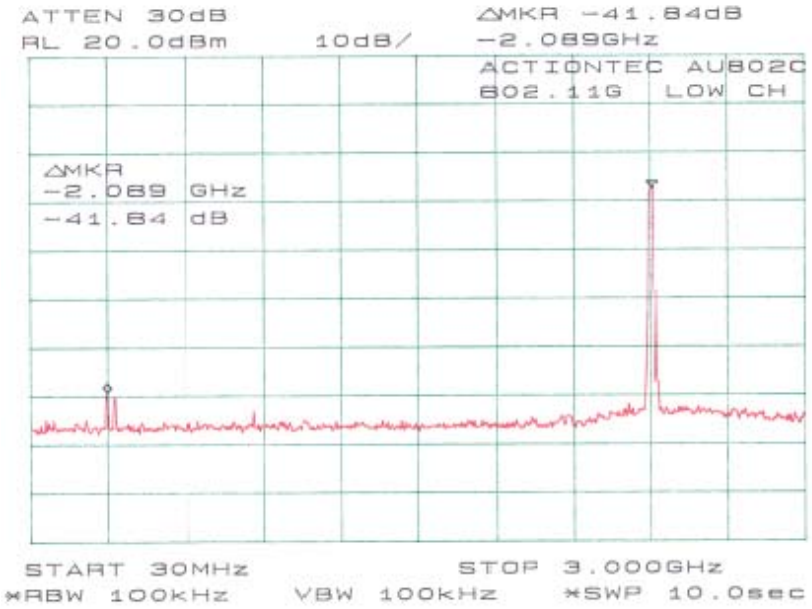
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

6.3 Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

6.4 Measurement Result

Please refer to following pages for plots of spurious emission.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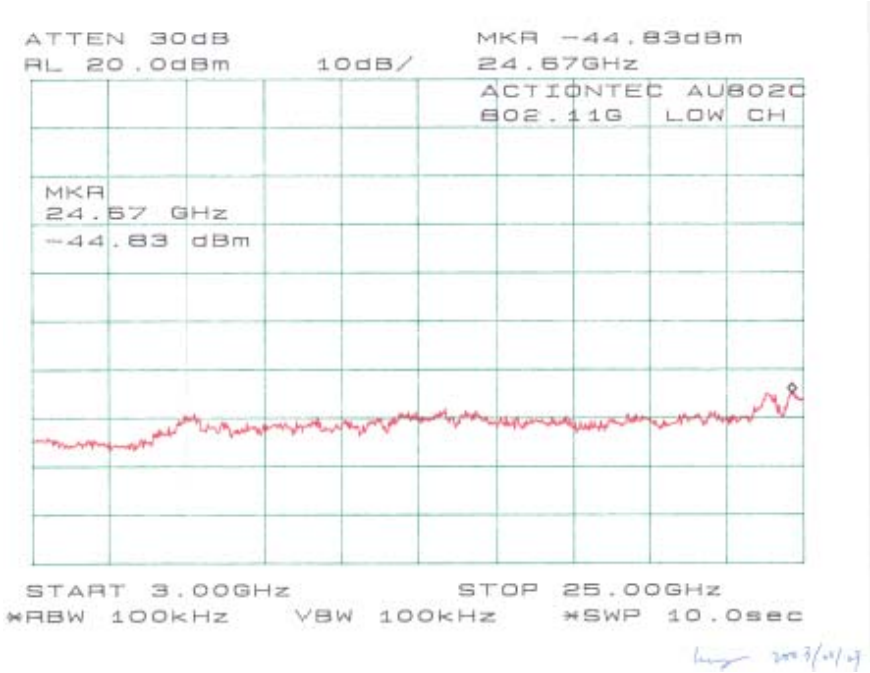
VBW 100kHz
#SWP 10.0sec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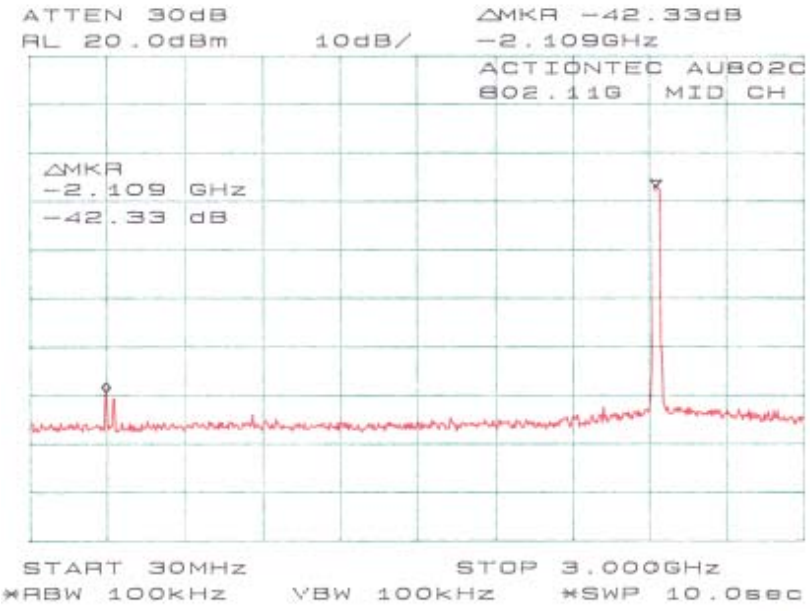
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-2.109GHz
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-2.109 GHz
-42.33 dB
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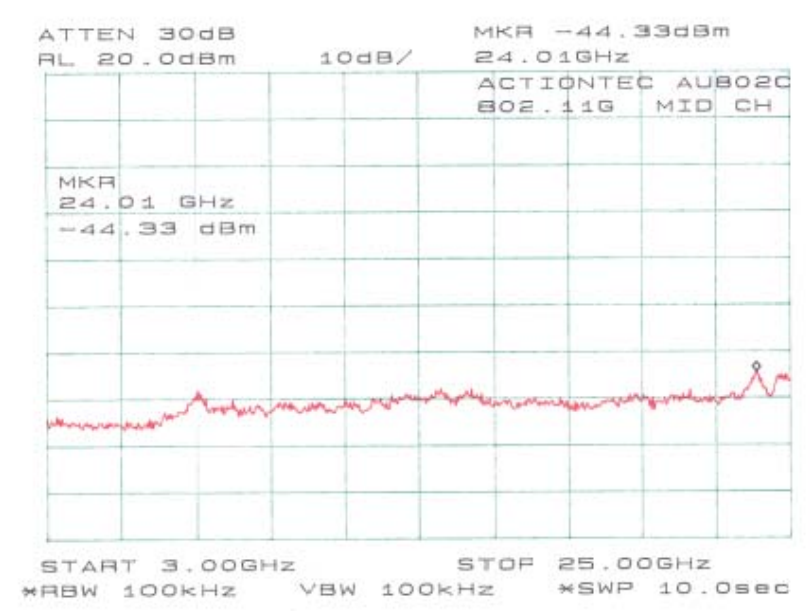
STOP 3.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec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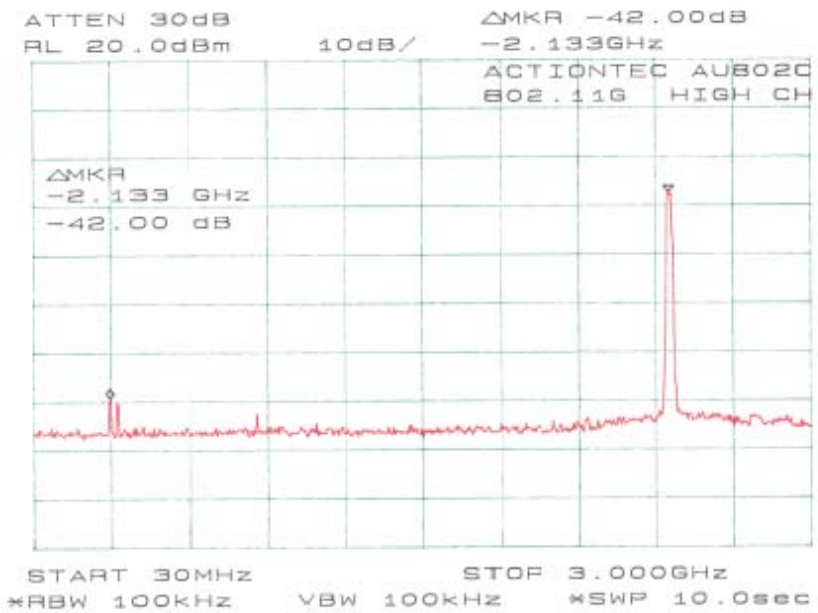
START 3.00GHz
STOP 25.00GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec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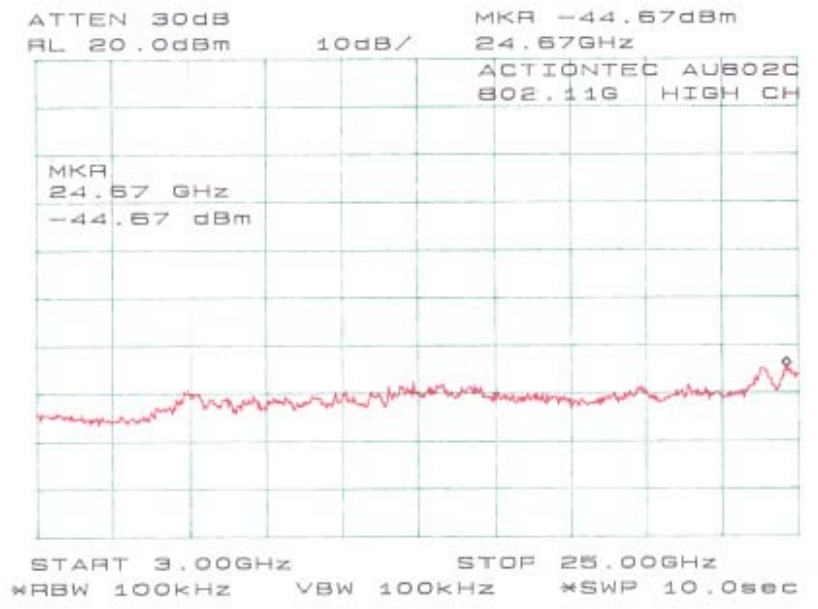
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VBW 100kHz
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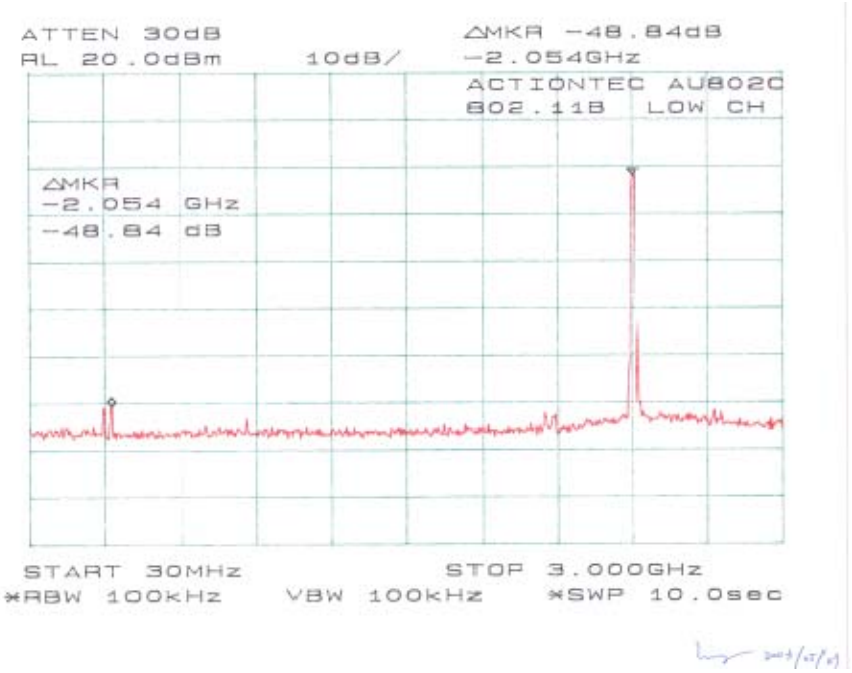
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802.11B LOW CH
ΔMKR
-2.054 GHz
-48.84 dB
START 30MHz
STOP 3.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 30dB
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10dB/
MKR -44.00dBm
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MKR
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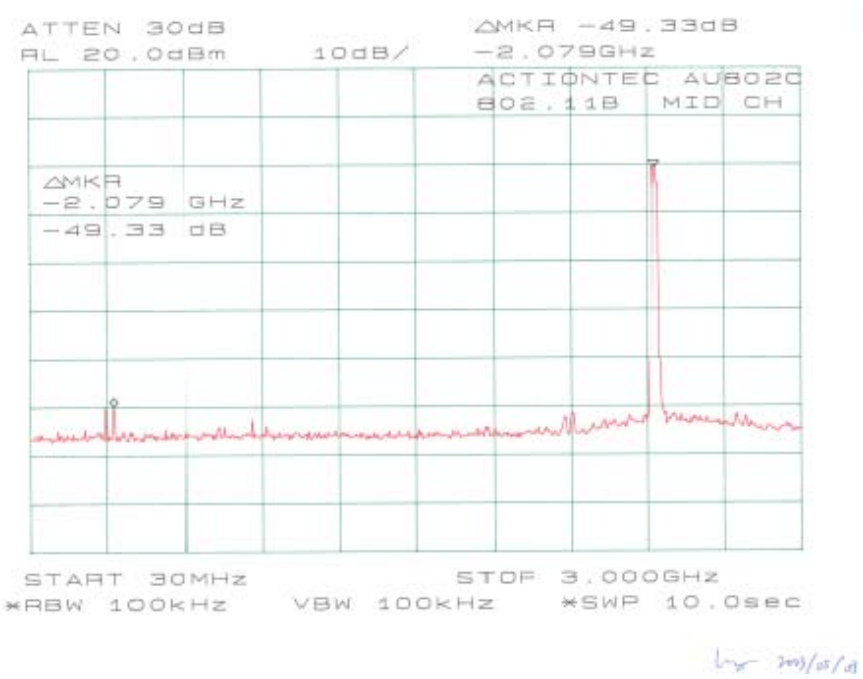
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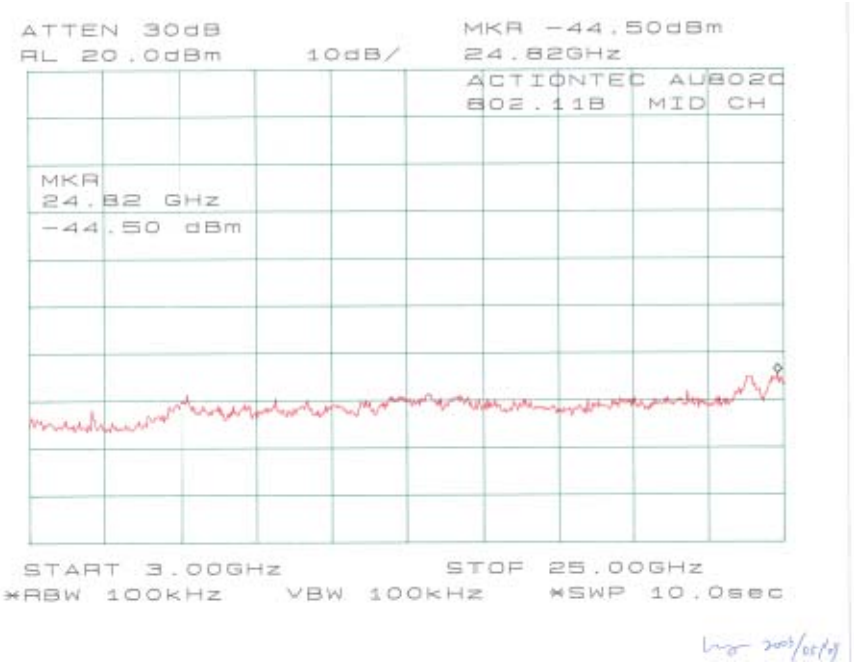
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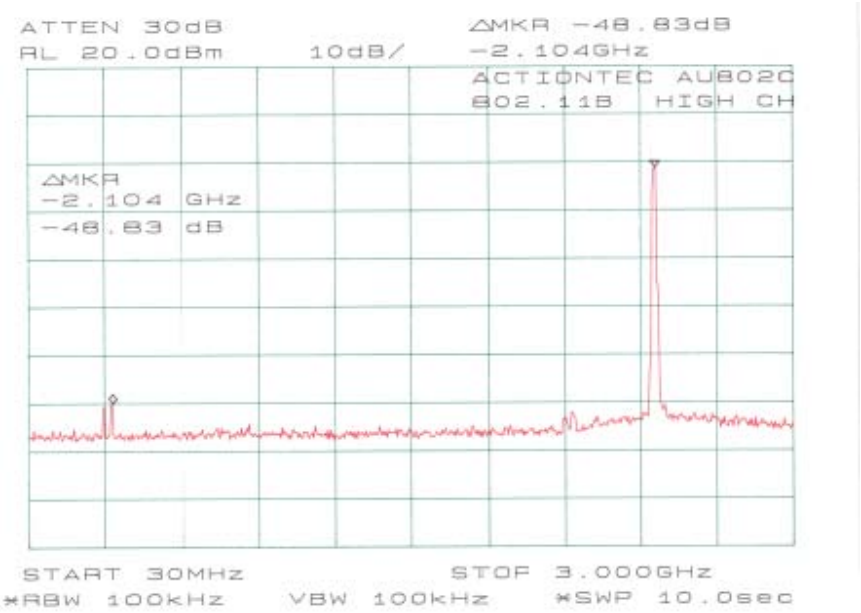
*SWP 10.0sec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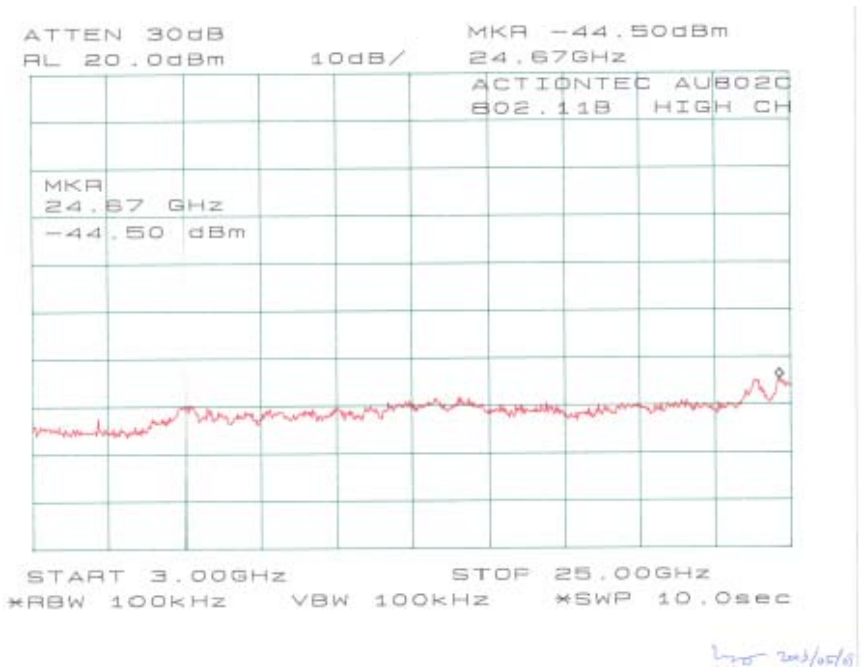

ATTEN 30dB
RL 20.0dBm
10dB/
MKR -44.50dBm
24.67GHz
ACTIONTEC AU802C
802.11B HIGH CH
MKR
24.67 GHz
-44.50 dBm
START 3.00GHz
STOP 25.00GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec

7 - PEAK POWER SPECTRAL DENSITY

7.1 Standard Applicable

According to §15.247 (d), digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

7.2 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 was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 6MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

7.3 Test Equipment

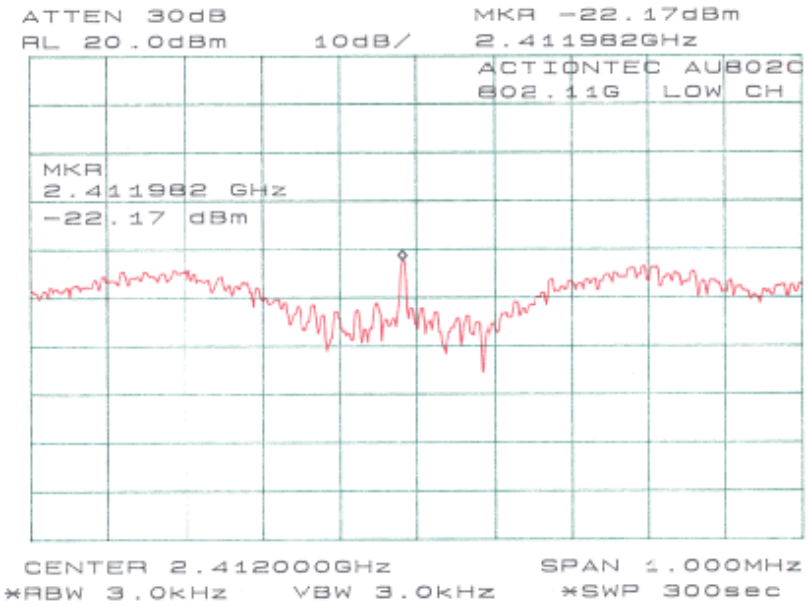
Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

7.4 Measurement Results

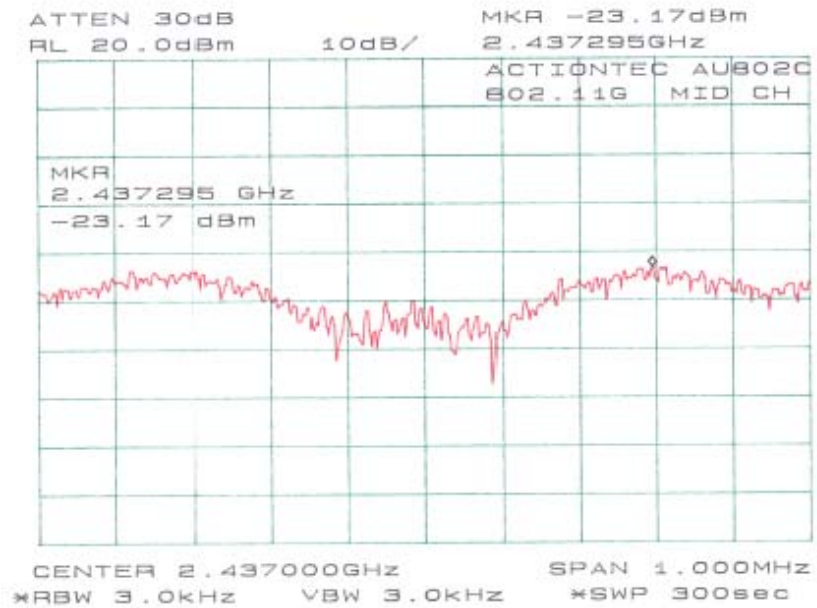
	Frequency (MHz)	Peak Power Spectral Density	Standard (dBm)	Result
802.11g	2412	-22.17	≤ 8	Compliant
	2437	-23.17	≤ 8	Compliant
	2462	-23.50	≤ 8	Compliant
802.11b	2412	-15.33	≤ 8	Compliant
	2437	-14.33	≤ 8	Compliant
	2462	-14.67	≤ 8	Compliant

7.5 Plot of Peak Power Spectral Density

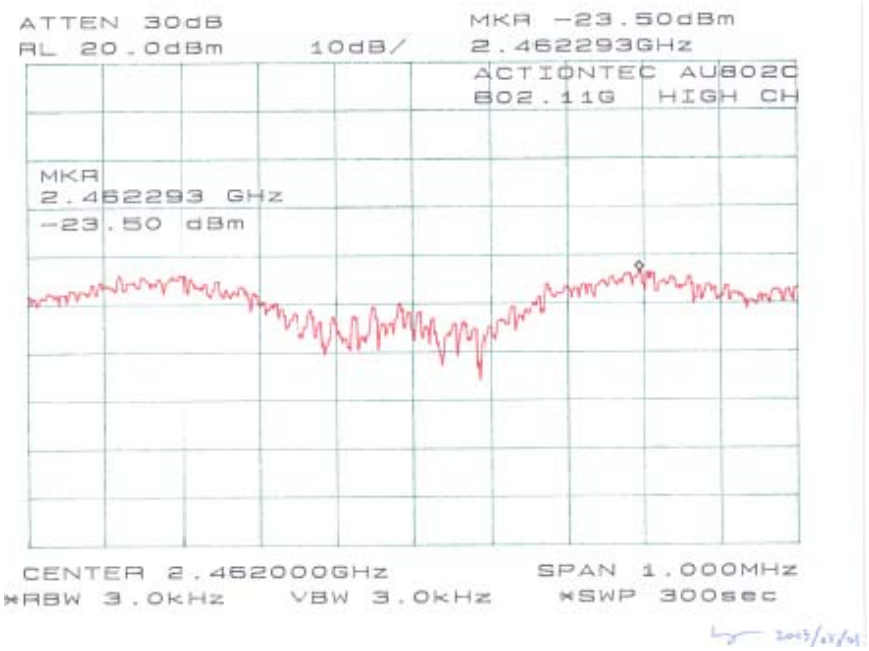
Please refer to following pages for plots of peak power spectral density.

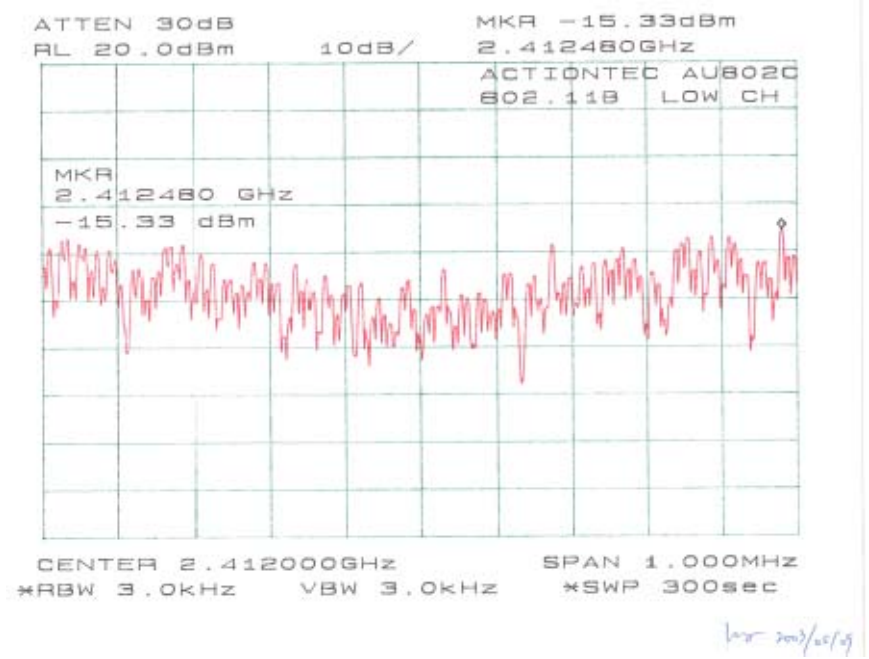


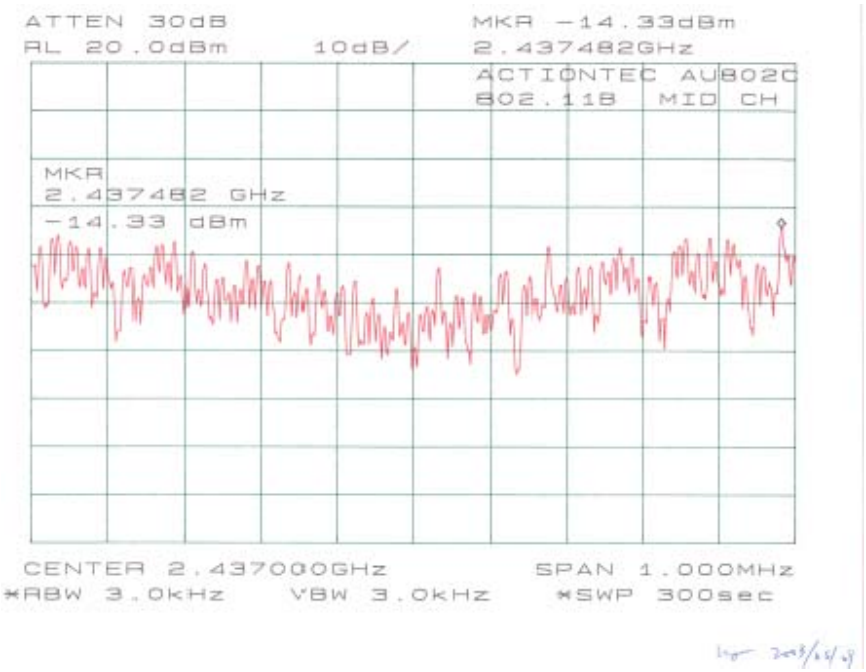
2003/05/09

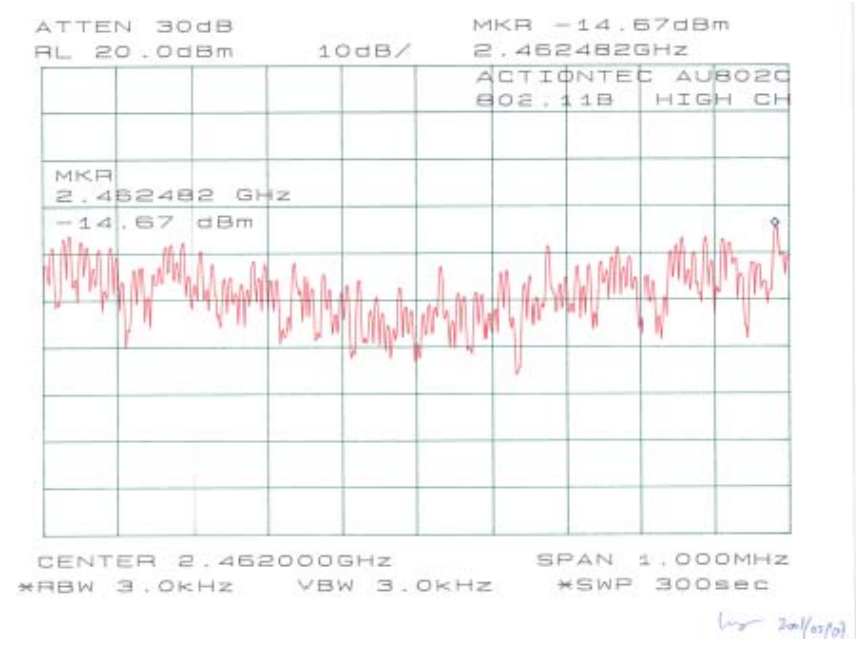


2003/05/09


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -23.50dBm
2.462293GHz
ACTIONTEC AU802C
802.11G HIGH CH
MKR
2.462293 GHz
-23.50 dBm
CENTER 2.462000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
*SWP 300sec


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -15.33dBm
2.412480GHz
ACTIONTEC AU802C
802.11B LOW CH
MKR
2.412480 GHz
-15.33 dBm
CENTER 2.412000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
*SWP 300sec


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -14.33dBm
2.437482GHz
ACTIONTEC AU802C
802.11B MID CH
MKR
2.437482 GHz
-14.33 dBm
CENTER 2.437000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
*SWP 300sec


ATTEN 30dB
RL 20.0dBm
10dB/
MKR -14.67dBm
2.462482GHz
ACTIONTEC AU802C
802.11B HIGH CH
MKR
2.462482 GHz
-14.67 dBm
CENTER 2.462000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
*SWP 300sec

8 - 100 KHZ BANDWIDTH OF BAND EDGES

8.1 Standard Applicable

According to §15.247(c), in *any* 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) see §15.205(c)).

8.2 Measurement Procedure

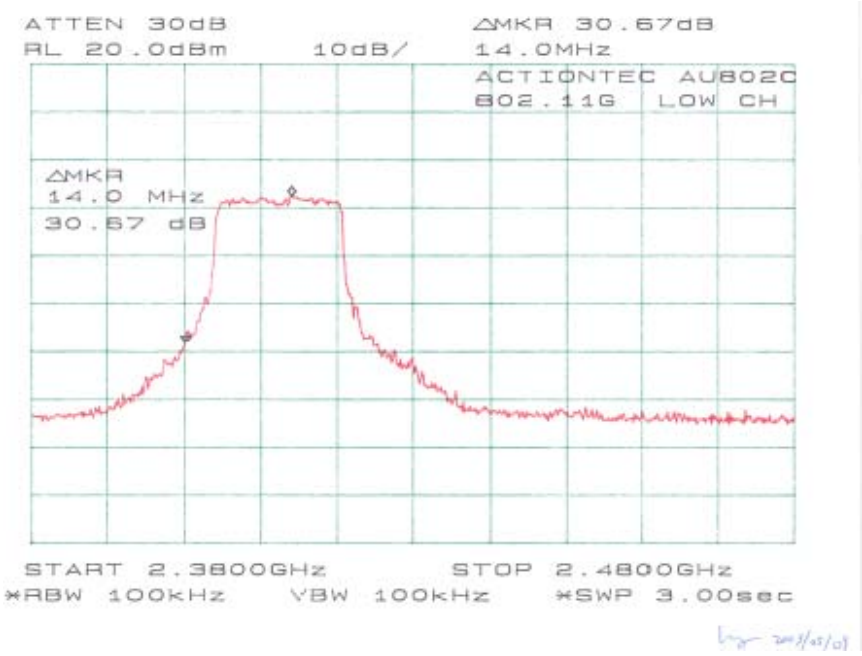
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

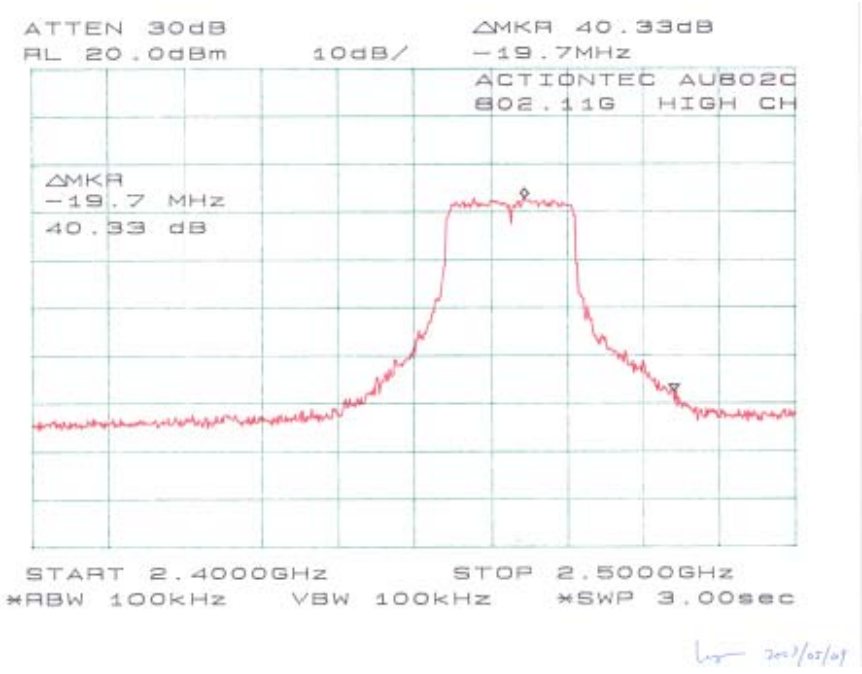
8.3 Test Equipment

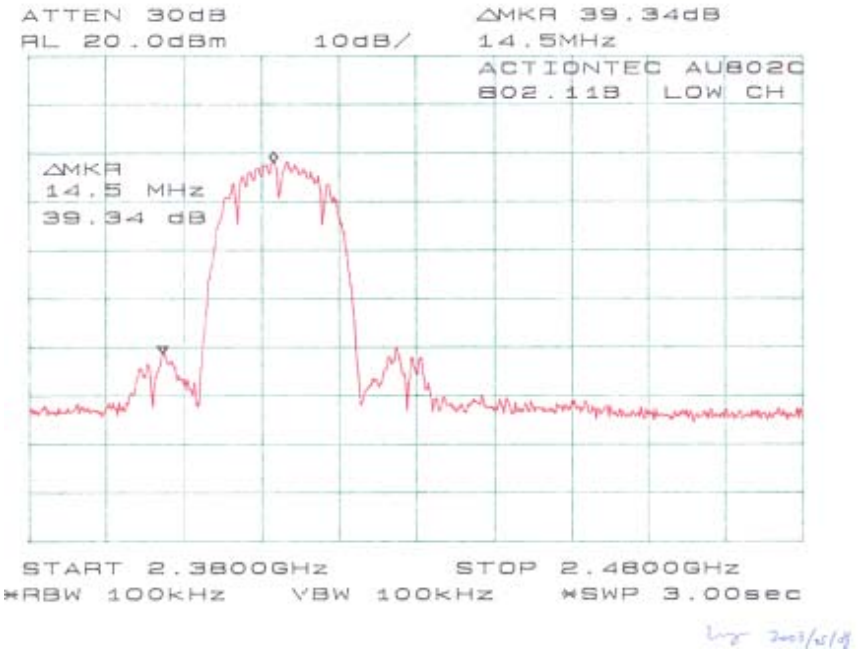
Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

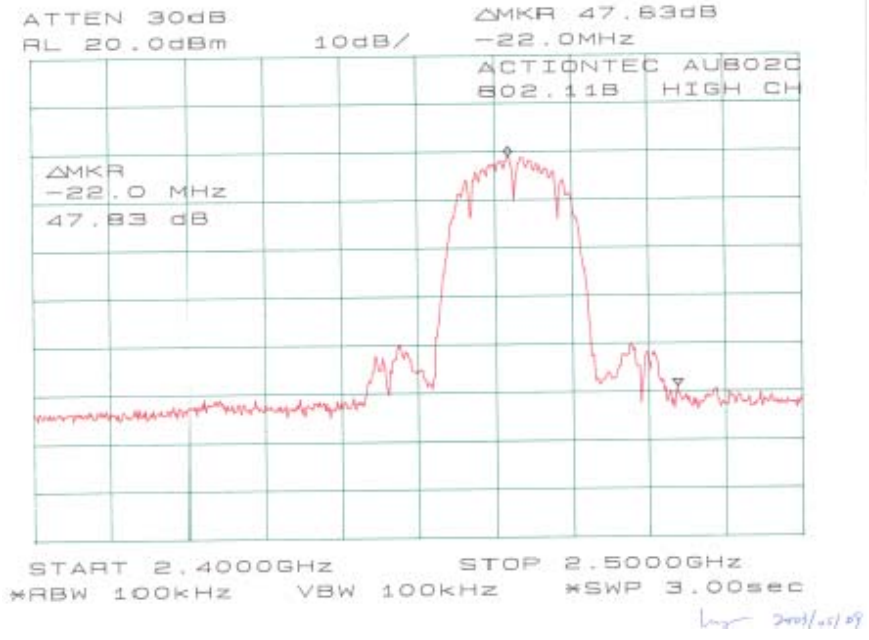
8.4 Measure Results

Please refer to following pages for plots of band edge.


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 30.67dB
14.0MHz
ACTIONTEC AU802C
802.11G LOW CH
ΔMKR
14.0 MHz
30.67 dB
START 2.3800GHz
STOP 2.4800GHz
*RBW 100kHz
VBW 100kHz
*SWP 3.00sec


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 40.33dB
−19.7MHz
ACTIONTEC AU802C
802.11G HIGH CH
ΔMKR
−19.7 MHz
40.33 dB
START 2.4000GHz
STOP 2.5000GHz
*RBW 100kHz
VBW 100kHz
*SWP 3.00sec


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 39.34dB
14.5MHz
ACTIONTEC AU802C
802.11B LOW CH
ΔMKR
14.5 MHz
39.34 dB
START 2.3800GHz
STOP 2.4800GHz
*RBW 100kHz
VBW 100kHz
*SWP 3.00sec


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 47.83dB
-22.0MHz
ACTIONTEC AU802C
802.11B HIGH CH
ΔMKR
-22.0 MHz
47.83 dB
START 2.4000GHz
STOP 2.5000GHz
*RBW 100kHz
VBW 100kHz
*SWP 3.00sec

9 - ANTENNA REQUIREMENT

9.1 Standard Applicable

For intentional device, 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.

And according to § 15.247 (1), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

9.2 Antenna Connected Construction

The directional gain of antenna used for transmitting is 3 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement.

10 - SPURIOUS RADIATED EMISSION

10.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties. 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 best estimate of the uncertainty of a radiation emissions measurement at BACL is $\pm$4.0 dB.

10.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4-1992. The specification used was the FCC 15 Subpart C 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.

The host PC system was connected with 120Vac/60Hz power source.

10.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 25GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

10.4 Test Procedure

For the radiated emissions test, the Host PC system power cord was connected to the AC floor outlet since the power supply used in the EUT did not provide an accessory power outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBµV of specification limits), and are distinguished with a "**Qp**" in the data table.

10.5 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:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

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

Margin = Corr. Ampl. – Subpart C Limit

10.6 Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

10.7 Summary of Test Results

According to the data in section 10.8, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207 and 15.247, and had the worst margin of:

For802.11g:

-11.4 dB at **7236.00 MHz** in the **Vertical** polarization, Low Channel

-11.4 dB at **7311.00 MHz** in the **Vertical** polarization, Middle Channel

-11.8 dB at **7386.00 MHz** in the **Vertical** polarization, High Channel

-6.1 dB at **429.55 MHz** in the **Vertical** polarization, Unintentional Emission

For 802.11b:

-10.9 dB at **7236.00 MHz** in the **Vertical** polarization, Low Channel

-11.1 dB at **7311.00 MHz** in the **Vertical** polarization, Middle Channel

-11.6 dB at **7386.00 MHz** in the **Vertical** polarization, High Channel

-10.5 dB at **430.50 MHz** in the **Vertical** polarization, Unintentional Emission

10.8.1 Final test data for 802.11g, 1 – 25 GHz

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
Low Channel											
2412.00	100.0	FUND/PEAK	300	1.8	V	28.1	3.4	30.0	101.5		
2412.00	91.2	FUND/PEAK	90	2.0	H	28.1	3.4	30.0	92.6		
2412.00	90.5	FUND/AVE	300	1.8	V	28.1	3.4	30.0	92.0		
2412.00	81.8	FUND/AVE	90	2.0	H	28.1	3.4	30.0	83.3		
7236.00	31.8	AVE	270	1.2	V	35.1	5.6	30.0	42.6	54	-11.4
7236.00	31.5	AVE	90	1.5	H	35.1	5.6	30.0	42.2	54	-11.8
7236.00	44.5	PEAK	270	1.2	V	35.1	5.6	30.0	55.2	74	-18.8
4824.00	27.3	AVE	45	1.5	V	32.5	4.9	30.0	34.7	54	-19.3
7236.00	43.7	PEAK	90	1.5	H	35.1	5.6	30.0	54.4	74	-19.6
4824.00	26.2	AVE	0	1.2	H	32.5	4.9	30.0	33.6	54	-20.4
4824.00	39.7	PEAK	45	1.5	V	32.5	4.9	30.0	47.1	74	-26.9
4824.00	38.7	PEAK	0	1.2	H	32.5	4.9	30.0	46.1	74	-27.9
Middle Channel											
2437.00	100.3	FUND/PEAK	60	1.8	V	28.1	3.4	30.0	101.8		
2437.00	93.2	FUND/PEAK	90	1.5	H	28.1	3.4	30.0	94.6		
2437.00	89.8	FUND/AVE	60	1.8	V	28.1	3.4	30.0	91.3		
2437.00	82.8	FUND/AVE	90	1.5	H	28.1	3.4	30.0	84.3		
7311.00	31.8	AVE	300	1.5	V	35.1	5.6	30.0	42.6	54	-11.4
7311.00	31.5	AVE	0	1.5	H	35.1	5.6	30.0	42.2	54	-11.8
4874.00	27.2	AVE	60	1.8	V	32.5	4.9	30.0	34.6	54	-19.4
7311.00	43.9	PEAK	300	1.5	V	35.1	5.6	30.0	54.6	74	-19.4
7311.00	43.5	PEAK	0	1.5	H	35.1	5.6	30.0	54.2	74	-19.8
4874.00	26.3	AVE	45	1.8	H	32.5	4.9	30.0	33.7	54	-20.3
4874.00	39.5	PEAK	60	1.8	V	32.5	4.9	30.0	46.9	74	-27.1
4874.00	38.7	PEAK	45	1.8	H	32.5	4.9	30.0	46.1	74	-27.9
High Channel											
2462.00	102.3	FUND/PEAK	300	1.5	V	28.1	3.4	30.0	103.8		
2462.00	91.8	FUND/PEAK	30	1.6	H	28.1	3.4	30.0	93.3		
2462.00	92.5	FUND/AVE	300	1.5	V	28.1	3.4	30.0	94.0		
2462.00	81.3	FUND/AVE	30	1.6	H	28.1	3.4	30.0	82.8		
7386.00	31.5	AVE	220	1.5	V	35.1	5.6	30.0	42.2	54	-11.8
7386.00	31.3	AVE	180	1.8	H	35.1	5.6	30.0	42.0	54	-12.0
4924.00	28.2	AVE	300	1.5	V	32.5	4.9	30.0	35.6	54	-18.4
7386.00	44.5	PEAK	220	1.5	V	35.1	5.6	30.0	55.2	74	-18.8
7386.00	43.8	PEAK	180	1.8	H	35.1	5.6	30.0	54.5	74	-19.5
4924.00	26.5	AVE	60	1.8	H	32.5	4.9	30.0	33.9	54	-20.1
4924.00	40.2	PEAK	300	1.5	V	32.5	4.9	30.0	47.6	74	-26.4
4924.00	39.5	PEAK	60	1.8	H	32.5	4.9	30.0	46.9	74	-27.1

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart B	
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB
429.55	45.7	270	1.8	V	16.5	2.7	25.0	39.9	46	-6.1
233.26	48.8	0	1.2	V	12.6	2.2	25.0	38.6	46	-7.4
270.00	46.7	300	1.5	H	13.3	2.2	25.0	37.2	46	-8.8
171.70	42.6	150	1.5	H	13.0	1.9	25.0	32.5	43.5	-11.0
351.69	39.2	150	1.2	V	15.5	2.3	25.0	32.0	46	-14.0
321.70	37.3	45	1.8	V	15.5	2.3	25.0	30.2	46	-15.8

Note:

AVG = average

10.8.2 Final test data for 802.11b, 1 – 25 GHz

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
Low Channel											
2412.00	100.2	FUND/PEAK	330	2.2	V	28.1	3.4	30.0	101.6		
2412.00	92.8	FUND/PEAK	270	1.8	H	28.1	3.4	30.0	94.3		
2412.00	96.2	FUND/AVE	330	2.2	V	28.1	3.4	30.0	97.6		
2412.00	87.3	FUND/AVE	270	1.8	H	28.1	3.4	30.0	88.8		
7236.00	32.3	AVE	90	1.5	V	35.1	5.6	30.0	43.1	54	-10.9
7236.00	31.8	AVE	270	2.0	H	35.1	5.6	30.0	42.5	54	-11.5
4824.00	28.2	AVE	0	1.2	V	32.5	4.9	30.0	35.6	54	-18.4
7236.00	44.0	PEAK	90	1.5	V	35.1	5.6	30.0	54.7	74	-19.3
7236.00	43.8	PEAK	270	2.0	H	35.1	5.6	30.0	54.5	74	-19.5
4824.00	26.5	AVE	300	2.0	H	32.5	4.9	30.0	33.9	54	-20.1
4824.00	39.0	PEAK	0	1.2	V	32.5	4.9	30.0	46.4	74	-27.6
4824.00	38.8	PEAK	300	2.0	H	32.5	4.9	30.0	46.2	74	-27.8
Middle Channel											
2437.00	102.33	FUND/PEAK	90	2.0	V	28.1	3.4	30.0	103.8		
2437.00	90.2	FUND/PEAK	250	2.2	H	28.1	3.4	30.0	91.6		
2437.00	98.17	FUND/AVE	90	2.0	V	28.1	3.4	30.0	99.6		
2437.00	86.0	FUND/AVE	250	2.2	H	28.1	3.4	30.0	87.5		
7311.00	32.2	AVE	180	1.2	V	35.1	5.6	30.0	42.9	54	-11.1
7311.00	31.5	AVE	90	1.5	H	35.1	5.6	30.0	42.2	54	-11.8
7311.00	44.2	PEAK	180	1.2	V	35.1	5.6	30.0	54.9	74	-19.1
7311.00	43.8	PEAK	90	1.5	H	35.1	5.6	30.0	54.5	74	-19.5
4874.00	27.0	AVE	180	1.2	H	32.5	4.9	30.0	34.4	54	-19.6
4874.00	26.8	AVE	250	1.5	V	32.5	4.9	30.0	34.2	54	-19.8
4874.00	39.5	PEAK	250	1.5	V	32.5	4.9	30.0	46.9	74	-27.1
4874.00	39.2	PEAK	180	1.2	H	32.5	4.9	30.0	46.6	74	-27.4
High Channel											
2462.00	100.2	FUND/PEAK	180	2.2	V	28.1	3.4	30.0	101.6		
2462.00	92.8	FUND/PEAK	120	1.5	H	28.1	3.4	30.0	94.3		
2462.00	95.2	FUND/AVE	180	2.2	V	28.1	3.4	30.0	96.6		
2462.00	88.3	FUND/AVE	120	1.5	H	28.1	3.4	30.0	89.8		
7386.00	31.7	AVE	90	1.2	V	35.1	5.6	30.0	42.4	54	-11.6
7386.00	31.7	AVE	150	2.0	H	35.1	5.6	30.0	42.4	54	-11.6
7386.00	44.2	PEAK	90	1.2	V	35.1	5.6	30.0	54.9	74	-19.1
4924.00	27.3	AVE	180	1.2	H	32.5	4.9	30.0	34.7	54	-19.3
7386.00	44.0	PEAK	150	2.0	H	35.1	5.6	30.0	54.7	74	-19.3
4924.00	27.1	AVE	270	1.8	V	32.5	4.9	30.0	34.5	54	-19.5
4924.00	39.0	PEAK	270	1.8	V	32.5	4.9	30.0	46.4	74	-27.6
4924.00	38.5	PEAK	180	1.2	H	32.5	4.9	30.0	45.9	74	-28.1

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart B	
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB
430.50	40.8	90	1.5	V	16.9	2.8	25.0	35.5	46	-10.5
270.52	43.7	330	1.8	H	13.3	2.2	25.0	34.2	46	-11.8
324.99	40.2	200	1.5	V	15.5	2.3	25.0	33.0	46	-13.0
353.31	38.5	270	1.8	V	15.5	2.3	25.0	31.3	46	-14.7
169.80	35.3	30	1.2	H	13.0	1.8	25.0	25.1	43.5	-18.4

Note:

AVG = average

11 - CONDUCTED EMISSIONS

11.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is $\pm$2.4 dB.

11.2 EUT Setup

The measurement was performed in the shielded room, using the same setup per ANSI C63.4-1992 measurement procedure. The specification used was FCC 15 Subpart C 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.

The host PC system was connected with 120Vac/60Hz power source.

11.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency..... 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed..... Auto
IF Bandwidth..... 10 kHz
Video Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth..... 9 kHz
Quasi-Peak Adapter Mode..... Normal

11.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dBµV of specification limits). Quasi-peak readings are distinguished with a "**Qp**".

11.5 Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

11.6 Summary of Test Results

According to the data in section 11.7, the EUT complies with the FCC Conducted margin for a Class B device, with the *worst* margin reading of:

-5.4 dBμV at 3.27 MHz in the Neutral mode

11.7 Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
3.270	40.6	AVG	Neutral	46	-5.4
2.800	40.2	AVG	Line	46	-5.8
0.200	43.8	AVG	Neutral	53.5	-9.7
0.200	52.1	QP	Line	63.5	-11.4
3.270	44.4	QP	Neutral	56	-11.6
2.800	43.7	QP	Line	56	-12.3
0.200	49.8	QP	Neutral	63.5	-13.7
29.805	46.3	QP	Neutral	60	-13.7
0.200	39.0	AVG	Line	53.5	-14.5
29.810	34.7	AVG	Neutral	50	-15.3
0.300	32.9	AVG	Line	50.6	-17.7
0.300	42.5	QP	Line	60.6	-18.1

11.8 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented hereinafter as reference.

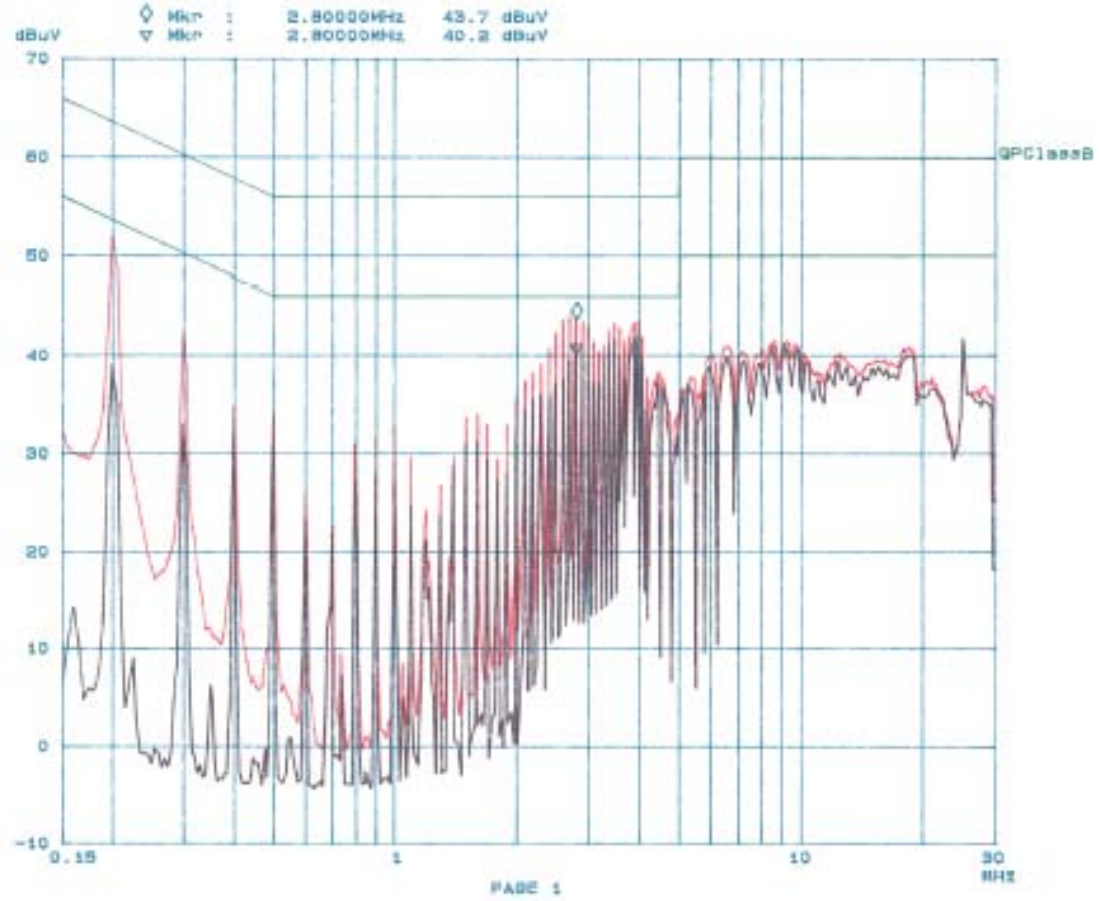
Bay Area Compliance Corporation 09. May 03 18:08
CISPR CLASS B

EUT:	AU802C
Manuf:	ACTIONTEC
Op Cond:	Normal
Operator:	Ling
Comment:	Line

Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	5k	9k	QP+AV	20ms	10dBLN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



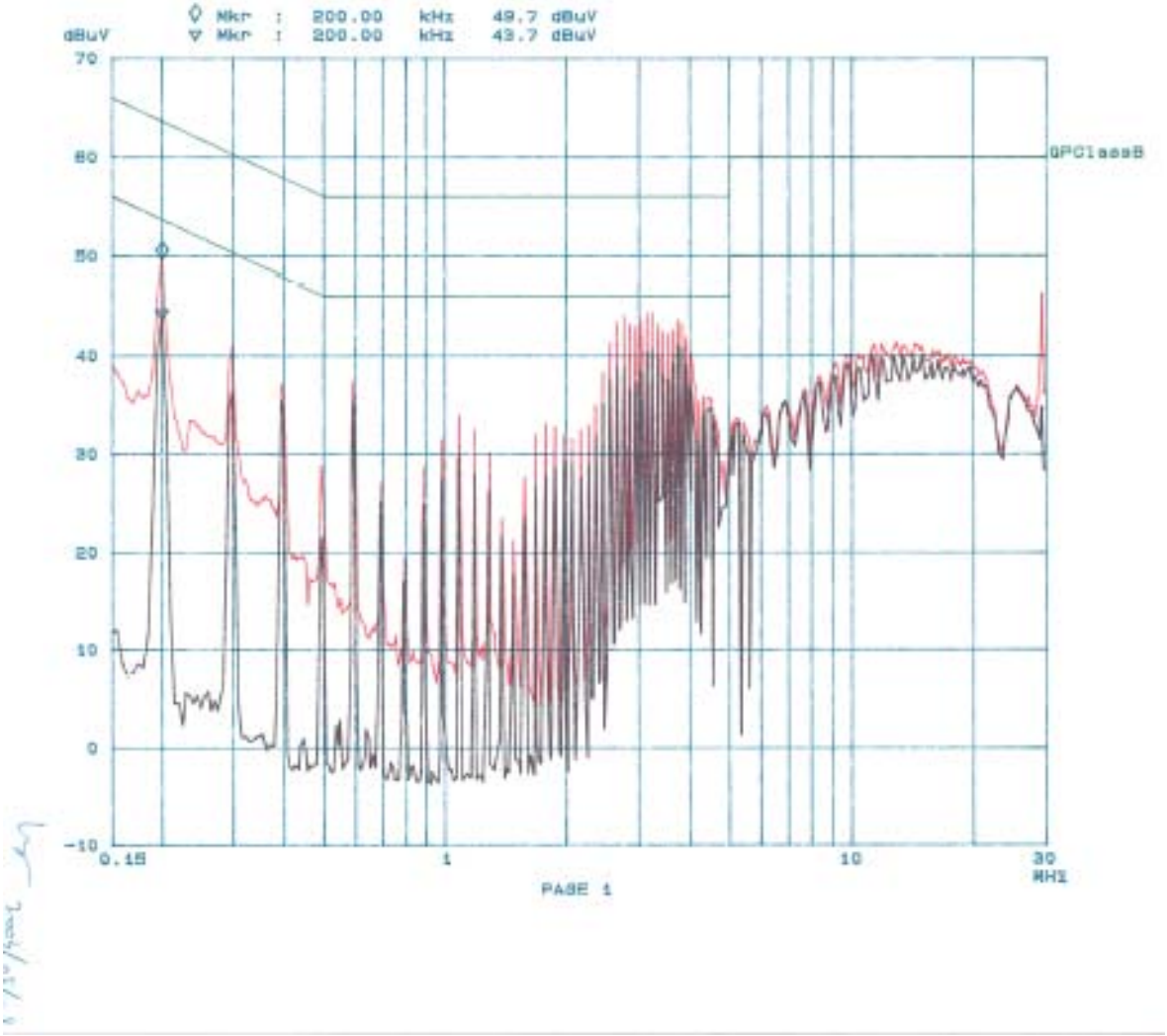
Bay Area Compliance Corporation 08. May 03 22:58
CISPR CLASS B

EUT: AU802G
Manuf: ACTIONTEC
Op Cond: Normal
Operator: Ling
Comment: Neutral

Scan Settings [1 Range]

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	5k	9k	QP+AV	20ms	10dBLN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



12 - RF EXPOSURE

According to §15.247(b)(4) and §1.1307(b)(1), 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 §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
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
1500-15000	/	/	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

Maximum peak output power at antenna input terminal: 17.10 (dBm)
Maximum peak output power at antenna input terminal: 51.29 (mW)
Prediction distance: 20 (cm)
Predication frequency: 2400 (MHz)
Antenna Gain (typical): 3 (dBi)
Maximum antenna gain: 2.00(numeric)
Power density at predication frequency at 20 cm: 0.0204 (mW/cm^2)
MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm^2)

Test Result

The predicted power density level at 20 cm is 0.0204 mW/cm^2. This is below the uncontrolled exposure limit of 1mW/cm^2 at 2400 MHz.