VERIFICATION TEST REPORT

for

400 – 512 MHz BASE STATION DATA RADIO
MODEL NUMBER: DR4B
FCC ID: MI7-ECSDR4BSTX

MEASUREMENTS PERFORMED IN ACCORDANCE WITH...

FCC TITLE 47, PART 90: Private Land Mobile Radio Services

ACCREDITED

PREPARED FOR:
ElectroCom Communications Systems
10400 Pioneer Blvd., Bldg. E2
Santa Fe Springs, California 90670

Contact: Mr. Louis Chagoya

PREPARED BY:
Aegis Labs, Inc.
22431 Antonio Parkway B160-417
Rancho S. Margarita, CA 92688

Contact: Mr. Louis Chagoya

Agent(s):

Mr. Steve Kuiper — 03/23/00 Date
President
Aegis Labs, Inc.

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Staff Engineer
Aegis Labs, Inc.

Test Report #: ELECT-990714F
Test Date(s): July 14, 15, 22 & Oct. 20, 1999

	REPORT BODY	APPENDICES *A*	*B*	*C*	TOTAL
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AEGIS LABS, INC 22431 Antonio Parkway B160-417, Rancho Santa Margarita, CA 92688

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Measurement/Technical Report Summary

Representative	Louis Chagoya
Manufacturer	ElectroCom Communication Systems
Address	10400 Pioneer Blvd., Bldg. E-2
City, State, Zip	Santa Fe Springs, CA 90670
Phone	(562) 946-9493
Fax	(562) 946-7483
Type of Authorization	Certification for 400-512MHz Base Station Data Radio
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	400MHz Base Station Data Radio
Production Quantity	Multiple Units
Identification of EUT	Model: DR4B FCC ID: MI7-ECSDR4BSTX
Testing Date	14, 15, 22 July 1999 & 20 October 1999

Test Facility	Aegis Labs, Inc.
Address	32231 Trabuco Creek Road 22431-B160 Antonio Parkway
City, State, Zip Code	Trabuco Canyon, CA 92678 Rancho Santa Margarita, CA 92688
Country	USA
Phone	(949) 459-7886
Fax	(949) 459-7869

1. GENERAL INFORMATION

1.1 Product Description

Equipment Under Test	400-512MHz Base Station Data Radio
Model Number	DR4B
Serial Number	Prototype
Description of EUT	The DR4B is a 400MHz base station data radio with integral diversity reception system. The transmitter portion of the DR4B operates in the frequency range of 400 – 512MHz, transmit power 40 watts. The receiver side of the DR4B is a post-detection diversity reception system.
Clock Frequencies	10MHz, 44.545MHz

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	ElectroCom	Base Station Data Radio	DR4B	Prototype	MI7-ECSDR4BSTX

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	1.2	8 gauge wires	EUT	Power Supply
B	DB25 Shielded Cable	1.0	RS232	EUT	Test Fixture
C	RF Coaxial Cable	0.3	RG214 (190-5773)	EUT	Directional Coupler
D	RF Coaxial Cable	1.2	RG214 (190-5773)	EUT (RX Port)	50 ohm Terminator
E	RF Coaxial Cable	0.3	RG214 (190-5773)	Directional Coupler	Spectrum Analyzer
F	RF Coaxial Cable	1.2	RG214 (190-5773)	Directional Coupler	50 ohm Terminator

1.3 Test Facility

The open area test site and measurement facility used to collect the test data is located at the Aegis Labs, Inc. chamber test facility in the city of Rancho Santa Margarita, CA and OATS facility in Trabuco Canyon, CA. This site has been fully described in a report submitted to the FCC and accepted in a letter dated 5, May 1997 (31040/SIT 1300F2). The test facility is also recognized and accredited from the following accreditation organizations.

A2LA (American Asso. for Lab Accredit)	Certificate No.: 1111-01 FCC, CISPR, AS/NZS	Dated:	02/28/2000

2. Technical Description

Type of Emission	20K0F1D
Frequency Range	400 - 512 MHz
Range of Operating Power	40W
Maximum output Power Level	40W
Maximum Specified Output Power Rating	Location Dependant per Part 90 Subpart S
Final Stage Amplifier DC Voltage, Current	Voltage: 13.8 Vdc Current: 5.5 Amps

2.1 Function of All Active Circuit Devices

Please refer to Attachment (Exhibits).

2.2 Circuit Diagram

Please refer to Figure in Attachment (Exhibits).

2.3 Instruction Manual(s)

Please see Attachment (Exhibits).

3. PRODUCT LABELING

3.1 FCC ID Label

FCC ID: MI7-ECSDR4BSTX

3.2 Location of Label on EUT

The FCC ID was located at the front topside of EUT. Please refer to the photo in Section 6.4 for the location.

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 the exercise of a software program used during testing to activate data from the PC to the modem and deliver to the test fixture by manually switching the EUT on or off.

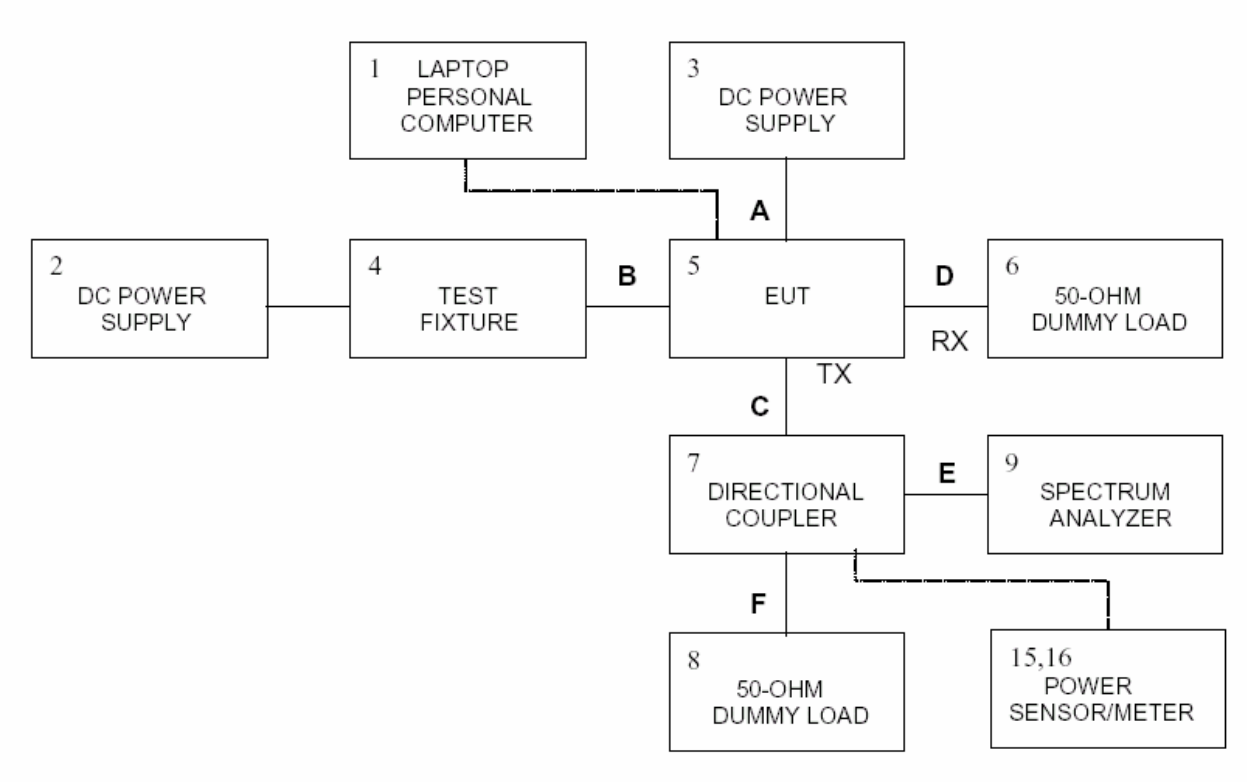
4.3 Special Accessories

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

4.4 Equipment Modifications

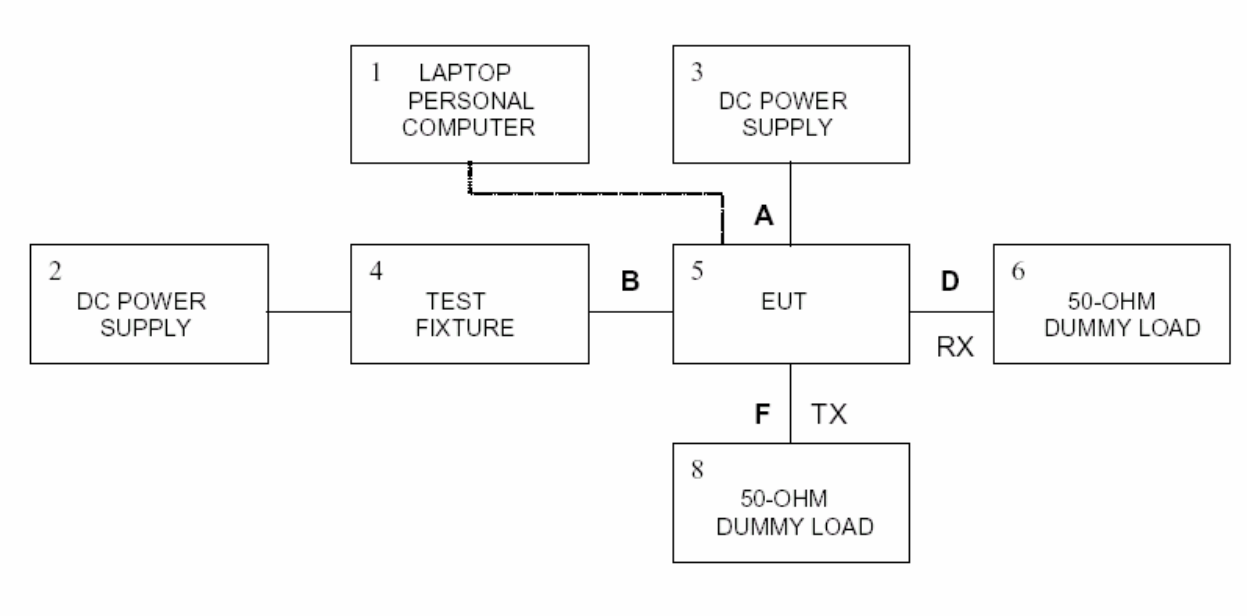
No modifications and/or adjustments were made to the EUT during compliance testing to achieve the required specification limits.

4.5 Configuration of Tested System



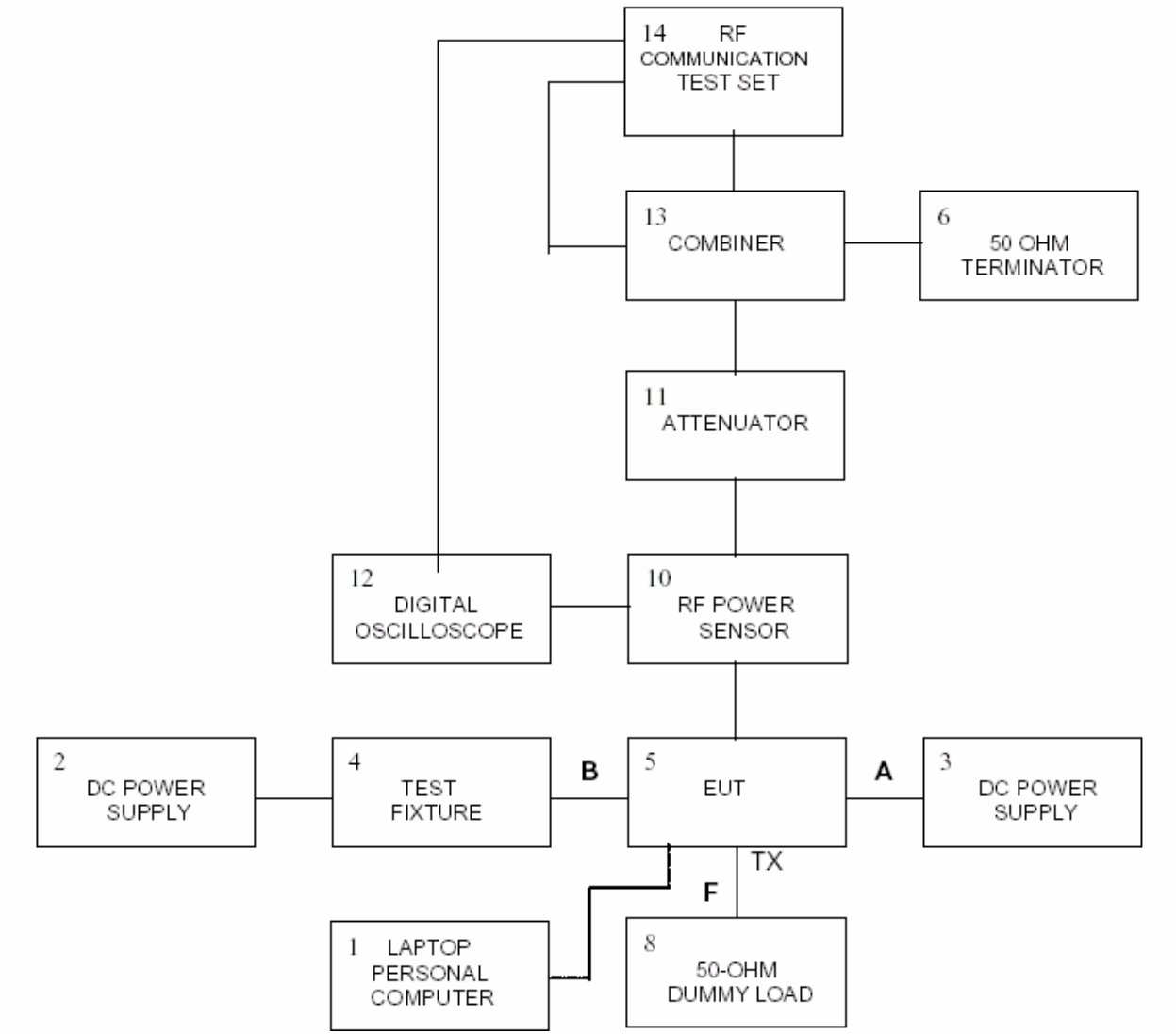
Test Setup Configuration 1

4.5 Configuration of Tested System (Continued)



Test Setup Configuration 2

4.5 Configuration of Tested System (Continued)



Test Setup Configuration 3

4.5 Configuration of Tested System (Continued)

Legend:

Item	Manufacturer	Description	Model No.	Serial No.	FCC ID
1	CTX	Laptop PC	EzBook	F2A300A-8121341	FCC Class B Logo
2	Astron	DC Power Supply	RS-12M	9404046	N/A
3	Astron	DC Power Supply	RS-70M	9702007	N/A
4	ElectroCom	Test Fixture	Prototype	N/A	N/A
5	ElectroCom	Data Radio (EUT)	DR4B	Prototype	MI7-ECSDR4BSTX
6	Pasterneck	50 ohm Terminator	PE6034	N/A	N/A
7	Hewlett Packard	Directional Coupler	778D	1144A08005	N/A
7	Hewlett Packard	Directional Coupler	11691D	1212A00305	N/A
8	Bird Electronics	50 ohm Load	1000-WT-FN	9924	N/A
9	Hewlett Packard	Spectrum Analyzer	8566B	2532A02014	N/A
10	DB Products	RF Power Sensor	DB8881A-350	N/A	N/A
11	Pasterneck	50 ohm Terminator	PE7021-40	N/A	N/A
12	Tektronix	Digital Oscilloscope	TDS-410A	B010112	N/A
13	Mini-circuits	RF Combiner	ZA3PD-1	09818	N/A
14	Hewlett Packard	RF Comm. Test Set	8920B	4500020132-10	N/A
15	Rohde & Schwarz	RF Power Sensor	NRV-Z5	844855/012	N/A
16	Rohde & Schwarz	RF Power Meter	NRVS	826149/077	N/A

Item	Description	Length (m)	Type	Connected from	Connected to
A	Power Cords	1.2	8 gauge wires	EUT	Power Supply
B	DB25 Shielded Cable	1.0	RS232	EUT	Test Fixture
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E	RF Coaxial Cable	0.3	RG214	Directional Coupler	Spectrum Analyzer
F	RF Coaxial Cable	1.2	RG214	Directional Coupler	50 ohm Terminator

5.0 TEST DATA

5.1 RF Power Output

Output power was measured at the Transmitter Module RF output terminal. The test setup and method as shown in Configuration 1.

The output power was measured 40W at each frequency 400MHz, 455MHz, 512MHz tuned with nominal voltage 13.80V and the output power was measured at the DC power supply was adjusted to ±15% of nominal voltage. The Rohde & Schwarz NRVS power meter and NRV-Z5 power sensor was used to measure RF output power.

Freq. Tuned	85% nominal voltage (11.73V)	nominal voltage (13.80V)	115% nominal voltage (15.87V)
400.0 MHz	22.3W	34.7W	39.3W
455.0 MHz	26.4W	39.9W	55.3W
512.0 MHz	22.5W	39.9W	53.8W

5.2 Modulation Characteristics

Please refer to Exhibit A, FSK modem, Product Support Manual and Product Specification Manual for details description. The modulation characteristics test results are enclosed in appendix B pages B4-B6.

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 C 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. Test results were attached in appendix B pages B7-B15.

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) dB (where Po is 40W maximum output power) below the maximum level of the carrier frequency in accordance with the transmitter 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 B16-B29.

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 meter 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 log-periodic and 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 59 dB below each tuned carrier field strength. Test results were attached in appendix B pages B30-B32.

* Field strength = $1/D \times (Po \times RL)^{1/2}$, where D = 3 meters, Po = 40.0W, RL= 50.2 ohm

= $1/3 \times (40 \times 50.2)^{1/2}$
= 143.5 dBμV/m

** FCC Limit = 43 + 10 log (Po) , where Po = 40W
= 59dB

5.6 Frequency Stability

The EUT carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency over the variations of extreme ambient temperature. The DR4B was placed in the temperature chamber and measured the power output with the variation of DC power input in room temperature. The temperature was set to the lowest requirement −30°C and wait for a period of at least 2 hours to reach stability inside the unit. Once the chamber temperature and inside unit thermocouple temperatures reach the −30°C, the unit was turned on and output power was measured within one minute with the variations of DC input power from 85% to 115% of nominal voltage. Increasing the temperature by every 10°C step to the maximum extreme temperature of this test is +50°C. For each temperature setting, wait for both chamber and unit inside thermocouple to reach the desired temperature and repeat the measurement. Please refer to pages B33−B35 in appendix B for the test results.

5.7 Transient Frequency Behavior

In the frequency band 400 to 512MHz, transient frequencies must be within the maximum frequency difference limits during the time intervals indicated:

t_1 = 10 ms
t_2 = 25 ms
t_3 = 10 ms

where

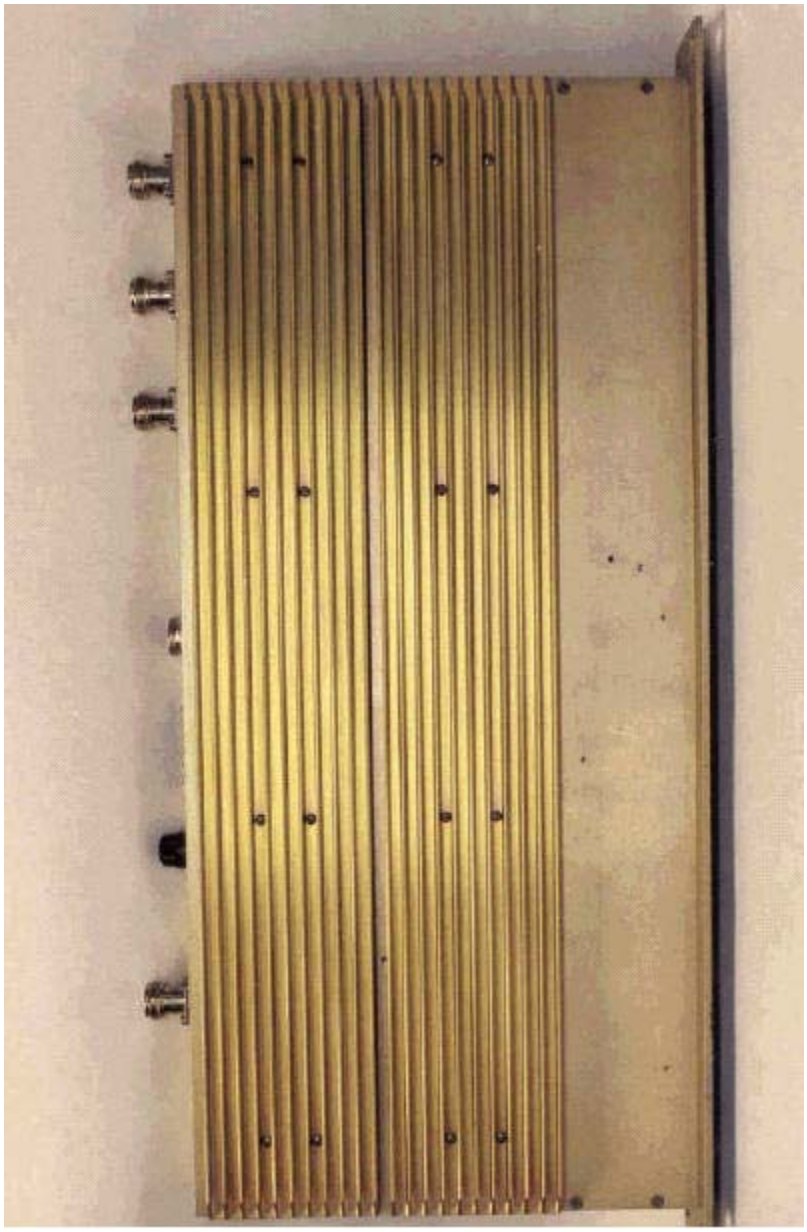
t_1 is the time period immediately following t_{on}.
t_2 is the time period immediately following t_1.
t_3 is the time period from the instant when the transmitter is turned off until t_{off}.
t_{on} is the instant when 1 KHz test signal is completely suppressed, including any capture time due to phasing.
t_{off} is the instant when the 1 KHz test signal start to rise.

Please refer to test configuration 3 for test setup and the appendix B36-B41 for test results.

6 PHOTOGRAPHS AND/OR DRAWINGS SHOWING CONSTRUCTION TECHNIQUES

6.1 Photo: EUT 3D View

6.2 Photo: EUT Top View

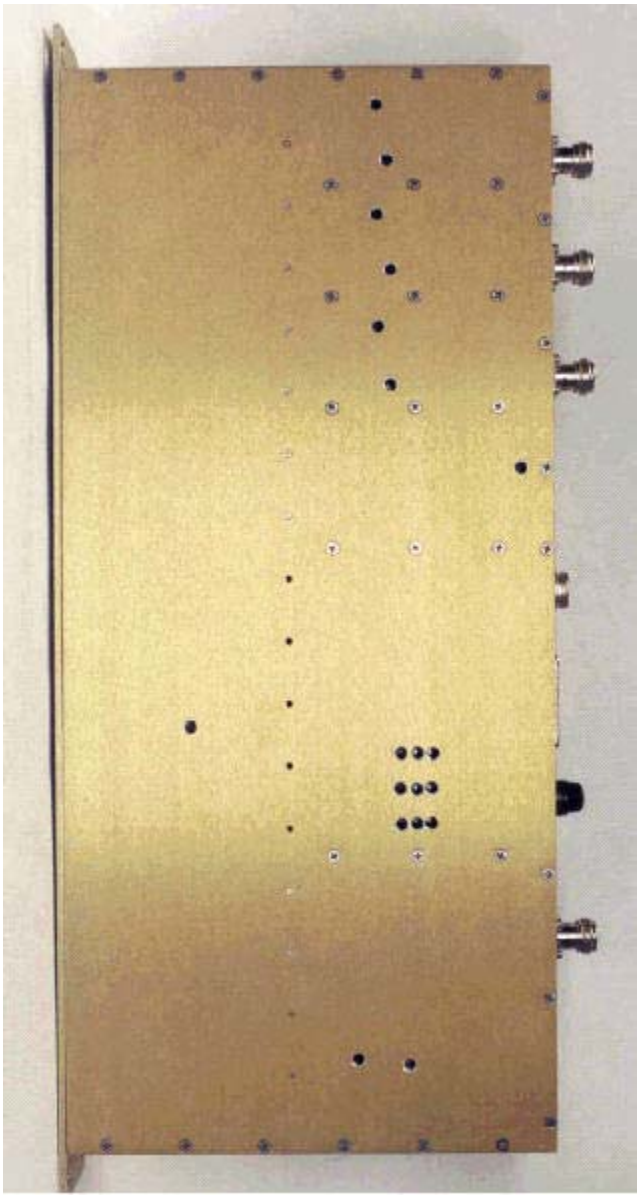


6.3 Photo: EUT Front View

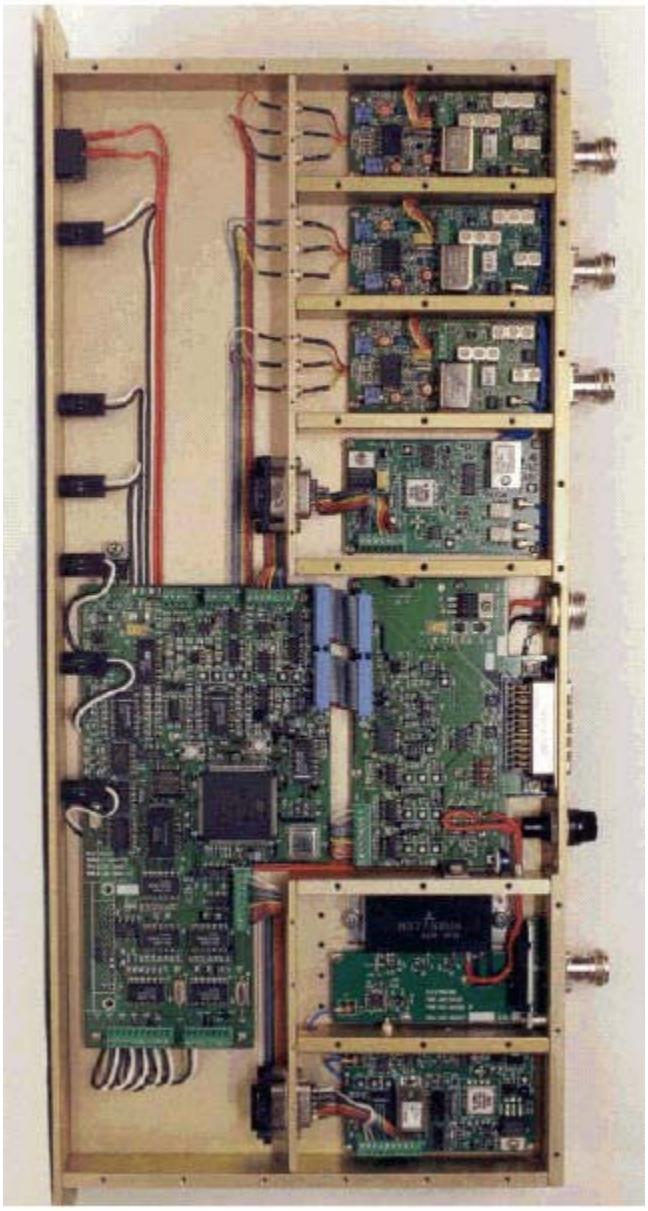
6.4 Photo: EUT Rear View

6.5 Photo: EUT Side View

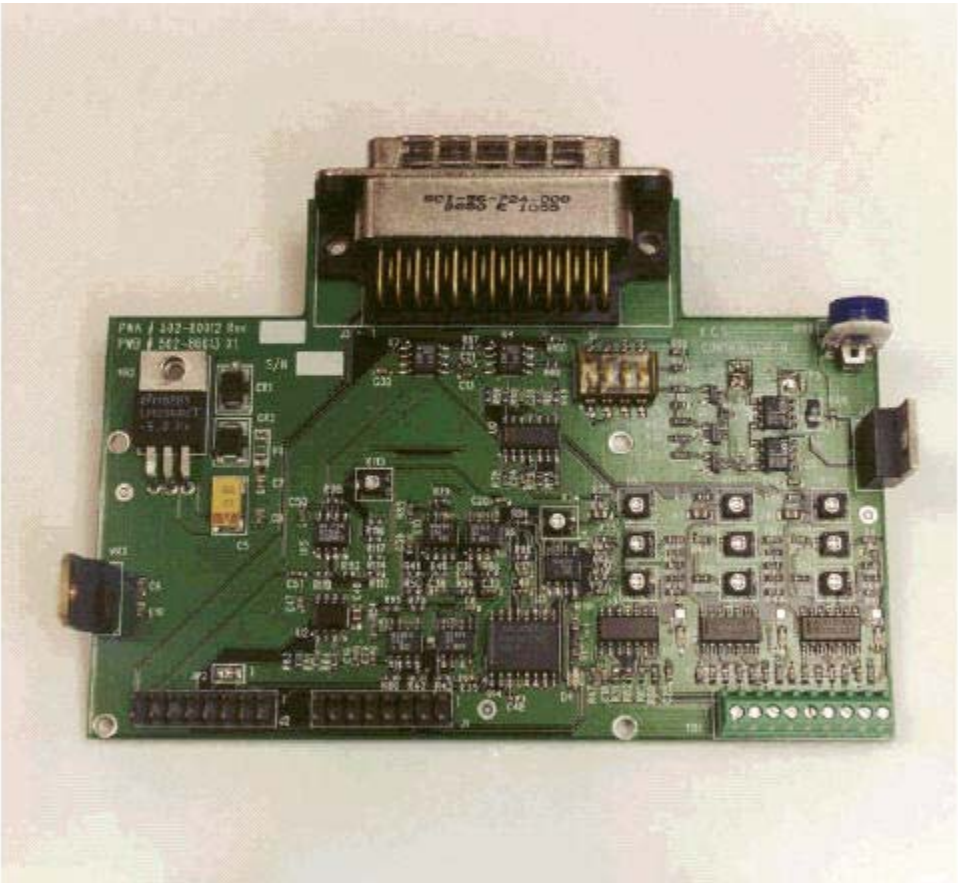
6.6 Photo: EUT Bottom View



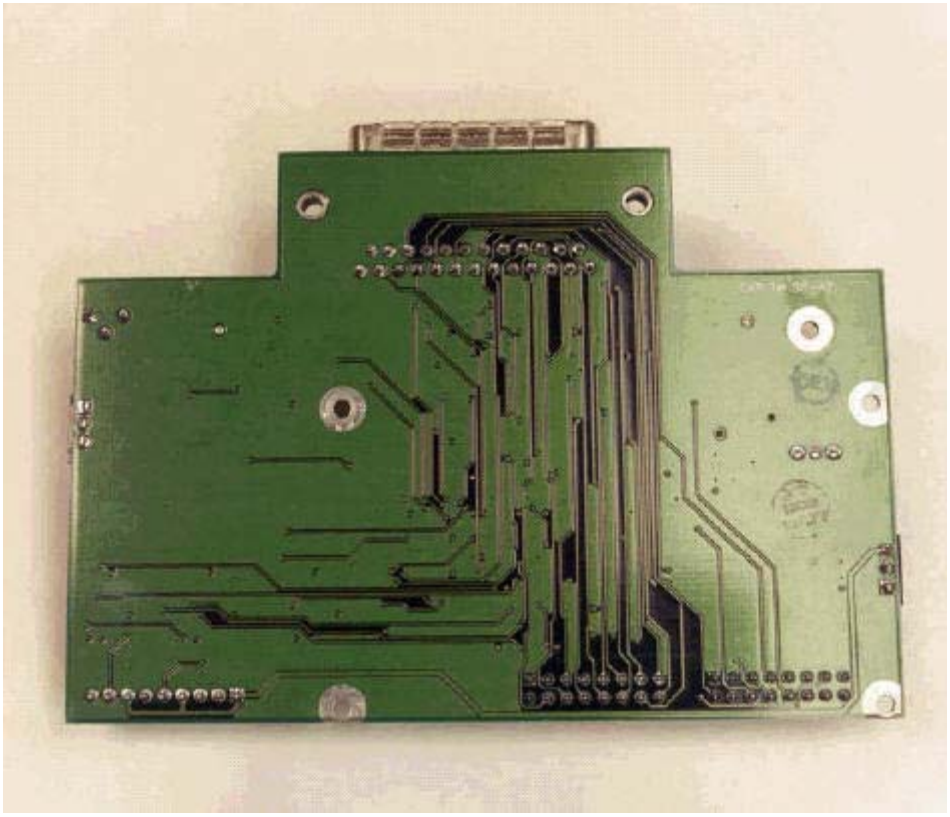
6.7 Photo: EUT with cover removed (Bottom View)



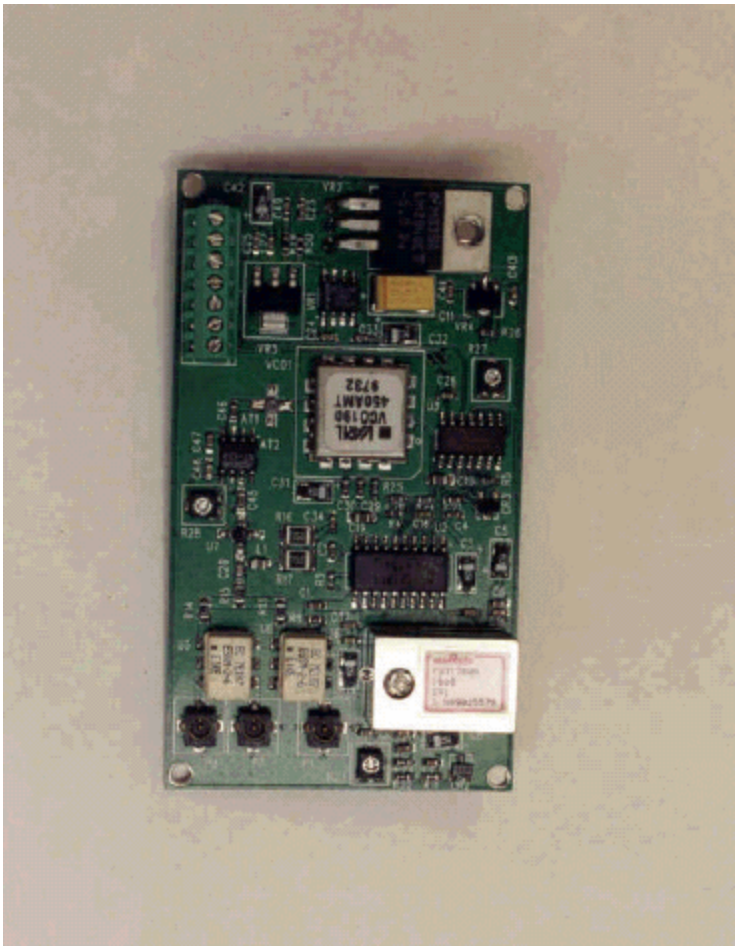
6.8 Photo: EUT Diversity Reception Controller PCB Top



6.9 Photo: EUT Diversity Reception Controller PCB Bottom

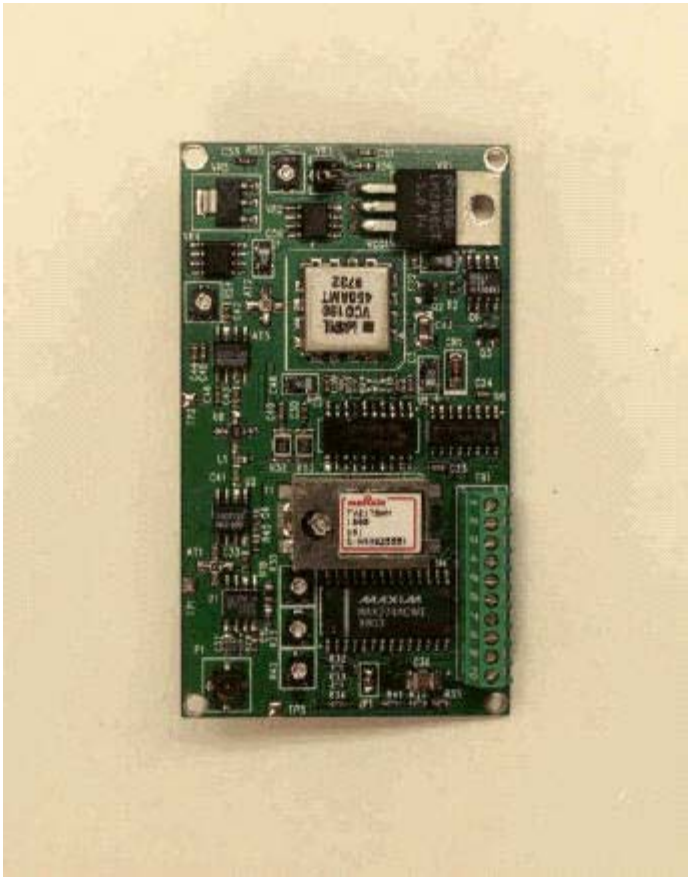


6.10 Photo: EUT RX Injection PCB Top



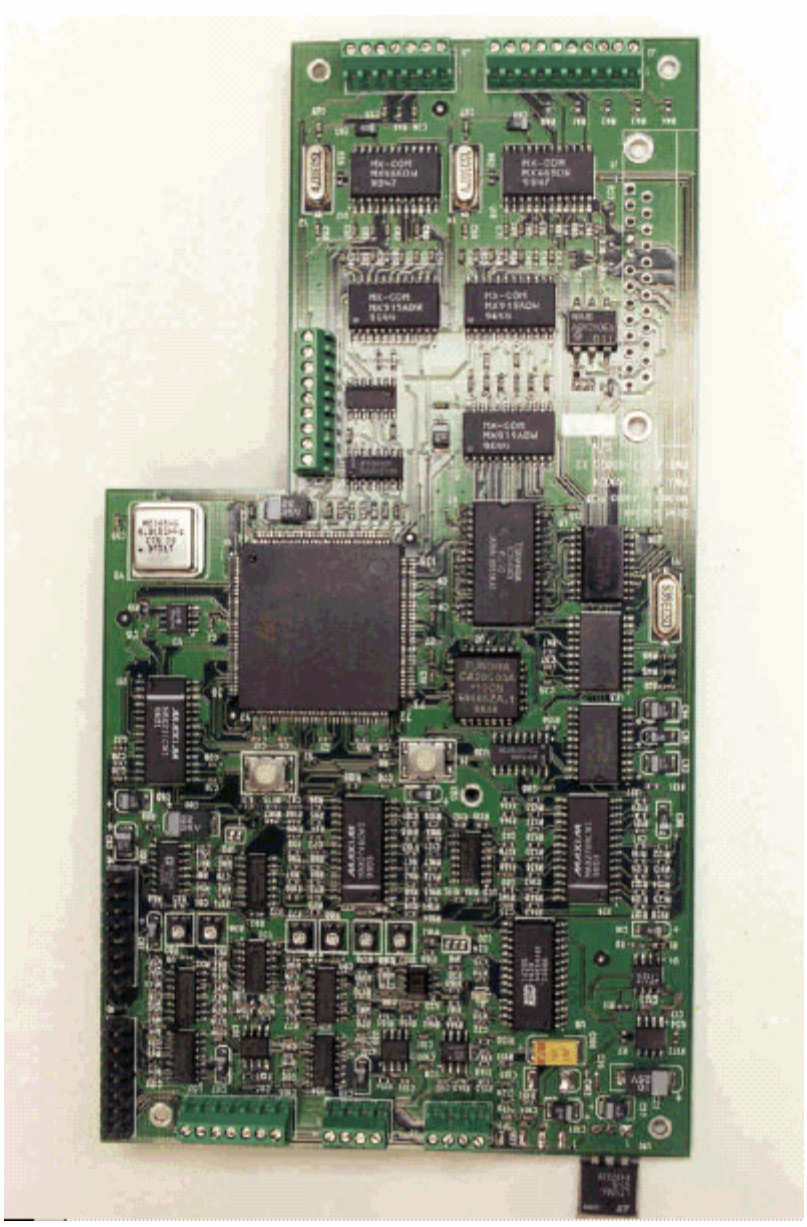
6.11 Photo: EUT RX Injection PCB Bottom

6.12 Photo: EUT Exciter PCB Top

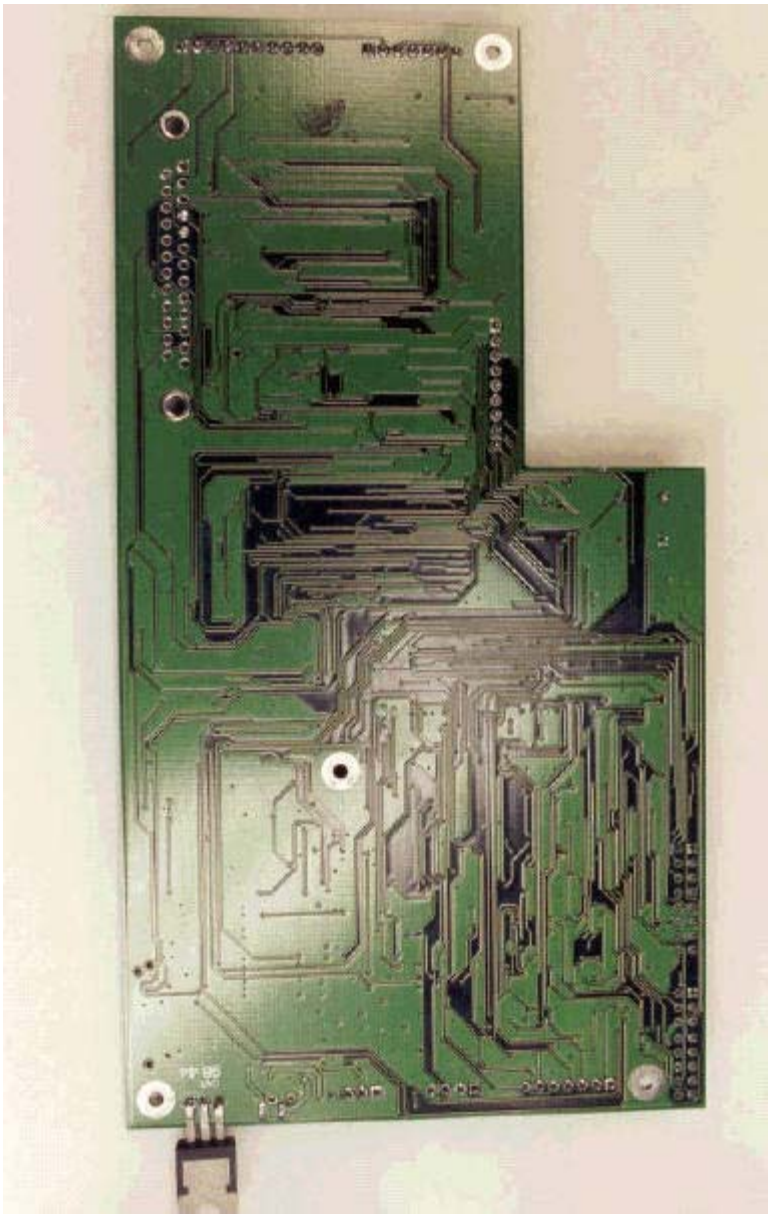


6.13 Photo: EUT Exciter PCB Bottom

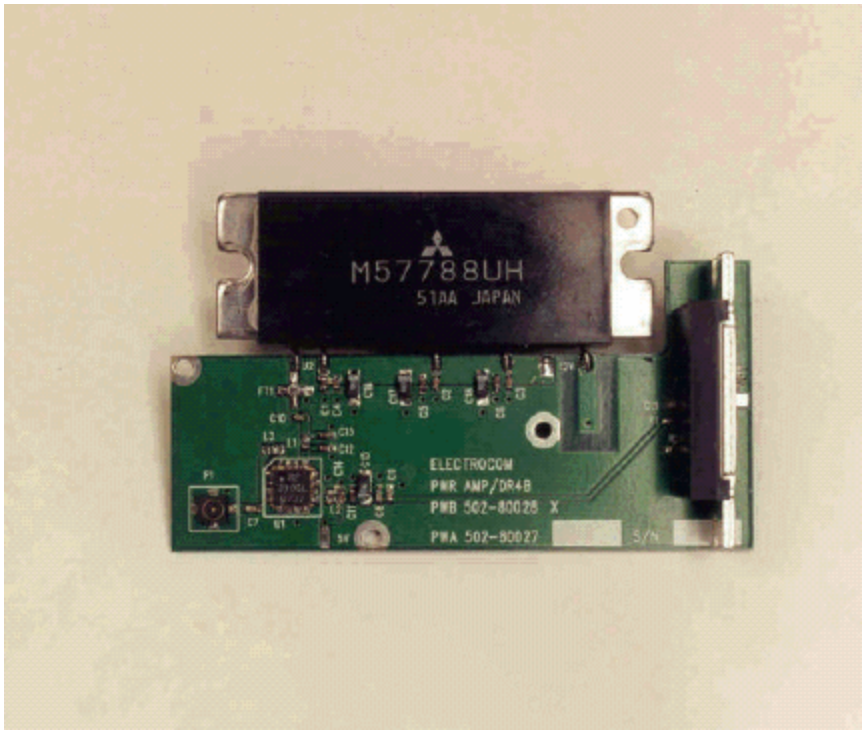
6.14 Photo: EUT System Controller PCB Top



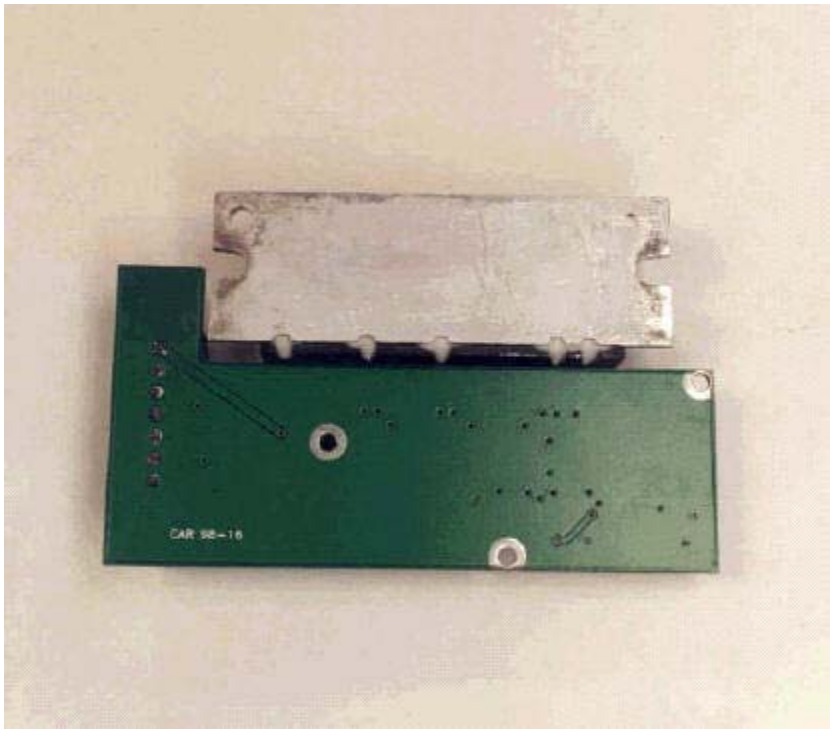
6.15 Photo: EUT System Controller PCB Bottom



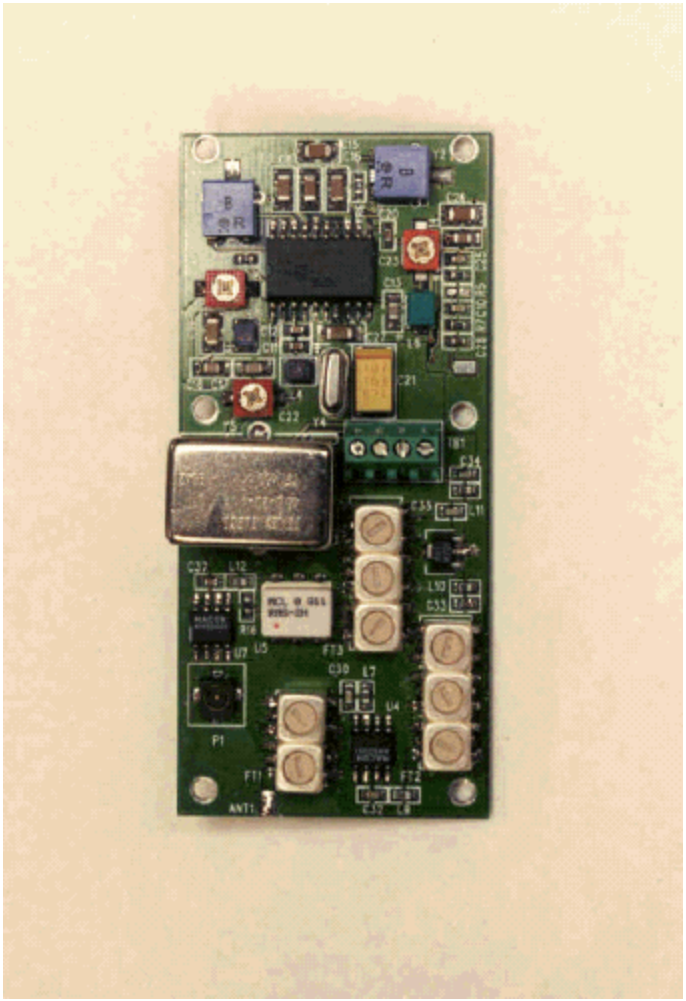
6.16 Photo: EUT Power Amplifier PCB Top



6.17 Photo: EUT Power Amplifier PCB Bottom



6.18 Photo: EUT Receiver PCB Top



APPENDIX A - Test Equipment Used

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 Aegis Labs offices in Trabuco Canyon or Rancho Santa Margarita, CA. All equipment is checked and verified for proper operation before and after each series of tests.

A.1 Specific Equipment Used

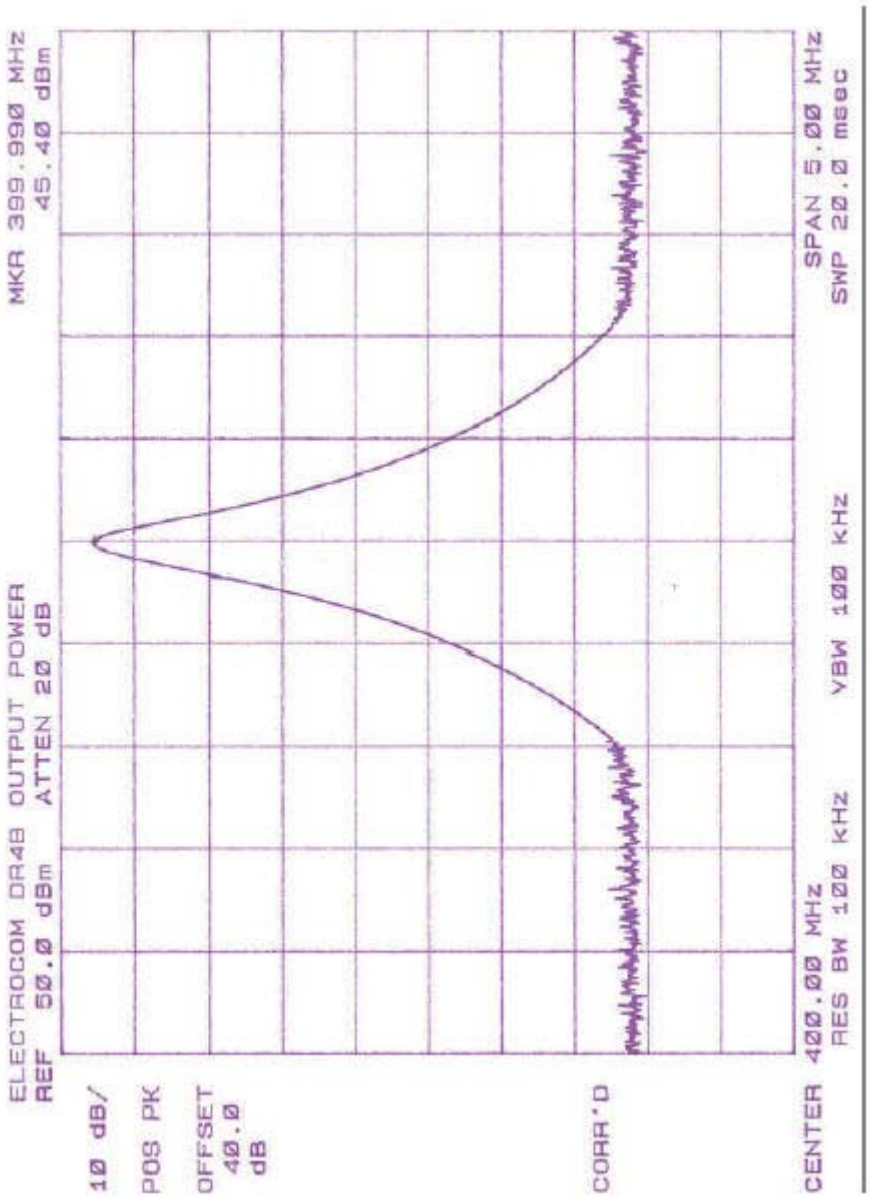
Test Instrument	*Mfg*	*Model No.*	*Serial No.*	*Freq. or Range*	*Cal. Due Date*
EMI Spectrum Analyzer	Hewlett Packard	8566B	2532A02014	100 Hz – 22GHz	02/16/00
Communication Test Set	Hewlett Packard	8920A	4500020132-10	.4 – 1000 MHz	03/22/00
Digitizing Oscilloscope	Tektronix	TDS410A	B010112	200MHz	04/19/00
Directional Coupler	Amp. Research	DC6080	25315	80 – 1000 MHz	02/25/00
Directional Coupler	Hewlett Packard	11692D	1212A00305	2 – 18 GHz	12/03/99
Directional Coupler	Hewlett Packard	778D	1144A08005	80 – 2000 MHz	12/01/99
Power Sensor	Rohde &	NRVS	826149/077	DC – 26.5 GHz	08/29/00
Digital Power Meter	Schwarz	NRV-Z5	844855/012	0.1 MHz – 6GHz	08/29/00
RF Preamplifier	Rohde &	PA-120	N/A	1 – 20 GHz	01/27/00
RF Preamplifier	Schwarz	CPPA-102	N/A	.1 – 1 GHz	12/30/99
Double Ridged Antenna	Com-Power	AH-118	10069	1 – 18 GHz	12/11/99
Log-Periodic Antenna	Com-Power	AL-100	16041	.3 – 1 GHz	12/30/99
Signal Generator	Com-Power	8673B	2823A01357	2 – 26 GHz	11/25/99
Signal Generator	Com-Power	6062A	9809906	.1 – 2.1 GHz	03/13/00
RF Attenuator	Hewlett Packard	PE7021-40	N/A	100W	CIP
RF Attenuator	Gigatronics	500-WA-FFN-	9903	500W	CIP
50 ohm Resistive Load	Pasterneck	1000-WT-FN	9924	1000W	CIP
50 ohm Resistive Load	Bird Electronics	PE6034	N/A	0.5W	CIP
RF Splitter/Combiner	Bird Electronics	ZA3PD-1	N/A	0.4 –1 GHz	CIP
RF Power Sensor	Pasterneck	DB8881A-350	N/A	0.4 –1 GHz	CIP
DC Power Supply	Mini-Circuits	RS-70M	N/A	0 – 18V, 0 – 70A	CIP
DC Power Supply	Decibel	RS-12M	N/A	0 – 18V, 0 – 12A	CIP

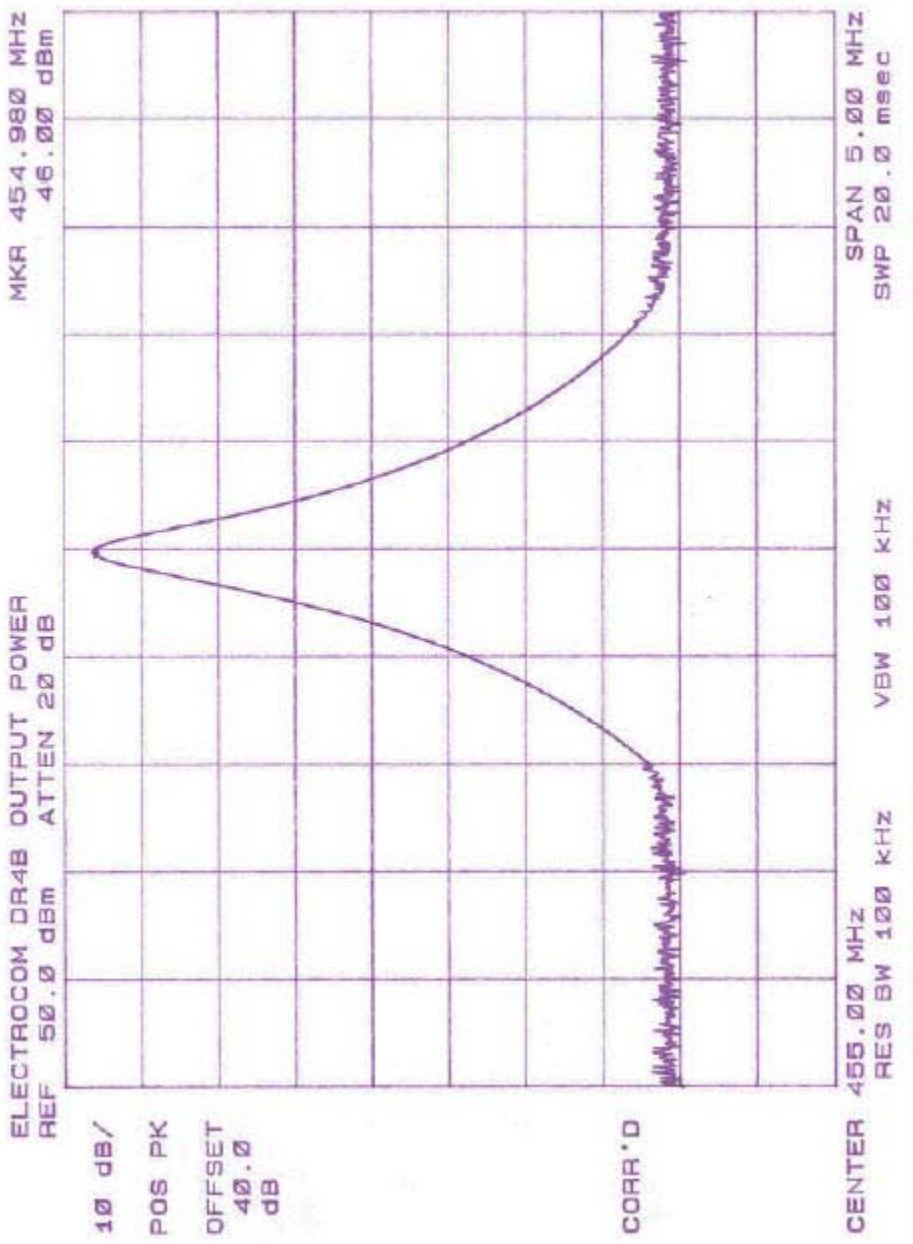
A.1 Specific Equipment Used

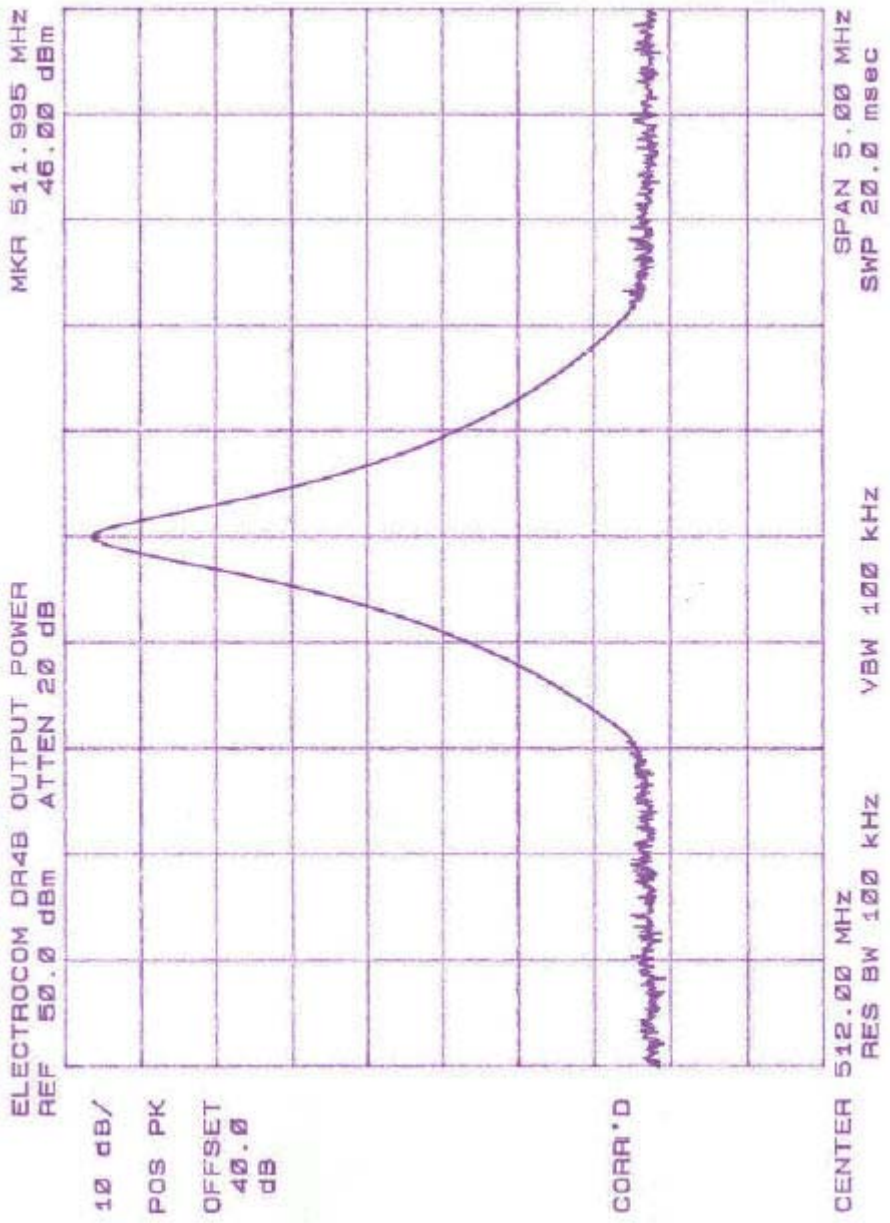
Test Instrument	*Mfg*	*Model No.*	*Serial No.*	*Freq. or Range*	*Cal. Due Date*
DC Power Supply	Sorensen	SRL-60-17M1	0431	0 – 60V, 0 – 17A	CIP
Temperature Chamber	Environ. Equip.	RB-16-705-705	0688603	– 73 ~ + 177°C	11/04/99
Temperature Recorder	Honeywell	DR4501-1000	930589598032	– 60 ~ + 160°C	11/13/99
RF Cables	United Microwave	190-57793	N/A	.1MHz – 10GHz	CIP

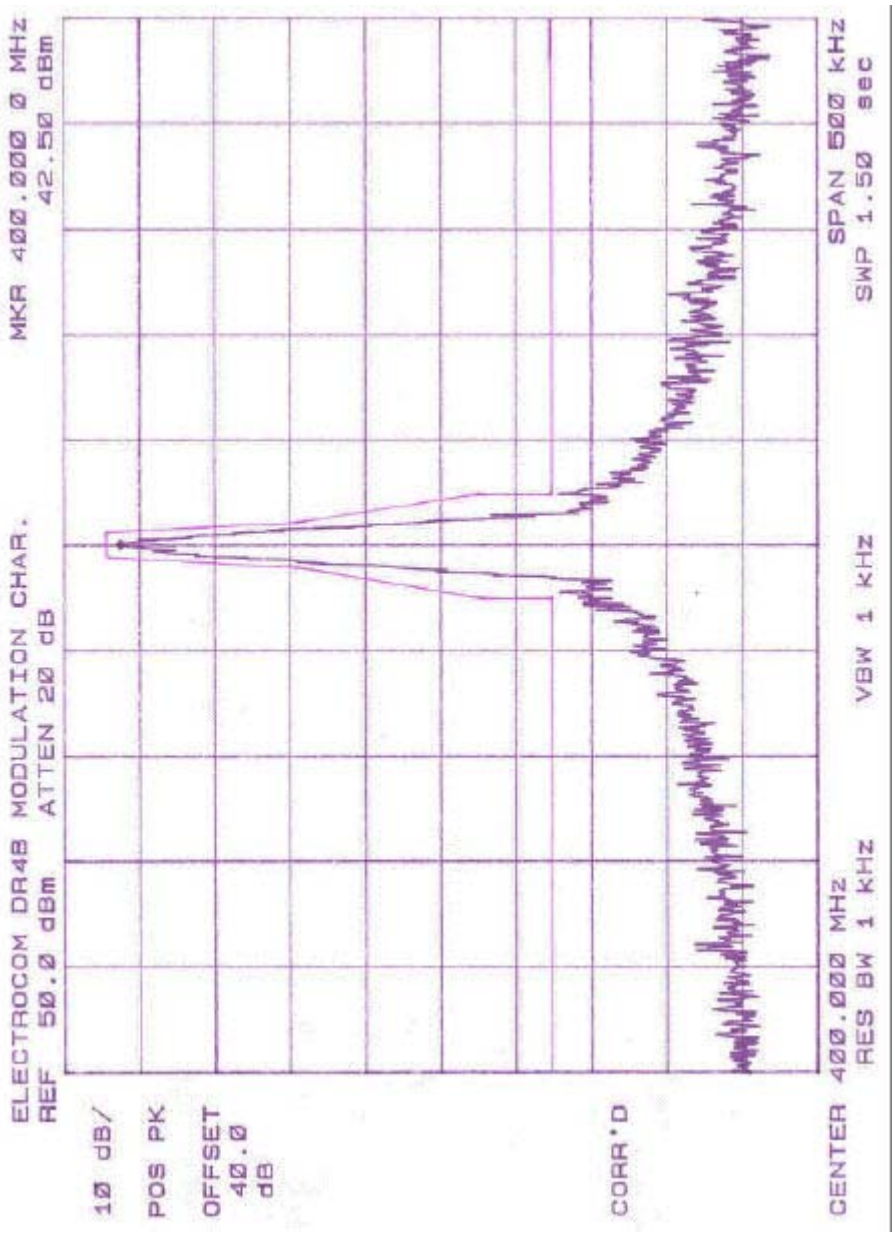
* CIP – calibrate in place

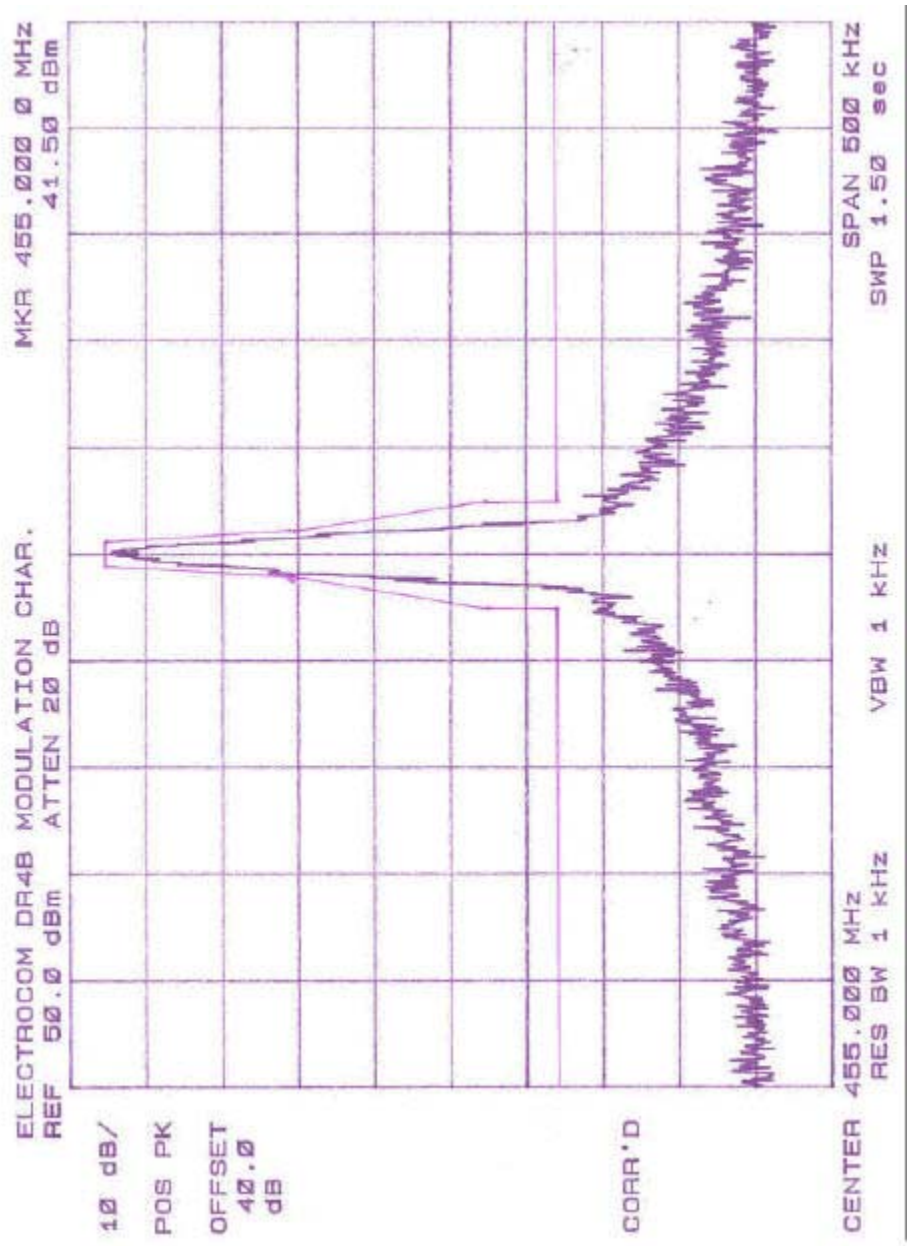
APPENDIX B – SUPPLEMENTS TEST DATA

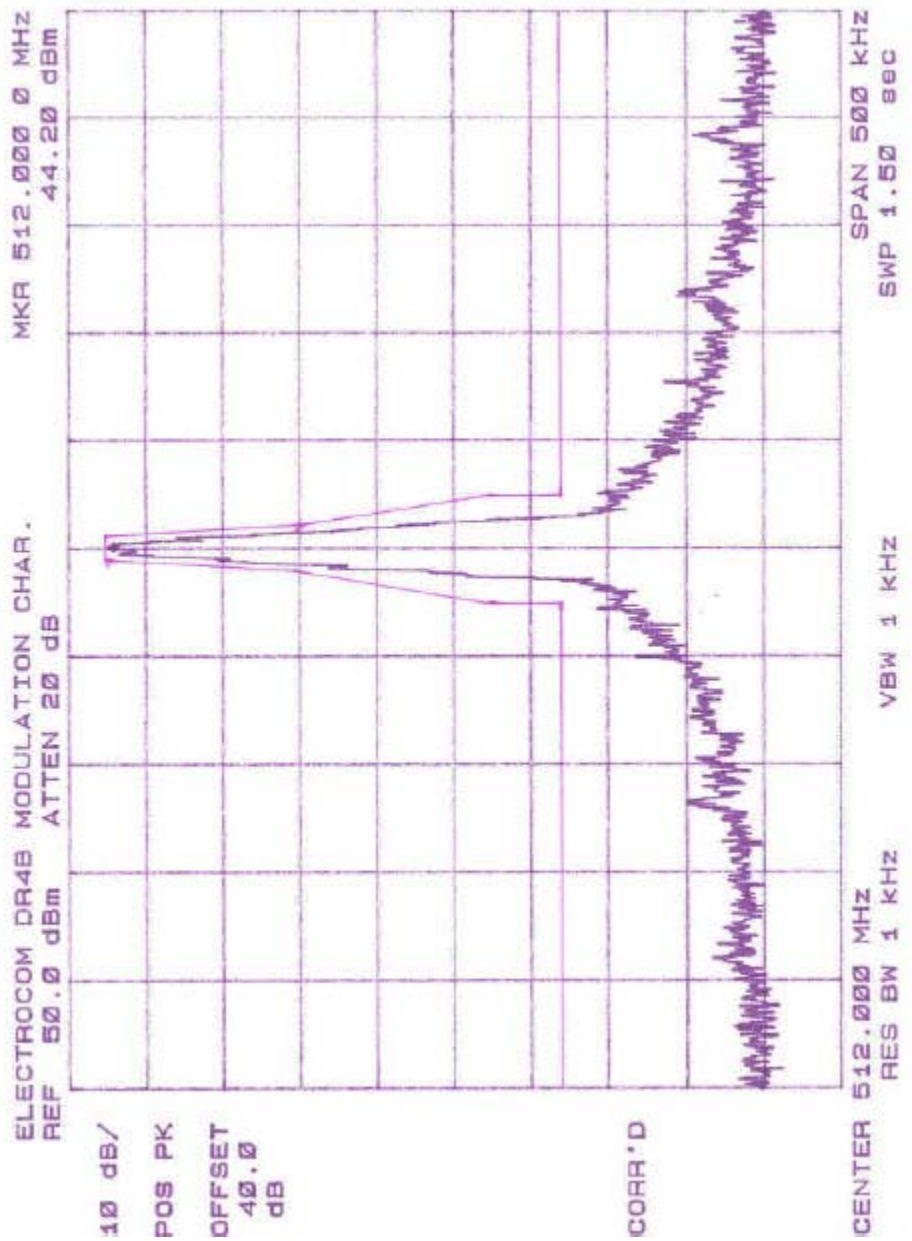


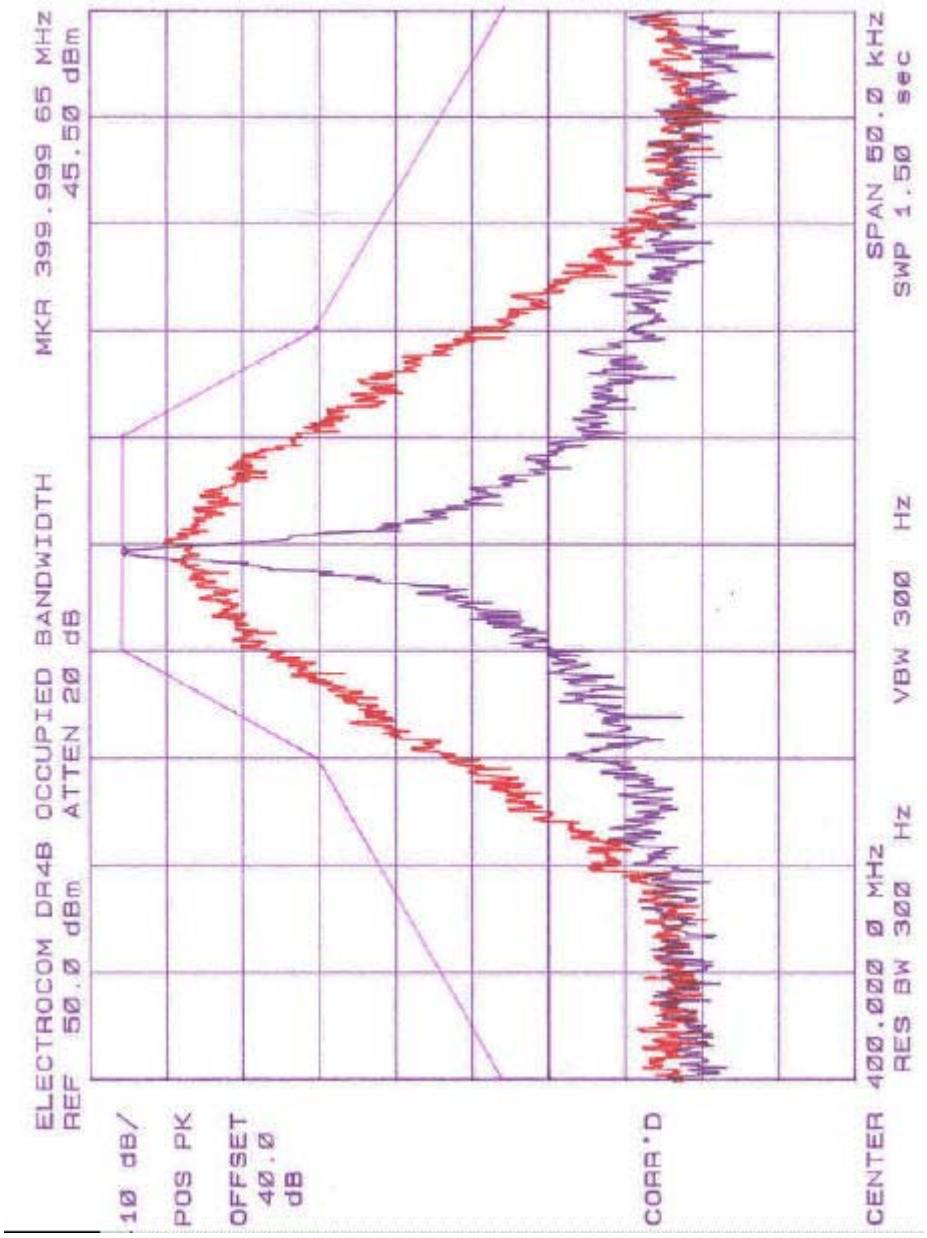

ELECTROCOM DR4B OUTPUT POWER
REF 50.0 dBm ATTEN 20 dB
MKR 454.980 MHz
46.00 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 455.00 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 5.00 MHz
SWP 20.0 msec

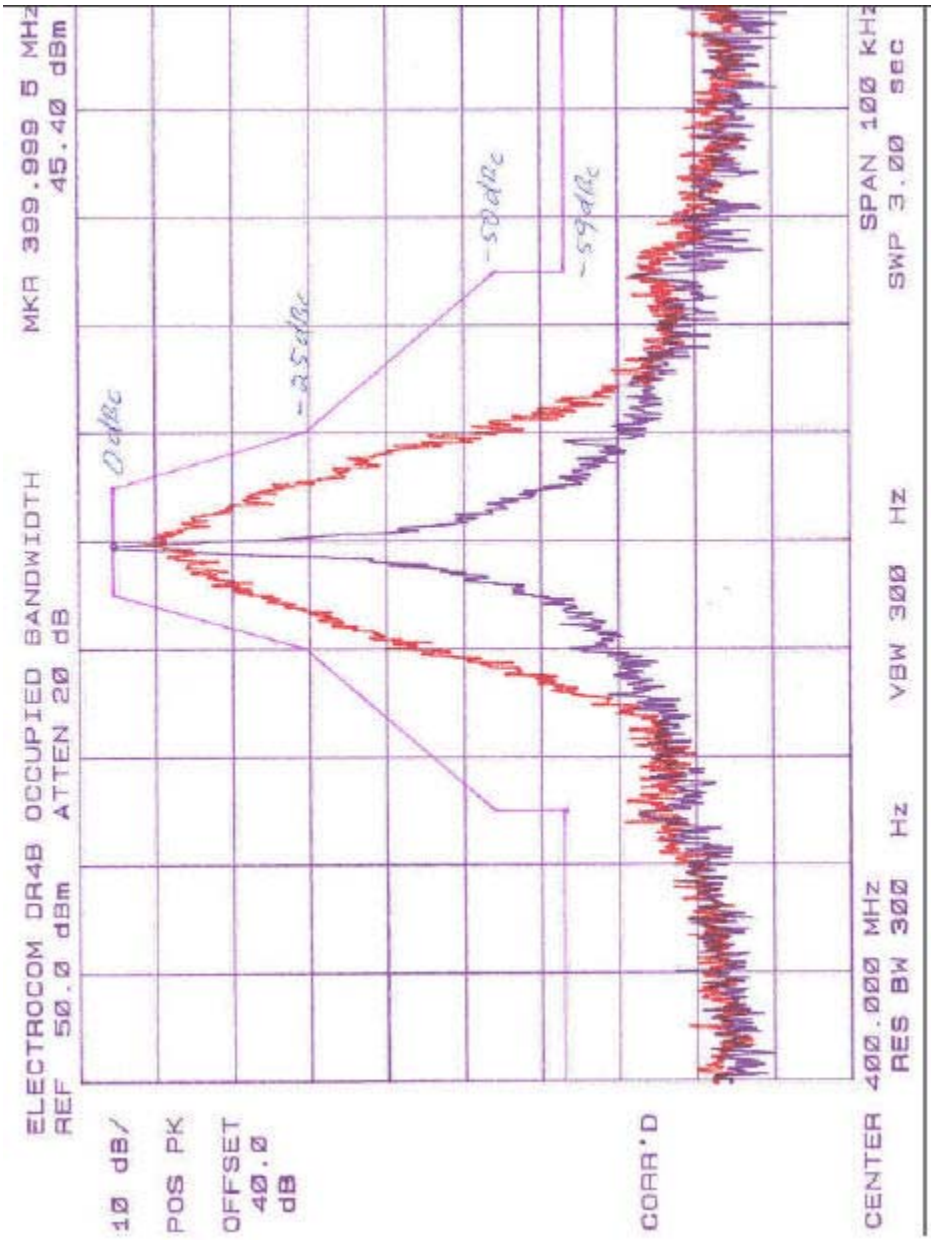

ELECTROCOM DR4B OUTPUT POWER
REF 50.0 dBm ATTEN 20 dB
MKR 511.995 MHz
46.00 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 512.00 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 5.00 MHz
SWP 20.0 msec

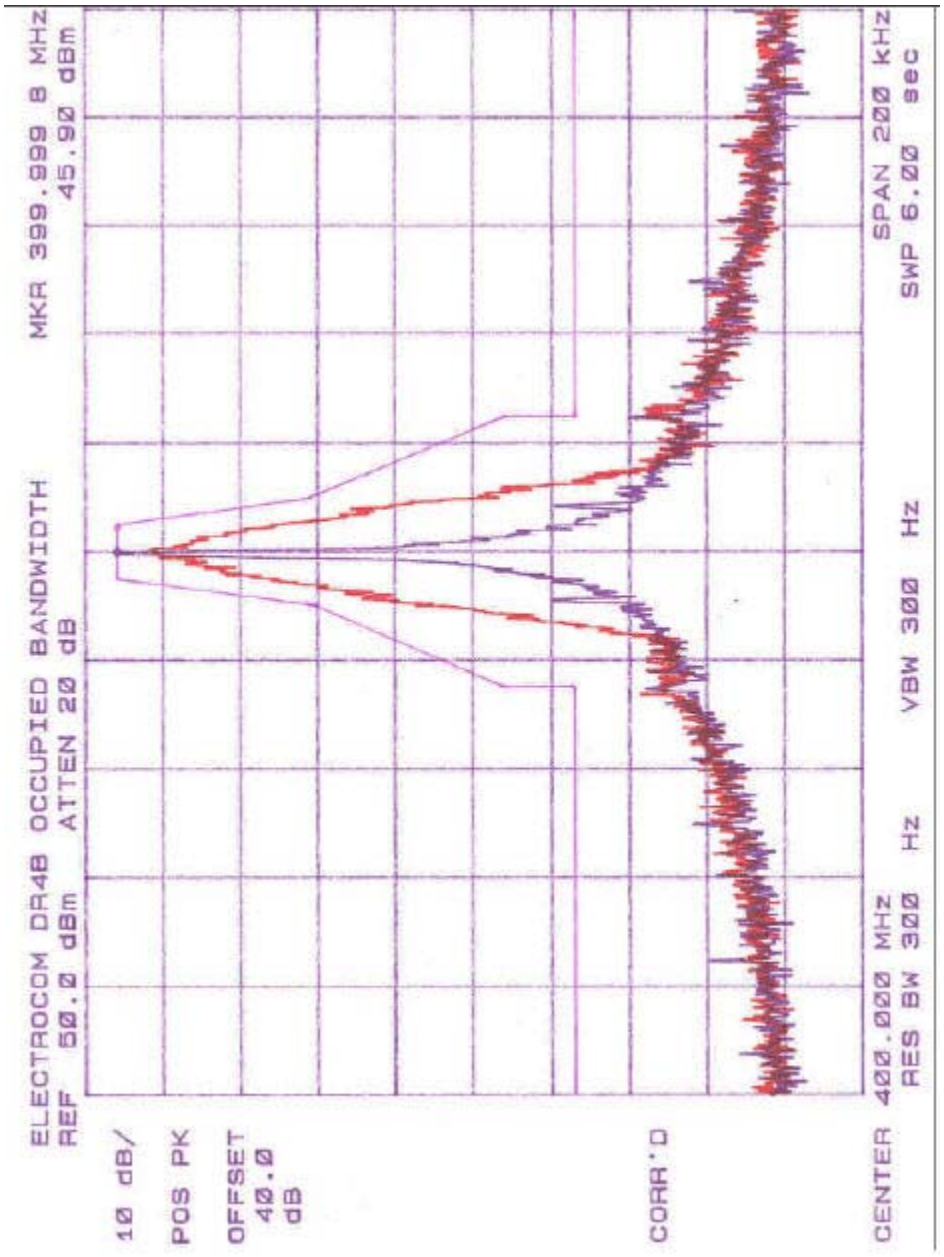

ELECTROCOM DR4B MODULATION CHAR.
REF 50.0 dBm ATTEN 20 dB
MKR 400.000 0 MHz
42.50 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 400.000 MHz
RES BW 1 kHz
VBW 1 kHz
SPAN 500 kHz
SWP 1.50 sec

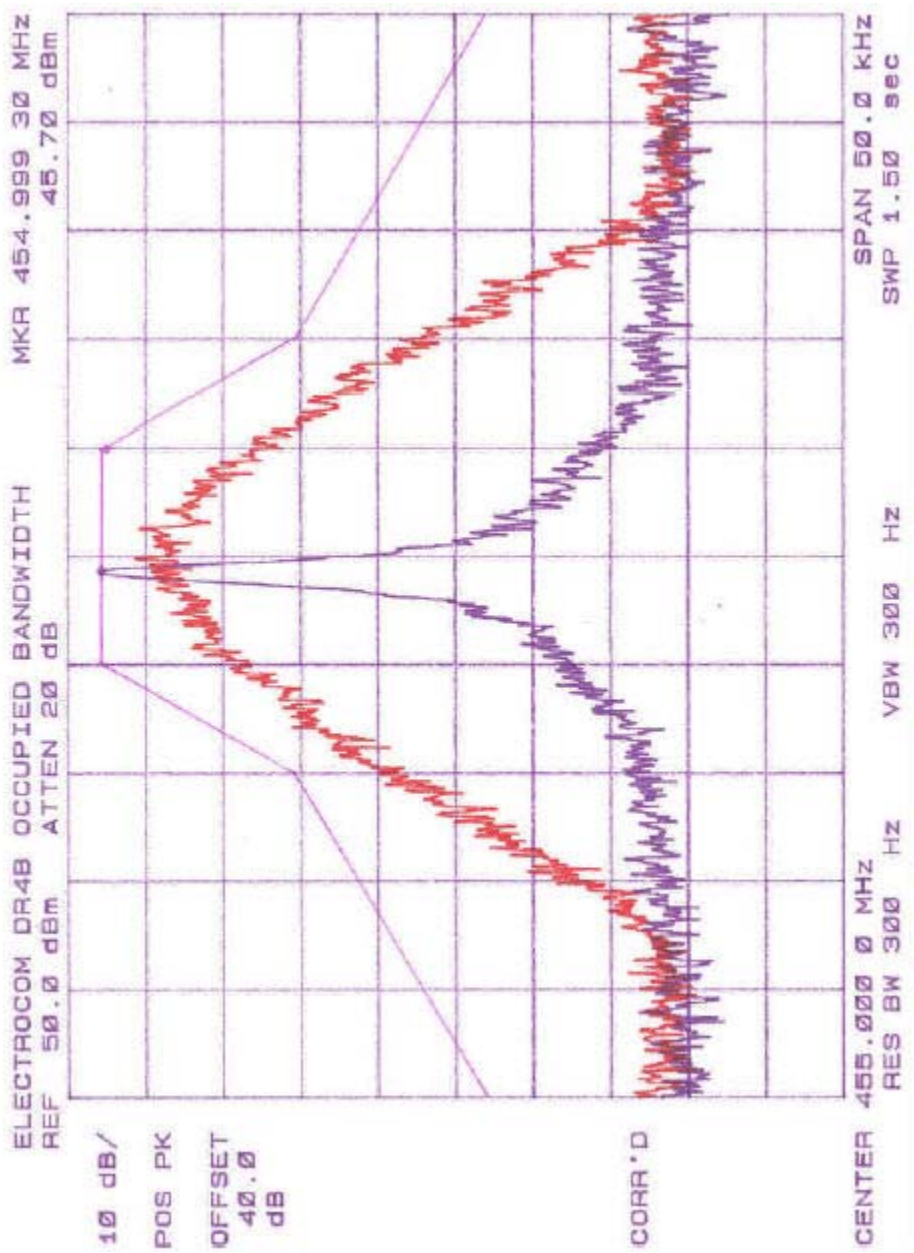

ELECTROCOM DR4B MODULATION CHAR.
REF 50.0 dBm ATTEN 20 dB
MKR 455.000 0 MHz
41.50 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 455.000 MHz
RES BW 1 kHz
VBW 1 kHz
SPAN 500 kHz
SWP 1.50 sec

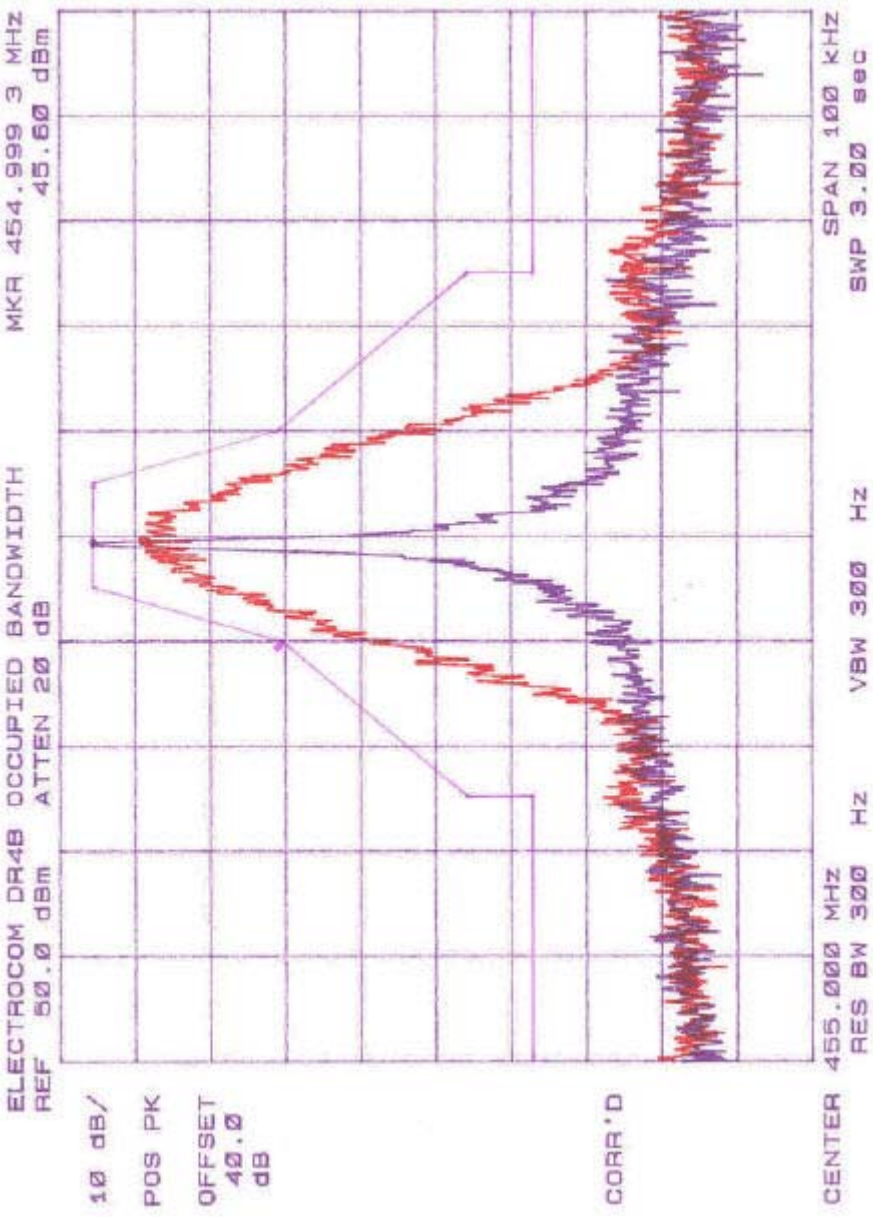

ELECTROCOM DR4B MODULATION CHAR.
REF 50.0 dBm ATTEN 20 dB
MKR 512.000 0 MHz
44.20 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 512.000 MHz
RES BW 1 kHz
VBW 1 kHz
SPAN 500 kHz
SWP 1.50 sec

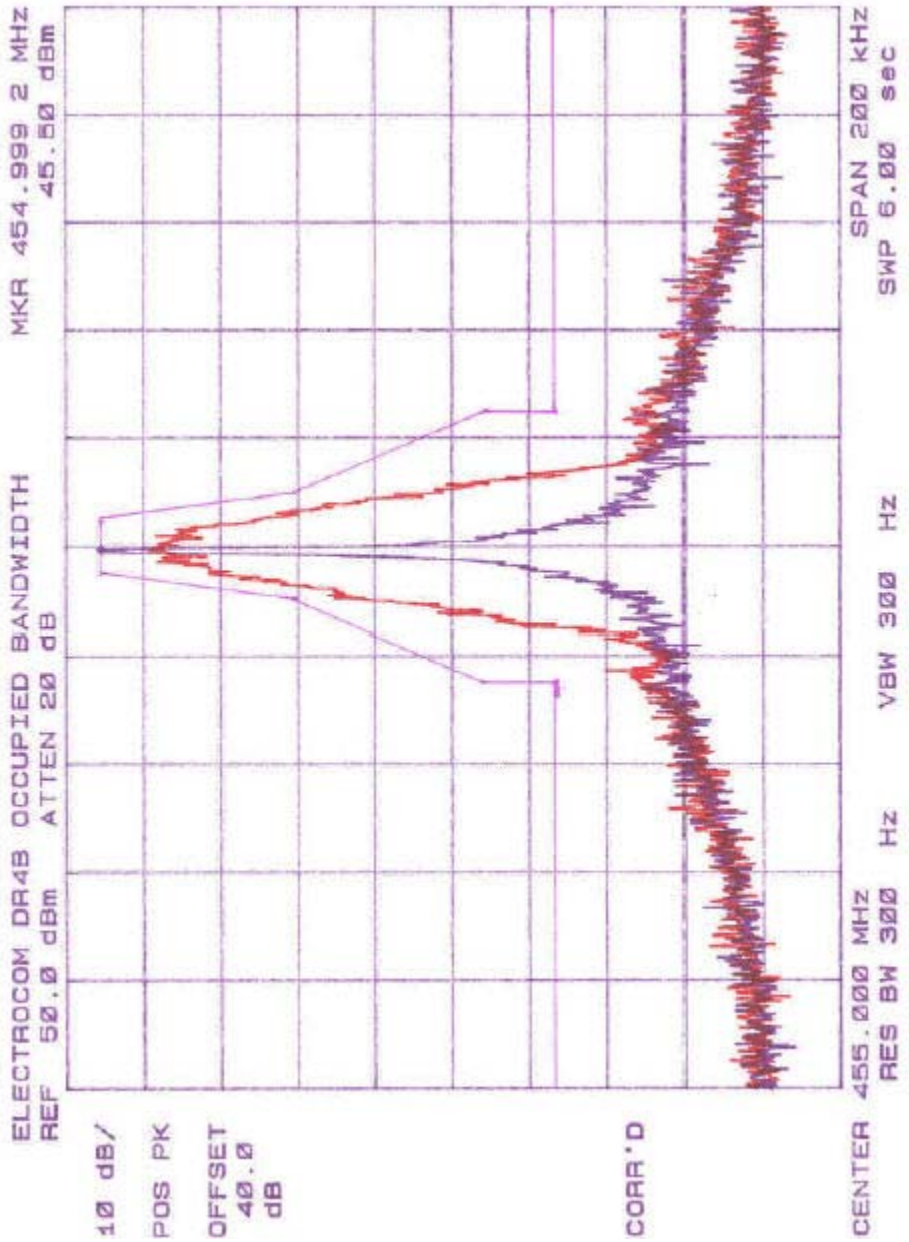

ELECTROCOM DR4B OCCUPIED BANDWIDTH
REF 50.0 dBm ATTEN 20 dB
MKR 399.999 65 MHz
45.50 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 400.000 0 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 50.0 kHz
SWP 1.50 sec

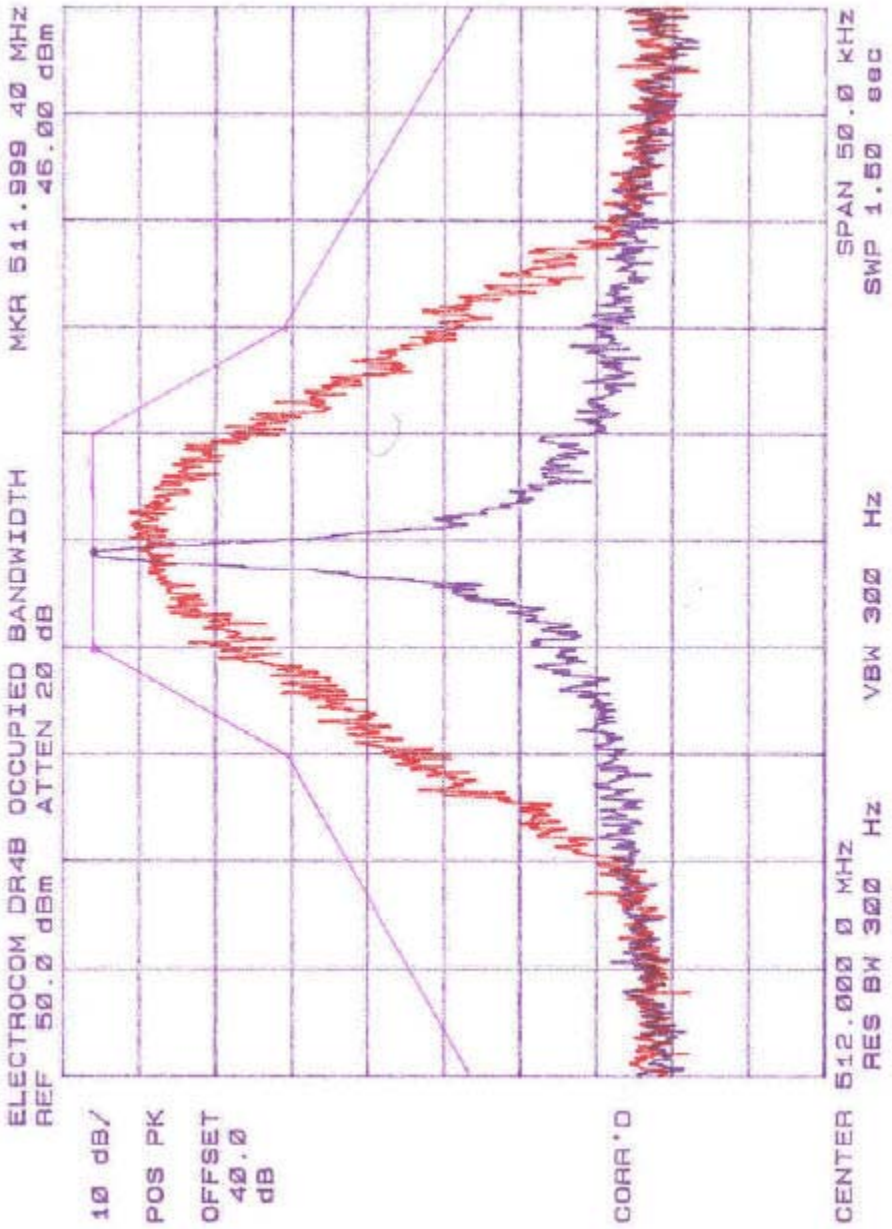

ELECTROCOM DR4B OCCUPIED BANDWIDTH
MKR 399.999 5 MHz
45.40 dBm
REF 50.0 dBm ATTEN 20 dB
10 dB/
POS PK
OFFSET
40.0
dB
0dBc
-25dBc
-50dBc
-59dBc
COAR'D
CENTER 400.000 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 KHz
SWP 3.00 sec

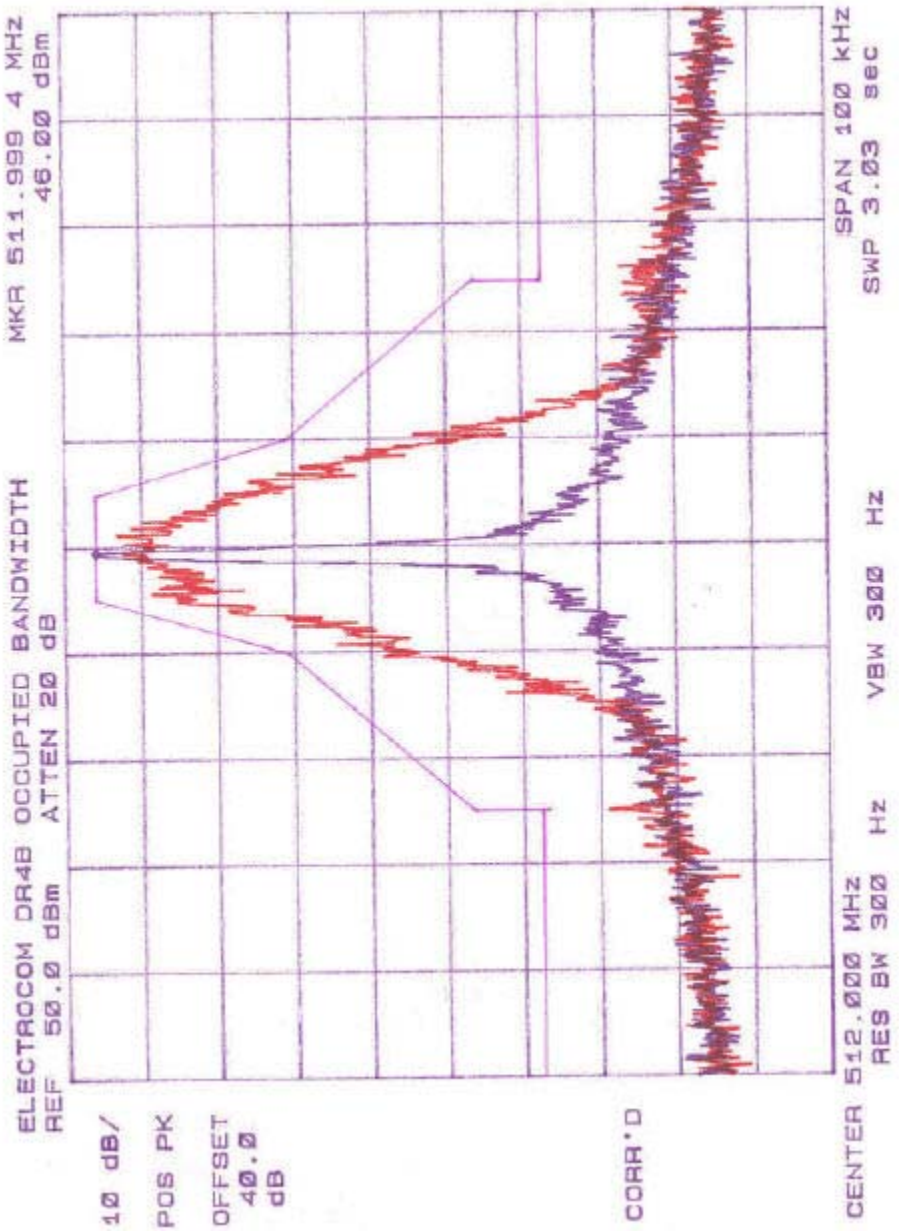

ELECTROCOM DR4B OCCUPIED BANDWIDTH
REF 50.0 dBm ATTEN 20 dB
MKR 399.999 8 MHz
45.90 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 400.000 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 200 kHz
SWP 6.00 sec

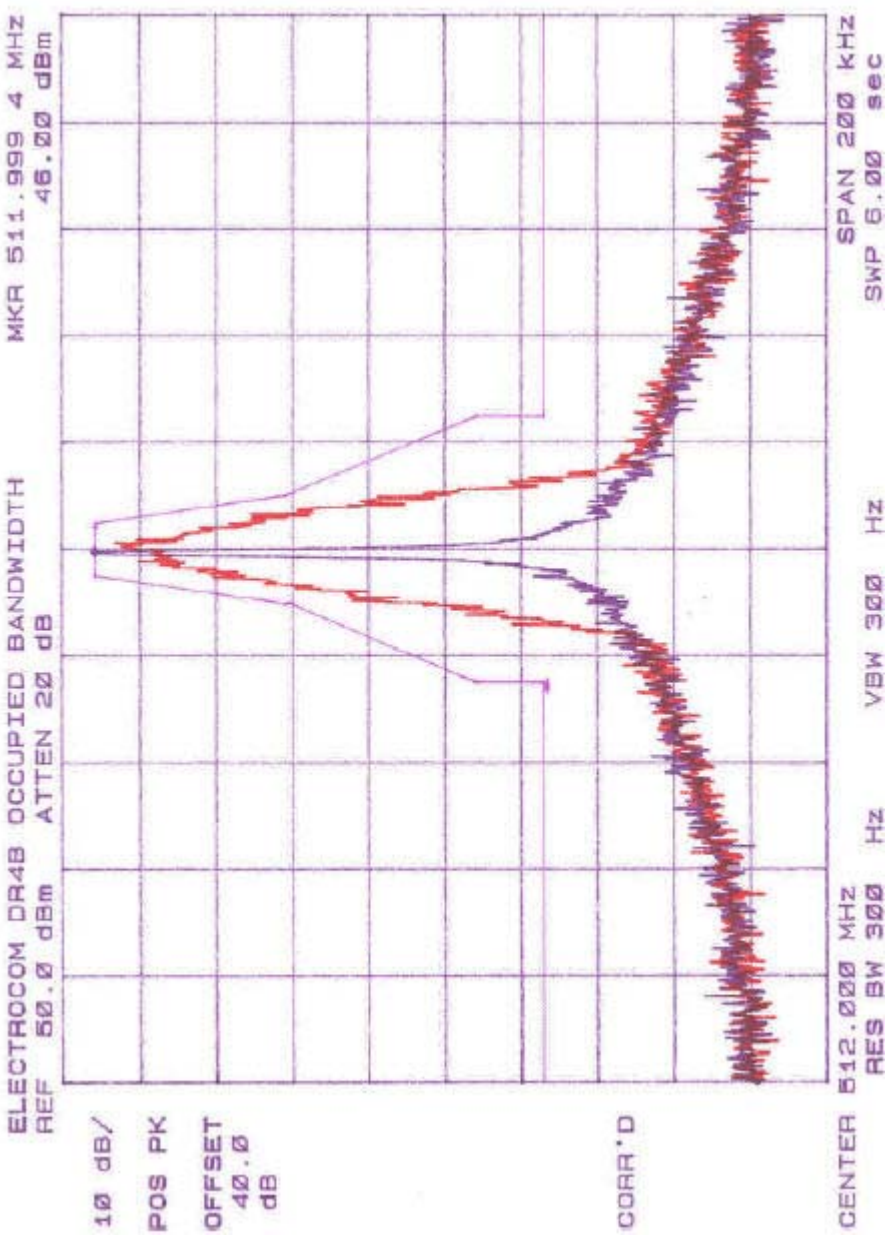

ELECTROCOM DR4B OCCUPIED BANDWIDTH
MKR 454.999 30 MHz
REF 50.0 dBm ATTEN 20 dB
45.70 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 455.000 0 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 50.0 kHz
SWP 1.50 sec

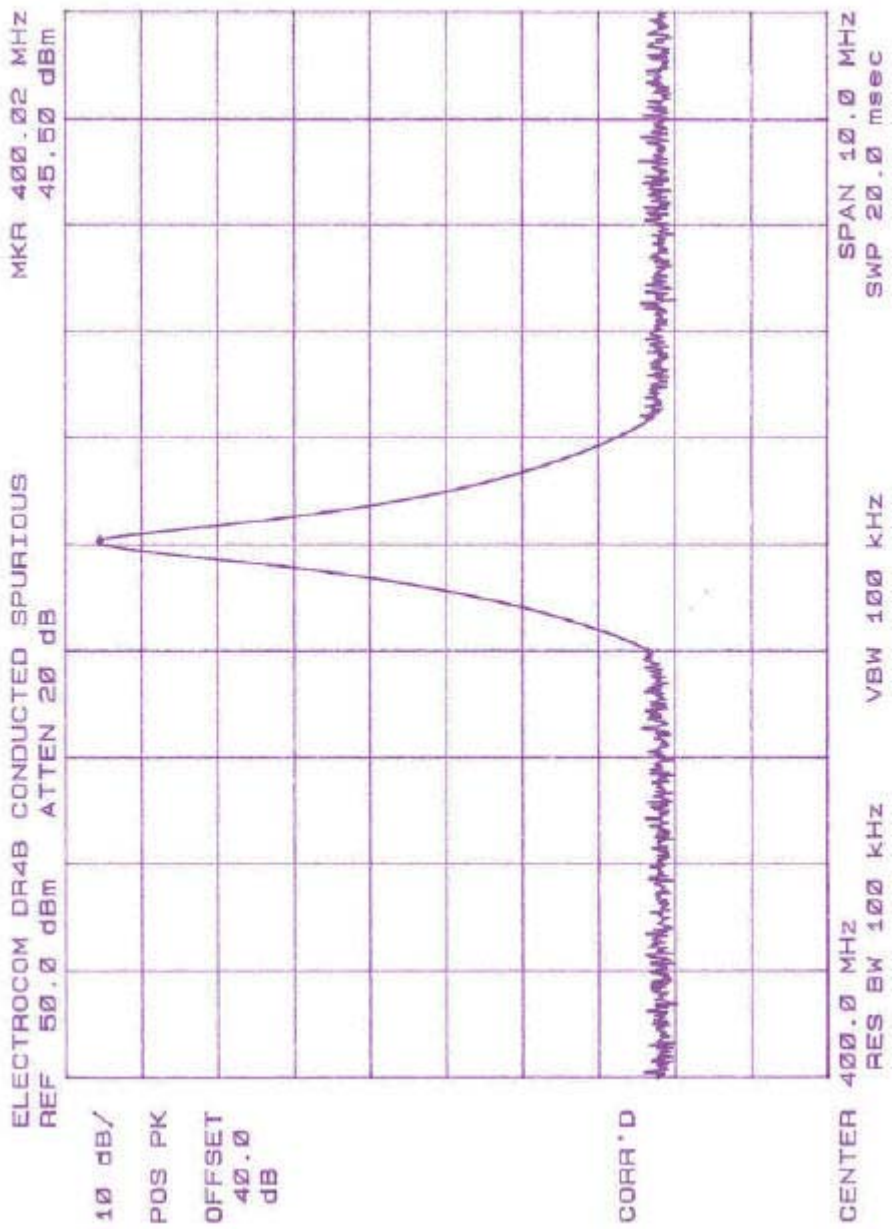

ELECTROCOM DR4B OCCUPIED BANDWIDTH
REF 50.0 dBm ATTEN 20 dB
MKR 454.999 3 MHz
45.60 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 455.000 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 kHz
SWP 3.00 sec

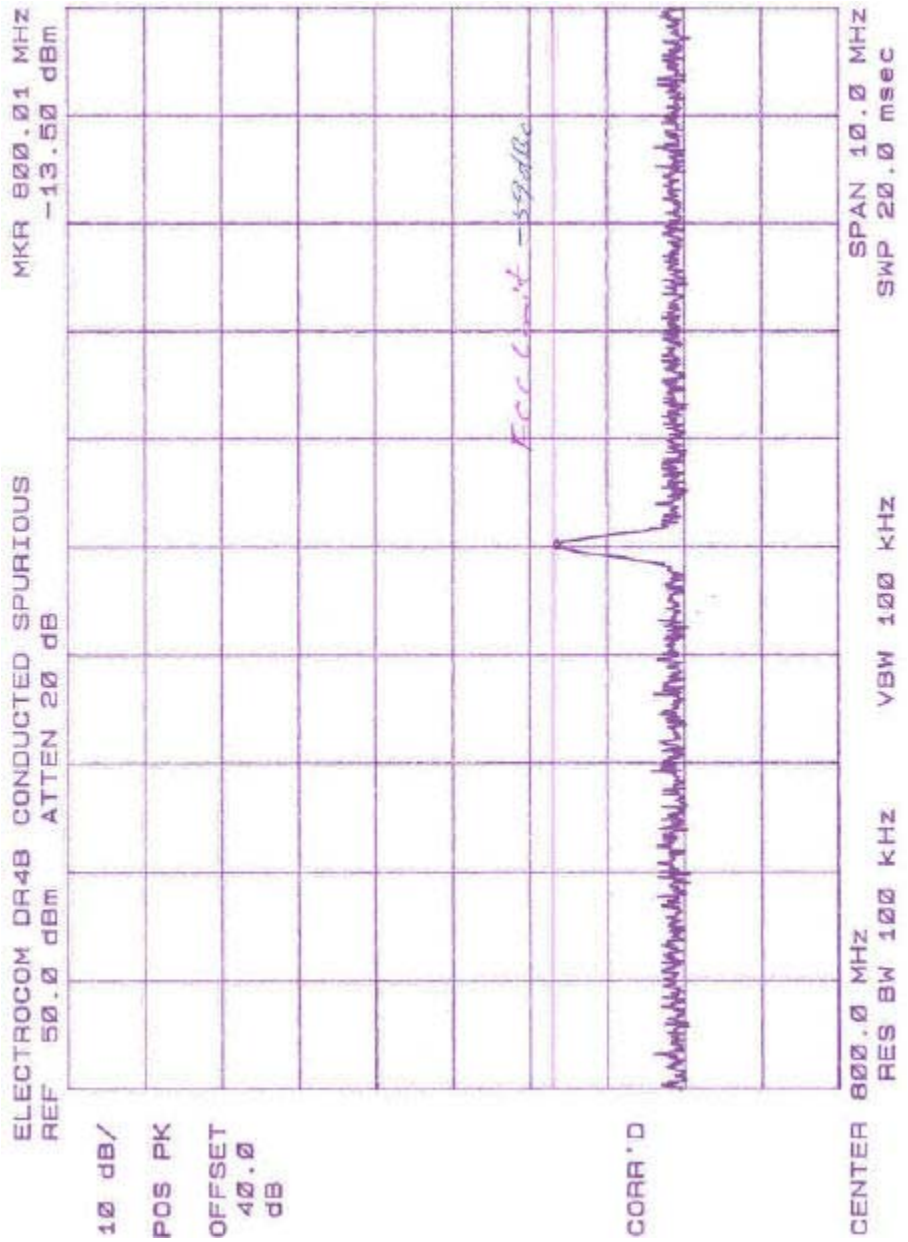

ELECTROCOM DR4B OCCUPIED BANDWIDTH
REF 50.0 dBm ATTEN 20 dB
MKR 454.999 2 MHz
45.50 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 455.000 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 200 kHz
SWP 6.00 sec

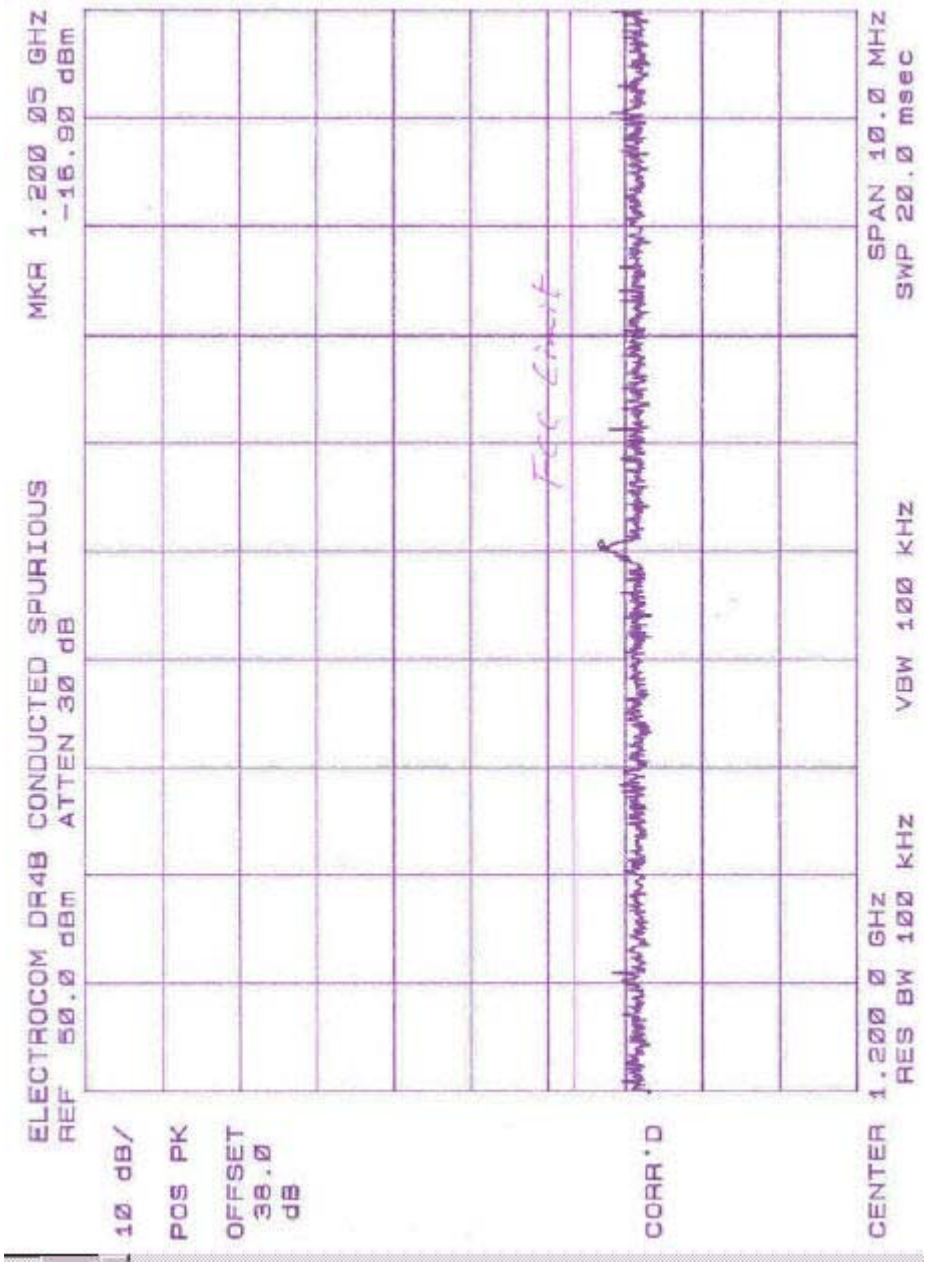

ELECTROCOM DR4B OCCUPIED BANDWIDTH
REF 50.0 dBm ATTEN 20 dB
MKR 511.999 40 MHz
46.00 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 512.000 0 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 50.0 kHz
SWP 1.50 sec

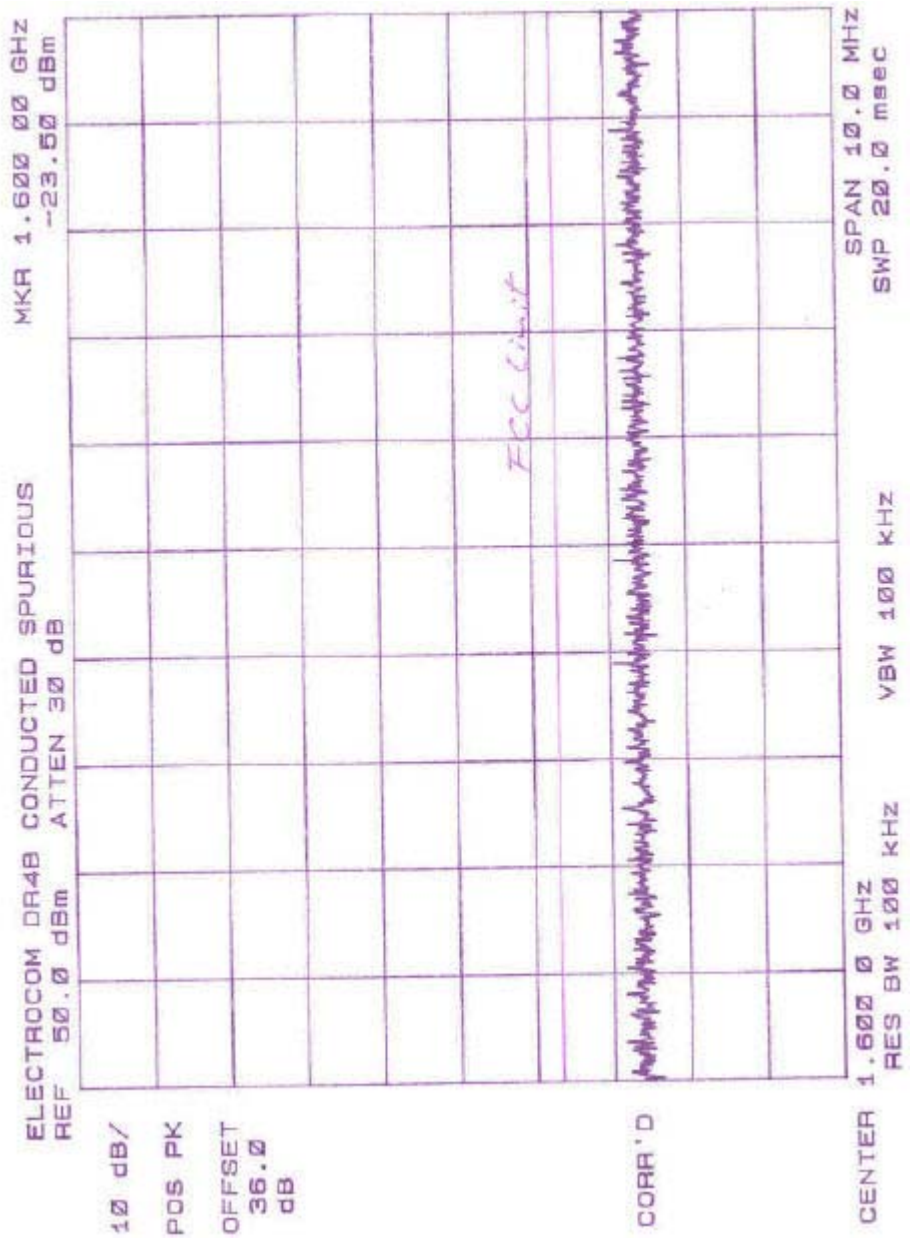

ELECTROCOM DR4B OCCUPIED BANDWIDTH
REF 50.0 dBm ATTEN 20 dB
MKR 511.999 4 MHz
46.00 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 512.000 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 kHz
SWP 3.03 sec

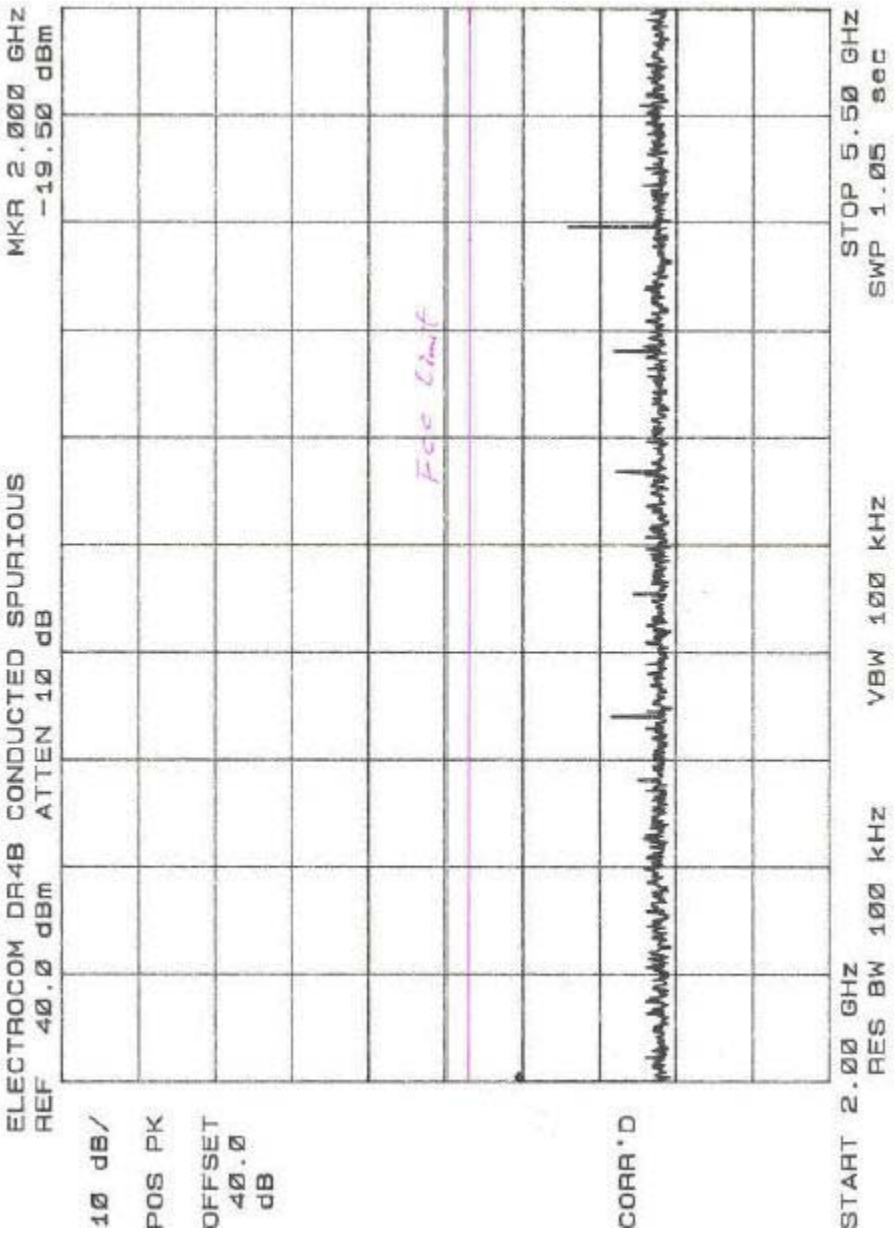

ELECTROCOM DR4B OCCUPIED BANDWIDTH
REF 50.0 dBm ATTEN 20 dB
MKR 511.999 4 MHz
46.00 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 512.000 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 200 kHz
SWP 6.00 sec

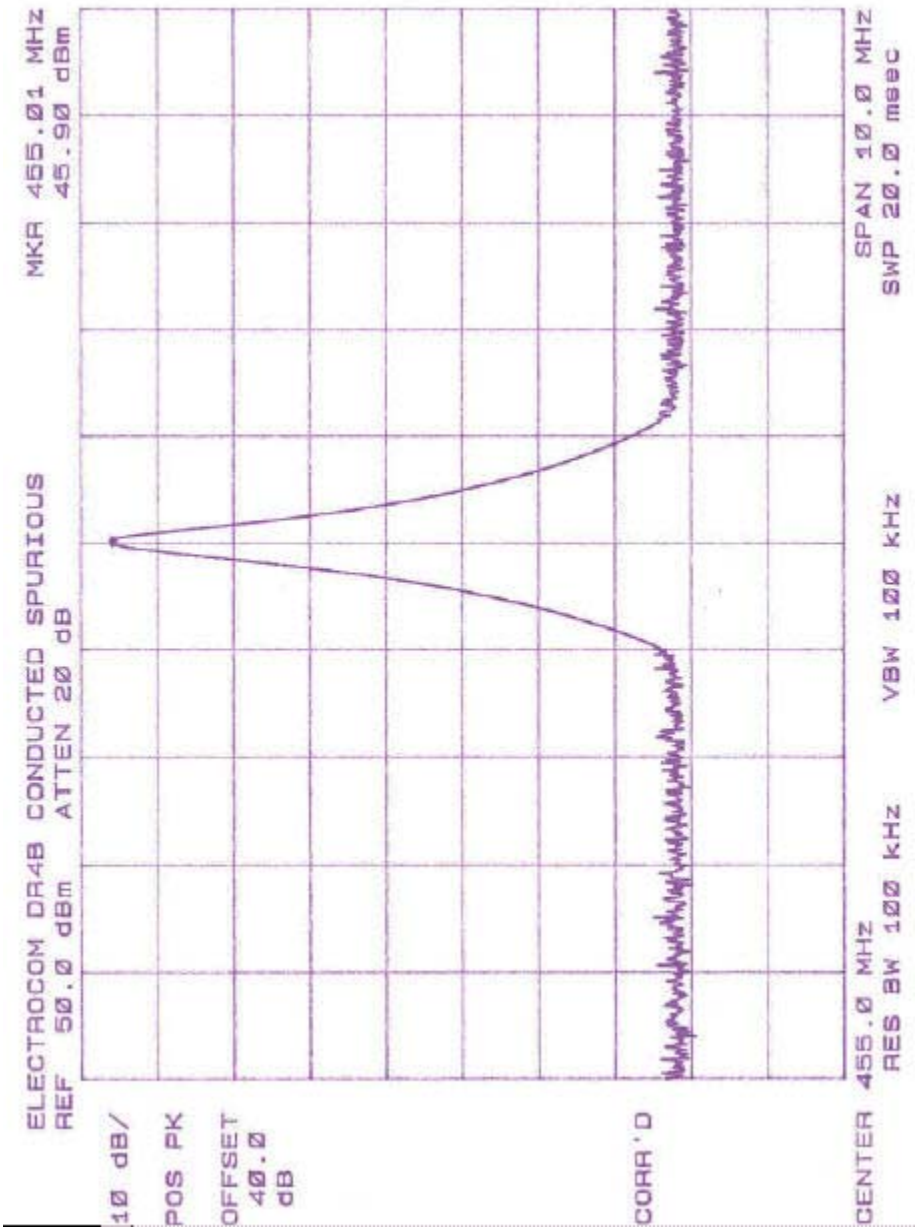

ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 20 dB
MKR 400.02 MHz
45.50 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 400.0 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec

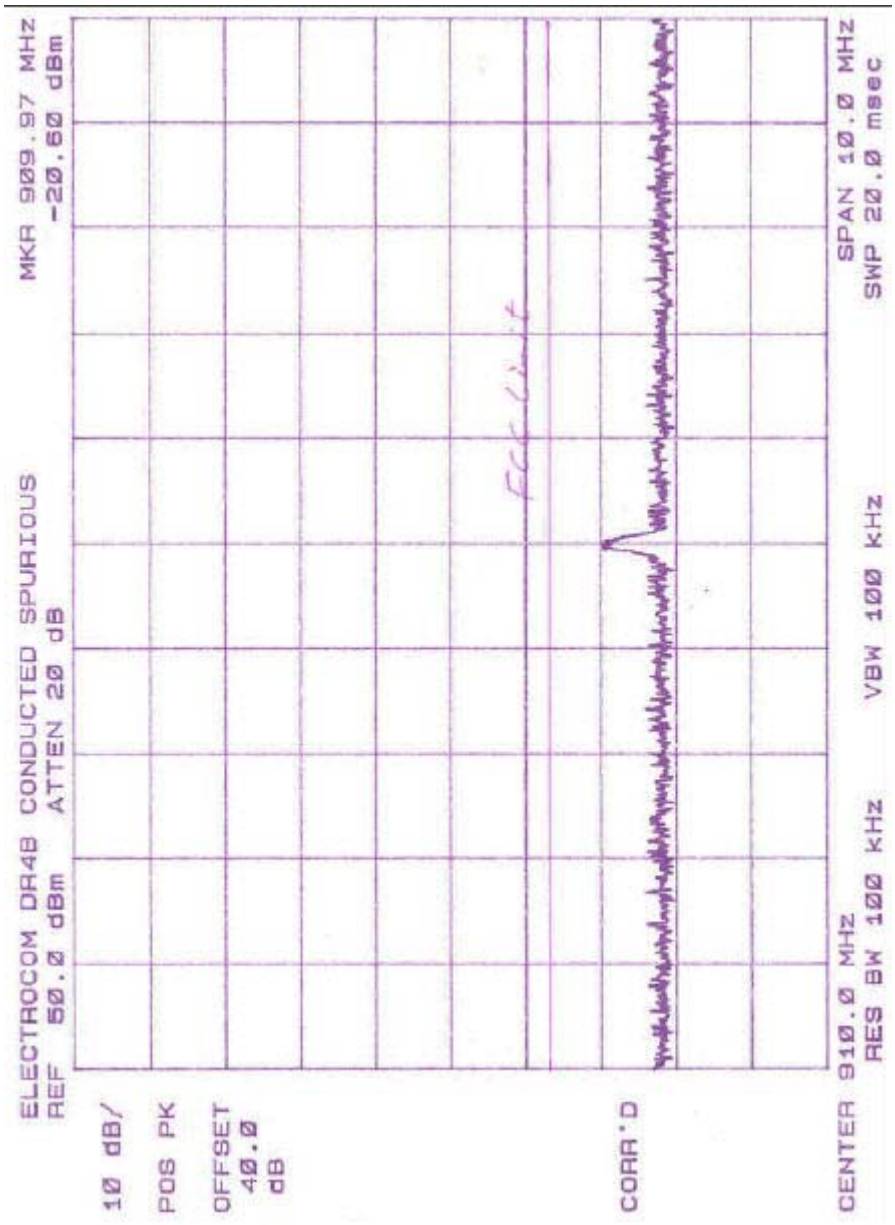

ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 20 dB
MKR 800.01 MHz
-13.50 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 800.0 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec

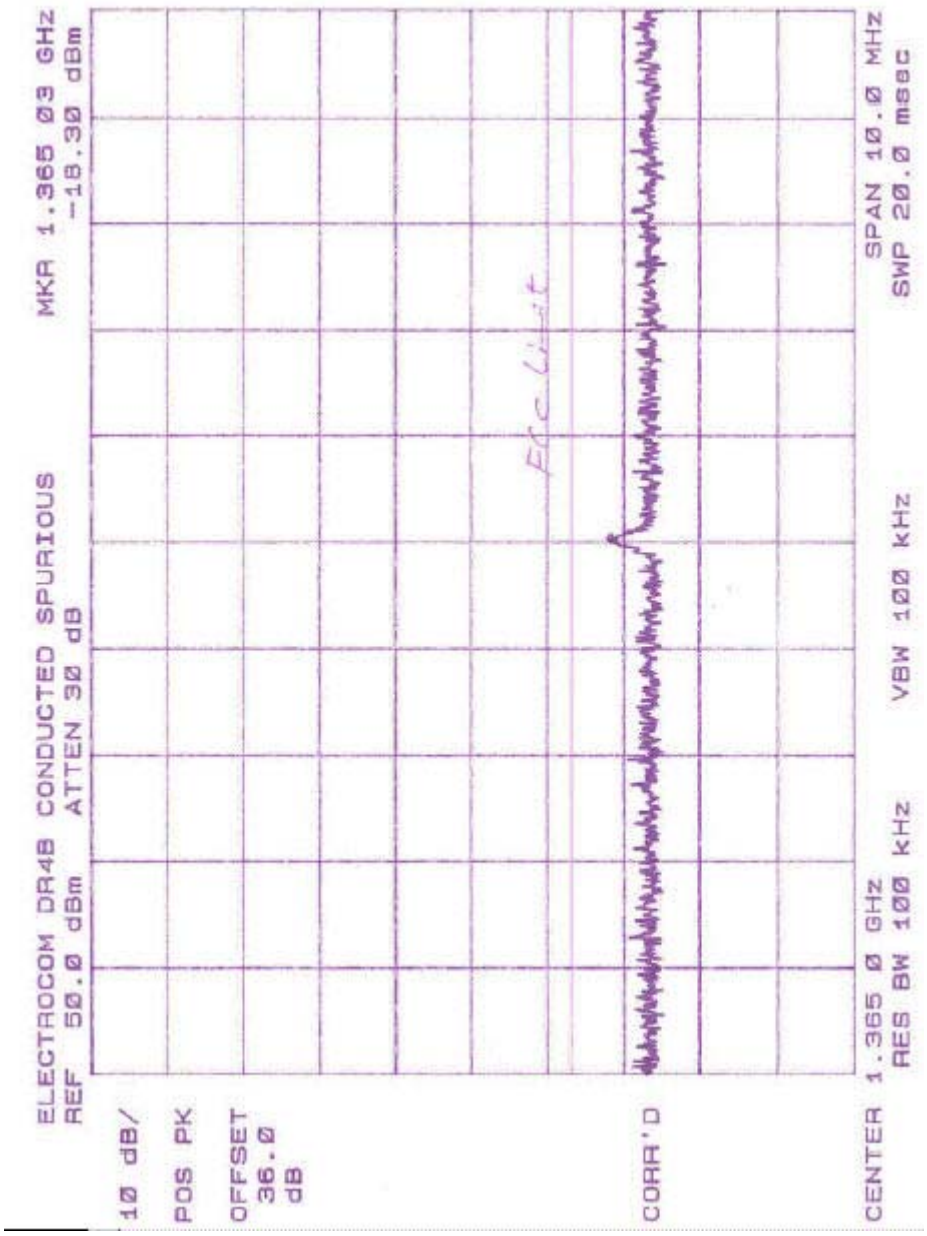

ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 30 dB
MKR 1.200 05 GHz
-16.90 dBm
10 dB/
POS PK
OFFSET
38.0
dB
CORR'D
FCC Limit
CENTER 1.200 0 GHz
RES BW 100 KHz
VBW 100 KHz
SPAN 10.0 MHz
SWP 20.0 msec

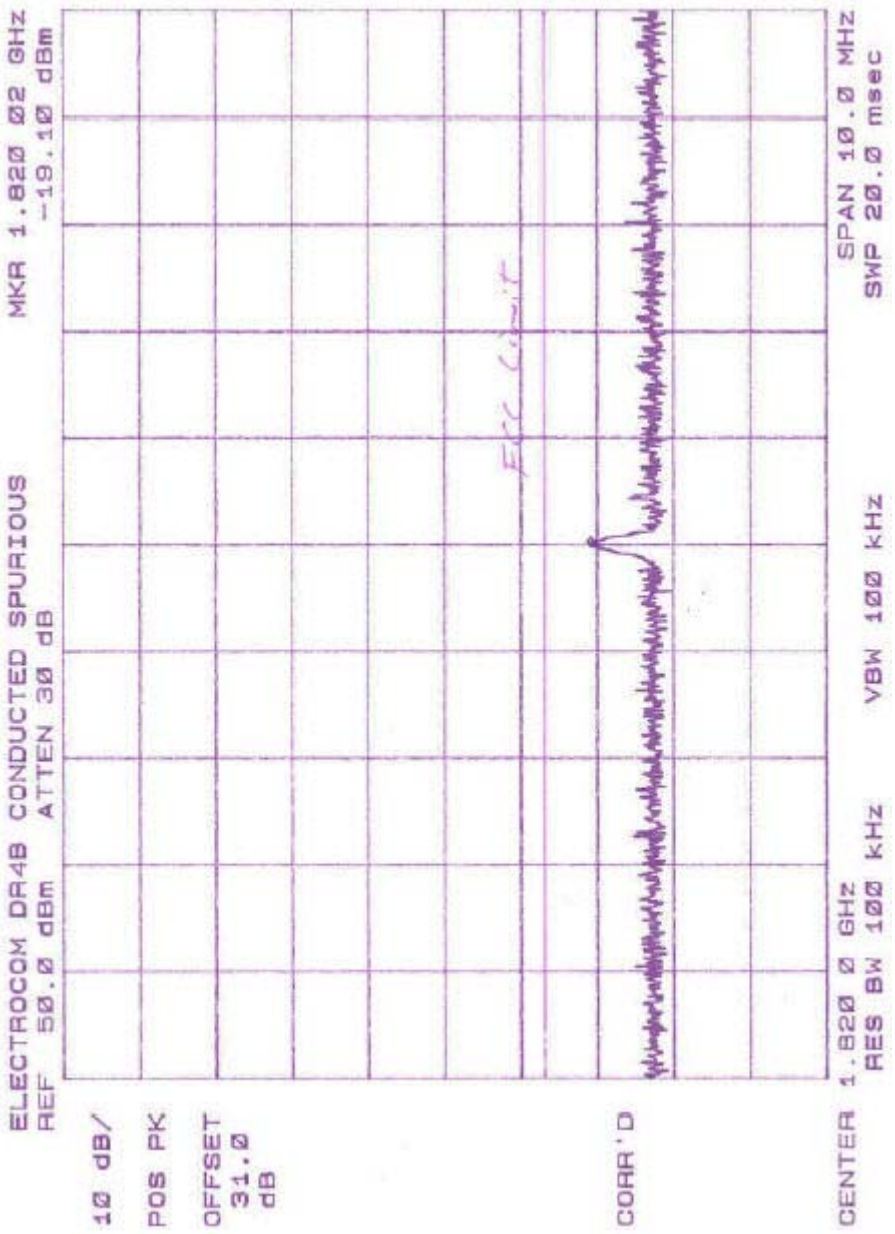

ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 30 dB
MKR 1.600 00 GHz
-23.50 dBm
10 dB/
POS PK
OFFSET
36.0
dB
FCC Limit
CORR'D
CENTER 1.600 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec

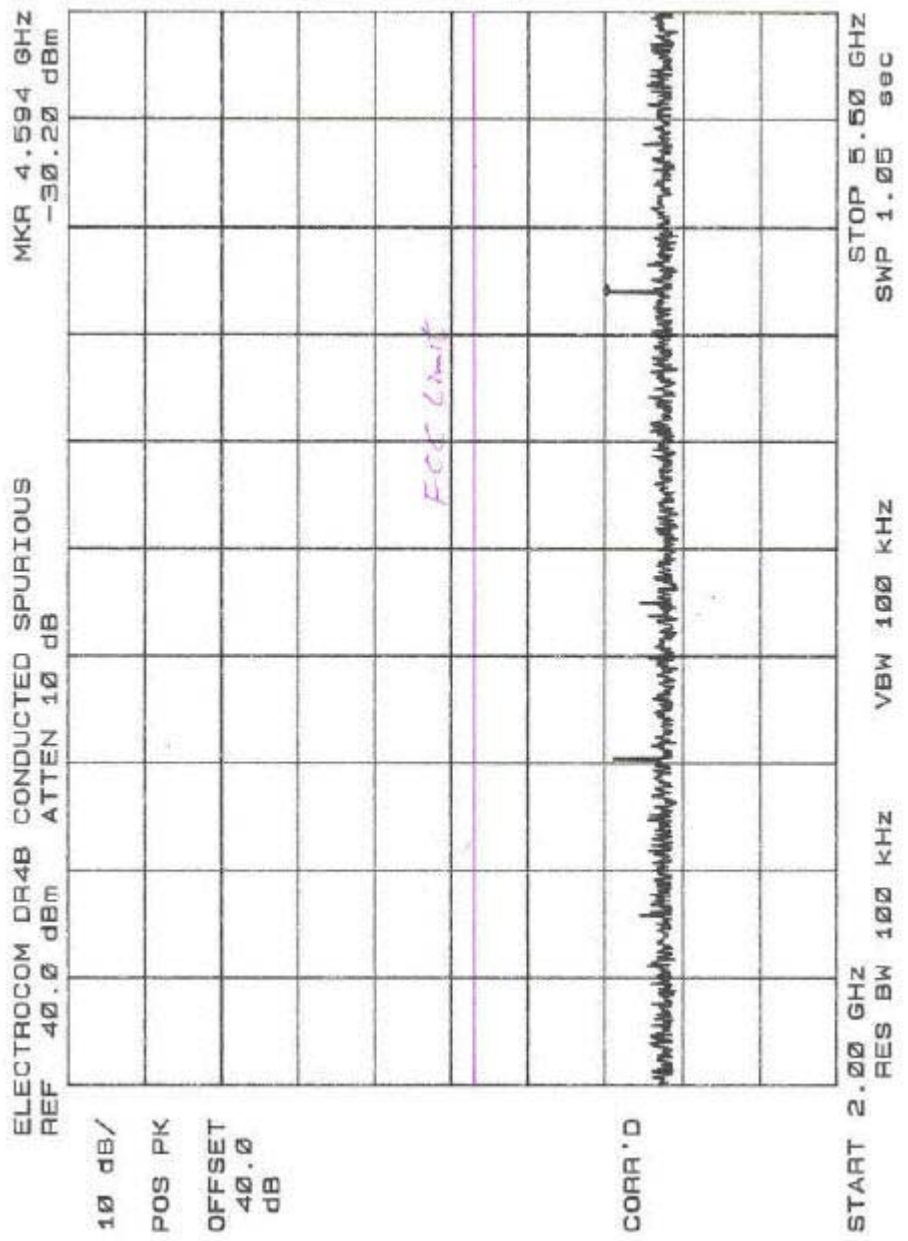

ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 40.0 dBm ATTEN 10 dB
MKR 2.000 GHz
-19.50 dBm
10 dB/
POS PK
OFFSET
40.0
dB
Fcc Limit
CORR'D
START 2.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 5.50 GHz
SWP 1.05 sec

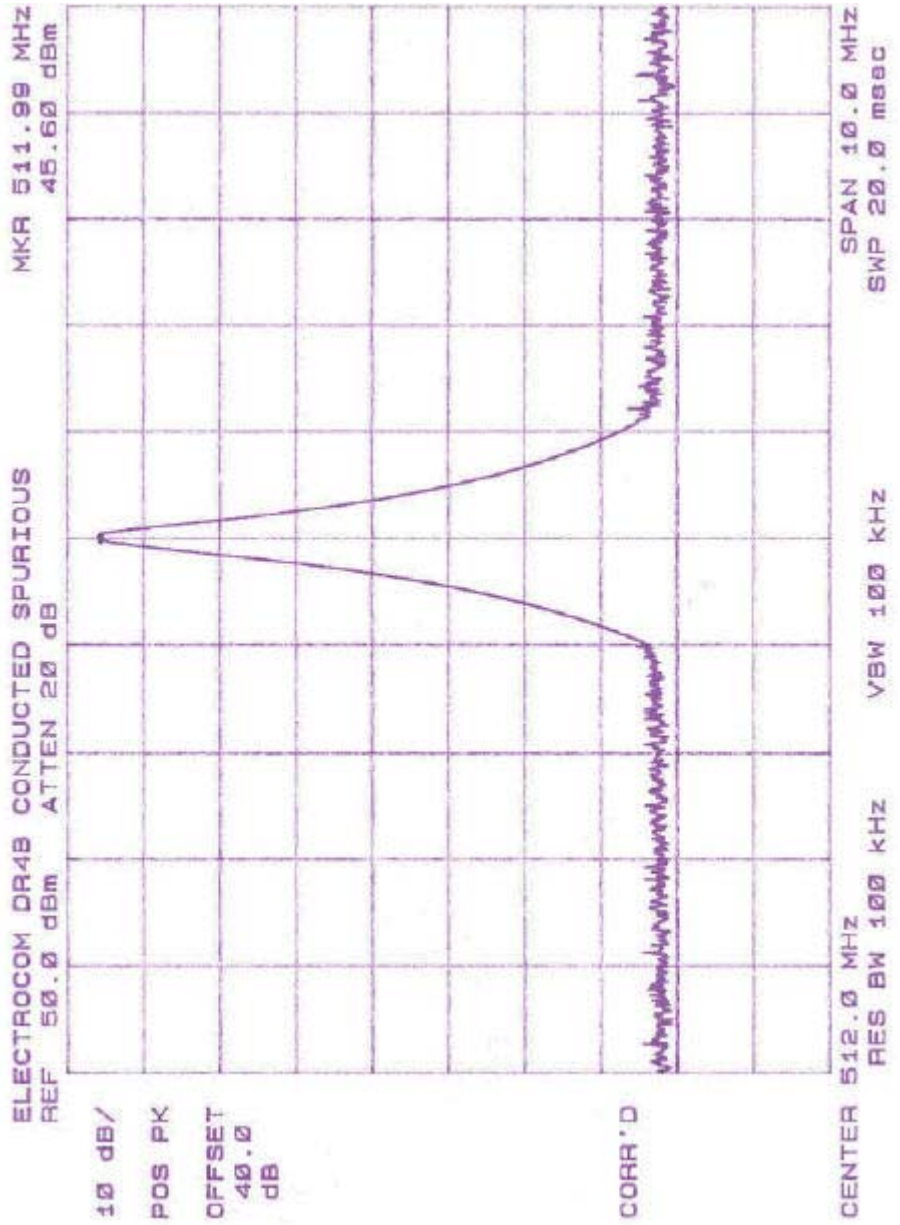

ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 20 dB
MKR 455.01 MHz
45.90 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 455.0 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec

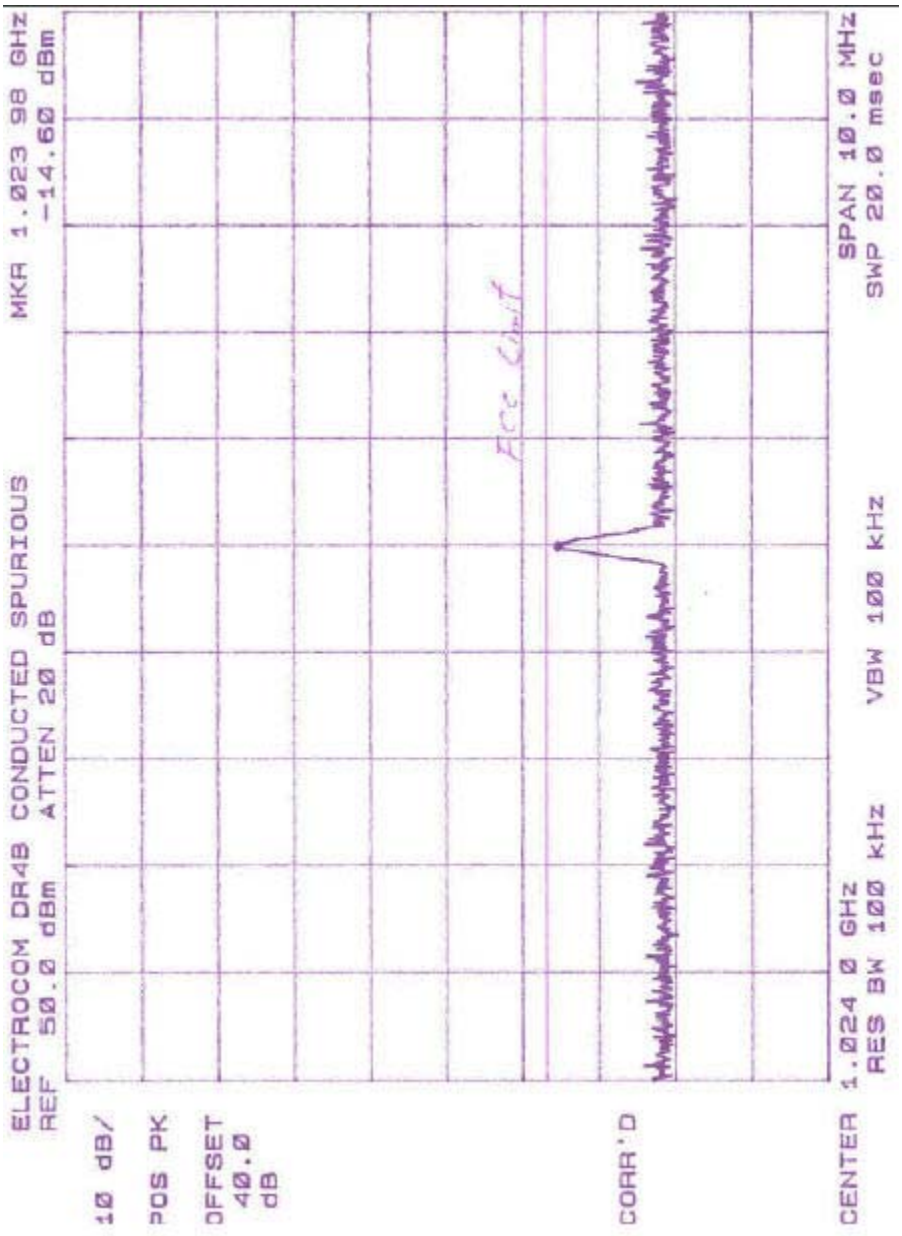

ELECTROCOM DR48 CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 20 dB
MKR 909.97 MHz
-20.60 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 910.0 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec

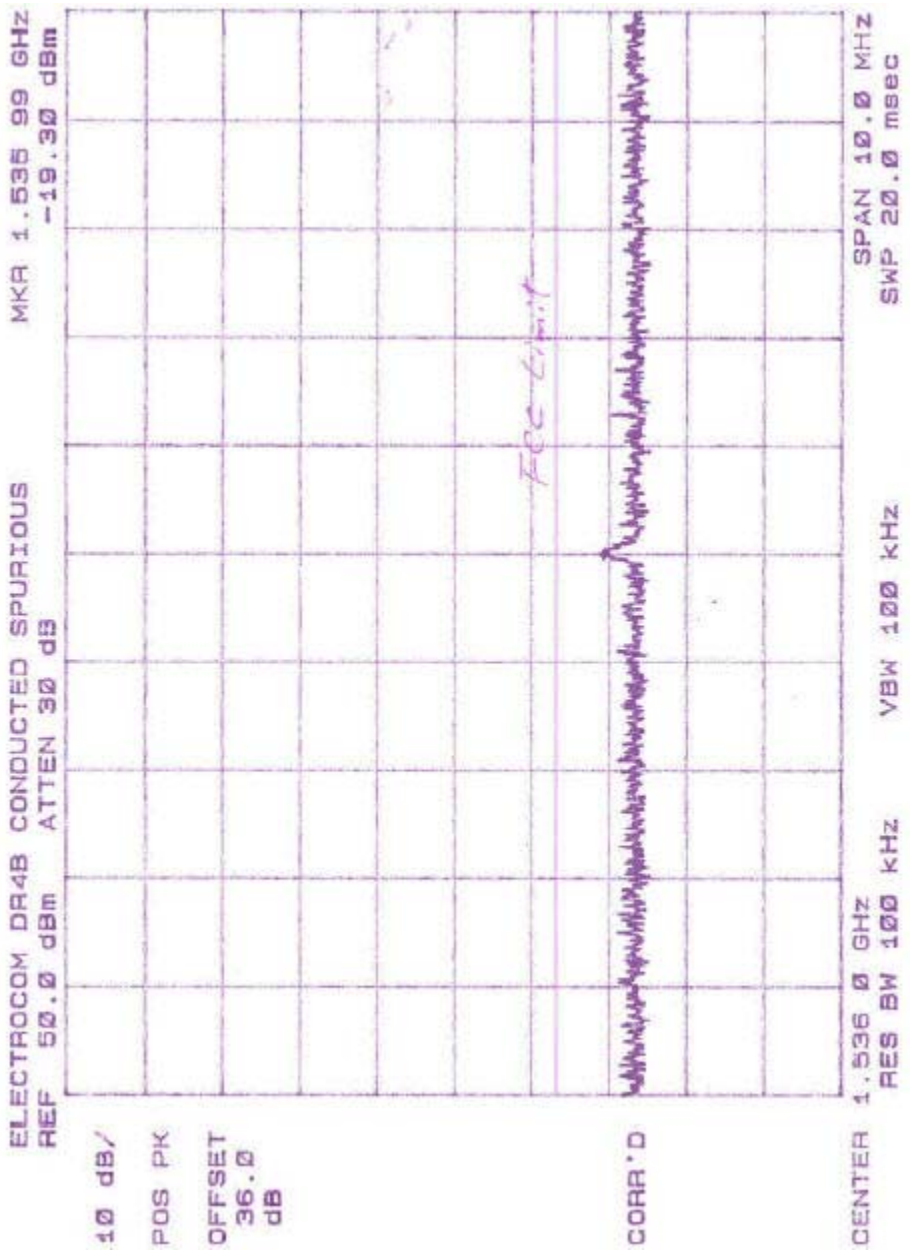

ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 30 dB
MKR 1.365 03 GHz
-18.30 dBm
10 dB/
POS PK
OFFSET
36.0
dB
CORR'D
Elect
CENTER 1.365 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec

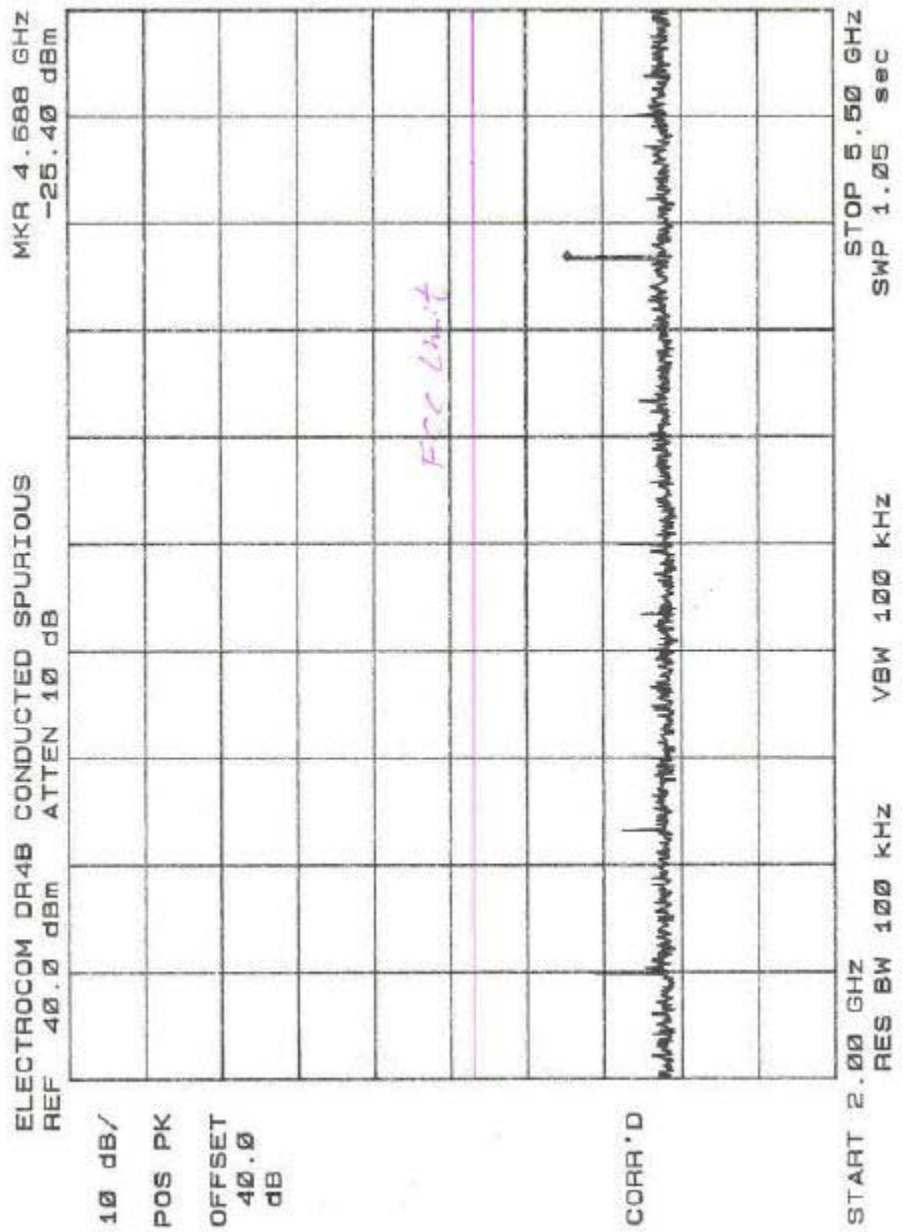

ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 30 dB
MKR 1.820 02 GHz
-19.10 dBm
10 dB/
POS PK
OFFSET
31.0
dB
CORR'D
CENTER 1.820 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec


ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 40.0 dBm ATTEN 10 dB
MKR 4.594 GHz
-30.20 dBm
10 dB/
POS PK
OFFSET
40.0
dB
FCC Limit
CORR'D
START 2.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 5.50 GHz
SWP 1.05 sec


ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 20 dB
MKR 511.99 MHz
45.60 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
CENTER 512.0 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec


ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 20 dB
MKR 1.023 98 GHz
-14.60 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
Ref Limit
CENTER 1.024 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec


ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 50.0 dBm ATTEN 30 dB
MKR 1.535 99 GHz
-19.30 dBm
10 dB/
POS PK
OFFSET
36.0
dB
CORR'D
CENTER 1.536 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 10.0 MHz
SWP 20.0 msec


ELECTROCOM DR4B CONDUCTED SPURIOUS
REF 40.0 dBm ATTEN 10 dB
MKR 4.688 GHz
-25.40 dBm
10 dB/
POS PK
OFFSET
40.0
dB
CORR'D
FCC Ltr.1
START 2.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 5.50 GHz
SWP 1.05 sec

Radiated Emissions Field Strength Measurement Data Sheet Date: 10/20/99

Antenna Polarization (V or H)	Frequency Tuned (MHz)	Frequency of Emission (MHz)	Spectrum Analyzer Reading (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp. Gain (dB)	Field Strength @ 3m (dBμV/m)	Field Strength below Carrier (dBμV/m)	FCC Limit @ 3m (dBμV/m)
V	400.0	800.0	53.1	23.1	4.0	34.7	45.5	–98.0	–59.0
H	400.0	800.0	56.9	23.1	4.0	34.7	49.3	–94.2	–59.0
V	400.0	1200.0	38.5	26.0	6.0	25.5	45.0	–98.5	–59.0
H	400.0	1200.0	36.6	26.0	6.0	25.5	43.1	–100.4	–59.0
V	400.0	1600.0	43.2	27.7	6.2	27.7	49.4	–94.1	–59.0
H	400.0	1600.0	39.6	27.7	6.2	27.7	45.8	–97.7	–59.0
V	400.0	2000.0	41.8	29.4	6.5	30.6	47.1	–96.4	–59.0
H	400.0	2000.0	40.7	29.4	6.5	30.6	46.0	–97.5	–59.0
V	400.0	2400.0	33.4	28.6	6.8	28.5	40.3	–103.2	–59.0
H	400.0	2400.0	34.8	28.6	6.8	28.5	41.7	–101.8	–59.0
V	400.0	2800.0	38.8	30.0	7.2	27.5	48.5	–95.0	–59.0
H	400.0	2800.0	39.7	30.0	7.2	27.5	49.4	–94.1	–59.0
V	400.0	3200.0	36.6	31.8	7.8	26.4	49.8	–93.7	–59.0
H	400.0	3200.0	37.5	31.8	7.8	26.4	50.7	–92.8	–59.0
V	400.0	3600.0	*						
H	400.0	3600.0	*						
V	400.0	4000.0	*						
H	400.0	4000.0	*						

* No detectable signal

Radiated Emissions Field Strength Measurement Data Sheet Date: 10/20/99

Antenna Polarization (V or H)	Frequency Tuned (MHz)	Frequency of Emission (MHz)	Spectrum Analyzer Reading (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp. Gain (dB)	Field Strength @ 3m (dBμV/m)	Field Strength below Carrier (dBμV/m)	FCC Limit @ 3m (dBμV/m)
V	455.0	910.0	56.4	23.0	4.6	35.0	49.0	–94.5	–59.0
H	455.0	910.0	62.2	23.0	4.6	35.0	54.8	–88.7	–59.0
V	455.0	1365.0	42.4	27.0	6.1	27.0	48.5	–95.0	–59.0
H	455.0	1365.0	40.4	27.0	6.1	27.0	46.5	–97.0	–59.0
V	455.0	1820.0	39.7	28.1	6.3	27.8	46.3	–97.2	–59.0
H	455.0	1820.0	41.0	28.1	6.3	27.8	47.6	–95.9	–59.0
V	455.0	2275.0	45.3	28.0	6.5	27.5	52.3	–91.2	–59.0
H	455.0	2275.0	42.5	28.0	6.5	27.5	49.5	–94.0	–59.0
V	455.0	2730.0	39.5	30.0	7.0	27.5	49.0	–94.5	–59.0
H	455.0	2730.0	38.6	30.0	7.0	27.5	48.1	–95.4	–59.0
V	455.0	3180.0	34.3	31.5	7.8	26.5	47.1	–96.4	–59.0
H	455.0	3180.0	35.4	31.5	7.8	26.5	48.2	–95.3	–59.0
V	455.0	3640.0	*						
H	455.0	3640.0	*						
V	455.0	4095.0	*						
H	455.0	4095.0	*						
V	455.0	4550.0	*						
H	455.0	4550.0	*						

* No detectable signal

Radiated Emissions Field Strength Measurement Data Sheet Date: 10/20/99

Antenna Polarization (V or H)	Frequency Tuned (MHz)	Frequency of Emission (MHz)	Spectrum Analyzer Reading (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp. Gain (dB)	Field Strength @ 3m (dBμV/m)	Field Strength below Carrier (dBμV/m)	FCC Limit @ 3m (dBμV/m)
V	512.0	1024.0	46.8	24.0	5.0	22.0	53.8	–89.7	–59.0
H	512.0	1024.0	48.4	24.0	5.0	22.0	55.4	–88.1	–59.0
V	512.0	1536.0	40.4	27.7	6.2	27.5	46.8	–96.7	–59.0
H	512.0	1536.0	39.2	27.7	6.2	27.5	45.6	–97.9	–59.0
V	512.0	2048.0	38.6	29.5	6.5	30.0	44.6	–98.9	–59.0
H	512.0	2048.0	36.4	29.5	6.5	30.0	42.4	–101.1	–59.0
V	512.0	2560.0	50.1	28.8	6.8	28.5	57.2	–86.3	–59.0
H	512.0	2560.0	48.3	28.8	6.8	28.5	55.4	–88.1	–59.0
V	512.0	3072.0	38.2	31.0	7.5	27.0	49.7	–93.8	–59.0
H	512.0	3072.0	36.8	31.0	7.5	27.0	48.3	–95.2	–59.0
V	512.0	3584.0	34.5	30.8	8.4	26.5	47.2	–96.3	–59.0
H	512.0	3584.0	34.2	30.8	8.4	26.5	46.9	–96.6	–59.0
V	512.0	4096.0	*						
H	512.0	4096.0	*						
V	512.0	4608.0	*						
H	512.0	4608.0	*						
V	512.0	5120.0	*						
H	512.0	5120.0	*						

* No detectable signal

Frequency Stability Measurement (Reference: FCC Part 2, Subpart J, §2.995)

Frequency Tuned: 400.0MHz Date: 07/22/99

Temperature (°C)	DC Power Supply Voltage						**FCC Limit** (2.5ppm)
	–15% Nominal Voltage (11.73V)		Nominal Voltage (13.80V)		+15% Nominal Voltage (15.87V)		
	Frequency (MHz)	Output (dBm)	Frequency (MHz)	Output (dBm)	Frequency (MHz)	Output (dBm)	Δf=0.001000MHz 0.000266
+24°C (Room Temp.)	399.999728	43.5	399.999734	45.4	399.999730	45.9	0.000436
–30°C	399.999574	43.2	399.999614	46.0	399.999655	47.0	0.000358
–20°C	399.999642	42.8	399.999676	45.6	399.999696	47.0	0.000378
–10°C	399.999722	42.4	399.999732	45.1	399.999744	46.8	0.000362
+ 0°C	399.999738	41.7	399.999761	44.6	399.999773	46.2	0.000262
+10°C	399.999769	41.3	399.999764	44.5	399.999738	46.0	0.000292
+20°C	399.999755	41.4	399.999738	44.3	399.999708	45.9	0.000296
+30°C	399.999774	42.1	399.999748	44.6	399.999704	46.0	0.000337
+40°C	399.999663	41.6	399.999684	44.2	399.999710	45.6	0.000402
+50°C	399.999650	41.4	399.999627	44.4	399.999598	45.8	Δf=0.001000MHz

Frequency Stability Measurement (Reference: FCC Part 2, Subpart J, §2.995)

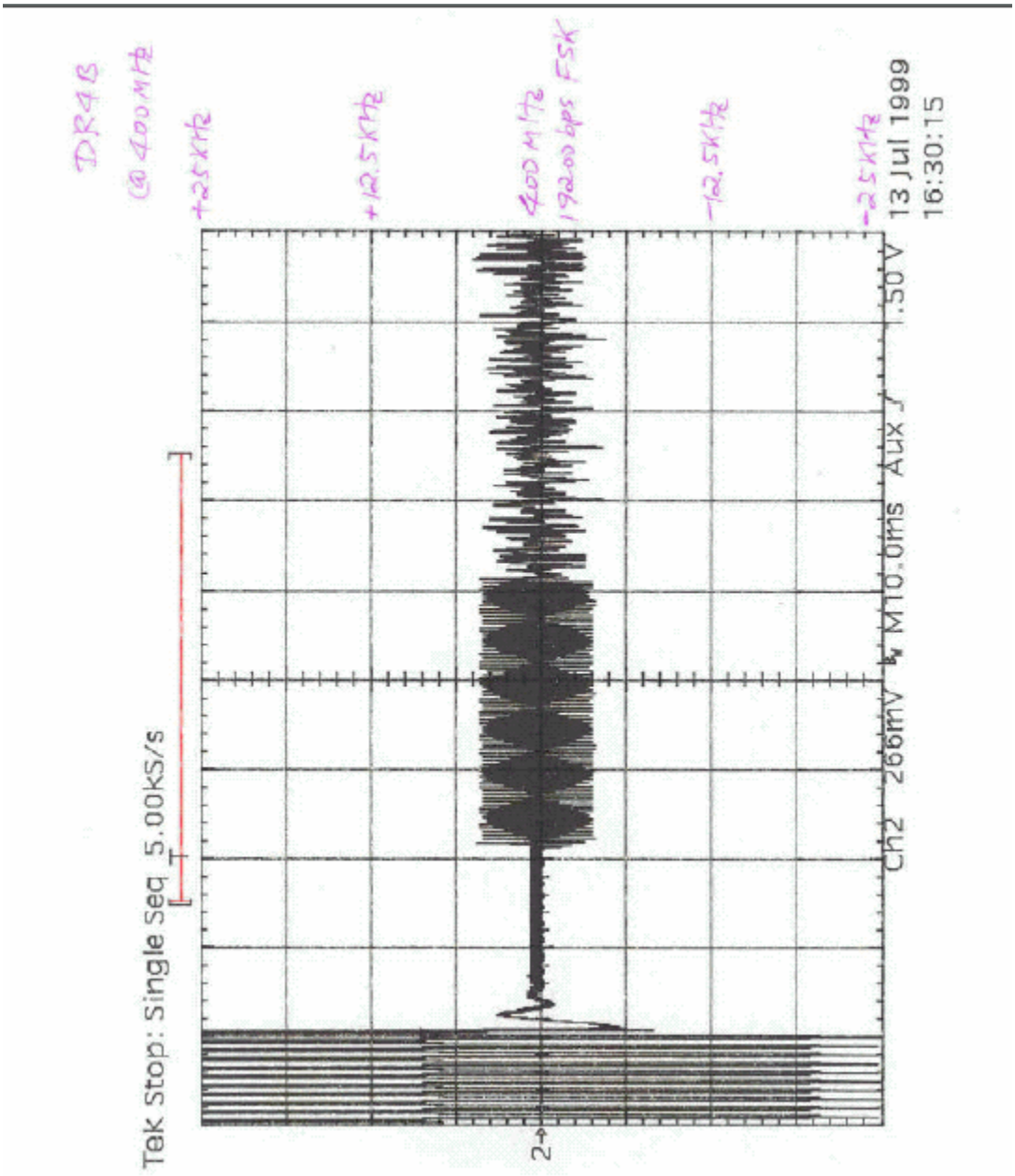
Frequency Tuned: 455.0MHz Date: 07/22/99

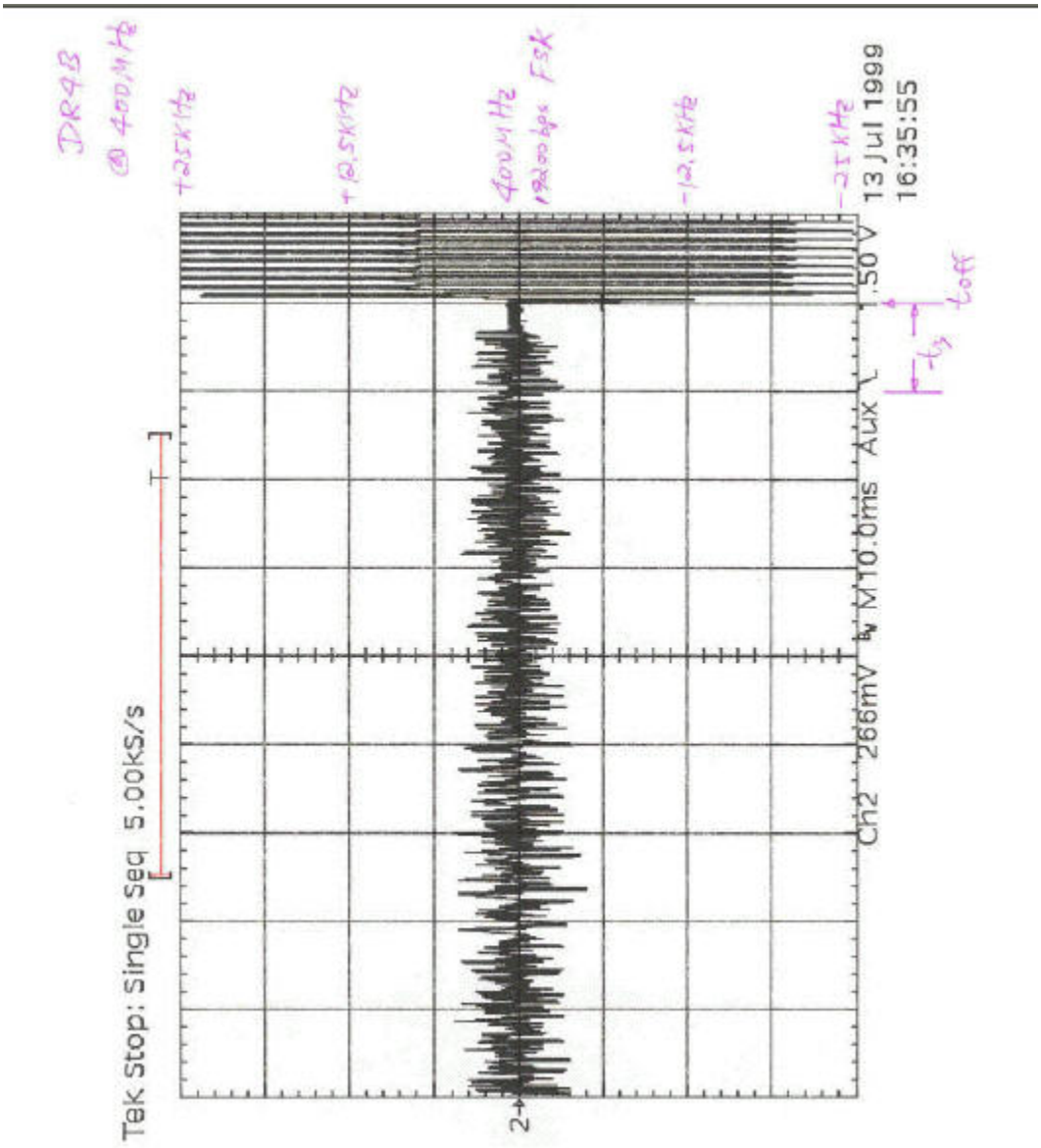
Temperature (°C)	DC Power Supply Voltage						**FCC Limit** (2.5ppm)
	–15% Nominal Voltage (11.73V)		Nominal Voltage (13.80V)		+15% Nominal Voltage (15.87V)		
	Frequency (MHz)	Output (dBm)	Frequency (MHz)	Output (dBm)	Frequency (MHz)	Output (dBm)	Δf=0.001137MHz 0.000065
+24°C (Room Temp.)	454.999955	44.2	454.999970	46.0	454.999935	46.5	0.000184
–30°C	454.999832	44.0	454.999875	46.1	454.999816	47.2	0.000098
–20°C	454.999946	44.3	454.999918	45.9	454.999912	47.2	0.000065
–10°C	455.000062	44.0	455.000063	45.8	455.000065	47.0	0.000070
+ 0°C	455.000070	43.8	455.000065	45.6	455.000060	46.8	0.000038
+10°C	455.000026	43.7	455.000034	45.5	455.000038	46.8	0.000078
+20°C	454.999922	43.5	454.999964	45.2	454.999985	46.4	0.000198
+30°C	454.999892	43.0	454.999857	44.9	454.999802	46.4	0.000288
+40°C	454.999780	42.8	454.999740	44.8	454.999712	46.2	0.000332
+50°C	454.999668	42.8	454.999693	44.4	454.999686	45.7	Δf=0.001137MHz

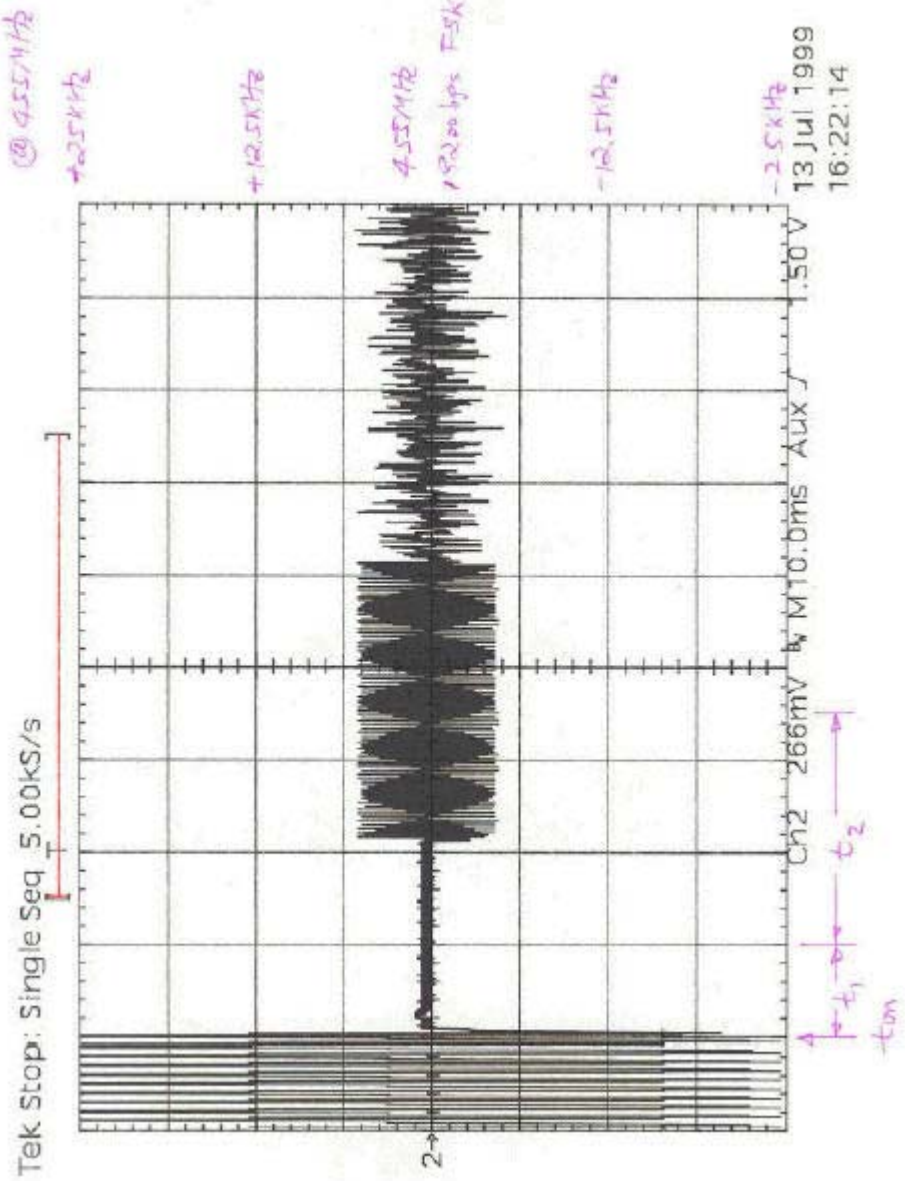
Frequency Stability Measurement (Reference: FCC Part 2, Subpart J, §2.995)

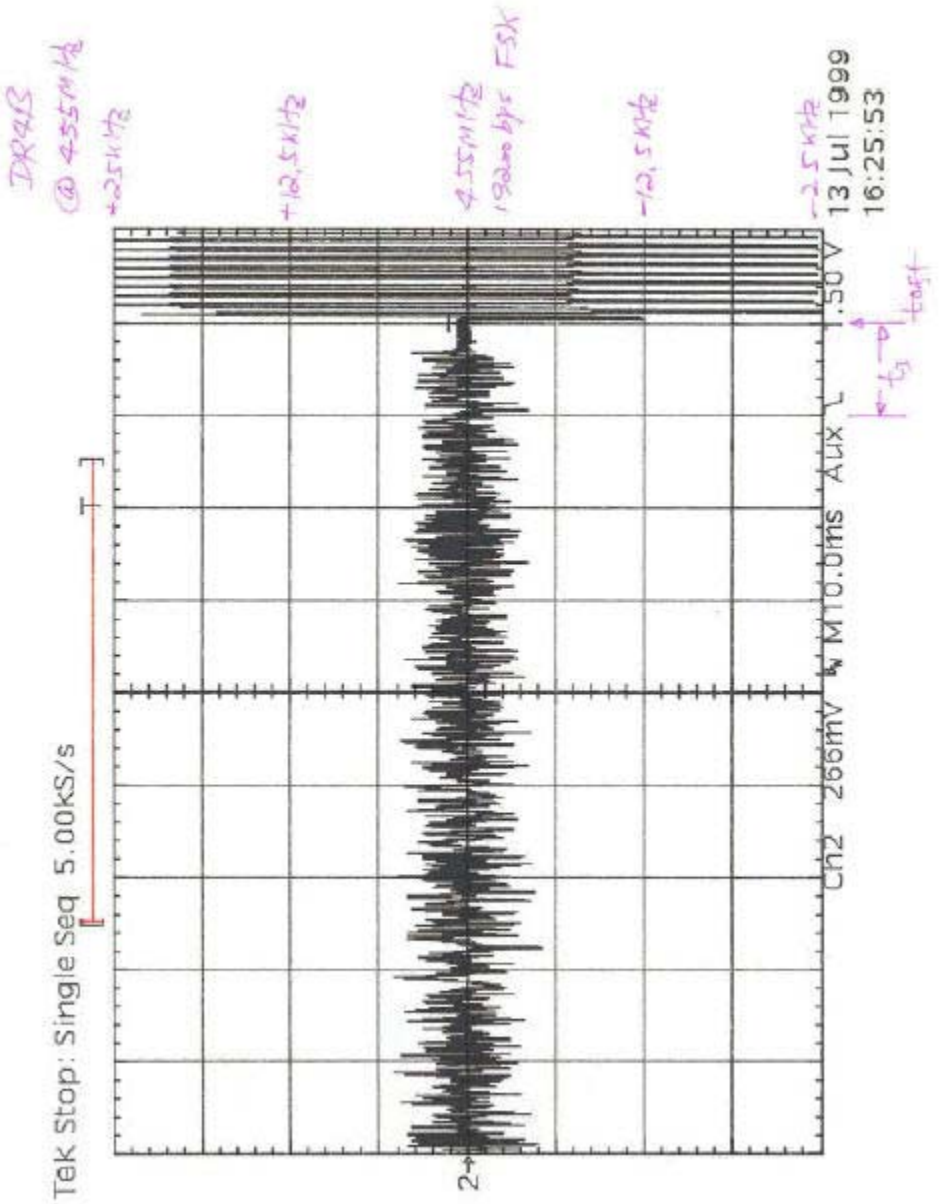
Frequency Tuned: 512.0MHz Date: 07/22/99

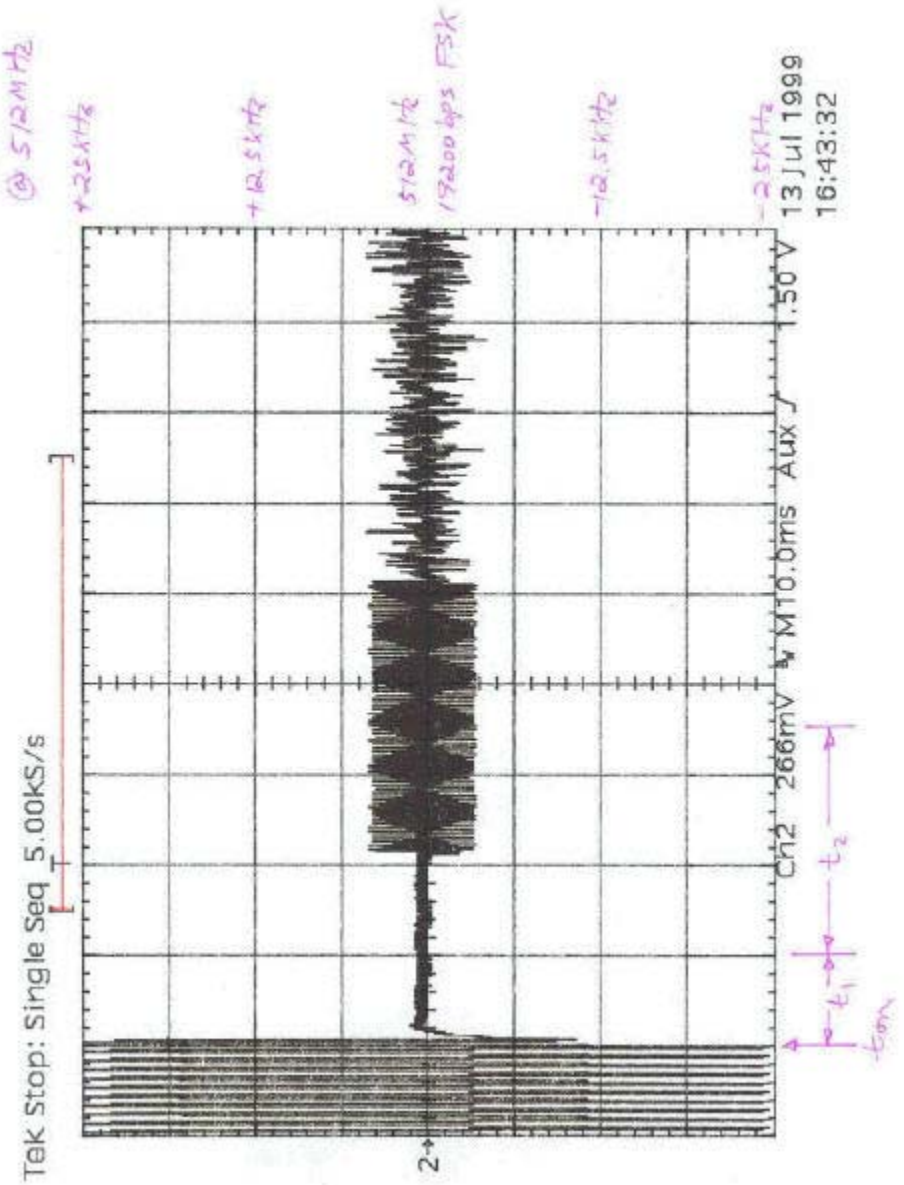
Temperature (°C)	DC Power Supply Voltage						**FCC Limit** (2.5ppm)
	–15% Nominal Voltage (11.73V)		Nominal Voltage (13.80V)		+15% Nominal Voltage (15.87V)		
	Frequency (MHz)	Output (dBm)	Frequency (MHz)	Output (dBm)	Frequency (MHz)	Output (dBm)	Δf=0.001280MHz 0.000568
+24°C (Room Temp.)	511.999432	43.5	511.999484	46.0	511.999515	47.3	0.000568
–30°C	511.999285	44.8	511.999320	46.5	511.999225	47.6	0.000775
–20°C	511.999310	44.6	511.999348	46.3	511.999402	47.6	0.000690
–10°C	511.999404	44.7	511.999382	46.3	511.999361	47.5	0.000639
+ 0°C	511.999458	44.5	511.999454	46.2	511.999460	47.2	0.000546
+10°C	511.999422	44.2	511.999444	45.9	511.999458	47.2	0.000578
+20°C	511.999386	44.0	511.999418	45.8	511.999442	47.0	0.000614
+30°C	511.999450	43.6	511.999492	45.6	511.999516	46.9	0.000550
+40°C	511.999395	43.5	511.999456	45.4	511.999514	46.6	0.000605
+50°C	511.999382	43.0	511.999438	44.6	511.999477	46.3	0.000618

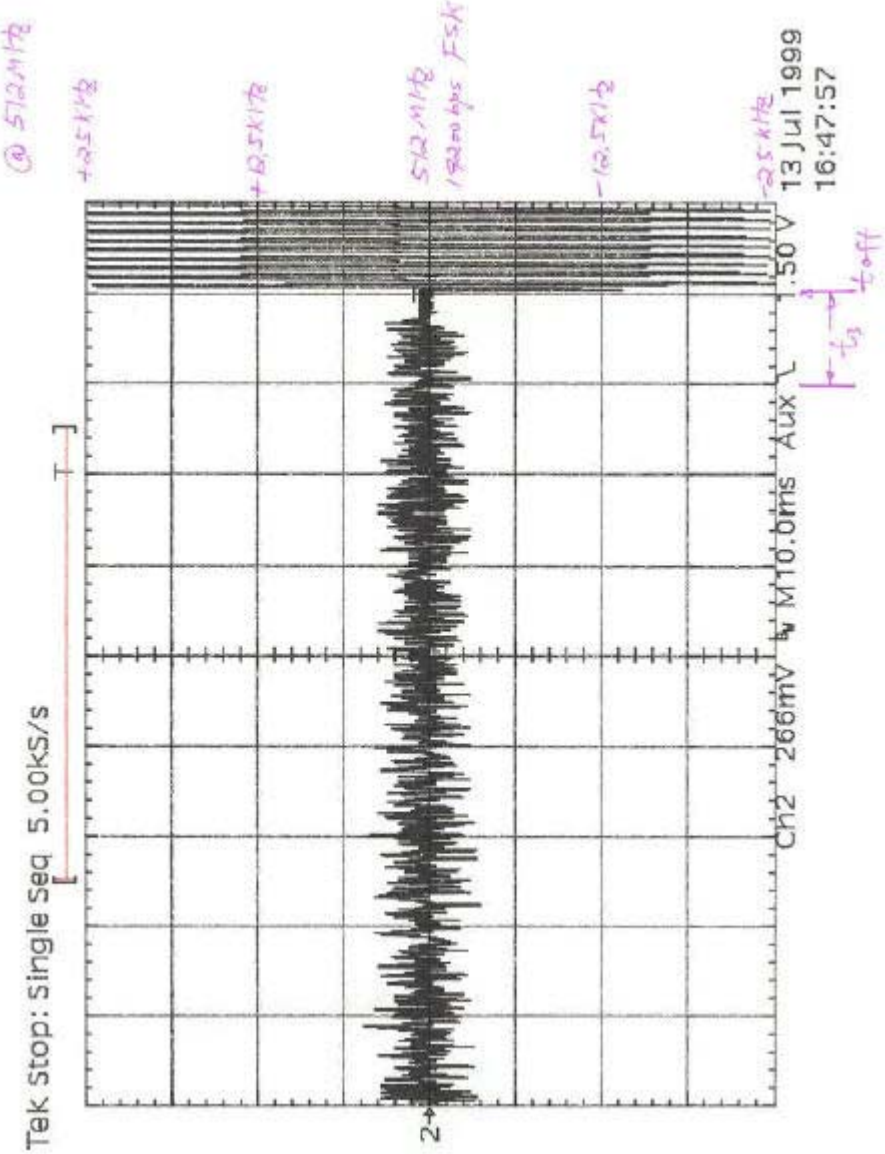

DR4S
@ 400 MHz
+25 KHz
+12.5 KHz
400 MHz
19200 bps FSK
-12.5 KHz
-25 KHz
13 Jul 1999
16:30:15
Ch2 266mV M10.0ms Aux 1.50 V
Tek Stop: Single Seq 5.00kS/s


DR93
@ 400.1 kHz
+25 kHz
+10.5 kHz
400.1 kHz
192.00 kbps FSK
-10.5 kHz
-25 kHz
13 Jul 1999
16:35:55
Ch2 266mV M10.0ms Aux 1.50 V
Tek Stop: Single Seq 5.00kS/s

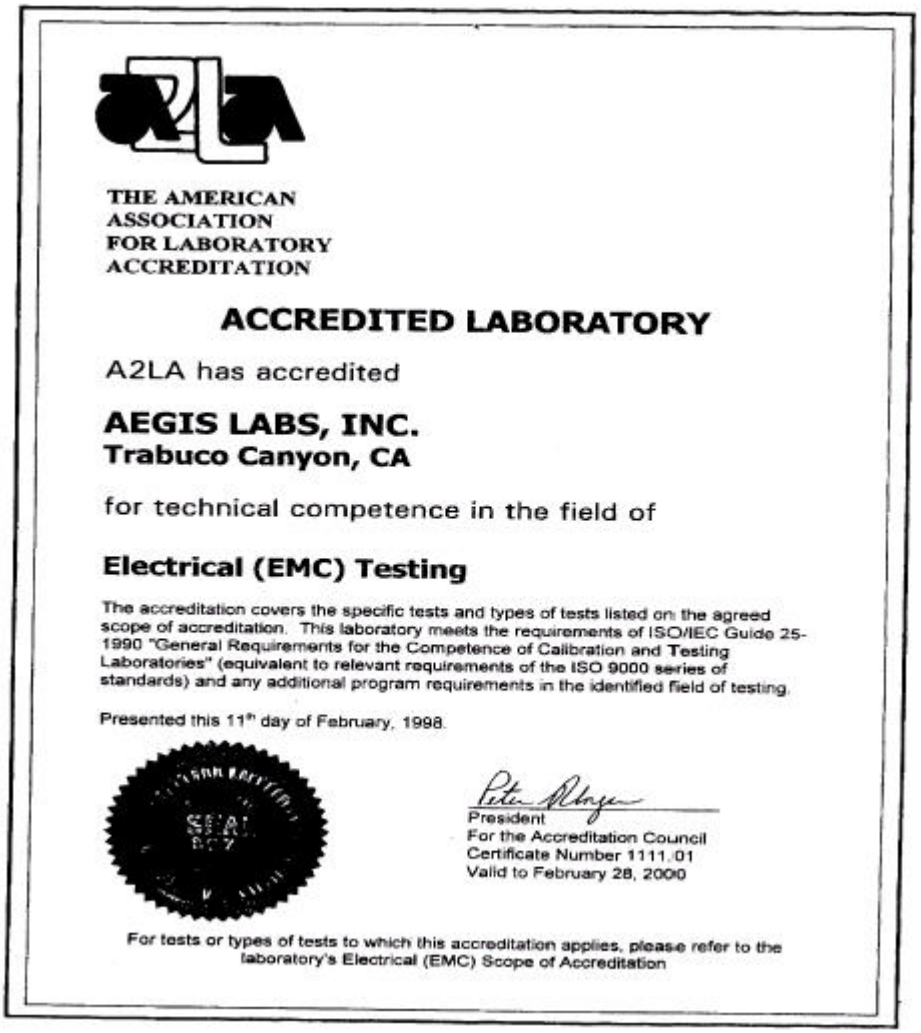

DR413
@ 455kHz
+25kHz
+12.5kHz
455kHz
12.8kbps FSK
-12.5kHz
-25kHz
13 Jul 1999
16:22:14
Tek Stop: Single Seq 5.00kS/s
Ch2 266mV M10.0ms Aux 1.50V
t1
t2
tm


DRAS
@ 455kHz
+2.5kHz
+12.5kHz
455kHz
1200 bps FSK
-12.5 kHz
-2.5kHz
13 Jul 1999
16:25:53
Ch2 266mV M10.0ms Aux
50 V
Tek Stop: Single Seq 5.00kS/s


DR4B
@ 512MHz
+25kHz
+12.5kHz
512MHz
19200 bps FSK
-12.5kHz
-25kHz
13 Jul 1999
16:43:32
1.50 V
Ch2 266mV M10.0ms Aux
Tek Stop: Single Seq 5.00kS/s
2
t_1
t_2
t_{on}


DR43
@ 512.4Hz
+25kHz
+12.5kHz
512.4Hz
1200 bps FSK
-12.5kHz
-25kHz
13 Jul 1999
16:47:57
Ch2 266mV M10.0ms Aux 1.50 V
Tek Stop: Single Seq 5.00kS/s

APPENDIX C – ACCREDITATION CERTIFICATE



THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

AEGIS LABS, INC.
Trabuco Canyon, CA

for technical competence in the field of

Electrical (EMC) Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

Presented this 11th day of February, 1998.

President
For the Accreditation Council
Certificate Number 1111.01
Valid to February 28, 2000

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC GUIDE 25-1990

AEGIS LABS, INC.
32231 Trabuco Creek Road
Trabuco Canyon, CA 92678
Steve Kuiper Phone: 714 459 7886

ELECTRICAL (EMC)

Valid to: February 28, 2000 Certificate Number: 1111-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Conducted Emissions

Radiated Emissions

Electrostatic Discharge (ESD)

Electrical Fast Transient/Burst

Surge

On materials and products related to the following:

Information Technology Equipment (ITE)

Using the following standards:

Code of Federal Regulations (CFR) 47, FCC Method Parts 15 and 18 (Class A & B) using ANSI C63.4 - 1992: Methods of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

AS/NZS 3548-1991: Emissions Standard for Residential, Commercial and Light Industry Environment of Information Technology Equipment

EN: 50082-1, 55011 (Class A), 55016, 55022 (Class A & B)

IEC 1000-4-2 - 95: Electrostatic Discharge Immunity Test

IEC 1000-4-4 - 95: Electrical Fast Transient/Burst Immunity Test

IEC 1000-4-5 - 95: Surge Immunity Test

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