



# FCC PART 90 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

## **OPISYS Incorporated**

9201 Irvine Blvd.  
Irvine, CA 92618

**FCC ID: Q4EUSHR-800NIH**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> iDEN Bi-directional Amplifier
<b>Test Engineer:</b> Daniel Deng	
<b>Report No.:</b> R0505164	
<b>Report Date:</b> 2005-05-27	
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**Note:** The test report is specially limited to the above company and this particular sample 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 certification, approval, or endorsement by NVLAP, NIST or any agency of the US Government.

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## GENERAL INFORMATION

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

The *OPISYS Incorporated's* product, FCC ID: *Q4EUSHR-800NIH* or the "EUT" as referred to in this report is an iDEN Bi-directional Amplifier, which measures approximately 148mmL x 118mmW x 57mmH.

*\*The test data gathered are from production sample serial number 05-03-004, provided by the manufacturer.*

### Objective

This type approval report is prepared on behalf of *OPISYS Incorporated* in accordance with Part 2 and Part 90 of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine compliance with FCC rules for output power, occupied bandwidth, spurious emission at antenna terminal, radiated spurious emission, two-tone test and RF exposure.

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

No Related Submittals

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003 and TIA/EIA 603A, 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 by 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 C63.4-2003.

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 current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

## SYSTEM TEST CONFIGURATION

### Justification

The EUT was configured for testing according to TIA/EIA-603.

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

### Block Diagram

Please refer to Exhibit D.

### Equipment Modifications

No modifications were made to the EUT.

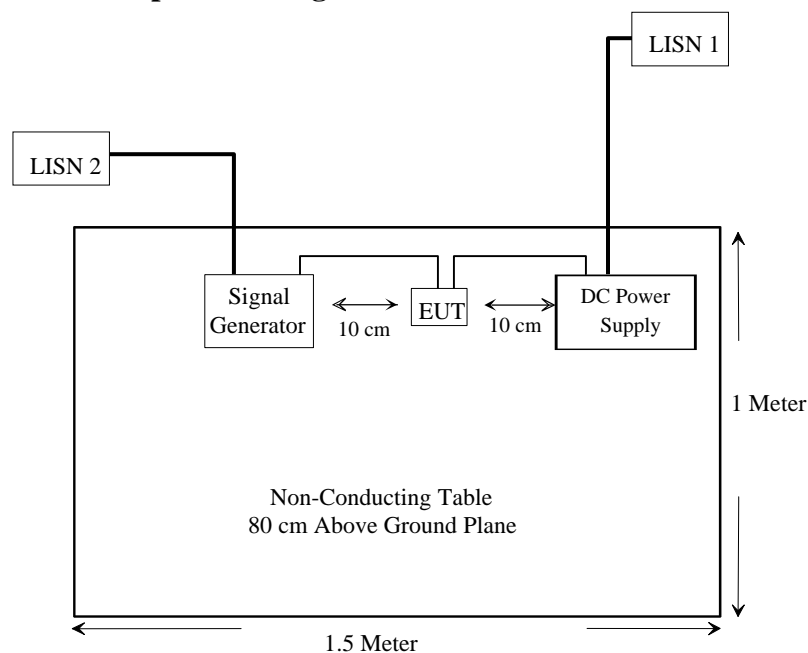
### Local Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
Agilent	ESGVector Signal Generator	E4438C	MY42081680	None

### Interface Ports and Cable in

Cable Description	Length (M)	From	To
RF Cable	1.5	EUT Uplink or Downlink port	Signal generator
Power cable	6	EUT Power port	DC Power Adapter

### Test Setup Block Diagram



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**SUMMARY OF TEST RESULTS**

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RULE	DESCRIPTION OF TEST	RESULT
§ 2.1046 § 90.205	Conducted Output Power	Compliant
§ 2.1049 § 90.209 § 90.210	Occupied Bandwidth	Compliant
§ 2.1051 § 90.210	Spurious Emissions at Antenna Terminals	Compliant
§ 2.1053 § 90.210	Radiated Spurious Emission	Compliant
§ 90.210	Two-Tone Test	Compliant
§ 1.1310 § 2.1091	RF Exposure	Compliant
§ 15.107	Conducted Emissions	Within the Measurement of Uncertainty

## §2.1046, and §90.205 - CONDUCTED OUTPUT POWER

### Provision Applicable

Per FCC §2.1046 and §90.205: maximum ERP is dependent upon the station's antenna HAAT and required service area. The maximum output power of the transmitter for mobile station is 100 watts (20dBw).

### Test Procedure

The RF output of the transceiver was connected to a power meter through appropriate attenuator.

### Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Power Meter	E4419B	MY4121511	2005-04-29

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

### Environmental Conditions

Temperature:	21° C
Relative Humidity:	43%
ATM Pressure:	1020 mbar

*The testing was performed by Daniel Deng on 2005-05-24.*

### Test Results

Uplink			
Channel	Frequency ( MHz )	Power (dBm)	Rated Power (dBm)
Low	806	11.87	12
Mid	815	11.93	12
High	821	11.79	12

Downlink			
Channel	Frequency ( MHz )	Power (dBm)	Rated Power (dBm)
Low	851	12.05	12
Mid	860	12.15	12
High	866	12.11	12

Note: The input signal reference level is -53dBm.

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**§2.1049, § 90.209, § 90.210 – OCCUPIED BANDWIDTH**

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**Applicable Standard**

§2.1049, §90.209 and §90.210(g).

**Test Procedure**

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 1 kHz and the spectrum was recorded in the frequency band  $\pm 50$  KHz from the carrier frequency.

**Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	8564E	3943A01781	2004-10-04
Hewlett Packard	Plotter	HP7470A	2541A49659	N/A
Agilent	Power Meter	E4419B	MY4121511	2005-04-29

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



**Environmental Conditions**

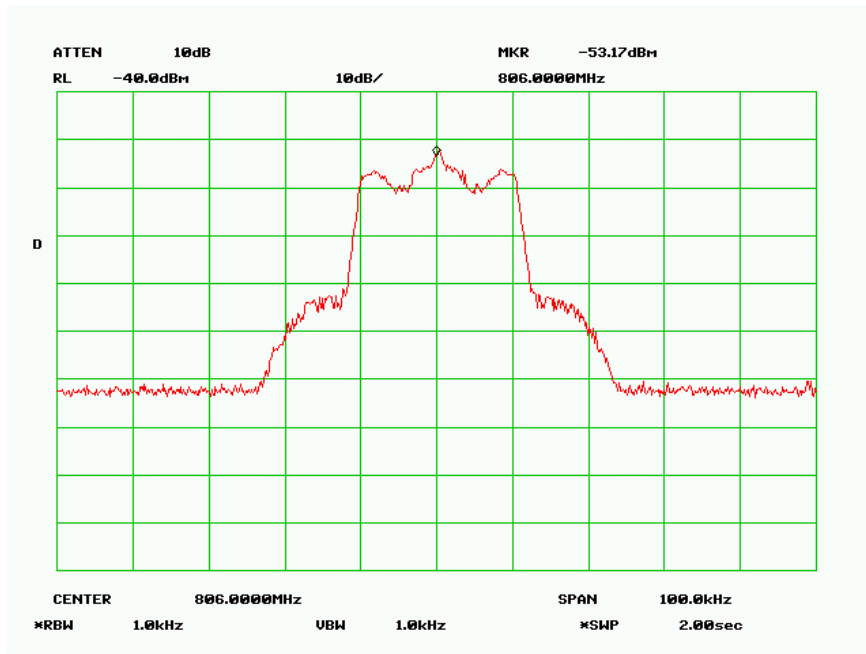
Temperature:	21° C
Relative Humidity:	43%
ATM Pressure:	1020 mbar

*The testing was performed by Daniel Deng on 2005-05-24.*

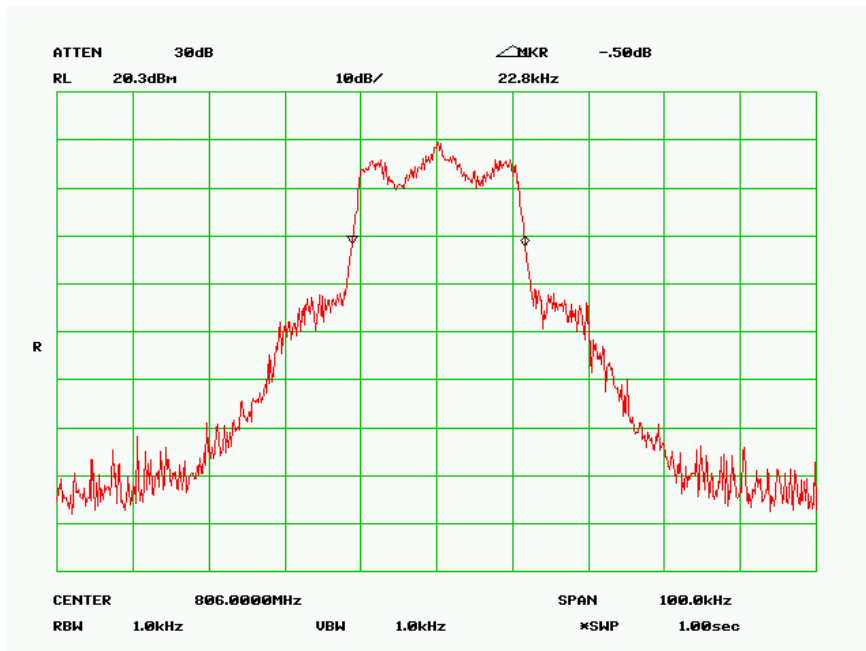
**Test Results**

Please refer to the hereinafter plots.

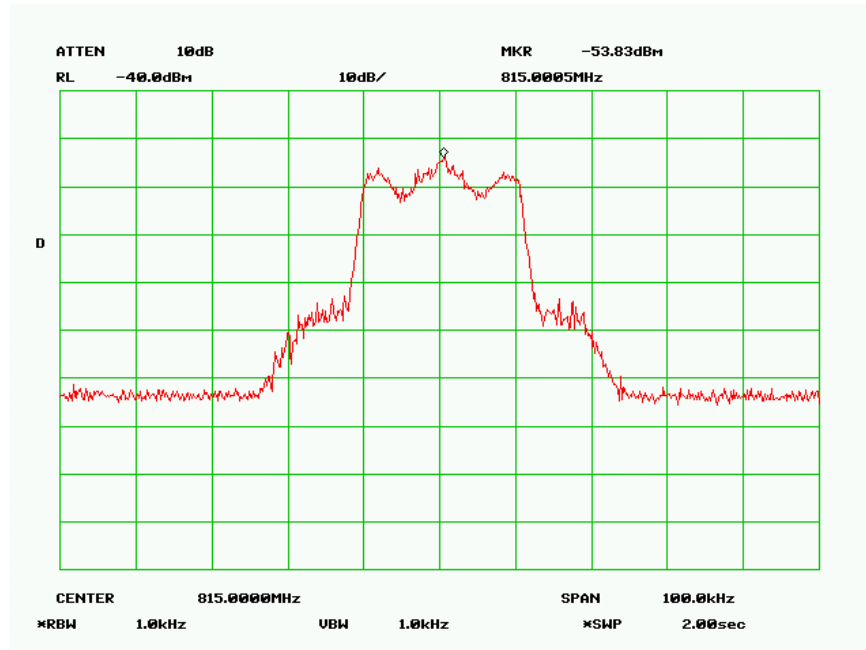
## Uplink: (Input Signal, Low Channel)



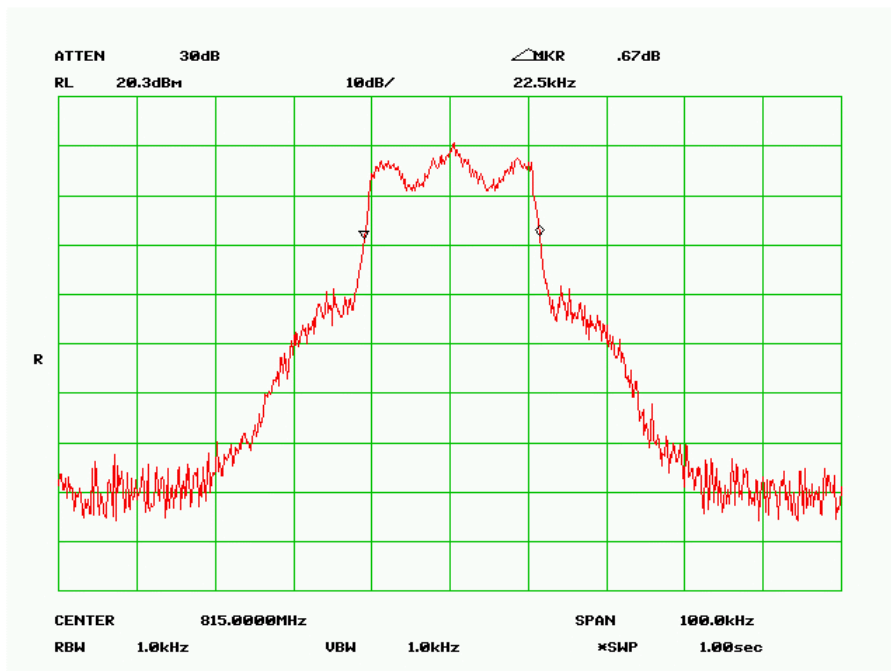
## Uplink: (Output Signal, Low Channel)



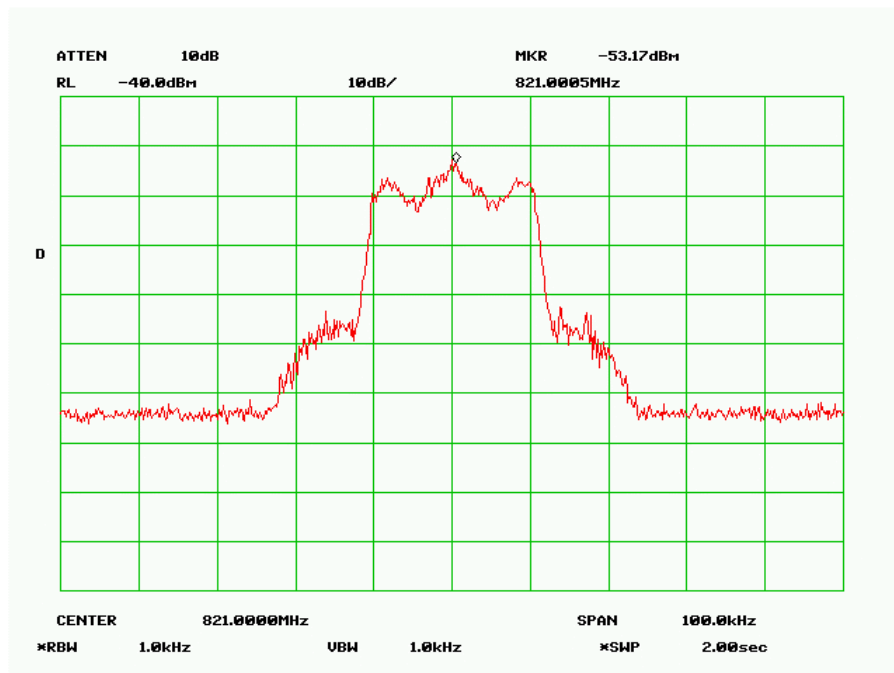
## Uplink: (Input Signal, Middle Channel)



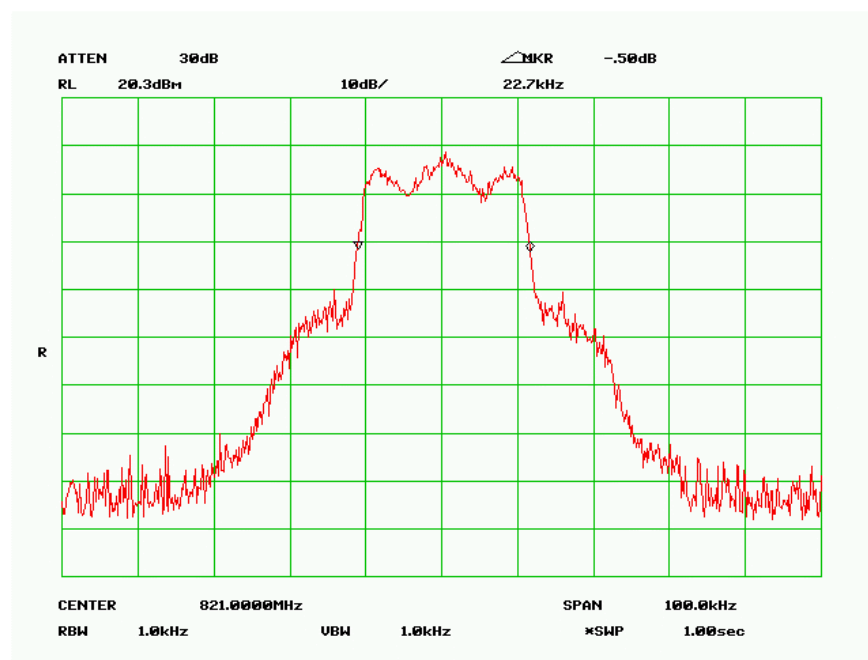
## Uplink: (Output Signal, Middle Channel)



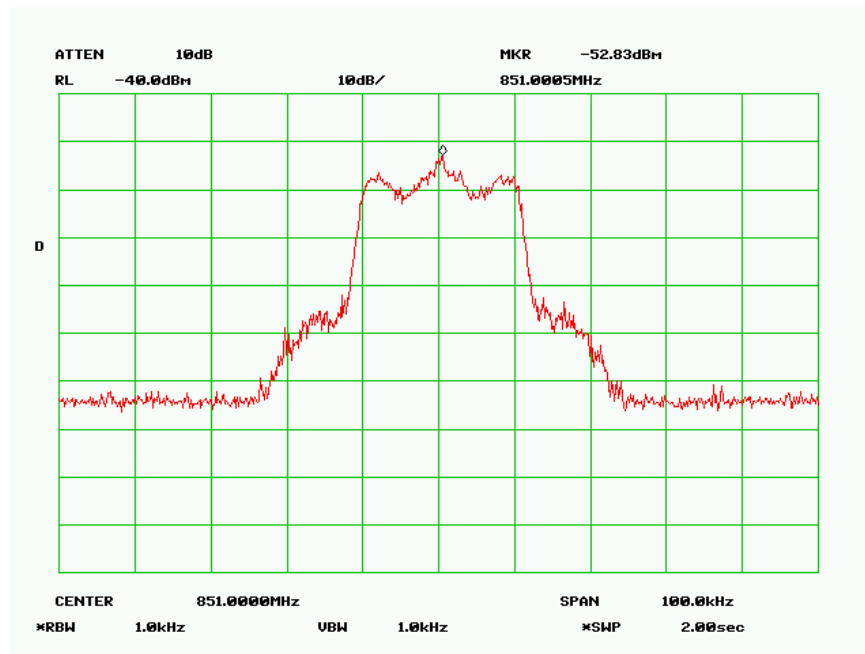
## Uplink: (Input Signal, High Channel)



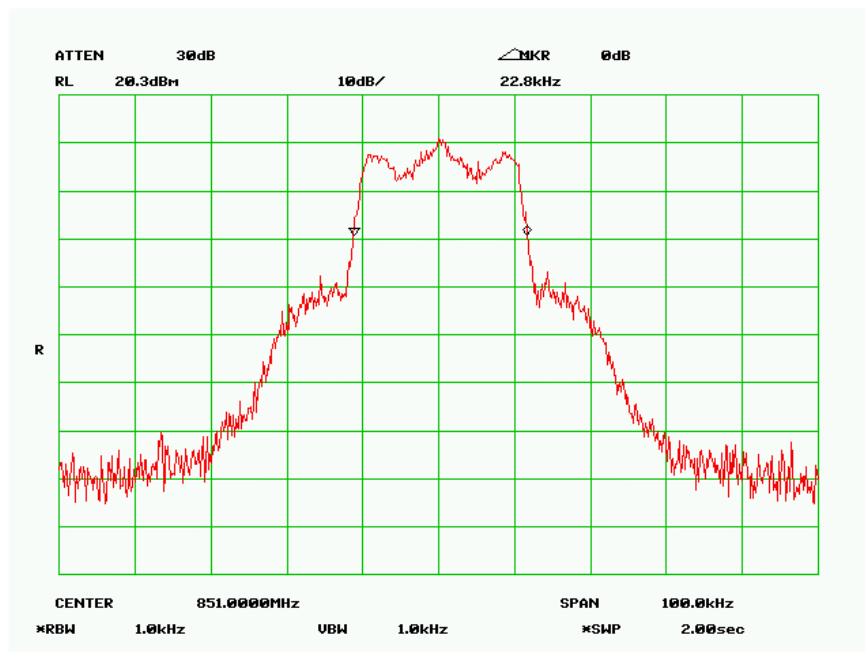
## Uplink: (Output Signal, High Channel)



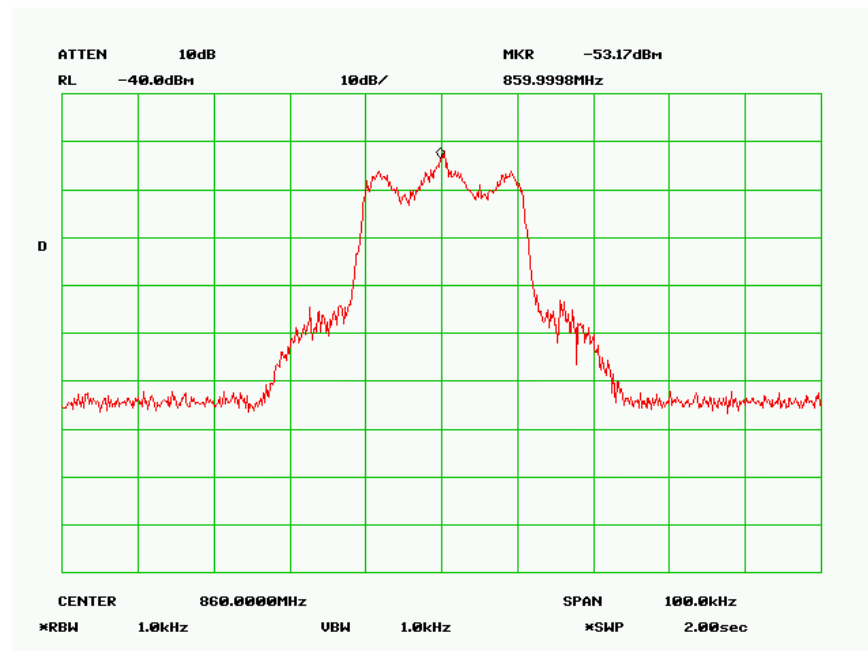
## Downlink: (Input Signal, Low Channel)



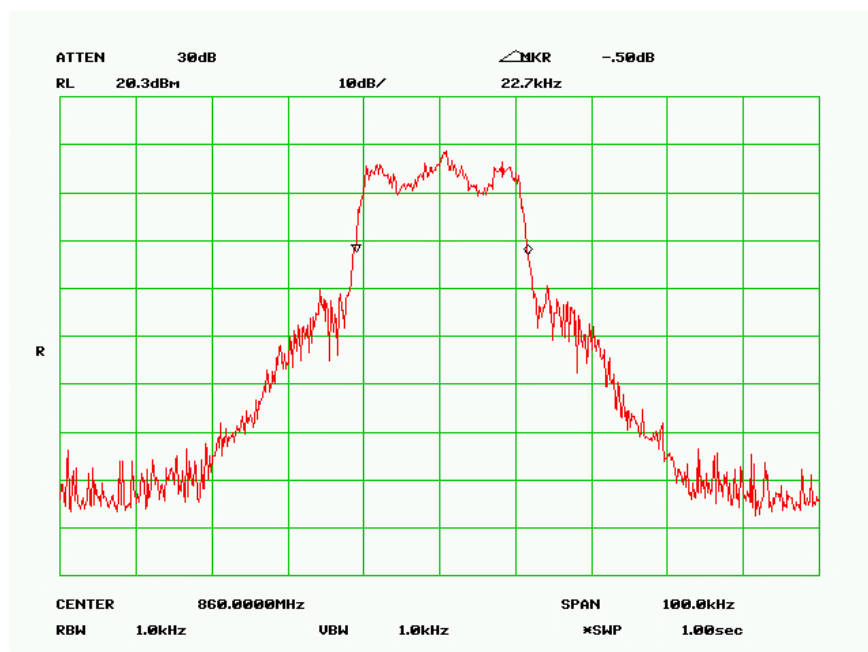
## Downlink: (Output Signal, Low Channel)



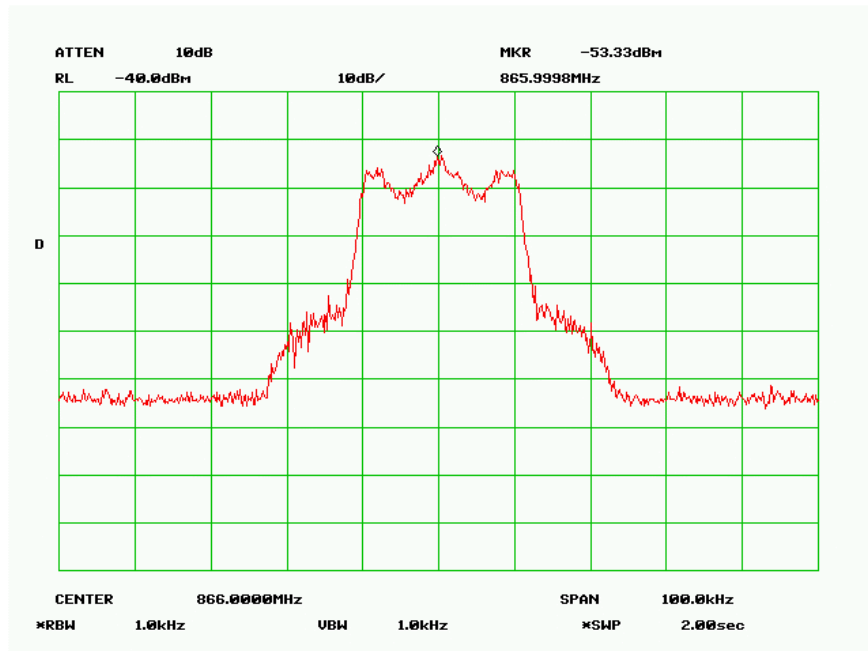
Downlink: (Input Signal, Middle Channel)



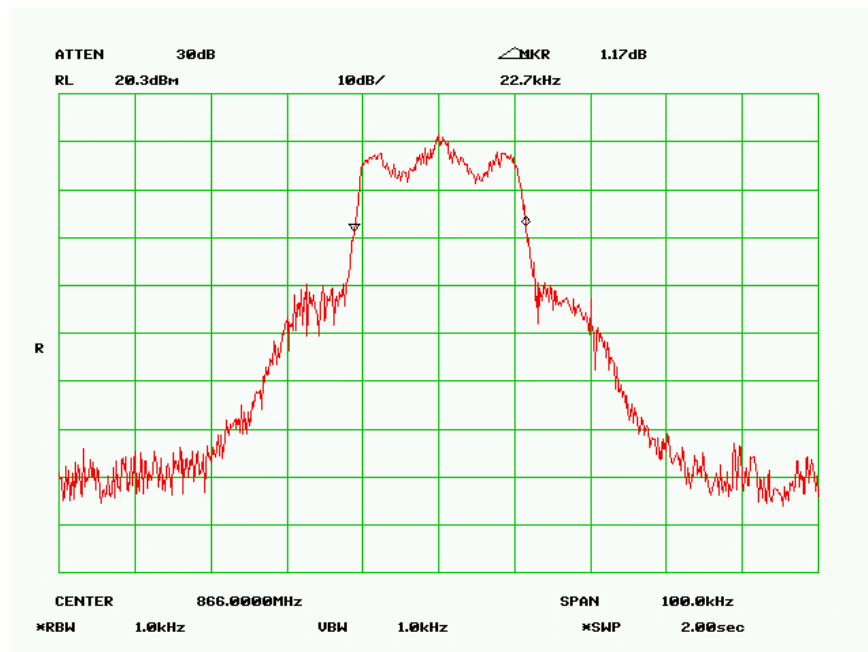
Downlink: (Output Signal, Middle Channel)



Downlink: (Input Signal, High Channel)



Downlink: (Output Signal, High Channel)



## **§2.1051 and §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS**

### **Applicable Standard**

§2.1051 and §90.210

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

$43 + 10 \log P$  dB

### **Test Procedure**

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.

### **Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	8564E	3943A01781	2004-10-04
Hewlett Packard	Plotter	HP7470A	2541A49659	N/R

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

### **Environmental Conditions**

Temperature:	21° C
Relative Humidity:	43%
ATM Pressure:	1020 mbar

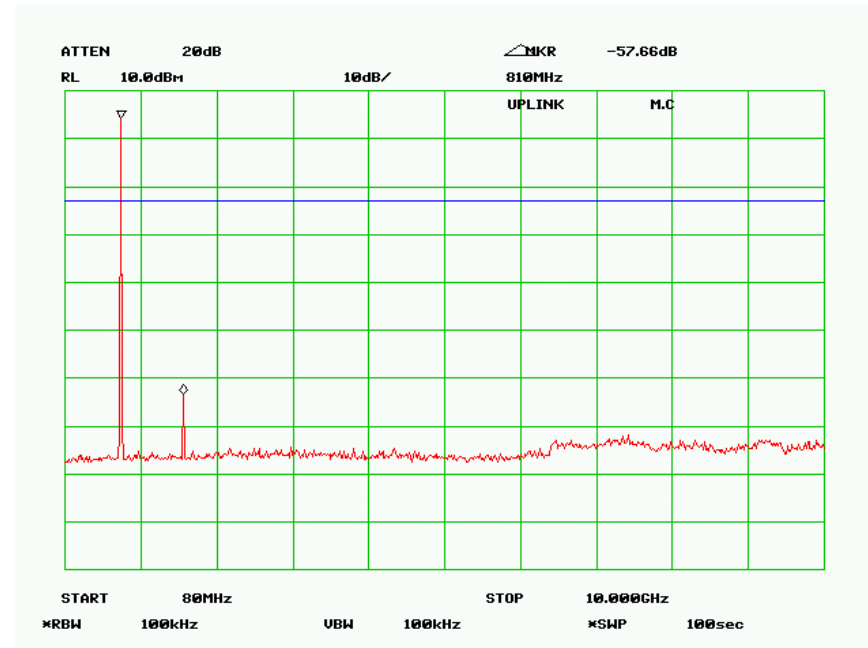
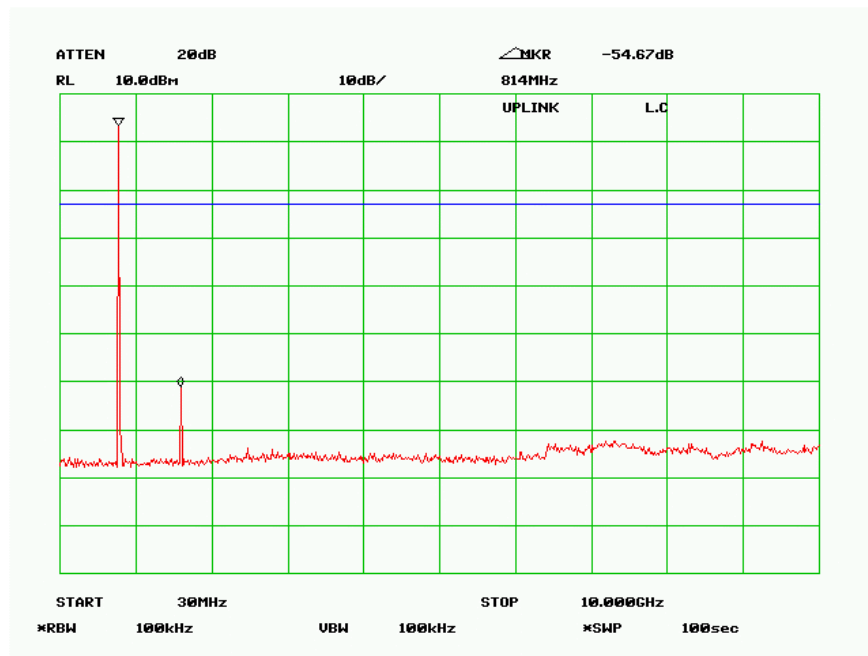
*The testing was performed by Daniel Deng on 2005-05-24.*

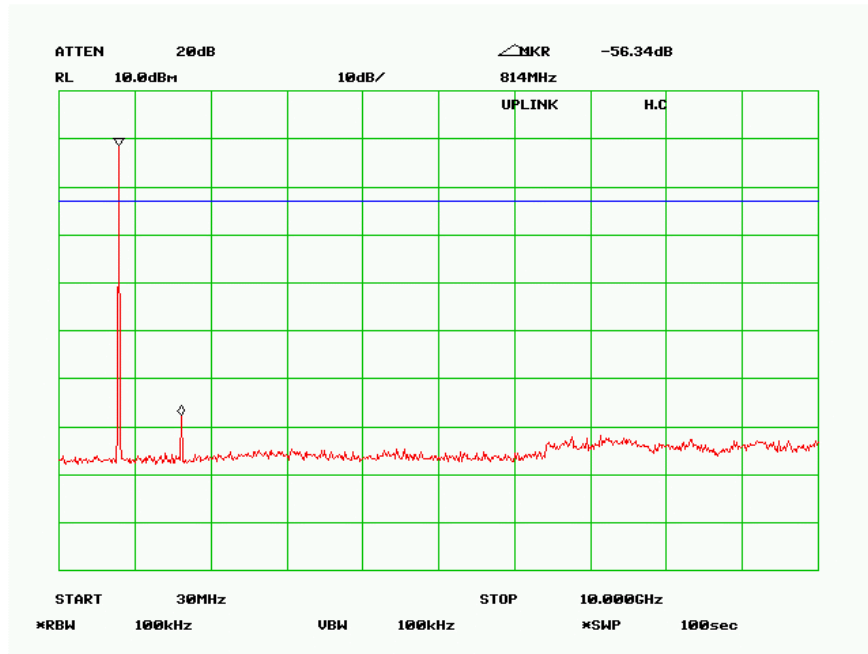
### **Test Results**

Please refer to the hereinafter plots.

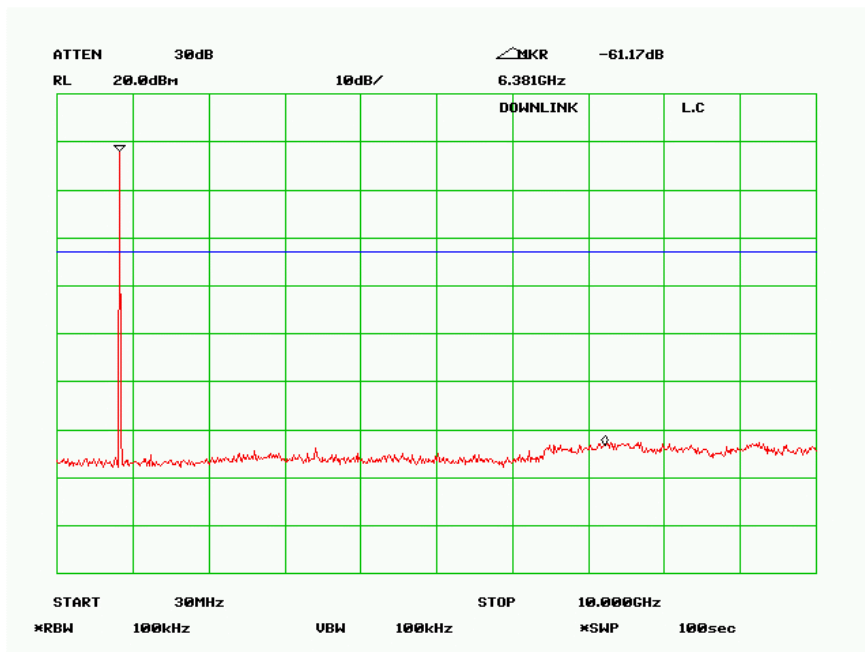


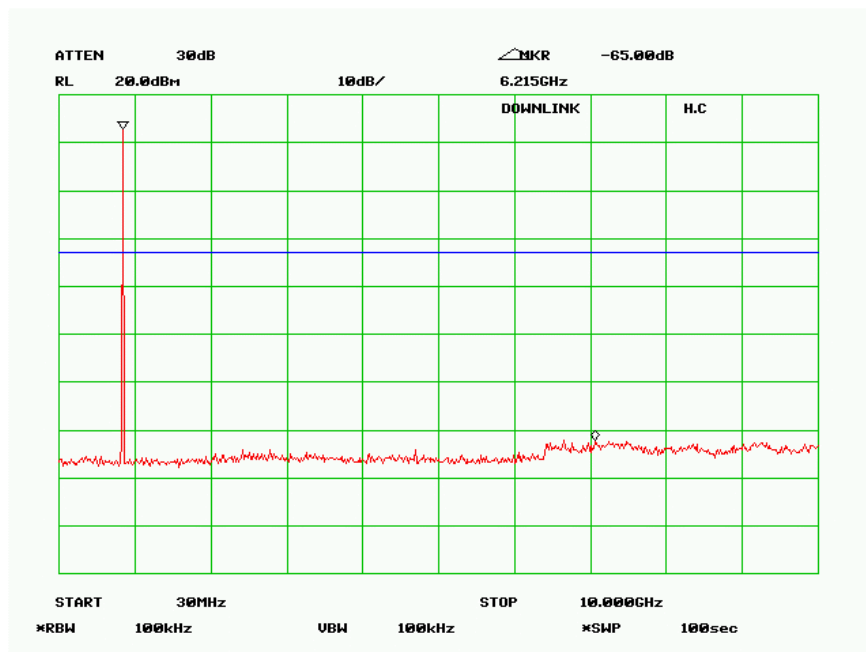
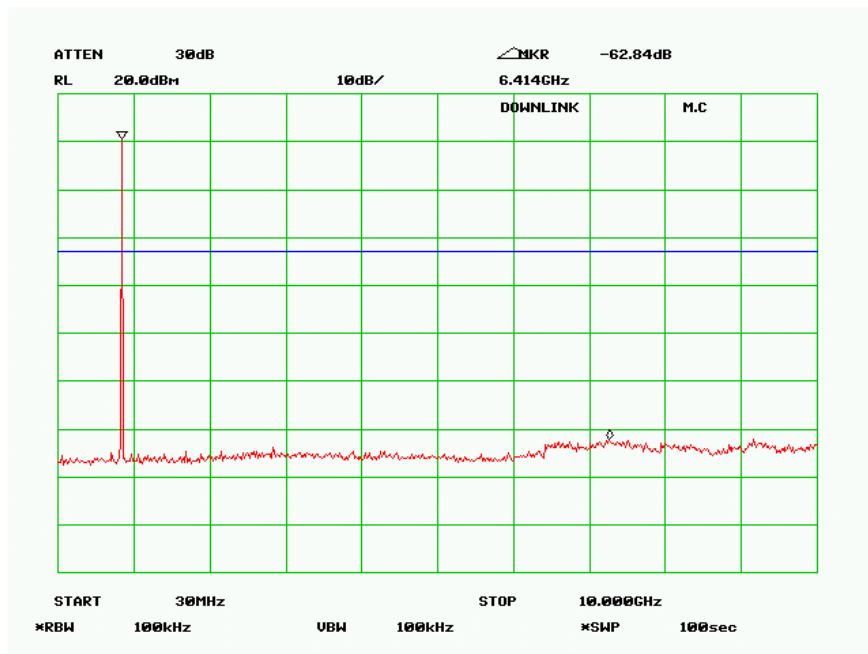
Uplink:





Downlink:





## §2.1053 and §90.210 - RADIATED SPURIOUS EMISSION

### Applicable Standard

§2.1053 and §90.210(g)

### Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

### Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
ETS	Biconical Antennas	3110B	9603-2315	2004-12-14
ETS	Log-Periodic Antenna	3148	4-1155	2004-12-14
Rohde&Schwarz	Signal Generator	SMIQ03	DE23746	2005-05-02
Agilent	Spectrum Analyzer	E4446A	US44300386	2004-11-10
Com-Power	Antenna, Dipole	AD-100	2222	2004-09-26
A.H. Systems	Antenna, Horn	SAS-200/571	261	2005-04-20
Sunol Sciences	Antenna	DRH-118	A052704	2004-06-02

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

### Environmental Conditions

Temperature:	21° C
Relative Humidity:	43%
ATM Pressure:	1020 mbar

*The testing was performed by Daniel Deng on 2005-05-24.*

**Test Result**

-51.70dB at 2445.00MHz, for Uplink Channel

-47.10dB at 2580.00MHz, for Downlink Channel

EUT					Generator					Standard	
Indicated		Table	Test Antenna		Substitution		Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Gain Corrected	Loss dB	Level dBm	Limit dBm	Margin dB
Uplink Middle Channel (f = 815MHZ)											
2445.00	10.66	0	1.5	v	2445.00	-72.4	9.3	1.60	-64.70	-13	-51.70
2445.00	9.89	0	1.4	h	2445.00	-73.2	9.3	1.60	-65.50	-13	-52.50
1630.00	12.65	0	1.5	v	1630.00	-74.4	9.3	1.30	-66.40	-13	-53.40
1630.00	11.38	90	1.5	h	1630.00	-75.7	9.3	1.30	-67.70	-13	-54.70
896.21	32.20	0	1.3	v	896.21	-68.5	0	0.85	-69.35	-13	-56.35
896.21	30.89	0	1.4	h	896.21	-69.8	0	0.85	-70.65	-13	-57.65
Downlink Middle Channel (f = 860MHZ)											
2580.00	12.35	0	1.3	v	2580.00	-67.8	9.3	1.60	-60.10	-13	-47.10
2580.00	12.02	0	1.4	h	2580.00	-68.2	9.3	1.60	-60.50	-13	-47.50
1720.00	13.85	0	1.5	v	1720.00	-73.7	9.3	1.30	-65.70	-13	-52.70
1720.00	13.12	0	1.4	h	1720.00	-74.4	9.3	1.30	-66.40	-13	-53.40
734.20	29.65	300	1.3	v	734.20	-69.8	0	0.80	-70.60	-13	-57.60
734.20	28.89	0	1.6	h	734.20	-70.5	0	0.80	-71.30	-13	-58.30

Note:

- 1) No preamplifier used.
- 2) Test in three orthogonal plane.
- 3) Normal condition

**Compliance Statement:**

According to FCC Part 15, at 3-meter distance the emission from an intentional radiator shall not exceed the field strength level 40 dBuV/m within 30-88 MHz, 43.5 dBuV/m within 88-216 MHz, 46 dBuV/m within 216-960 MHz, 54 dBuV/m above 960 MHz. The level of any unwanted emissions shall not exceed the level of the fundamental frequency.

The levels of unwanted emission of this device were below the above limits. This device was compliant with the FCC Part 15. Please see the following test data:

**-4.0 dB at 43.58MHz in the Vertical polarization**

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15B	
Frequency MHz	Ampl. dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dB	Cable dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
43.58	48.5	200	1.2	V3	14.7	1.4	28.6	36	40	-4.0
870.99	37.8	180	1.2	V3	22.5	7	27.7	39.6	46	-6.4
67.83	46.1	160	1.2	H3	8.2	1.7	28.4	27.6	40	-12.4
672.14	35.9	200	1.2	V3	20.3	5.7	28.5	33.4	46	-12.6
873.90	29.2	180	1.5	H3	22.5	7	27.7	31	46	-15.0
600.36	32.3	100	1.5	H3	19.5	5.4	28.6	28.6	46	-17.4

## §2.1051 & §90.210(g) - TWO-TONE INTERMODULATION TEST

### Applicable Standards

According to §2.1051 & §90.210(g), Intermodulation products must be attenuated below the rated power of the EUT by at least  $43 + 10\log(P)$ , equivalent to -13 dBm.

### Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 30 kHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic. Two input signals are equal in level (and can be raised equally), were sent to the EUT.

### Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde&Schwarz	Generator, Signal	SMIQ03	DE23746	2005-05-02
Agilent	Generator, Signal	E4438C	MY42081680	2005-03-05
Agilent	Analyzer	8564E	3943A01781	2004-10-04
HP	Plotter	HP7470A	2541A4965S	N/R

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

### Test Results

#### Environmental Conditions

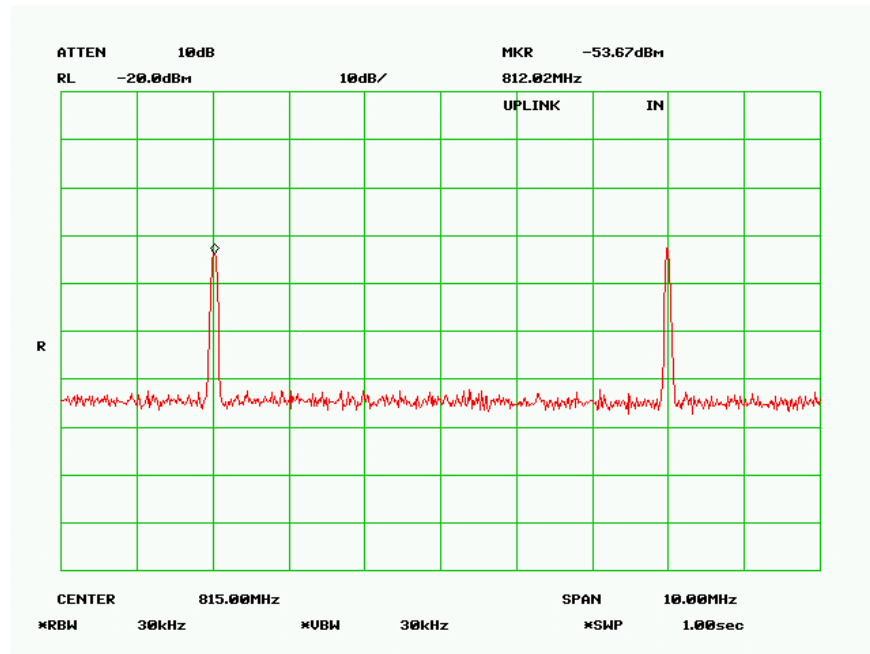
Temperature:	21° C
Relative Humidity:	43%
ATM Pressure:	1020 mbar

*The testing was performed by Daniel Deng on 2005-05-24.*

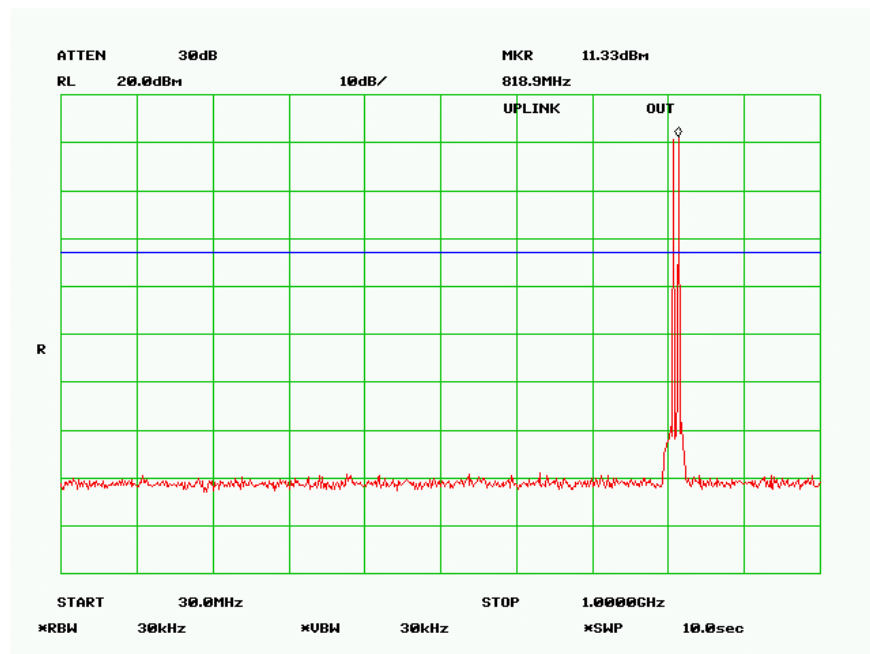
### Plots of Two-Tone Test Result

Please refer to plots hereinafter.

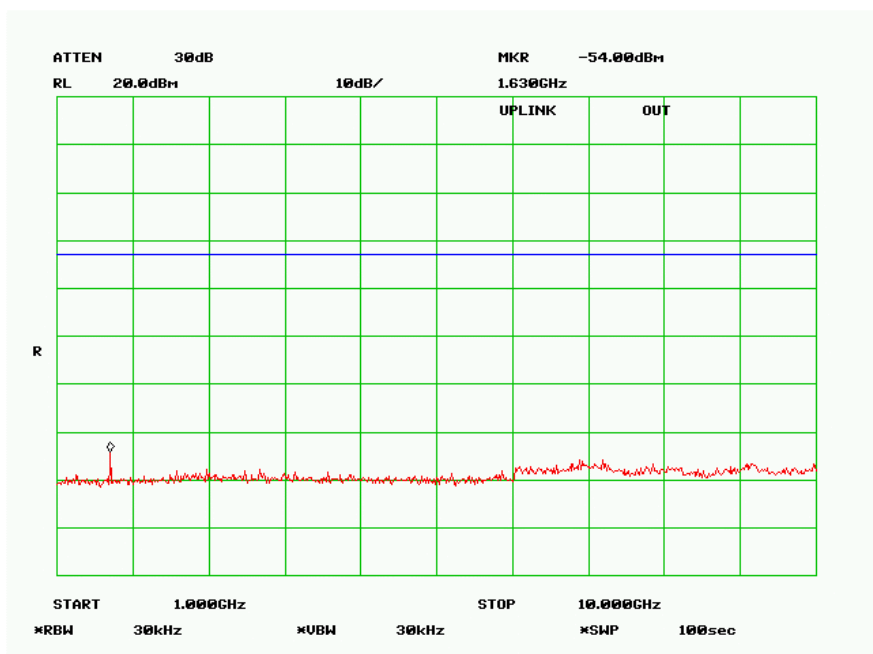
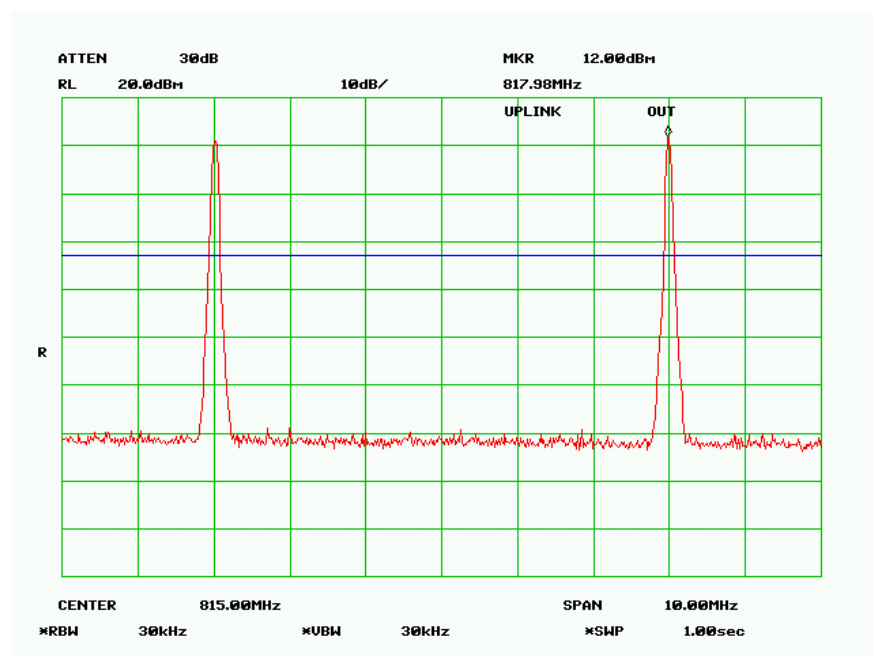
## Uplink: (Input Signal)



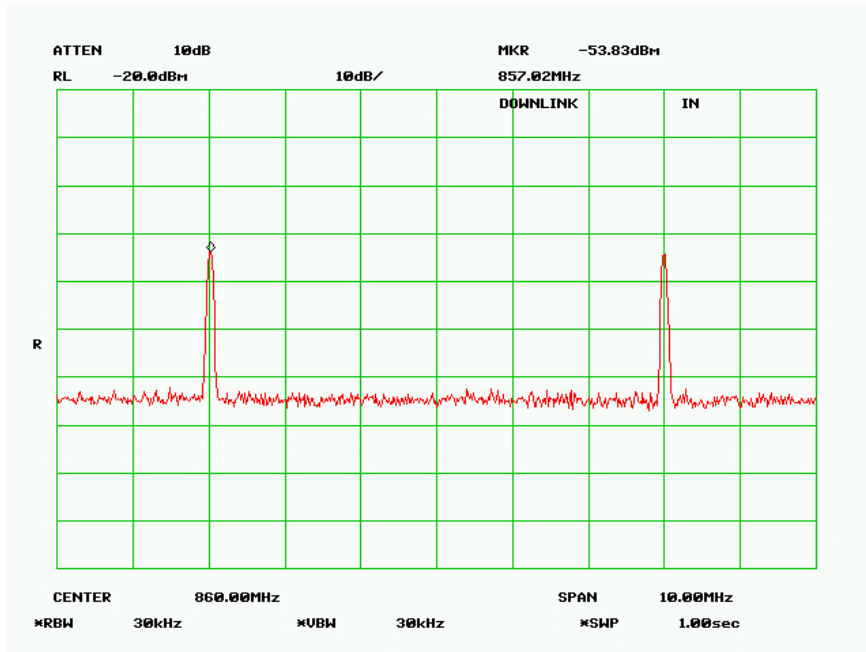
## Uplink: (Output Signal)



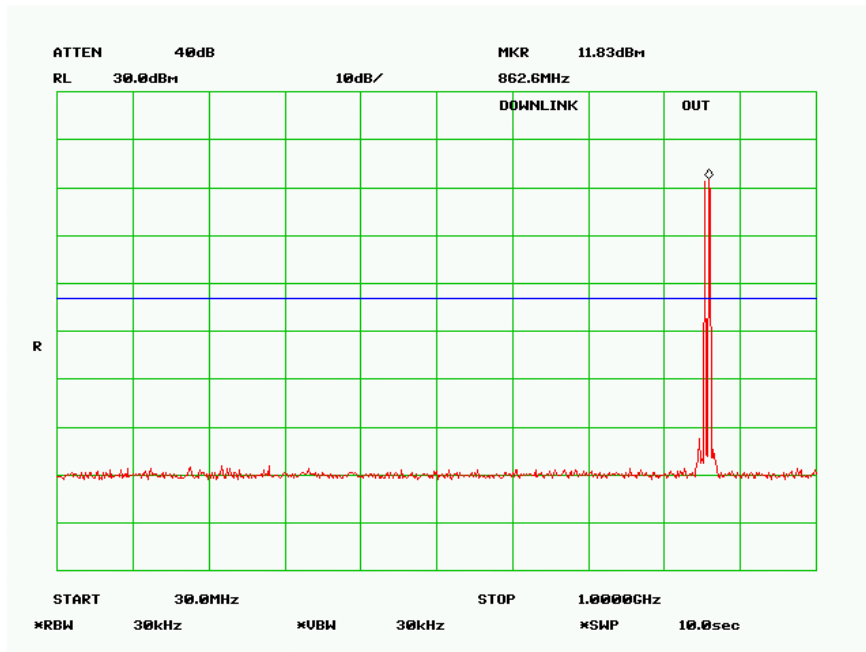


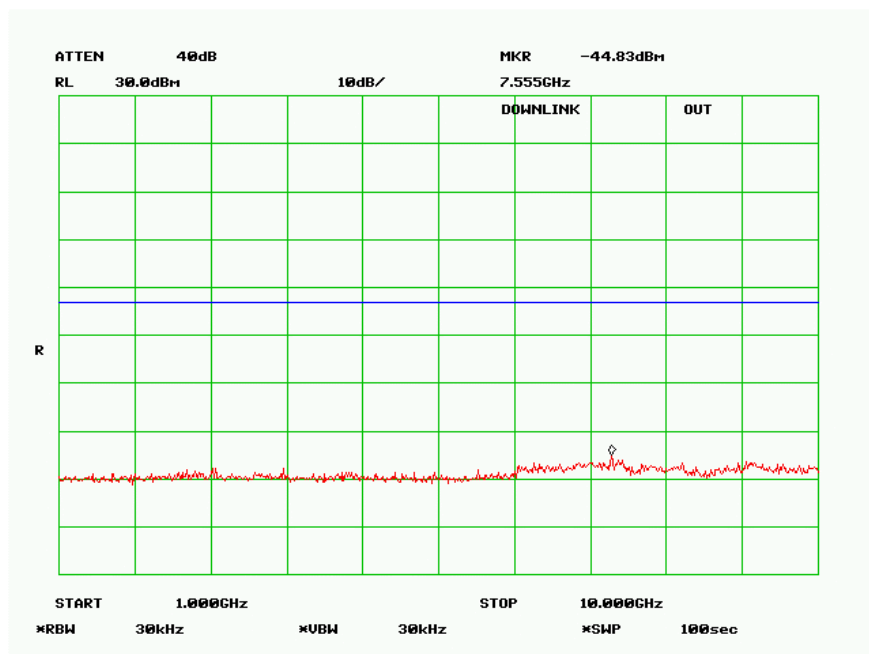
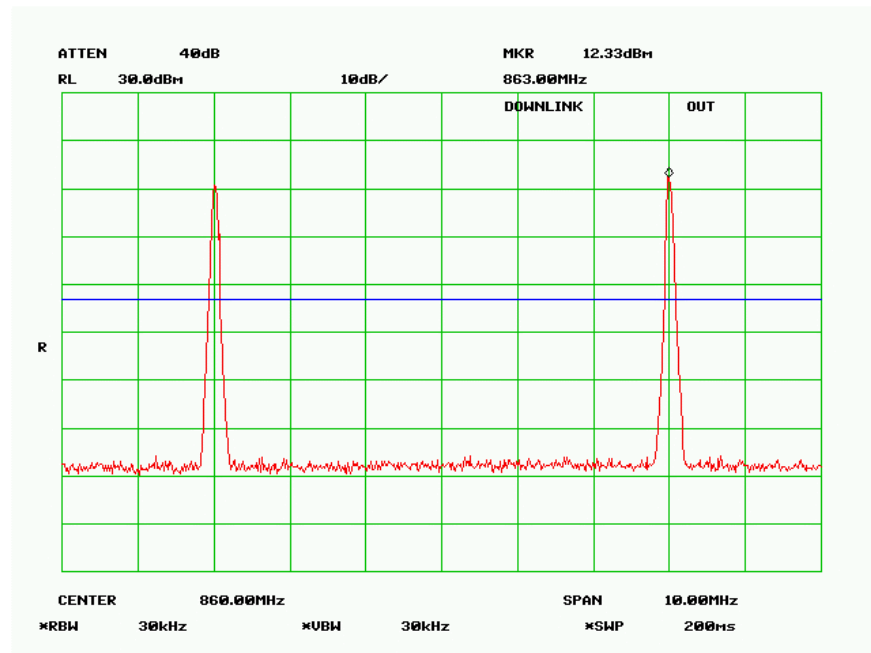


## Downlink: (Input Signal)



## Downlink: (Output Signal)





## §15.107 - CONDUCTED EMISSIONS

### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are receiver, 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 shielded room, using the same setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC 15 Class B limits.

The external I/O cables were draped along the test table and bundled as required.

The EUT was connected to 120Vac/60Hz power source.

### Receiver Setup

The receiver was set to investigate the frequency from 150 kHz to 30MHz.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2004-08-16
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2004-09-15
Fluke	Calibrated Voltmeter	189	18485-38	2004-12-29

\* **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 emission test, the EUT was connected to the mains outlet of the LISN-1. Maximizing procedure were performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Average readings are distinguished with an "Ave".

### Test Results Summary

According to the recorded data, the EUT test data are within the measurement uncertainty  $\pm 2.4$  dB, with the worst margin reading of:

**-0.6 dB at 4.88 MHz on the Neutral conductor mode.**

## Conducted Emissions Test Data

### Environmental Conditions

Temperature:	20° C
Relative Humidity:	38%
ATM Pressure:	1025mbar

*\*Testing was performed by Daniel Deng on 2005-05-19.*

LINE CONDUCTED EMISSIONS				FCC15 CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
4.88	45.4	Ave	Neutral	46.0	-0.6
4.62	45.2	Ave	Neutral	46.0	-0.8
4.09	44.9	Ave	Line	46.0	-1.1
4.9	44.4	Ave	Line	46.0	-1.6
4.5	44.2	Ave	Line	46.0	-1.8
4.93	51.9	QP	Line	56.0	-4.1
4.11	51.7	QP	Line	56.0	-4.3
4.49	51.3	QP	Line	56.0	-4.7
4.61	49.8	QP	Neutral	56.0	-6.2
4.84	49.6	QP	Neutral	56.0	-6.4
0.26	41.5	Ave	Neutral	51.4	-9.9
0.26	50.1	QP	Neutral	61.4	-11.3

### Plots of Conducted Emission

The plots of conducted emission are presented hereinafter as reference.

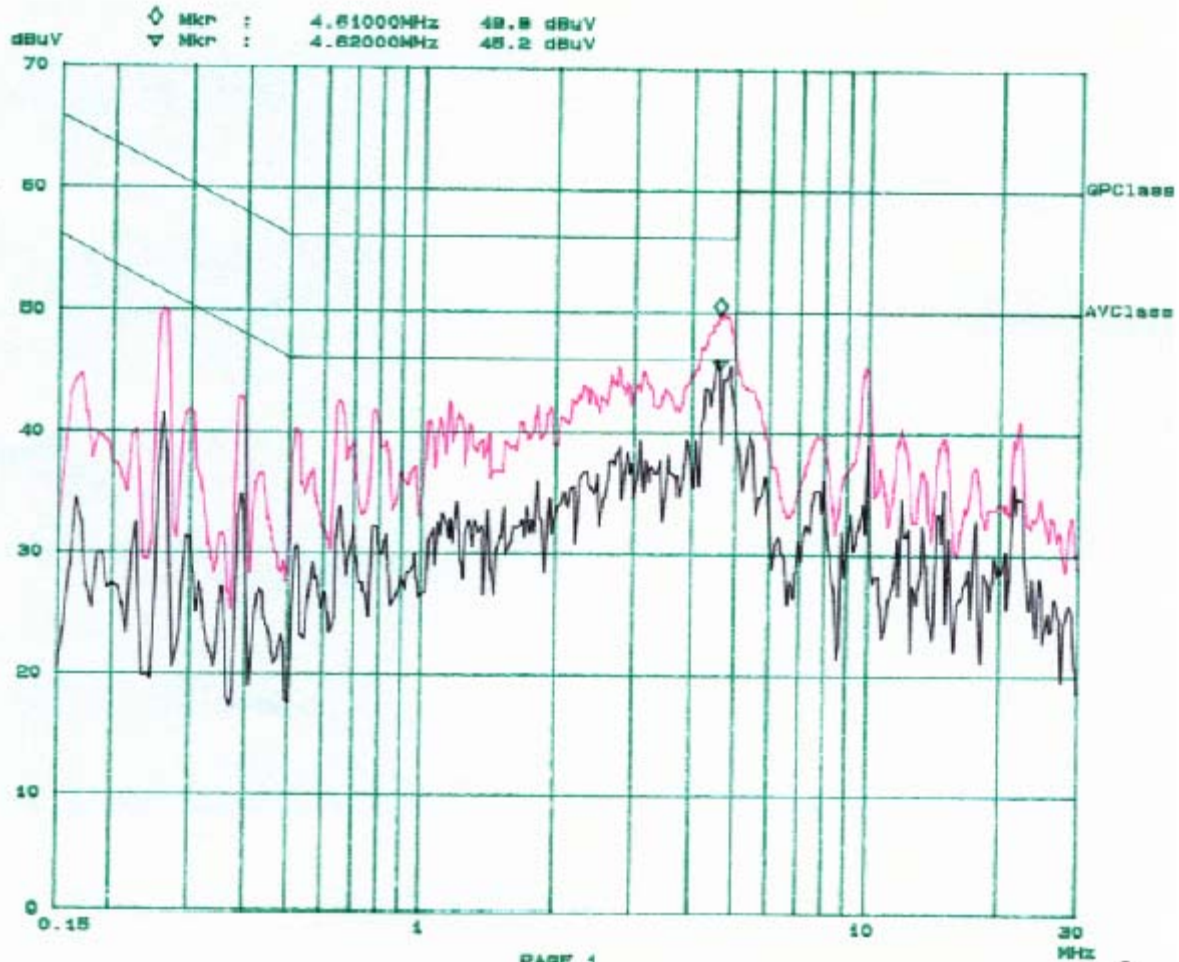
**Bay Area Compliance Laboratory Corp**  
**Class B**

19. May 06 14:17

EUT: Amplifier  
Manuf: Opaya  
Op Cond: Normal  
Operator: Daniel  
Comment: N  
120VAC

**Scan Settings (3 Ranges)**

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



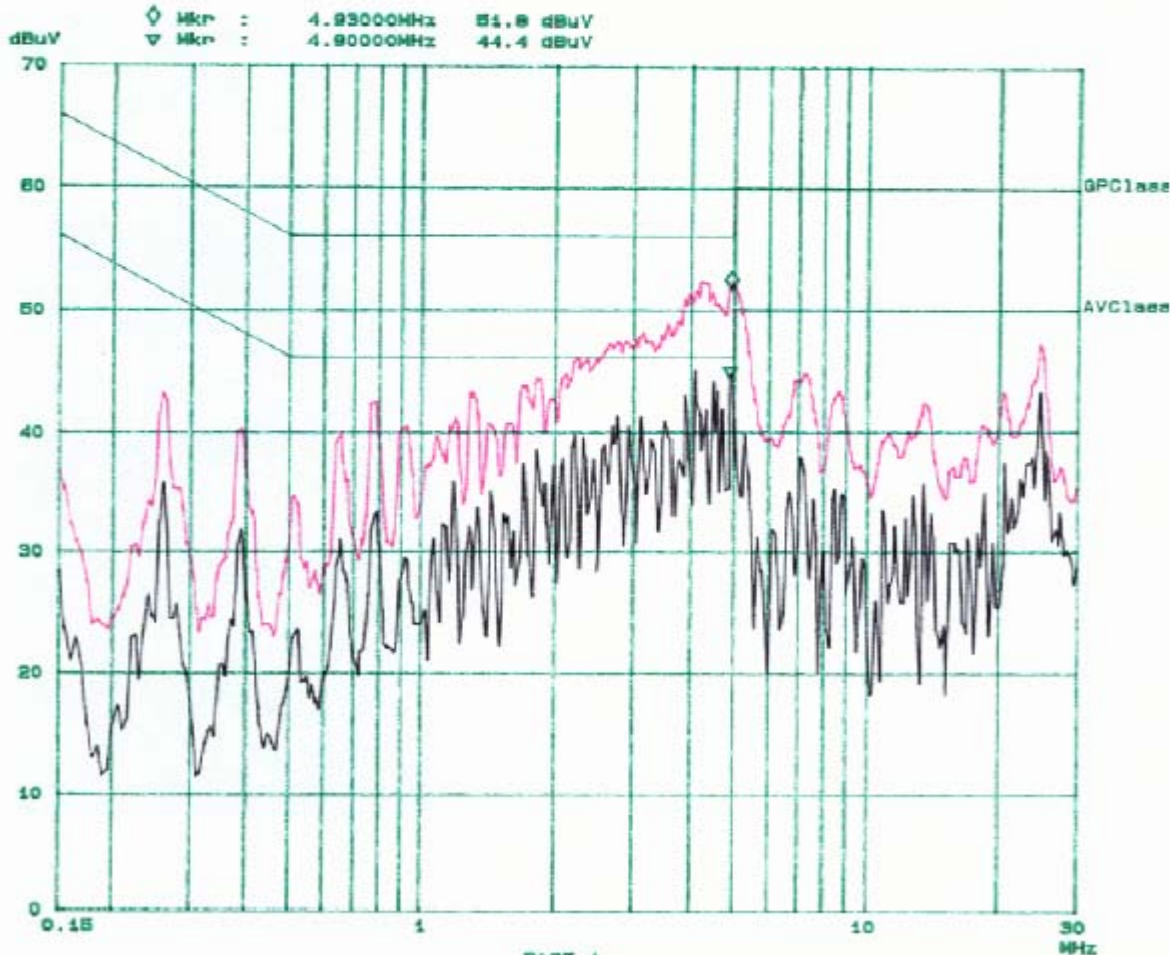
**Bay Area Compliance Laboratory Corp**  
**Class B**

19. May 08 14:58

EUT: Amplifier  
Manuf: Opisys  
Op Cond: Normal  
Operator: Daniel  
Comment: L  
120VAC

**Scan Settings (3 Ranges)**

Frequency			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	5k	GP+AV	20ms	10dB LN	OFF
1M	5M	10k	5k	GP+AV	1ms	10dB LN	OFF
5M	30M	100k	5k	GP+AV	1ms	10dB LN	OFF



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19/5/08