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Bravo Tech, Inc.

EMC Measurement / Technical Report

Test Specification : FCC Part 90,
Private Land Mobile Radio Services

Equipment Authorization : Certification

Manufacturer : Bravo Tech, Inc.

Equipment Under Test : LPA800
Multi-Carrier Power Amplifier

Test Report No. : BRAVO 0000001

Document History					
Revision	**Issue Date**	**Affected Pages**	**Description of Modifications**	**Revised By**	**Approved By**
0	27 November, 2000		Initial release		

BTI **Bravo Tech, Inc.**

EMC Measurement / Technical Report

Document No.: 000001

Bravo Tech, Inc.

LPA800 Multi-Carrier Power Amplifier
FCC ID: O2H8002001

WRITTEN BY	REVIEWED BY	REVIEWED BY
Dick Chiang *EMC Consulting Engineer*	*Minh Nguyen* *Technical Manager*	*Bailey Zheng* *President*

Test Personnel	***Test Dates***
Dick P. Chiang	26, 27, 29 April & 18, 20 May 2000

Test Facility	Garwood Laboratories	Bravo Tech, Inc.
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Bravo Tech, Inc.

MEASUREMENT/TECHNICAL REPORT SUMMARY

Representative	Bailey Zheng
Manufacturer	Bravo Tech, Inc.
Address	4260 Cerritos Ave.
City, State, Zip	Los Alamitos, CA 90720
Phone	(714) 952-8324
Fax	(714) 952-0107
Type of Authorization	Certification for 850-870MHz Multi-Carrier Power Amplifier
Applicable FCC Rules	PART 90 – Private Land Mobile Radio Services Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 (10-1-98 Edition). The following subparts are applicable to the results in this test report: Part 90, Subpart I – General Technical Standards Part 2, Subpart J – Equipment Authorization Procedures for Certification, and FCC98058 Document The test data presented in this report has been acquired using the guidelines set forth in FCC Part 2 section §2.981 through §2.1005 and Part 90. The test results presented in this document are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with identical measurement conditions.
Equipment Under Test	800MHz Multi-Carrier Power Amplifier
Production Quantity	Multiple Units
Identification of EUT	Model: LPA800 FCC ID: O2H8002001
Testing Date	26, 27, 29 April & 18, 20 May 2000

1. GENERAL INFORMATION

1.1 Product Description

Equipment Under Test	850-870MHz Multi-Carrier Power Amplifier
Model Number	LPA800
Serial Number	Prototype
Description of EUT	The EUT is a multi-channel feed-forward 35 dB gain linear RF Power Amplifier which is specially designed for trunking systems. The input signals are split into two paths. One path is to the main amplifier path, the carriers are amplified. The other path is to the delay line. The phase and amplitude of the amplified signals are adjusted by phase and attenuator loops and signal errors are cancelled from the delay line loops. The output signals will be cleaned after the cancellation. Refer to the operating manual for details.
Clock Frequencies	None for the Amplifier 11.0MHz for the Microprocessor Controller

Refer to the product specification data that has been included as an attachment of this report for additional details.

1.2 Tested System Details

The following table lists all of the components of the tested system. FCC ID numbers are included if available for a tested system component. Refer to the table following Tested System Details for cabling information.

Tested System Details					
Item	Manufacturer	Description	Model No.	Serial No.	FCC ID
1	Bravo Tech	Multi-Carrier Power Amplifier	LPA800	Prototype	O2H8002001

The following table lists all of the cabling details for the tested system.

Cabling of the Tested System					
Item	Description	Length (m)	Type	Connected from	Connected to
A	Power Cords	1.5	10 gauge wires	EUT	Power Supply
B	RF Coaxial Cable	0.5	RG214 equiv.	EUT	Test Fixture (Pre-amp.)
C	RF Coaxial Cable	0.5	RG214 equiv.	EUT	Directional Coupler
D	RF Coaxial Cable	0.5	RG214 equiv.	Directional Coupler	Spectrum Analyzer
E	RF Coaxial Cable	0.5	RG214 equiv.	Directional Coupler	50 ohm Terminator
F	DB9 Shielded Cable	1.2	RS232	EUT	Unterminated
G	DB9 Shielded Cable	1.2	Status Output	EUT	Unterminated

2. Technical Description

Type of Emission	20K0F1E
Frequency Range	850 ~ 870 MHz
Range of Operating Power	100 ~ 200W
Maximum output Power Level	200W
Maximum Specified Output Power Rating	Location Dependant per Part 90 Subpart S
Final Stage Amplifier DC Voltage, Current	Voltage: 27.0 Vdc, Current: 51 Amps

2.1 Function of All Active Circuit Devices

Board-TSLPA900-00009-2 Pre-Driver

- D3-D10: varactor diodes comprising part of voltage controlled phase shifter
- D1-D2: PLN diodes comprising part of voltage variable attenuator (VVA)
- Q1:current booster for VVA driver on DCXX-00101
- U1: Detector for RF input power level
- U4: hybrid RF amplifier, driver for Q3
- Q3: Pre-driver output stage
- U2-U3: voltage regulators

Board-TSLPA900-00011-2 Pre-Error Amp

- D3-D10: varactor diodes comprising part of voltage controlled phase shifter
- D1-D2: PIN diodes comprising part of voltage variable attenuator (VVA)
- U1: Detector for first loop cancellation power level
- Q1-Q2: Rf amplifiers, pre –drivers for CP1 on XM120-006-1
- U2: voltage regulator

Board-PSXXX-001-1 Power Conditioner

- Q1-Q8: relay drivers
- D1-D4: relay flyback diodes
- U1-U3: voltage regulators
- U4-U5: voltage inverters

Board-XM120-006-1 Error Amp

- U1: 120W Hybrid power amplifier module, output stage for error amp
- U2: voltage regulator

Board-DCXX-001-1 Controller

- U1: Op-amp
- U2: voltage regulator
- U3: 8-bit microcontroller
- U4: voltage inverter
- U5-U6: voltage regulators
- U7-U8: Op-amps
- U9: voltage regulator
- U10: D-A converter
- Q2: current boost for VVA on pre-error amp

Board-COMSXXX-001 Driver

- U1: Hybrid RF amplifier, driver for main amp

2.2 Circuit Diagram

Please refer to Attachment (Exhibit C).

2.3 Instruction Manual(s)

See Attachment (Exhibit A).

3. PRODUCT LABELING

3.1 FCC ID Label

FCC ID: O2H8002001

3.2 Location of Label on EUT

The FCC ID was located at the rear side of EUT. Please refer to engineering drawing which was included in Attachment. (Exhibit D).

3.3 Information to User

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

4. SYSTEM TEST CONFIGURATION

4.1 Justification

The EUT was used in a system configured for testing in a typical installation as a customer would normally use it.

4.2 EUT Exercise Software/Equipment

The EUT requires exercise software program used during testing to activate data from PC to controller and deliver to EUT.

4.3 Special Accessories

The EUT requires no special accessories to comply with the FCC regulations.

The EUT was incorporated the following constructions and components to suppressed the spurious emissions;

- Finger stock to seal main box lids
- All main circuit blocks are contained in covered aluminum boxes, grounded to chassis, all DC/CTRL signals I/O via feedthrough capacitors
- Helical type bypass filter on output of main amplifier
- Alarm reports loop failure; automatic microprocessor controlled loop reduces inter-modulation distortion to acceptable limits.

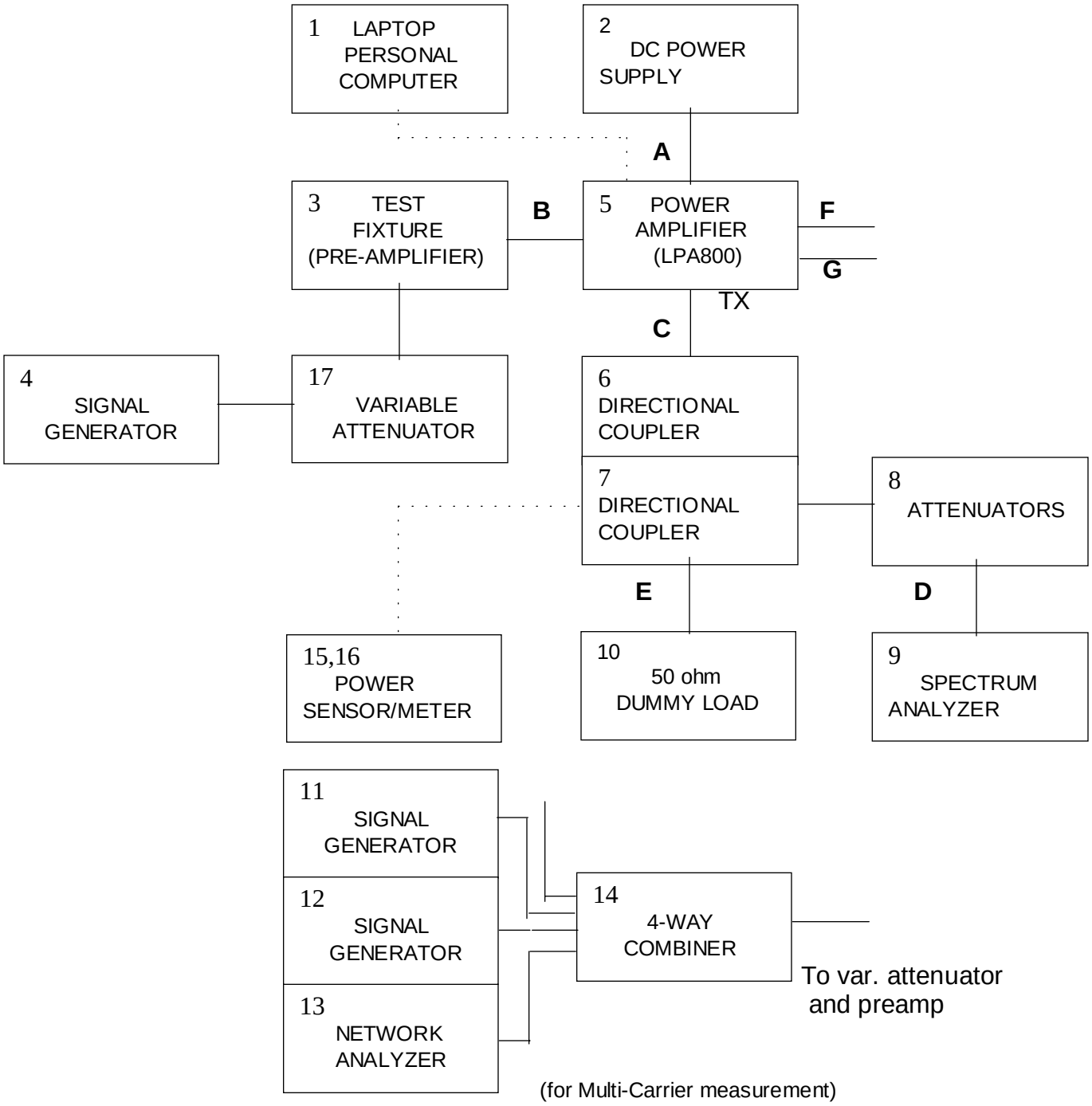
The following features were incorporated to limit output power;

- Circulators on output of main and error amplifiers for VSWR protection
- VSWR fault shuts down amplifier and informs system
- RF power fault - in event of RF power output exceeding rating, bias to main amplifier and RF power to error amplifier are shut down
- Under normal condition, microprocessor controlled loop regulates gain to within ±1 dB
- Input over-voltage alarm shuts down system in event of Vin exceeding safe limits

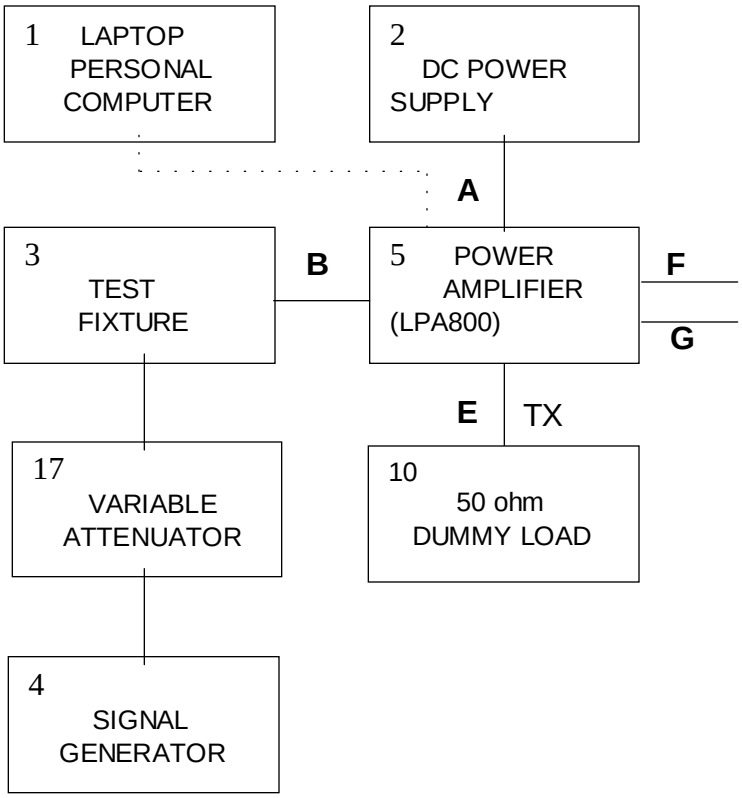
4.4 Equipment Modifications

No modifications and or adjustments were made to the EUT during compliance testing to achieve the required specification limits.

4.5 Configuration of Tested System



Test Setup Configuration 1



Test Setup Configuration 2

Legend:

Item	Manufacturer	Description	Model No.	Serial No.	FCC ID
1	Sony	Laptop PC	PCG-F280	4-643-160-01	FCC Class B Logo
2	Sorenson	DC Power Supply	DCR40-125A	900	N/A
3	Bravo Tech	Linear Amplifier	Test Fixture	N/A	N/A
4	Hewlett-Packard	Signal Generator	8648C	3537A02356	N/A
5	Bravo Tech	Power Amp. (EUT)	LPA800	Prototype	O2H8002001
6	Narda	Directional Coupler	3020A	30332	N/A
7	Narda	Directional Coupler	3004-20	10835	N/A
8	JFW	Attenuator	50FHC-010-50	N/A	N/A
9	Hewlett Packard	Spectrum Analyzer	E4407B	US39010169	N/A
10	Bird Electronics	50 ohm Load	8404	1177	N/A
11	Hewlett-Packard	Signal Generator	8656B	2703U01835	N/A
12	Rohde & Schwarz	Signal Generator	SMIQ	DE26622	N/A
13	Agilent	Network Analyzer	8720ES	US39170083	N/A
14	Mini-circuits	RF Combiner	ZA4PD-2	09730	N/A
15	Hewlett-Packard	RF Power Sensor	8482H	2349A08983	N/A
16	Hewlett-Packard	RF Power Meter	EMP-441A	US37480524	N/A
17	Weinschel	Attenuator	910-20-11	9175	N/A

Item	Description	Length (m)	Type	Connected from	Connected to
A	Power Cords	1.5	10 gauge wires	EUT	Power Supply
B	RF Coaxial Cable	0.5	RG214 equiv.	EUT	Test Fixture (Pre-amp.)
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E	RF Coaxial Cable	0.5	RG214 equiv.	Directional Coupler	50 ohm Terminator
F	DB9 Shielded Cable	1.2	RS232	EUT	Unterminated
G	DB9 Shielded Cable	1.2	RS232	EUT	Unterminated

5. TEST DATA

5.1 RF Power Output

Output power was measured at the Transmitter Module RF final stage output terminal. The test setup and method as shown in Configuration 1.
The output power was measured at each frequency 850MHz, 860MHz, 870MHz tuned with nominal voltage 27.0V at EUT terminals (operating input voltage 26V ~ 28V). The Hewlett-Packard power meter and power sensor was used to measure RF output power. And output power was measured at 100w and 200w settings (Weinschel variable attenuator was used to adjust input level to preamplifier), and result plots were attached in appendix B pages 33 – 35.

Freq. Tuned	nominal voltage (@27.0V)	Freq. Tuned	nominal voltage (@27.0V)
850.0 MHz	100.0W	850.0 MHz	200.0W
860.0 MHz	100.0W	860.0 MHz	200.0W
870.0 MHz	100.0W	870.0 MHz	200.0W

5.2 Modulation Characteristics

The modulation characteristics was measured with signal generator input FM signal tuned at each frequency with typical 2.4kHz frequency modulated 5.0kHz deviation, the test results are enclosed in appendix B pages 36 – 38.

5.3 Occupied Bandwidth

Occupied bandwidth is the frequency bandwidth below its lower and above its upper frequency limits, the mean power radiated by a given emission, the measurements were made with the modulating signal. The authorized occupied bandwidth for emission mask G is 20KHz. The measured occupied bandwidth that was the manufacturer intended to design for sufficient data transmission. Test setup was connected the equipment per configuration 1. The test signal was typical FM signal with 2.4kHz tone and 5.0kHz deviation, test results were attached in appendix B pages 39- 49.

Necessary bandwidth Bn = 2M + 2D = 19.6KHz
Where M = 4.8KHz
D = 5.0KHz

5.4 Spurious Emissions at Antenna Terminals

Antenna conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information or required quality for the class of communication desired. The reduction in the level of the spurious emissions will not affect the quality of the information being transmitted. Conducted spurious emissions shall be attenuated at least; 43 + 10 log (Po) = 63 dB (where Po is 100W) and 66 dB (where Po is 200W maximum output power) below the maximum level of the carrier frequency in accordance with the amplifier was authorized. Connect the equipment as shown in configuration 1. Adjust the spectrum analyzer to display the modulated carrier, and scan the frequency spectrum from the lowest radio frequency generated in the equipment through the 10th harmonic of the carrier frequency. Test results were attached in appendix B pages 49 – 79. The multi-carrier (typical 4-channel and output power @100W & 160W) test results were included in appendix B pages 79 – 109.

5.5 Radiated Spurious Emission

Emissions from the equipment when connected into a non-radiating load on a frequency of frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communication desired. The reduction in the level of these spurious emissions will not affect the quality of the information being transmitted. Connect the equipment as shown in configuration 2. All cables connected to generate maximum emissions from the EUT. The EUT was placed 80 centimeters above the ground plane on a non-conductive tabletop 1.0 meters wide by 1.5 meters long. The amplitude levels of the emissions were maximized by varying the configuration of the EUT and cables. The highest emissions were maximized by rotating the turntable 360 degrees and varying the antenna height 1 to 4 meters. The frequency range was measured up to 10th harmonic utilizing a Double-Ridged Horn antenna. measurements were made in vertical and horizontal polarizations. The distance between EUT and measuring antenna is 3 meters. Amplitude levels were recorded in dBμV/m. All spurious emissions were attenuated at least 66 dB below each tuned carrier field strength. Test results were attached in appendix B pages 109 - 110.

* Field strength = $1/D \times (Po \times RL)^{1/2}$, where D = 3 meters, Po = 200.0W, RL= 50.1 ohm

= $1/3 \times (200 \times 50.1)^{1/2}$

= 148.0 dBμV/m

** FCC Limit = 43 + 10 log (Po) , where Po = 200W

= 66dB

5.6 Conducted Emissions at Power Lines

The EUT was intended to operate and transmit with the AC/DC power supply which was connected to the public power line. The EUT was setup in a shielded enclosure in a typical installation configuration. The EUT was connected to the grounding system in accordance with installation practices. The configuration of the EUT was consistent with typical applications. The EUT was powered from the Line Impedance Stabilization Networks (LISN). The LISN's were earth grounded to the floor of the enclosure using a 5 centimeters long ground strap. The LISN's which (not connected to the receiver system) were terminated with 50Ω loads. The EUT was set up in the following manner.

The EUT was placed 80 centimeters above the ground plane on a non-conductive tabletop 1.0 meters wide x 1.5 meters long. The EUT was placed 0.4 meters from the wall of the shielded enclosure. The amplitude levels of the emissions were maximized by varying the configuration of the EUT and peripherals. The test result was enclosed in appendix B pages 111 – 116.

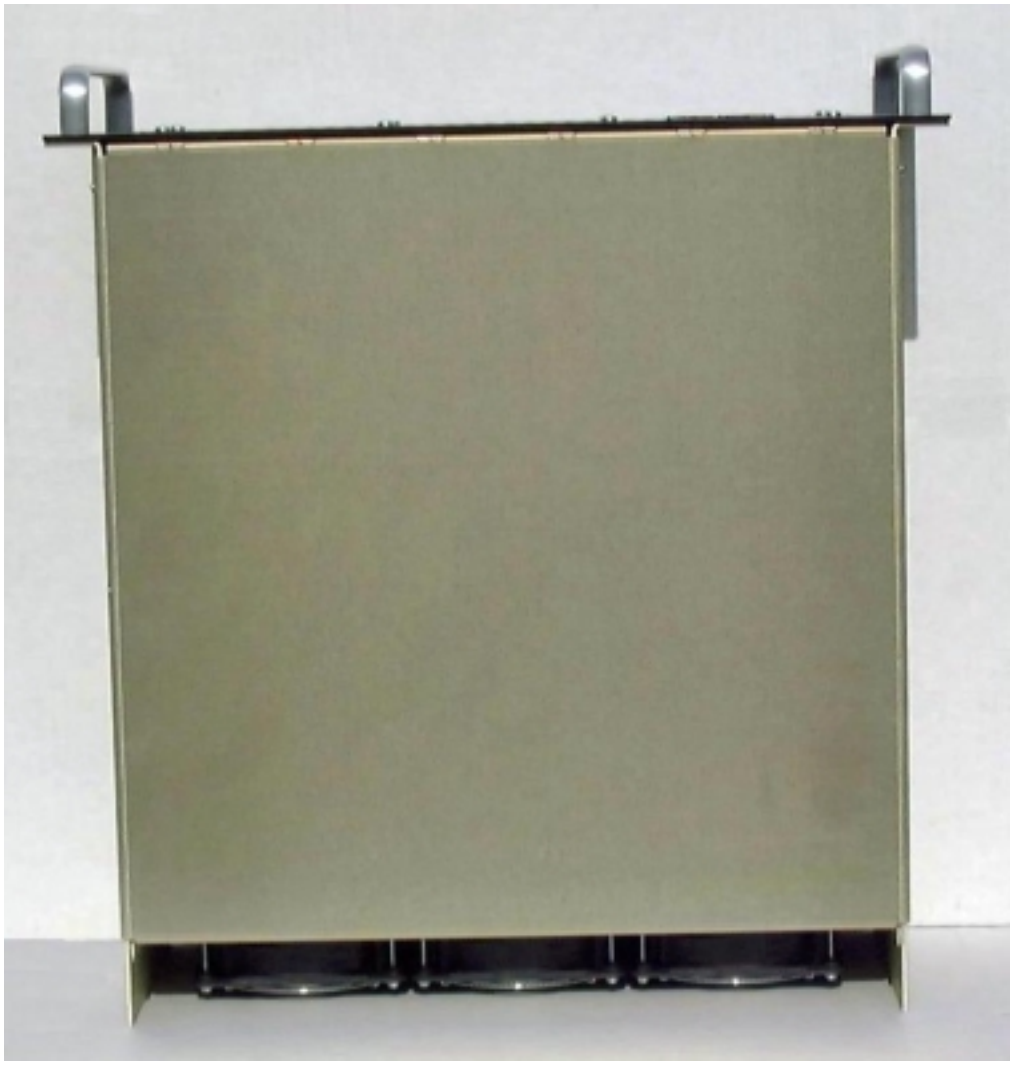
5.7 Frequency Stability

The EUT contains no frequency generated oscillator or crystal. The frequency stability measurement was non-required.

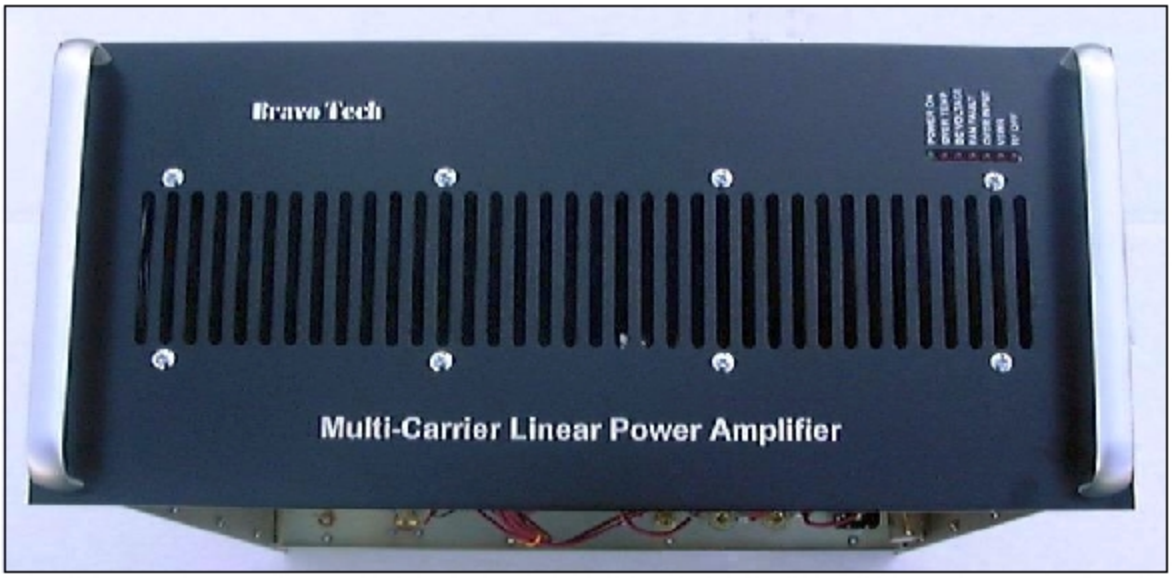
6 PHOTOGRAPHS AND/OR DRAWINGS SHOWING CONSTRUCTION TECHNIQUES

6.1 Photo: EUT Overall View

6.2 Photo: EUT Top View

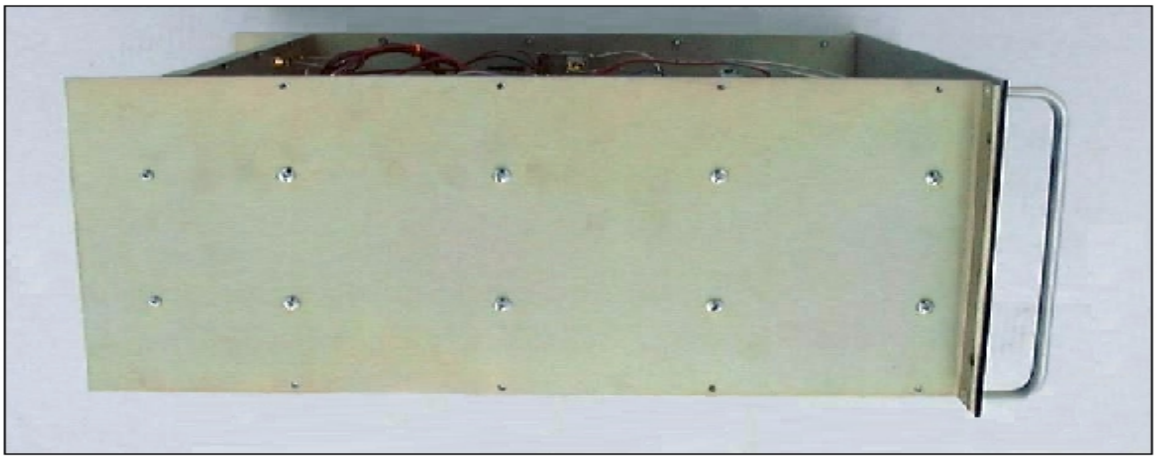


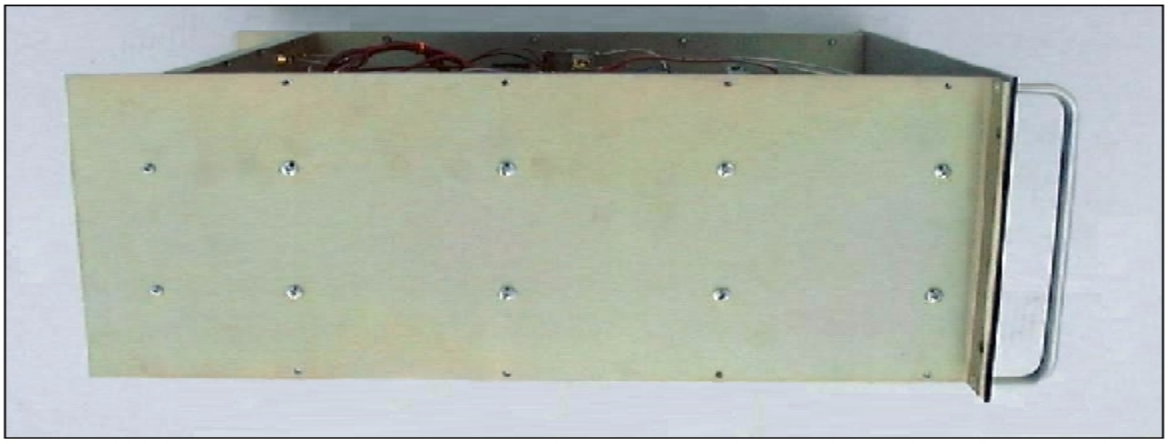
6.3 Photo: EUT Front View



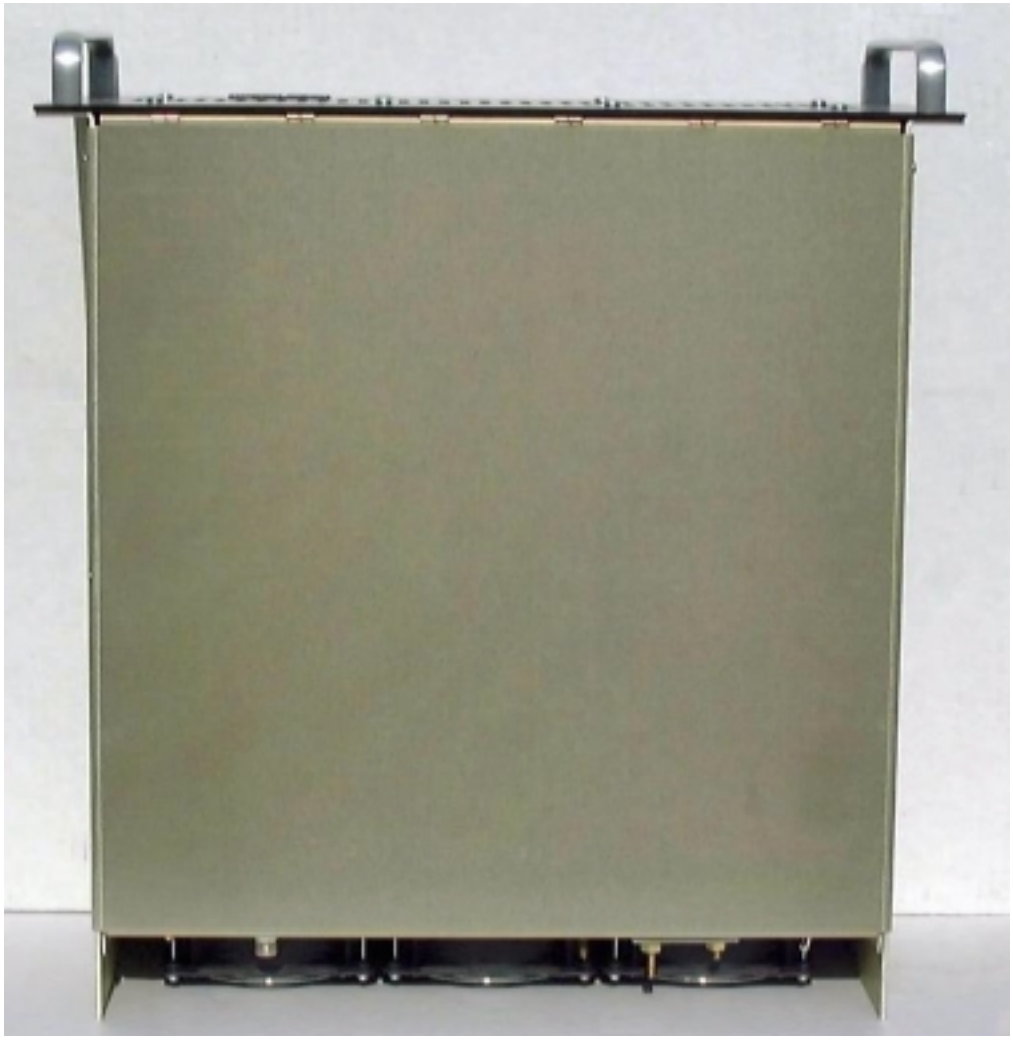
6.4 Photo: EUT Rear View.

6.5 Photo: EUT Side View

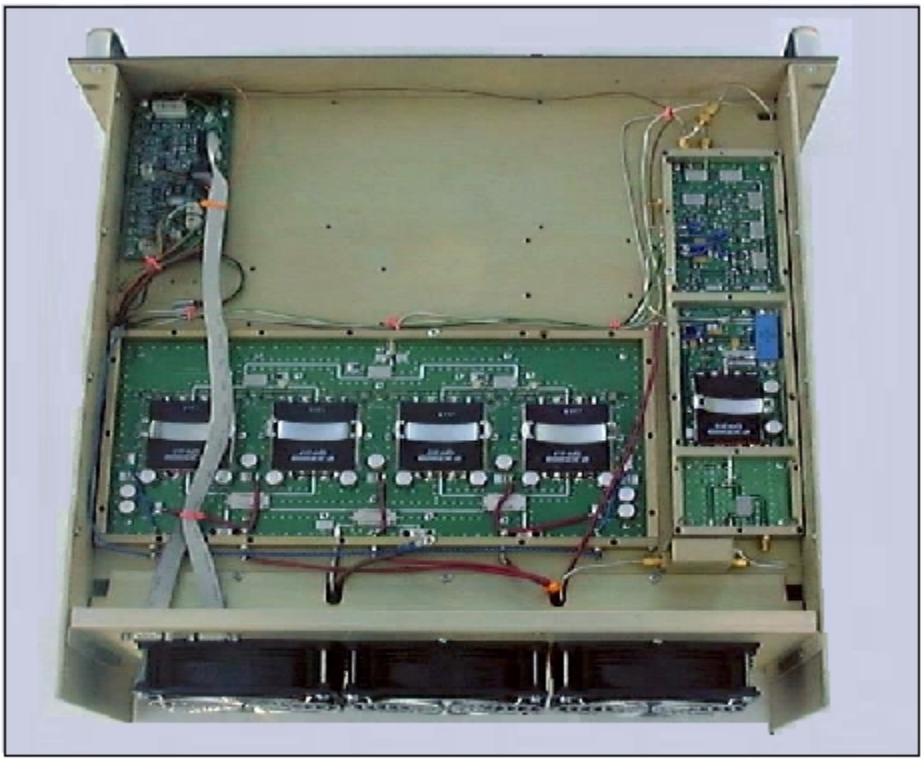




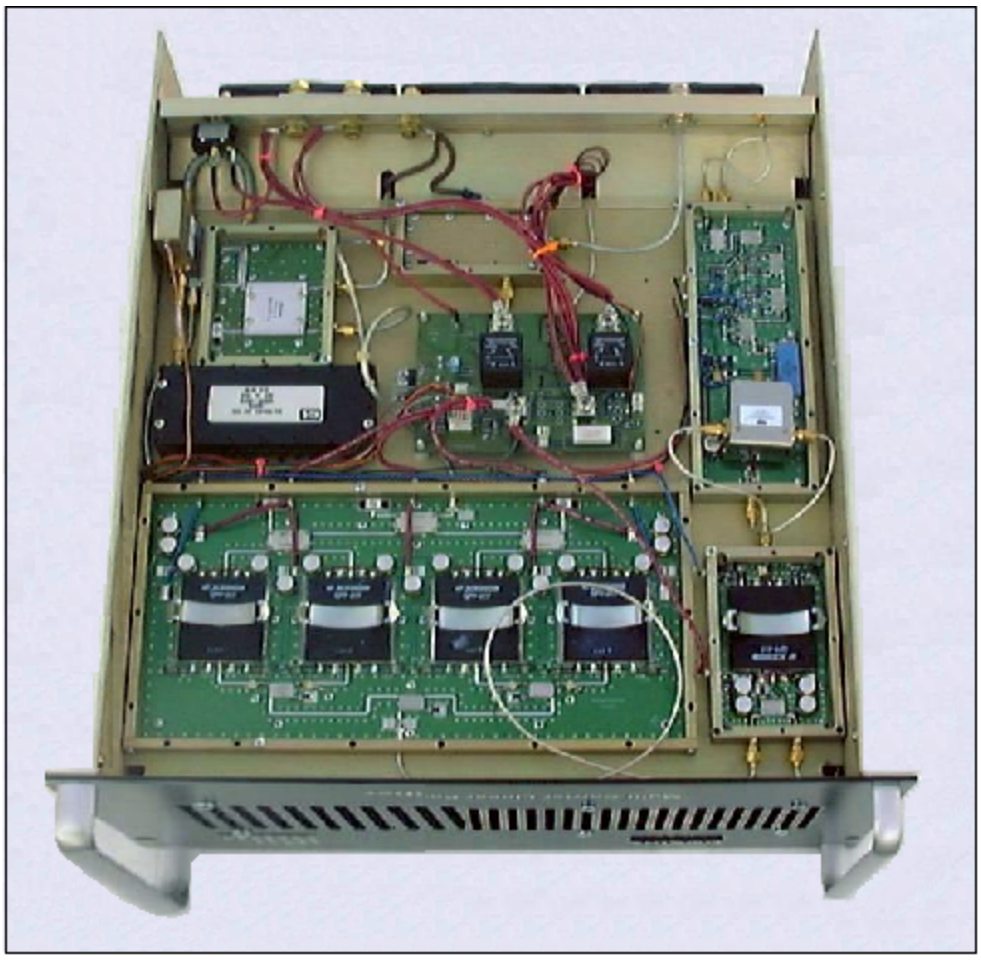
6.6 Photo: EUT Bottom View



6.7 Photo: EUT Top View (with cover removed)



6.8 Photo: EUT Bottom View (with cover removed)



6.9 Photo: EUT PCB Circuitry Layout (Refer to exhibit B)

Appendix A

TEST EQUIPMENT USED

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A complete list of test equipment used for each test can be found in their perspective test procedure. The equipment absolute performance calibration, of the equipment requiring calibration, is performed on an as needed basis in accordance with MIL-STD-45662. However, calibration periods do not exceed one (1) year. The test equipment is capable of making measurements within tolerances of at least ±2 dB amplitude and ±2% frequency deviation. Equipment certifications showing traceability to NIST (National institute of Standards and Technology) are maintained on file at Garwood Laboratories in Placentia, CA and Bravo Tech in Los Alamitos, CA. All equipment is checked and verified for proper operation before and after each series of tests.

A.1 Specific Equipment Used

Manufacturer	*Test Equipment*	*Model No./Asset No.*	*Serial No.*	*Freq. or Range*	*Cal. Due Date*
Sorenson	DC Power Supply	DCR40-125A	900	0–125A	CIP*
Hewlett-Packard	Signal Generator	8648C	3537A02356	100kHz-3200 MHz	11/20/00
Narda	Directional Coupler	3020A	30332	.05–4GHz	10/26/00
Narda	Directional Coupler	3004-20	10835	4–10GHz	10/26/00
JFW	Attenuator	50FHC-010-50	N/A	10dB	CIP
JFW	Attenuator	50FHC-060-50	N/A	6dB	CIP
JFW	Attenuator	50FHC-003-10	N/A	3dB	CIP
Weinschel	Attenuator	910-20-11	9175	0 – 20dB	CIP
Hewlett-Packard	Spectrum Analyzer	E4407B	US39010169	9kHz–26.5GHz	01/14/01
Bird Electronics	50 ohm Load	8404	1177	600W	CIP
Hewlett-Packard	Signal Generator	8656B	2703U01835	0.1MHz-990MHz	CIP
Rohde & Schwarz	Signal Generator	SMIQ 03	DE26622	300kHz–3.3GHz	12/01/00
Agilent	Network Analyzer	8720ES	US39170083	.05 – 20 GHz	04/20/01
Mini-circuits	RF Combiner	ZA4PD-2	09730	0.1 MHz – 6GHz	CIP
Hewlett-Packard	RF Power Sensor	8482H	2349A08983	1 – 18 GHz	12/21/00
Hewlett-Packard	RF Power Meter	EMP-441A	US37480524	.3 – 1 GHz	12/21/00
MicroCoax	RF Coaxial	UAF210B-0-0360	N/A	.5 – 10GHz	CIP
Hewlett-Packard	RF Coaxial	8120-563997W	N/A	.5 – 10GHz	CIP
Hewlett-Packard	Spectrum Analyzer	6566B	20257	100kHz-2.5 GHz 2GHz-22GHz	01/04/01
ETS	Horn Antenna	DRG	N/A	18 GHz	05/15/01
Hewlett-Packard	Preamplifier	HP8449B	20003	1.0GHz- 26.5GHz	CIP
Time Microwave	RF Coaxial Cable	LMR600	20180	DC-5GHz	02/24/01

* CIP – calibrate in place

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Appendix B

SUPPLEMENTAL TEST DATA

Basic Standard	*Details*	*Data Format*	*Page No.*
FCC Part 90 FCC Part 15 FCC Part 2	RF Output Power	Printed	33-35
	Modulation Characteristics	Printed	36-38
	Occupied Bandwidth	Printed	39-49
	Antenna Terminal Spurious	Printed	49-109
	Radiated Spurious Emissions	Tabulated	109-110
	Conducted Emissions	Plotted	111-116

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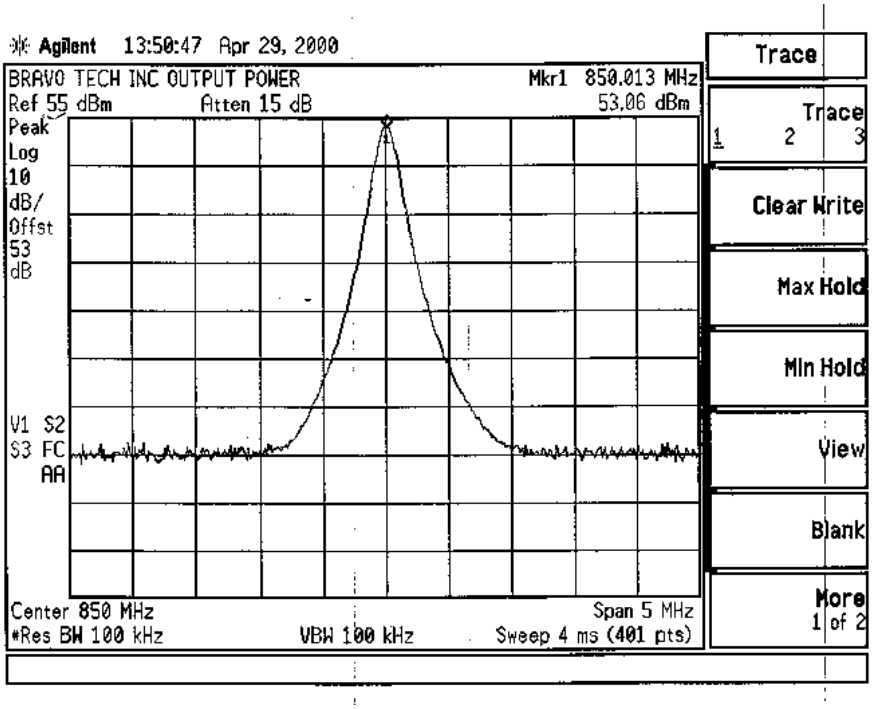

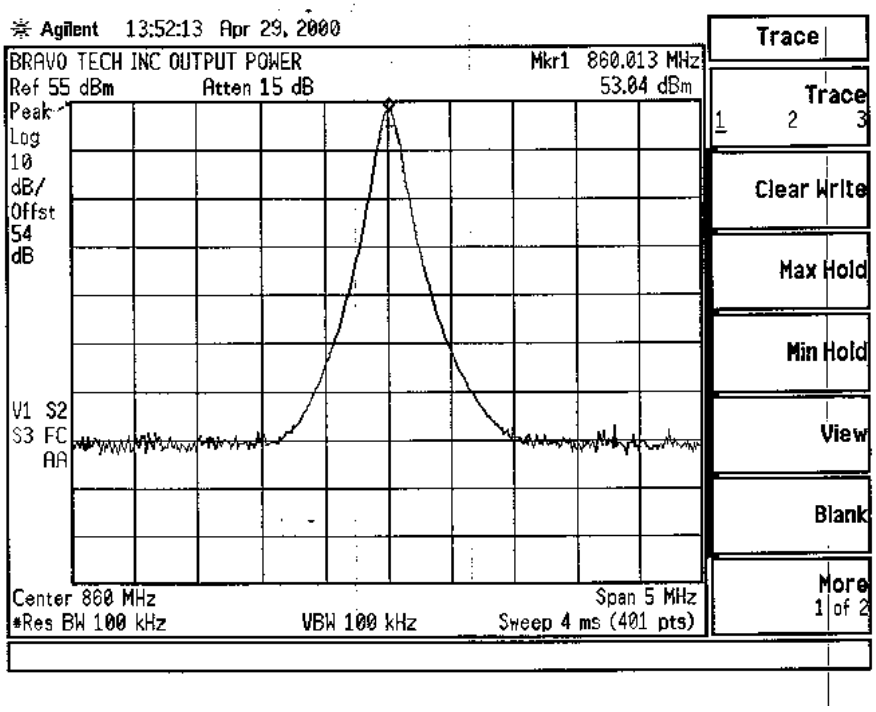

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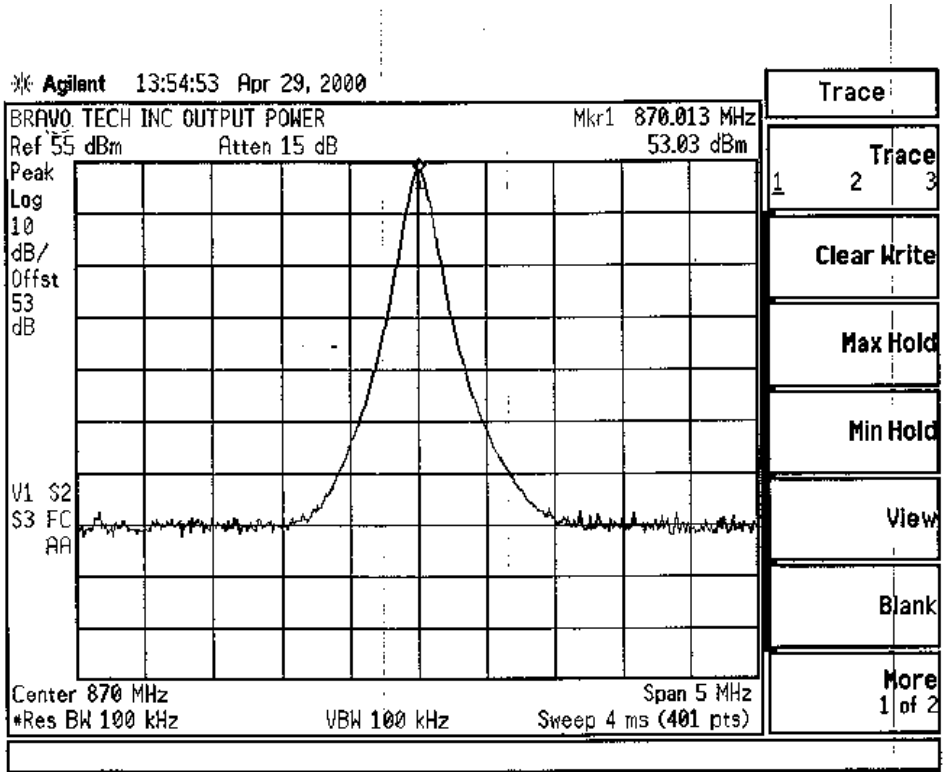

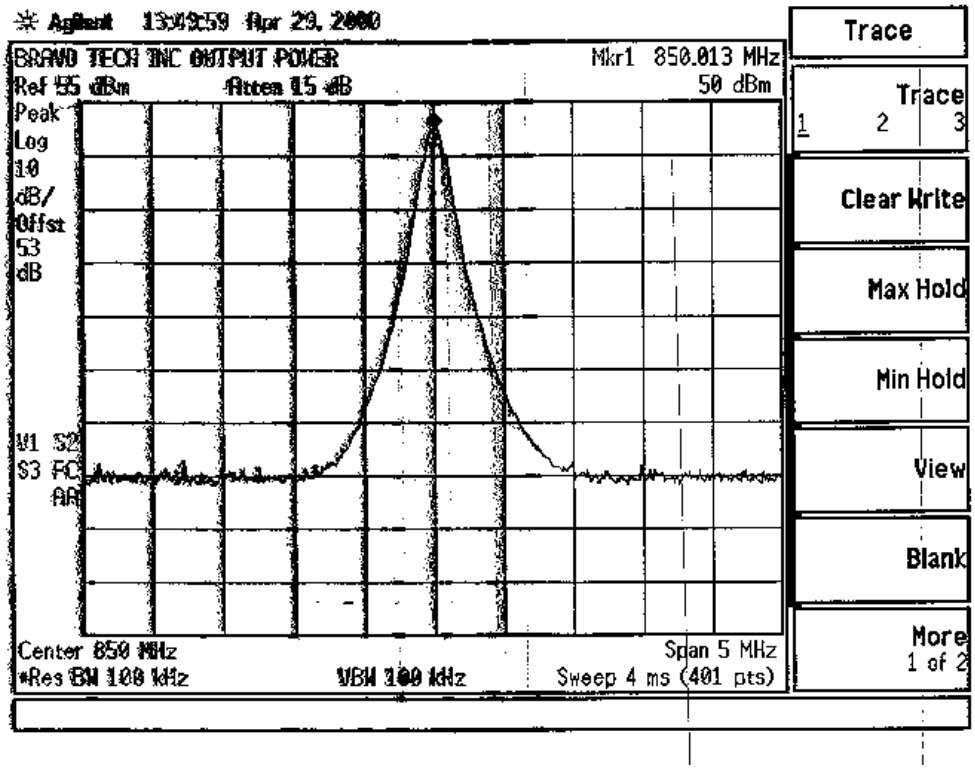

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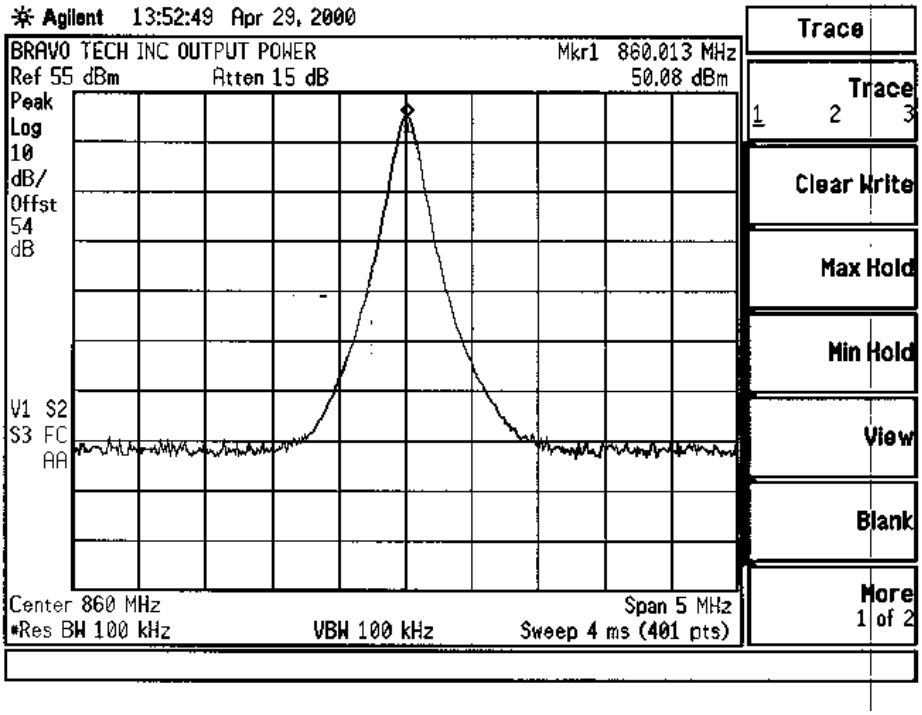

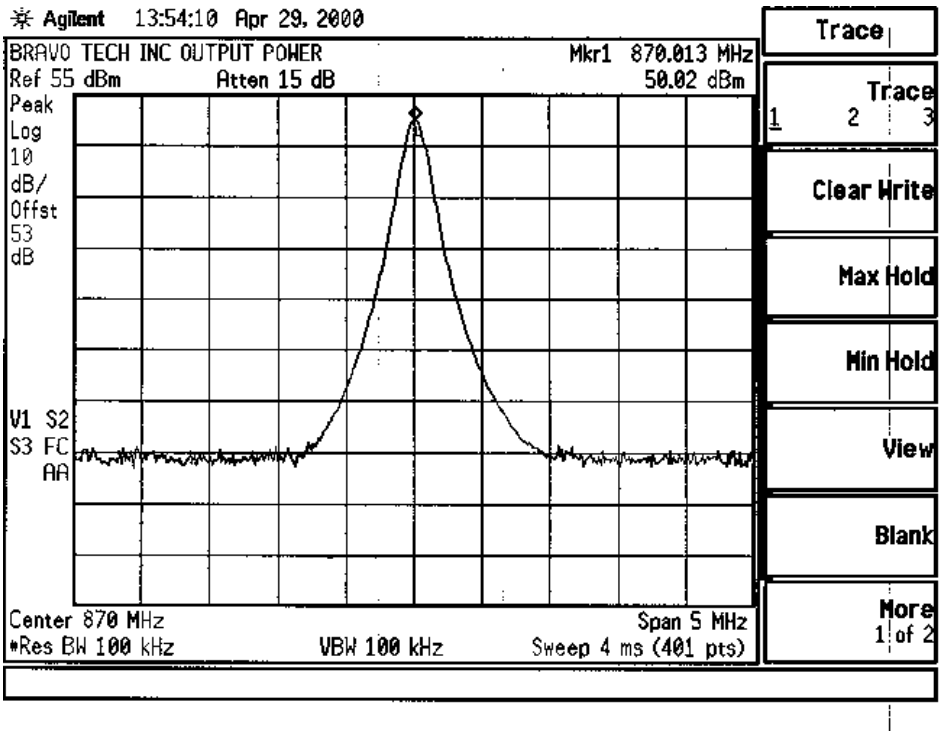

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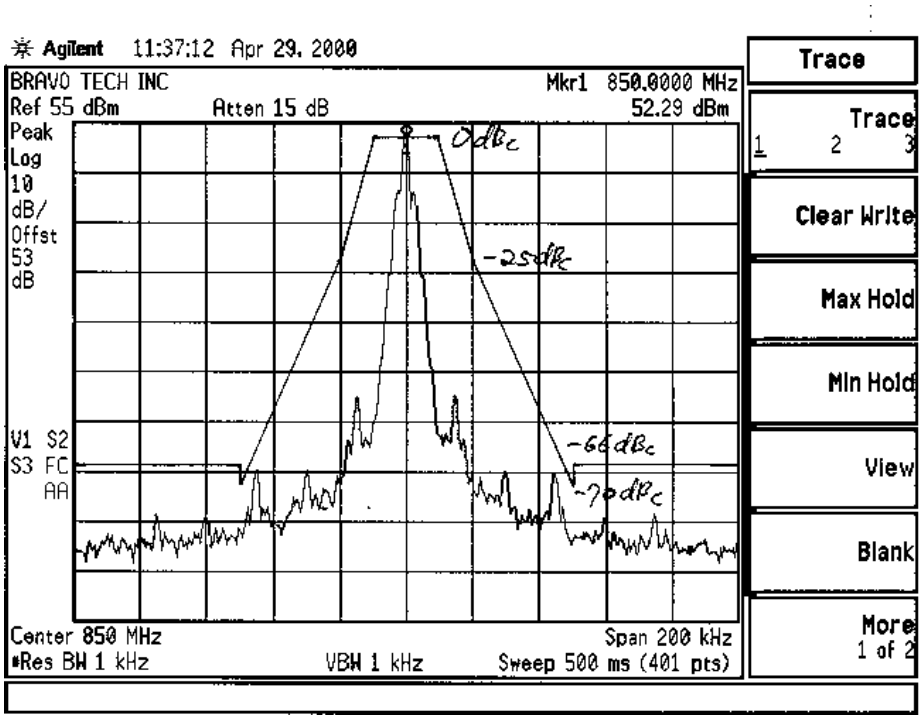

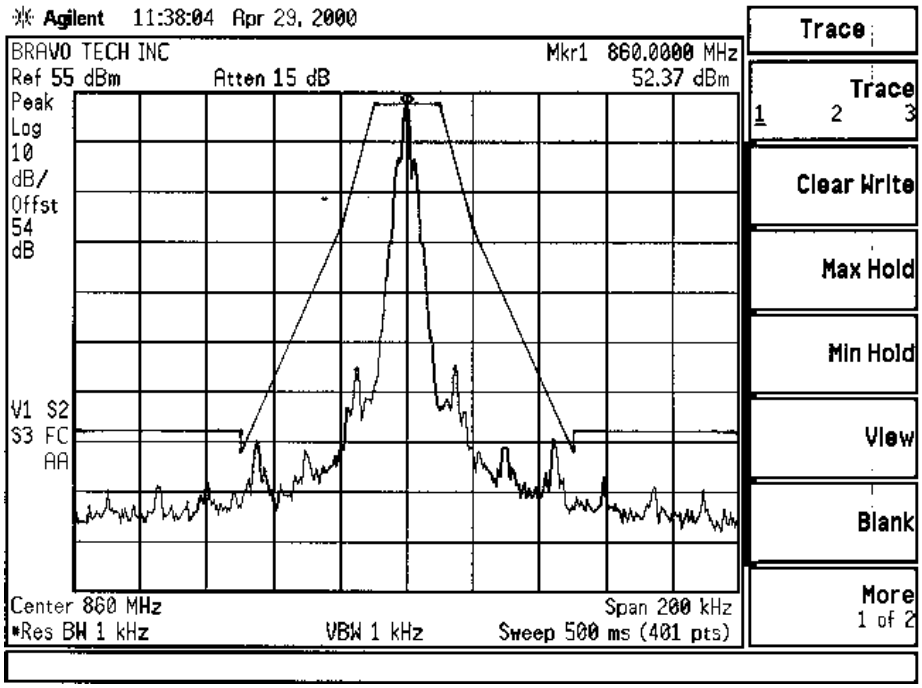

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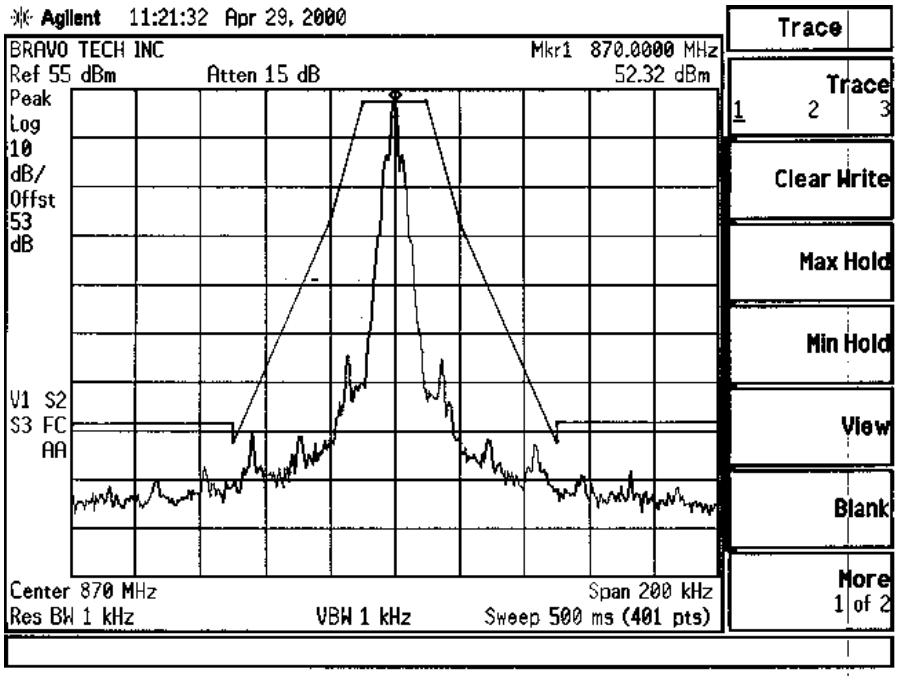

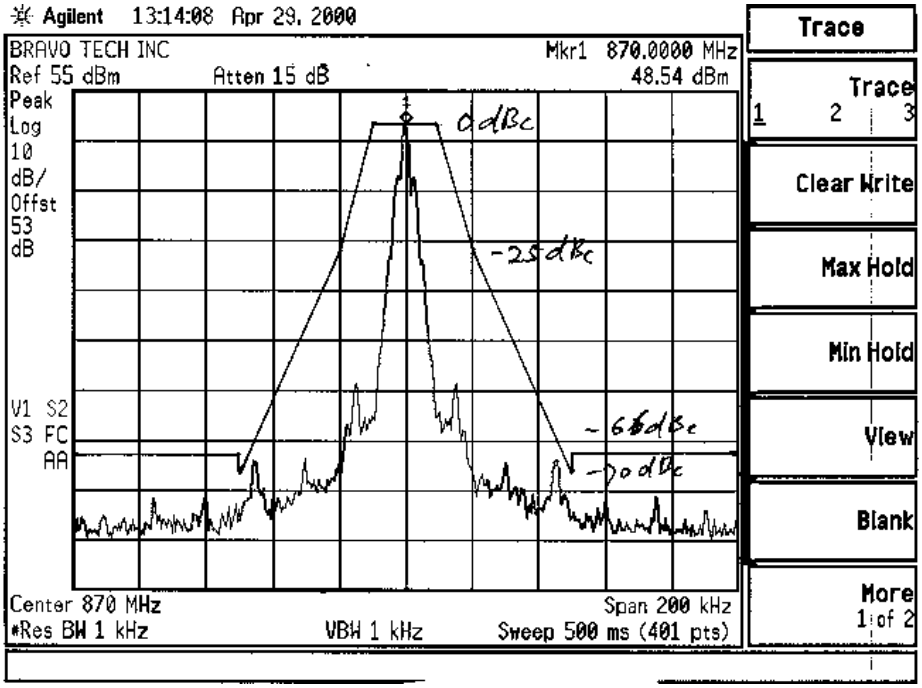

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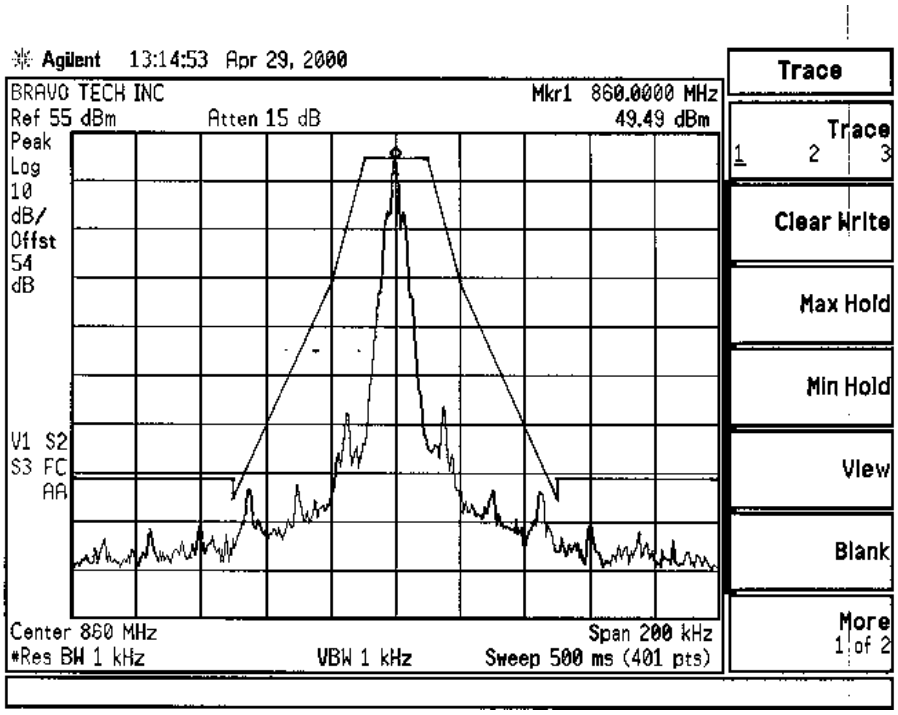
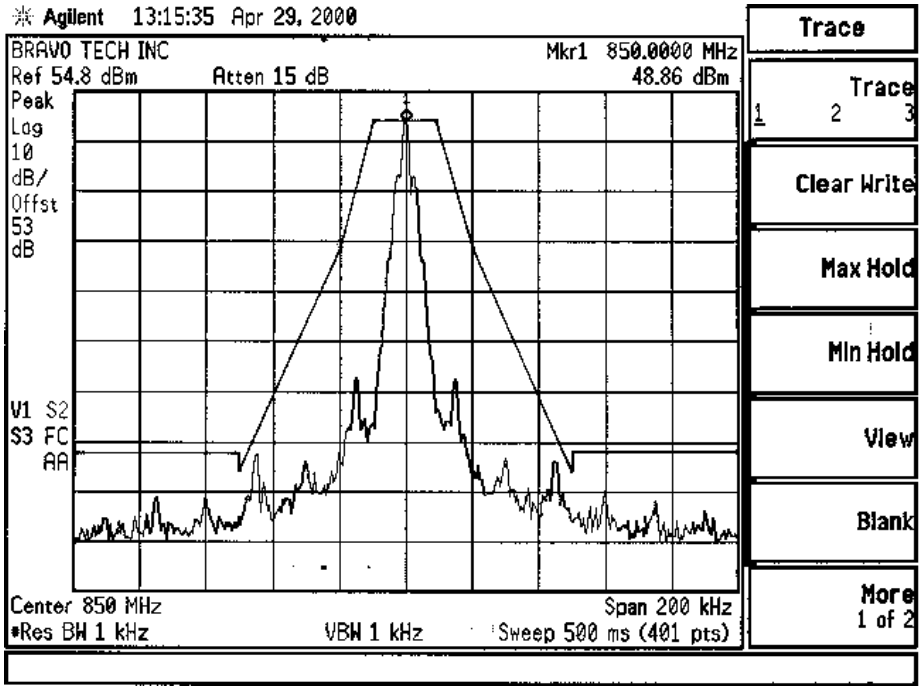
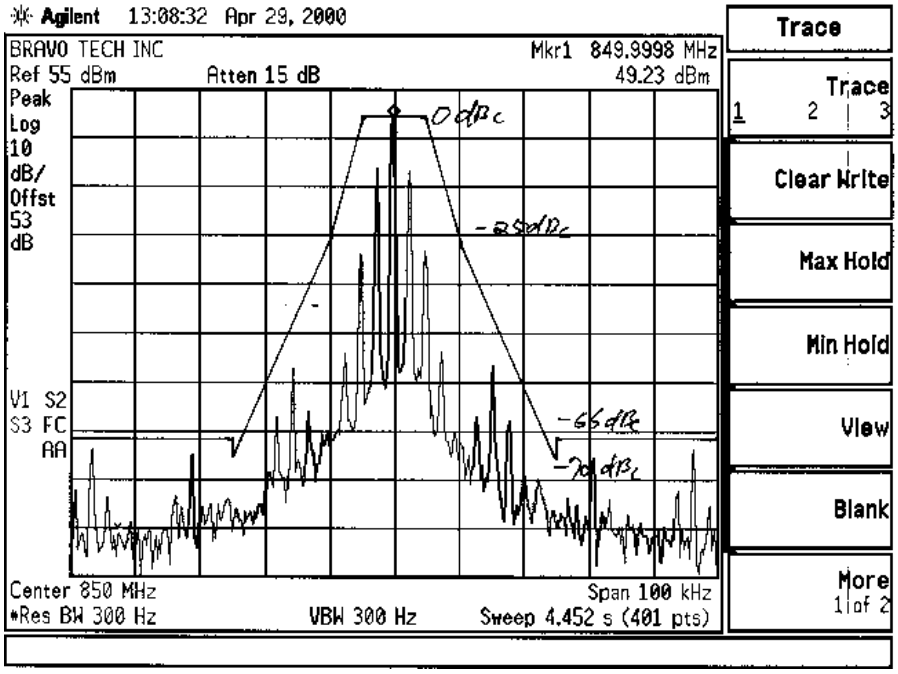
Bravo Tech, Inc.

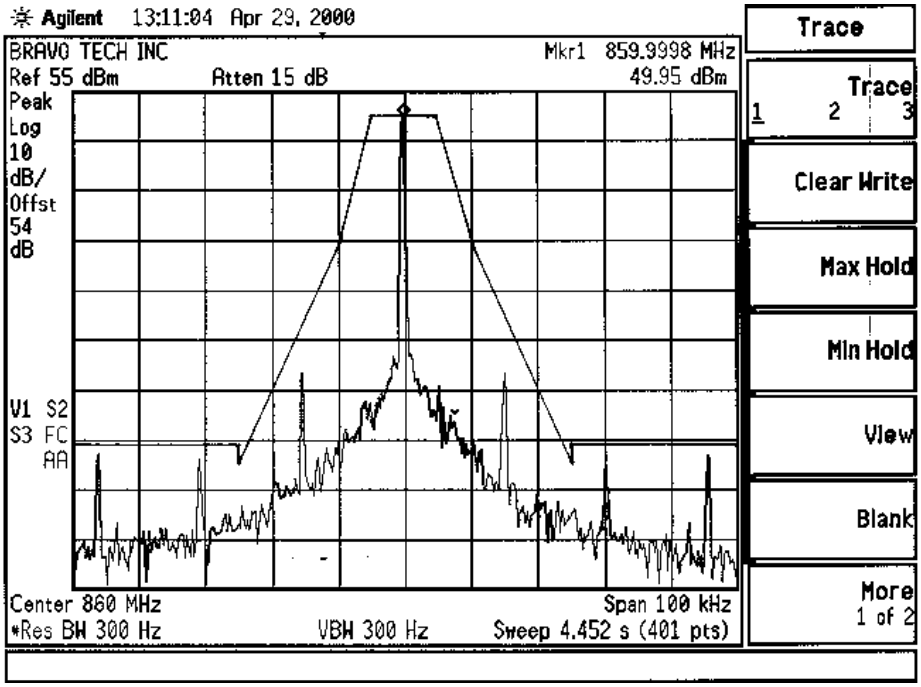




BTI

Bravo Tech, Inc.





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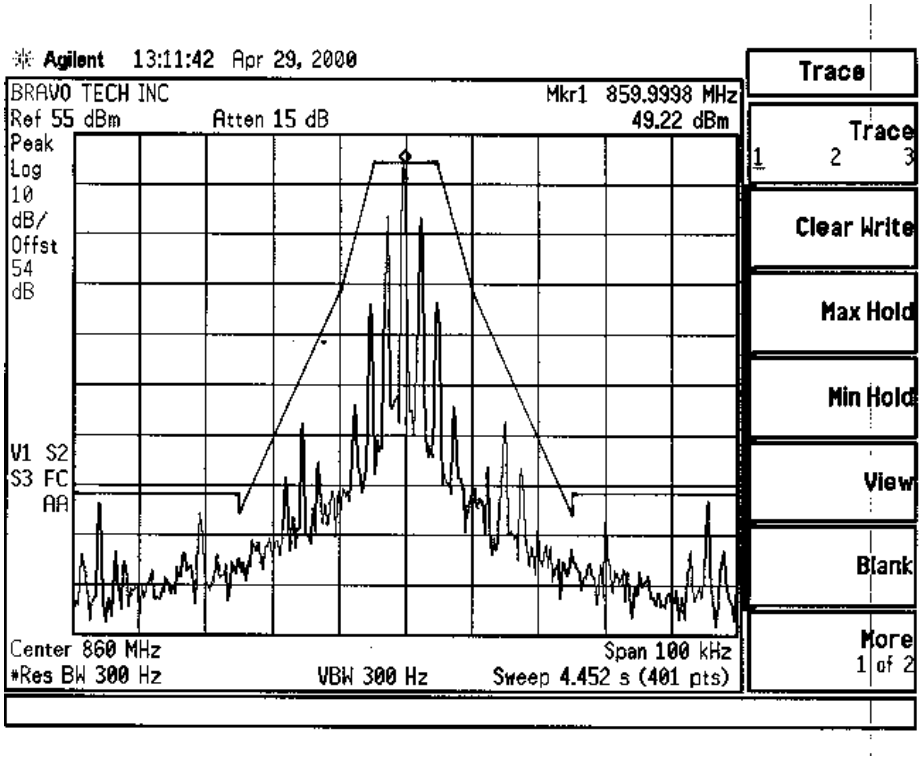
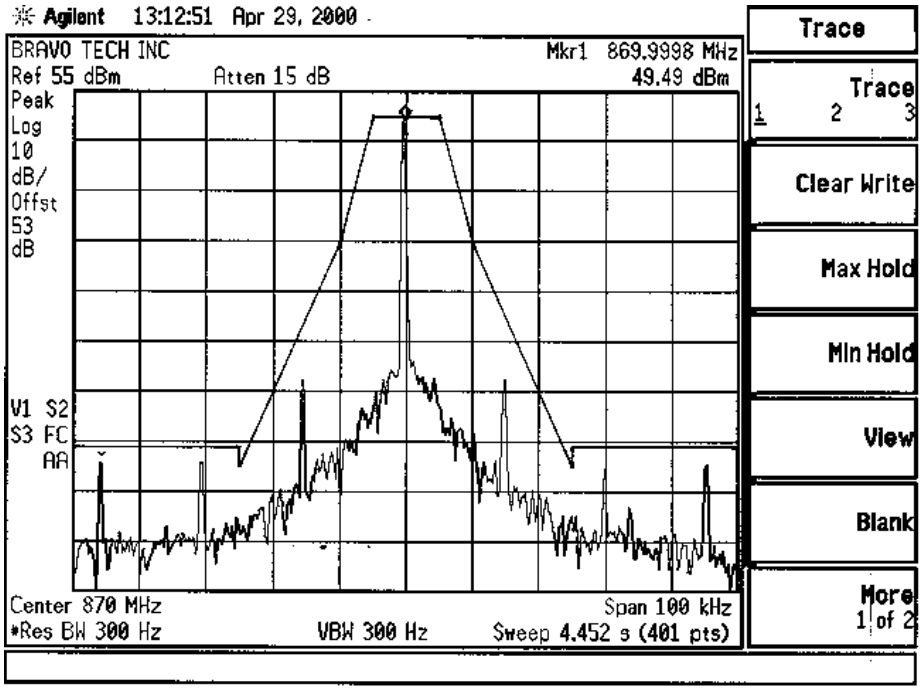
Bravo Tech, Inc.





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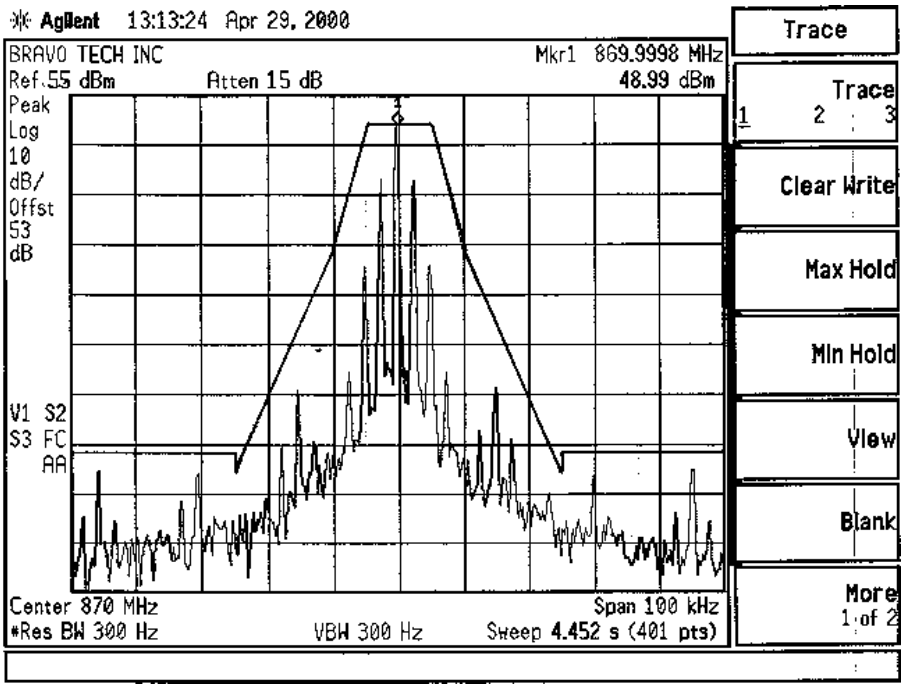
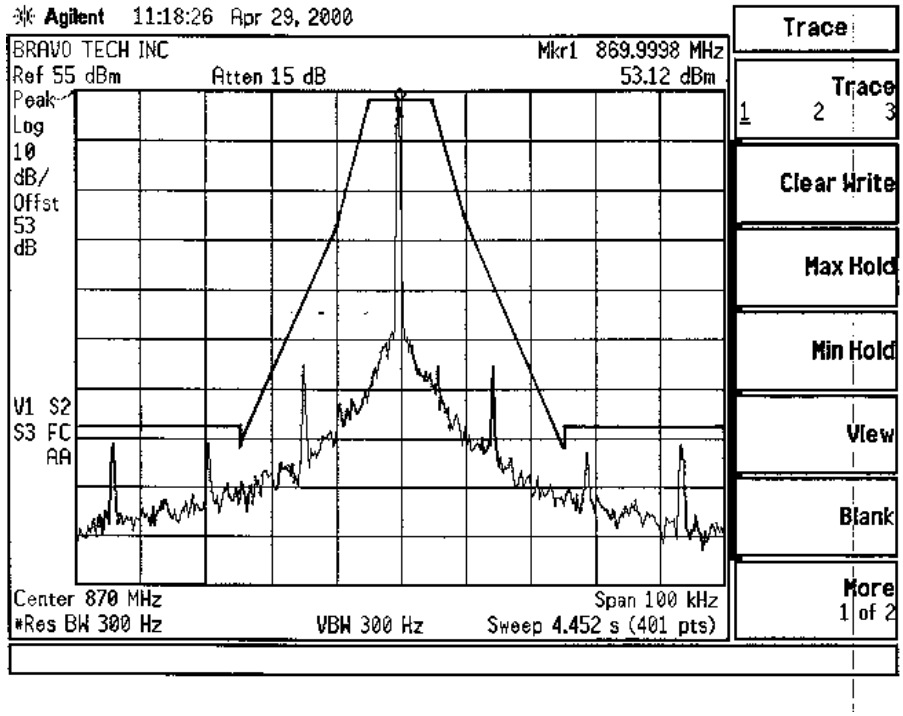
Bravo Tech, Inc.





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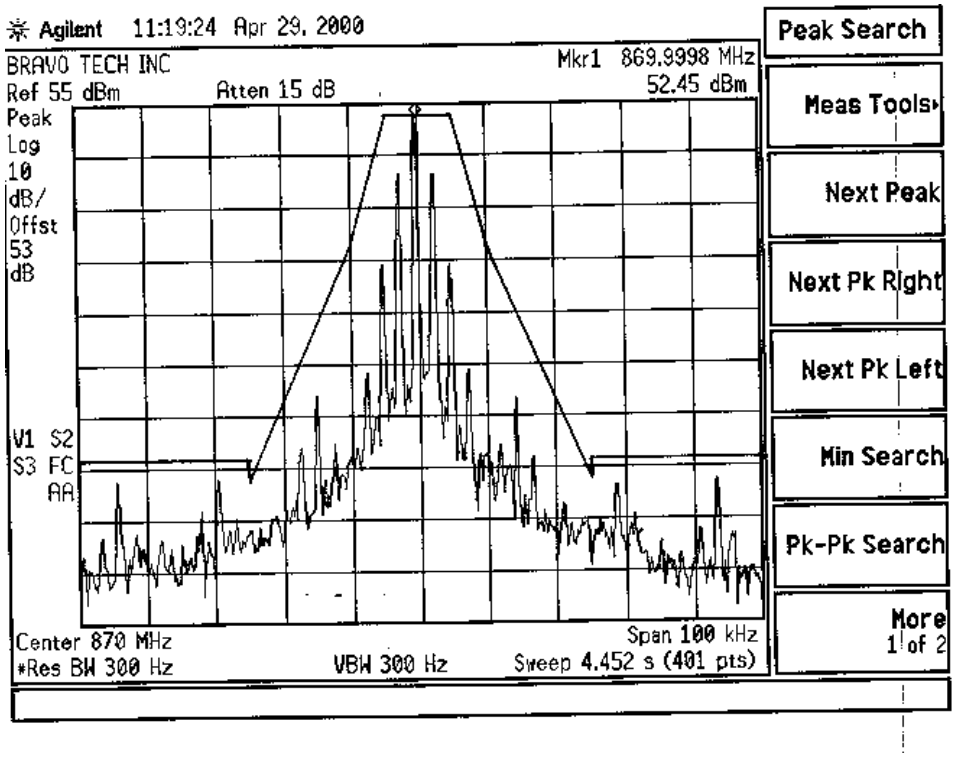
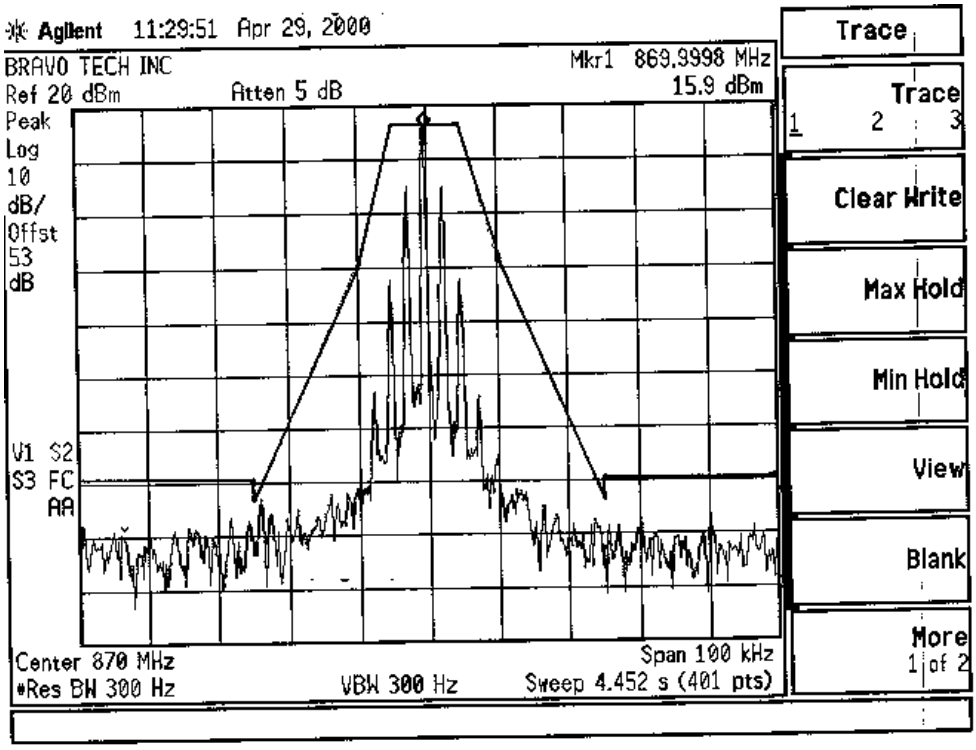
Bravo Tech, Inc.





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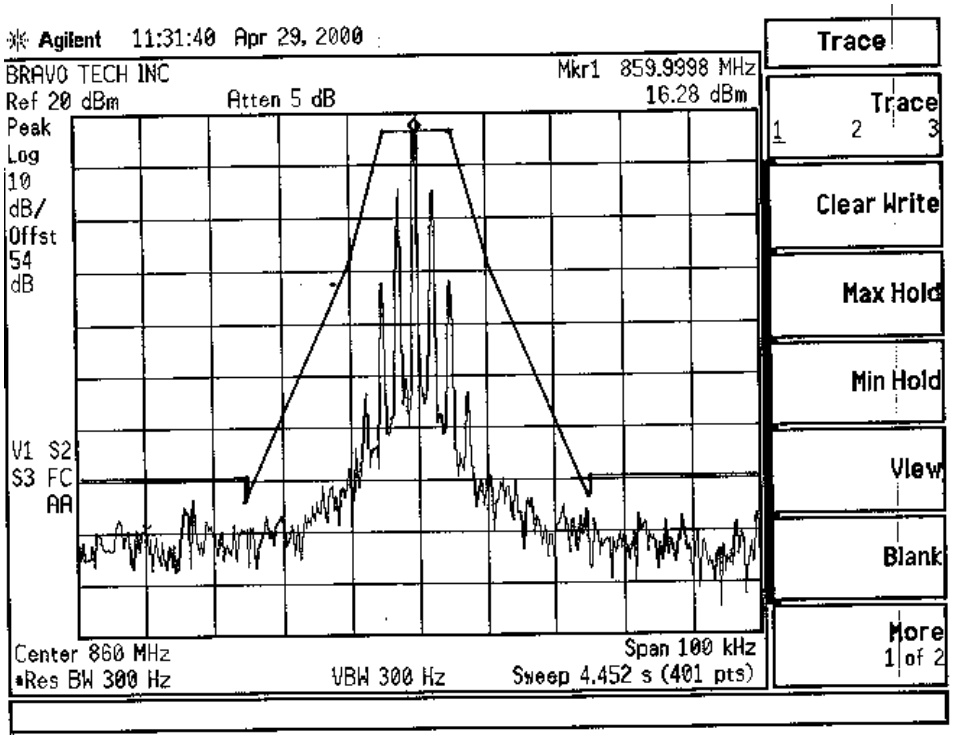

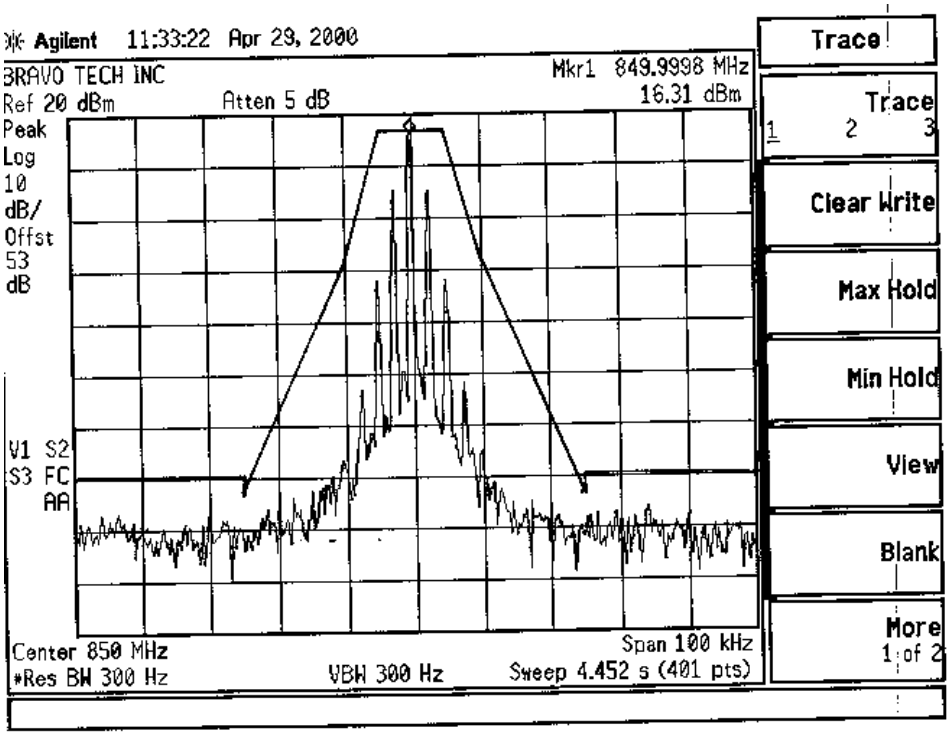

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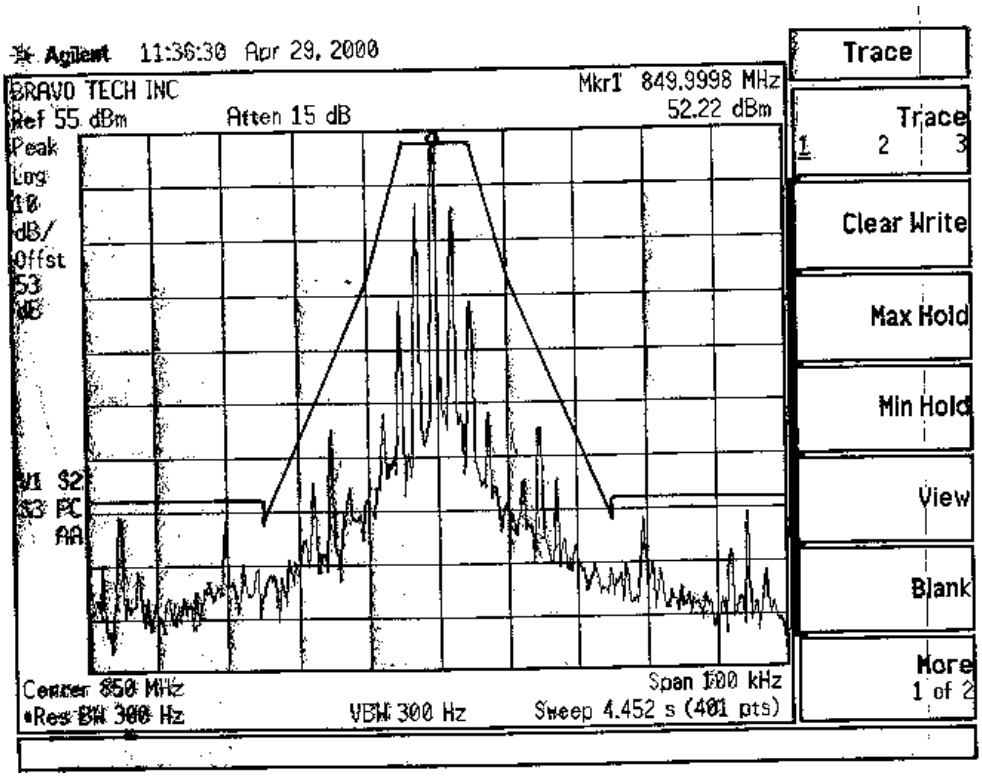

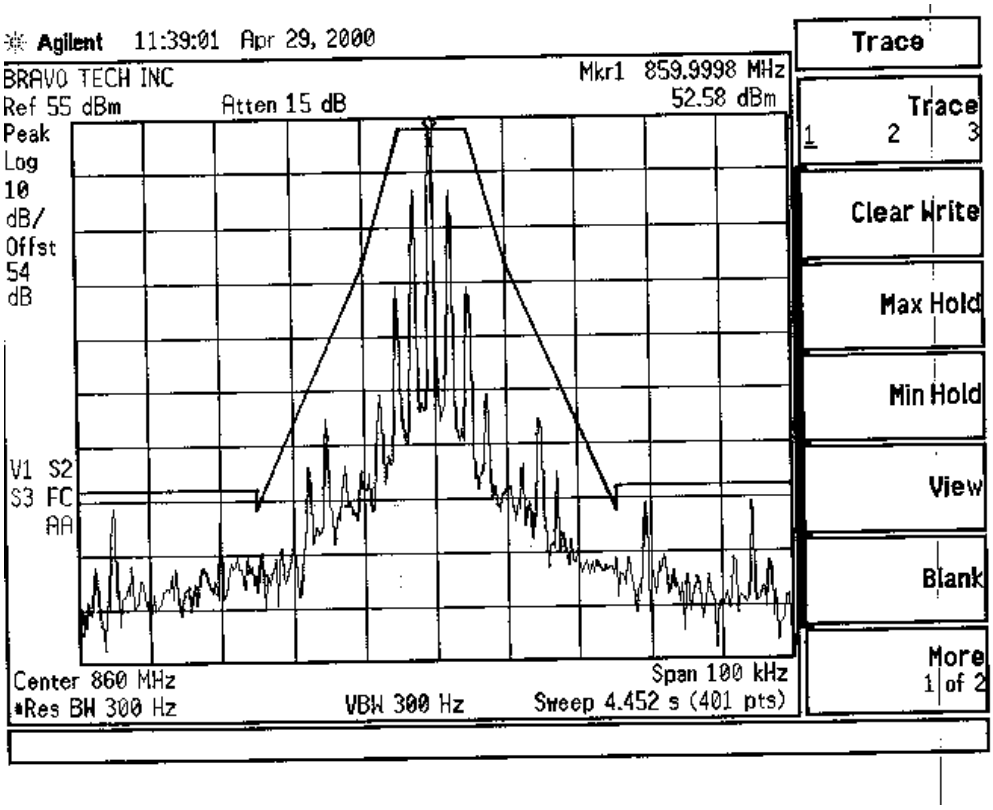

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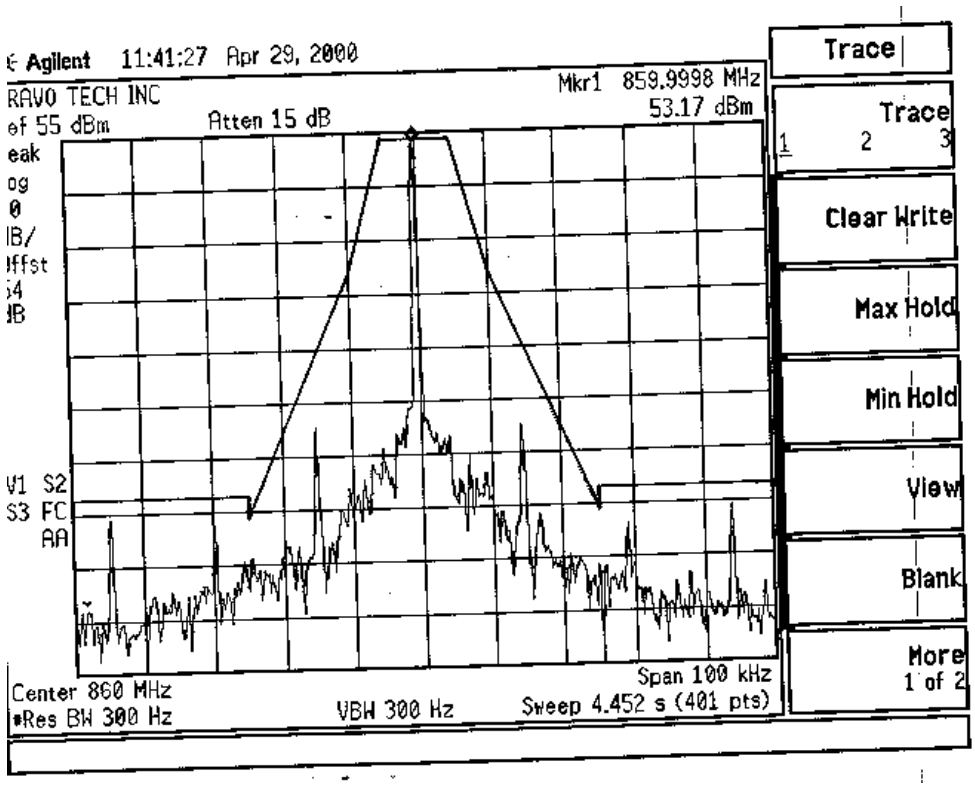

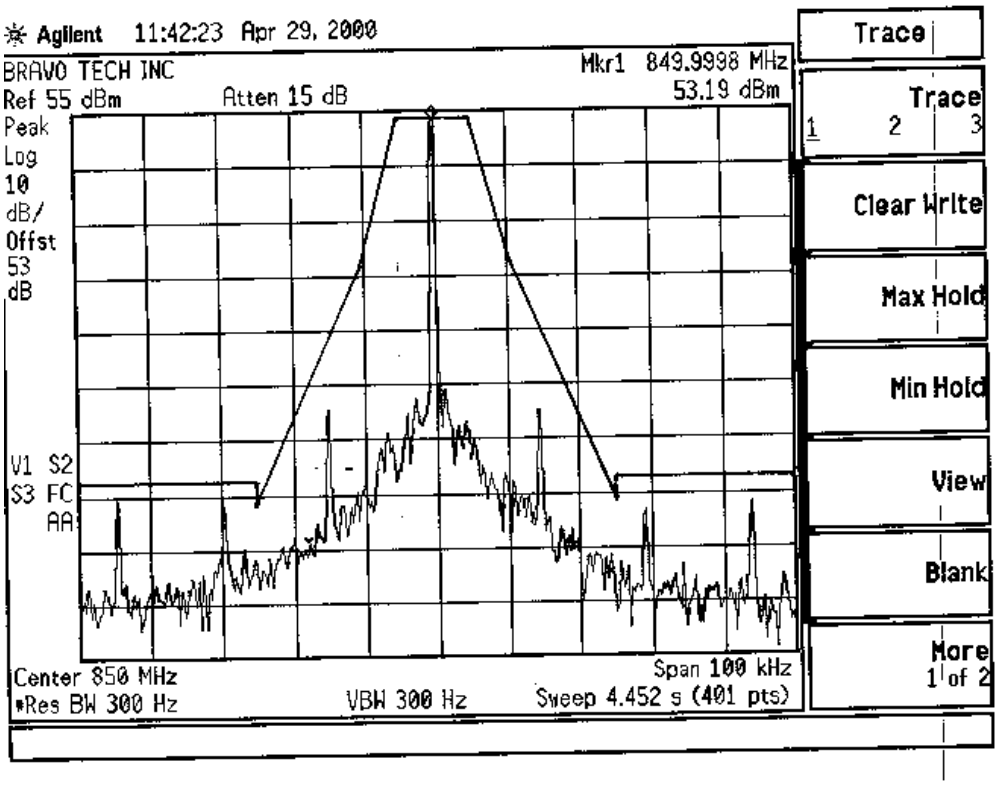

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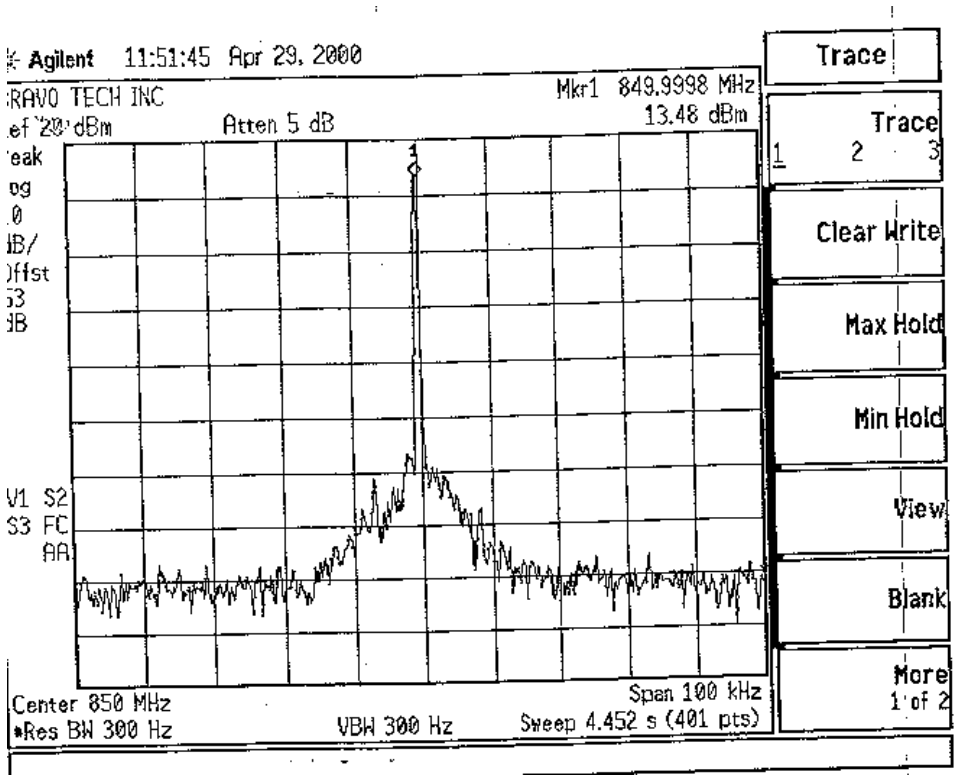

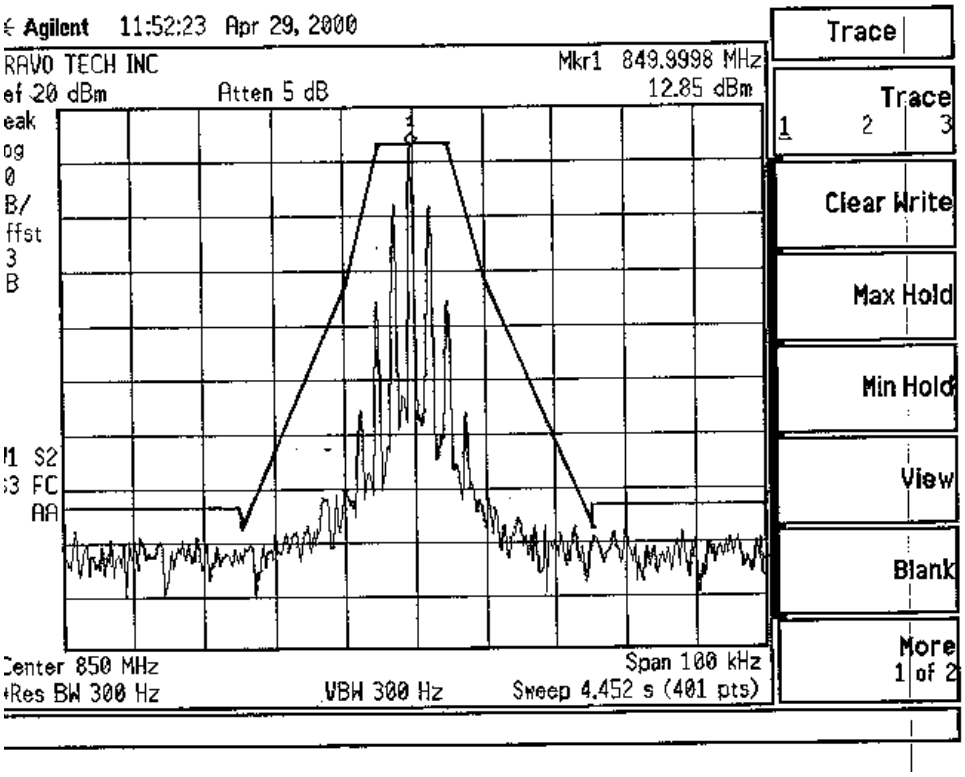

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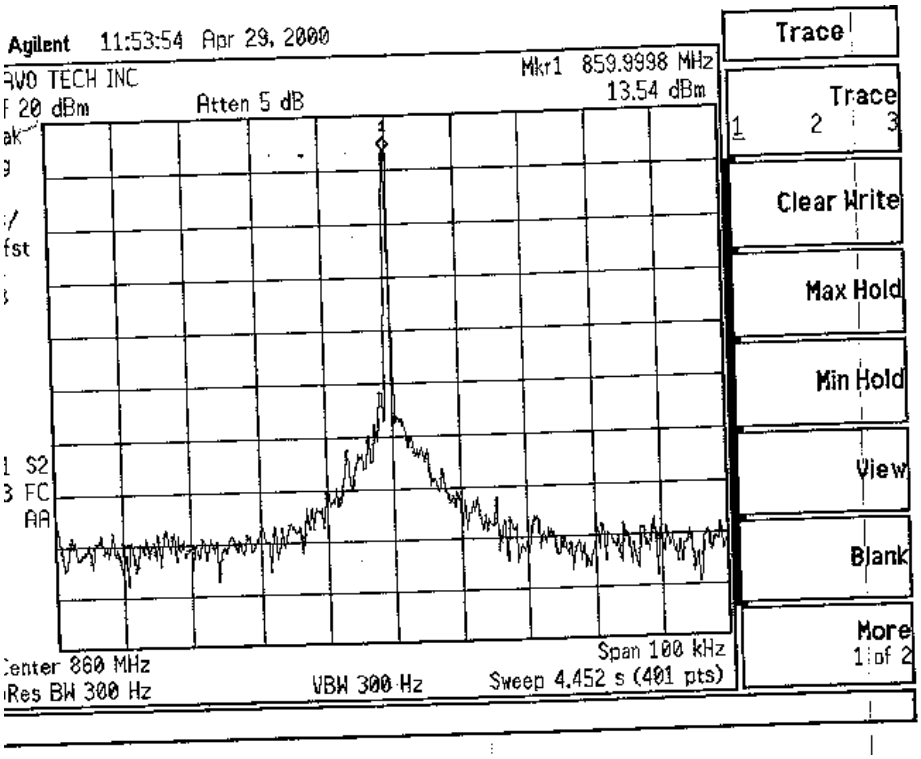

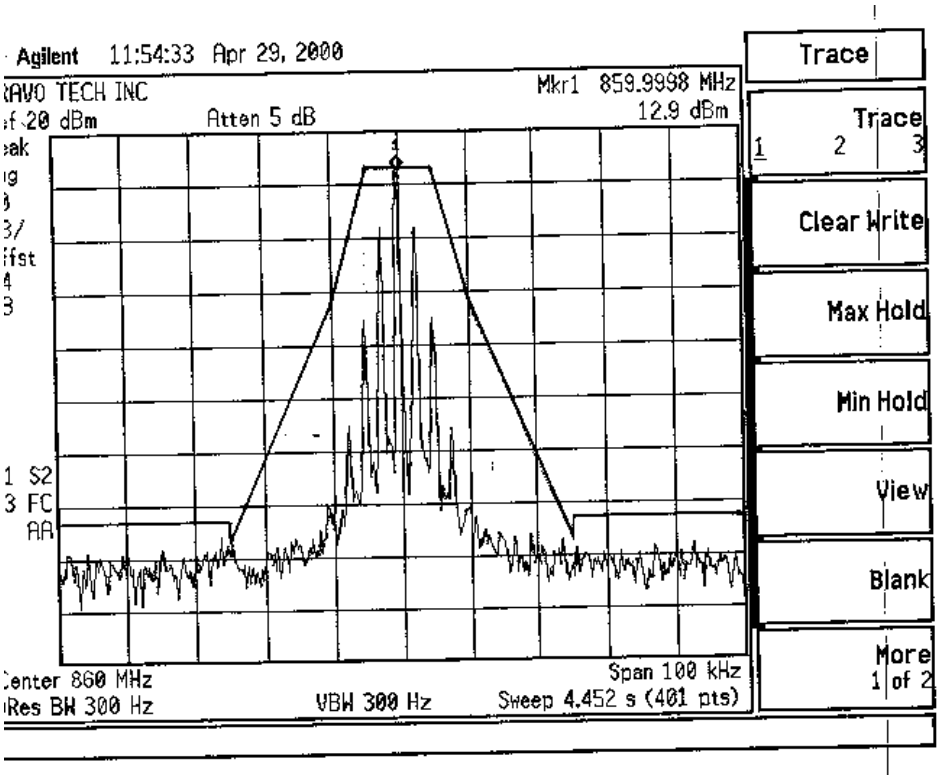

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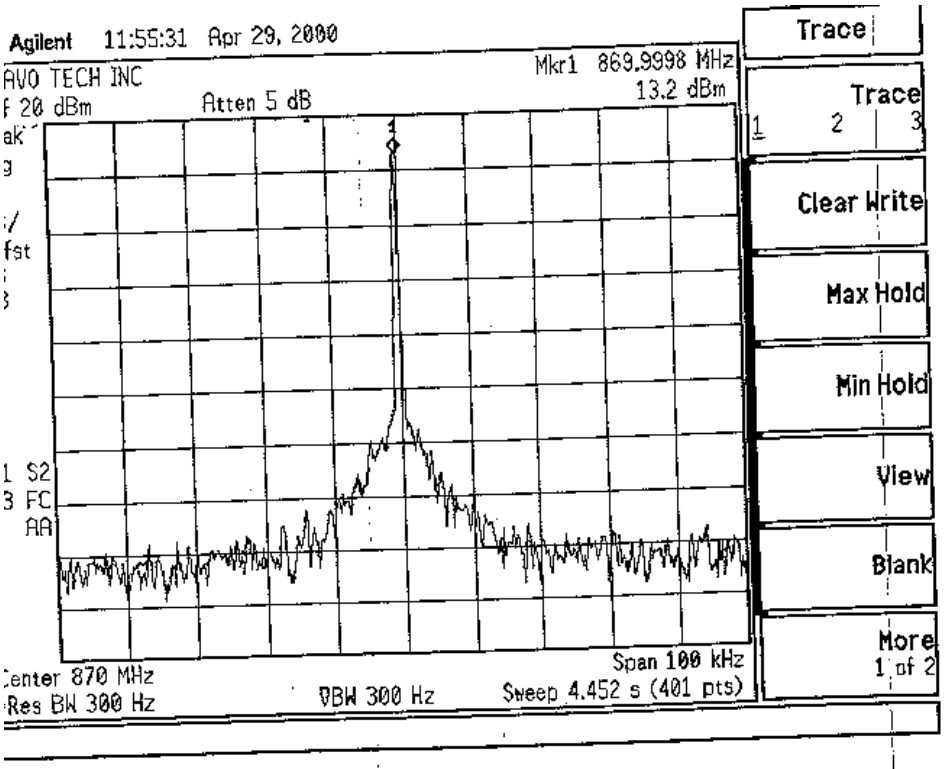

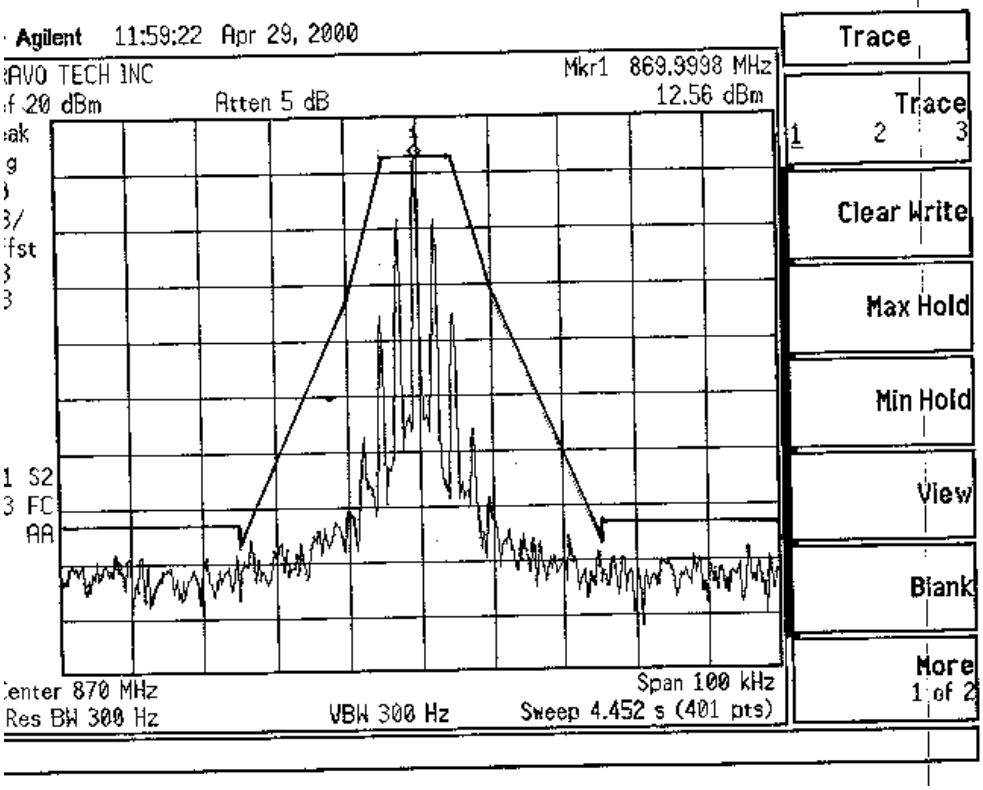

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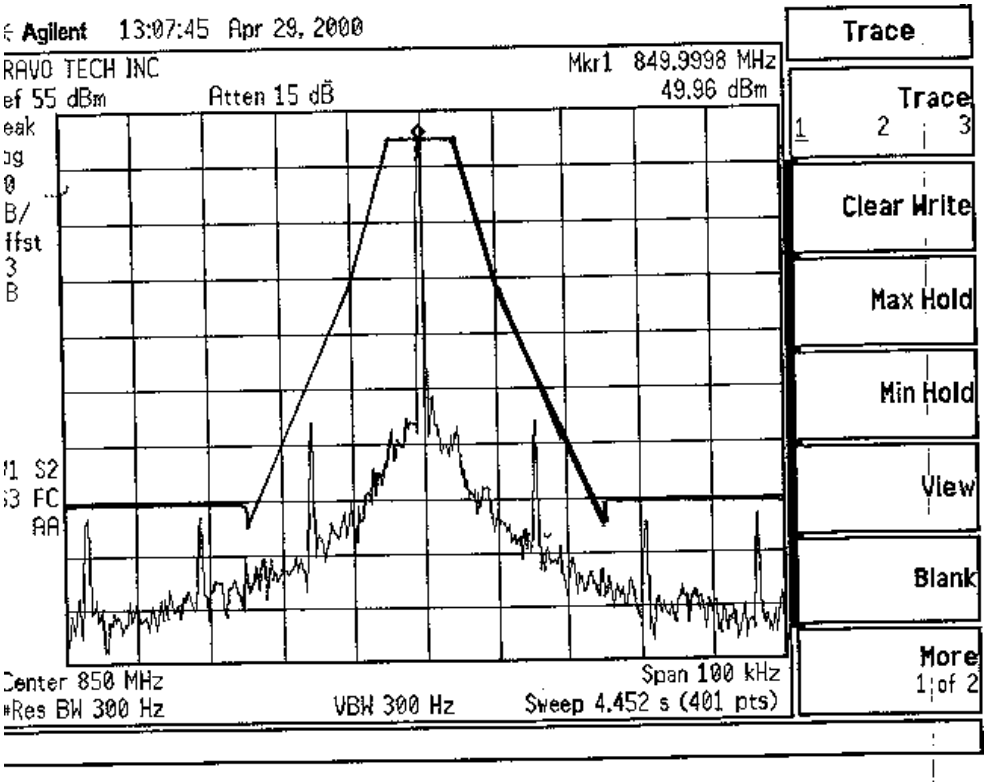
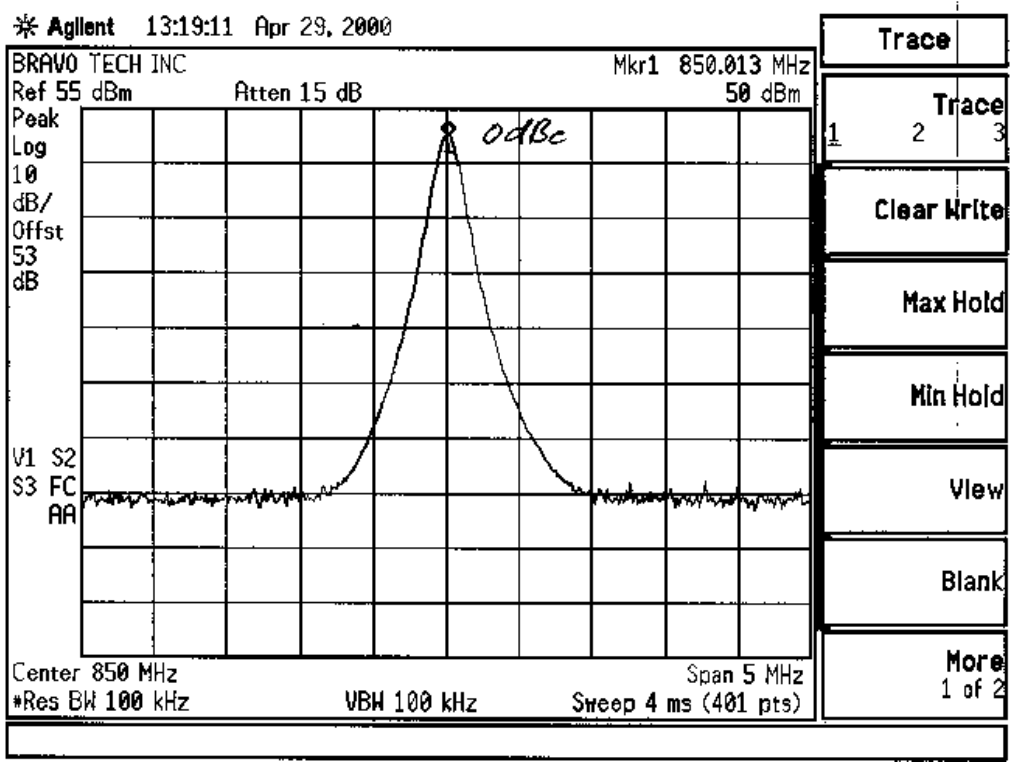
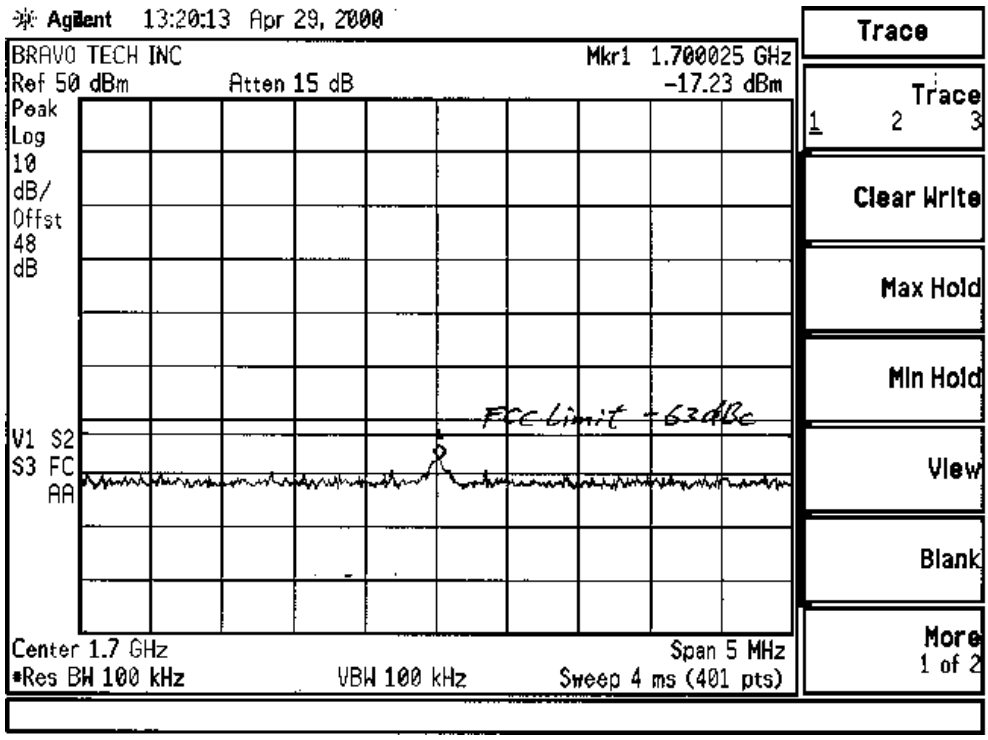
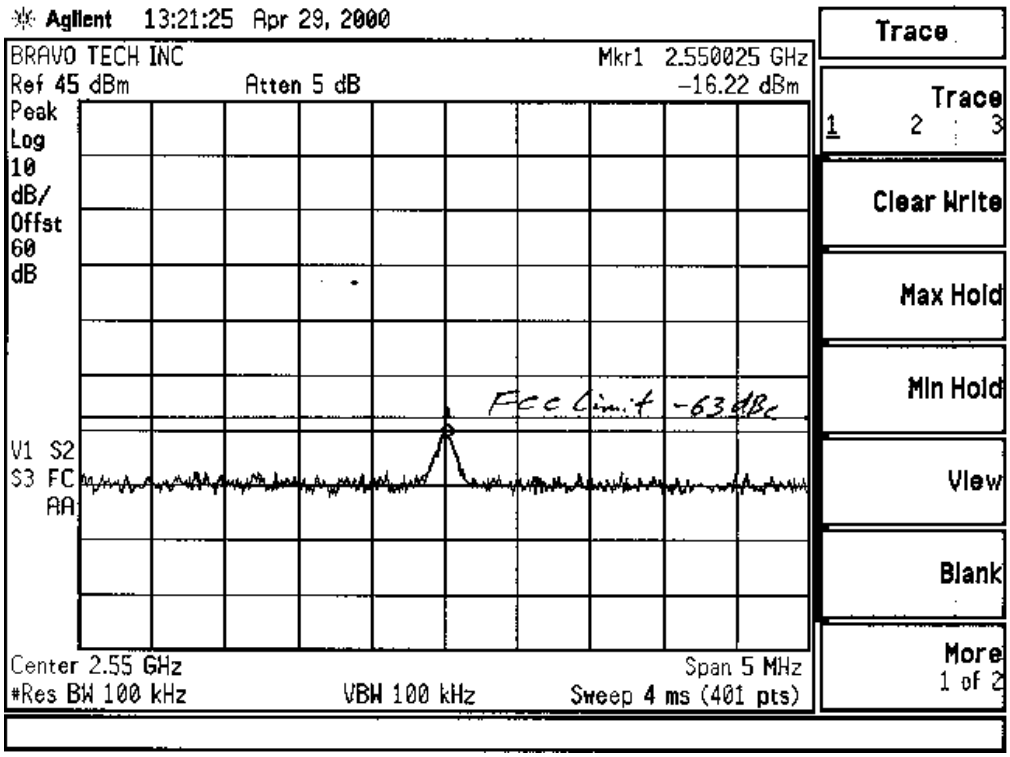


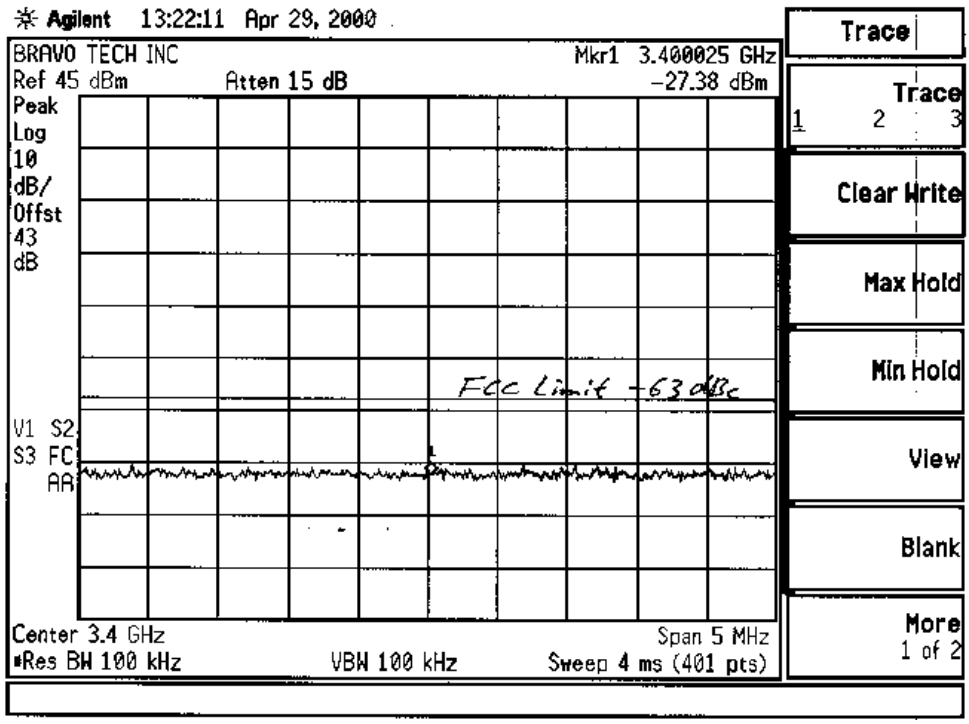


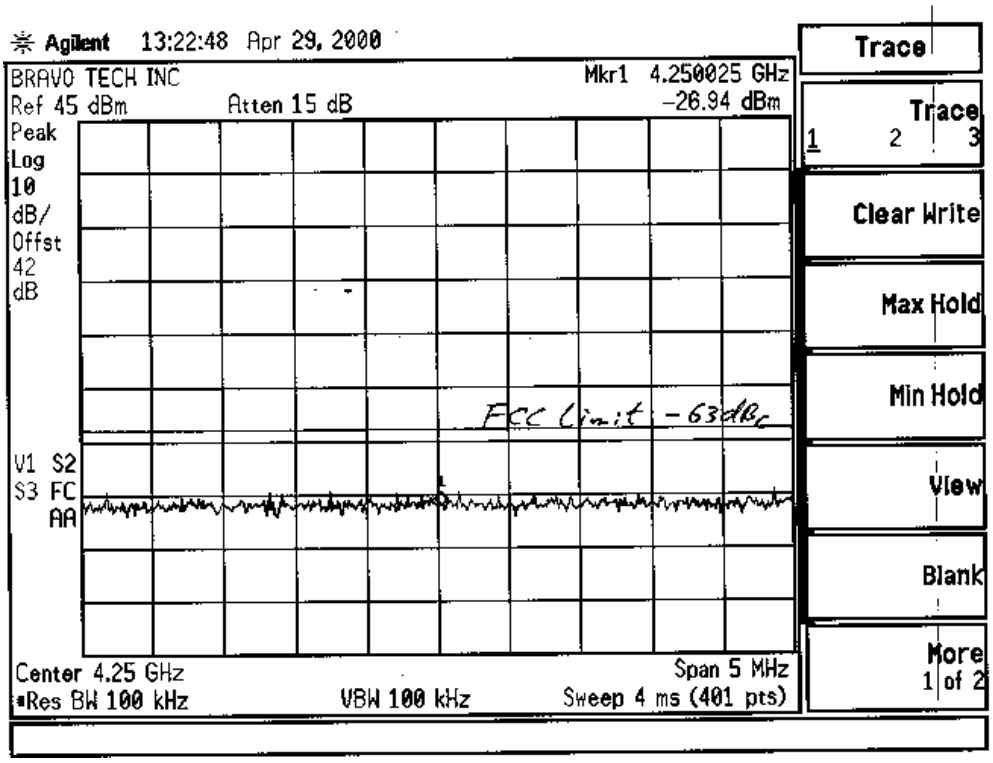

Agilent 13:20:13 Apr 29, 2000
BRAVO TECH INC
Ref 50 dBm
Atten 15 dB
Mkr1 1.700025 GHz
-17.23 dBm
Peak
Log
10
dB/
Offst
48
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 1.7 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


Agilent 13:21:25 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 5 dB
Mkr1 2.550025 GHz
-16.22 dBm
Peak
Log
10
dB/
Offst
60
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 2.55 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

BTI

Bravo Tech, Inc.





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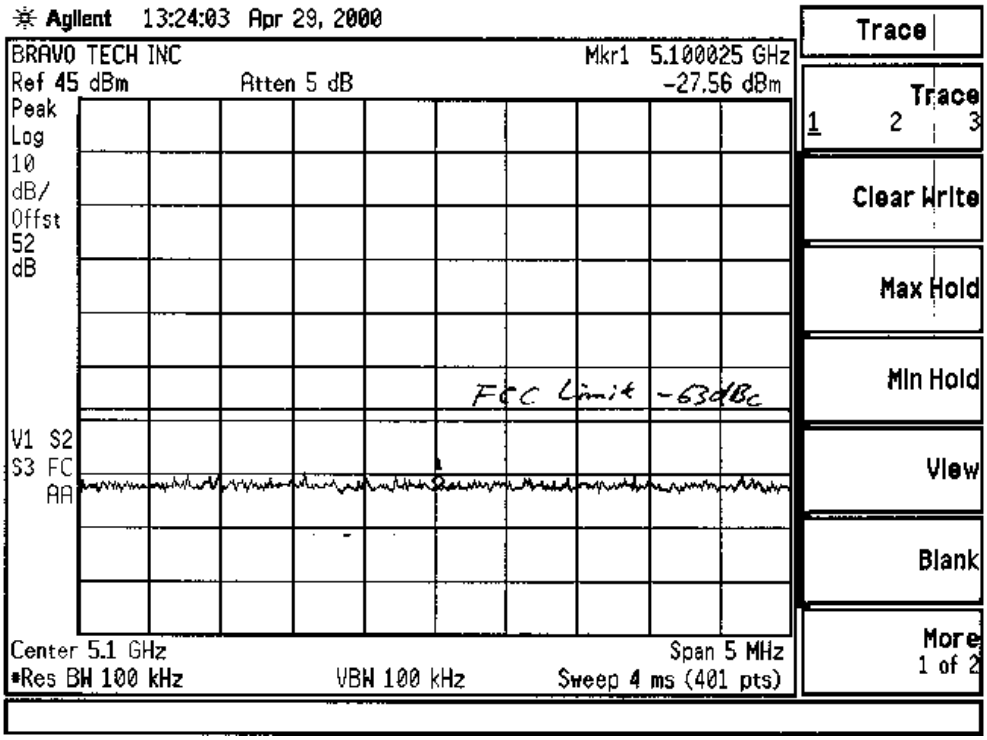
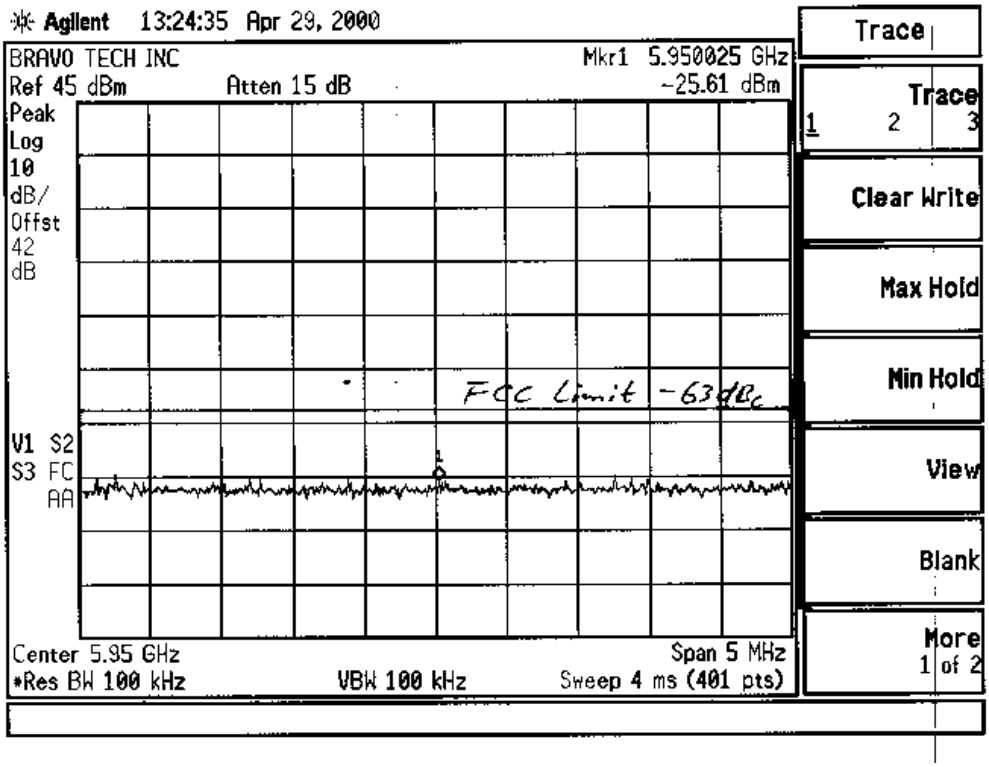
Bravo Tech, Inc.





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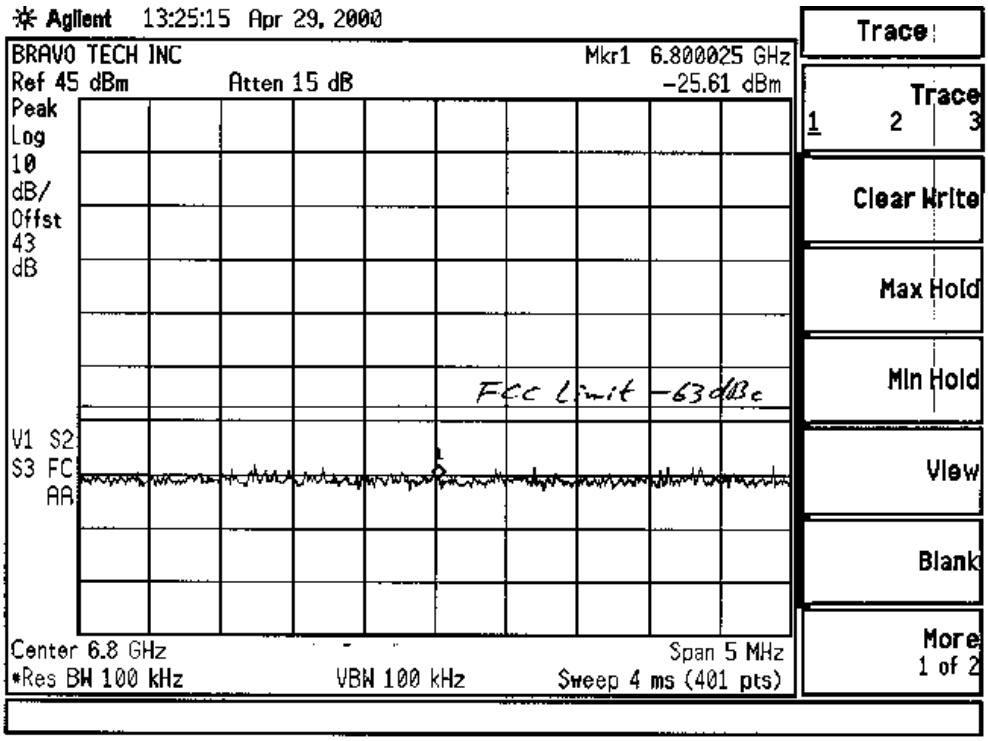

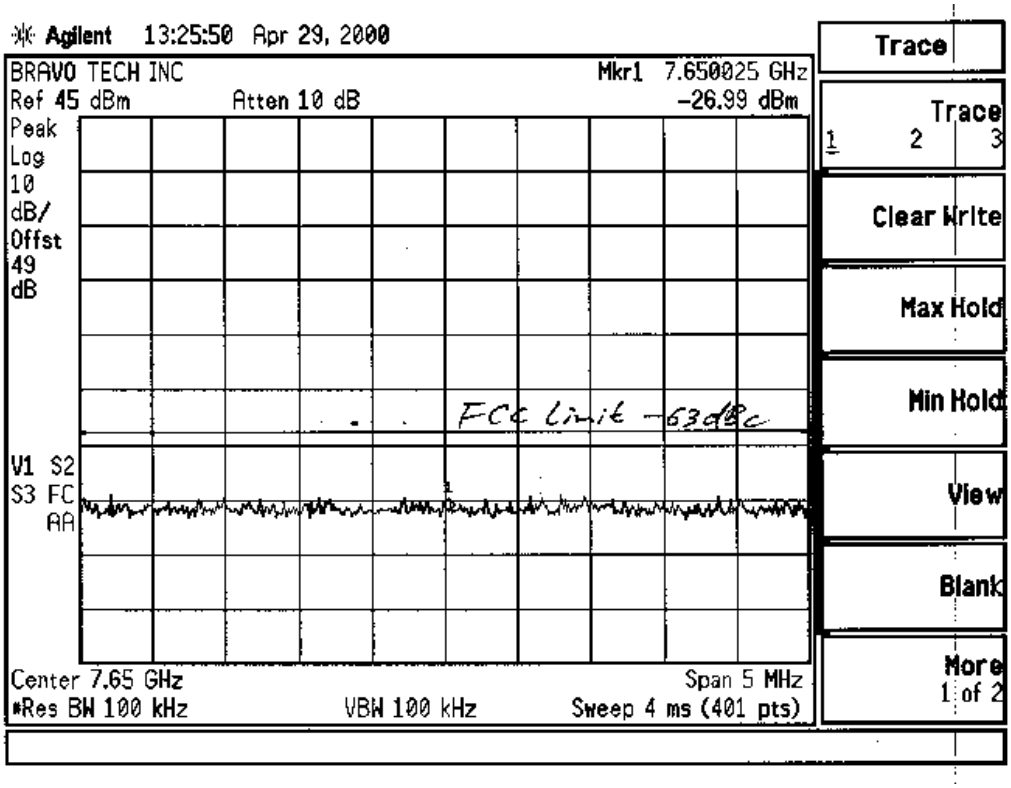

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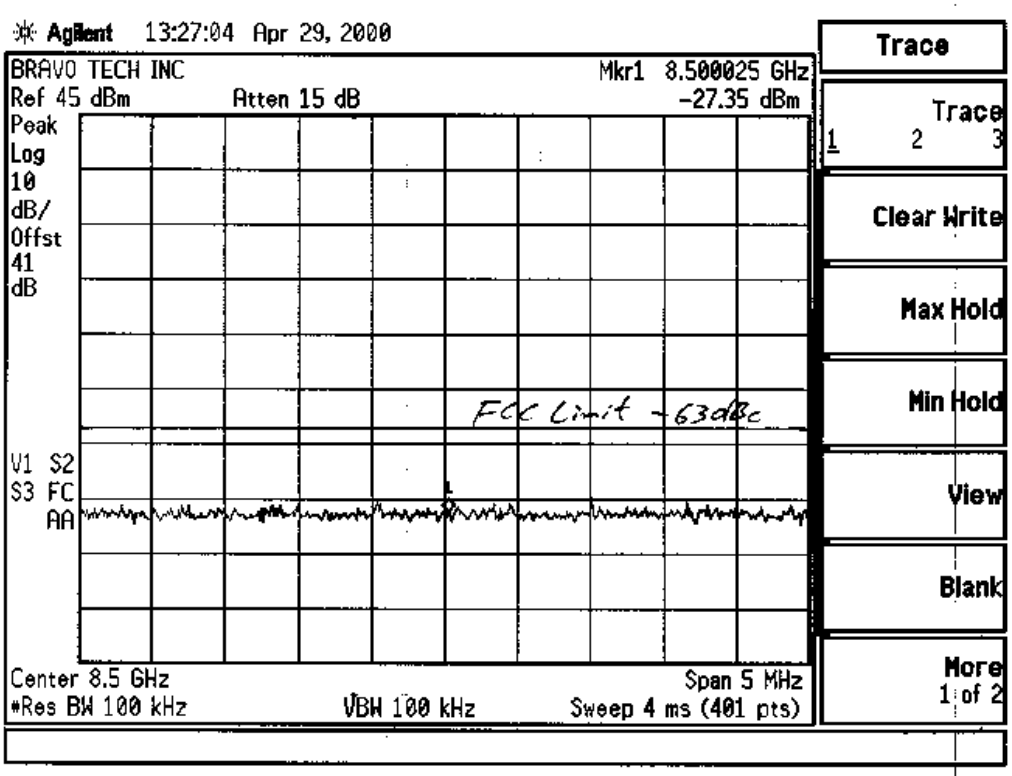
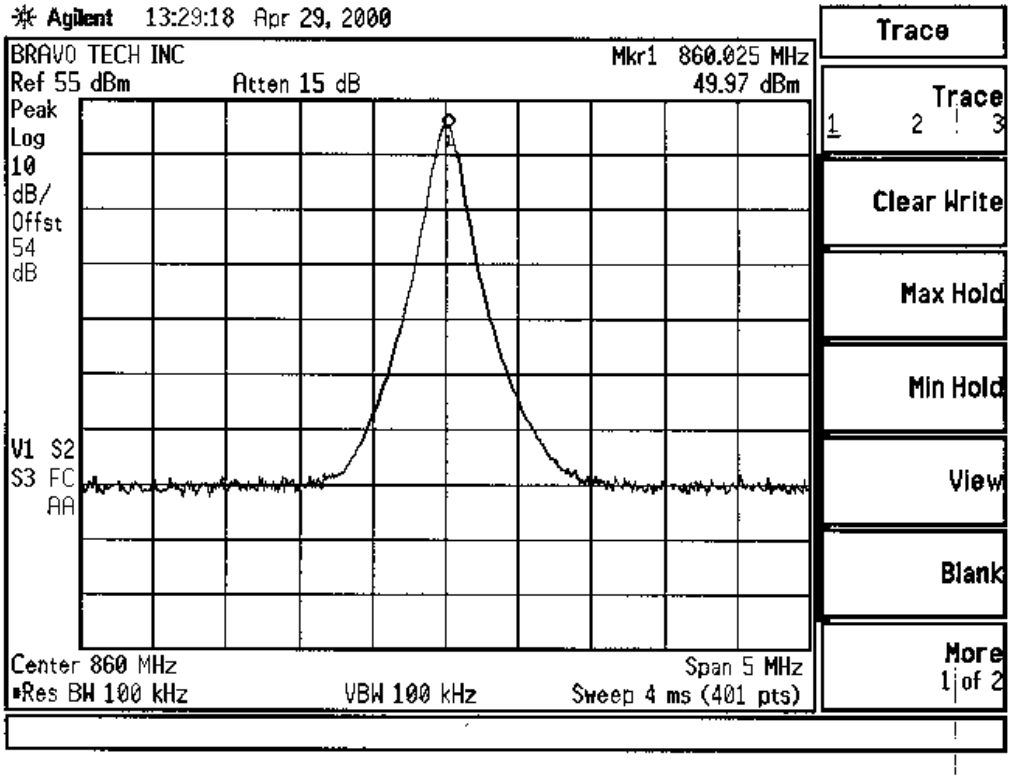
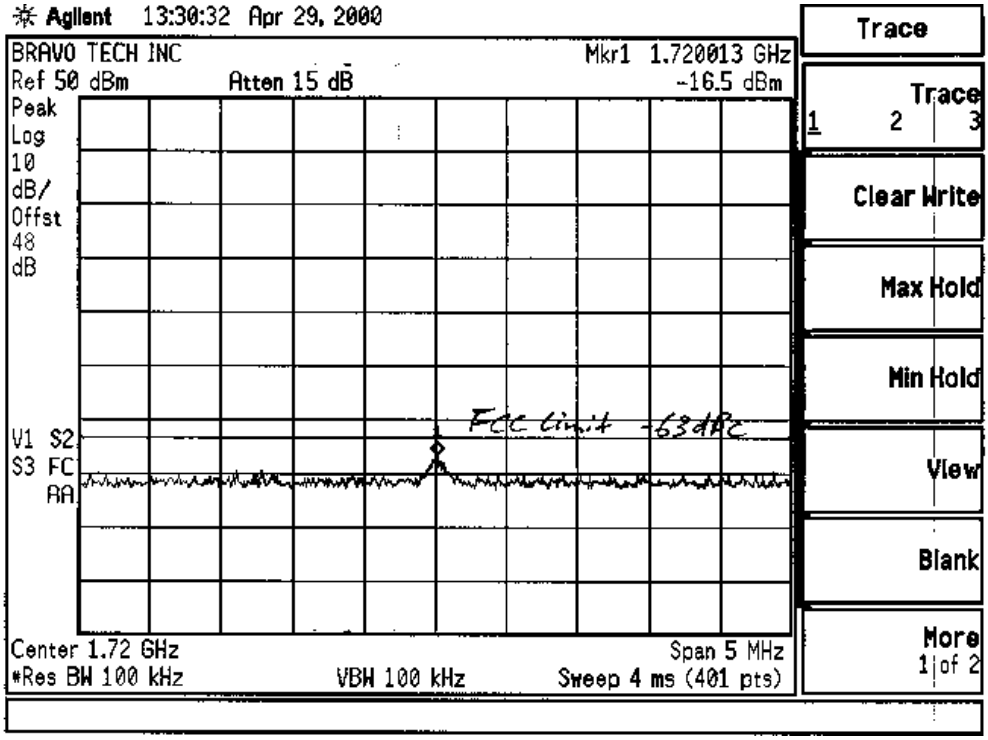
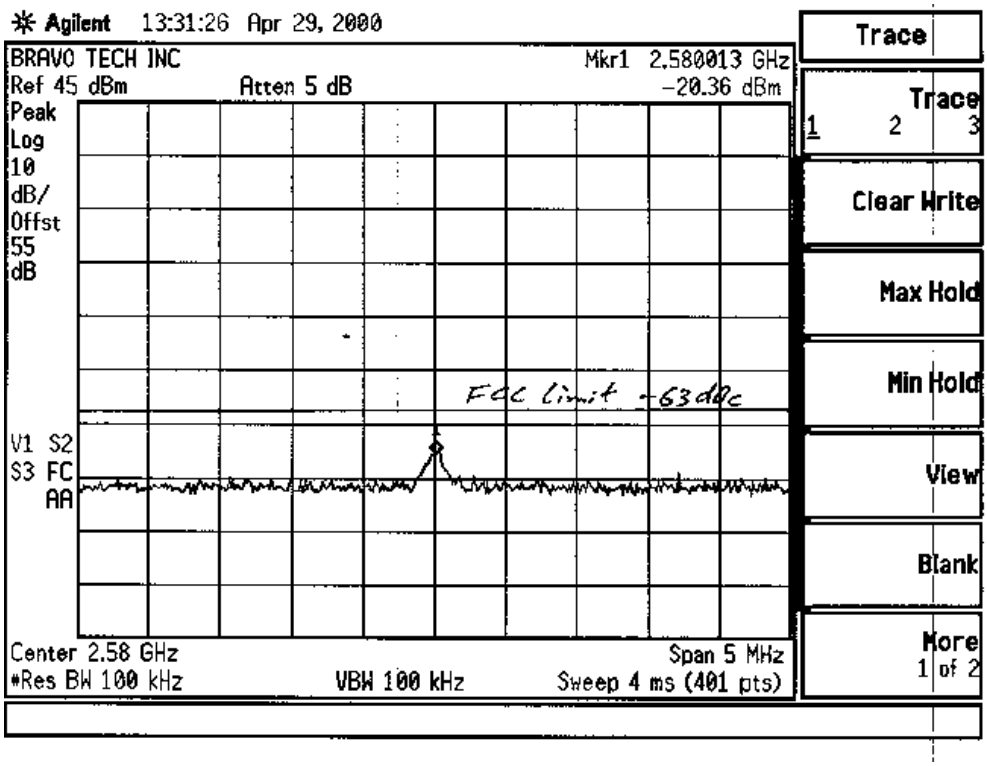
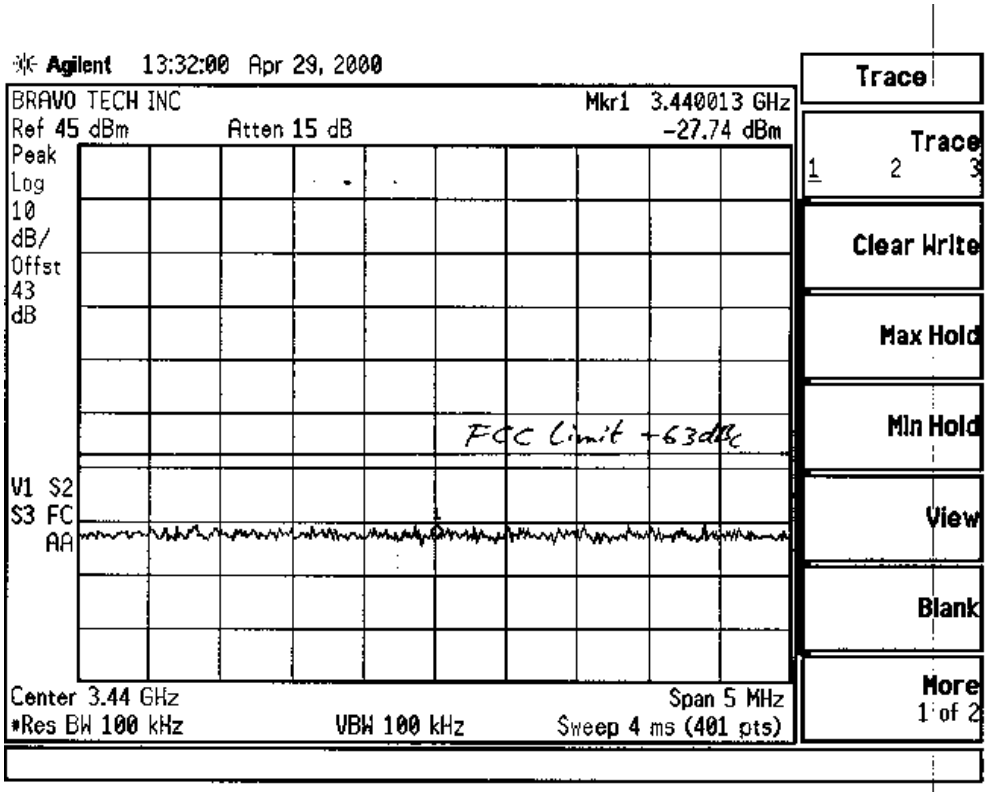
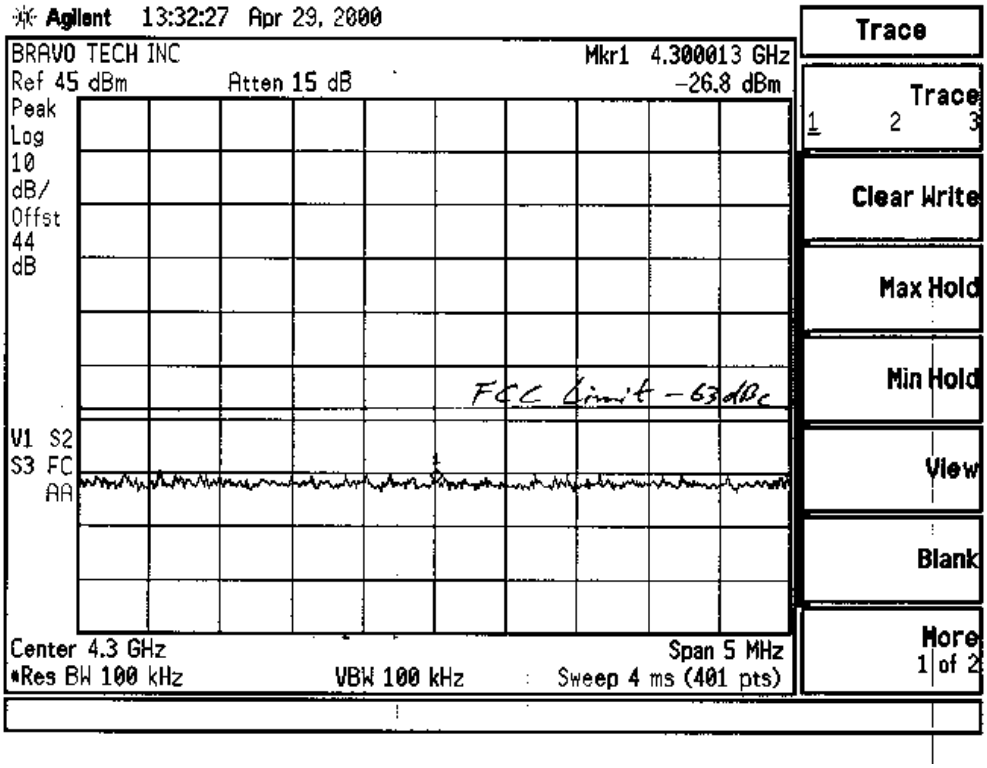


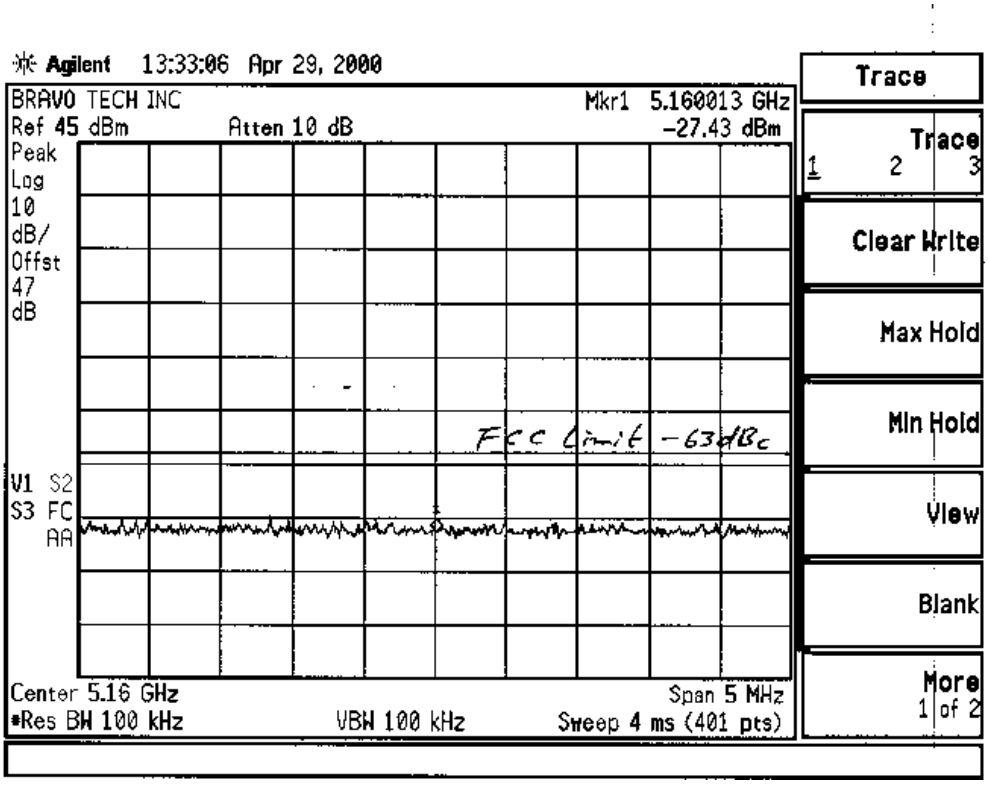


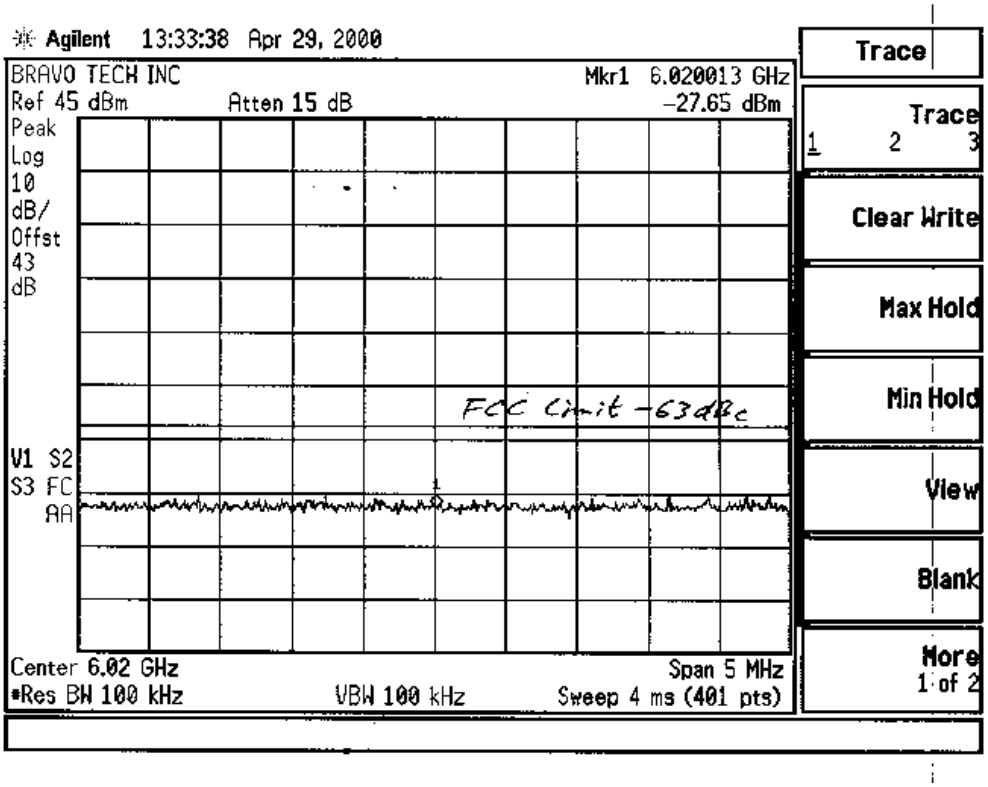

Agilent 13:30:32 Apr 29, 2000
BRAVO TECH INC
Ref 50 dBm
Atten 15 dB
Mkr1 1.720013 GHz
-16.5 dBm
Peak
Log
10
dB/
Offst
48
dB
FCC limit -63dBc
V1 S2
S3 FC
AA
Center 1.72 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


Agilent 13:31:26 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 5 dB
Mkr1 2.580013 GHz
-20.36 dBm
Peak
Log
10
dB/
Offst
55
dB
FCC limit -63dBc
V1 S2
S3 FC
AA
Center 2.58 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


Agilent 13:32:00 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 3.440013 GHz
-27.74 dBm
Peak
Log
10
dB/
Offst
43
dB
FCC Limit +63dBc
V1 S2
S3 FC
AA
Center 3.44 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

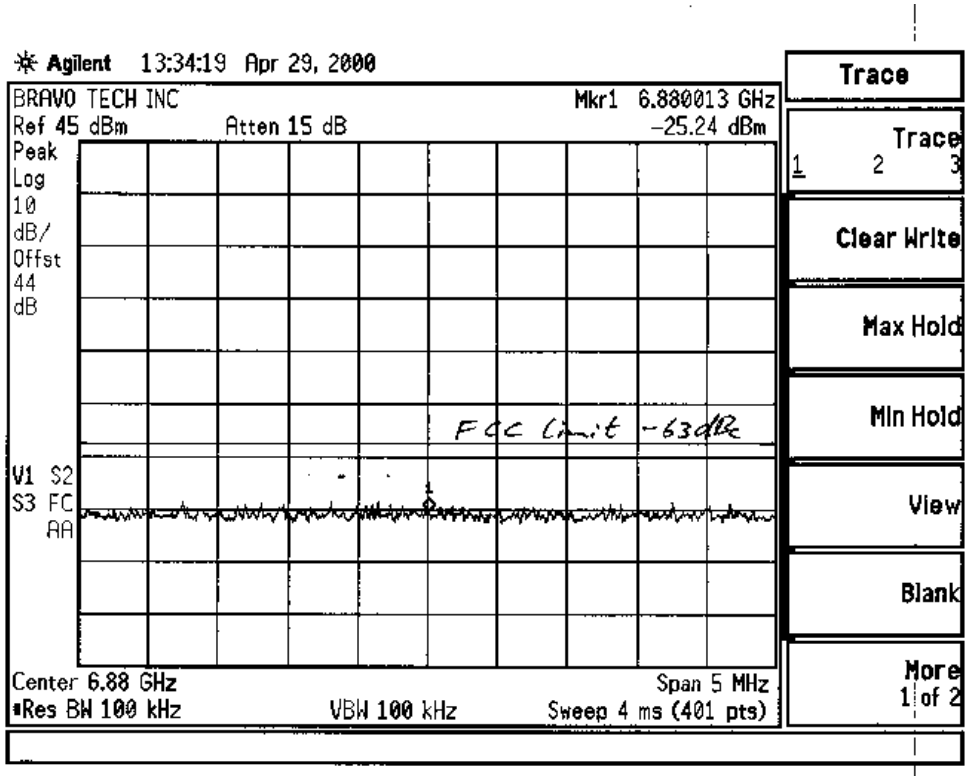

Agilent 13:32:27 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 4.300013 GHz
-26.8 dBm
Peak
Log
10
dB/
Offst
44
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 4.3 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

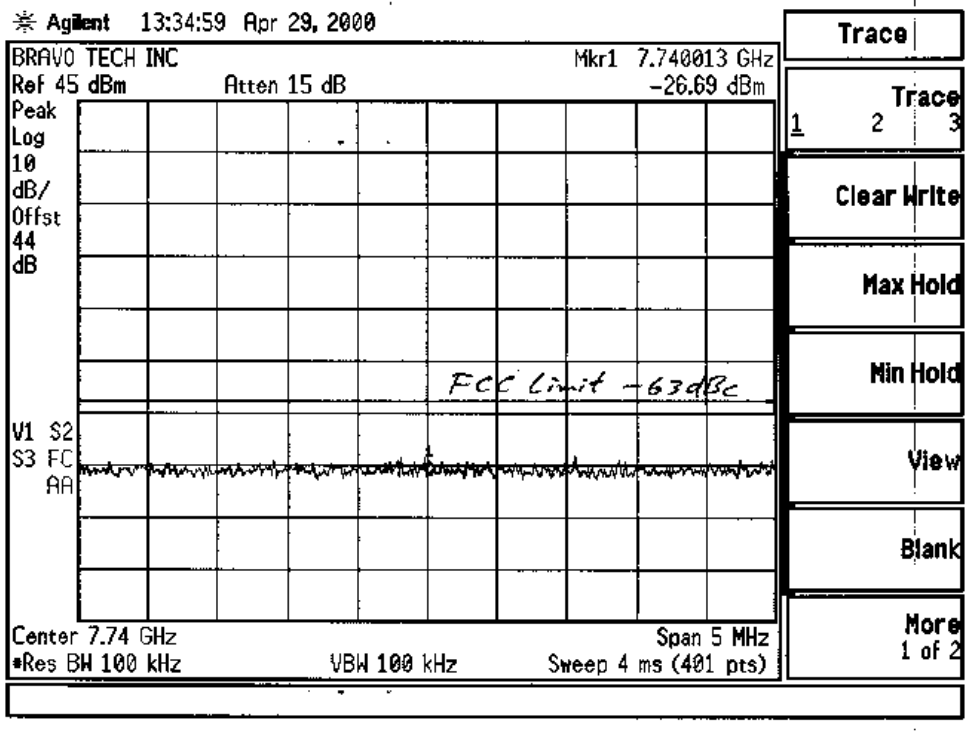

Agilent 13:33:06 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 10 dB
Mkr1 5.160013 GHz
-27.43 dBm
Peak
Log
10
dB/
Offst
47
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 5.16 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


Agilent 13:33:38 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 6.020013 GHz
-27.65 dBm
Peak
Log
10
dB/
Offst
43
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 6.02 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

BTI

Bravo Tech, Inc.





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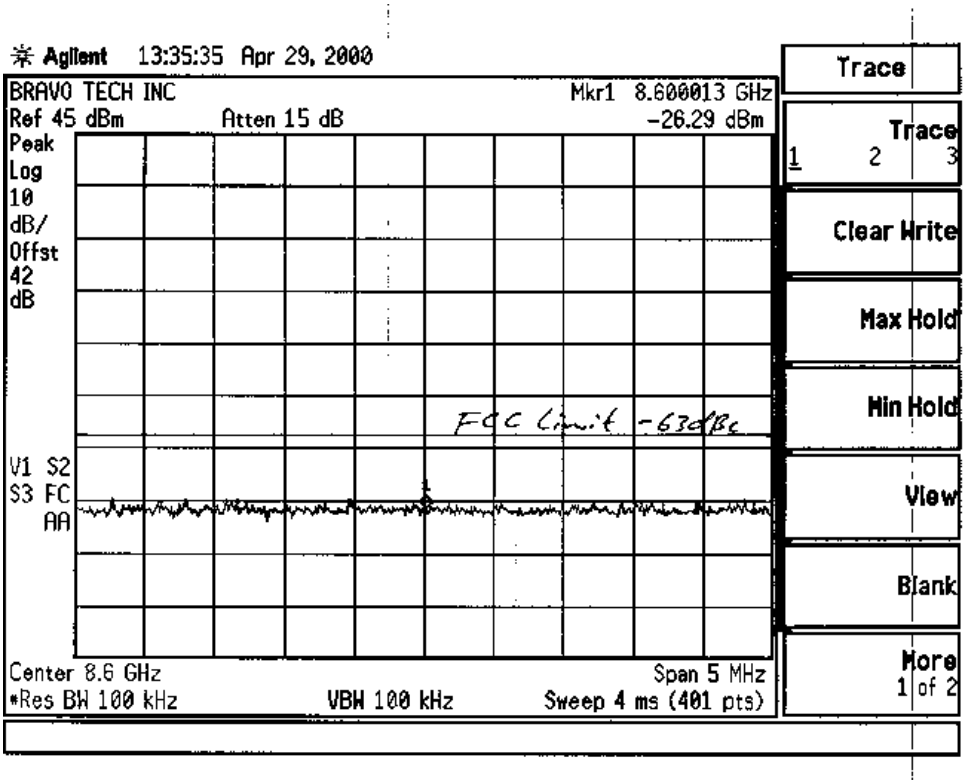
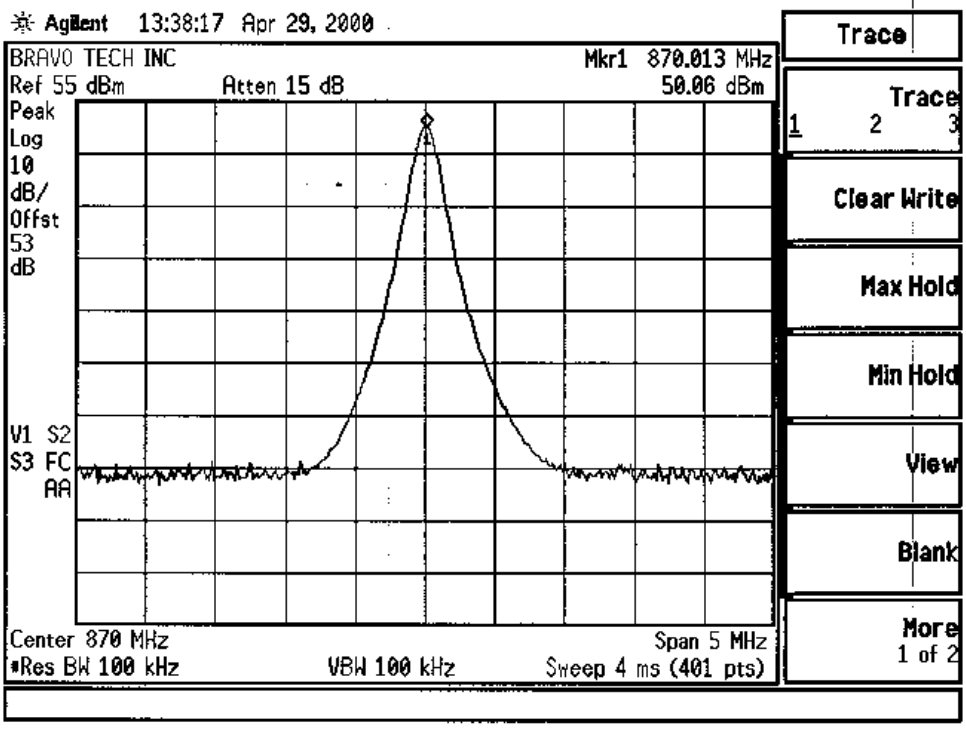
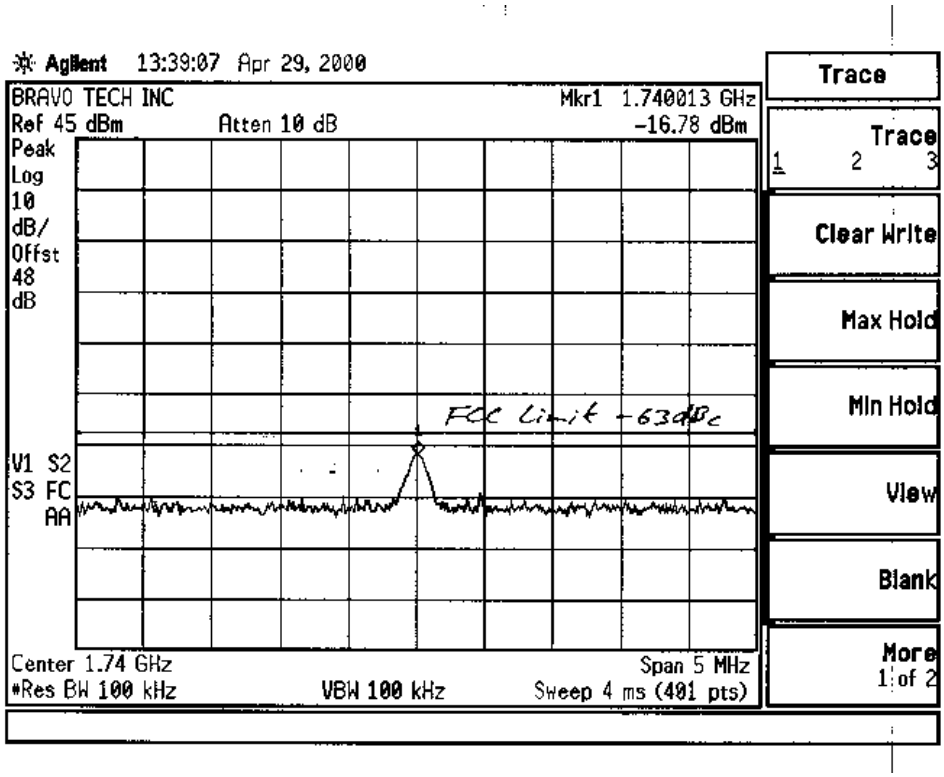
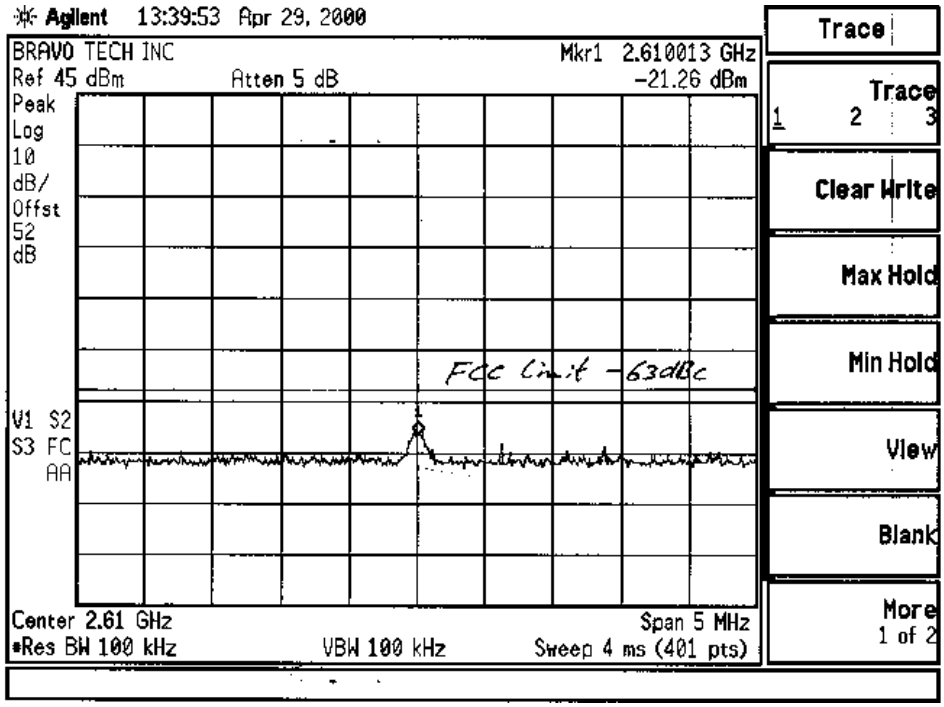
Bravo Tech, Inc.



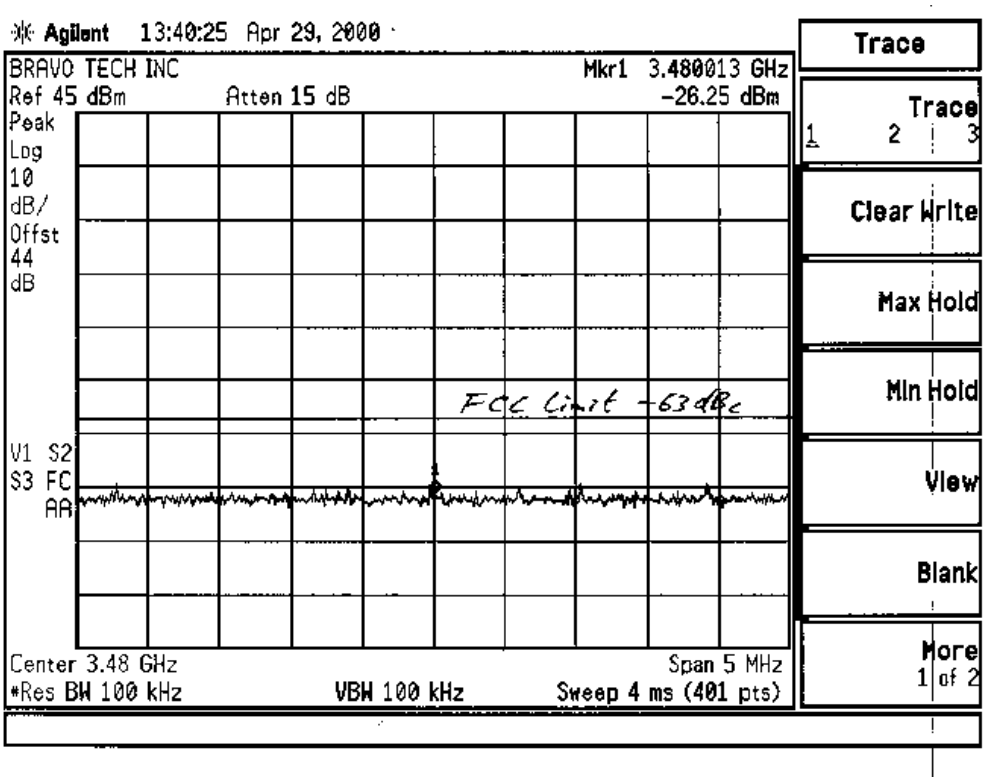


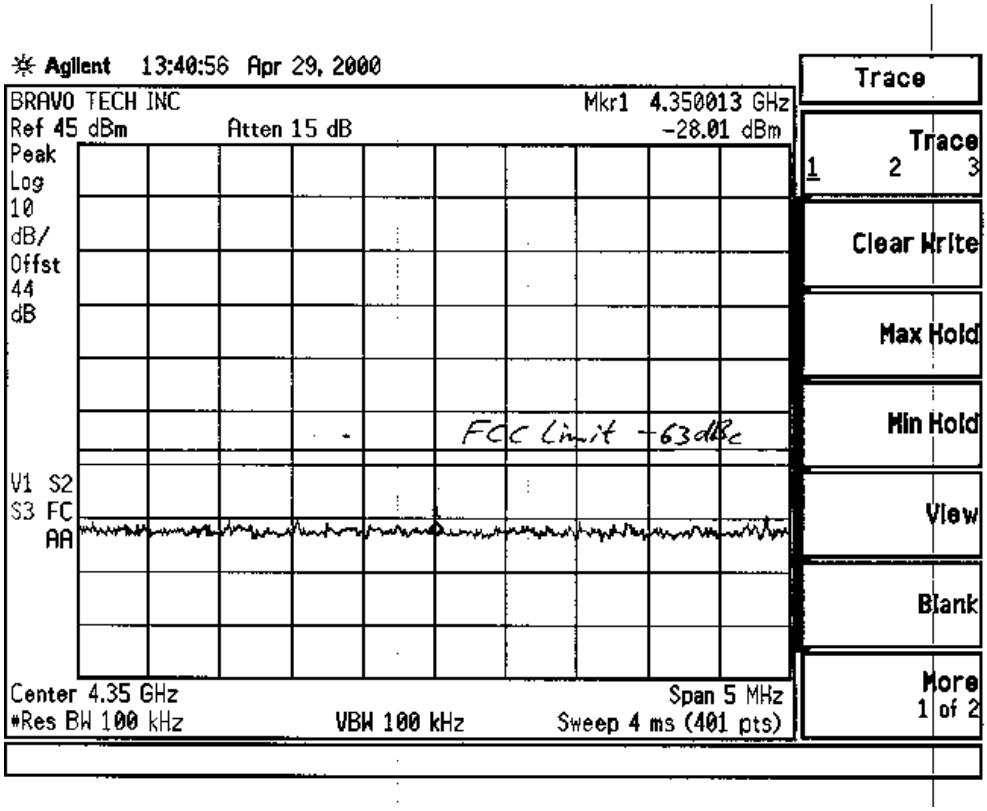

Agilent 13:39:07 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 10 dB
Mkr1 1.740013 GHz
-16.78 dBm
Peak
Log
10
dB/
Offst
48
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 1.74 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


Agilent 13:39:53 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 5 dB
Mkr1 2.610013 GHz
-21.26 dBm
Peak
Log
10
dB/
Offst
52
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 2.61 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

BTI

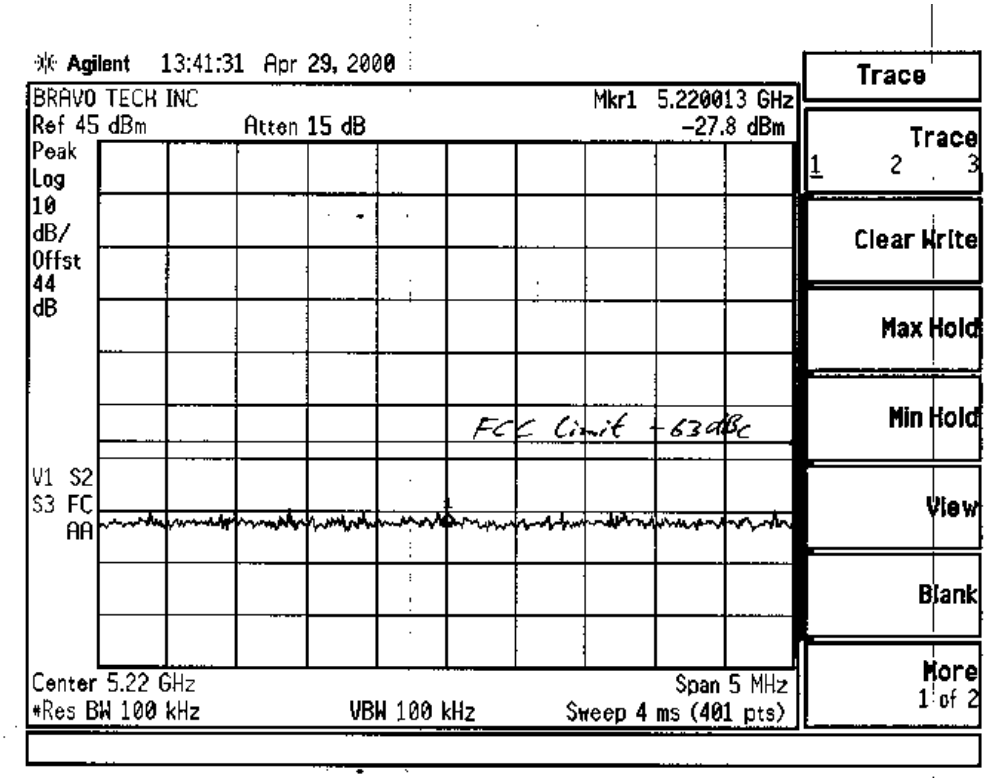
Bravo Tech, Inc.

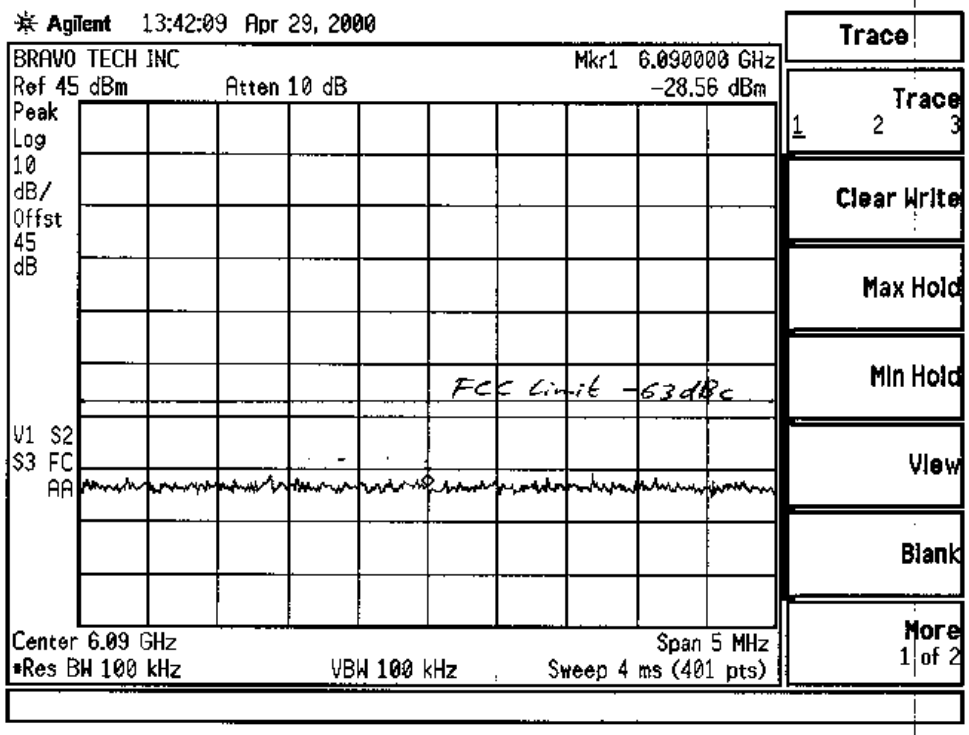




BTI

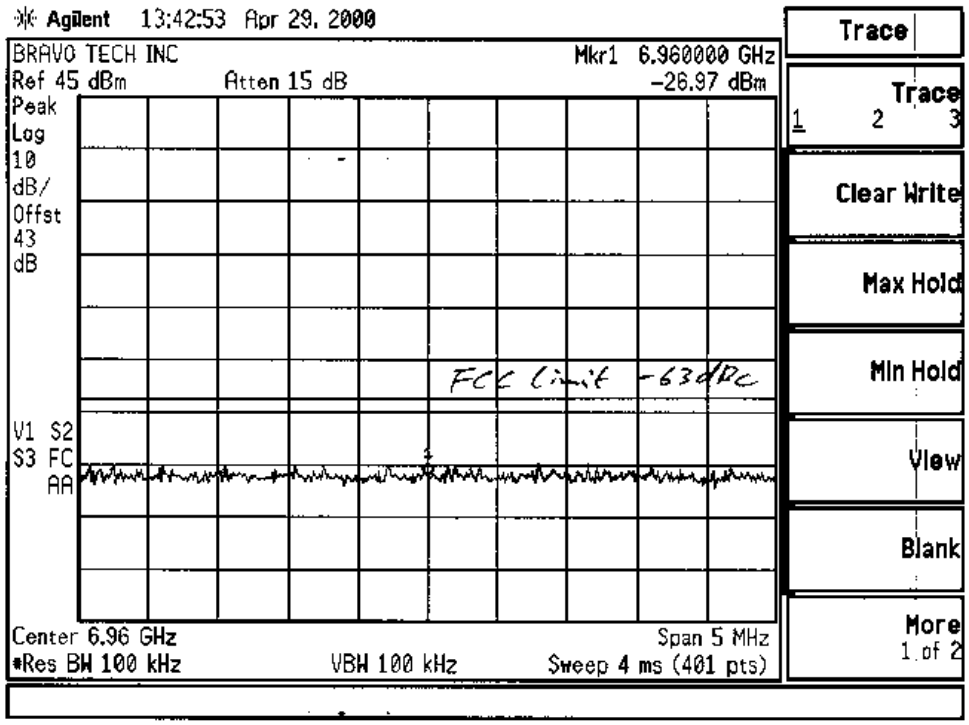
Bravo Tech, Inc.

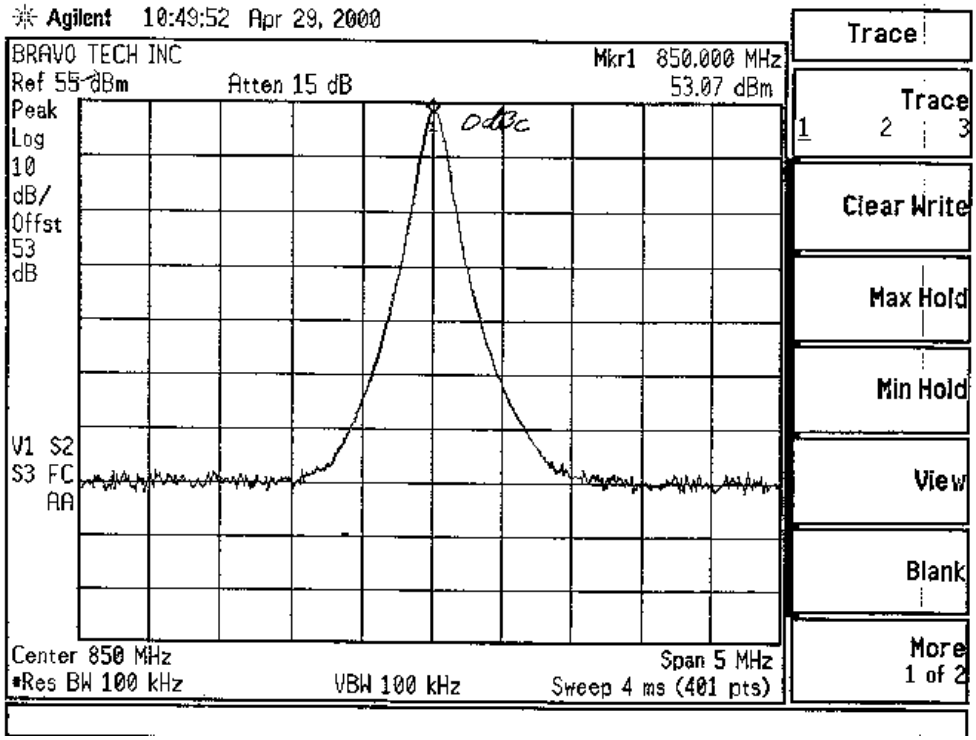


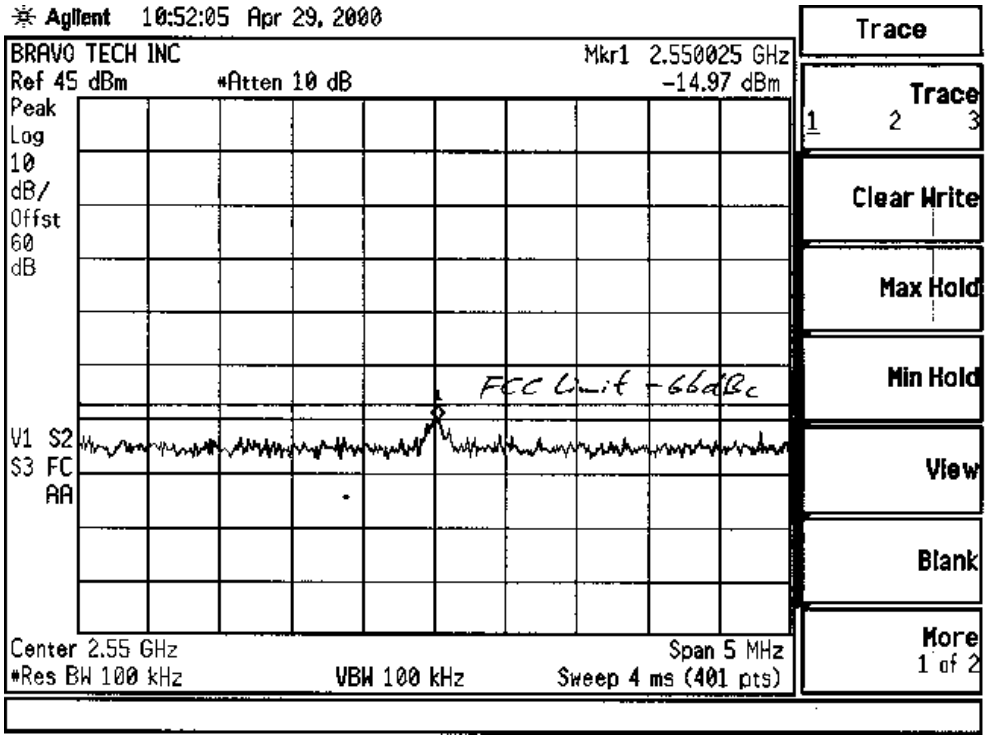


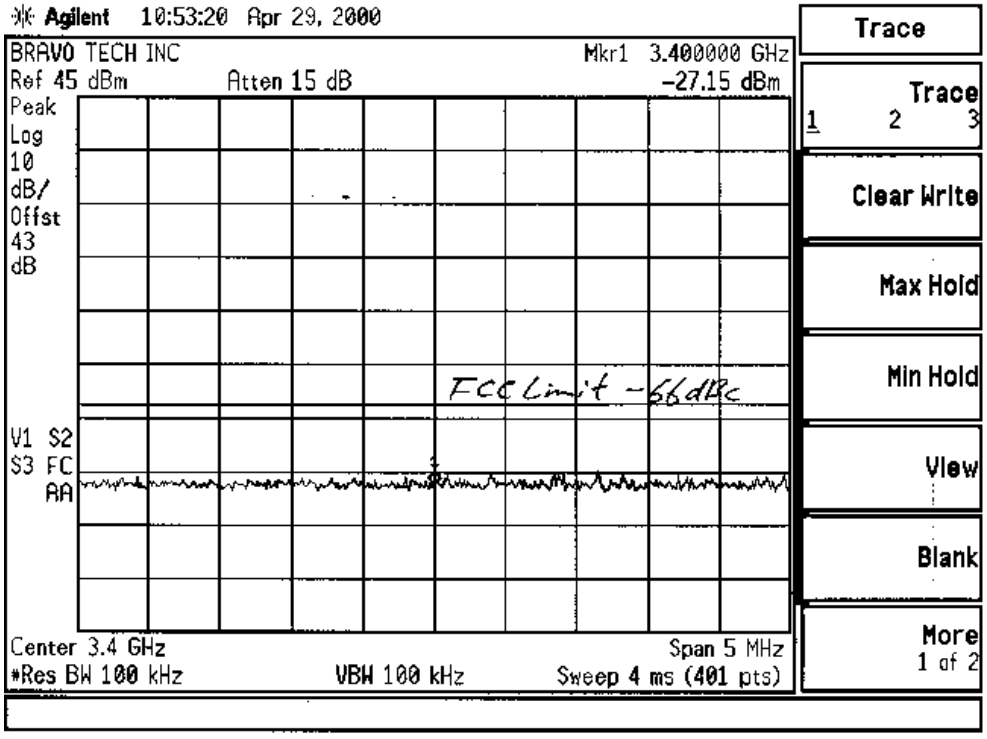
BTI

Bravo Tech, Inc.



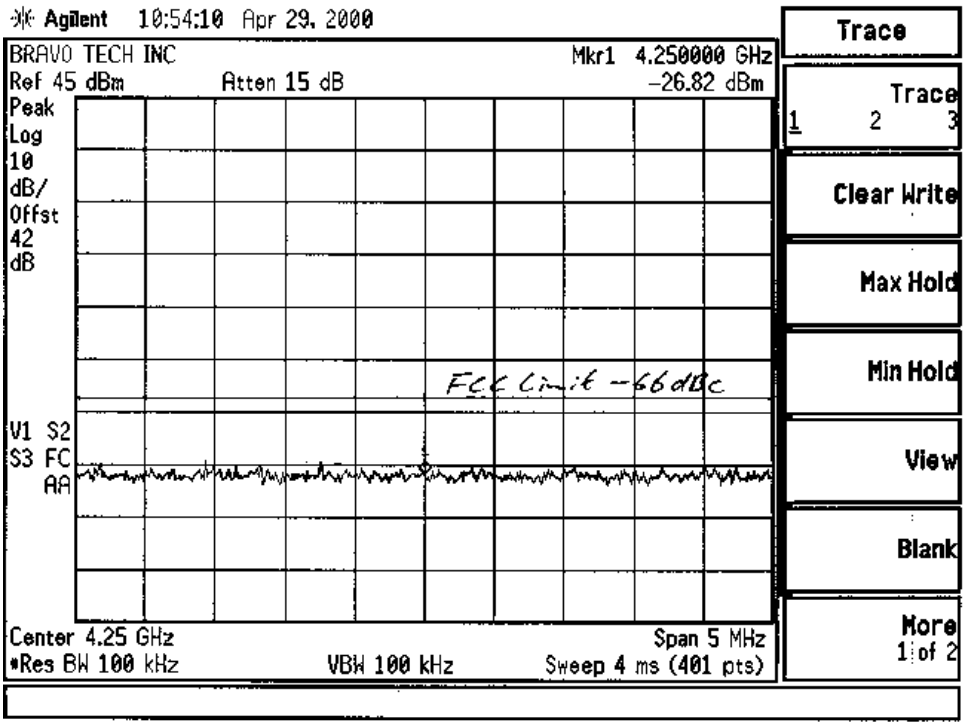


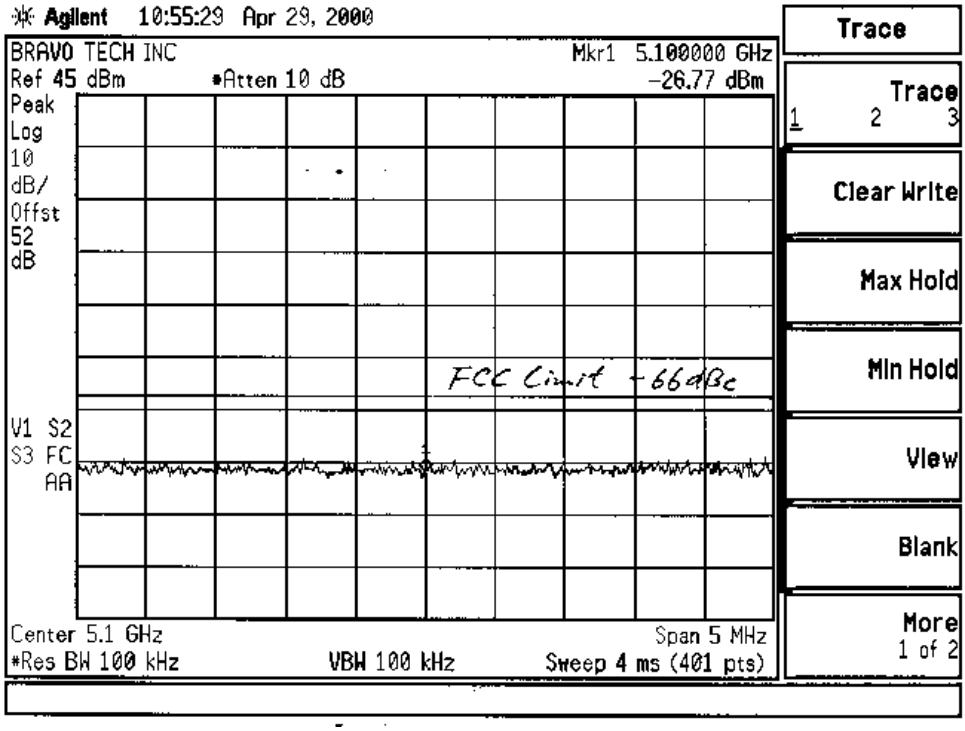

Agilent 10:52:05 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
#Atten 10 dB
Mkr1 2.550025 GHz
-14.97 dBm
Peak
Log
10
dB/
Offst
60
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 2.55 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


Agilent 10:53:20 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 3.400000 GHz
-27.15 dBm
Peak
Log
10
dB/
Offst
43
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 3.4 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

BTI

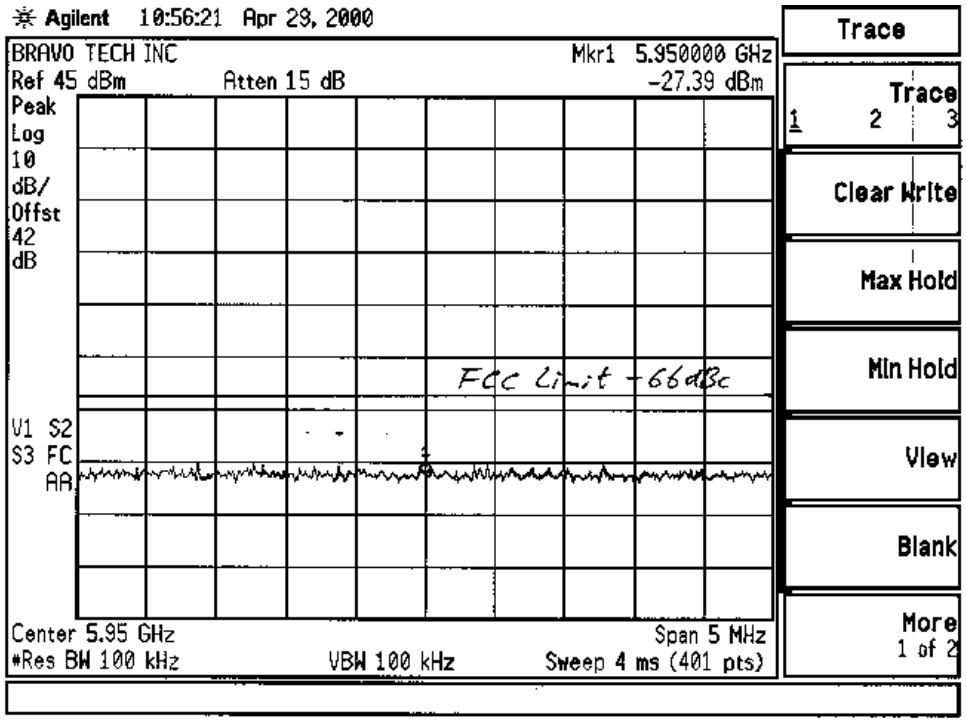
Bravo Tech, Inc.

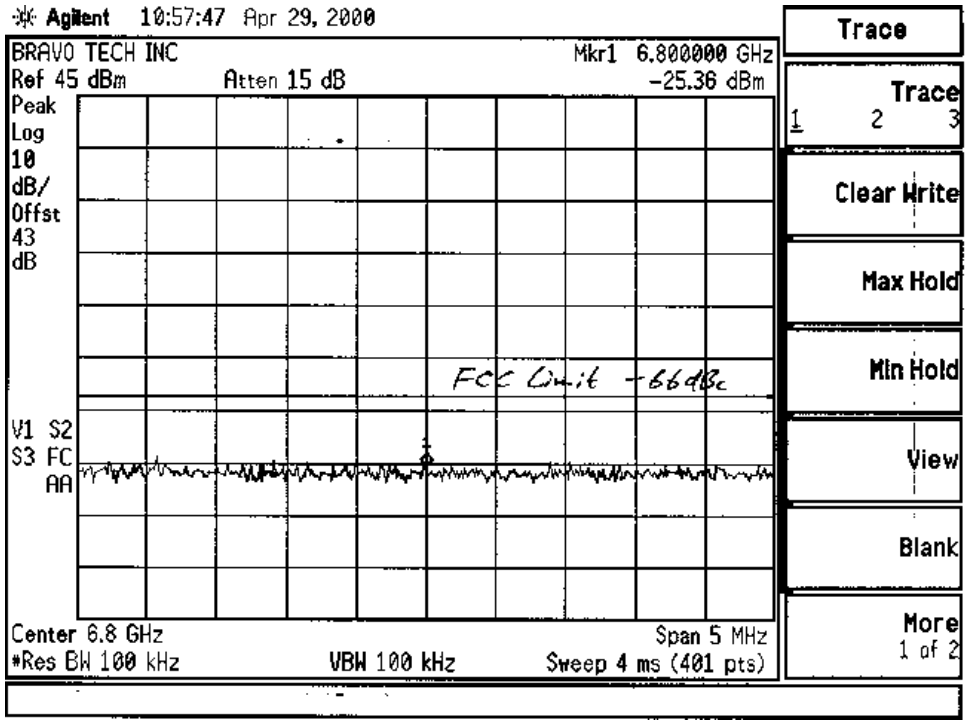




BTI

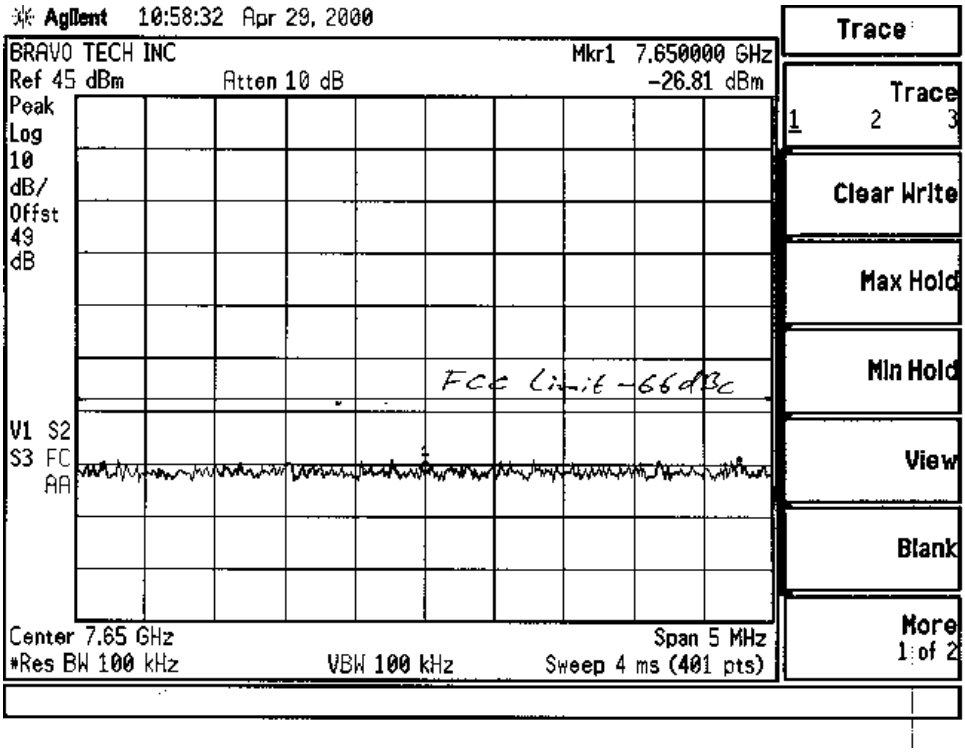
Bravo Tech, Inc.

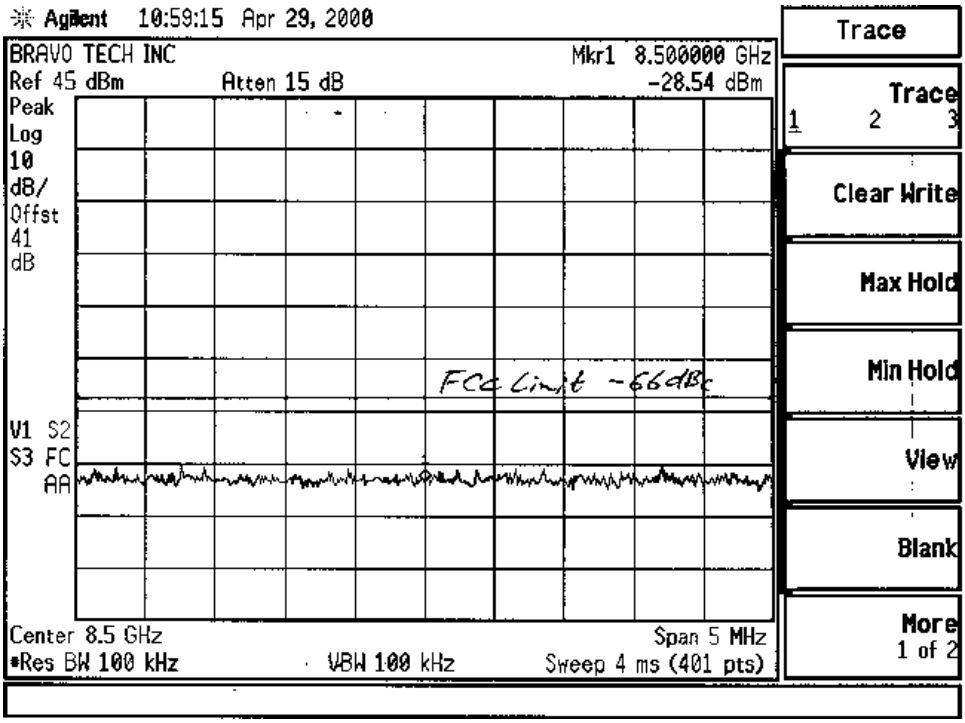




BTI

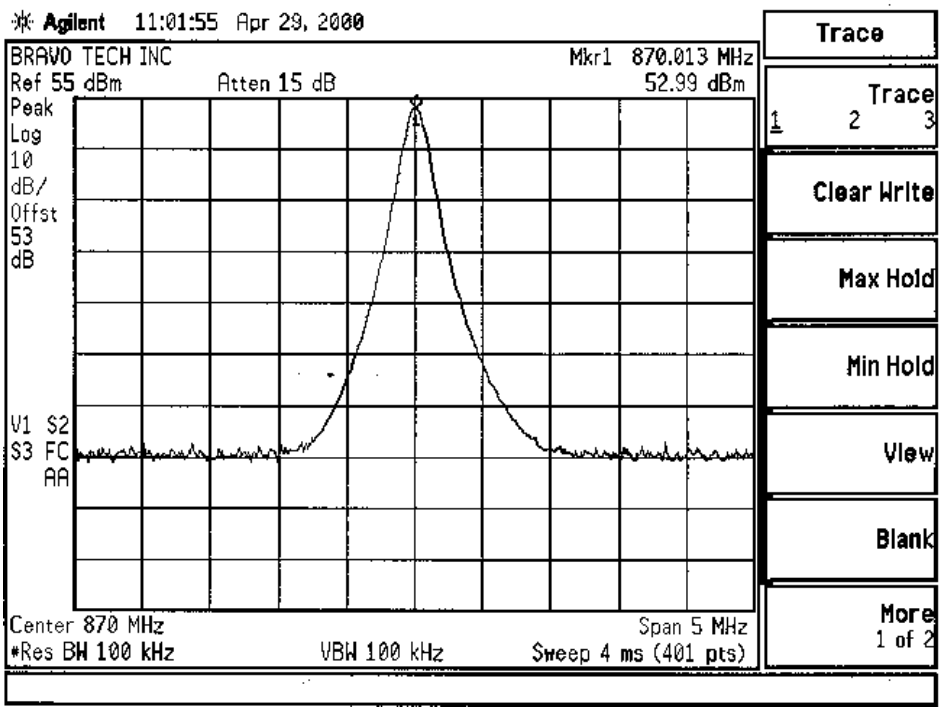
Bravo Tech, Inc.

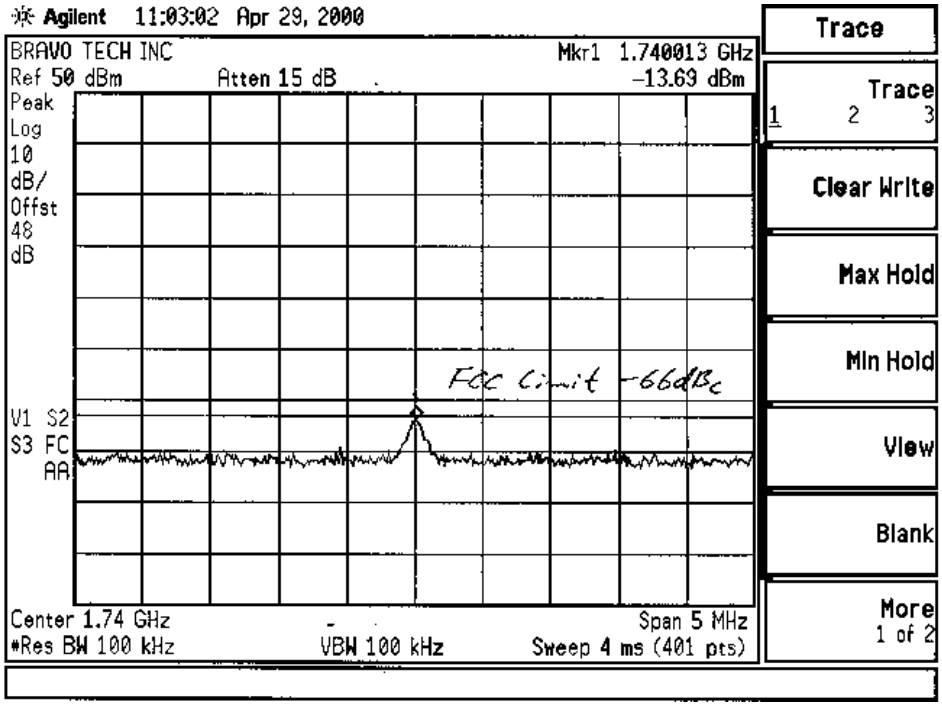




BTI

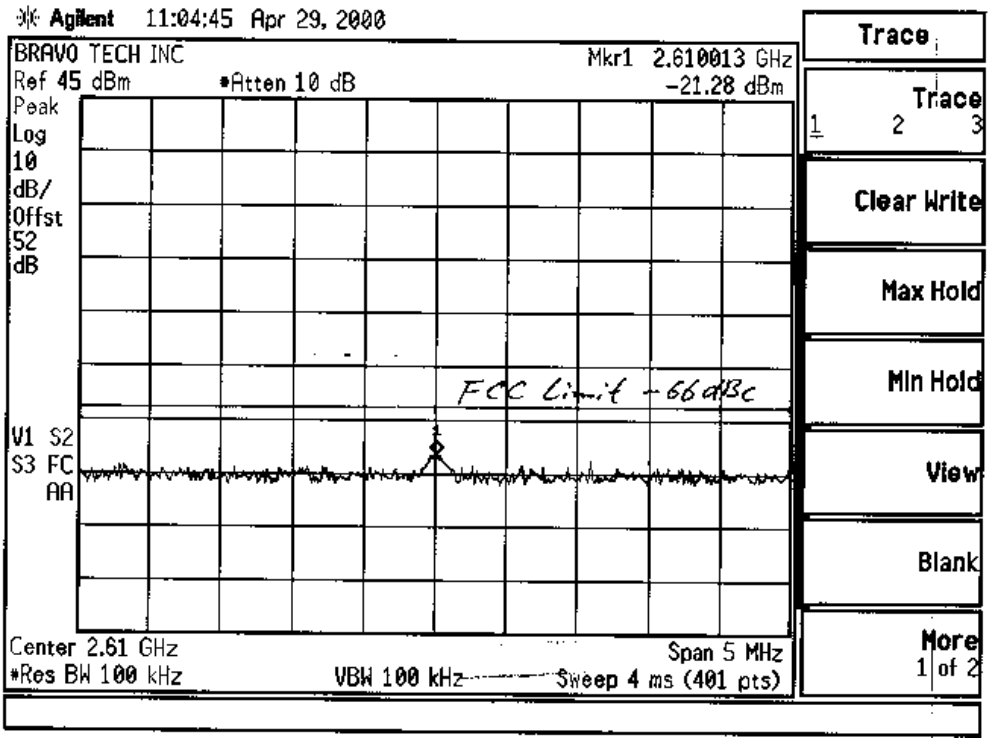
Bravo Tech, Inc.

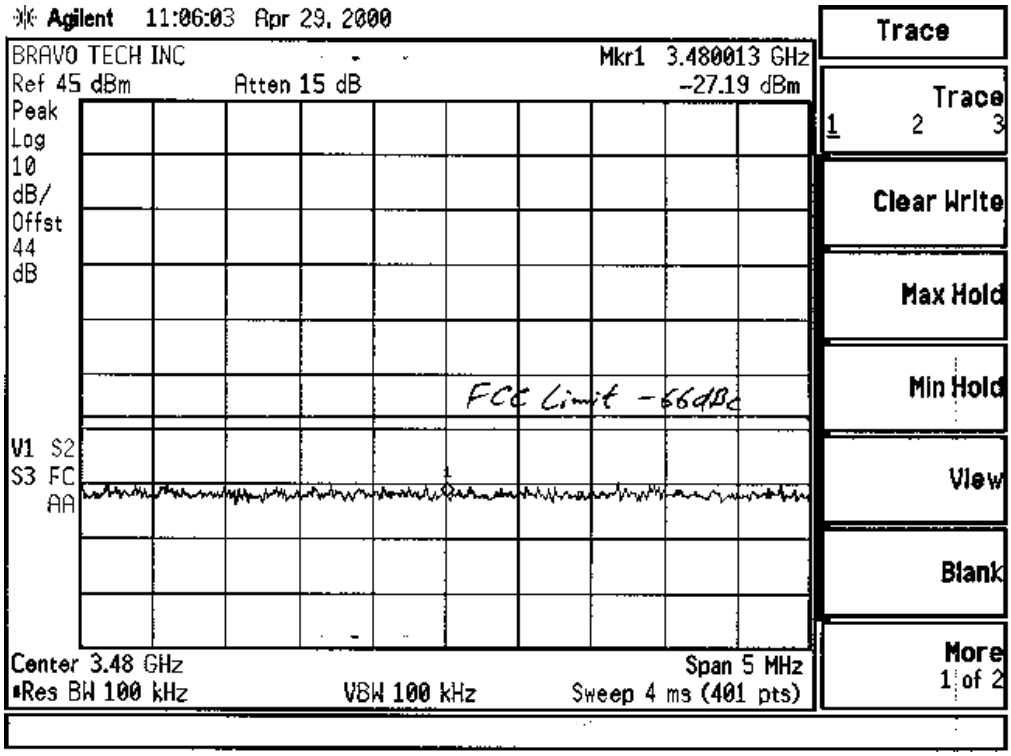


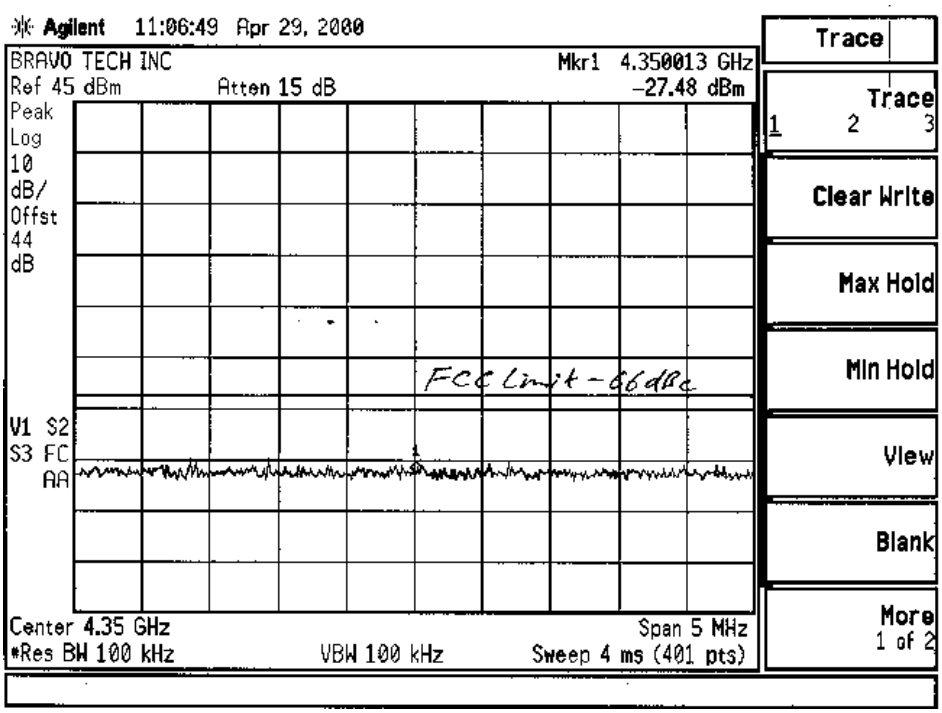


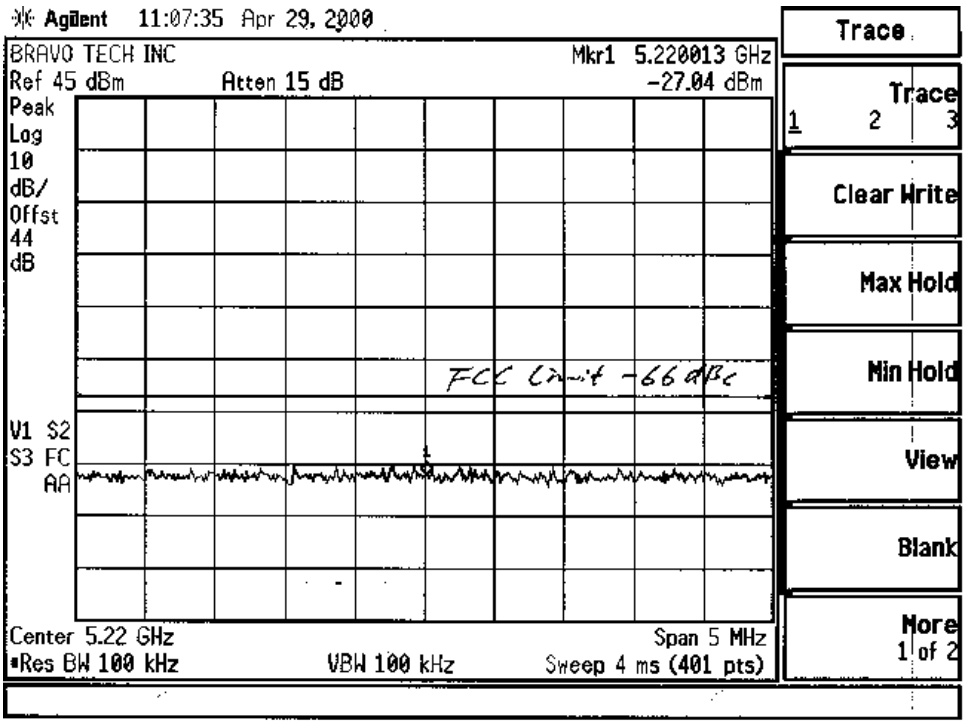
BTI

Bravo Tech, Inc.



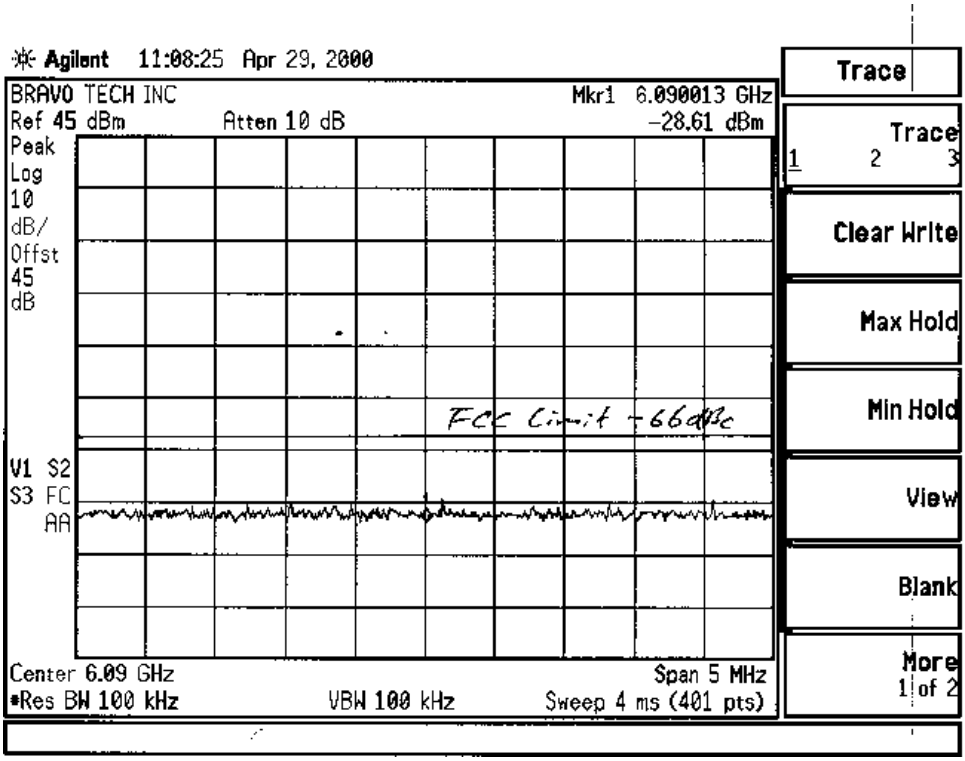


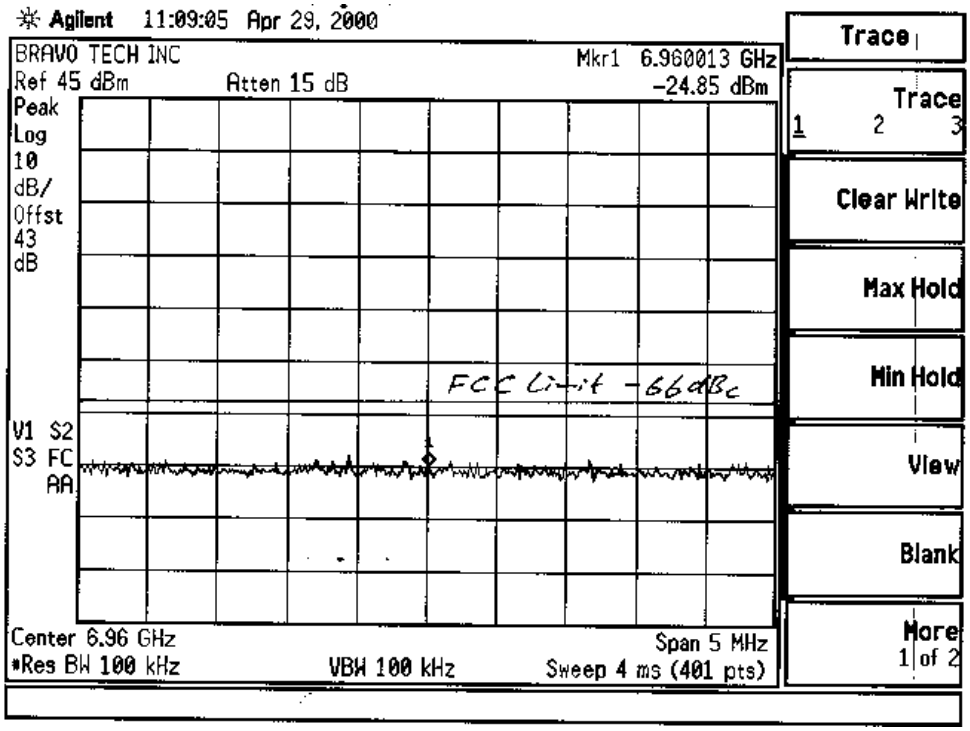

Agilent 11:06:49 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 4.350013 GHz
-27.48 dBm
Peak
Log
10
dB/
Offst
44
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 4.35 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

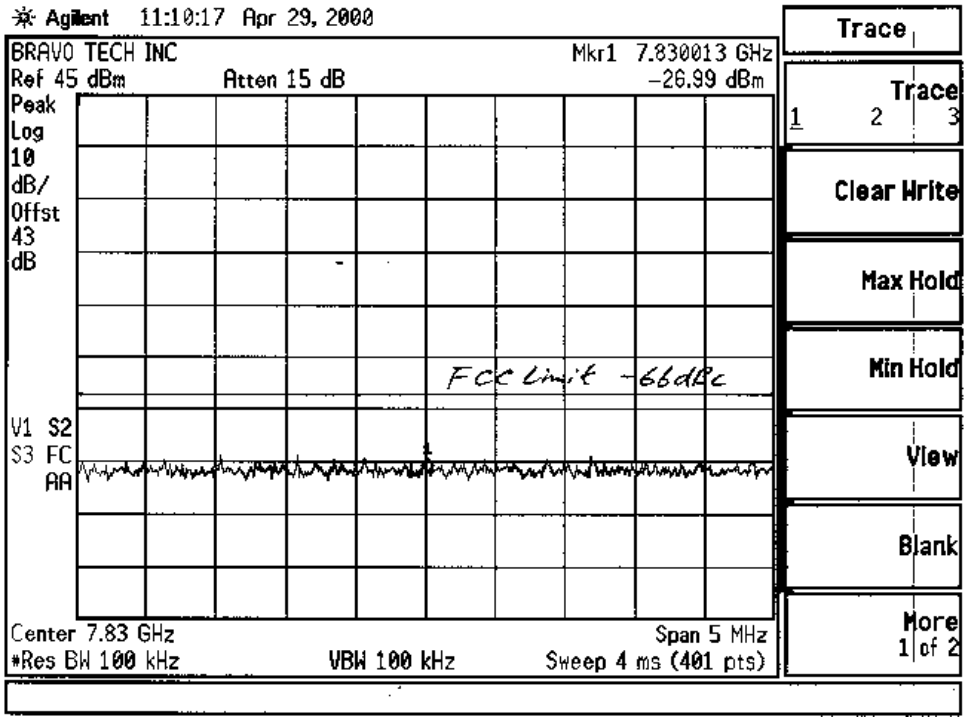

Agilent 11:07:35 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 5.220013 GHz
-27.04 dBm
Peak
Log
10
dB/
Offst
44
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 5.22 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

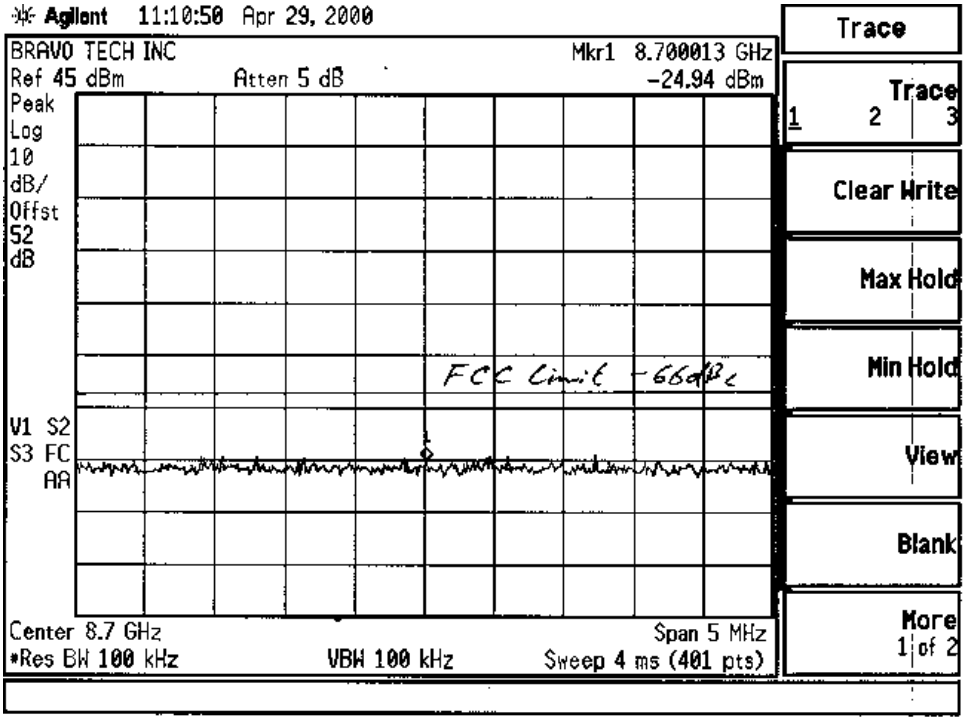
BTI

Bravo Tech, Inc.



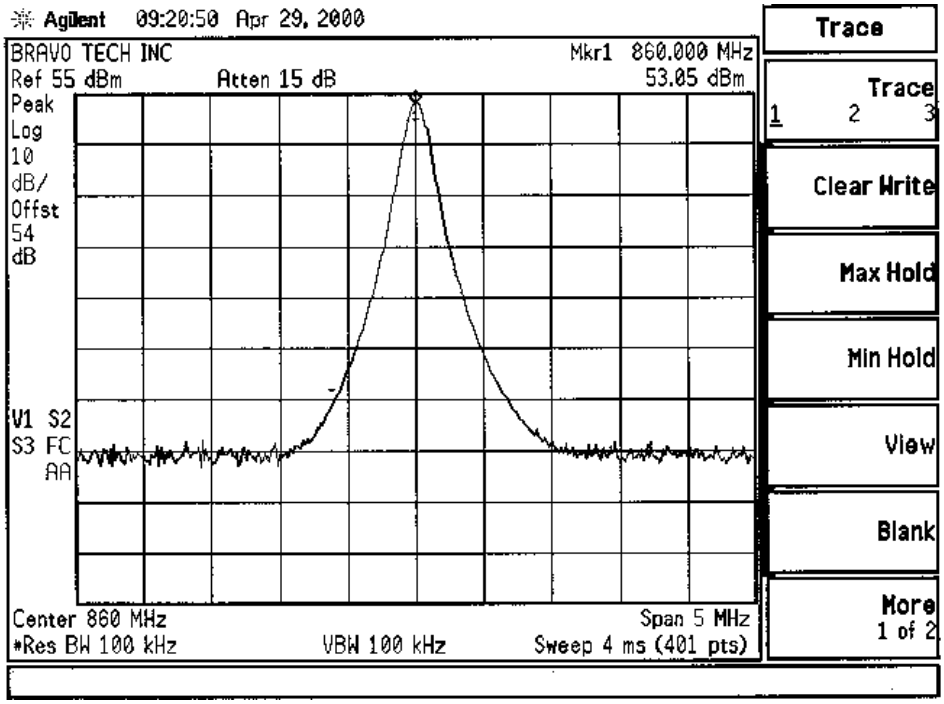


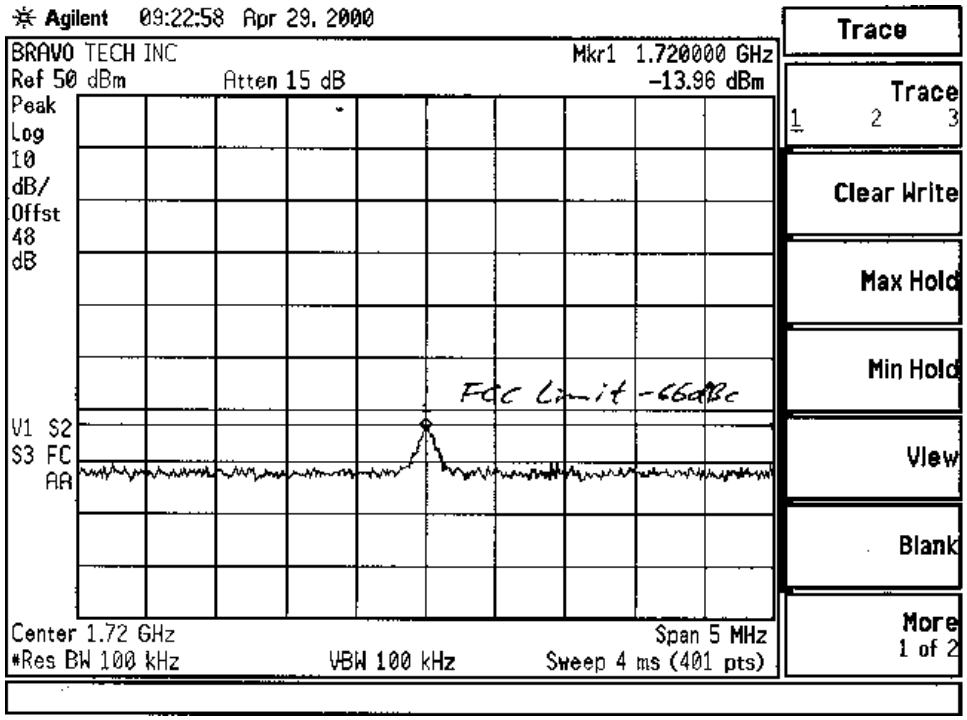

Agilent 11:10:17 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 7.830013 GHz
-26.99 dBm
Peak
Log
10
dB/
Offst
43
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 7.83 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

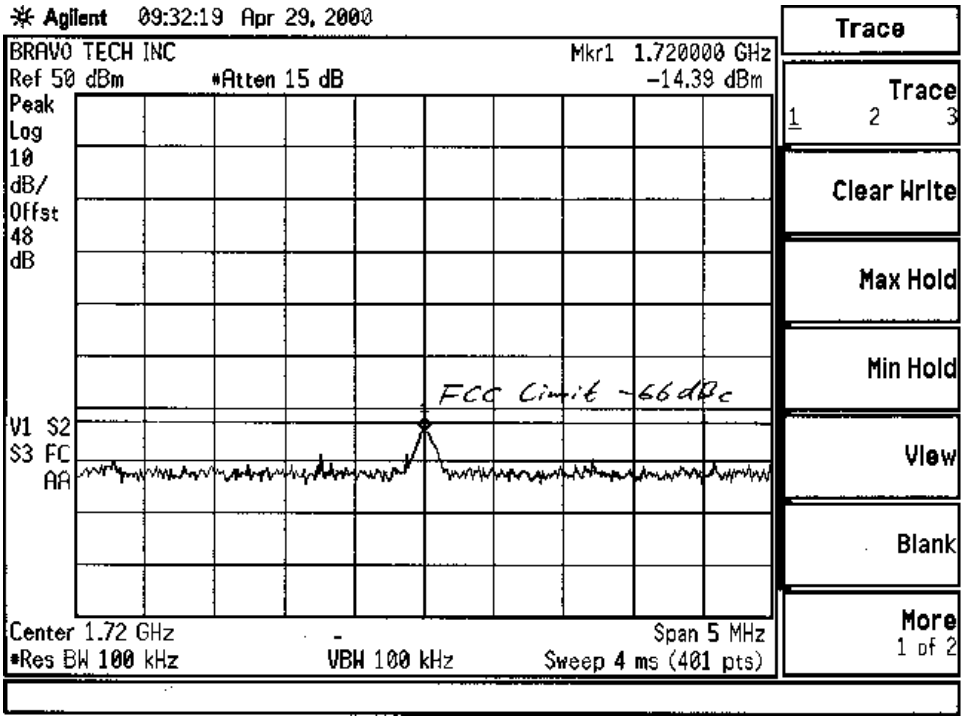

Agilent 11:10:50 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 5 dB
Mkr1 8.700013 GHz
-24.94 dBm
Peak
Log
10
dB/
Offst
52
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 8.7 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

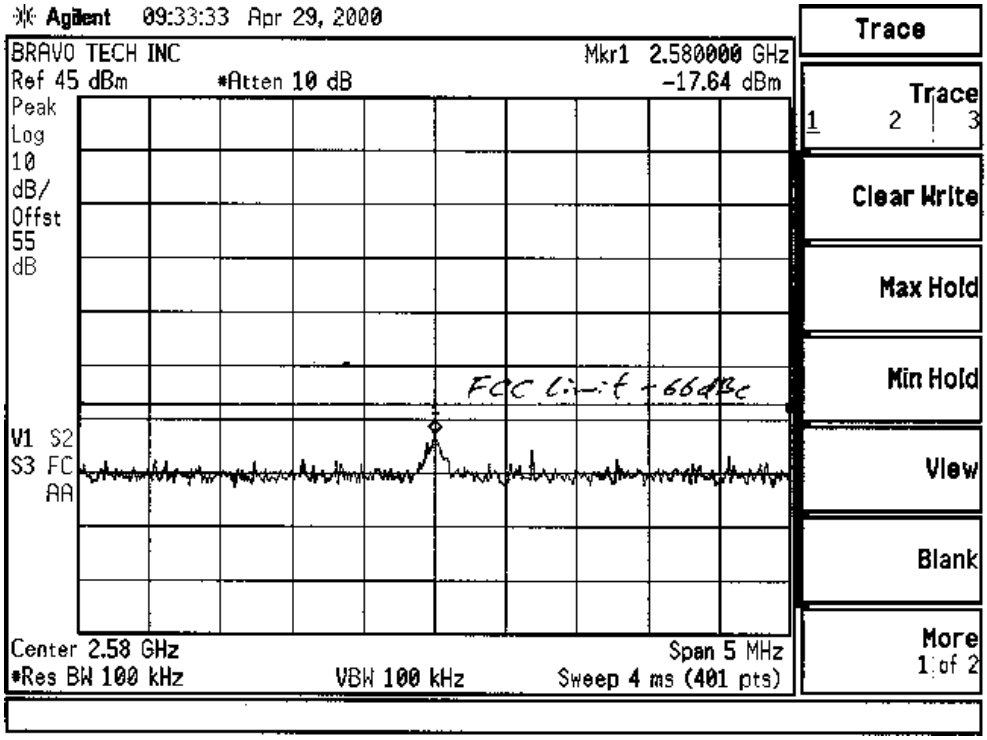
BTI

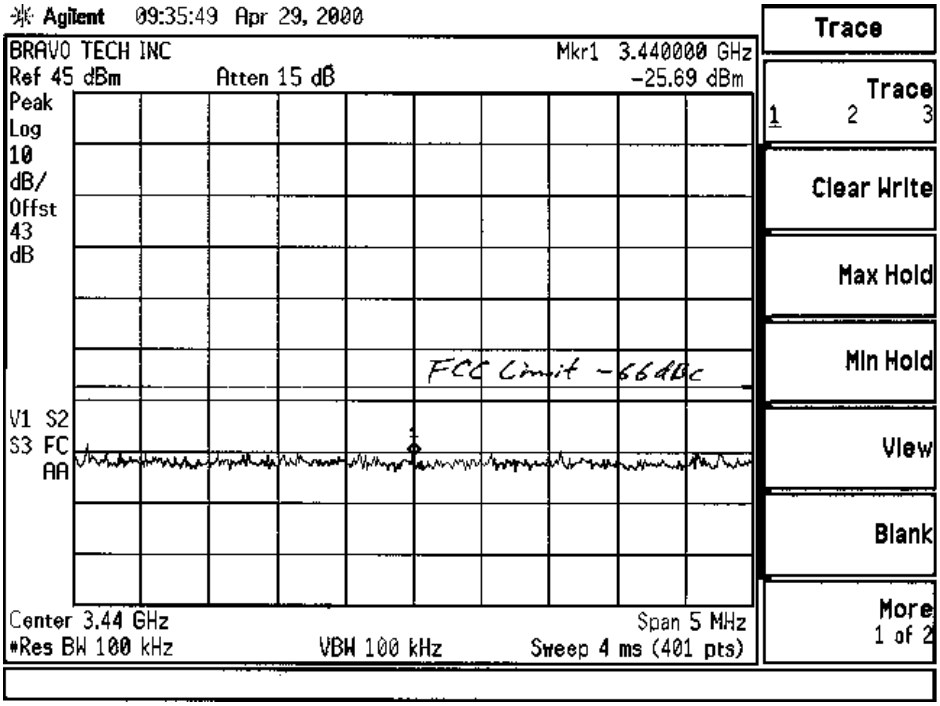
Bravo Tech, Inc.

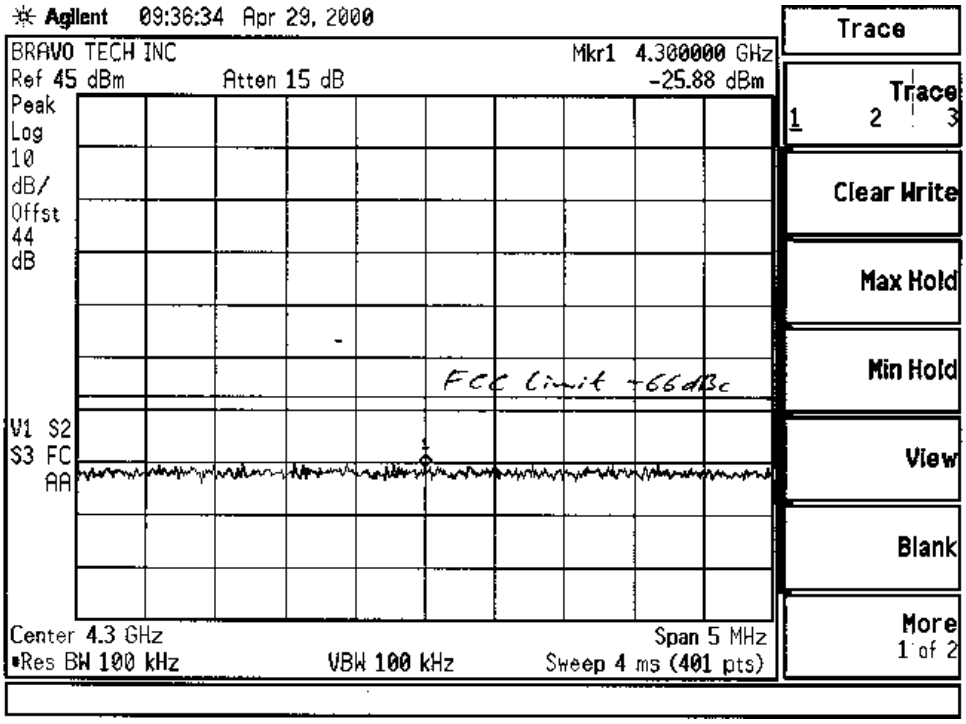





Agilent 09:32:19 Apr 29, 2000
BRAVO TECH INC
Ref 50 dBm
#Atten 15 dB
Mkr1 1.720000 GHz
-14.39 dBm
Peak
Log
10
dB/
Offst
48
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 1.72 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

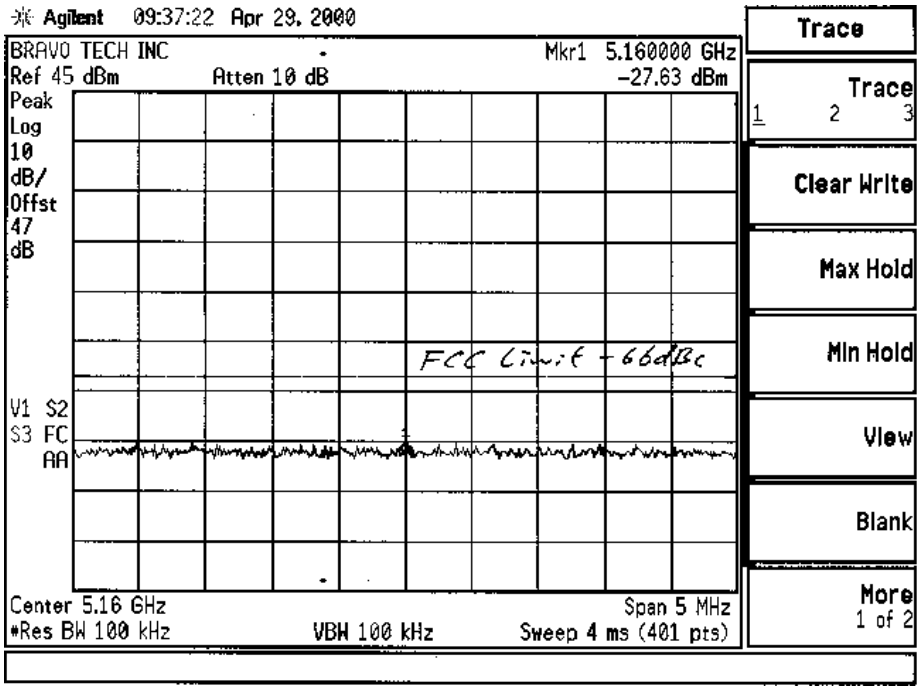

Agilent 09:33:33 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
#Atten 10 dB
Mkr1 2.580000 GHz
-17.64 dBm
Peak
Log
10
dB/
Offst
55
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 2.58 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

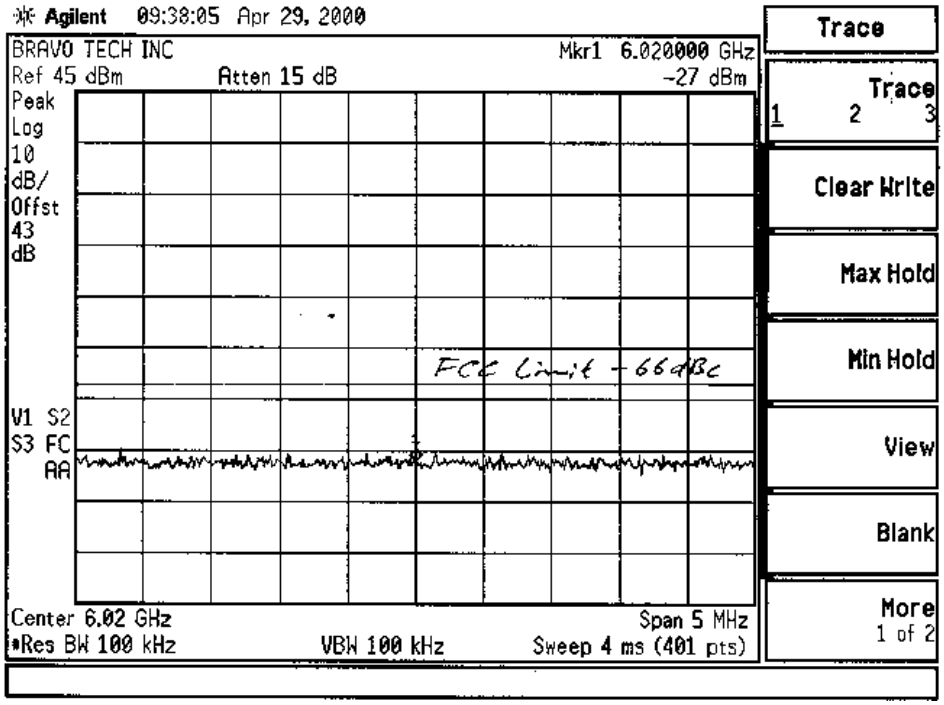

Agilent 09:35:49 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 3.440000 GHz
-25.69 dBm
Peak
Log
10
dB/
Offst
43
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 3.44 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


Agilent 09:36:34 Apr 29, 2000
BRAVO TECH INC
Ref 45 dBm
Atten 15 dB
Mkr1 4.300000 GHz
-25.88 dBm
Peak
Log
10
dB/
Offst
44
dB
FCC Limit -66dBc
V1 S2
S3 FC
AA
Center 4.3 GHz
#Res BW 100 kHz
VBW 100 kHz
Span 5 MHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

BTI

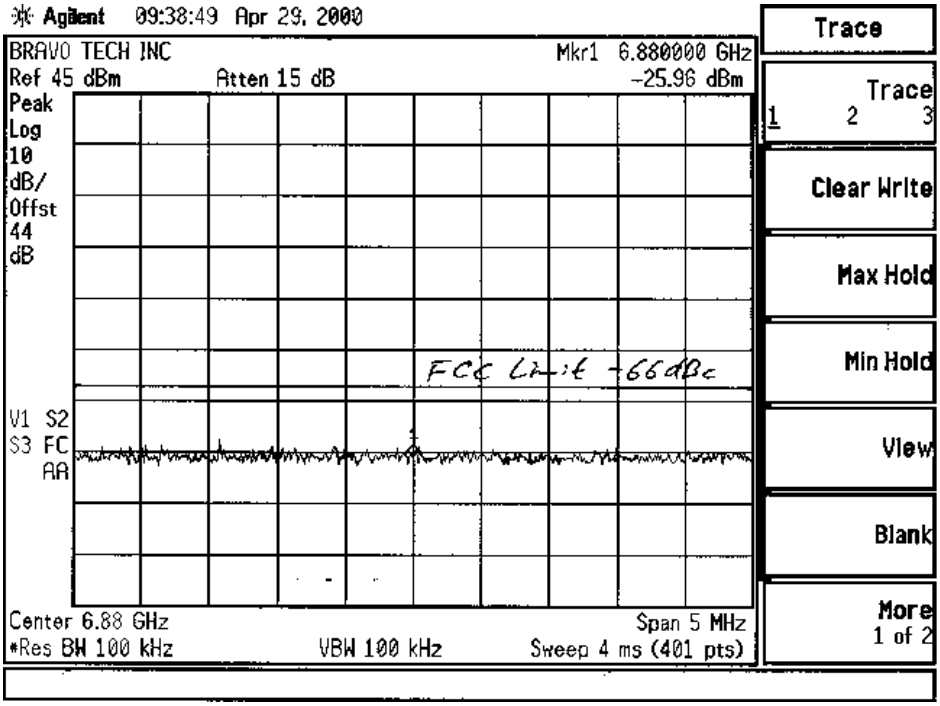
Bravo Tech, Inc.

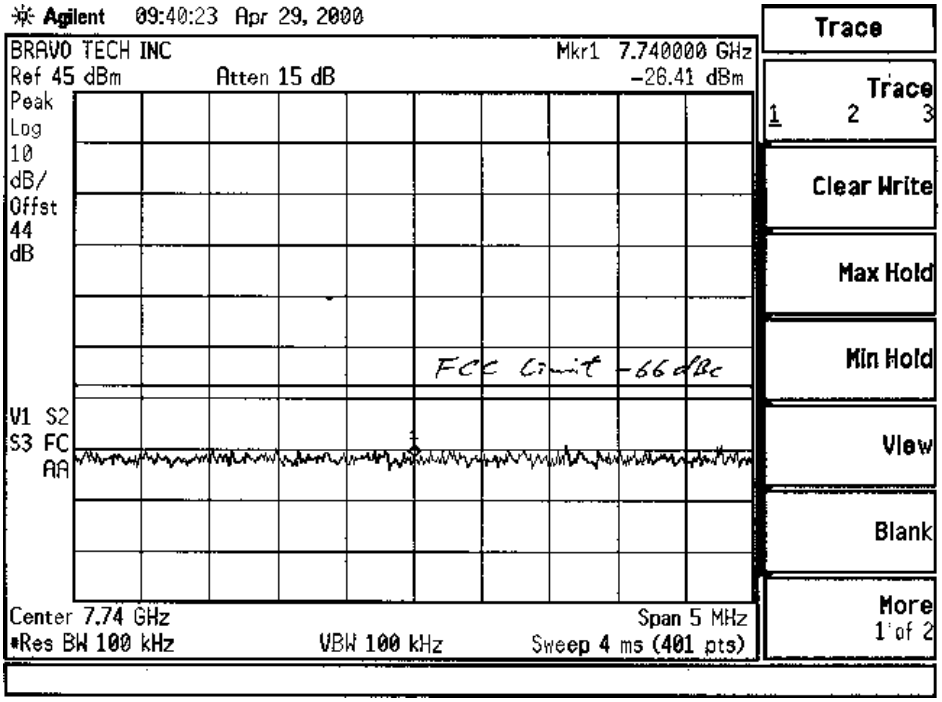




BTI

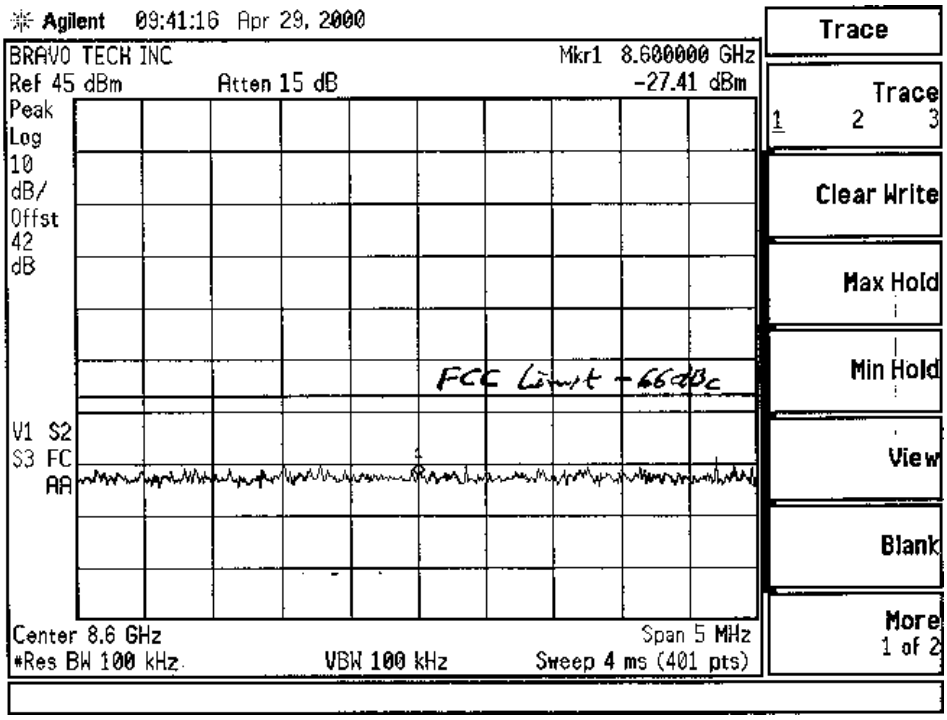
Bravo Tech, Inc.

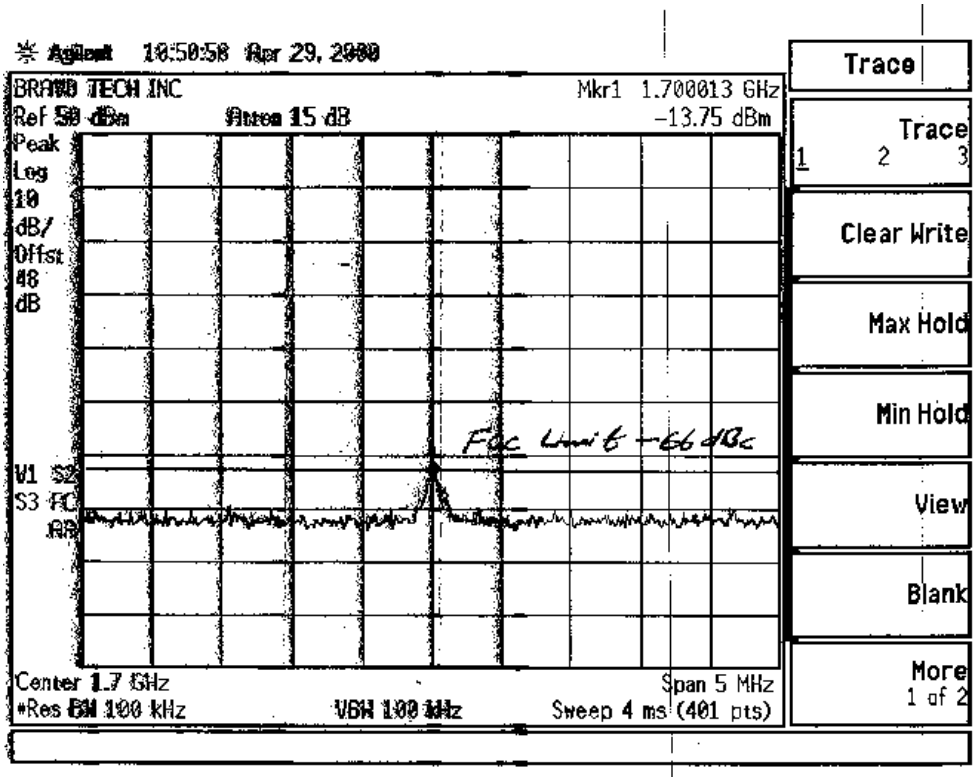


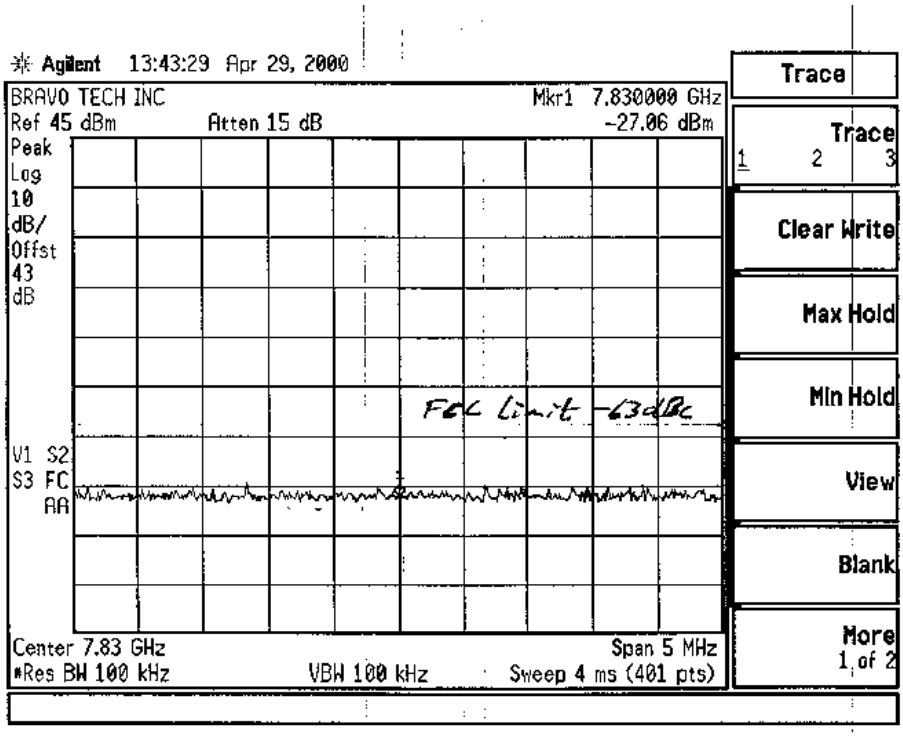


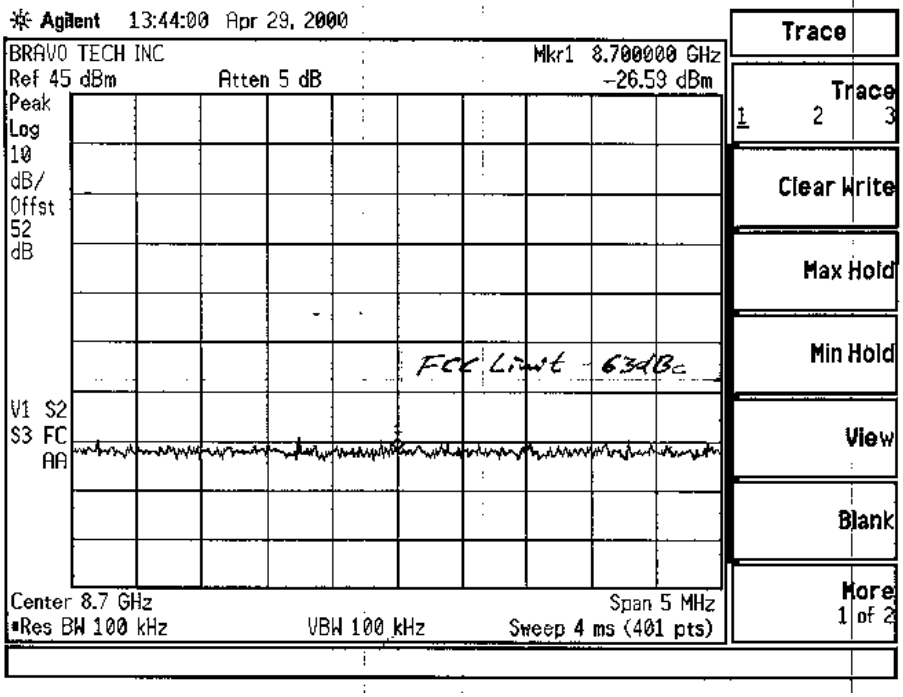
BTI

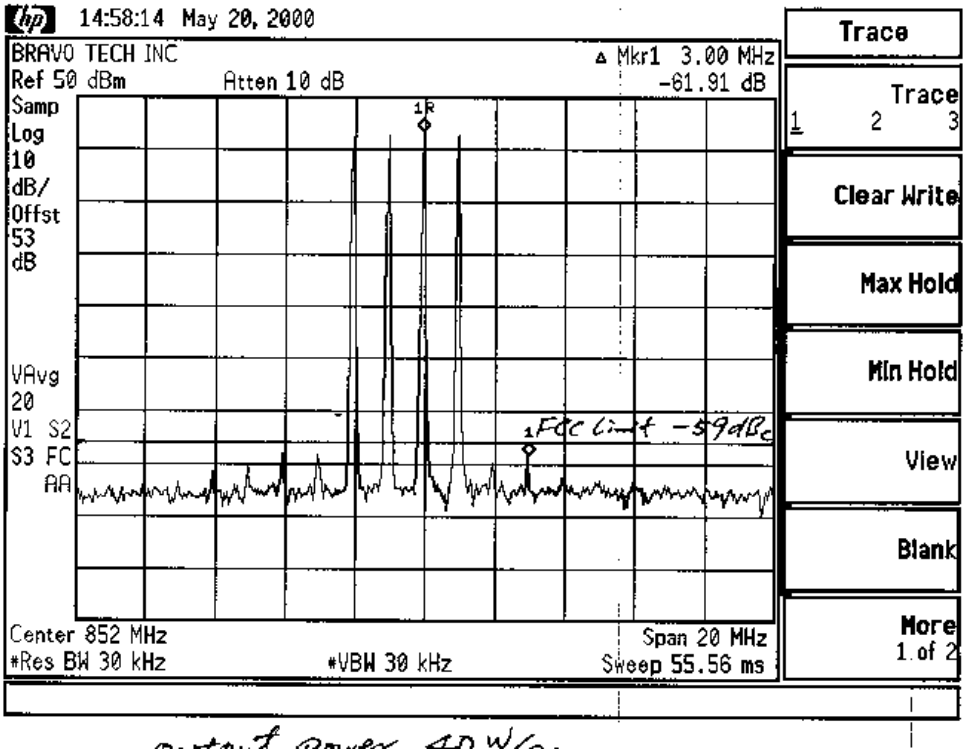
Bravo Tech, Inc.



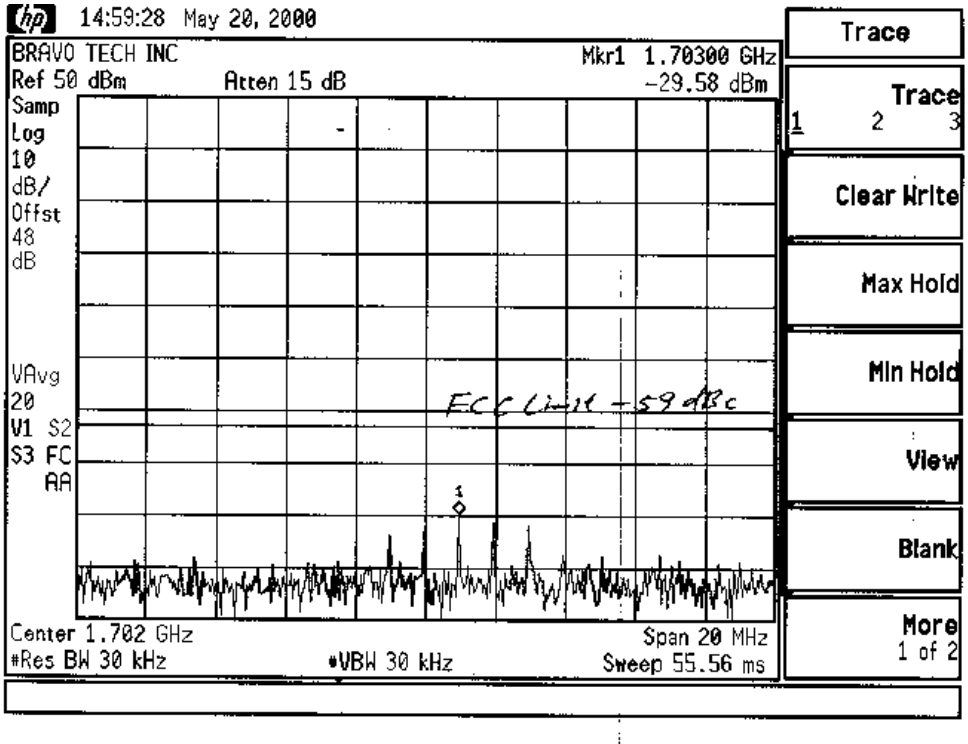


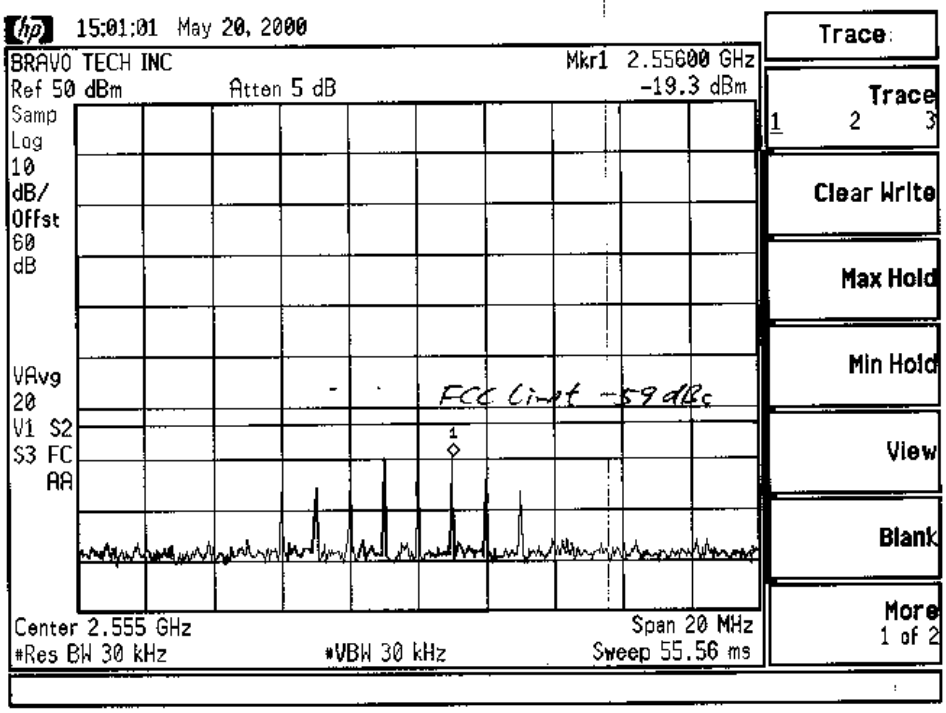

Agilent 13:43:29 Apr 29, 2000
BRAVO TECH INC
Mkr1 7.830000 GHz
Ref 45 dBm
Atten 15 dB
-27.06 dBm
Peak
Log
10
dB/
Offst
43
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 7.83 GHz
Span 5 MHz
#Res BW 100 kHz
VBW 100 kHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

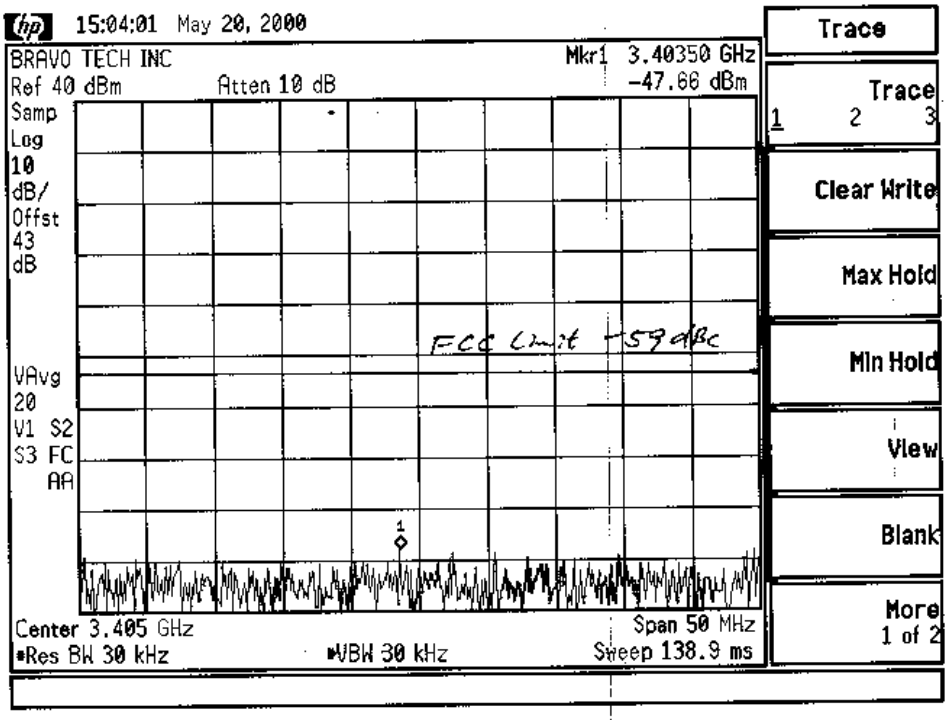

Agilent 13:44:00 Apr 29, 2000
BRAVO TECH INC
Mkr1 8.700000 GHz
Ref 45 dBm
Atten 5 dB
-26.59 dBm
Peak
Log
10
dB/
Offst
52
dB
FCC Limit -63dBc
V1 S2
S3 FC
AA
Center 8.7 GHz
Span 5 MHz
#Res BW 100 kHz
VBW 100 kHz
Sweep 4 ms (401 pts)
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

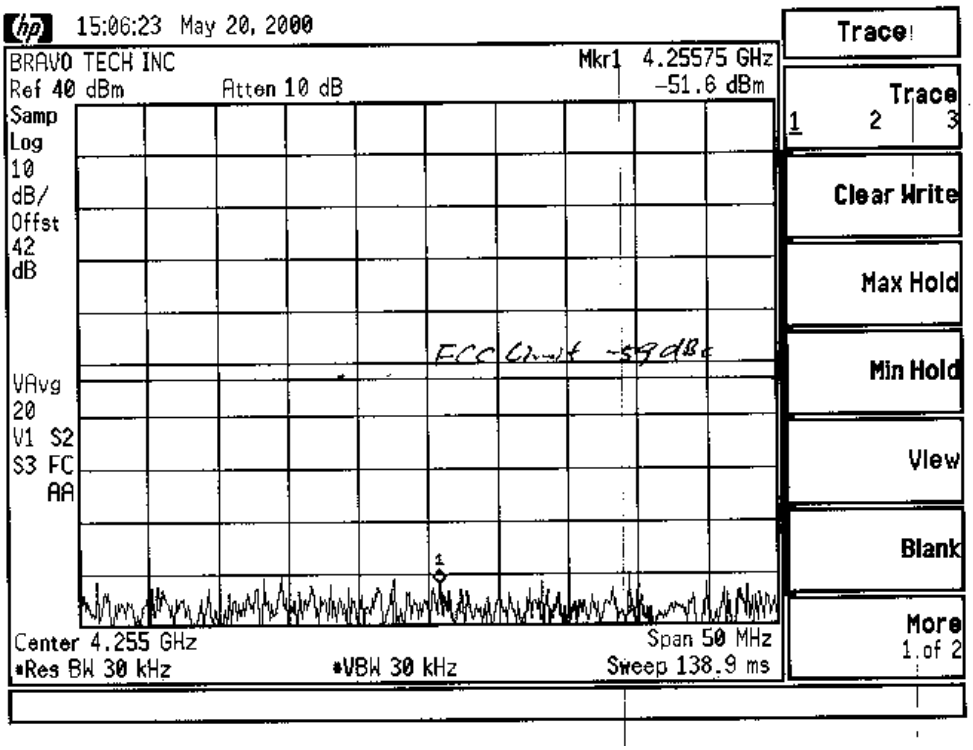


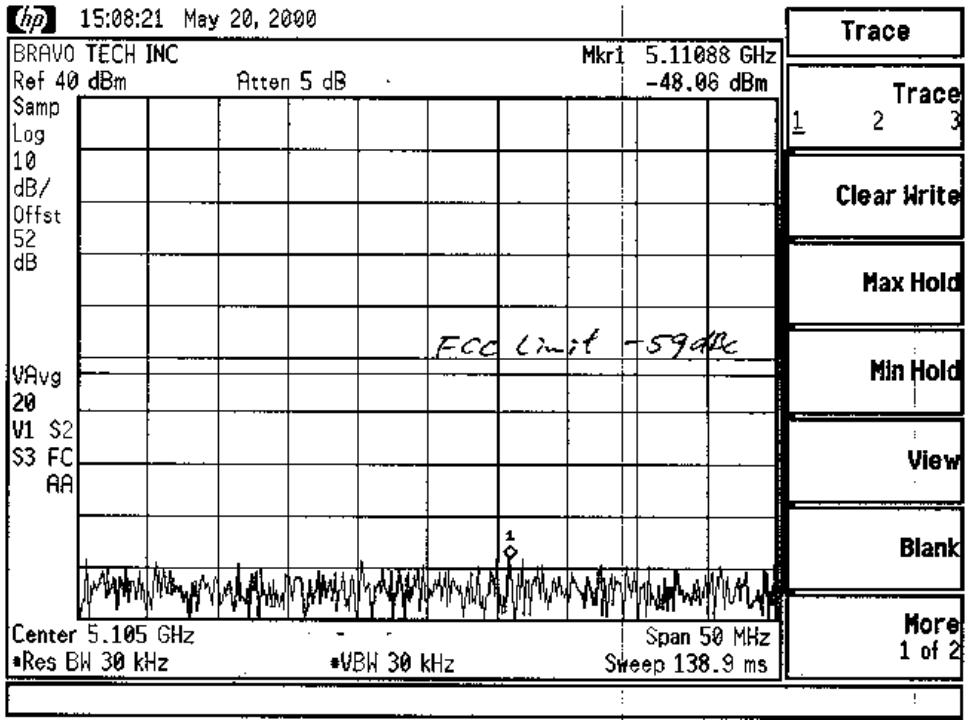
output power 40 W/ch




15:01:01 May 20, 2000
BRAVO TECH INC
Ref 50 dBm
Atten 5 dB
Mkr1 2.55600 GHz
-19.3 dBm
Samp
Log
10
dB/
Offst
60
dB
VAvg
20
V1 S2
S3 FC
AA
FCC Limit -59dBc
Center 2.555 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 20 MHz
Sweep 55.56 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

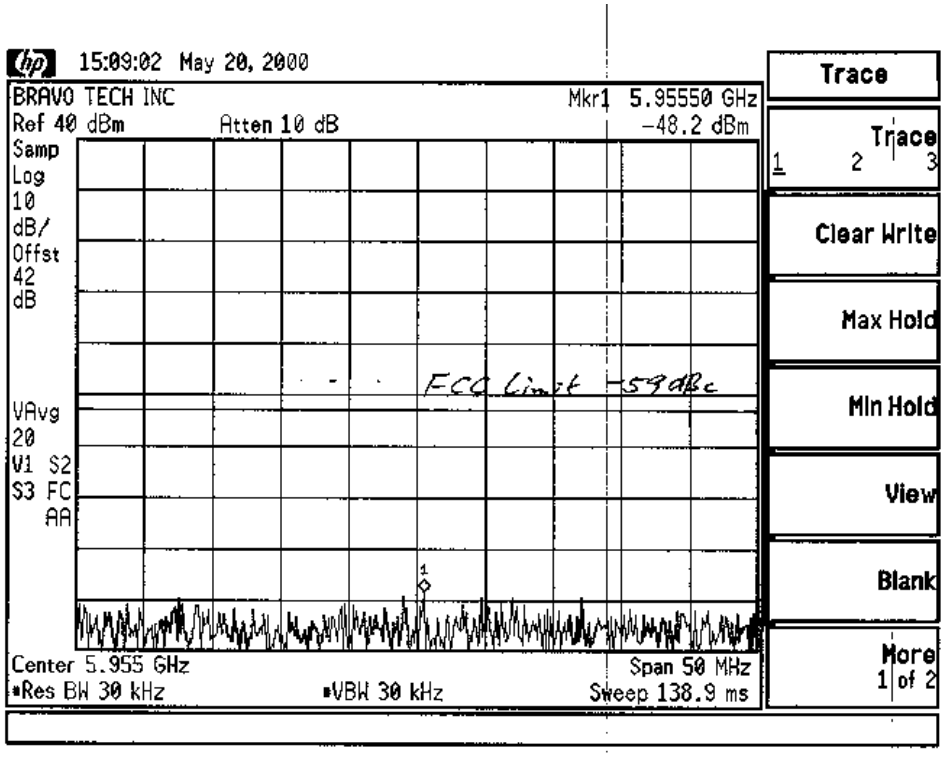

15:04:01 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 3.40350 GHz
-47.66 dBm
Samp
Log
10
dB/
Offst
43
dB
VAvg
20
V1 S2
S3 FC
AA
FCC Limit -59dBc
Center 3.405 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

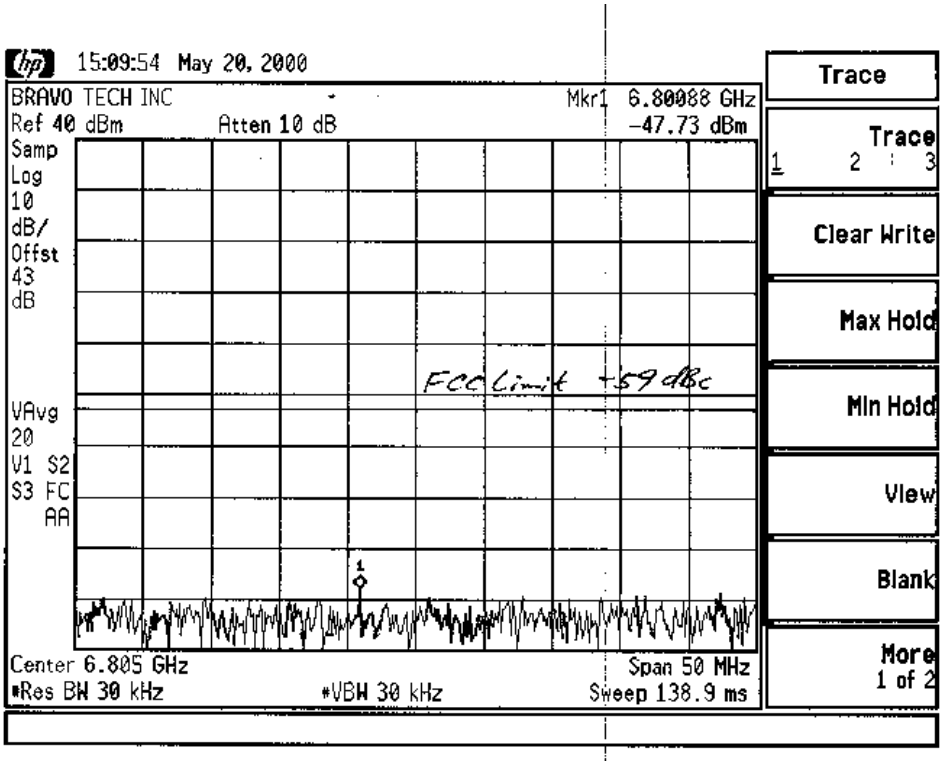

15:06:23 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 4.25575 GHz
-51.6 dBm
Samp
Log
10
dB/
Offst
42
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 4.255 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

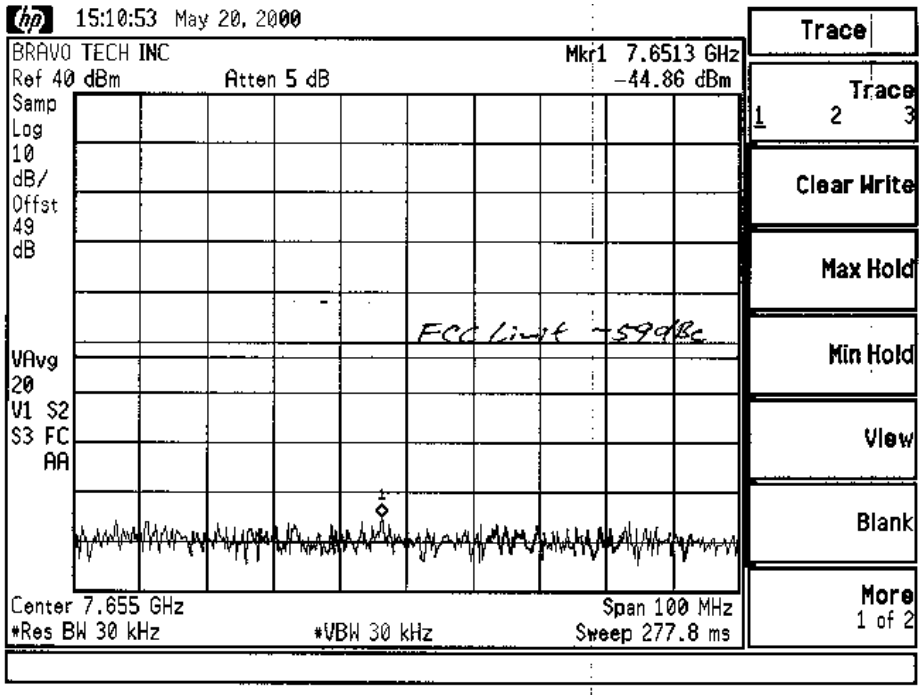

15:08:21 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 5 dB
Mkr1 5.11088 GHz
-48.06 dBm
Samp
Log
10
dB/
Offst
52
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 5.105 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

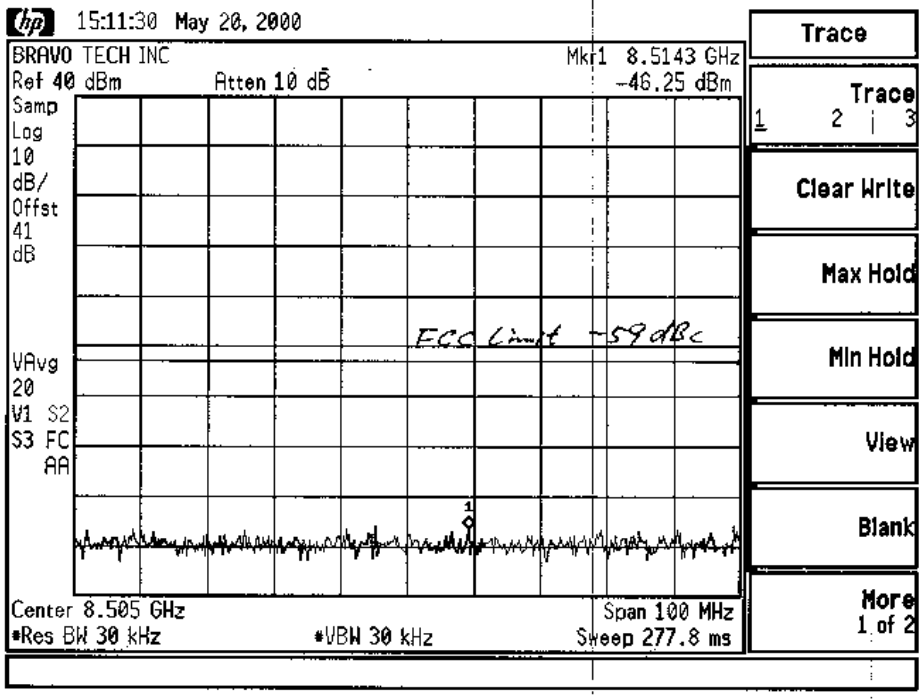
BTI

Bravo Tech, Inc.



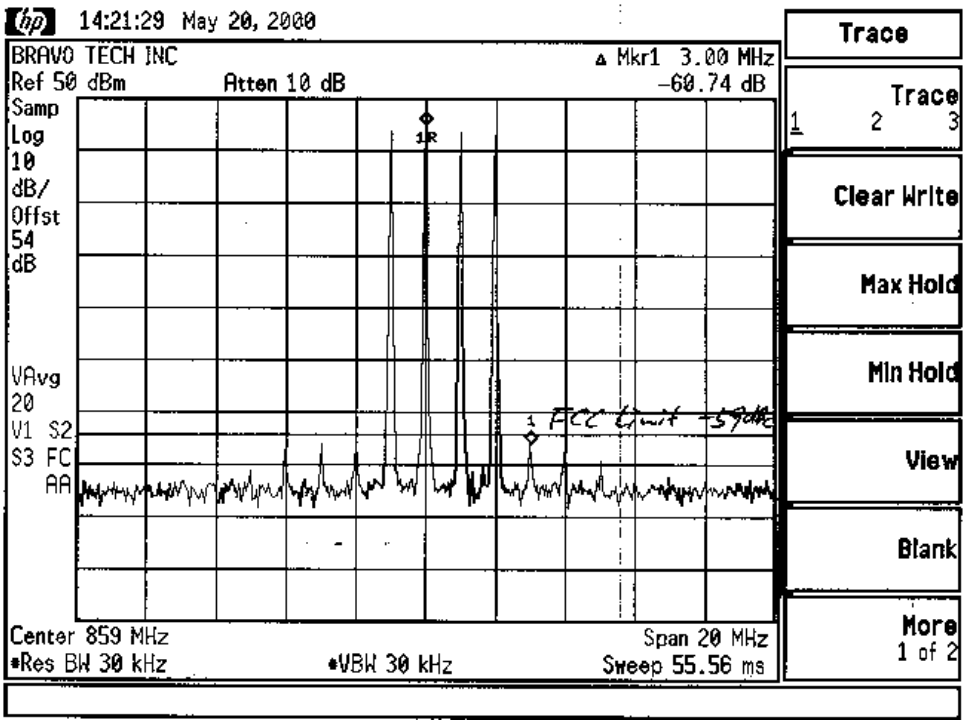


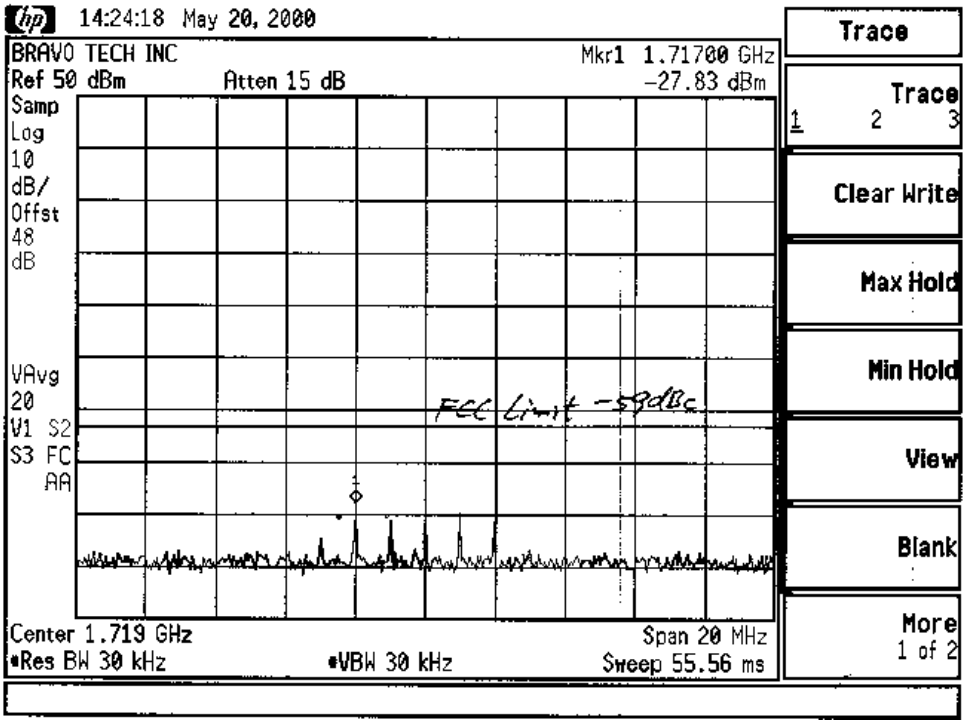

15:10:53 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 5 dB
Mkr1 7.6513 GHz
-44.86 dBm
Samp
Log
10
dB/
Offst
49
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 7.655 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 100 MHz
Sweep 277.8 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


15:11:30 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 8.5143 GHz
-46.25 dBm
Samp
Log
10
dB/
Offst
41
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 8.505 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 100 MHz
Sweep 277.8 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

BTI

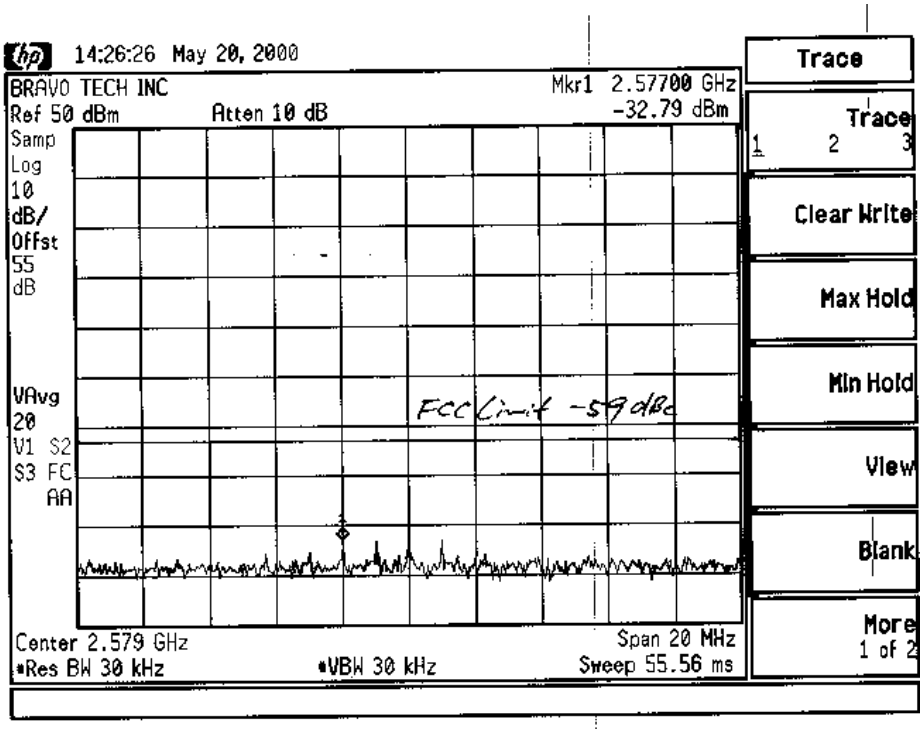
Bravo Tech, Inc.

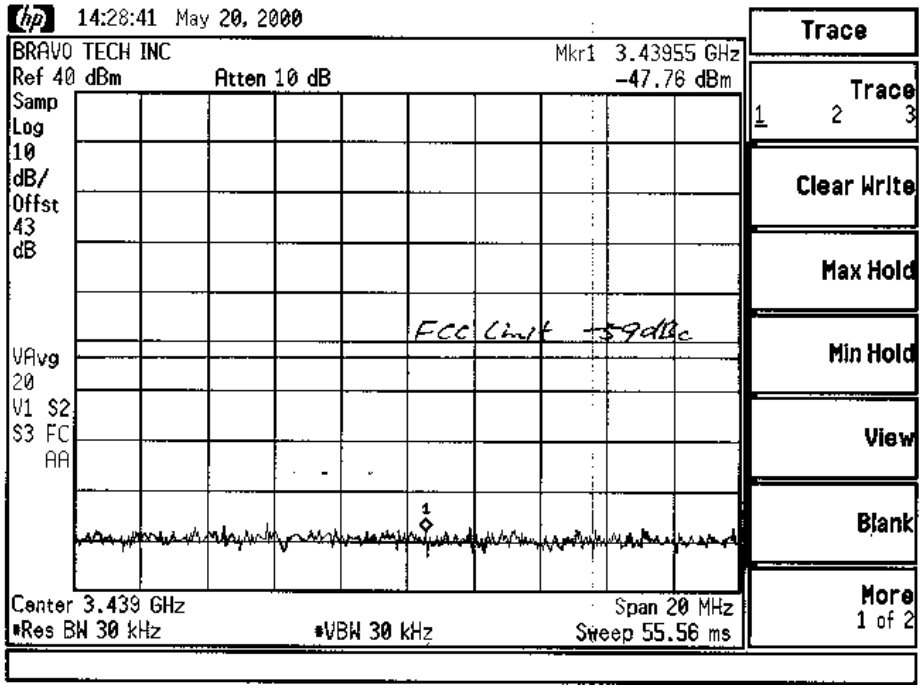


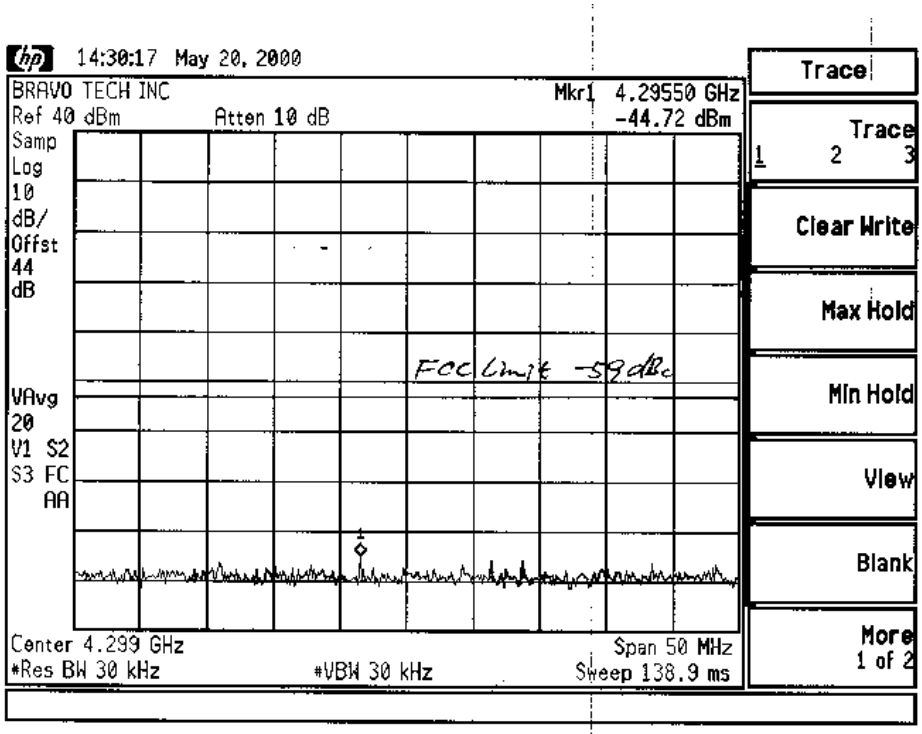


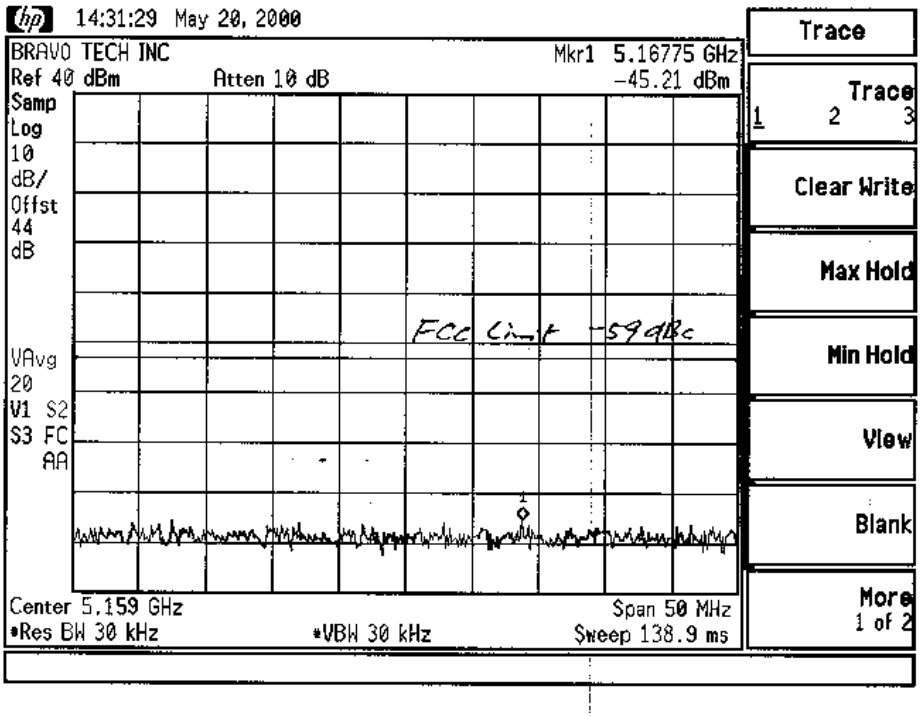
BTI

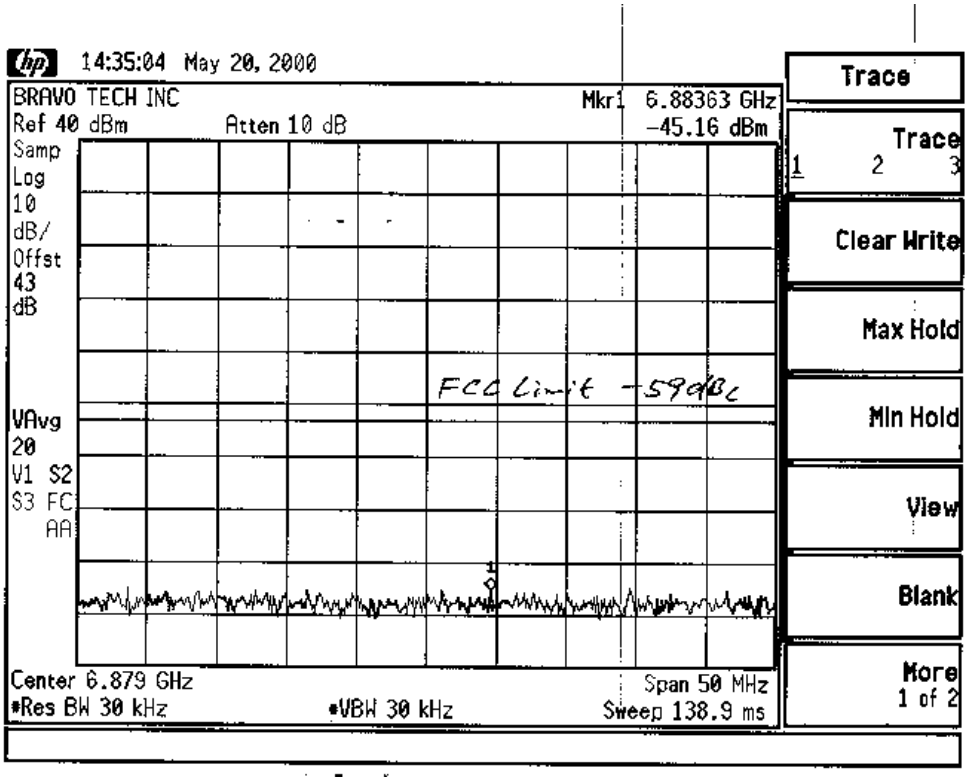
Bravo Tech, Inc.

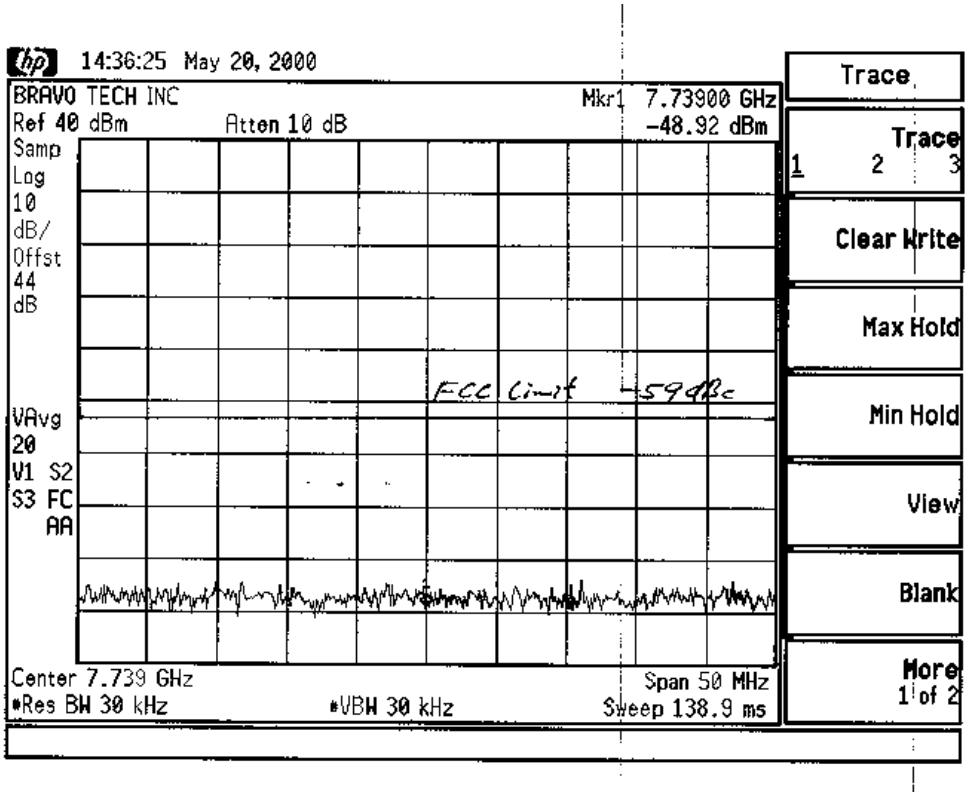





14:30:17 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 4.29550 GHz
-44.72 dBm
Samp
Log
10
dB/
Offst
44
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 4.299 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

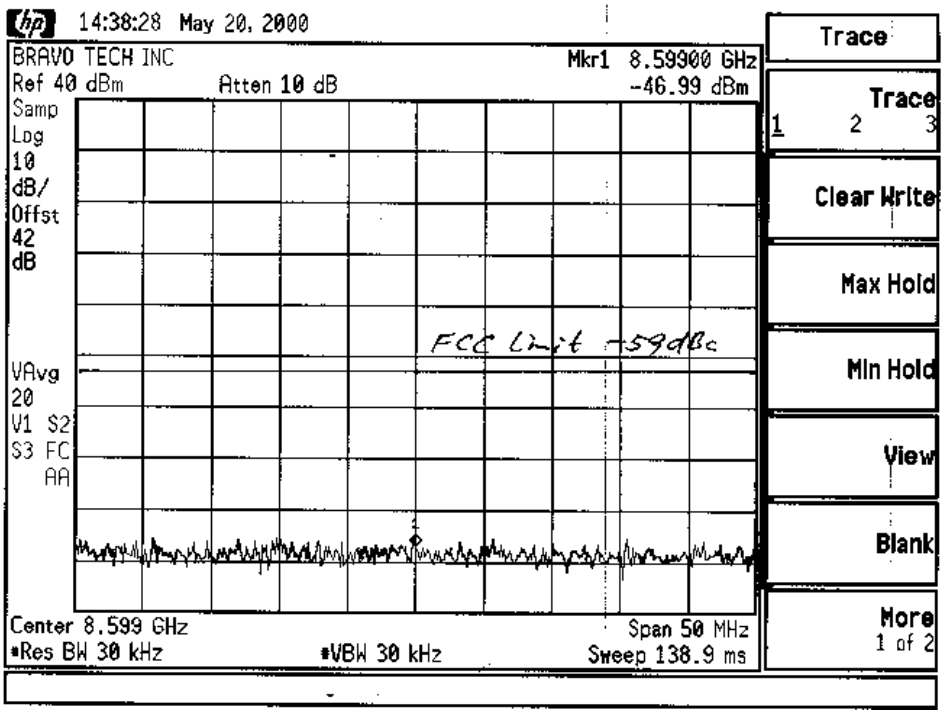

14:31:29 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 5.16775 GHz
-45.21 dBm
Samp
Log
10
dB/
Offst
44
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 5.159 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

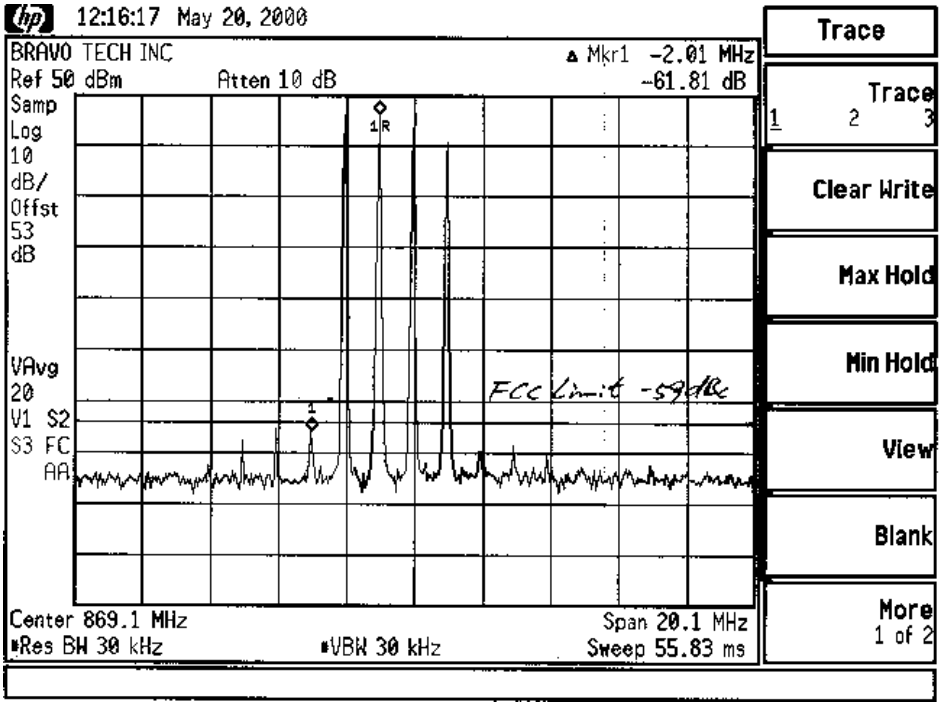

14:35:04 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 6.88363 GHz
-45.16 dBm
Samp
Log
10
dB/
Offst
43
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 6.879 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

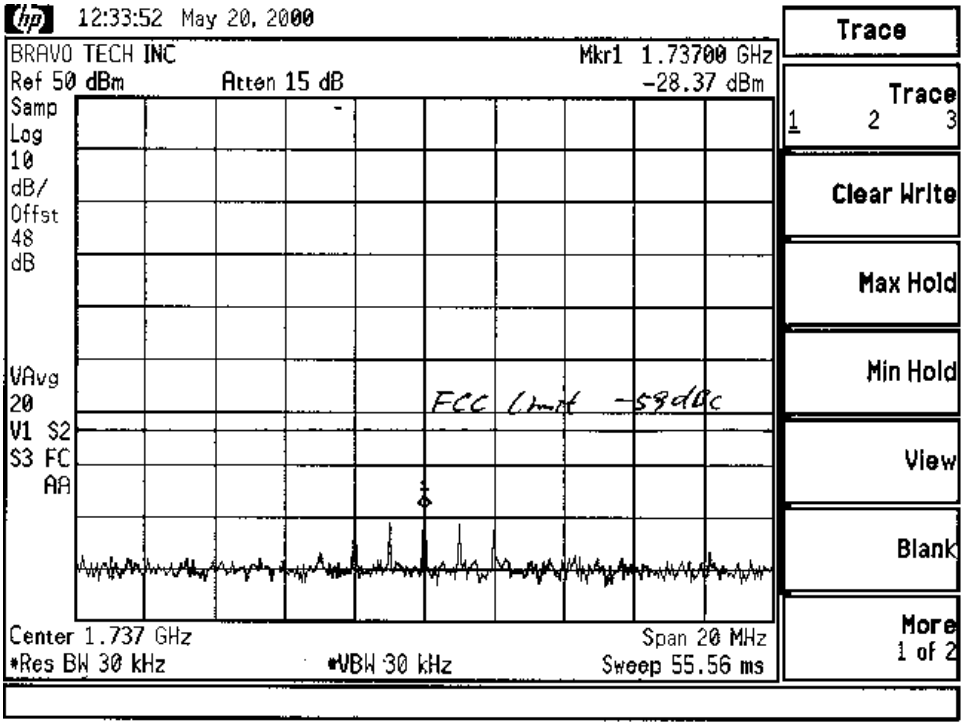

14:36:25 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 7.73900 GHz
-48.92 dBm
Samp
Log
10
dB/
Offst
44
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 7.739 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

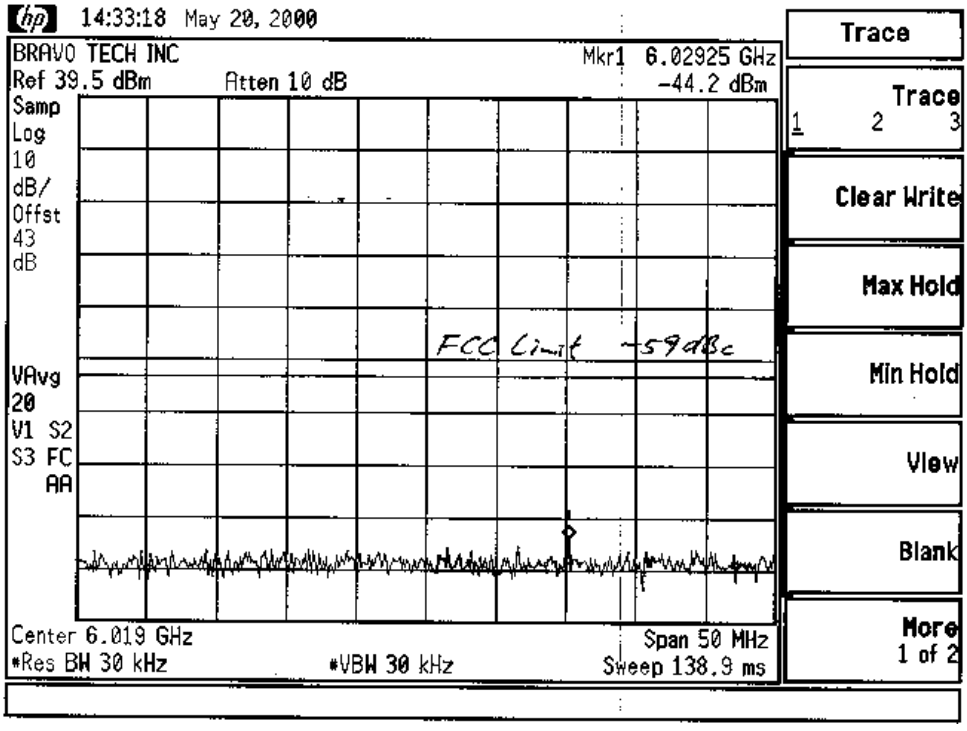
BTI

Bravo Tech, Inc.



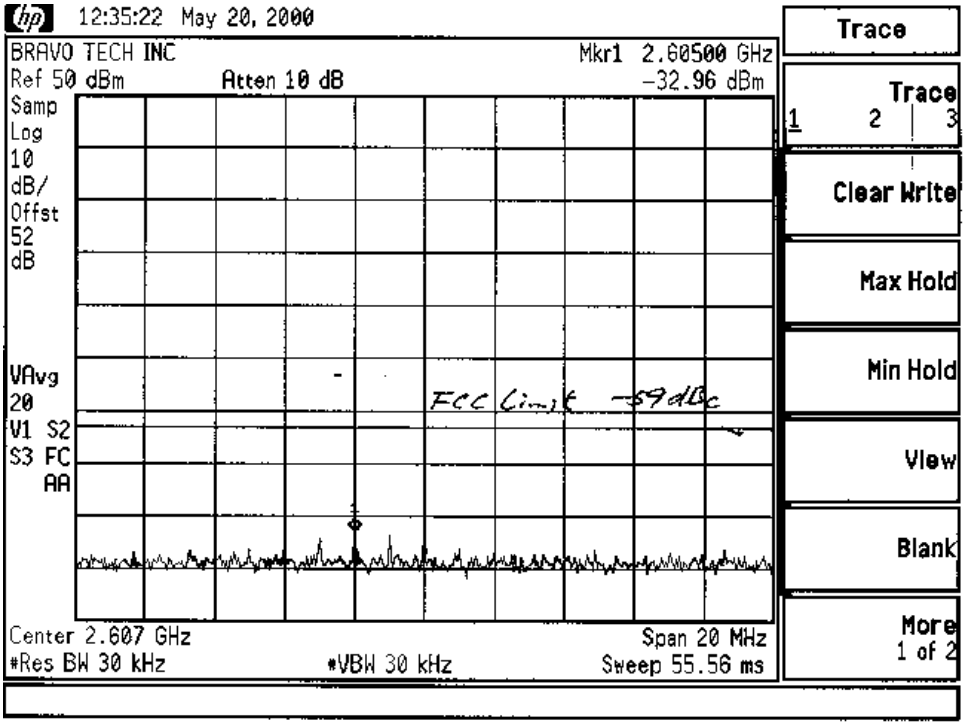


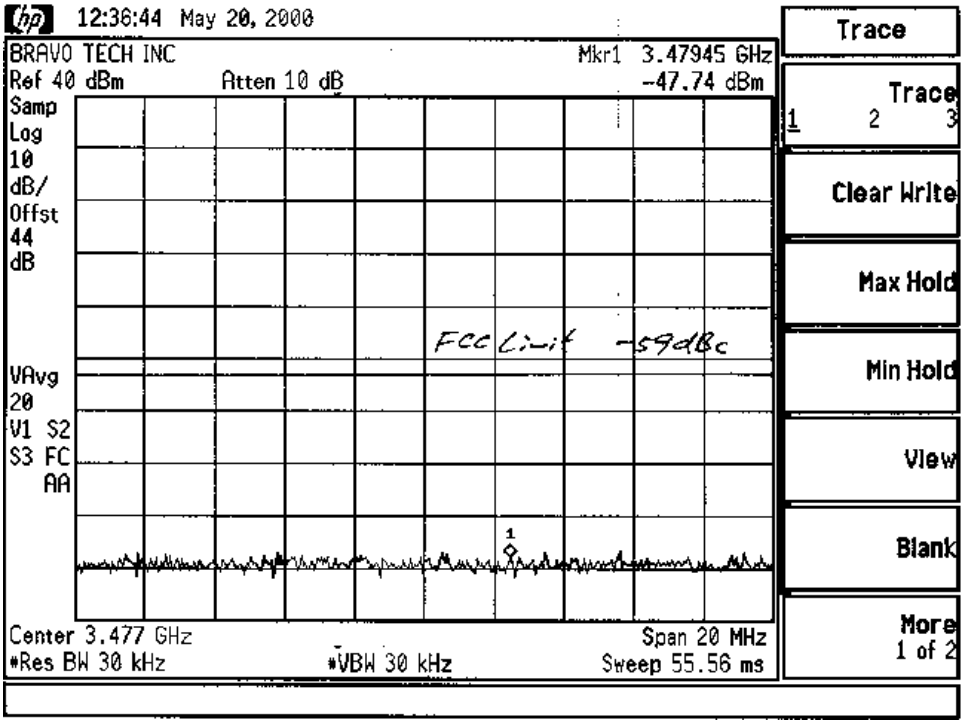

12:33:52 May 20, 2000
BRAVO TECH INC
Ref 50 dBm
Atten 15 dB
Mkr1 1.73700 GHz
-28.37 dBm
Samp
Log
10
dB/
Offst
48
dB
VAvg
20
V1 S2
S3 FC
AA
FCC Limit -59dBc
Center 1.737 GHz
*Res BW 30 kHz
*VBW 30 kHz
Span 20 MHz
Sweep 55.56 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

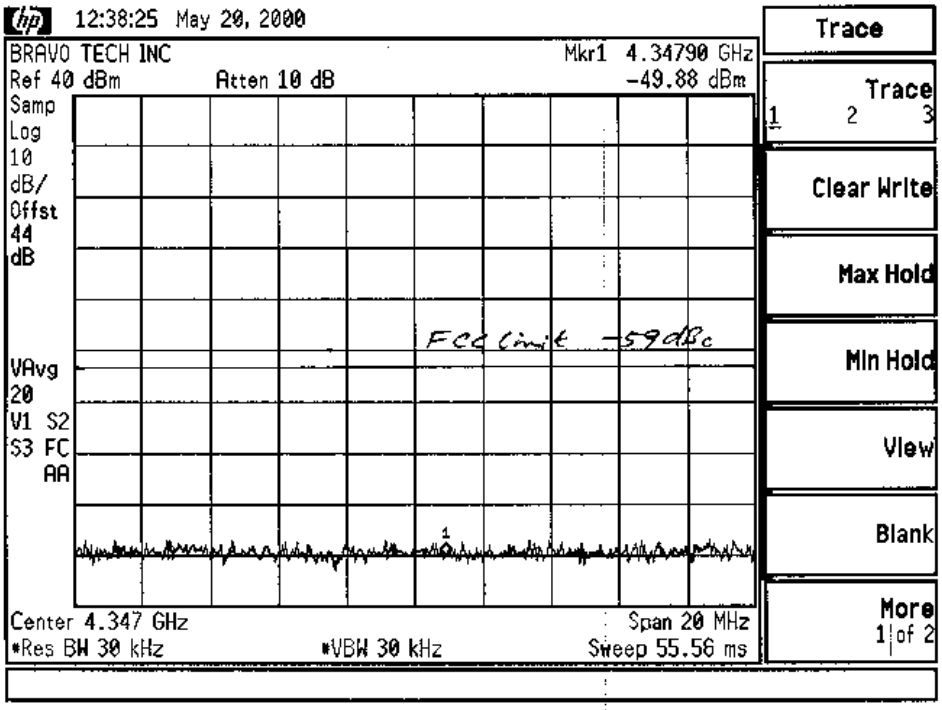

14:33:18 May 20, 2000
BRAVO TECH INC
Ref 39.5 dBm
Atten 10 dB
Mkr1 6.02925 GHz
-44.2 dBm
Samp
Log
10
dB/
Offst
43
dB
VAvg
20
V1 S2
S3 FC
AA
FCC Limit -59dBc
Center 6.019 GHz
*Res BW 30 kHz
*VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

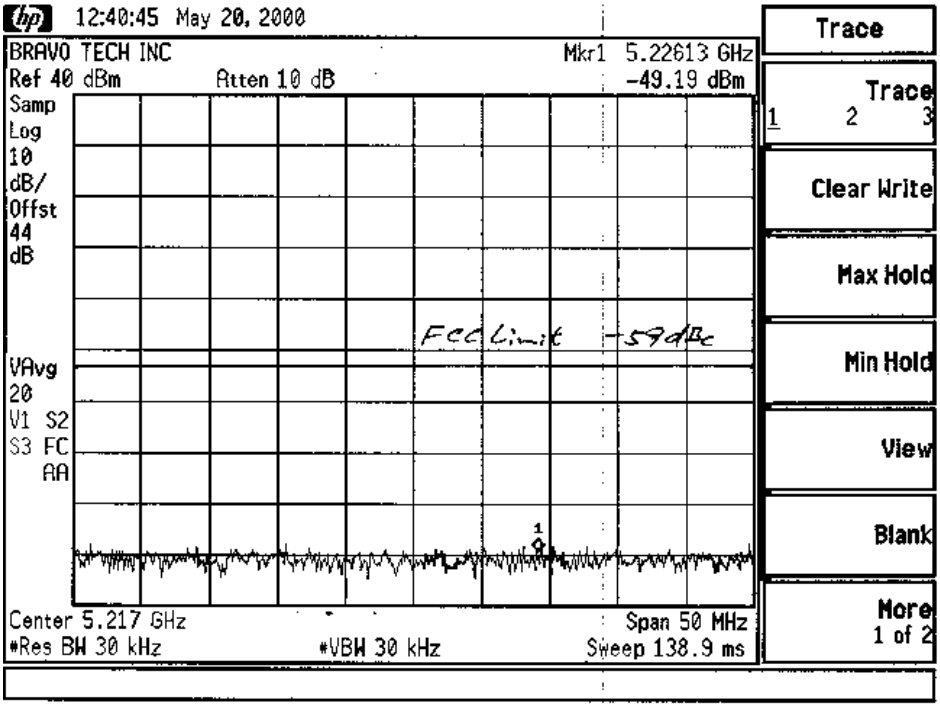
BTI

Bravo Tech, Inc.



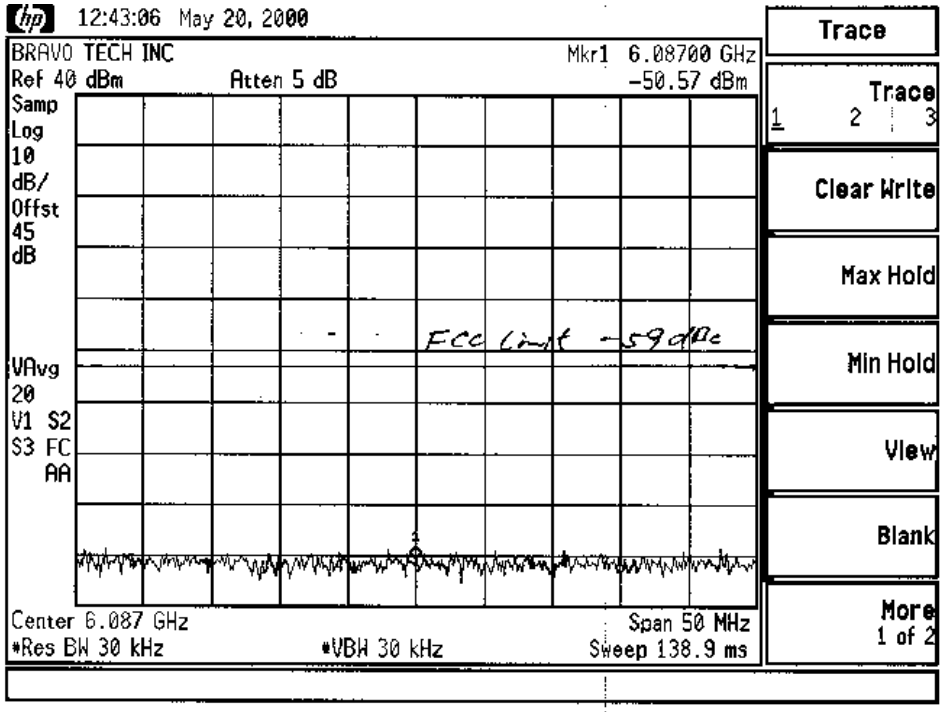


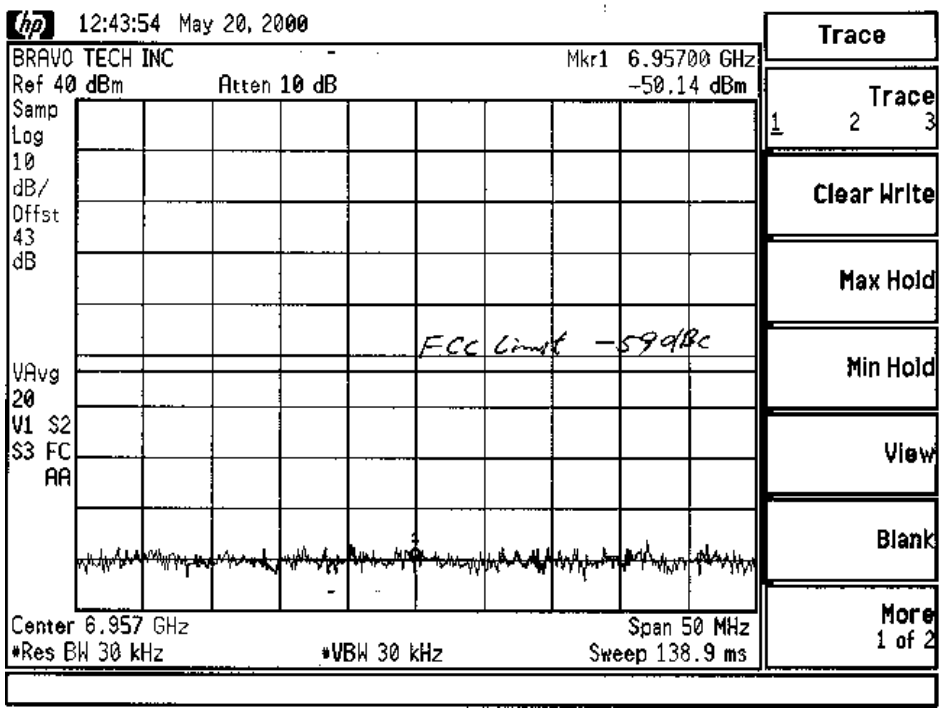

12:38:25 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 4.34790 GHz
-49.88 dBm
Samp
Log
10
dB/
Offst
44
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 4.347 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 20 MHz
Sweep 55.56 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


12:40:45 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 5.22613 GHz
-49.19 dBm
Samp
Log
10
dB/
Offst
44
dB
FCC Limit -59dBc
VAvg
20
V1 S2
S3 FC
AA
Center 5.217 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 50 MHz
Sweep 138.9 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

BTI

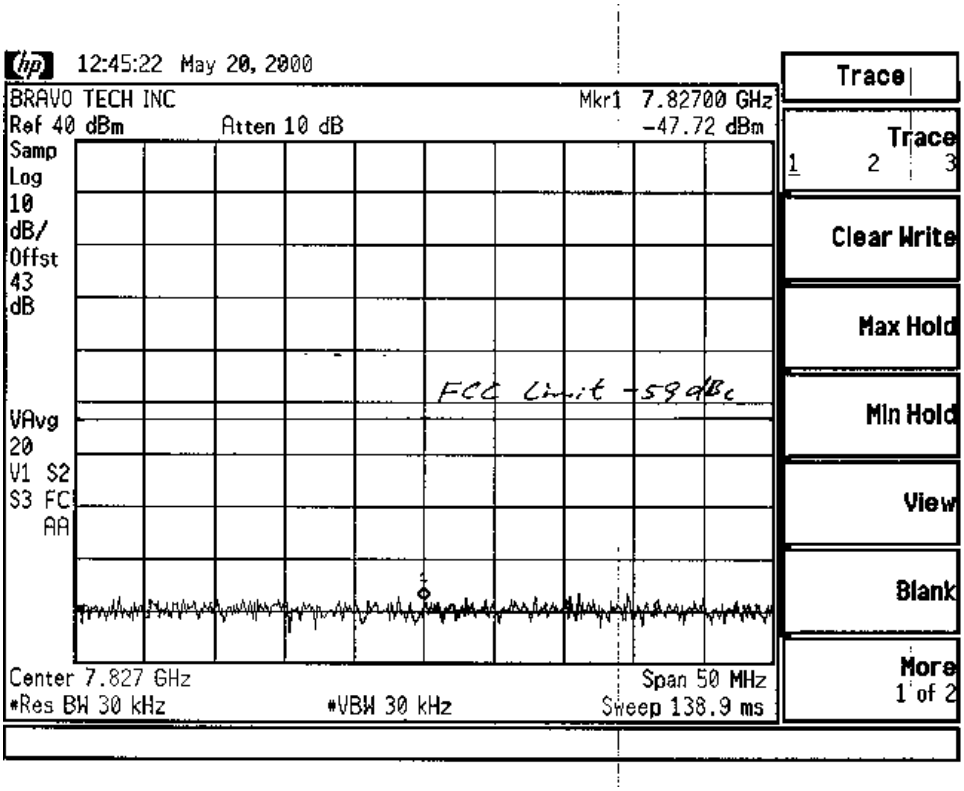
Bravo Tech, Inc.

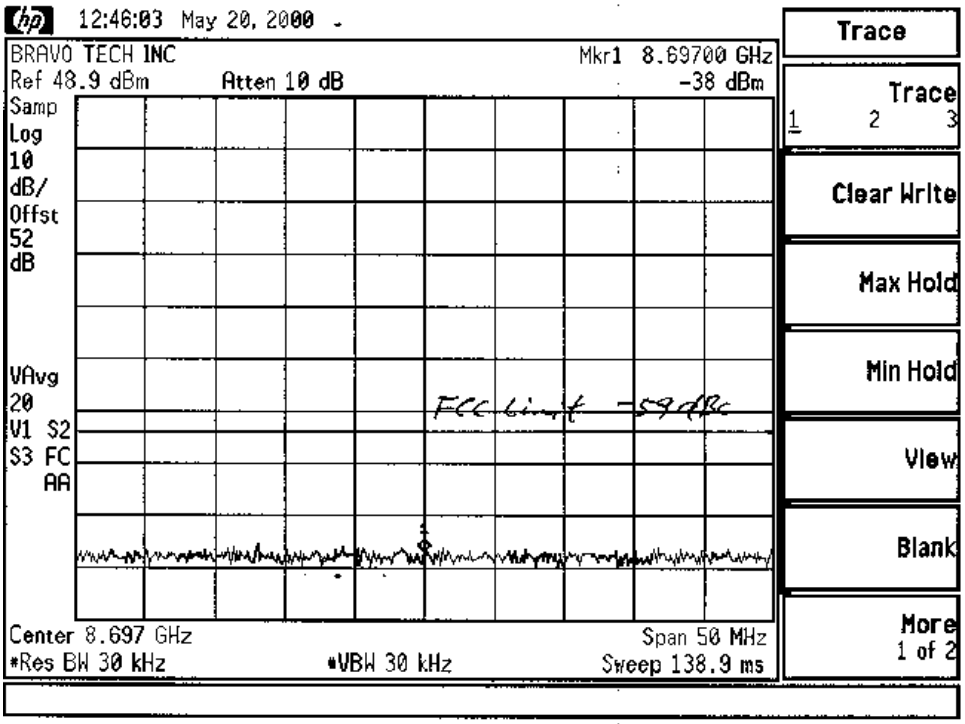




BTI

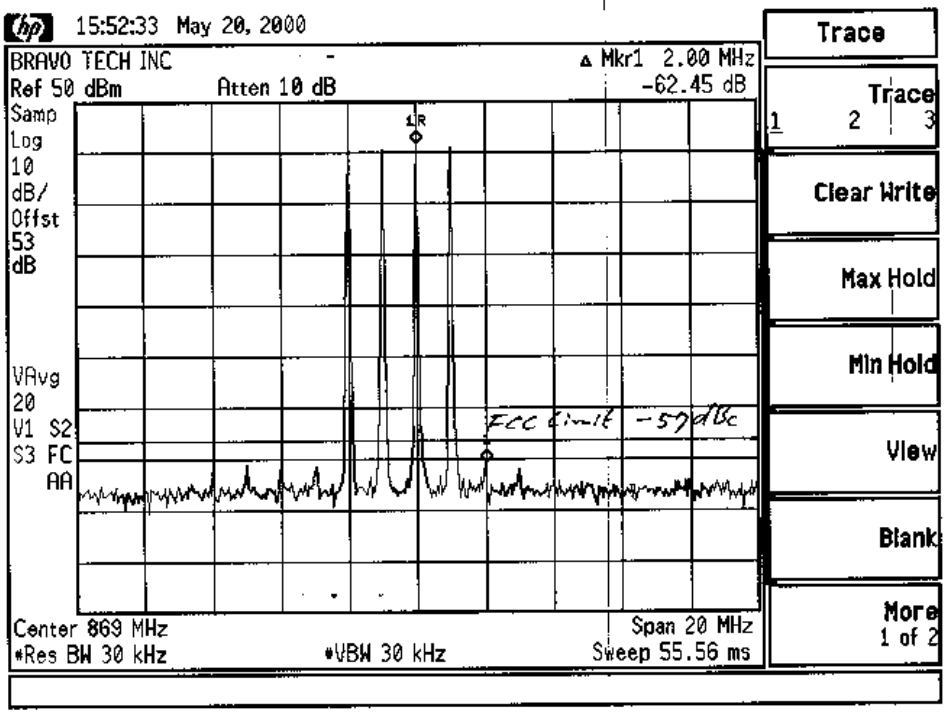
Bravo Tech, Inc.

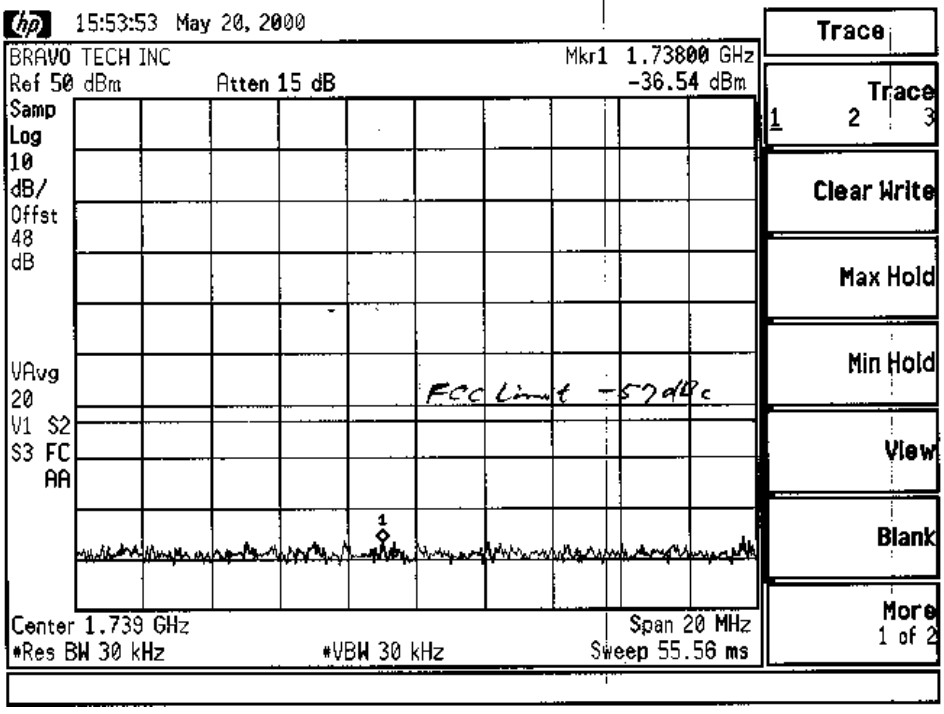




BTI

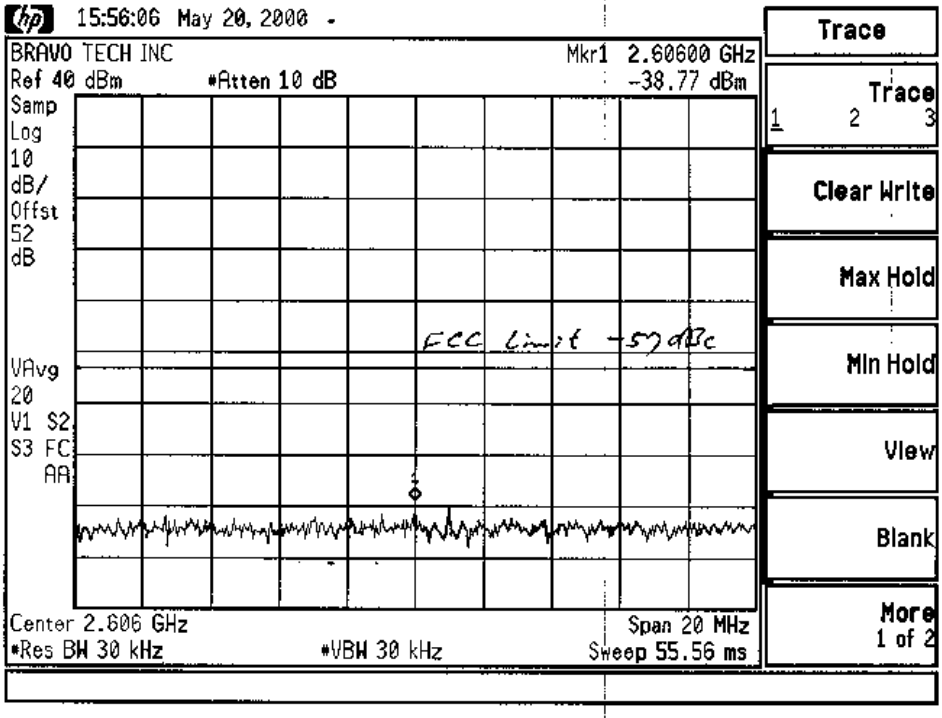
Bravo Tech, Inc.

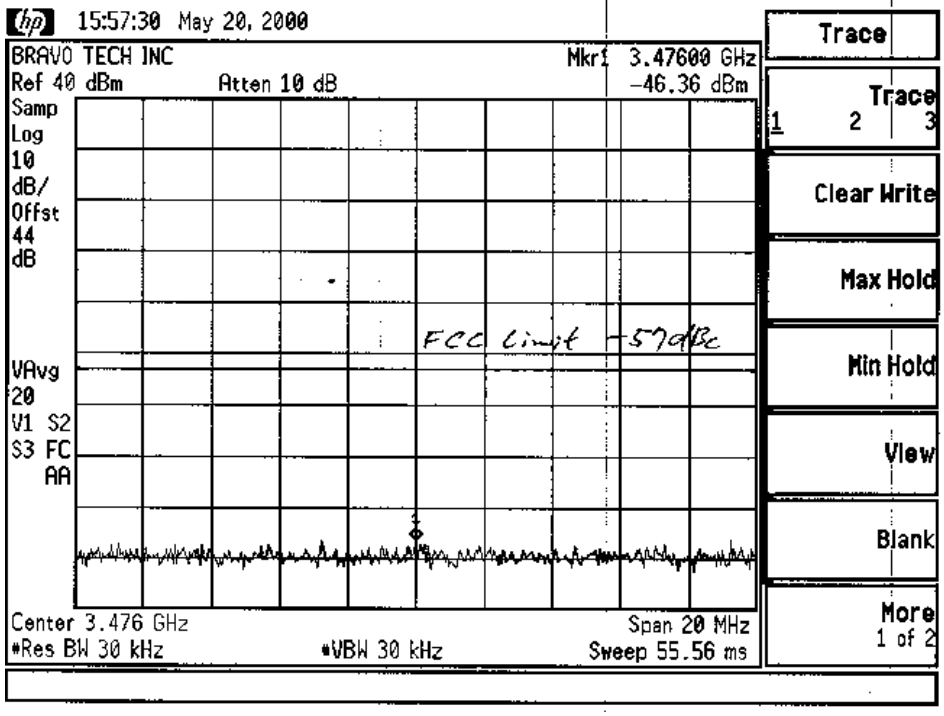


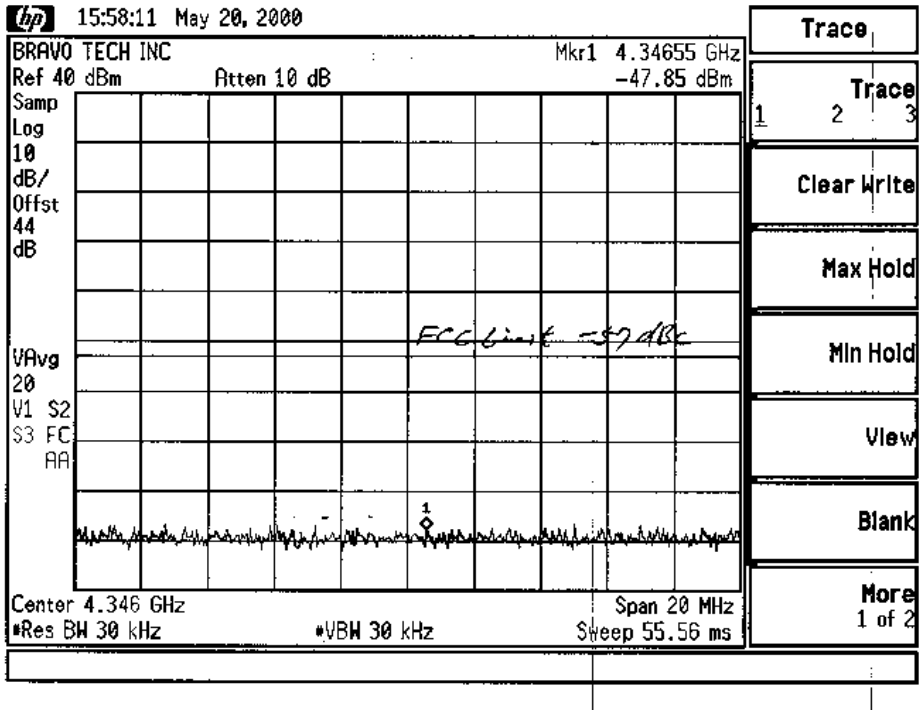


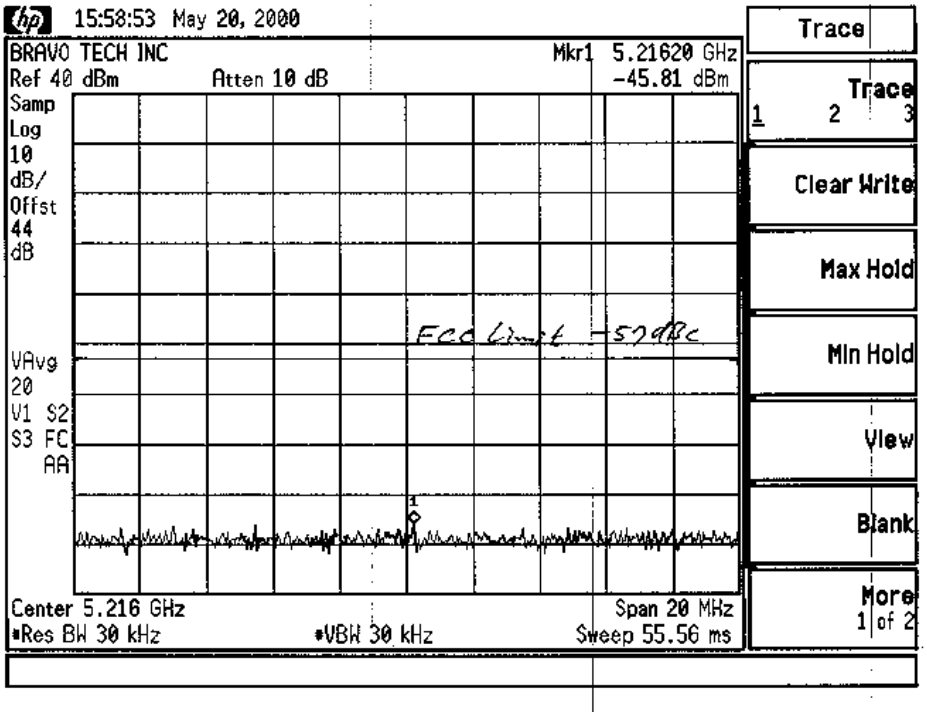
BTI

Bravo Tech, Inc.



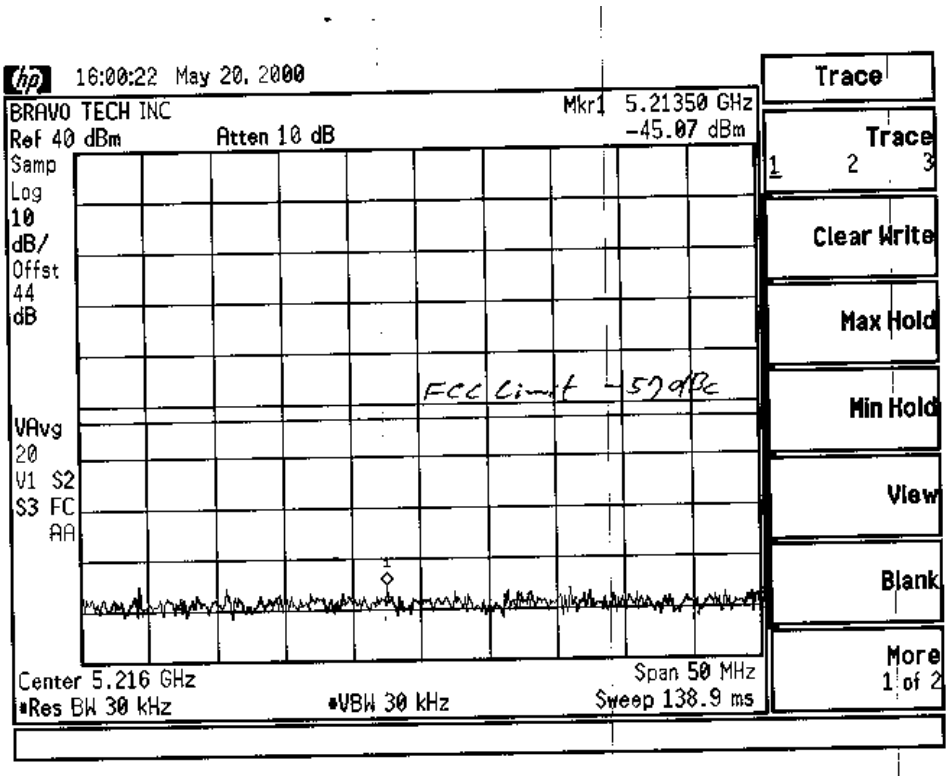


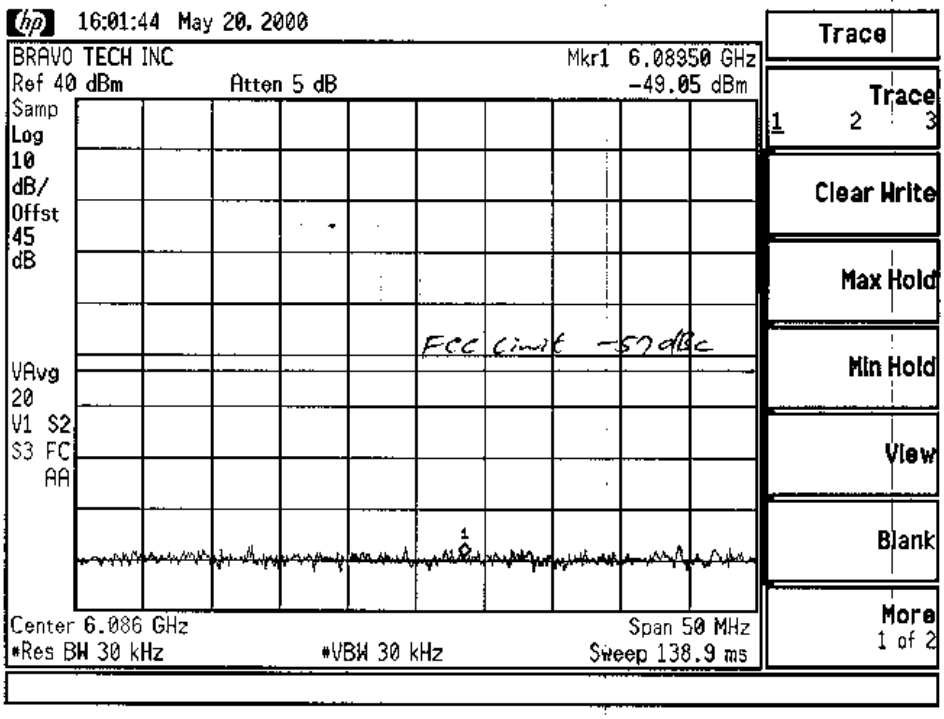

15:58:11 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 4.34655 GHz
-47.85 dBm
Samp
Log
10
dB/
Offst
44
dB
FCC Limit -57dBc
VAvg
20
V1 S2
S3 FC
AA
Center 4.346 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 20 MHz
Sweep 55.56 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2


15:58:53 May 20, 2000
BRAVO TECH INC
Ref 40 dBm
Atten 10 dB
Mkr1 5.21620 GHz
-45.81 dBm
Samp
Log
10
dB/
Offst
44
dB
FCC Limit -57dBc
VAvg
20
V1 S2
S3 FC
AA
Center 5.216 GHz
#Res BW 30 kHz
#VBW 30 kHz
Span 20 MHz
Sweep 55.56 ms
Trace
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

BTI

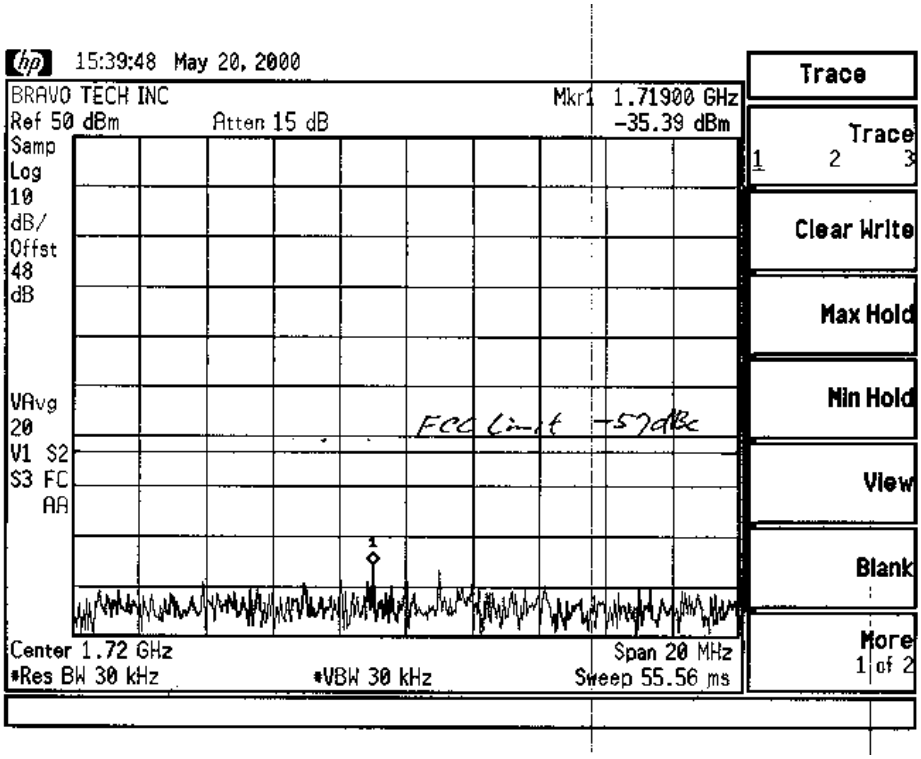
Bravo Tech, Inc.

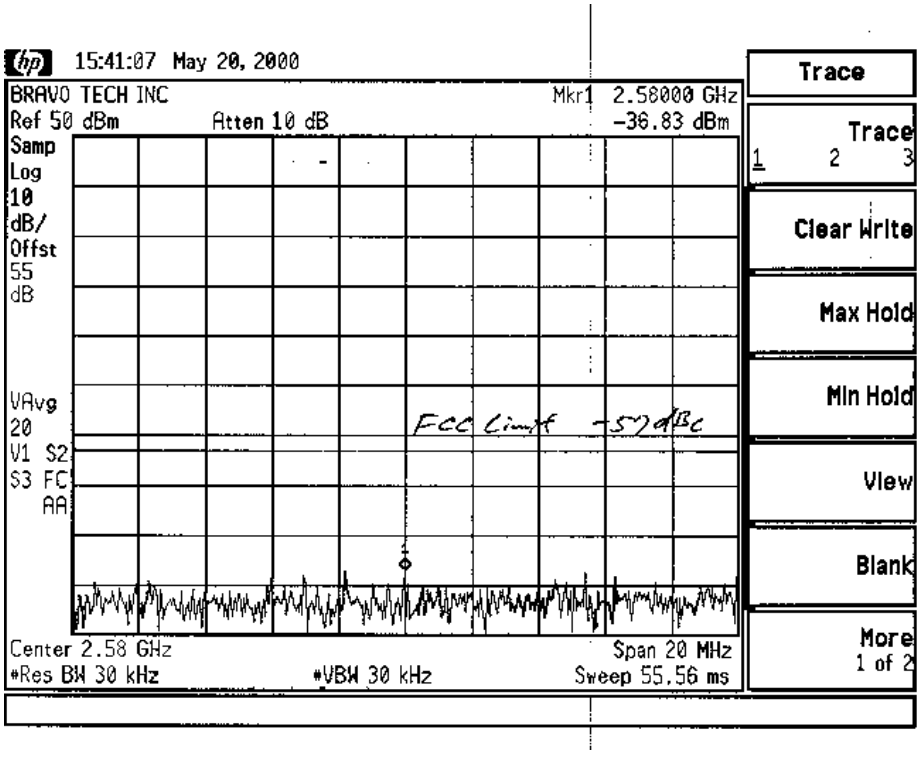




BTI

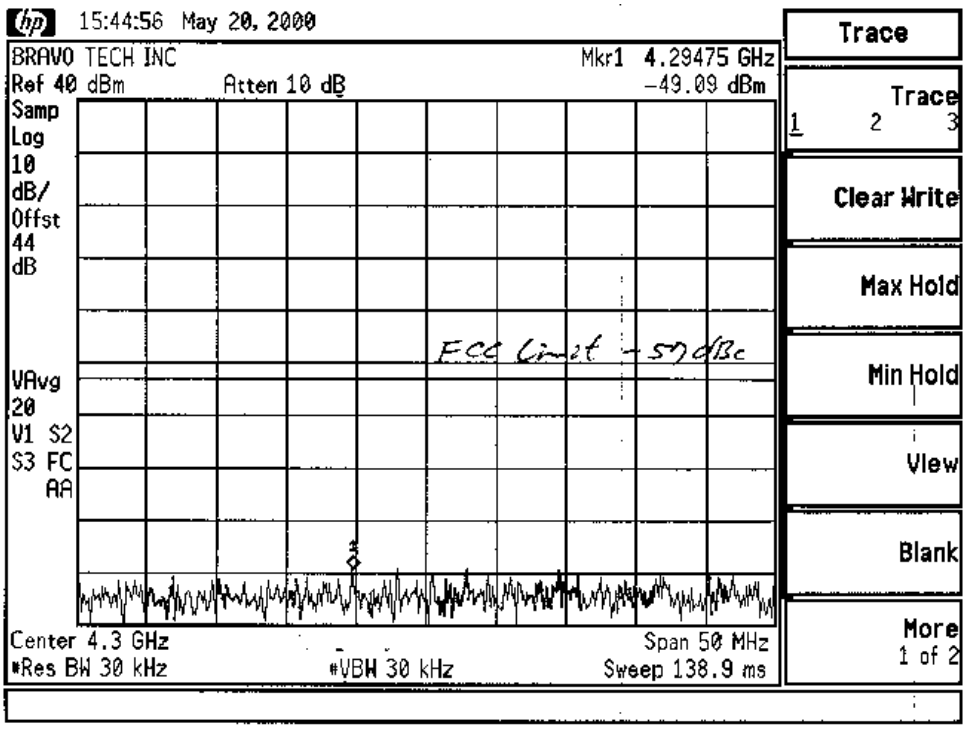
Bravo Tech, Inc.

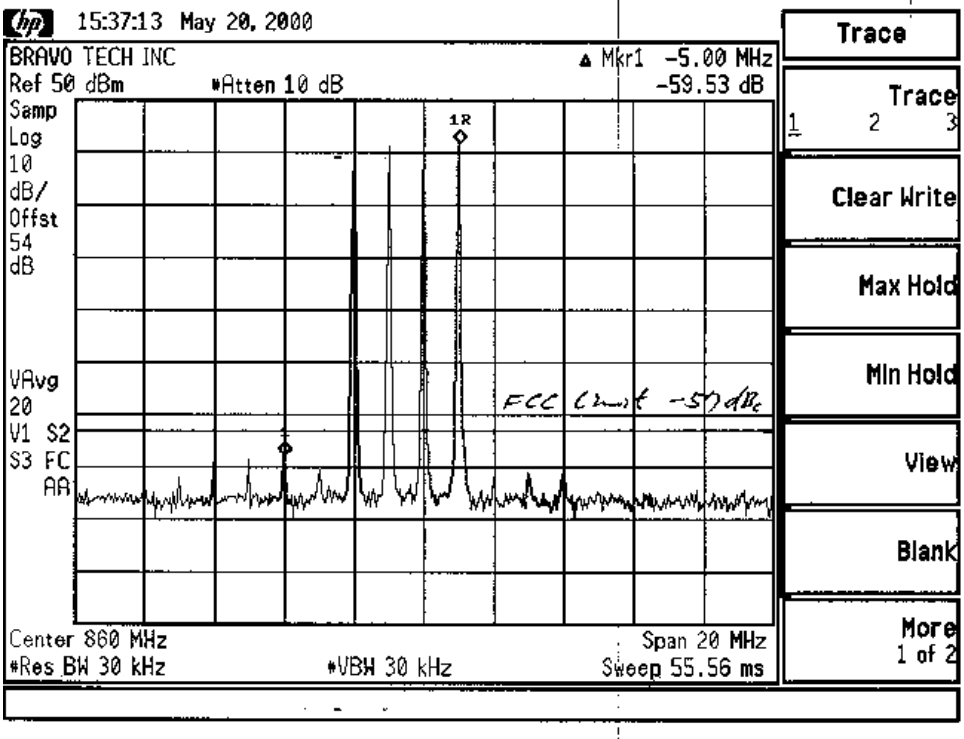




BTI

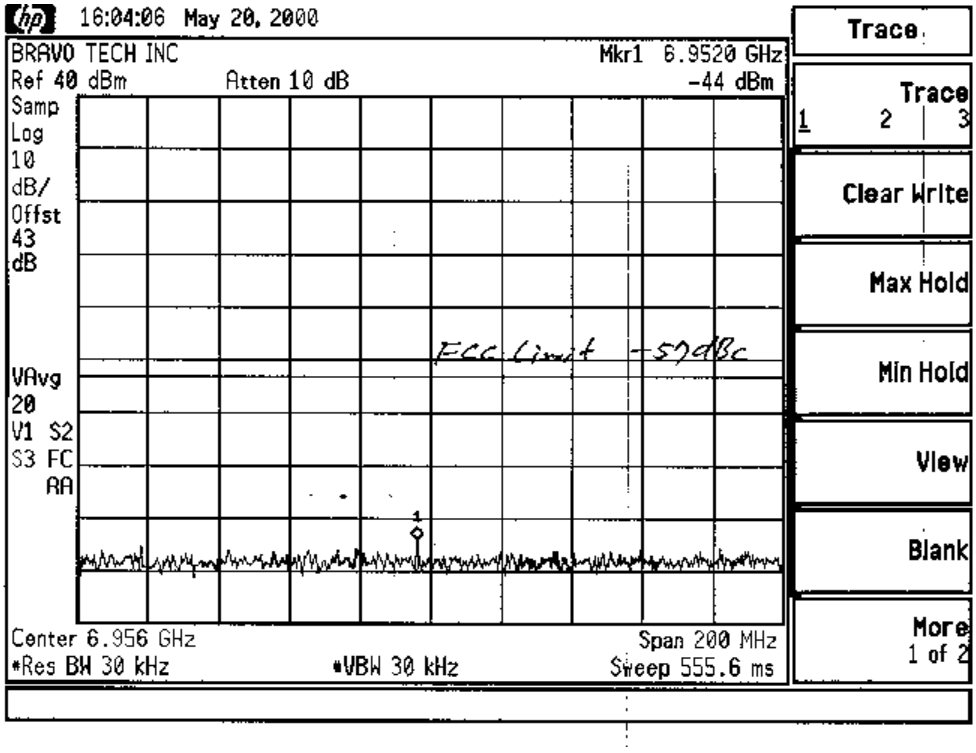
Bravo Tech, Inc.

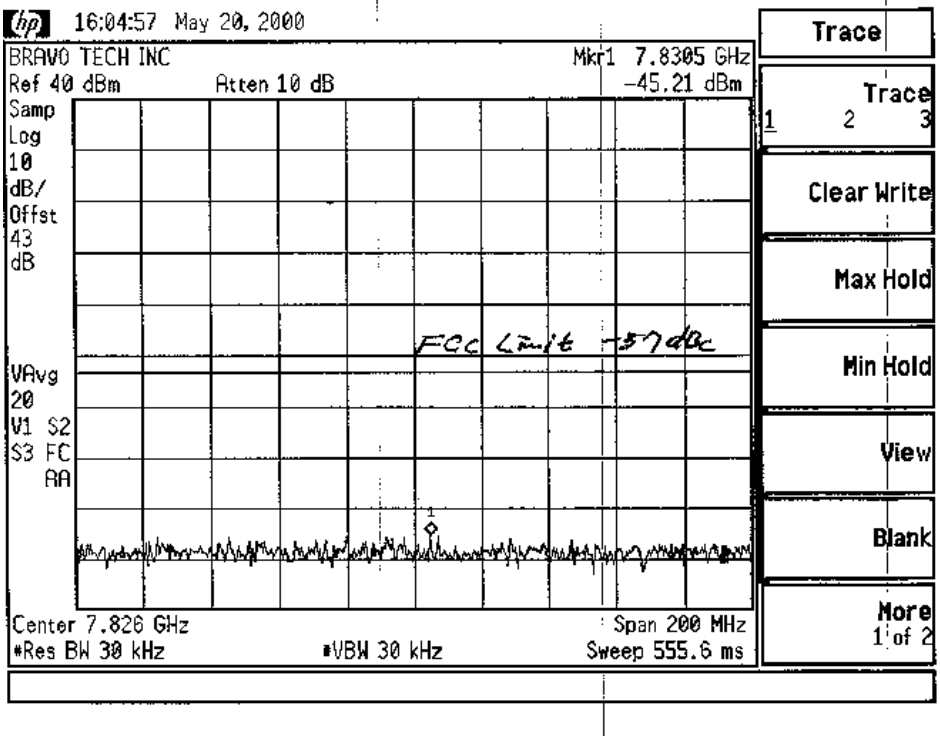




BTI

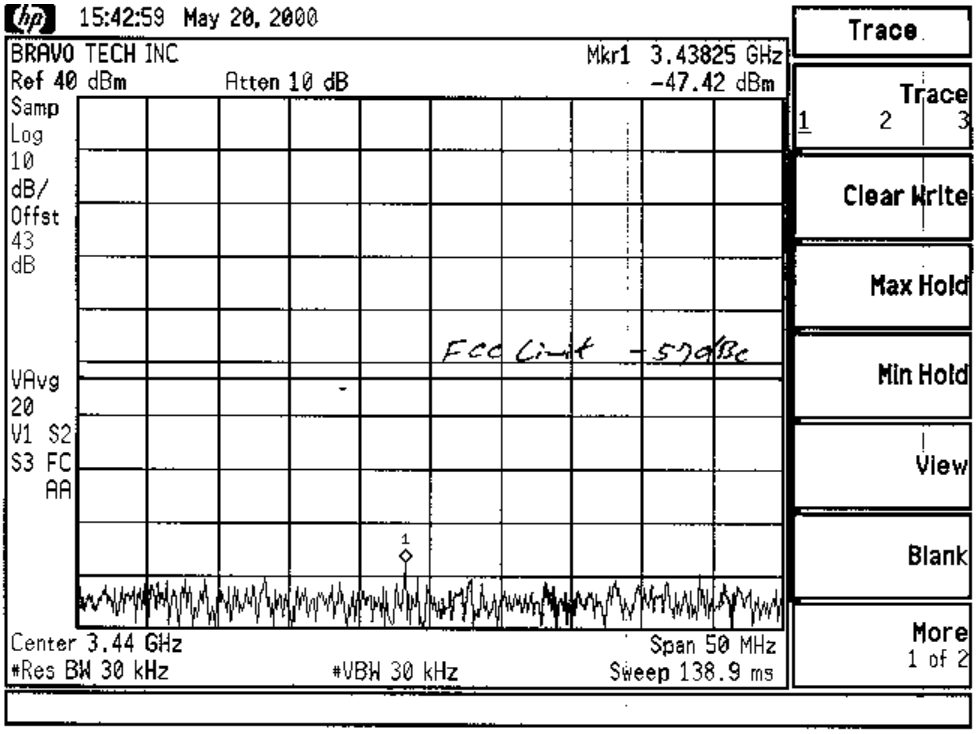
Bravo Tech, Inc.

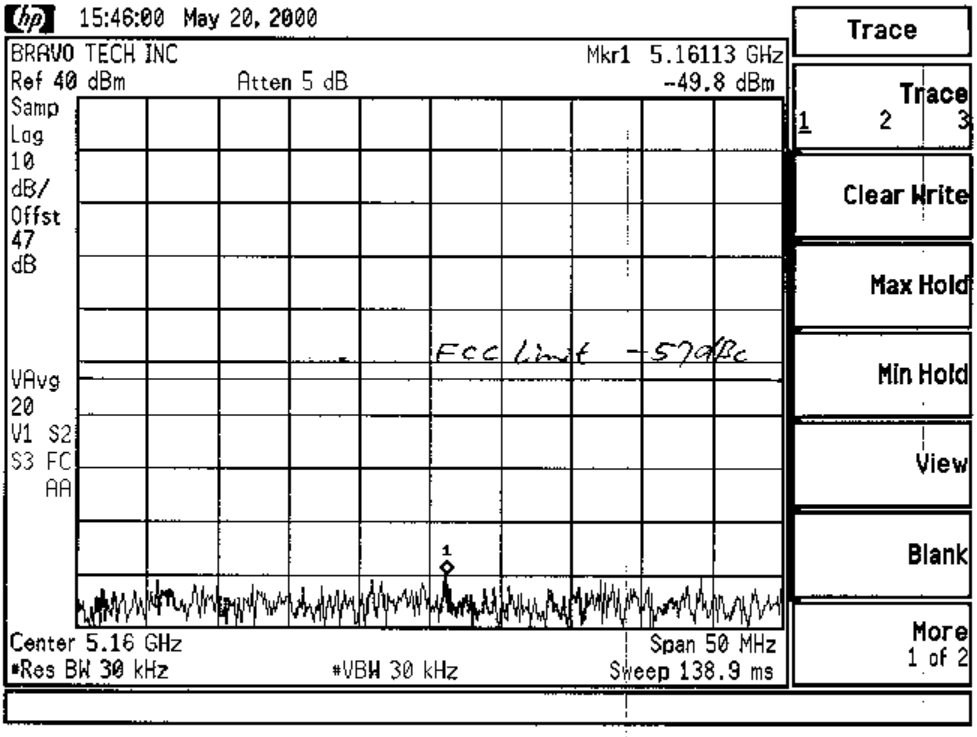




BTI

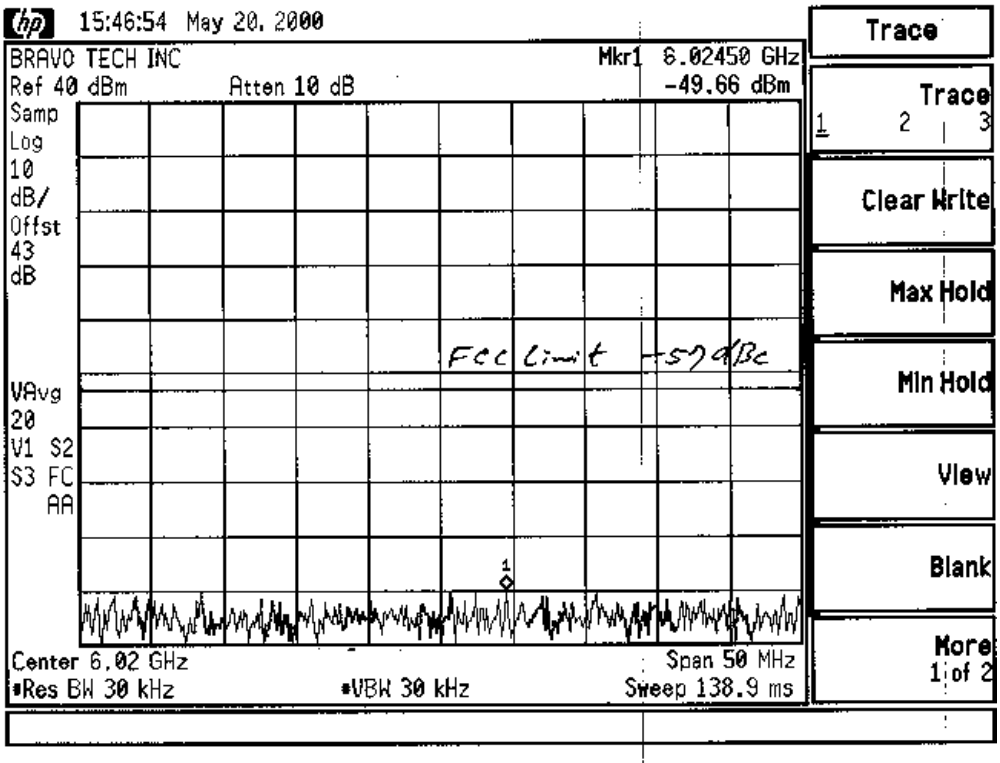
Bravo Tech, Inc.

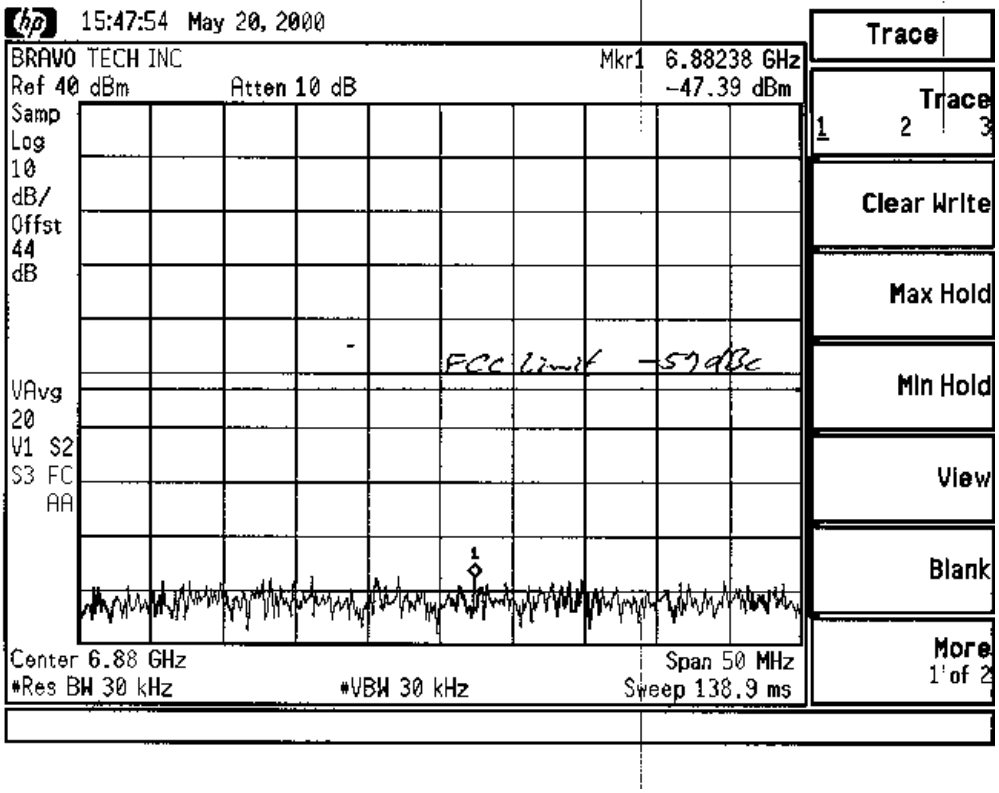




BTI

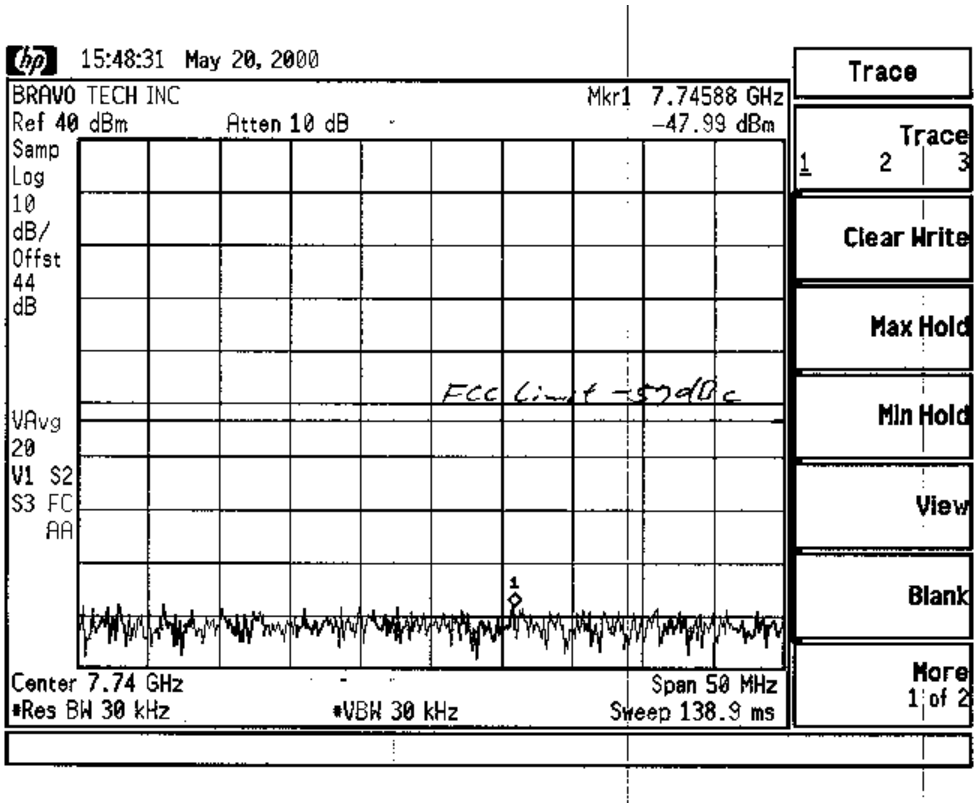
Bravo Tech, Inc.

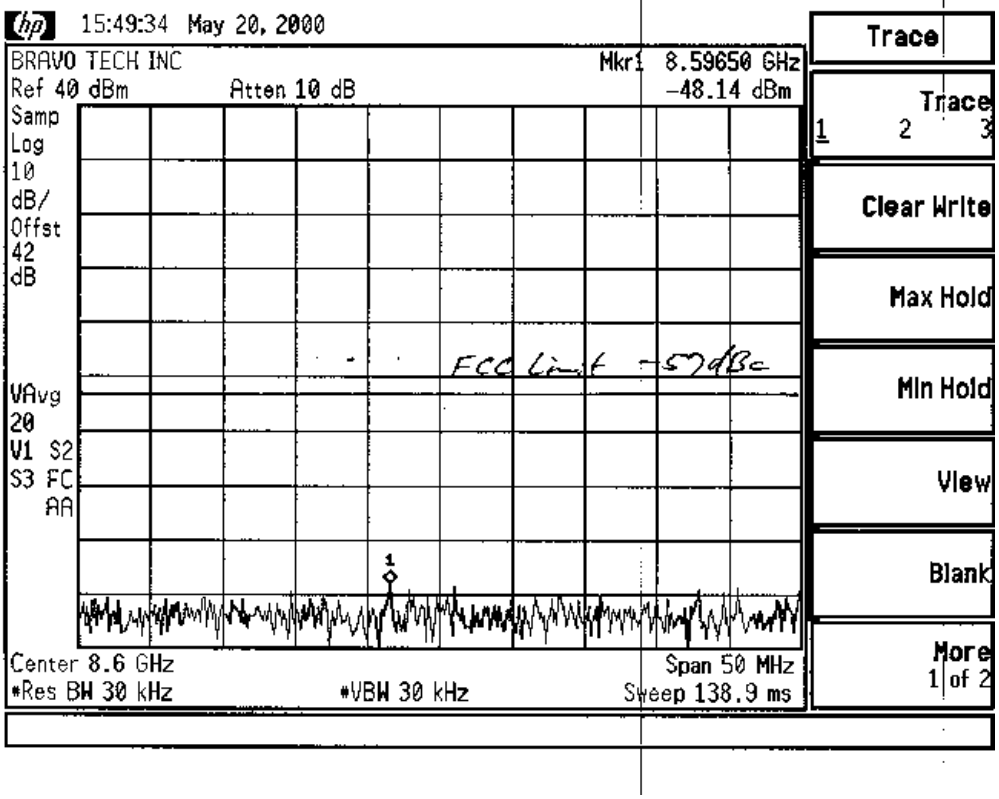




BTI

Bravo Tech, Inc.





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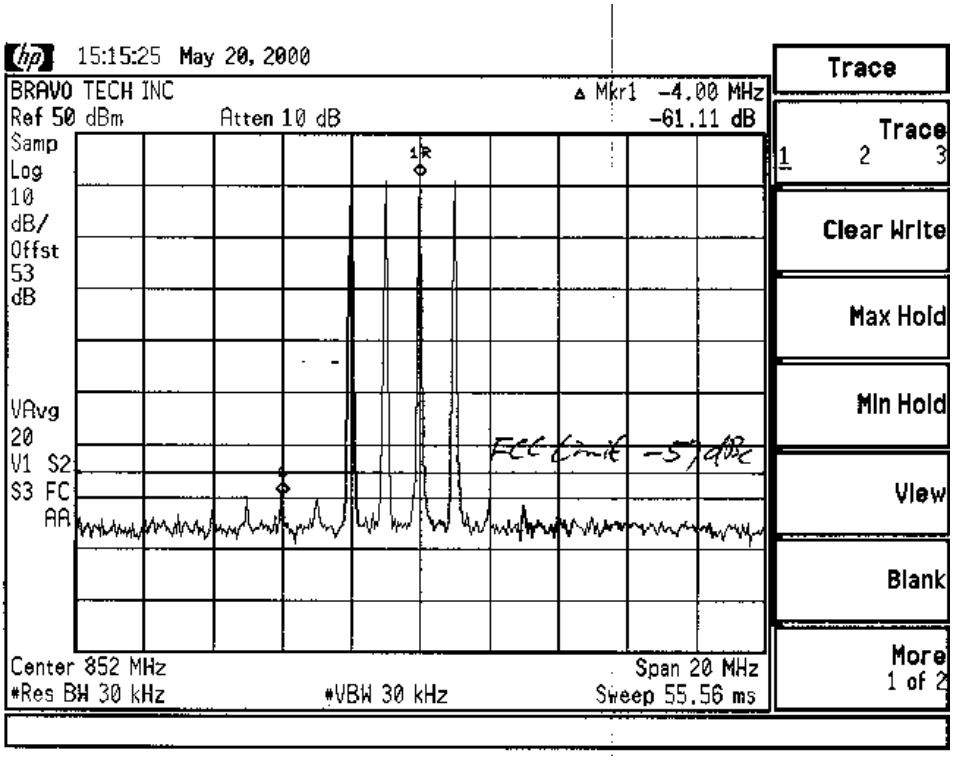

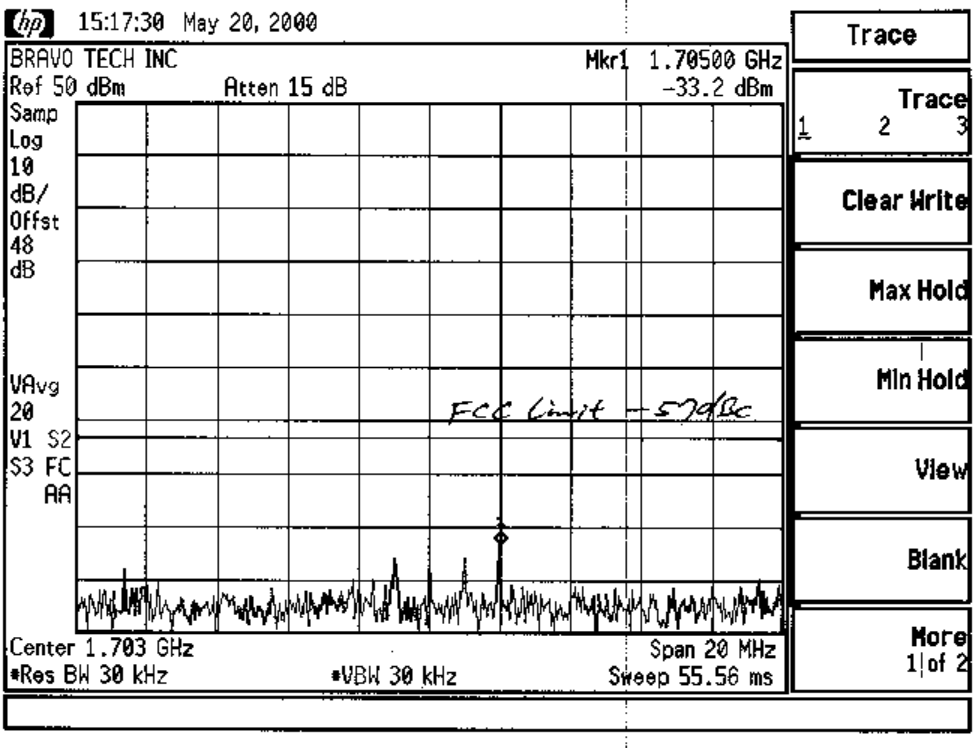

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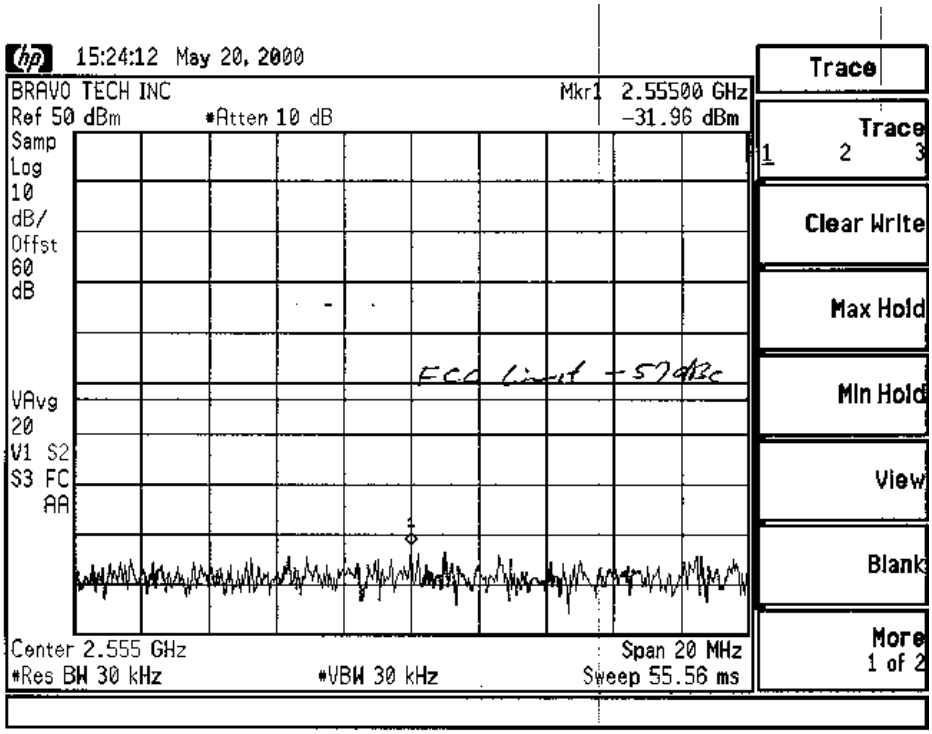

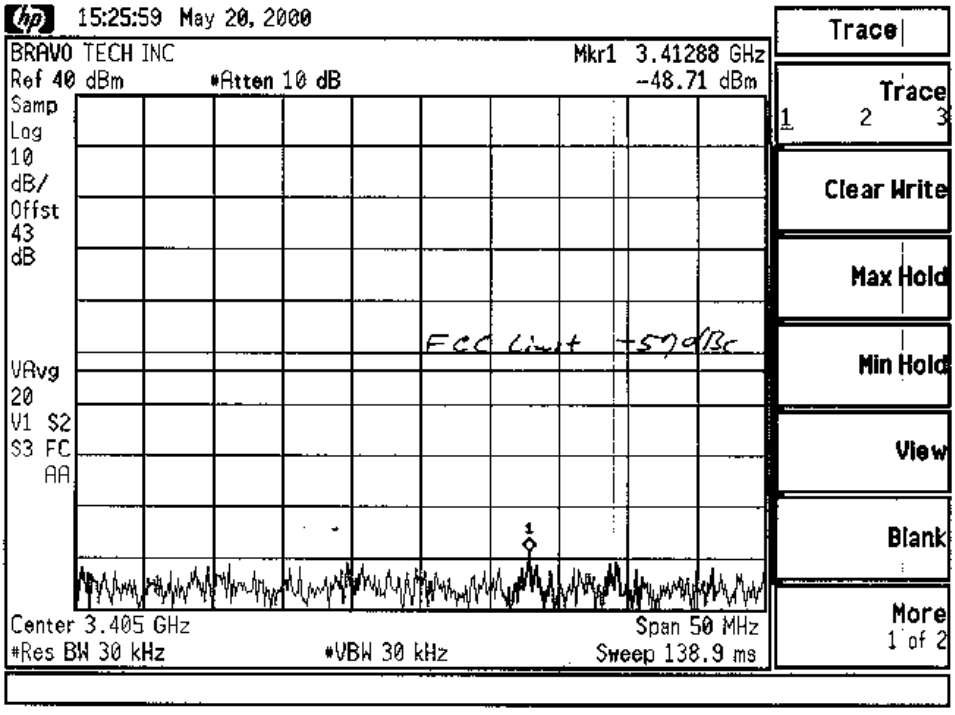

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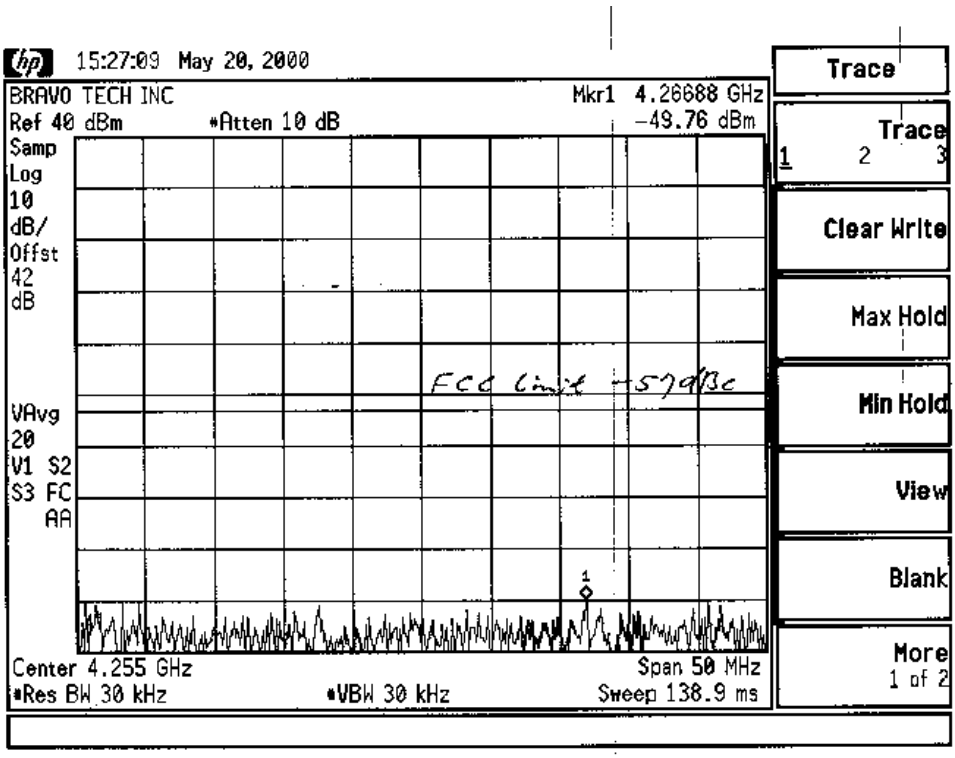

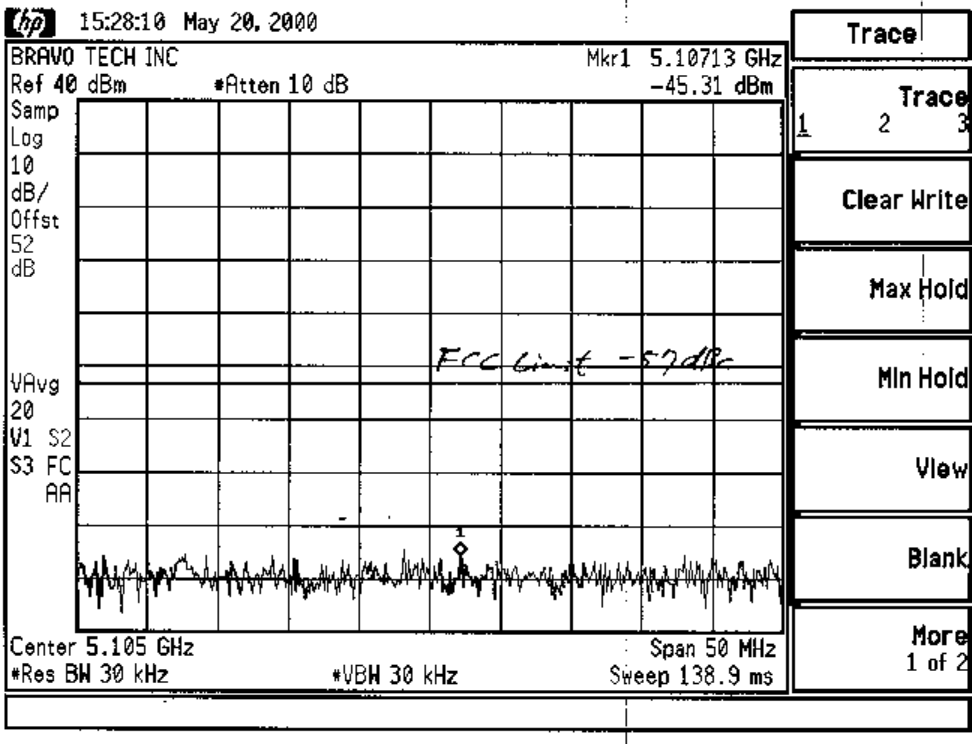

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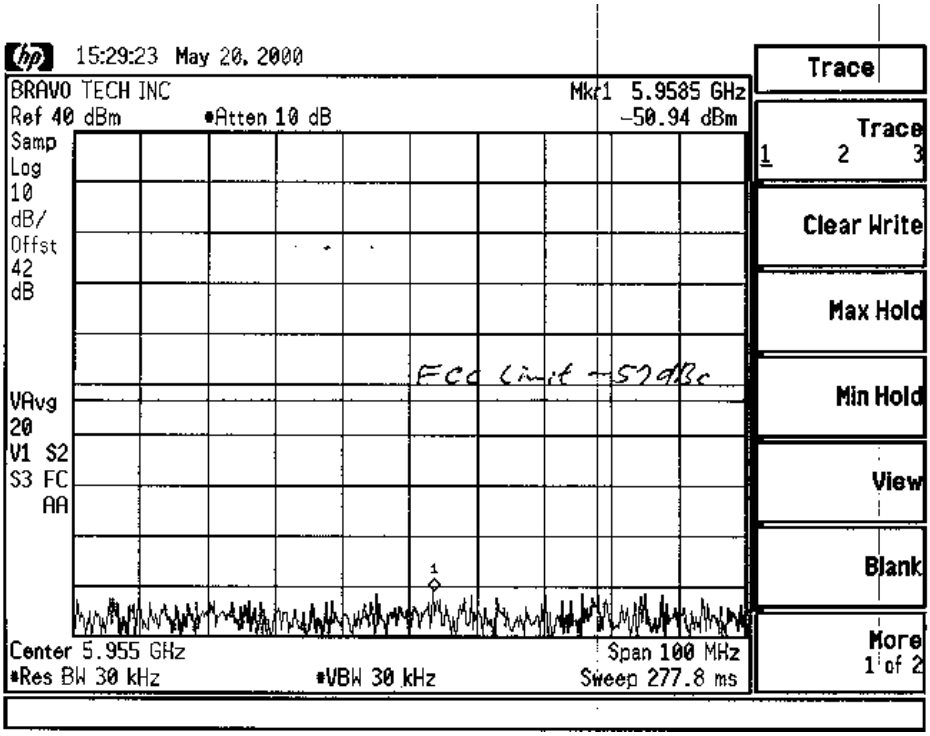

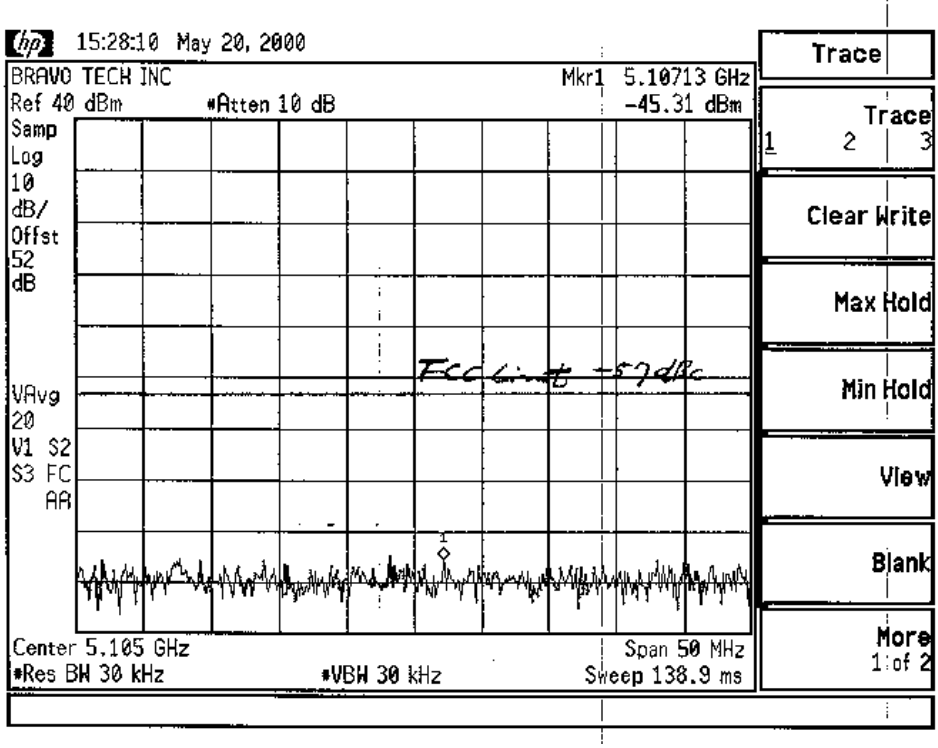

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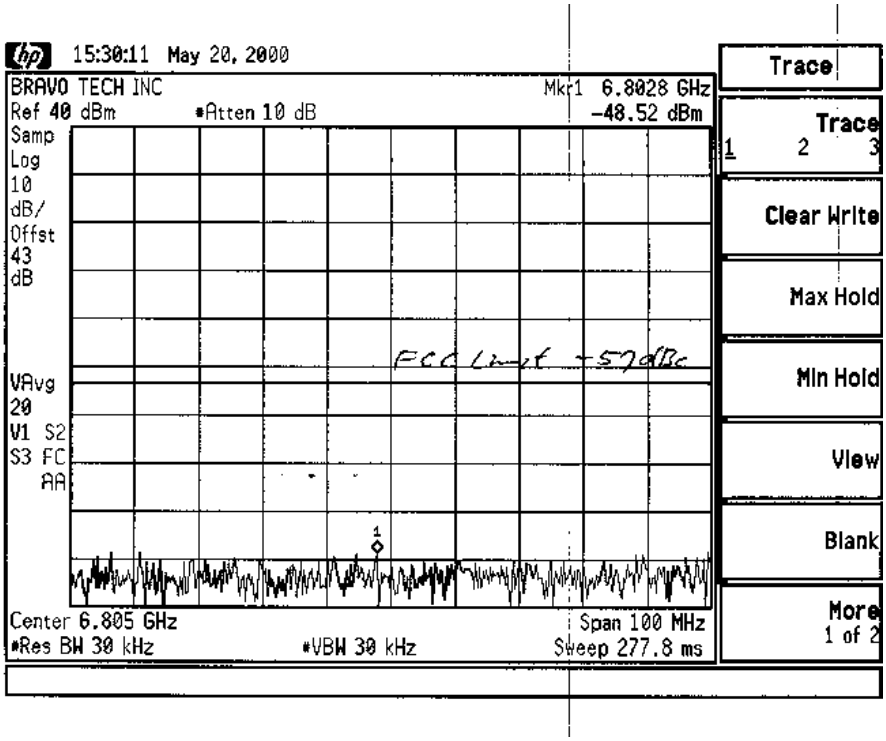

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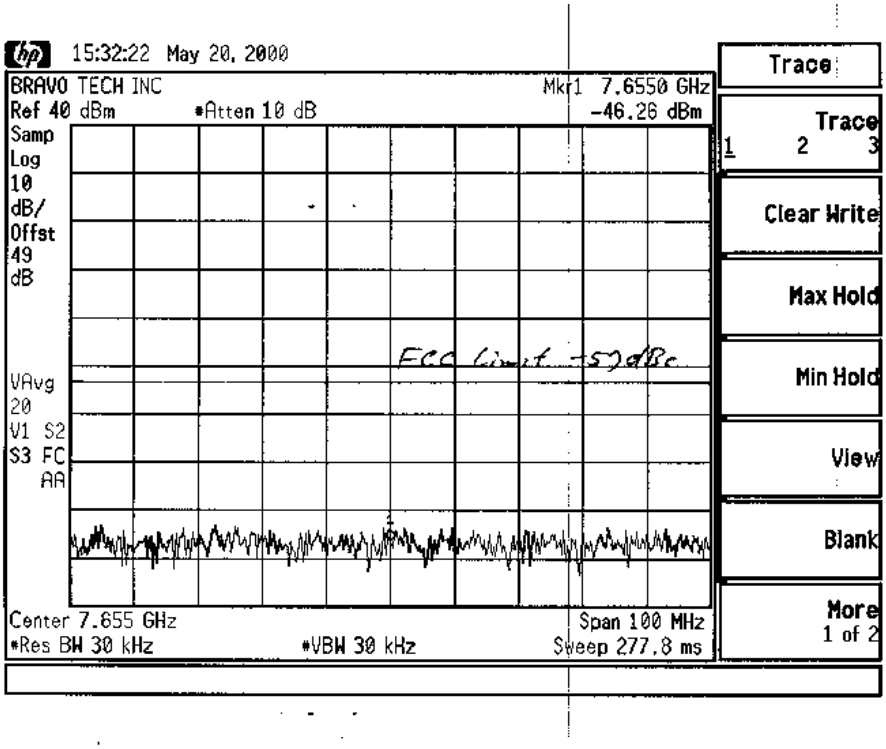
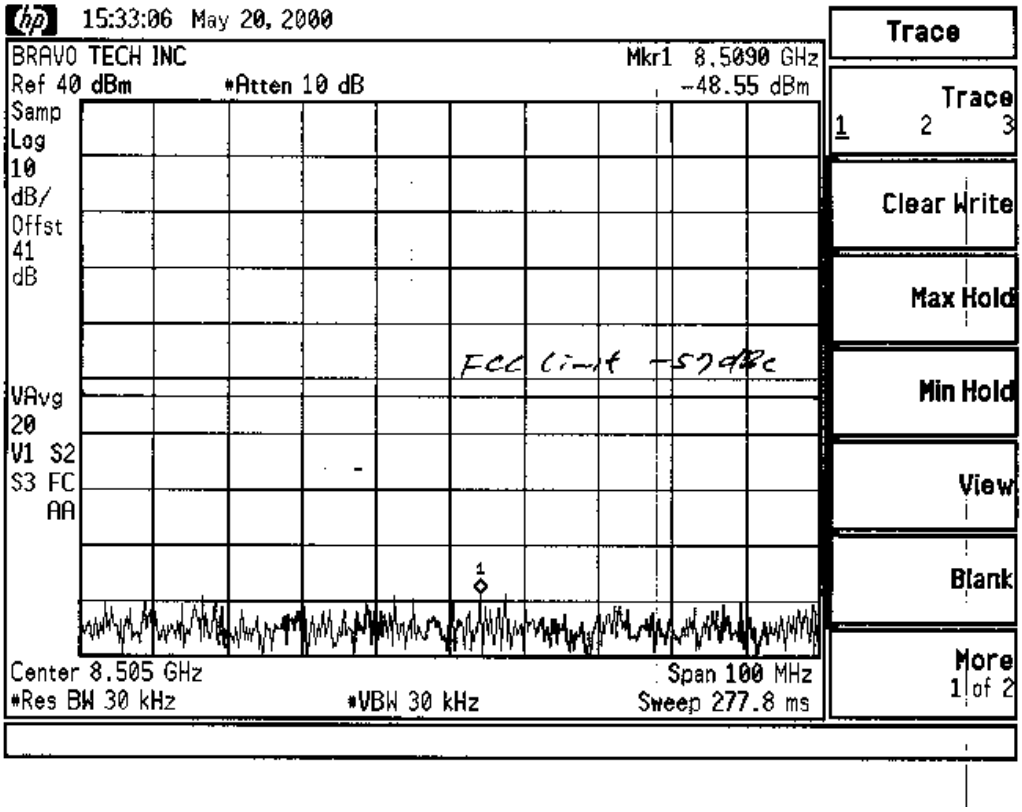




Garwood Laboratories, Inc. - World Compliance Division
Electromagnetic Compatibility

Company Bravo Tech, Inc.
EUT: Multi-Carrier Linear Power Amplifier
Model #: Not Available

FCC OATS Spurious Emissions Measurements
Operating Frequency Band: 850 - 870MHz
Antenna Port was terminated with a high power load. Transmitter Output Power 200Watts.
Frequency tested high end: 870MHz
Test Distance 3 meters
FCC limit = 43 + 10 log (P) = 66dBc
Calculated Field Strength: E = Square Root (P/0.3) = 148dBuV

Antenna Polarity (V or H)	Frequency of Emission (MHz)	S.A. Peak Reading (dBµV)	Correction Factor (dB)	Corrected Reading 3m (dBµV/m)	Attenuation Below Carrier (dBc)	FCC Limit @ 3 meter (dBc)
V	1740	63.9	2.45	61.45	86.55	66
H	1740	59.1	2.45	56.65	91.35	66
V	2610	50.6	-4.15	54.75	93.25	66
H	2610	48.5	-4.15	52.65	95.35	66
V	3480	31.8	-9.11	40.91	107.09	66
H	3480	30.5	-9.11	39.61	108.39	66
V	4350	30.2	-12.48	42.68	105.32	66
H	4350	31.9	-12.48	44.38	103.62	66
V	5220	NDS	-	NDS	NDS	66
H	5220	NDS	-	NDS	NDS	66
V	6090	NDS	-	NDS	NDS	66
H	6090	NDS	-	NDS	NDS	66
V	6960	NDS	-	NDS	NDS	66
H	6960	NDS	-	NDS	NDS	66
V	7830	NDS	-	NDS	NDS	66
H	7830	NDS	-	NDS	NDS	66
V	8700	NDS	-	NDS	NDS	66
H	8700	NDS	-	NDS	NDS	66

Garwood Laboratories, Inc. - World Compliance Division
Electromagnetic Compatibility

Company Bravo Tech, Inc.
EUT: Multi-Carrier Linear Power Amplifier
Model #: Not Available

FCC OATS Spurious Emissions Measurements
Operating Frequency Band: 850 - 870MHz
Antenna Port was terminated with a high power load. Transmitter Output Power 200Watts.
Frequency tested low end: 850MHz
Test Distance 3 meters
FCC limit = 43 + 10 log (P) = 66dBc
Calculated Field Strength: E = Square Root (P/0.3) = 148dBuV

Antenna Polarity (V or H)	Frequency of Emission (MHz)	S.A. Peak Reading (dBµV)	Correction Factor (dB)	Corrected Reading 3m (dBµV/m)	Attenuation Below Carrier (dBc)	FCC Limit @ 3 meter (dBc)
V	1700	72	2.79	69.21	78.79	66
H	1700	67.6	2.79	64.81	83.19	66
V	2550	56.2	-3.69	59.89	88.11	66
H	2550	54.6	-3.69	58.29	89.71	66
V	3400	34.7	-8.77	43.97	104.03	66
H	3400	38.6	-8.77	47.37	100.63	66
V	4250	NDS	-12.19	NDS	NDS	66
H	4250	29.8	-12.19	41.99	106.01	66
V	5100	NDS	-	NDS	NDS	66
H	5100	NDS	-	NDS	NDS	66
V	5950	NDS	-	NDS	NDS	66
H	5950	NDS	-	NDS	NDS	66
V	6800	NDS	-	NDS	NDS	66
H	6800	NDS	-	NDS	NDS	66
V	7650	NDS	-	NDS	NDS	66
H	7650	NDS	-	NDS	NDS	66
V	8500	NDS	-	NDS	NDS	66
H	8500	NDS	-	NDS	NDS	66

Garwood Laboratories, Inc. - World Compliance Division
Electromagnetic Compatibility

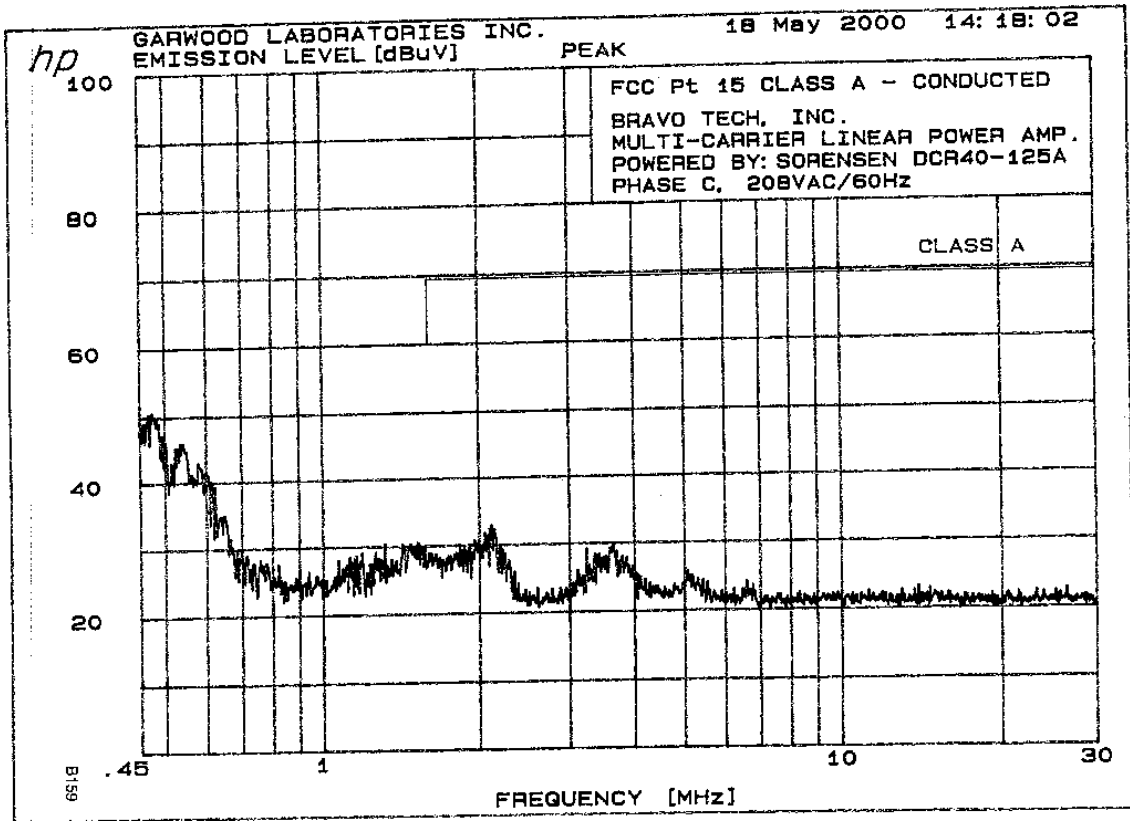
Company Bravo Tech, Inc.
EUT: Multi-Carrier Linear Power Amplifier
Model #: Not Available

FCC OATS Spurious Emissions Measurements
Operating Frequency Band: 850 - 870MHz
Antenna Port was terminated with a high power load. Transmitter Output Power 200Watts.
Frequency tested high end: 860MHz
Test Distance 3 meters
FCC limit = 43 + 10 log (P) = 66dBc
Calculated Field Strength: E = Square Root (P/0.3) = 148dBuV

Antenna Polarity (V or H)	Frequency of Emission (MHz)	S.A. Peak Reading (dBµV)	Correction Factor (dB)	Corrected Reading 3m (dBµV/m)	Attenuation Below Carrier (dBc)	FCC Limit @ 3 meter (dBc)
V	1720	86.6	2.62	83.98	84.02	66
H	1720	69	2.62	66.38	81.62	66
V	2580	54.8	-3.92	58.72	89.28	66
H	2580	53.5	-3.92	57.42	90.58	66
V	3440	31.7	-8.94	40.64	107.36	66
H	3440	44.5	-8.94	53.44	94.56	66
V	4300	29.9	-12.34	42.24	105.76	66
H	4300	NDS	-12.34	NDS	NDS	66
V	5160	NDS	-	NDS	NDS	66
H	5160	NDS	-	NDS	NDS	66
V	6020	NDS	-	NDS	NDS	66
H	6020	NDS	-	NDS	NDS	66
V	6880	NDS	-	NDS	NDS	66
H	6880	NDS	-	NDS	NDS	66
V	7740	NDS	-	NDS	NDS	66
H	7740	NDS	-	NDS	NDS	66
V	8600	NDS	-	NDS	NDS	66
H	8600	NDS	-	NDS	NDS	66

BTI

Bravo Tech, Inc.



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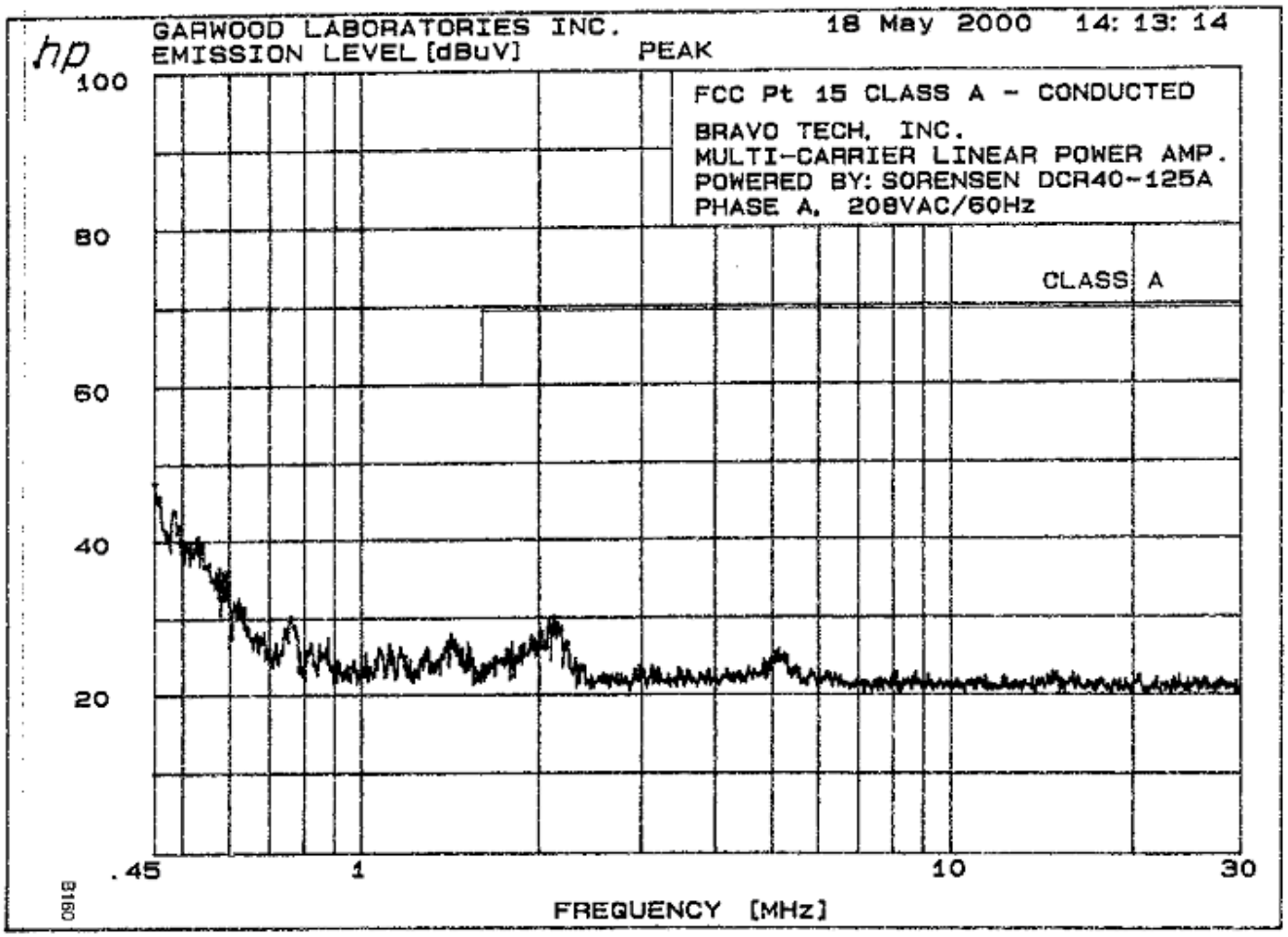

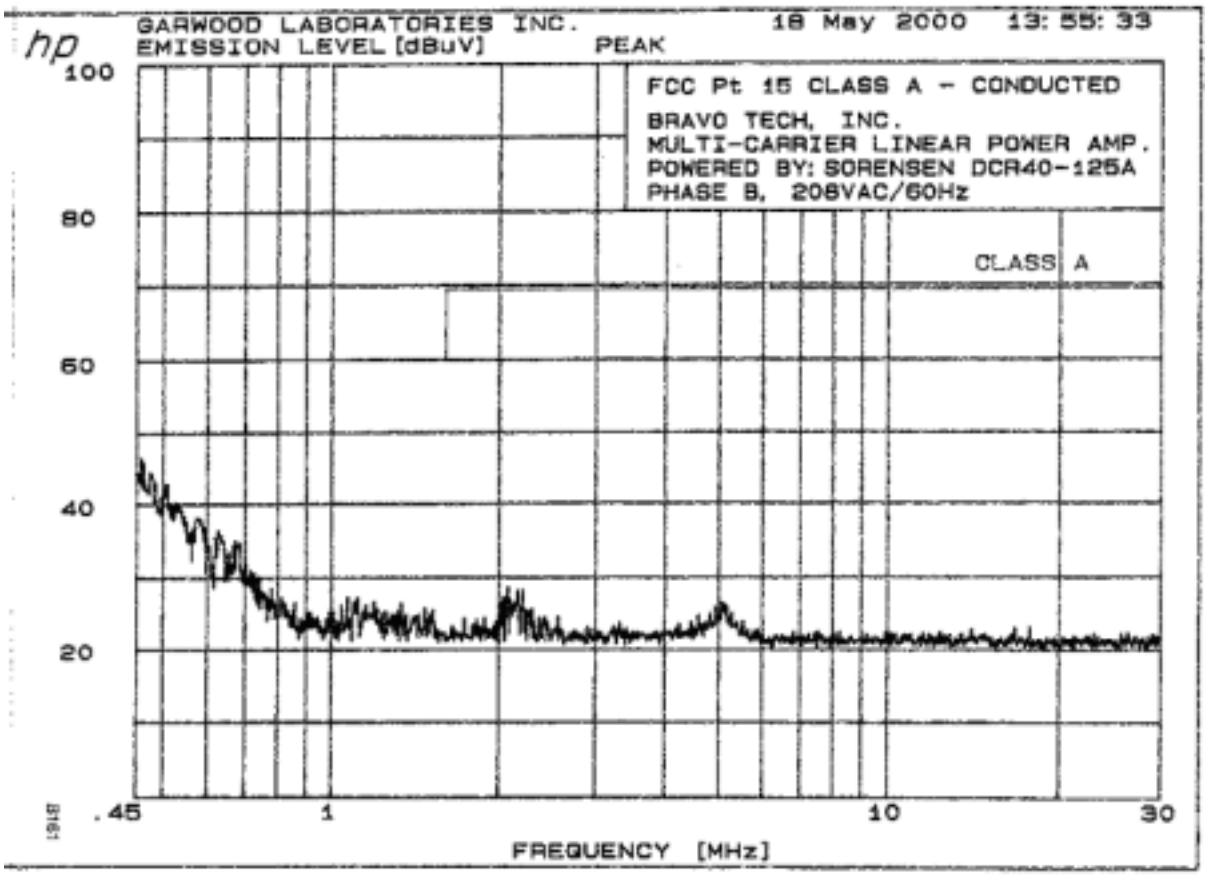
GARWOOD LABORATORIES INC.
EMISSION LEVEL [dBuV]
PEAK
18 May 2000 13: 55: 33
FCC Pt 15 CLASS A - CONDUCTED
BRAVO TECH, INC.
MULTI-CARRIER LINEAR POWER AMP.
POWERED BY: SORENSEN DCR40-125A
PHASE B, 208VAC/60Hz
CLASS A
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

Bravo Tech, Inc.

EXHIBITS

INDEX OF EXHIBITS

BTI

Bravo Tech, Inc.

Exhibit A

LPA OPERATING MANUAL

BTI **Bravo Tech, Inc.**

LPA800 Operating Manual
Table of Contents

BTI **Bravo Tech, Inc.**

SECTION 1

GENERAL

1-1. INTRODUCTION.

Congratulation on purchasing Bravo Tech's advanced linear power amplifier. Our goal is to satisfy you with our RF technology expertise, offering the best product with unsurpassed quality, performance and at the best price. In fact, a strong background in wireless communication technologies enables Bravo Tech to provide highly integrated products with the most advanced features in the industry. Our commitment to quality and product excellence makes Bravo Tech a strong contender in the industry.

Bravo Tech designs, manufactures, and markets the most advanced Linear Power Amplifiers for use in wireless communication systems. Our Linear Power Amplifiers are designed with the most advanced RF and digital control technology.

Our focus on high-end power amplifiers at affordable price results in total commitment to offering state of the art products to meet the growing needs of today‘s exploding wireless communication market. We consider "value" a requirement in every facet of a product, not just a feature. When comparing Power Amplifiers, consider all the essential factors in your decision. Price and performance characteristics such as distortion specifications, flexibility, reliability and design parameters are critical. And not least of all the warranty- will the manufacturer stand behind their products? Bravo Tech will consistently outpace the competition in every category.

This manual contains information and procedures for installation, operation, and maintenance of the LPA800 Series multichannel feed-forward linear power amplifier system. The manual is organized into five sections as follows:

Section 1. General Description
Section 2. Installation
Section 3. Operating Instructions
Section 4. Principles of Operation
Section 5. Maintenance

1-2. GENERAL DESCRIPTION

The LPA800 Series multichannel feed-forward linear power amplifier is specially designed for trunking systems, featuring bandwidth up to 20 MHz and output power up to 200W per system. Our Power Amplifiers are designed with our advanced RF and digital control technology. They provide unsurpassed power, linearity, efficiency, and system flexibility in trunking, cellular, and wireless local loop systems. The intelligent digital control system constantly fine-tunes the amplifiers to ensure optimum operation over a wide variety of electrical and environmental conditions. The amplifiers can be fed up to 16 channels and meet all FCC requirements.

The system is designed to provide trouble free operation with minimum maintenance. The LED-based operational status and fault indicators help minimize downtime. The turn-on and turn-off sequences of voltages are fully automatic, as is overload protection, making the amplifier virtually impervious to failures caused by system problems.

RF I/O and D.C. Power are connected to the rear panel of the amplifier. The rear panel also has the serial port connectors that interface with the host control system. The system status connector allows the host system to monitor performance of the amplifier. The front panel of the amplifier equipped with fault indicators. D.C. power

for the amplifier system is +27 Vdc. Cooling for the amplifier is provided by three fans mounted on the rear of the system. The fans draw outside air through the front of and exhaust hot air through the rear of the rack.

1-3. FUNCTIONAL AND PHYSICAL SPECIFICATIONS

Functional and physical specifications for the amplifier system are listed in Table 1.

PARAMETER	SPECIFICATIONS
Frequency Range	850 - 870 MHz
Output Power	100-200 W Average
Peak Power Capacity	1600 W
IMD	Meet FCC Requirements
RF Gain	35 dB
RF Gain Variation Over Frequency Band	+/- 0.5 dB over the whole frequency band
RF Gain Variation Over Temperature	+/- 0.7 dB (Max.)
Input / Output VSWR	<2 : 1
Output Protection	Isolator
Harmonic & Sprurious Emissions	Meet FCC Requirements
DC Power Voltage Current Consumption	27V +/- 1.0 VDC 65A max @ 27VDC
Operation Temperature	0 To + 55C
Physical Dimensions	19" Rack Standard
Over Power Output Alarm	
High Temperature Alarm and Shut-Down	@95C +/- 6 on the case of power transistor and recovery @ 85C +/- 6
Output VSWR Alarm	@ 3: 1

Table 1 – Functional and physical specifications for the amplifier systems

1-4 EQUIPMENT CHANGES

Bravo Tech reserves the right to make any changes to the equipment without notice, including but not necessarily limited to component substitution and circuitry changes.

SECTION 2

INSTALLATION

2-1. INTRODUCTION

This section contains installation recommendations for the LPA800 amplifier. Please read the material in this section prior to installation of the amplifier into a system.

2-2. ELECTRICAL SERVICE RECOMMENDATIONS

Bravo Tech recommends that proper AC line conditioning and surge suppression is provided on the primary AC input to the +27 Vdc power source. All electrical service should be installed in accordance with any applicable government or local regulations (codes) and good engineering practice.

2-3. UNPACKING AND INSPECTION

This equipment has been tested and calibrated at the factory. Only in the event of severe shocks or other mistreatment should any substantial readjustment be required. Check the outside of the shipping container for instructions regarding unpacking. Carefully open the container and remove the amplifier module. Retain all packing material that can be reassembled in the event the unit must be returned to the factory.

CAUTION

- Exercise care in handling equipment during inspection to prevent damage.
- Visually inspect the amplifier for damage that may have occurred during shipment.
- Check for evidence of water damage, bent or warped chassis, loose screws or nuts, or extraneous packing material in connectors or fans.
- Inspect all connectors for bent connector pins. If the equipment is damaged, a claim should be filed with the carrier once the extent of any damage is assessed. We cannot stress too strongly the importance of IMMEDIATE careful inspection of the equipment and the subsequent
- IMMEDIATE filing of the necessary claims against the carrier if necessary. If possible, inspect the equipment in the presence of the delivery person. If the equipment is damaged, the carrier is your first area of recourse. If the equipment is damaged and must be returned to the factory, please contact Bravo Tech for a return authorization. Bravo Tech may not accept returns without a return authorization. Claims for loss or damage may not be withheld from any payment to Bravo Tech, nor may any payment due be withheld pending the outcome thereof.

2-4. INSTALLATION INSTRUCTIONS

To install the amplifier proceed as follows:

1. Install amplifier in equipment rack, and secure in place with four screws
2. Connect load cable to RF OUT connector on rear of amplifier.
3. Connect transceiver or exciter input to RF IN on rear of amplifier.
4. Connect +27 Vdc and GROUND to appropriate terminals on the amplifier rear panel.
5. Connect statas port on rear panel (if applicable).
6. Check your work before applying DC voltage to the amplifier. Make certain all connections are tight and correct.
7. Measure primary DC input voltage. DC input voltage should be +26-28 Vdc. If the DC input voltage is above or below the limits, call and consult Bravo Tech before you apply power to your amplifier.

2-5. AMPLIFIER STATUS

The amplifier has a remote alarm connector that is used by the host system to monitor the amplifier. The status connections are made through a 9-pin D-Sub male connector and are listed and described in Figure 1.

SECTION 3

OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

This section contains operating instructions for the LPA800. Series Amplifier System.

3-2. Connections

LPA800 Input/Output Connectors (Rear Panel)

NUMBER		NAME FUNCTION	
1		+27V Input and RTN	Input terminals for primary DC source voltage
2	Jl	9-pin, male type D-SUB connector. Fault and control signals to host system for each of the plug-in amplifier modules. Refer to Figure1 for a description of the signals	
3	J2	9-pin, female type D-SUB serial connector.	
4	RF IN	Type SMA female bulkhead connector.	
5	RF OUT	Type N female bulkhead connector.	

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OPERATING REQUIREMENTS

RF Input power = 100 mWatts
RF Output power = 150 Watts
VDC = 27.0 ±1.0 Vdc
Idc = 60 Amps
Connections = see drawing

Status Out, pin connections:
1 - Ground
2 - 5V
3 - Fan Fault
4 - Over Input
5 - VSWR
6 - Over Temperature
7 - Under/Over DC
8 - RF Off
9 - Shutdown Control Input

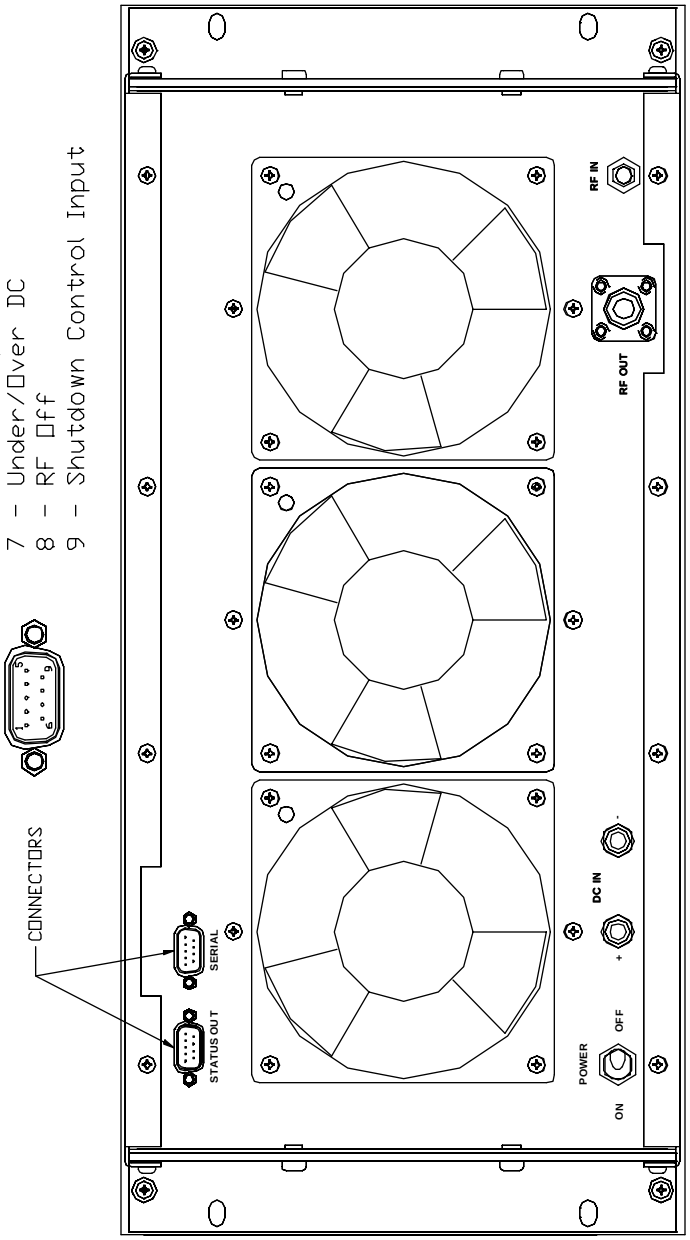

Figure 1 - BACK PANEL

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LPA800 STATUS INDICATORS (Front Panel)

NUMBER	NAME FUNCTION	
1	POWER ON Indicator	Green Led. When lit, indicates that +27 Vdc is applied to the amplifier module.
2	OVER TEMP	Red Led indicates over temperature conditions
3	DC VOLTAGE	Red Led indicates under or over voltage conditions
4	FAN FAULT	Red Led indicates fan fault conditions
5	OVER INPUT	Red Led indicates over input power conditions
6	VSWR	Red Led indicates bad antenna connections
7	RF OFF	Red Led indicates RF power is turned off by system controller

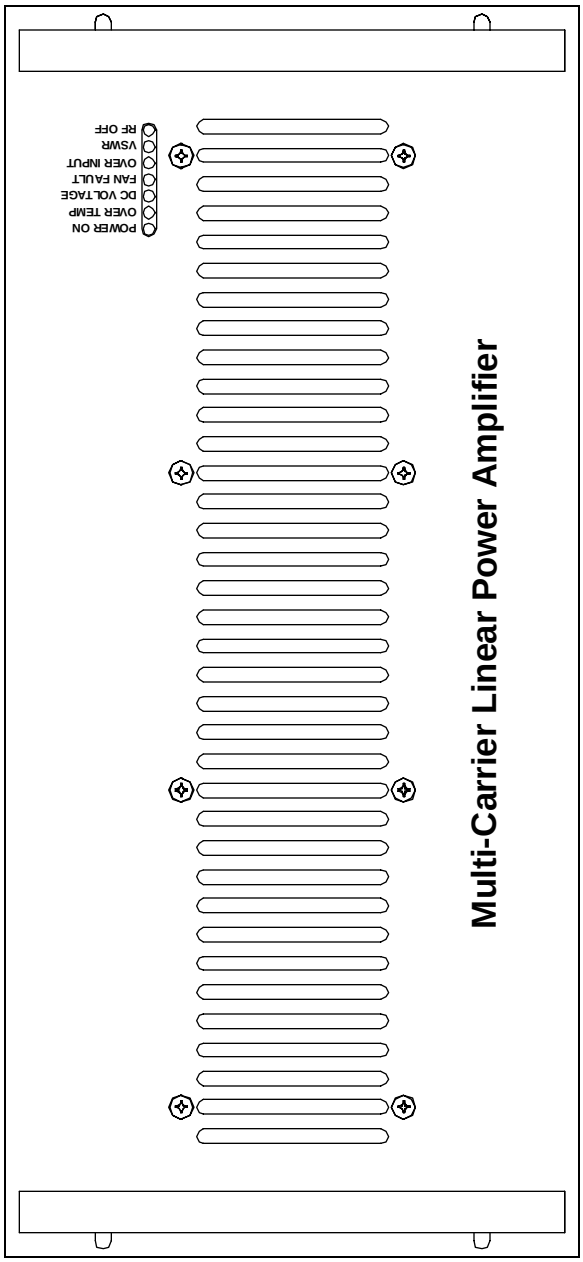

Figure 2 - FRONT PANEL

3-3. INITIAL START-UP AND OPERATING PROCEDURES

Double check to ensure that all input and output cables are properly connected.

WARNING
Before applying power, make sure that the input and output of the amplifier are properly terminated at 50 ohms. Do not operate the amplifier without a load attached. Refer to Table1 for input power requirements. Excessive input power may damage the amplifier

NOTE

- The output coaxial cable between the amplifier and the antenna must be 50 Ohm coaxial cable. Use of any other cable, will distort the output

- Turn on supply that provides +26-28 Vdc to the amplifier system. Visually check the amplifier as it is turned on, and verify that the DC ON indicator (green) comes on.

- As the LPA800 is controlled by an internal microprocessor-based optimization loop, the specified linearity performance may not be obtained until several minutes after initial turn-on.

SECTION 4

PRINCIPLES OF OPERATION

4-1. INTRODUCTION

This section contains a functional description of the LPA800 Series linear amplifier.

4-2. RF INPUT SIGNAL

The maximum input power for all carrier frequencies should not exceed the limits specified in table 1. The input VSWR should be 2:1 maximum (or better).

4-3. RF OUTPUT LOAD

The load impedance should be as good as possible (1.5:1 or better) in the working band for good power transfer to the load.

4-4. AMPLIFIER FUNCTIONAL DESCRIPTION

The amplifier is designed based on the feed-forward technique. The input RF carriers are split into two paths at the coupler 1. One path is to the 1 loop delay line and the other path is to the main amplifier path. The carriers' are amplified by the main output stage where distortion signal components are generated. The amplified signals, carriers plus distortions, are fed into the second loop delay line while very small part of the output signals are coupled by coupler 2 into the coupler 3, where the carrier components of the coupled signals are cancelled with the pure input carriers at the coupler 3, resulting in error signals. The phase-1 and attenuator-1 are adjusted to ensure the carrier cancellation at the coupler 3 so that only error signals are fed into the second loop and amplified by the error amplifier, which is a linear relatively low power amplifier. The phase and amplitude of the amplified error signals are adjusted by phase-2 and attenuator_2, respectively, so that they are cancelled with the error signals from the second loop delay line at the coupler 4. After the cancellation, the output signals will be cleaned up so that the amplifier can meet the FCC requirements.

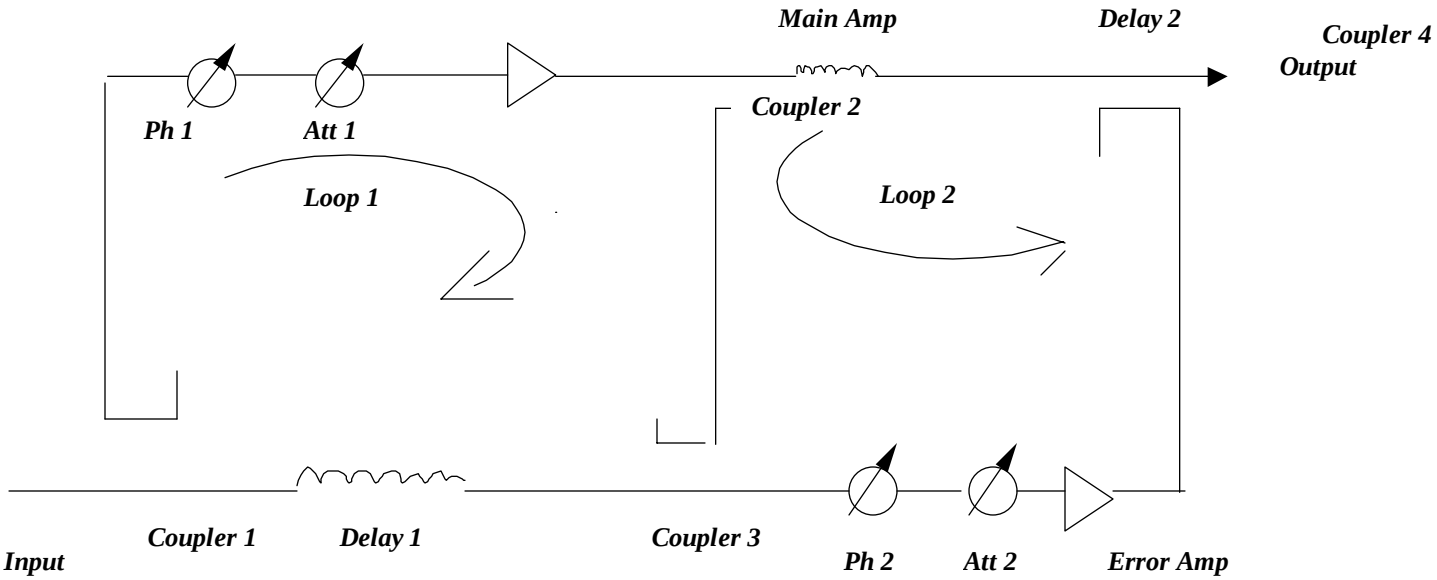

Figure 3 – Loop Feed Forward

4-5. AMPLIFIER MONITORING

The microprocessor control allows the amplifier to protect itself against external occurrences. In routine operation, all normal variations are automatically compensated for. When large variations occur the modules generate alarm outputs. The alarms are displayed on the front panel indicator and output via a connector on the rear of the rack for remote monitoring. Faults and alarms are summarized in Figure 1.

4-6. AMPLIFIER MODULE COOLING

Three fans are used for forced air cooling .The fans are located on the rear of the amplifier and exhaust hot air out the back of the module.

SECTION 5

MAINTENANCE

The LPA800 amplifier contains no user-serviceable parts. There is no maintenance that can be performed by the user other than ensuring that the external connections to the amplifier are sound. Breaking the seals around the outside of the unit will render the warranty null and void. If your LPA800 amplifier requires any servicing, or fails to perform to specifications in any way, please contact factory for RMA number and ship in the original packing box to:

Bravo Tech Inc.
4260 Cerritos Ave.
Los Alamitos, CA 90720
Phone: 714-952-8324
Fax: 714-952-0107

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Exhibit B

LPA800 SCHEMATICS – CIRCUITRY

(FCC Confidentiality Application)

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Exhibit C

LPA800 PCB LAYOUT

(FCC Confidentiality Application)

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Exhibit D

FCC ID ENGINEERING DRAWING


Bravo Tech
MODEL :LPA800-200
SERIAL :001006
FCC ID : O2H 8002001

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