

**FCC PART 15**



**EMI MEASUREMENT AND TEST REPORT**

For  
**Actiontec Electronics, Inc.**

760 North Mary Ave.  
Sunnyvale, CA 94086

**FCC ID: LNQ802CI3A**

2004-02-27

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> 802.11b Wireless PCMCIA Card
<b>Test Engineer:</b> Ming Jing / 	
<b>Report No.:</b> R0402022	
<b>Test Date:</b> 2004-02-12	
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**Note:** This test report is specially limited to the above client company and product model only. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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## GENERAL INFORMATION

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### Product Description for Equipment Under Test (EUT)

The *Actiontec Electronics, Inc.* 's, model: *802CI3*, or the "EUT" as referred to in this report is an 802.11b Wireless PCMCIA Card which is measured approximately 4.65"L x 2.1"W x 0.2"H.

The EUT utilized the Toshiba power adapter, M/N: PA3083U-1ACA.

*\* The test data gathered are from a production sample, S/N: BXU40500006, provided by the manufacturer.*

### Objective

This type approval report is prepared on behalf of *Actiontec Electronics, Inc.* 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 Output Power, Antenna Requirements, 6 dB Bandwidth, power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Out of Band Emission, Spurious Emission, Conducted and Spurious Radiated Emission.

### Related Submittal(s)/Grant(s)

No Related Submittals.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001, 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.

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 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 C63.4-2001.

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.

## SYSTEM TEST CONFIGURATION

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### Justification

The host system was configured for testing according to ANSI C63.4-2001.

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

### EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the system components. The test software, provided by the customer, is started the Windows terminal program under the Windows 98/2000/ME/XP operating system.

Once loaded, set the Tx channel to low, mid and high for testing.

### Special Accessories

As shown in following test block diagram, all interface cables used for compliance testing are shielded. The host PC and the peripherals featured shielded metal connectors.

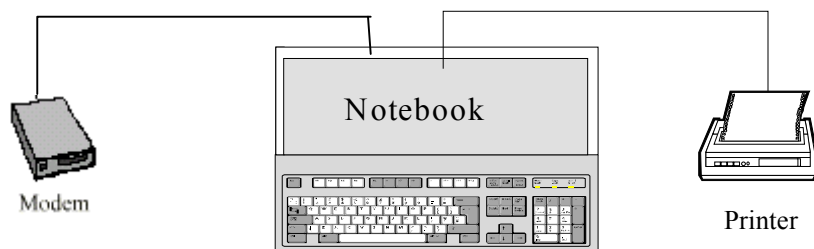
### Schematics / Block Diagram

Please refer to Appendix A.

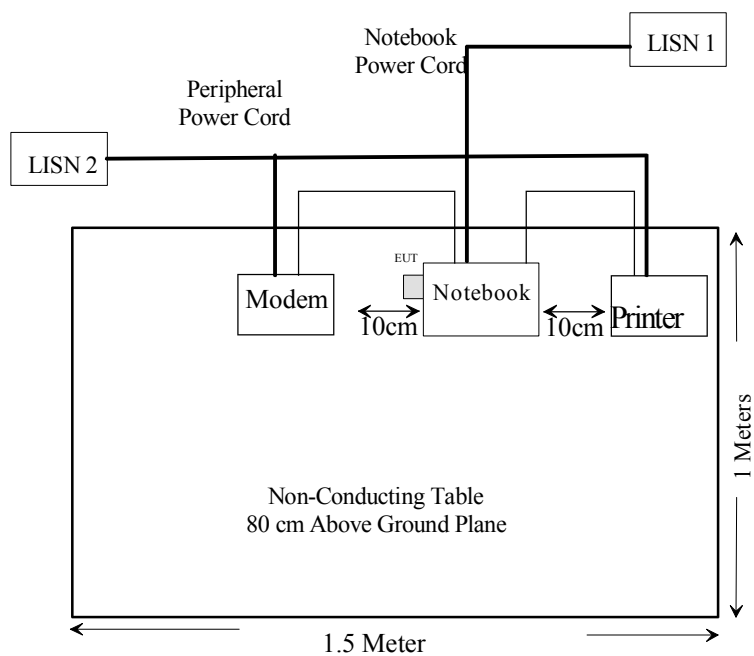
### Equipment Modifications

No modifications were made to the EUT.

## Configuration of Test System



## Test Setup Block Diagram



**Support Equipment List and Details**

Manufacturer	Description	Model	Serial Number	FCC ID
Toshiba	Notebook PC	1805-S24	Y1094933P	DOC
HP	Printer	Thinkjet 2225C	2512S43681	BS46XU2225C
Everex	Modem	Evercom 24E	N/A	E3E5UVEV-945

**External I/O Cabling List and Details**

Cable Description	Length (M)	Port/From	To
Shield Cable	1.5	Modem Port / PC	EVEREX Modem
Shielded Printer Cable	2.0	Parallel / PC	HP Printer
Unshielded RJ45 Cable	1.0	Ethernet Port / PC	Ethernet



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## SUMMARY OF TEST RESULTS

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Results reported relate only to the product tested, serial number: *BXU40500006*.

FCC RULES	DESCRIPTION OF TEST	RESULT
§2.1091	RF Exposure	Pass
§15.203	Antenna Requirement	Pass
§ 15.207 (a)	Conducted Emissions	Pass
§15.209 (a)	Spurious Emission	Pass
§15.247 (a)(2)	6 dB Bandwidth	Pass
§15.247 (b)(3)	Maximum Peak Output Power	Pass
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edge	Pass
§15.247 (d)	Peak Power Spectral Density	Pass
§15.205	Restricted Band	Pass

## **§15.203 - ANTENNA REQUIREMENT**

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### **Standard Applicable**

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 (b) (4), 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.

The antenna for this device is an integral antenna.

## §15.207(a) - CONDUCTED EMISSIONS

### 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.

### EUT Setup

The measurement was performed in the shield room, using the same setup per ANSI C63.4-2001 measurement procedure. The specification used was FCC 15 Subpart B 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.

### Spectrum Analyzer Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30Mhz.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Artificial LISN	ESH2-Z5	871884/039	2003-03-28
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2003-05-06

\* **Statement of Traceability:** BACL Corp. certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### 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  $-4$  dB $\mu$ V of specification limits). Quasi-peak readings are distinguished with a "Qp".

## Summary of Test Results

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

-2.8 dB at 0.950 in the Neutral mode

## Environmental Conditions

Temperature:	16° C
Relative Humidity:	52%
ATM Pressure:	1032 mbar

## Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency MHz	Amplitude dB $\mu$ V	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dB $\mu$ V	Margin dB
0.950	43.2	AVG	Neutral	46	-2.8
10.500	43.6	AVG	Neutral	50	-6.4
0.950	47.3	QP	Neutral	56	-8.7
9.360	48.7	QP	Neutral	60	-11.3
20.100	33.1	AVG	Line	50	-16.9
20.100	35.6	QP	Line	60	-24.4
0.950	20.2	AVG	Line	46	-25.8
0.150	38.2	QP	Neutral	66	-27.8
0.150	37.9	QP	Line	66	-28.1
0.950	27.1	QP	Line	56	-28.9
0.150	26.1	AVG	Neutral	56	-29.9
0.150	24.8	AVG	Line	56	-31.2

## Plot of Conducted Emissions Test Data

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

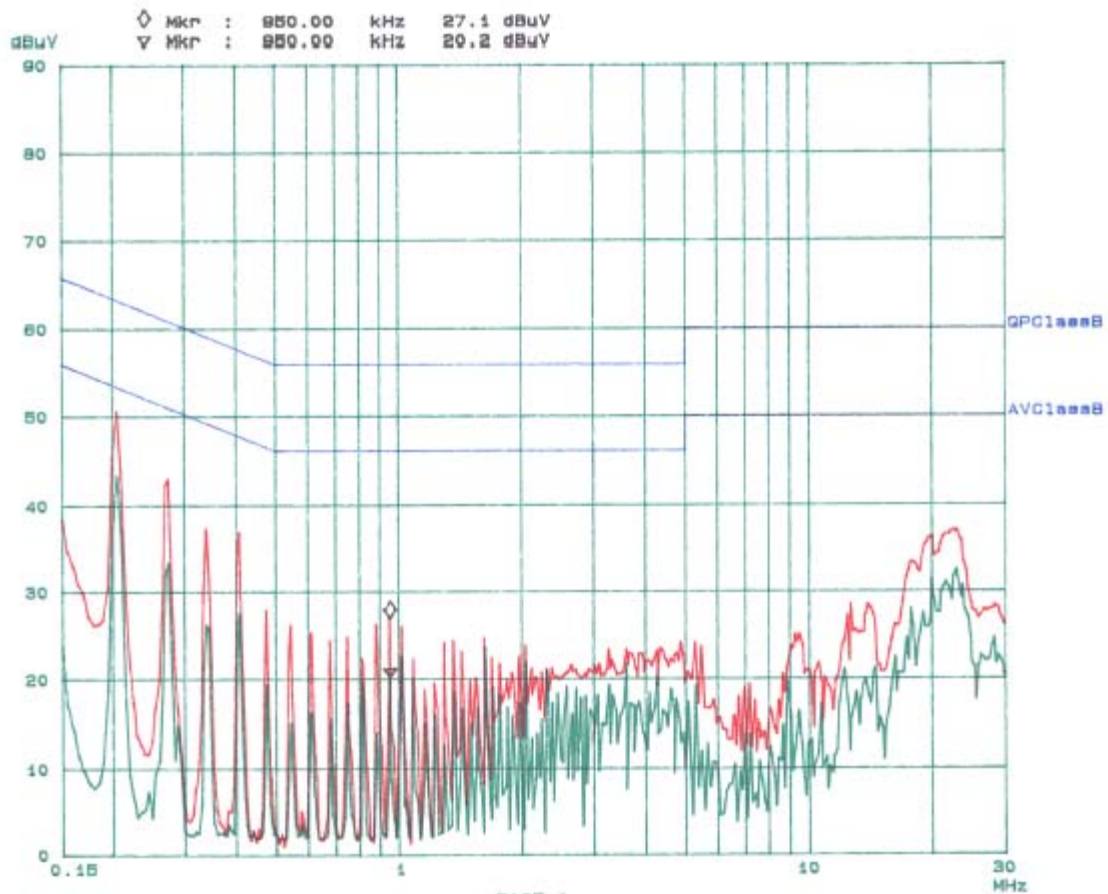
Bay Area Compliance Laboratory Corp  
Class B

12. Feb 04 15:20

EUT: 802013  
Manuf: Actiontec  
Op Cond: Normal  
Operator: Ming  
Comment: N

Scan Settings (3 Ranges)			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	18dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF

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



*2-8-2-12*

Bay Area Compliance Laboratory Corp  
Class B

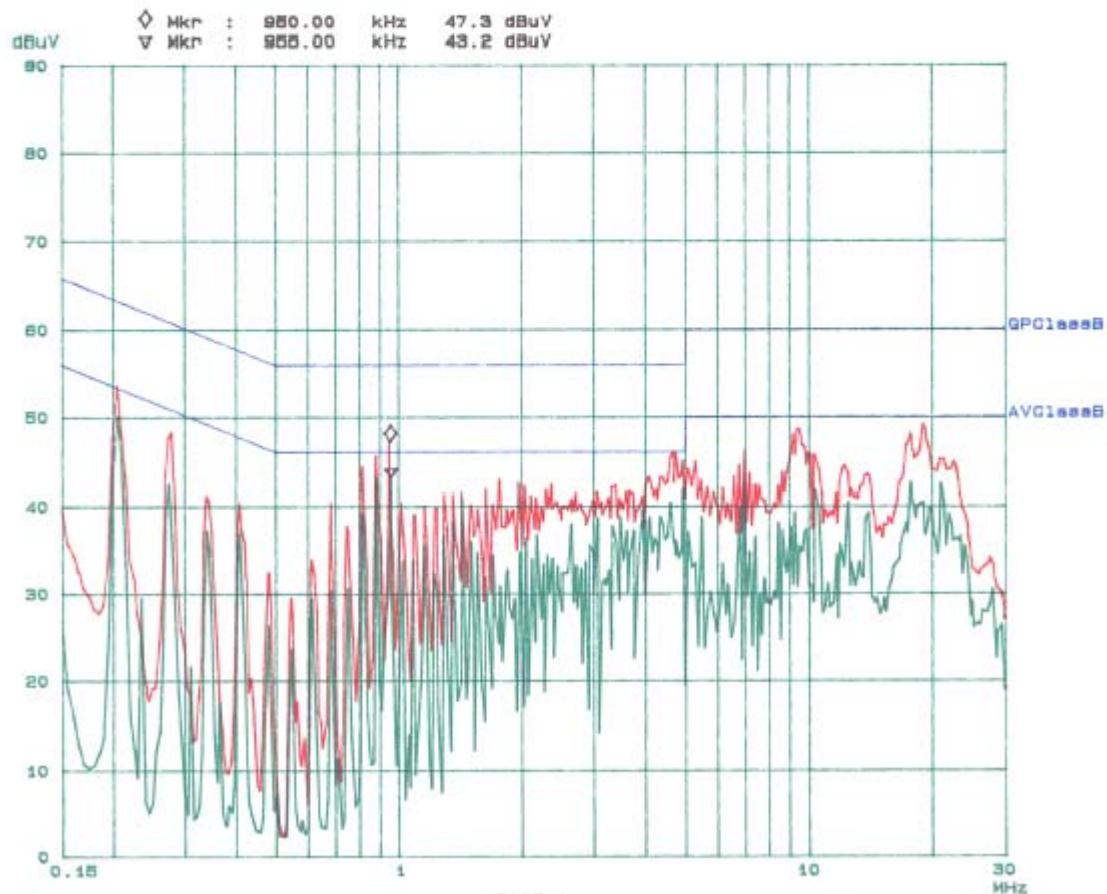
12. Feb 04 15:47

EUT: 802CI3  
Manuf: Actiontec  
Op Cond: Normal  
Operator: Ming  
Comment: L

## Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preampl
150k	1M	5k	9k	QP+AV	20ms	15dB	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB	OFF

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



## §15.209(a) - SPURIOUS EMISSION

### 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)	Measurement Field strength (microvolts/meter)	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

### 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 on a bench 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.

### Equipment Lists

Manufacturer	Model No.	Description	Calibration Date
HP	8565EC	Spectrum Analyzer	2003-06-30

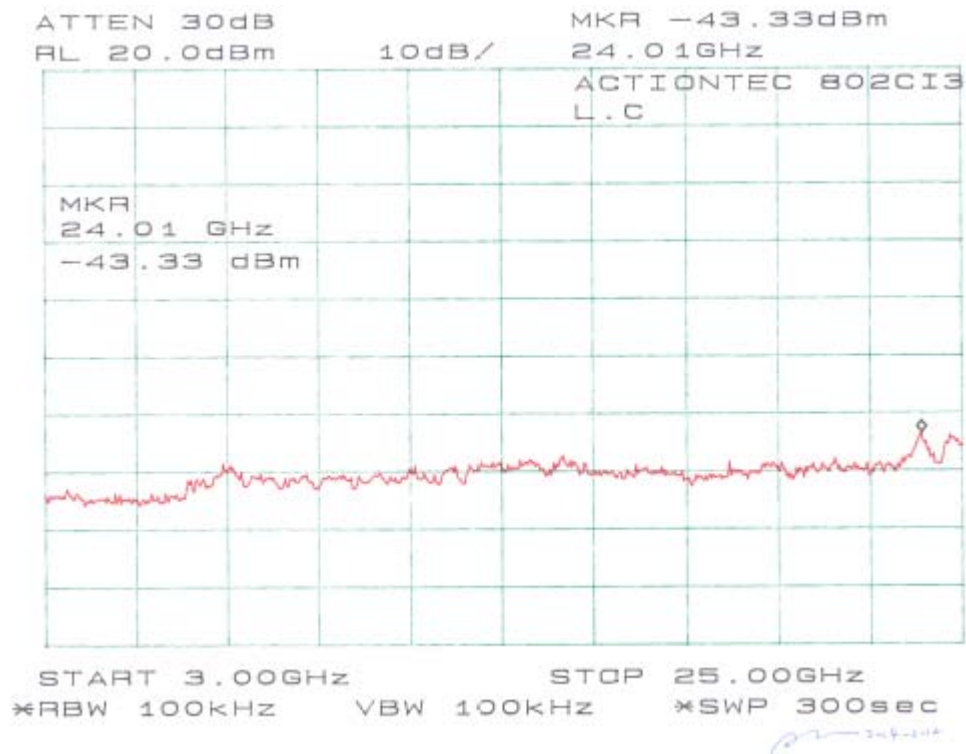
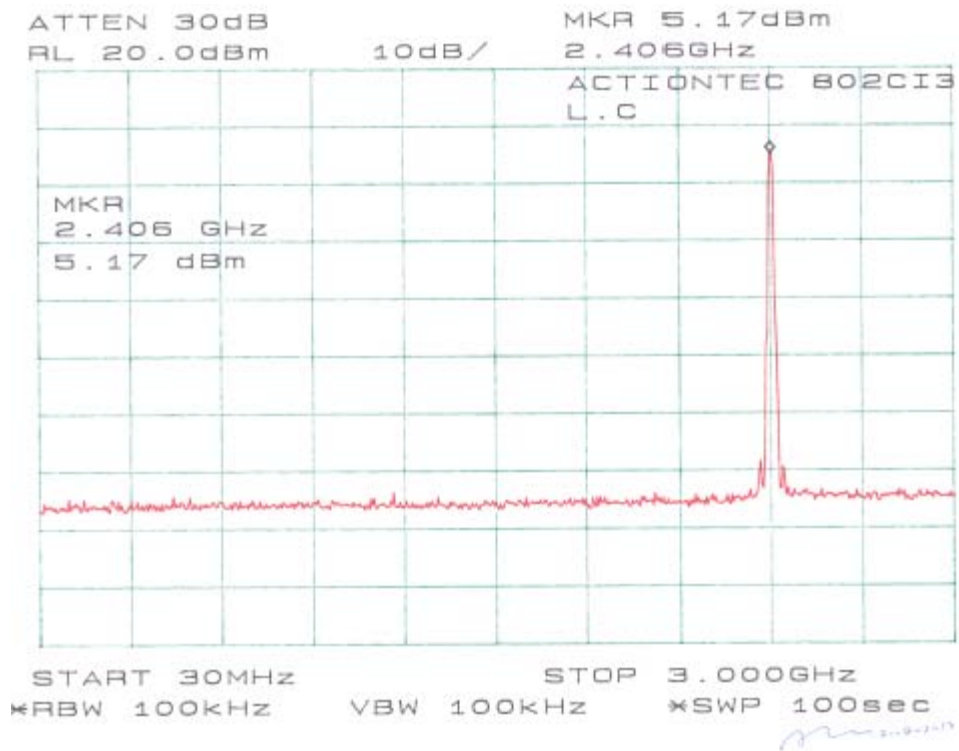
**Measurement Result**

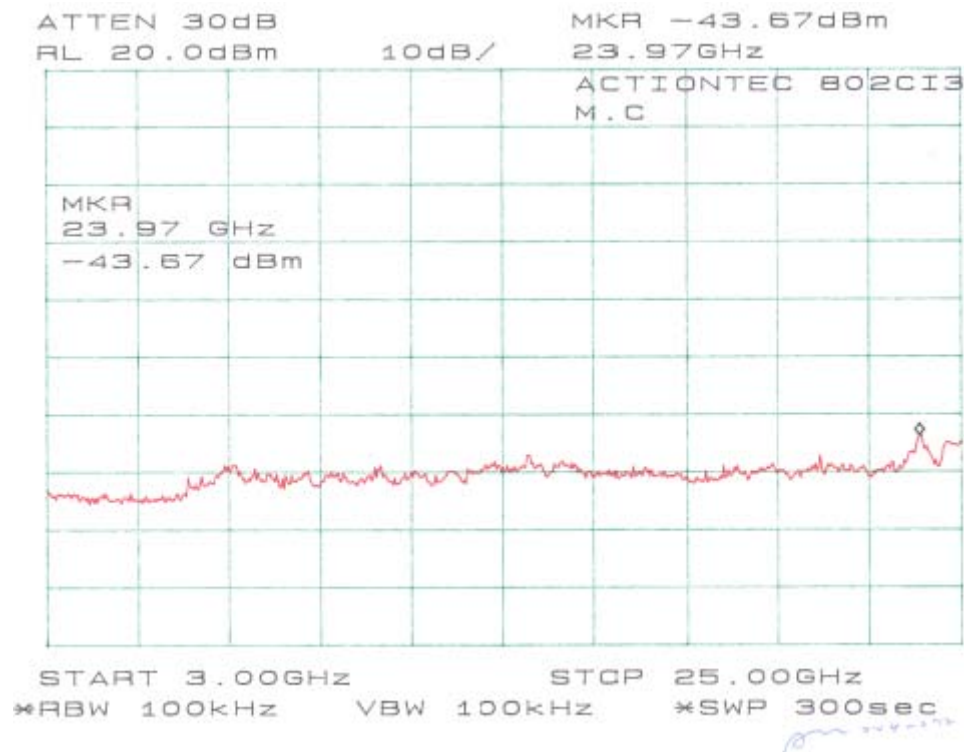
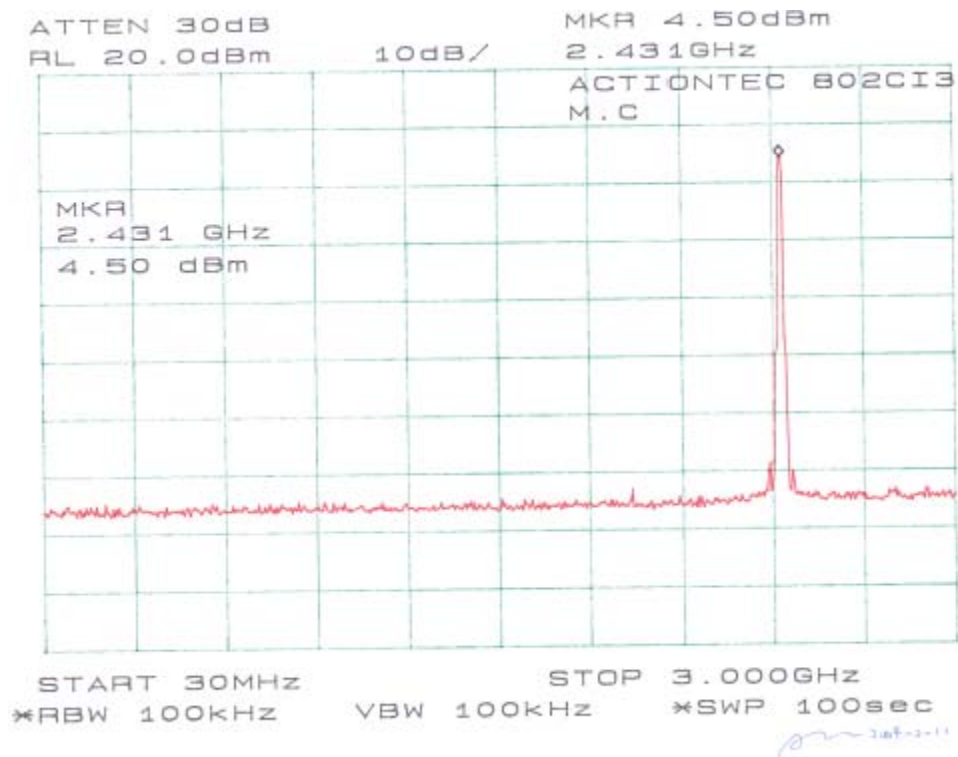
Please refer to following pages for plots of spurious emission.

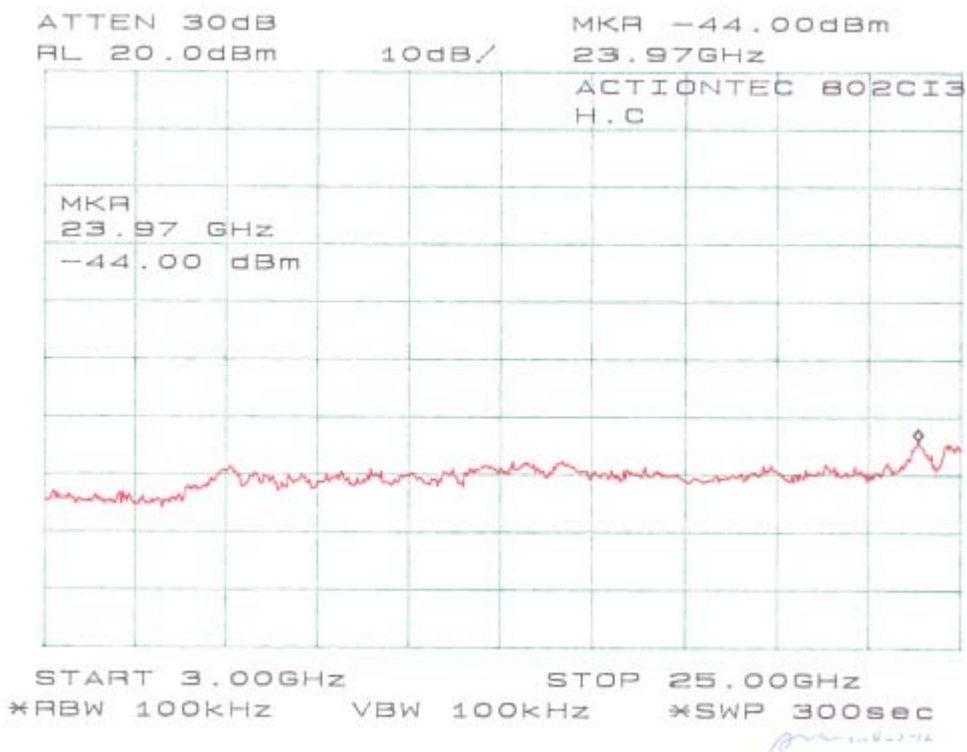
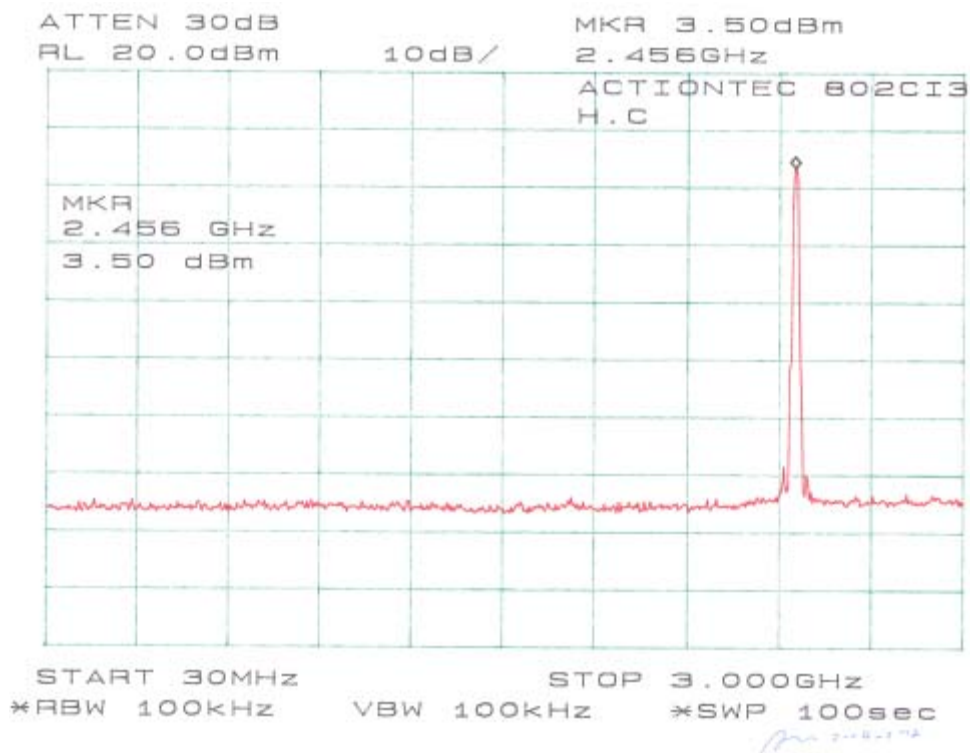
**Environmental Conditions**

Temperature:	16° C
Relative Humidity:	52%
ATM Pressure:	1032 mbar









## §15.209 - SPURIOUS RADIATED EMISSION

### 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.

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

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

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510MHz

<sup>2</sup> Above 38.6

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

According to §15.209, the device shall meet radiated emission general requirements.

Except for Class A device, the filed strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength	
	(Microvolts/meter)	(dB $\mu$ V/meter)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

### EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2001. The specification used was the FCC 15.209 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.

### Spectrum Analyzer Setup

According to FCC Rules, 47 CFR, Section 15.33, the frequency was investigated from 30 to 2500 MHz.

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

<i><b>Frequency Range</b></i>	<i><b>RBW</b></i>	<i><b>Video B/W</b></i>
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

### Test Equipment List and Details

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Cal. Date</b>
HP	Amplifier, Microwave	8449B	3147A00400	3/14/2003
HP	Amplifier, Pre	8447E	1937A01057	8/4/2003
HP	Amplifier, Pre	8447E	1937A01046	8/2/2003
HP	Analyzer, Spectrum	8565EC	3946A00131	6/30/2003
ETS	Antenna, Biconical	3110B	9603-2315	10/11/2003
A.R.A.	Antenna, Horn, DRG	DRG-118/A	1132	9/30/2003
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	2455-261	8/1/2003
ETS	Antenna, logperiodic	3148	0004-1155	10/11/2003
EMCO	Antenna, Loop, H-Field Gain/AF	6512	00029604	2/12/2004

\* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the 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.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dB $\mu$ V of specification limits), and are distinguished with a "Qp" in the data table.

## 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB $\mu$ V means the emission is 7dB $\mu$ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC 15.209 Limit}$$

## Summary of Test Results

According to the data in section 12.7, 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:

### Environmental Conditions

Temperature:	16° C
Relative Humidity:	52%
ATM Pressure:	1032 mbar

**-15.4 dB at 4824.00 MHz in the Vertical polarization, Low Channel**

**-17.0 dB at 4874.00 MHz in the Vertical polarization, Middle Channel**

**-5.8 dB at 2483.50 MHz in the Horizontal polarization, High Channel**

**-6.4 dB at 989.33 MHz in the Vertical polarization, Unwanted Emission**

**Radiated Emission Test Result**

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency	Ampl.	Comments	Angle	Height	Polar	Anten na	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/ m		Degree	Meter	H/ V	dBμV/ m	DB	DB	dBμV/m	dBμV/m	dB
Low Channel, 1-25GHz											
2412.00	112.3	Fund/Peak	180	1.5	v	28.1	3.4	35.2	108.6		
2412.00	104.9	Fund/Peak	210	1.3	h	28.1	3.4	35.2	101.2		
2412.00	105.5	Fund/Ave	180	1.5	v	28.1	3.4	35.2	102.8		
2412.00	98.8	Fund/Ave	210	1.3	h	28.1	3.4	35.2	95.1		
4824.00	34.2	Ave	90	1.2	v	32.5	4.9	33.0	38.6	54	-15.4
4824.00	33.5	Ave	110	1.5	h	32.5	4.9	33.0	37.9	54	-16.1
2390.00	33.9	Ave	230	1.5	v	28.1	3.4	35.1	30.3	54	-23.8
2390.00	33.1	Ave	180	1.5	h	28.1	3.4	35.1	29.5	54	-24.6
4824.00	44.3	Peak	90	1.2	v	32.5	4.9	33.0	48.7	74	-25.3
4824.00	43.6	Peak	110	1.5	h	32.5	4.9	33.0	48.0	74	-26.0
2390.00	44.1	Peak	230	1.5	v	28.1	3.4	35.1	40.5	74	-33.6
2390.00	43.6	Peak	180	1.5	h	28.1	3.4	35.1	40.0	74	-34.1
Middle Channel, 1-25GHz											
2437.00	112.1	Fund/Peak	230	1.2	v	28.1	3.4	35.2	108.4		
2437.00	104.8	Fund/Peak	90	1.5	h	28.1	3.4	35.2	101.1		
2437.00	106.3	Fund/Ave	230	1.2	v	28.1	3.4	35.2	102.6		
2437.00	98.5	Fund/Ave	90	1.5	h	28.1	3.4	35.2	94.8		
4874.00	32.6	Ave	90	1.5	v	32.5	4.9	33.0	37.0	54	-17.0
4874.00	31.7	Ave	15	1.2	h	32.5	4.9	33.0	36.1	54	-17.9
4874.00	43.8	Peak	90	1.5	v	32.5	4.9	33.0	48.2	74	-25.8
4874.00	43.3	Peak	15	1.2	h	32.5	4.9	33.0	47.7	74	-26.3
High Channel, 1-25GHz											
2462.00	112.2	Fund/Peak	110	1.8	v	28.1	3.4	35.2	108.5		
2462.00	105.1	Fund/Peak	0	1.5	h	28.1	3.4	35.2	101.4		
2462.00	106.1	Fund/Ave	110	1.8	v	28.1	3.4	35.2	102.4		
2462.00	99.2	Fund/Ave	0	1.5	h	28.1	3.4	35.2	95.5		
2483.50	52.9	Ave	90	1.6	v	28.1	3.4	36.1	48.3	54	-5.8
2483.50	45.1	Ave	15	1.8	h	28.1	3.4	36.1	40.5	54	-13.6
4924.00	32.7	Ave	60	1.2	v	32.5	4.9	33.0	37.1	54	-16.9
2483.50	60.8	Peak	90	1.6	v	28.1	3.4	36.1	56.2	74	-17.9
4924.00	31.6	Ave	30	1.5	h	32.5	4.9	33.0	36.0	54	-18.0
2483.50	53.4	Peak	15	1.8	h	28.1	3.4	36.1	48.8	74	-25.3
4924.00	43.9	Peak	60	1.2	v	32.5	4.9	33.0	48.3	74	-25.7
4924.00	43.4	Peak	30	1.5	h	32.5	4.9	33.0	47.8	74	-26.2

Frequency MHz	Indicated		Table Height Meter	Antenna		Correction Factor			FCC 15 Subpart B	
	Ampl. dB $\mu$ V/m	Direction Degree		Polar H/V	Antenna dB $\mu$ V/m	Cable Loss dB $\mu$ V/m	Amp. dB	Corr. Ampl. dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
989.33	40.3	310	1.8	v	23.8	4.2	28.7	39.6	46	-6.4
45.52	44.1	15	1.2	h	11.1	1.1	28.5	27.8	40	-12.3
30.97	39.8	180	1.5	h	14.9	0.8	28.7	26.8	40	-13.2
304.51	39.5	130	1.6	h	14.4	2.3	28.2	28.0	46	-18.0
348.16	38.4	270	1.2	v	15.4	2.3	28.2	27.9	46	-18.1
237.58	41.2	90	1.5	v	12.6	2.2	28.5	27.5	46	-18.5

FUND = Fundamental

AVG = average



## §15.247(a)(2) – 6 DB BANDWIDTH

### Standard Applicable

According to §15.247(a)(2), for digital modulation techniques, the minimum 6dB bandwidth shall be at least 500 kHz.

### 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. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

### Equipment Lists

Manufacturer	Model No.	Description	Calibration Date
HP	8565EC	Spectrum Analyzer	2003-06-30

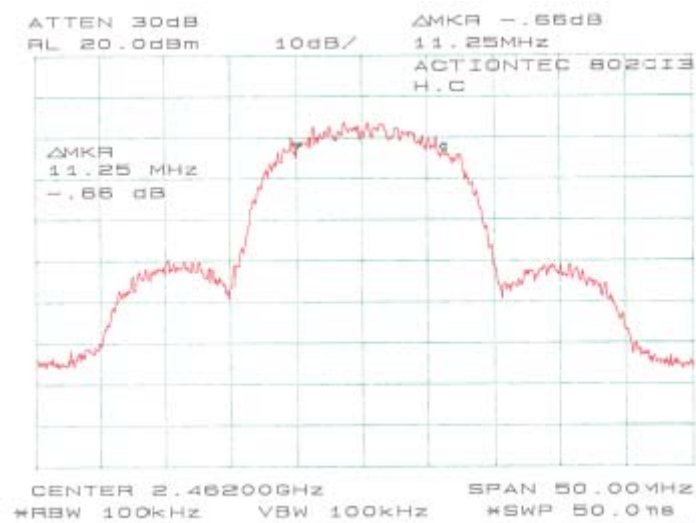
### Measurement Result

#### Environmental Conditions

Temperature:	16° C
Relative Humidity:	52%
ATM Pressure:	1032 mbar

#### Test Result

Channel	Frequency (MHz)	Measured (MHz)	Measured (kHz)	Standard (kHz)	Result
Low	2412	11.17	11170	≥ 500	Pass
Mid	2437	11.08	11080	≥ 500	Pass
High	2462	11.25	11250	≥ 500	Pass



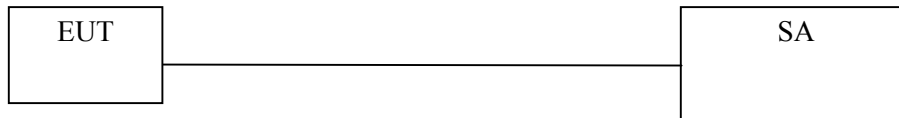
## §15.247(b)(3) - PEAK OUTPUT POWER MEASUREMENT

### Standard Applicable

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

### 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	Model No.	Description	Calibration Date
HP	8565EC	Spectrum Analyzer	2003-06-30

### Measurement Result

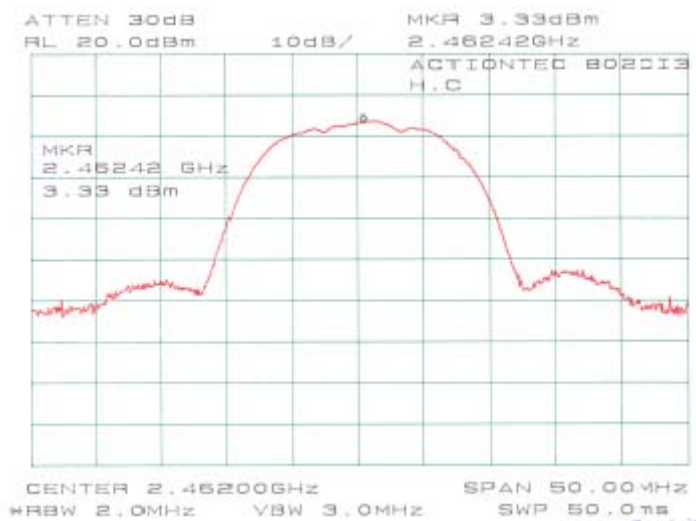
#### Environmental Conditions

Temperature:	16° C
Relative Humidity:	52%
ATM Pressure:	1032 mbar

#### Output Power

Channel	Frequency (MHz)	RF Power (dBm)	Correction Factor (dB)	Corrected RF Power (dBm)	Corrected RF Power (W)	Limit
Low (Ch1)	2412	3.17	7.4	10.57	0.0114	1W (30dBm)
Mid (Ch7)	2437	3.33	7.4	10.73	0.0118	1W (30dBm)
High (Ch11)	2462	3.33	7.4	10.73	0.0118	1W (30dBm)

Note: Correction Factor =  $10\log(\text{BW}_{6\text{dB}}/\text{RBW}) = 10\log(11.2/2) = 7.4 \text{ dB}$



## §15.247(c) - 100 KHZ BANDWIDTH OF BAND EDGES

### 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)).

### 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.

### Equipment Lists

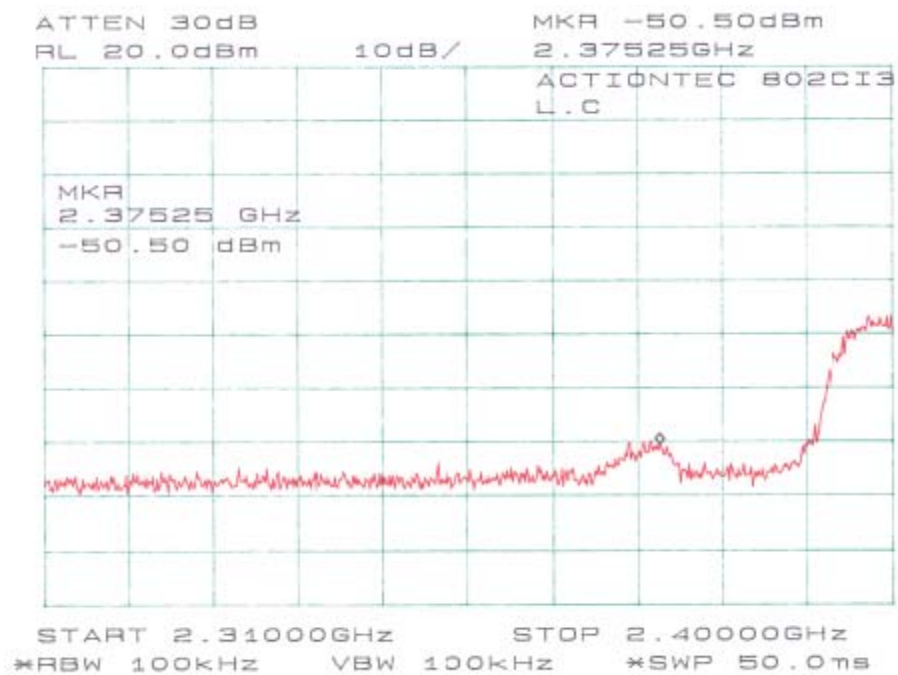
Manufacturer	Model No.	Description	Calibration Date
HP	8565EC	Spectrum Analyzer	2003-06-30

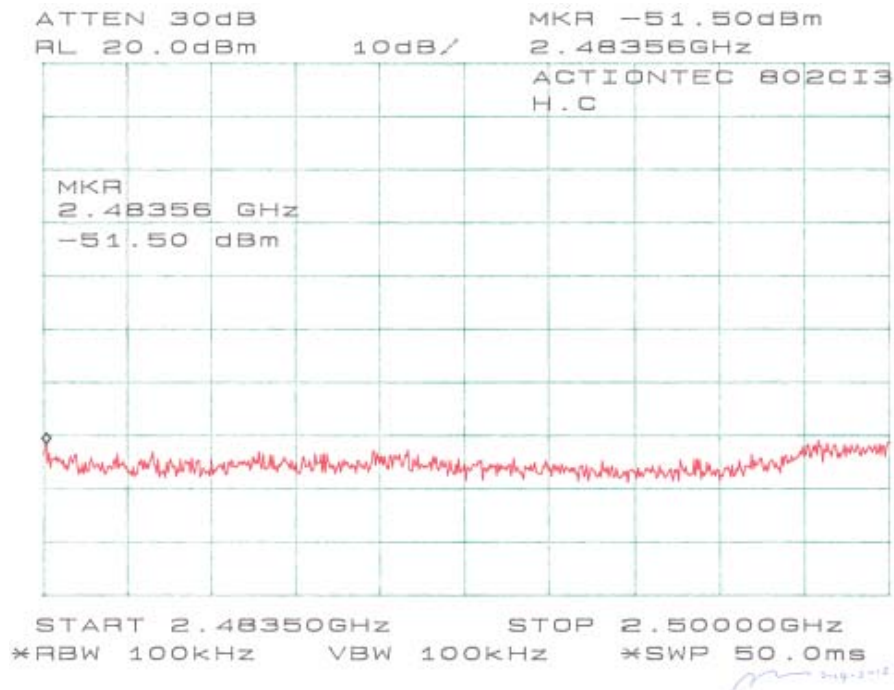
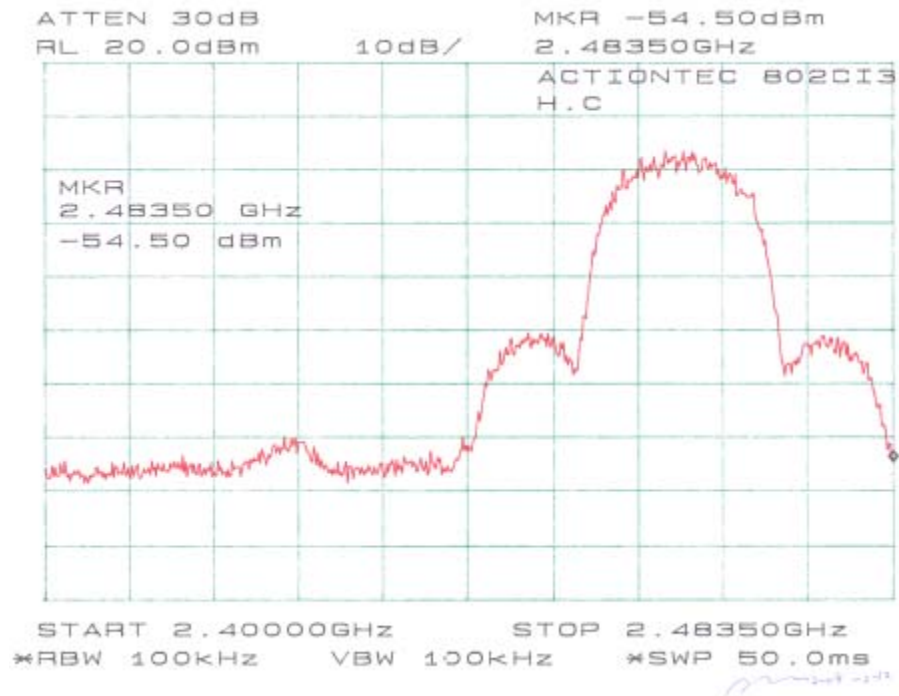
### Measure Results

#### Environmental Conditions

Temperature:	16° C
Relative Humidity:	52%
ATM Pressure:	1032 mbar

Please refer to following pages for plots of band edge.





## §15.247(d) - POWER SPECTRAL DENSITY

### Standard Applicable

According to §15.247 (d), for direct sequence 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.

### 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. (DTS)
4. Adjust the center frequency of SA on any frequency be measured and set SA to 50MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (UNII)
5. Repeat above procedures until all frequencies measured were complete.

### Equipment Lists

Manufacturer	Model No.	Description	Calibration Date
HP	8565EC	Spectrum Analyzer	2003-01-22

### Measurement Results

#### Environmental Conditions

Temperature:	16° C
Relative Humidity:	52%
ATM Pressure:	1032 mbar

#### Test Result

Channel	Frequency (MHz)	Peak Power Spectral Density (dBm)	Standard (dBm)	Result
Low	2412	-7.33	≤ 8	Pass
Mid	2437	-9.67	≤ 8	Pass
High	2462	-10.50	≤ 8	Pass



