Application for Certification
For an RF Power Amplifier

ElectroCom Systems
11909 E. Telegraph Rd.
Santa Fe Springs, CA 90670-3728

RF Amplifier:

Model # HPA8

FCC ID: MI7-ECSHPA80TX

REPORT # RA054930/10120

This report was prepared in accordance with the requirements of the FCC Rules and Regulations Part 2, Subpart J, 2.1031 through 2.1057, Part 90 and other applicable sections of the rules as indicated herein.

Prepared By:

Fred Gurule

DNB Engineering, Inc.
3535 W. Commonwealth Ave.
Fullerton, CA 92833

4 MARCH 2001

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1.0 ADMINISTRATIVE DATA

1.1 Certifications and Qualifications

I certify that DNB Engineering, Inc conducted the tests performed in order to obtain the technical data presented in this application. Also, based on the results of the enclosed data, I have concluded that the equipment tested meets or exceeds the requirements of the Rules and Regulations governing this application.

1.2 Measurement Repeatability Information

The test data presented in this report has been acquired using the guidelines set forth in FCC Part 2.1031 through 2.1057, 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. These conditions include: The same test distance, EUT Height, Measurement Site Characteristics, and the same EUT System Components. The system must have the same Interconnecting Cables arranged in identical placement to that in the test set-up, with the system and/or EUT functioning in the identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and the environment on the date of the test may result in measurement repeatability difficulties.
All changes made to the EUT during the course of testing as identified in this test report must be incorporated into the EUT or identical models to ensure compliance with the FCC regulations.

Bryan Broaddus (Para. 1.1)
Manager, Test Dept.
DNB Engineering, Inc.
Tel. (714) 870-7781 FAX (714) 870-5081

2.1033 (C) (1) Application for Certification

Name of Applicant:		ElectroCom Systems 11909 E. Telegraph Rd. Santa Fe Springs, CA 90670-3728
Applicant is:	X	Manufacturer Vendor Licensee Prospective Licensee Other
Description:		RF Amplifier
Part Number:		HPA8
Anticipated Production Quantity:		Multiple Units

2.1033 (C) 2) FCC Identifier

FCC ID: MI7-ECSHPA80TX

2.1033 (C) 3) Installation and Operating Instructions

Please refer to Appendix A

2.1033 (C) (4) Type of Emission

N/A

2.1033 (C) (5) Frequency Range

851 - 866 MHz

2.1033 (C) 6) Operating Power

80 Watts

2.1033 (C) (7) Maximum Power Allowed in Applicable Part(s) of the Rules

RULES PART	MAXIMUM POWER (WATTS)
Part 90.213	80

2.1033 (C) (8) Final RF Amplifier Input Power Characteristics

Input Voltage:	12 Vdc Nominal
Input Current:	15 Adc Nominal

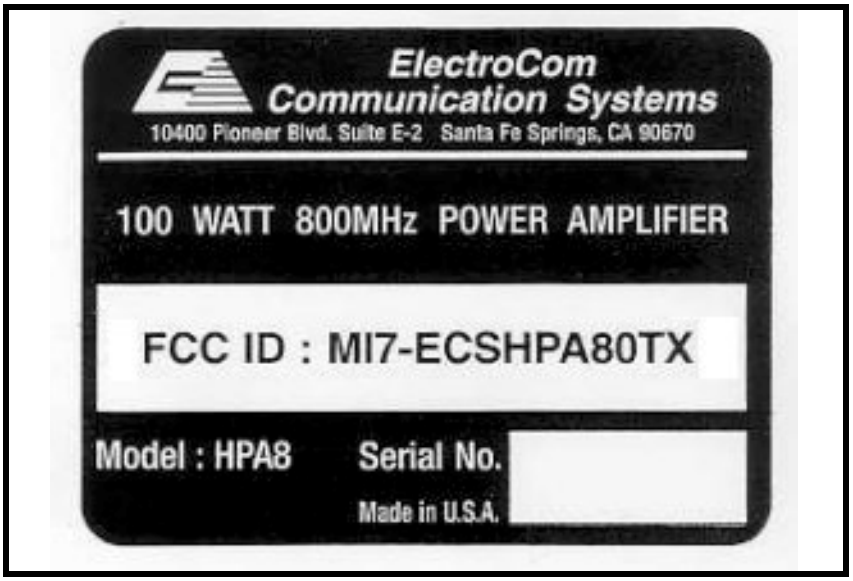
2.1033 (C) (9) Tune Up Procedure

Please refer to Appendix A.

2.1033 (C) (10) Schematic Diagram and Circuit Description

Please refer to Appendix B

2.1033 (C) (11) Equipment Identification Plate



NOTES:
Label will be constructed of 0.02 inch aluminum as shown on the equipment with permanent adhesive.

All information on the label will be etched or stamped. Both methods will exceed the expected lifetime of the equipment.

The label will be large enough to allow all information to be legible.

2.1033 (C) 11) Equipment Photographs

Note: The Main Circuit Board shown in these photos has no components on the reverse side.

Photo 1 Main Circuit Board (Overall View)

Photo 2 Main Circuit Board (Detail)

Photo 3 External Front , Back and Side Views

Photo 1 Main Circuit Board (Overall View)

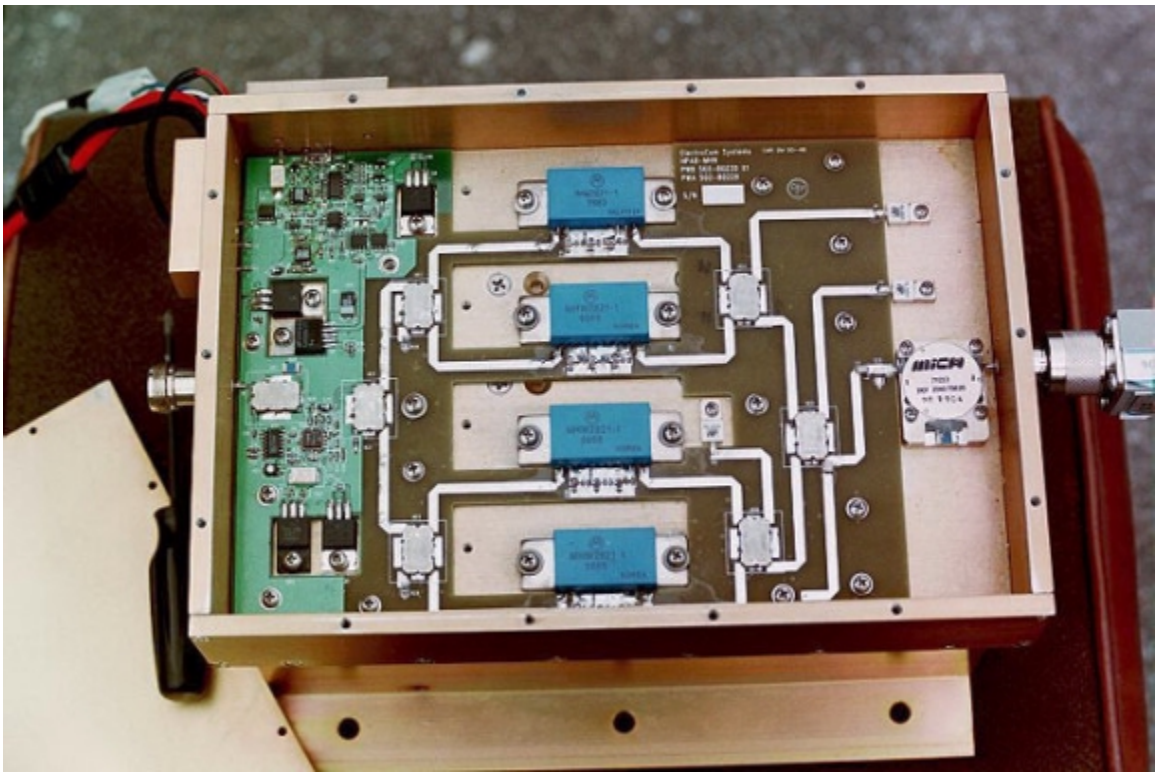


Photo 2 Main Circuit Board (Detail)

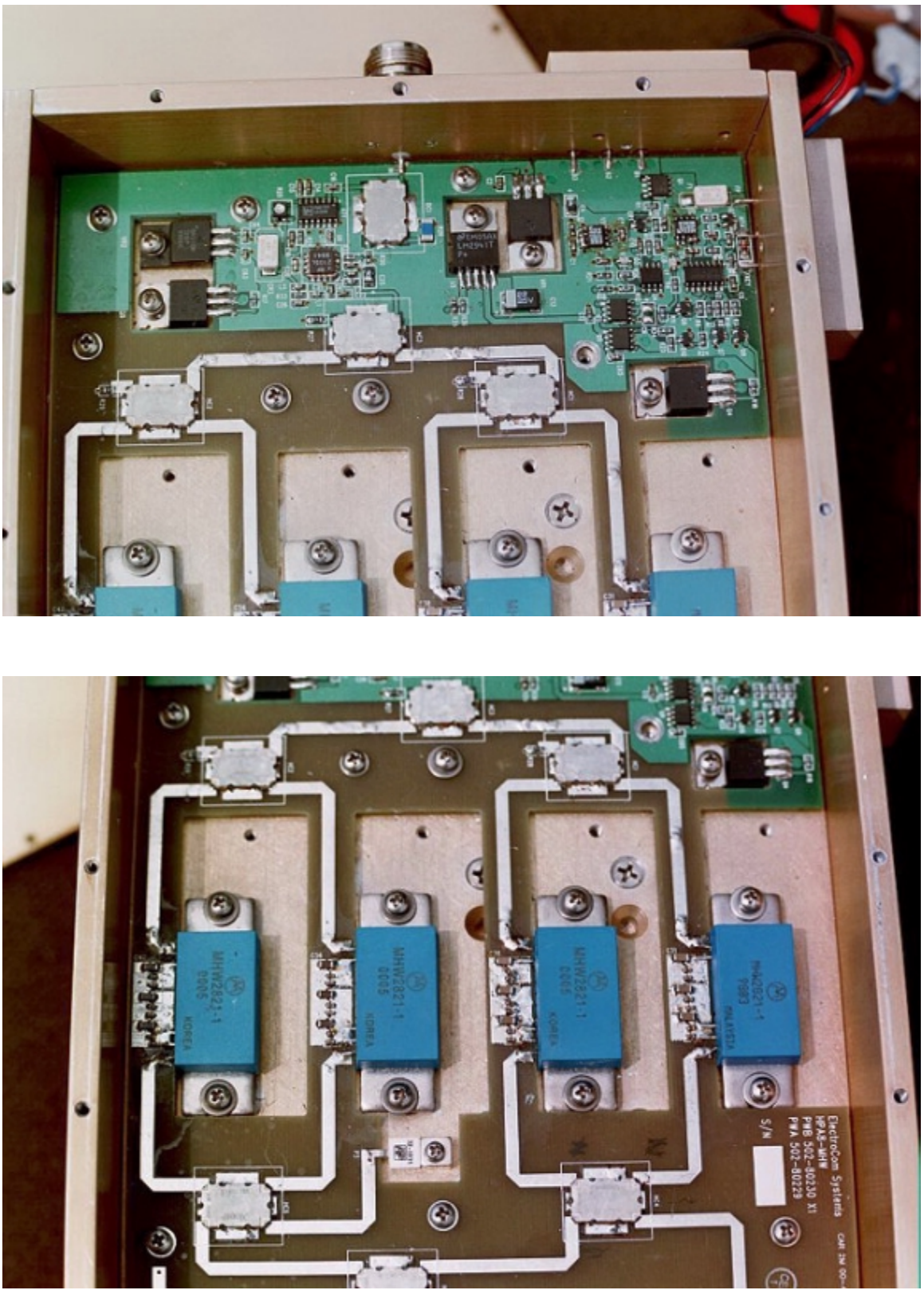
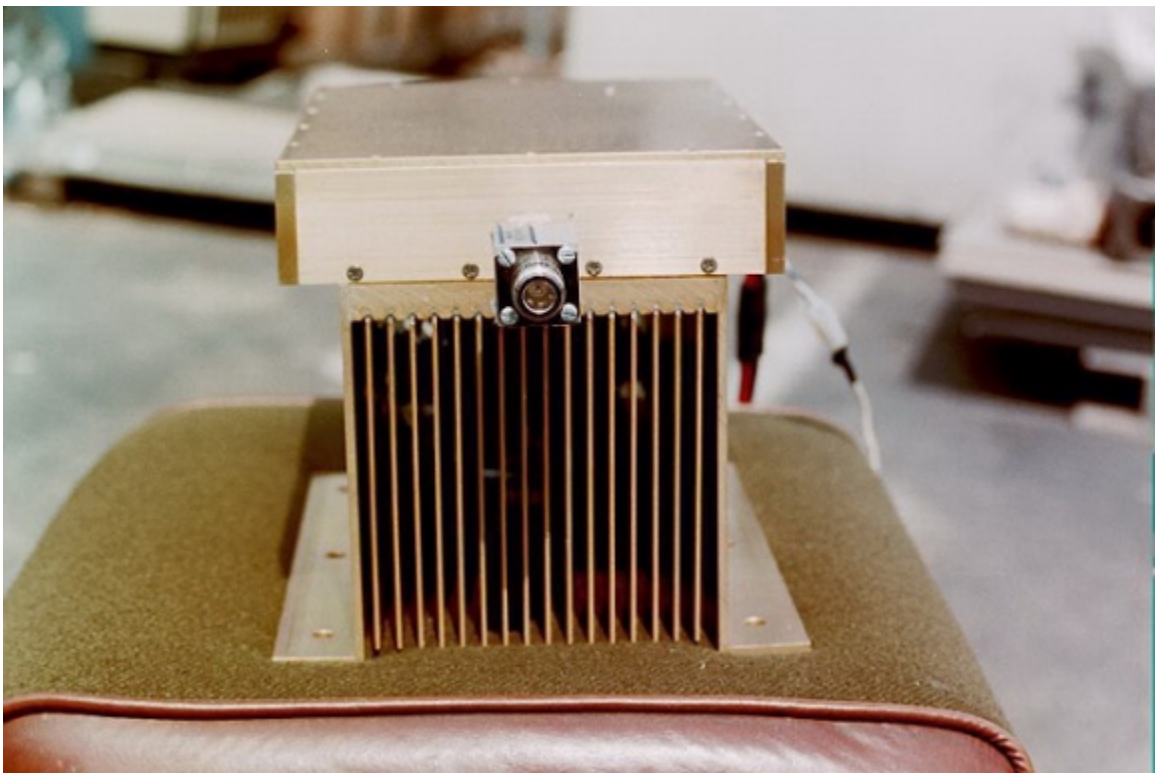
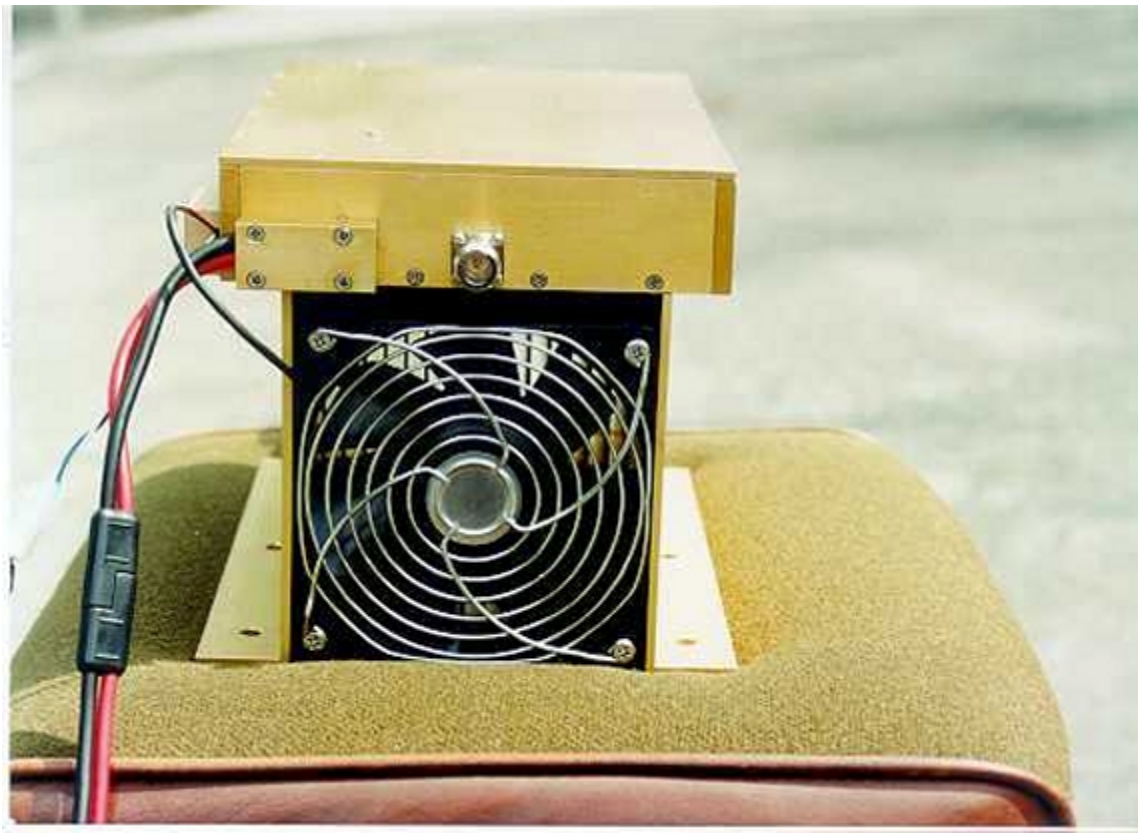
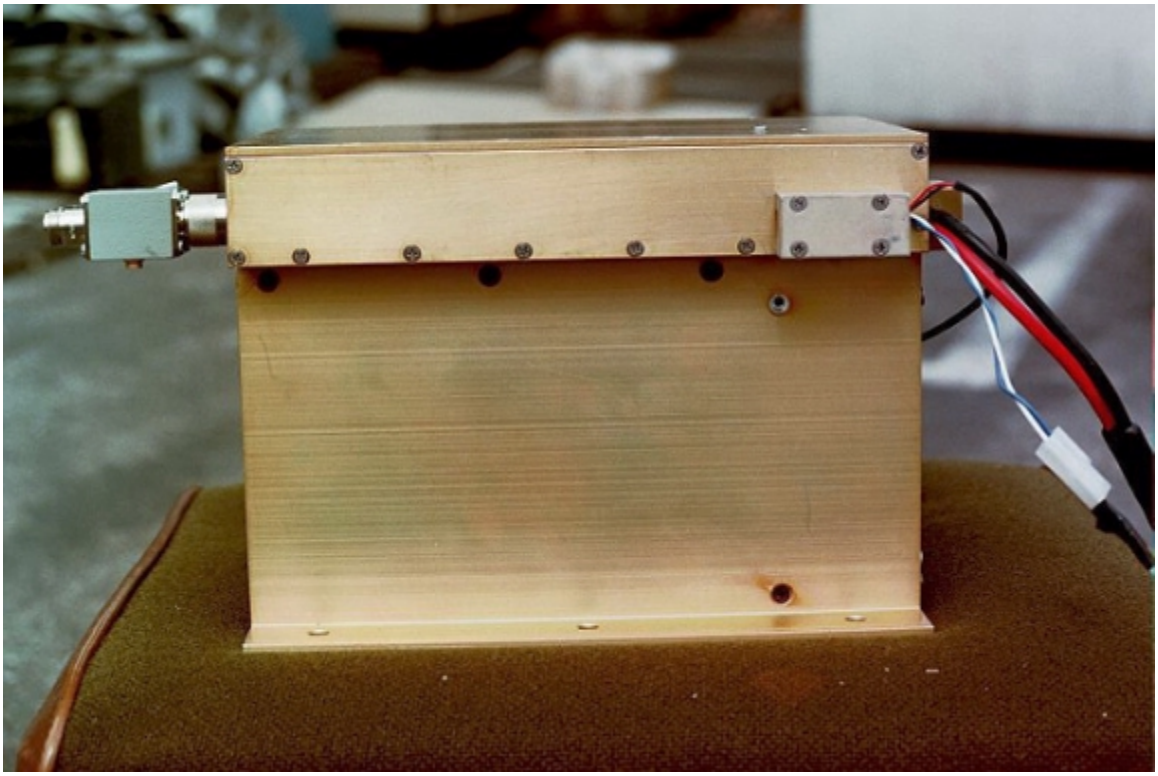
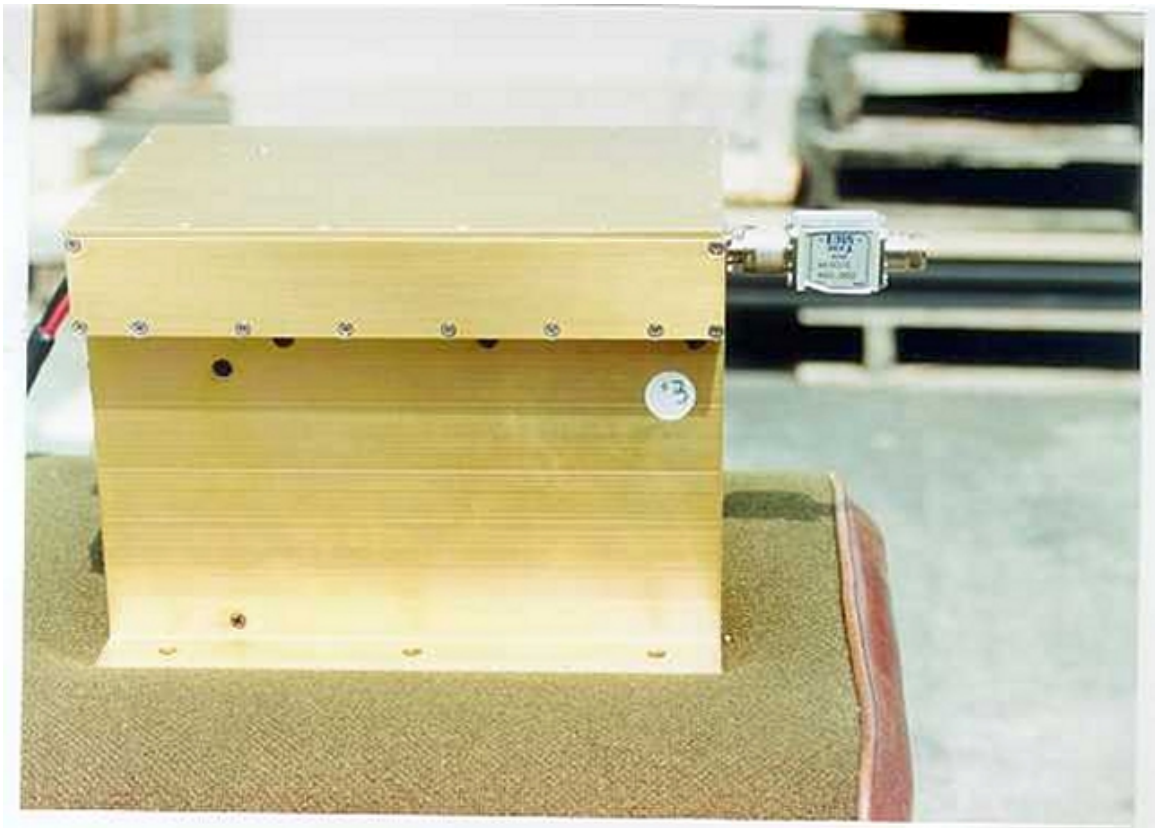


Photo 3 External Front, Side and Back View









2.1033 (C) (13) Digital Modulation Techniques

Not Applicable

2.1033 (c) (14) Test Data

Refer to 2.1046 through 2.1057

2.1046 Measurement of RF Power Output

Definition: For RF Amplifiers.

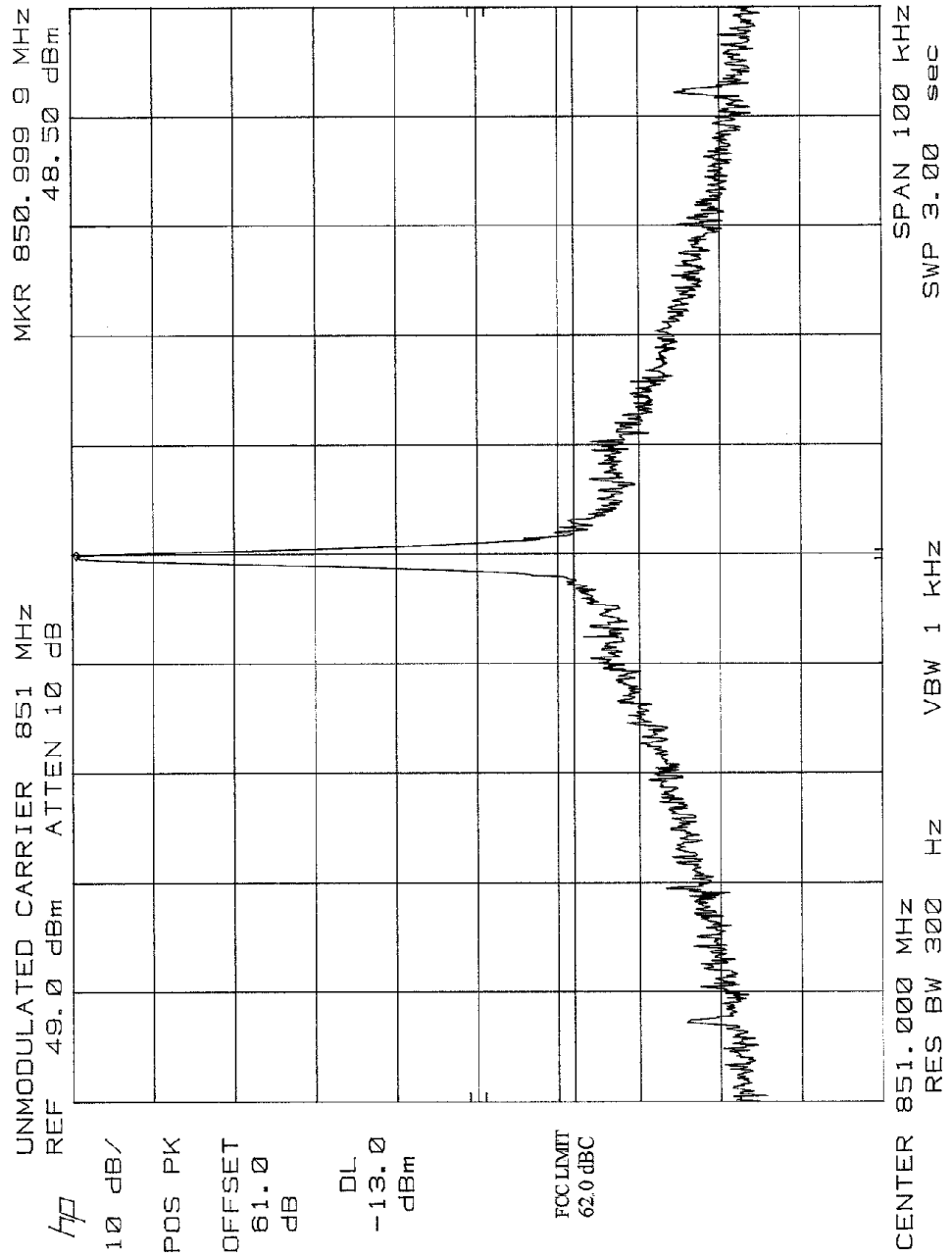
Test Method: See FIGURE 1.

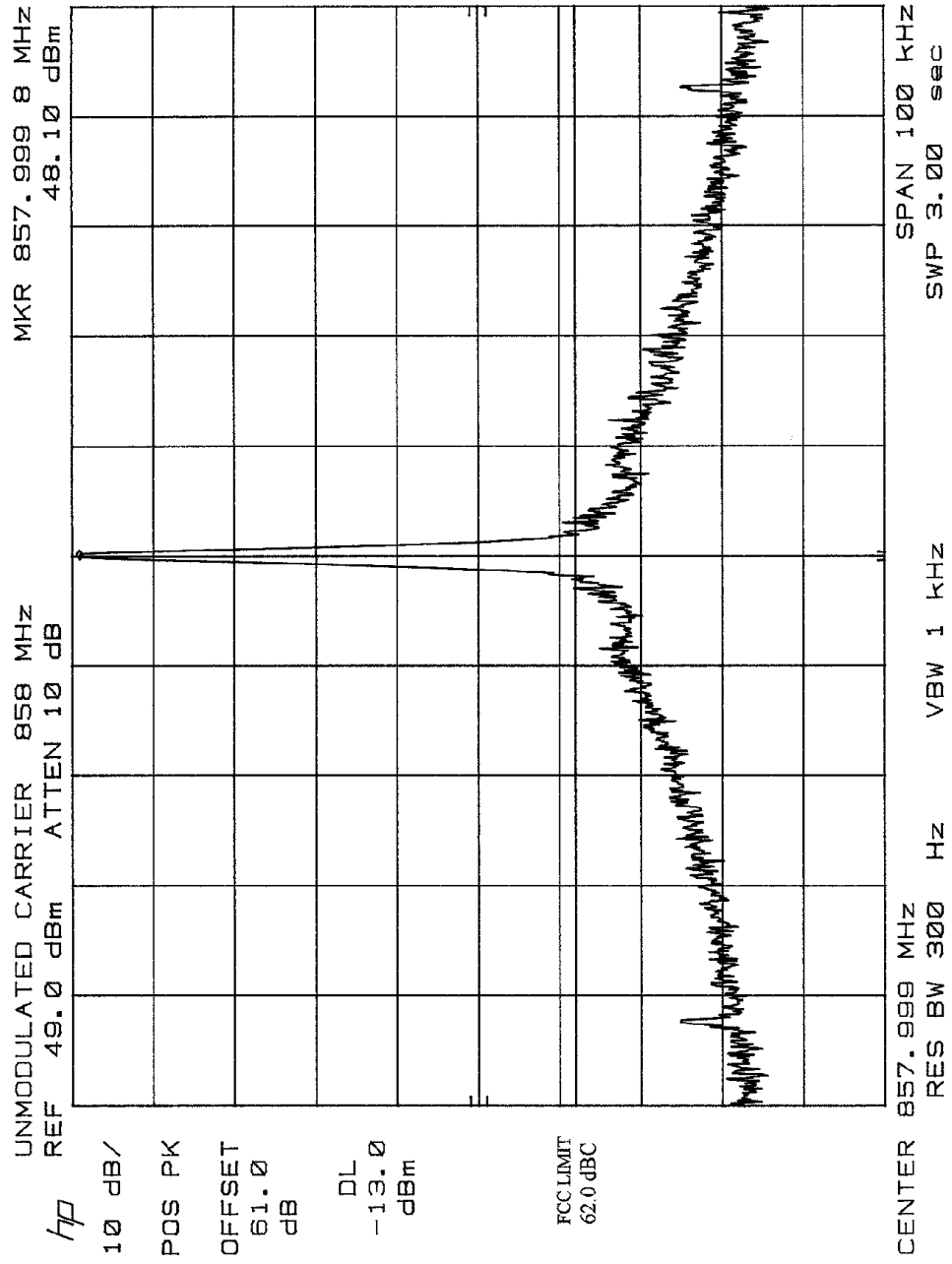
Output Power is measured across a precision 50 ohm load with a Spectrum Analyzer

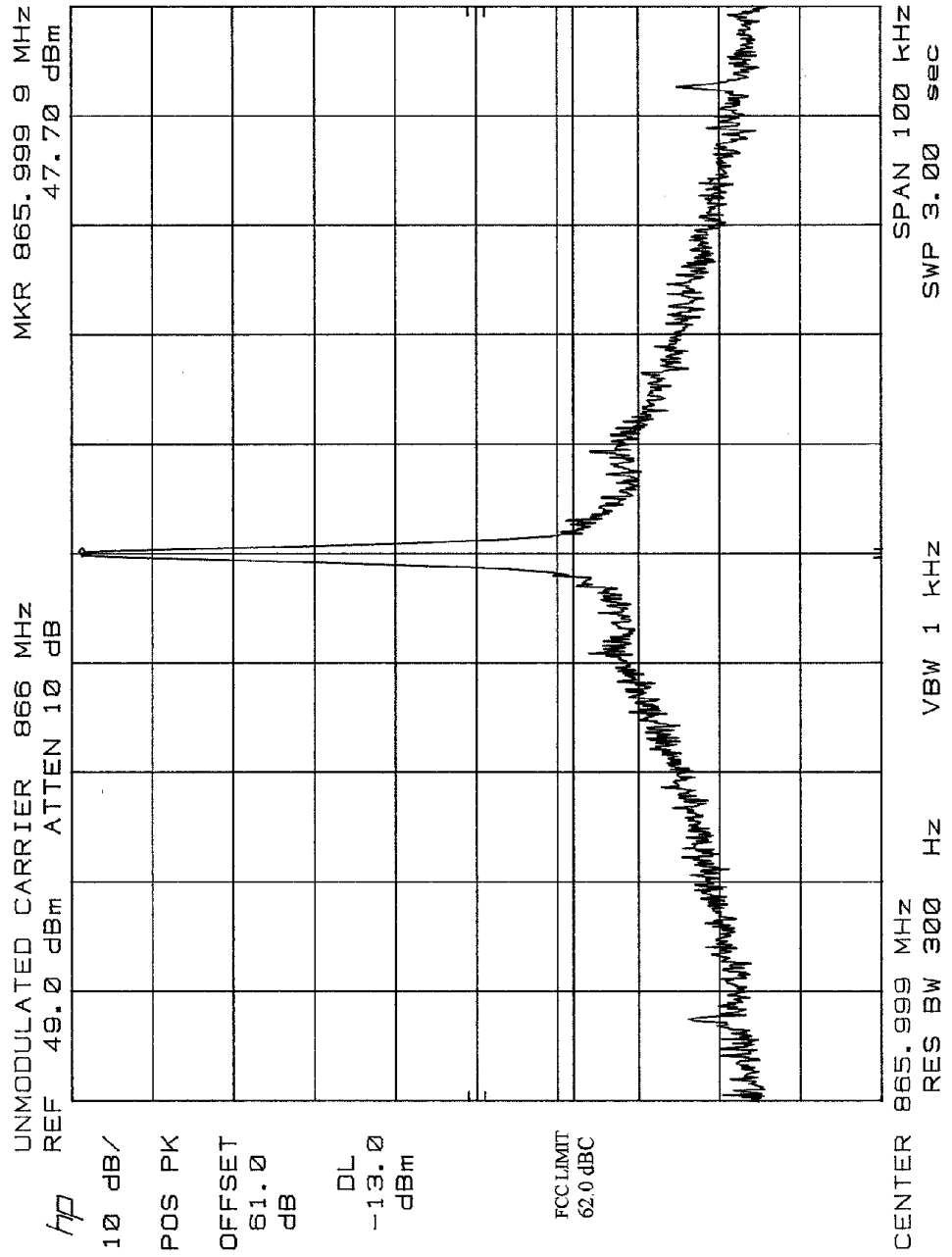
Test Results:

POWER OUTPUT MEASURED AT NOMINAL VOLTAGE WAS:

Frequency (MHz)	Power (dBm)	Power (W)
851	48.5	70.8


UNMODULATED CARRIER 851 MHz
REF 49.0 dBm ATTEN 10 dB
MKR 850.999 9 MHz
48.50 dBm
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
CENTER 851.000 MHz
RES BW 300 Hz
VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec


UNMODULATED CARRIER 858 MHz
REF 49.0 dBm ATTEN 10 dB
MKR 857.999 8 MHz
48.10 dBm
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
CENTER 857.999 MHz
RES BW 300 Hz VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec


UNMODULATED CARRIER 866 MHz
REF 49.0 dBm ATTEN 10 dB
MKR 865.999 9 MHz
47.70 dBm
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
CENTER 865.999 MHz
RES BW 300 Hz VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec

2.1049 Measurement of Occupied Bandwidth

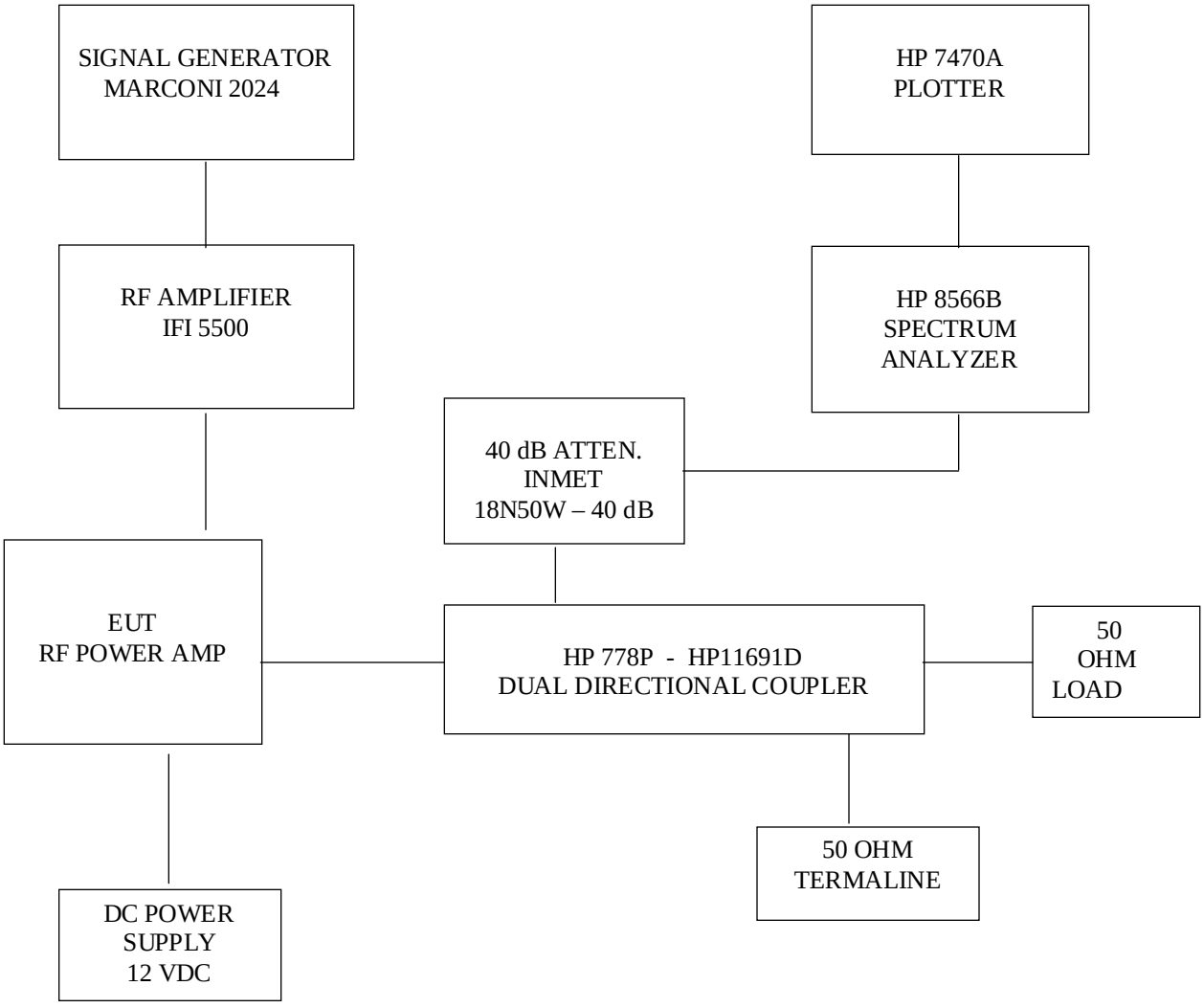
Definition:
Occupied Bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a given emission.

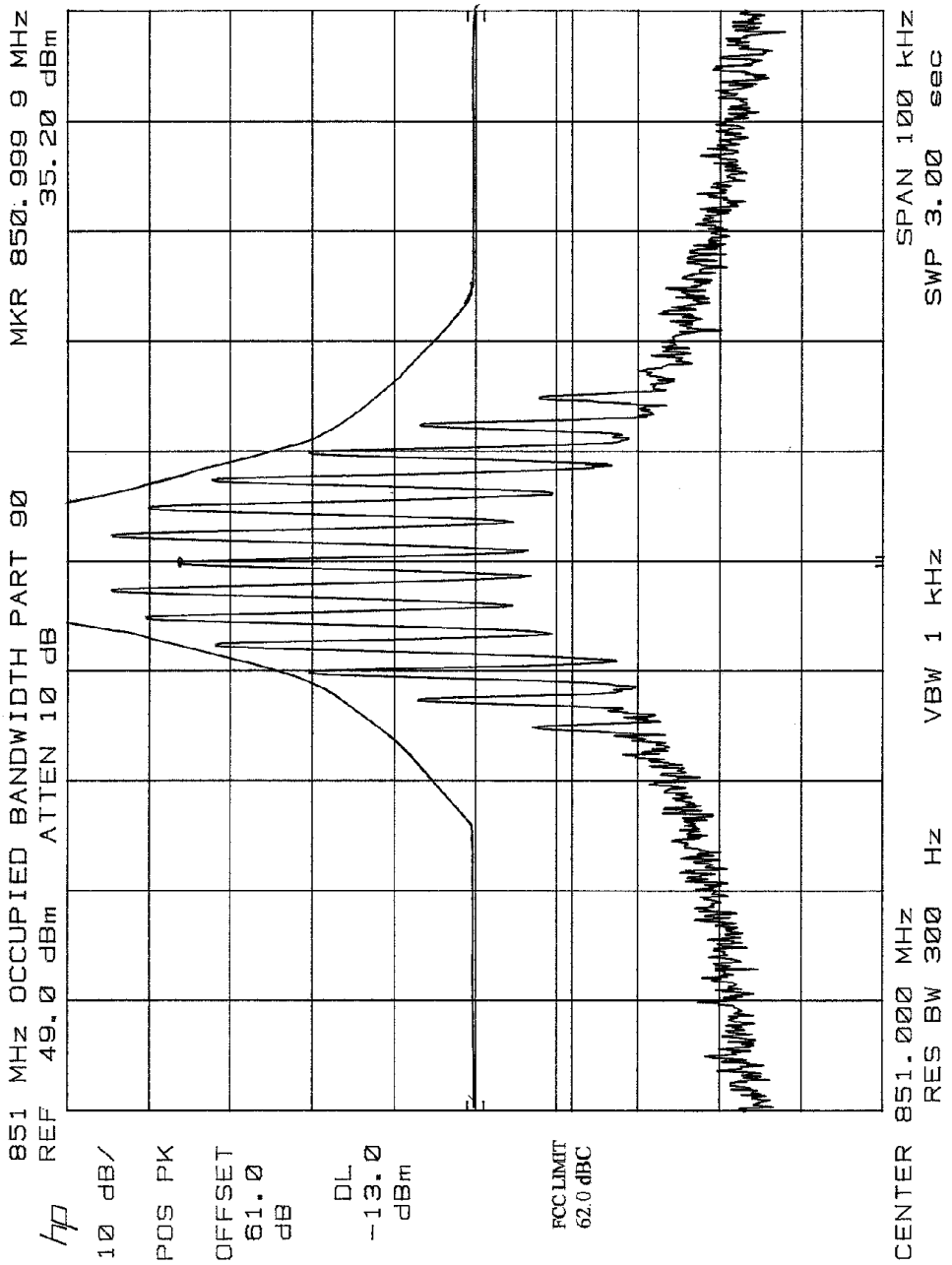
Test Method: Connect the Equipment per FIGURE 1.
Measurements were made with the modulating signal at 2.5 kHz with 5 kHz of FM deviation.

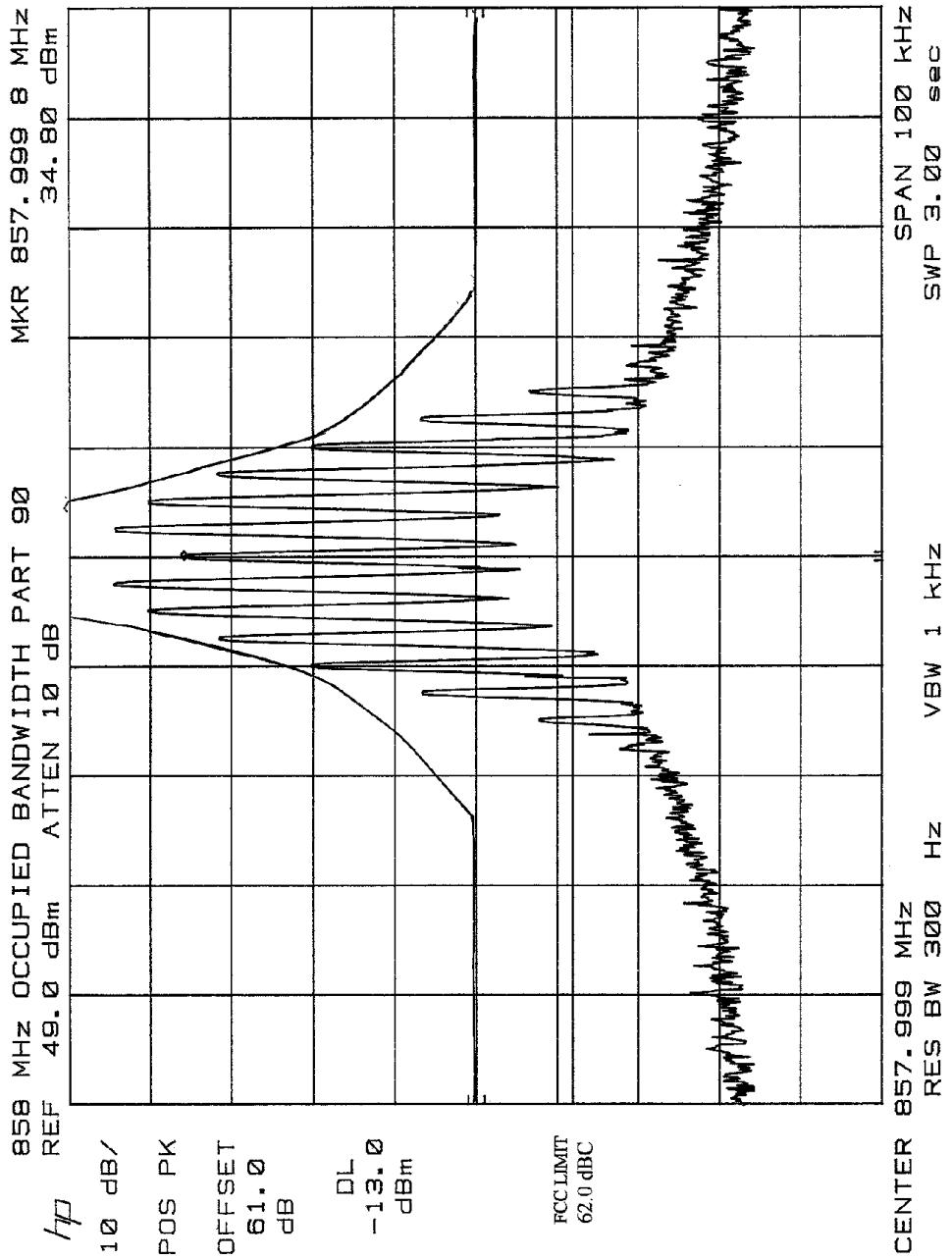
Test Results: See Plots following FIGURE 1.

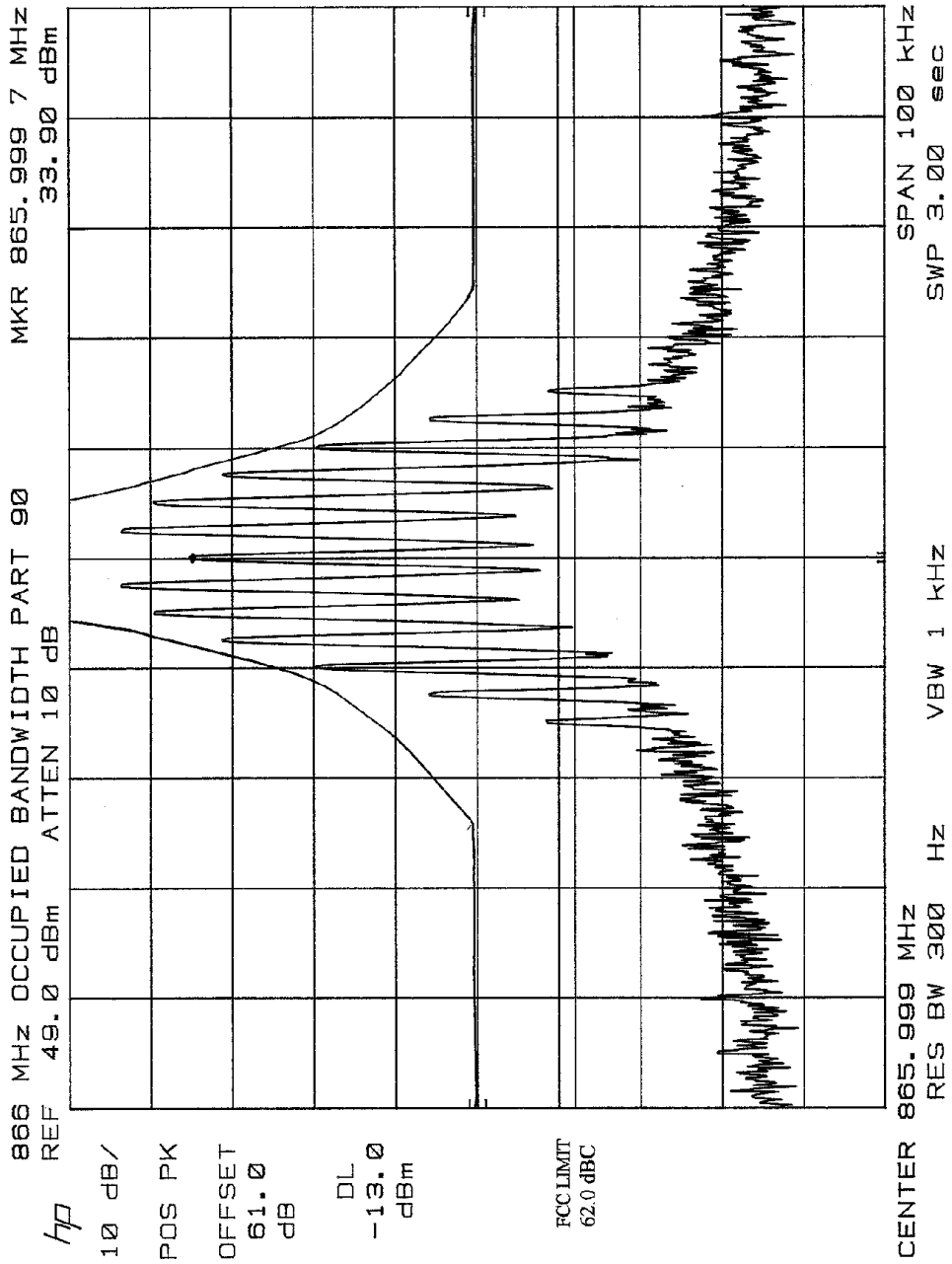
The center frequency of the signal did not shift with modulation. The Spectrum Bandwidth was well within the limits specified in the FCC Regulations.

FIGURE 1: Block Diagram
(Occupied Bandwidth tests)




851 MHz OCCUPIED BANDWIDTH PART 90
MKR 850.999 9 MHz
35.20 dBm
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
CENTER 851.000 MHz
RES BW 300 Hz
VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec


858 MHz OCCUPIED BANDWIDTH PART 90
MKR 857.999 8 MHz
34.80 dBm
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
CENTER 857.999 MHz
RES BW 300 Hz
VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec


866 MHz OCCUPIED BANDWIDTH PART 90
MKR 865.999 7 MHz
33.90 dBm
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
CENTER 865.999 MHz
RES BW 300 Hz
VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec

2.1051 Spurious Emissions at Antenna Terminals

Definition:
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 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.

Conducted Spurious Emissions shall be attenuated below the maximum level of the carrier frequency in accordance with the following formula:

Spurious attenuation in dB = $43 + 10 \log_{10} Po$

Where Po = Output in Watts

= $43 + 10 \log_{10} (500)$

= 62 dB

Note: The actual limit line has been adjusted to correspond to the actual measured power.

Test Method: Per EIA RS 152-B, Paragraph 4.

Connect the equipment as shown in FIGURE 2.

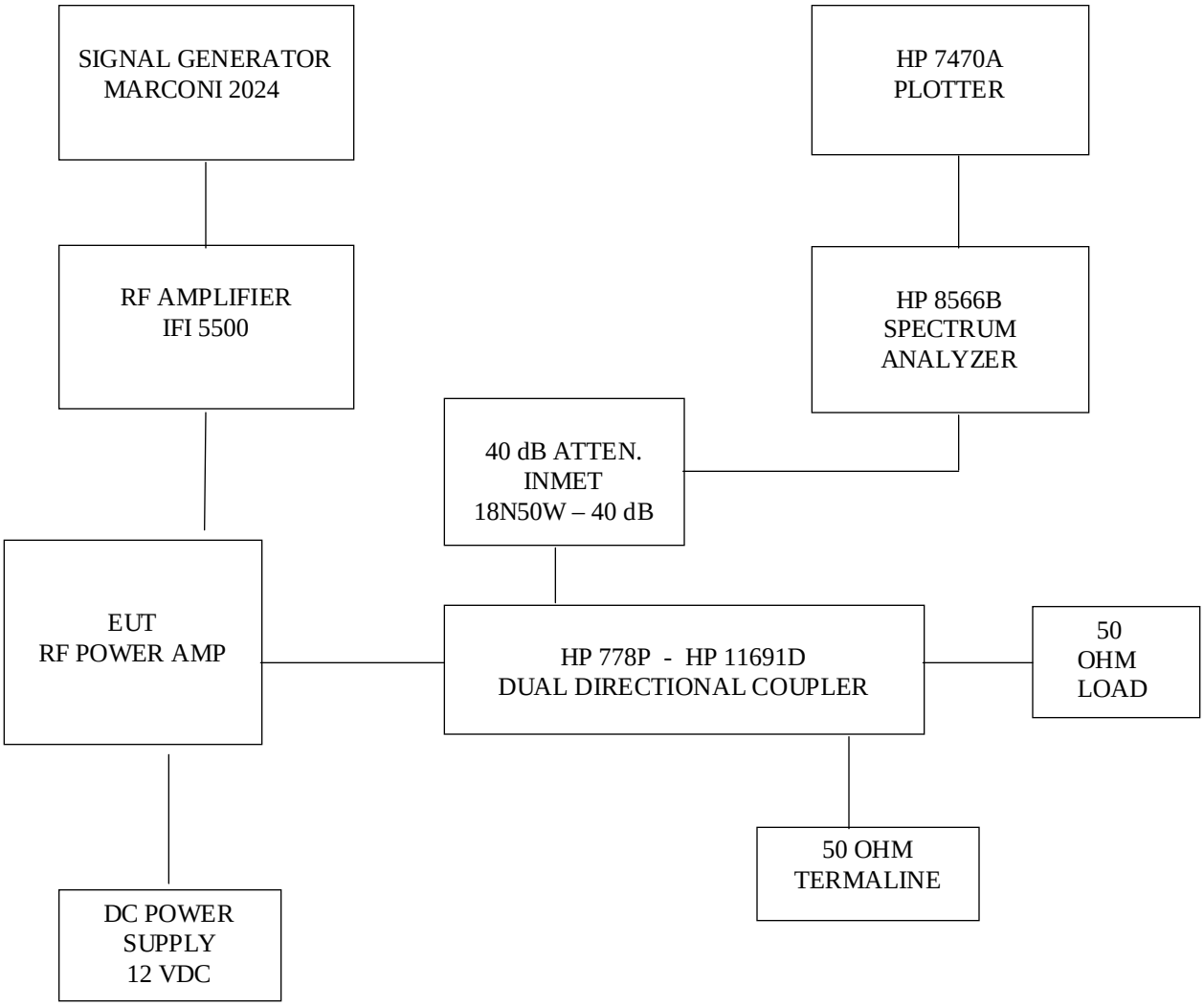
Adjust the Audio Oscillator so that the frequency deviation of the transmitter is a 5 kHz at a modulation frequency of 2.5 kHz. Adjust the Spectrum Analyzer to display the Modulated Carrier.

Scan the frequency spectrum from the lowest radio frequency generated in the equipment through the 10^{th} harmonic of the carrier frequency.

Test Results: See Plots following FIGURE 2.

All spurious emissions at the antenna terminals are below the FCC specifications

FIGURE 2: Block Diagram
(Spurious Emissions tests)



TEST EQUIPMENT LOG

Customer: Electrocom Systems
EUT: RF Amplifier
Model / Part #: HPA8
Serial #:

Test Procedure: FCC CFR 47
Test Specification: Conducted Tests
Test Engineer: Chi Cai
Customer Rep:

DESCRIPTION	MANUFACTURER	MODEL # / SERIAL #	CAL. DATE
Spectrum Analyzer	HP	8566B / 2407A13212	03/08/01
Directional Coupler	HP	778D	Cal prior to Use
Directional Coupler	HP	11691D	Cal prior to Use
Signal Generator	Marconi	2024 / 112236 / 202	04/26/01
50 ohm load (1500W)	Dielectric	5750 / 0910861	Reference
Power Supply	Sorensen	DCR40-250	N/A
RF Amplifier	IFI	5500	N/A

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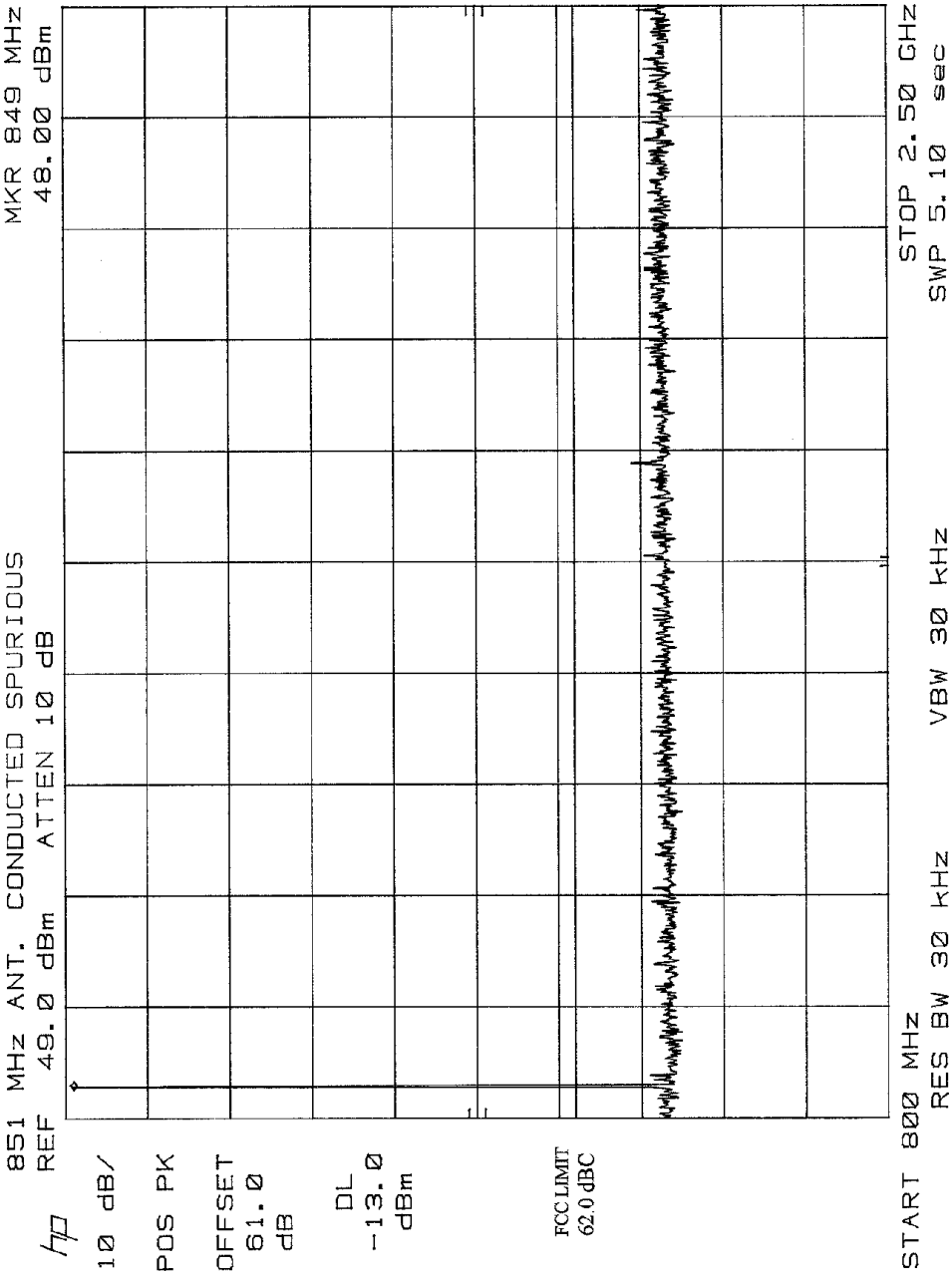
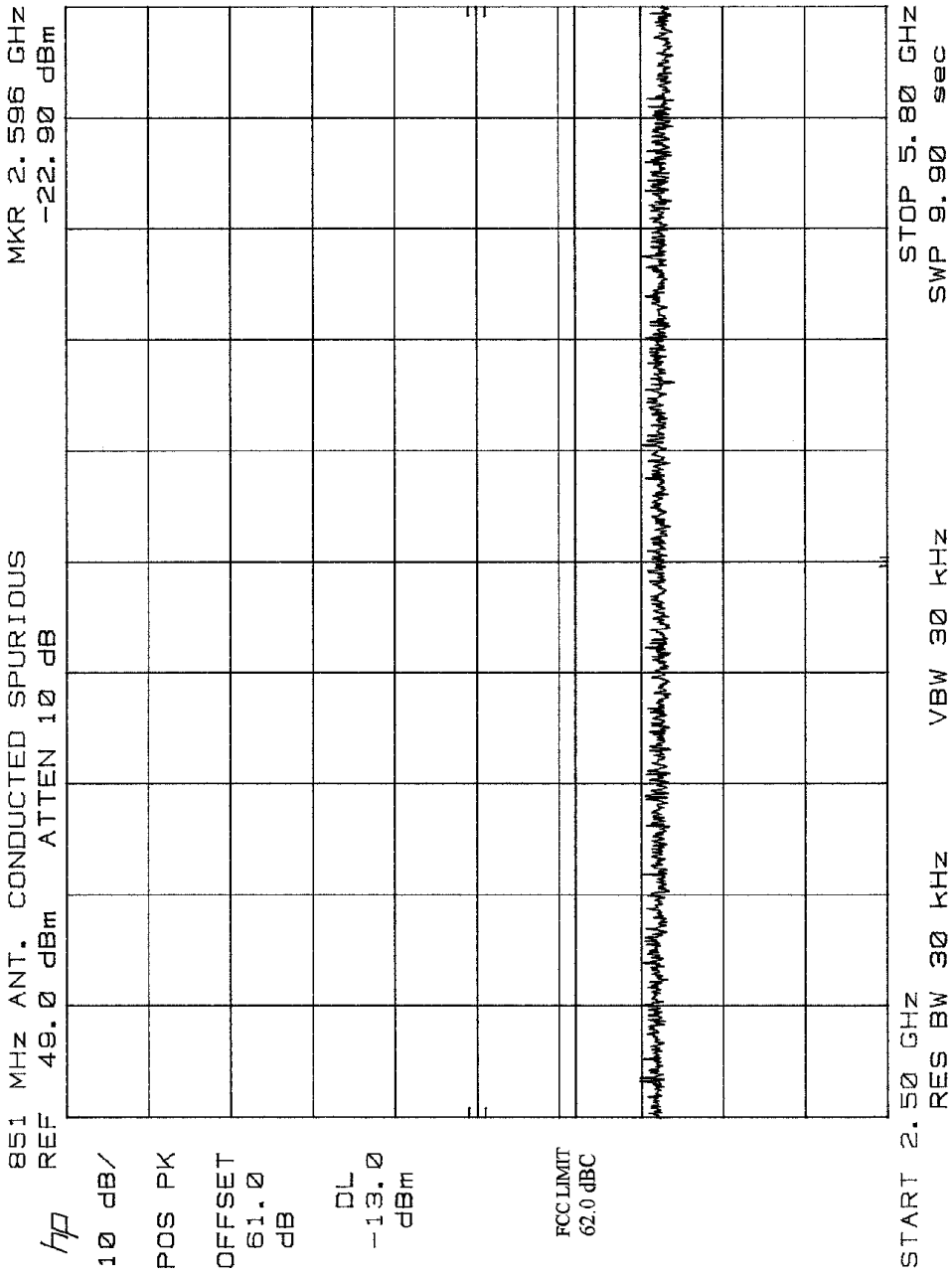
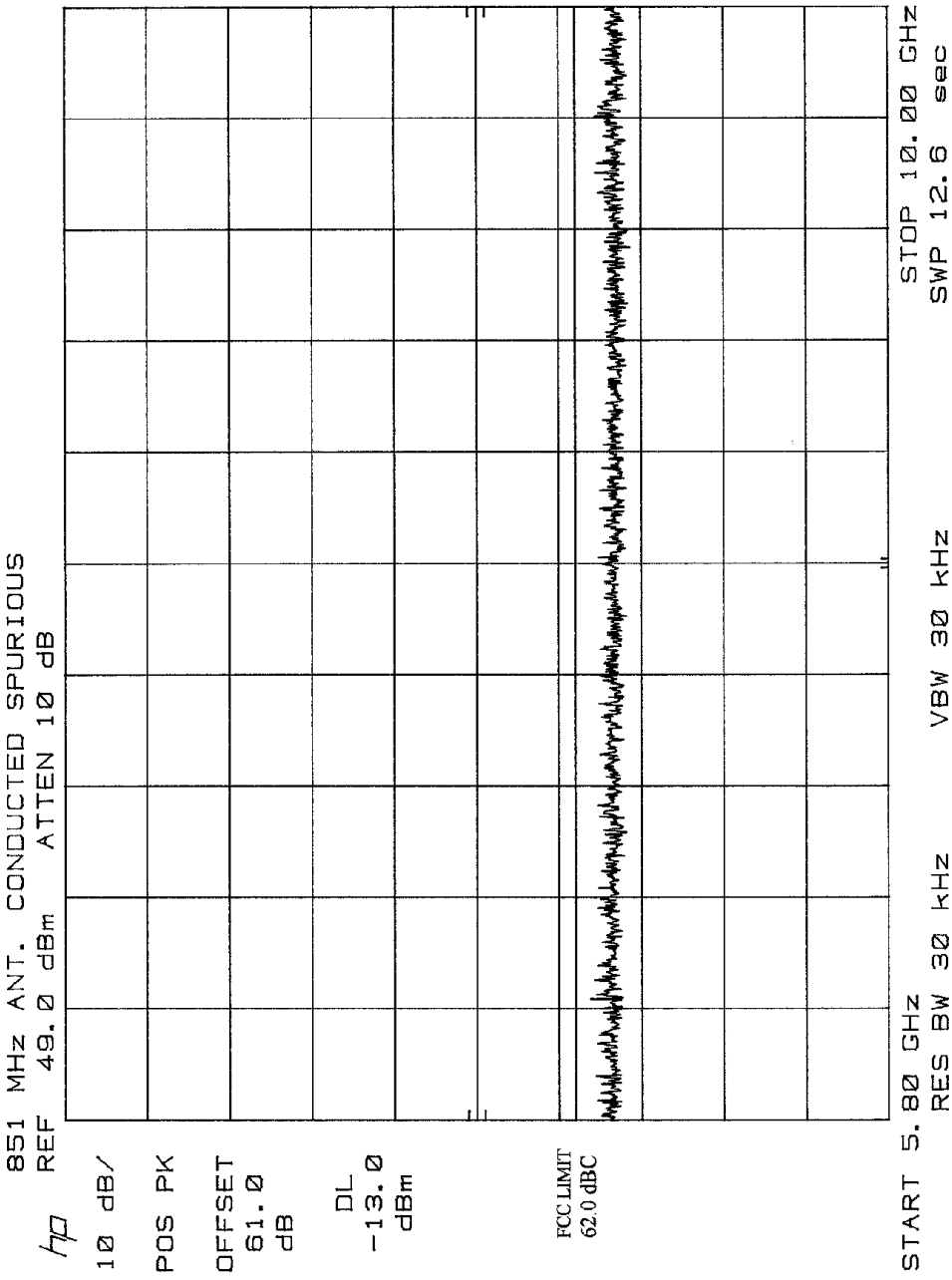
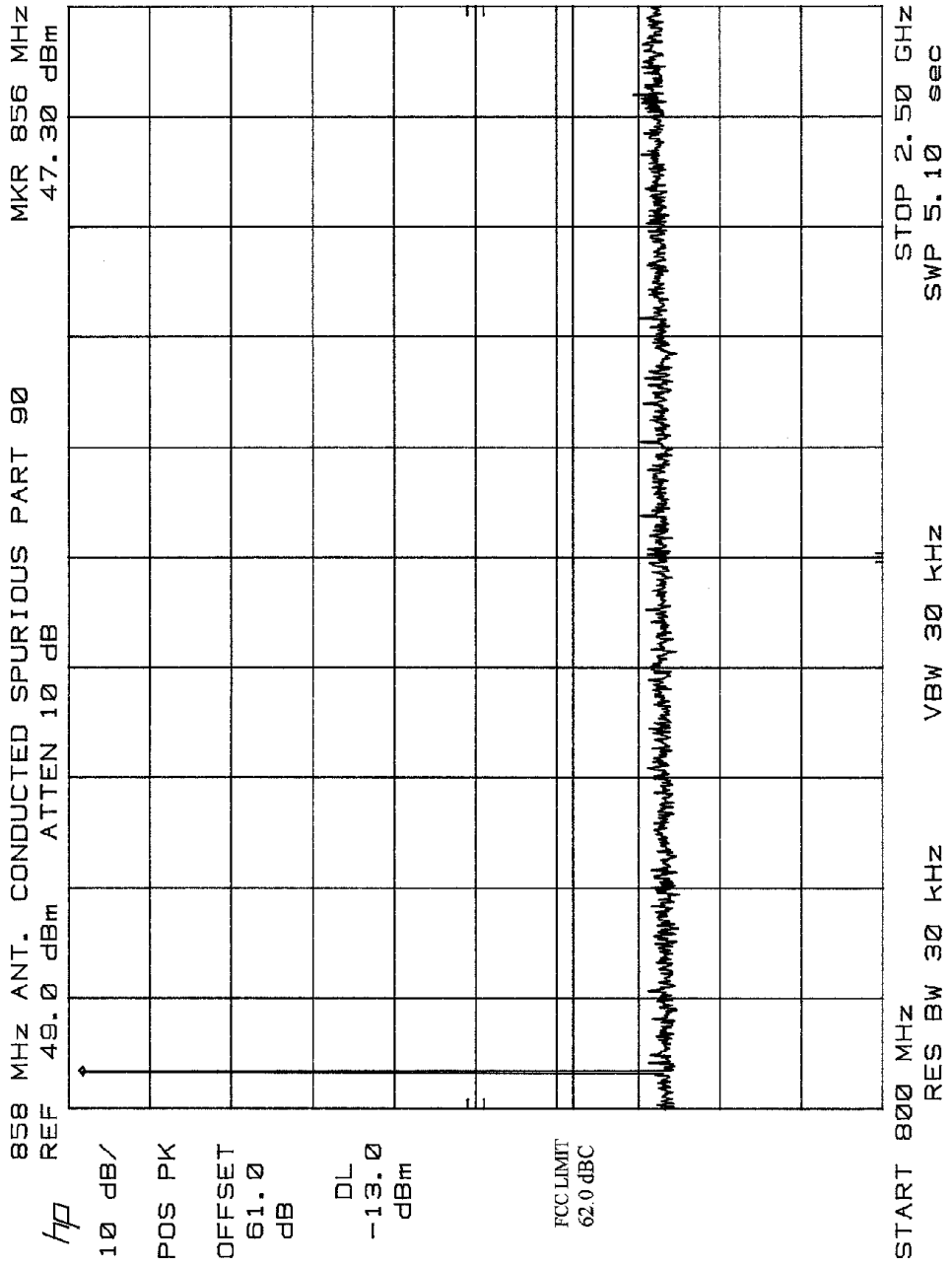
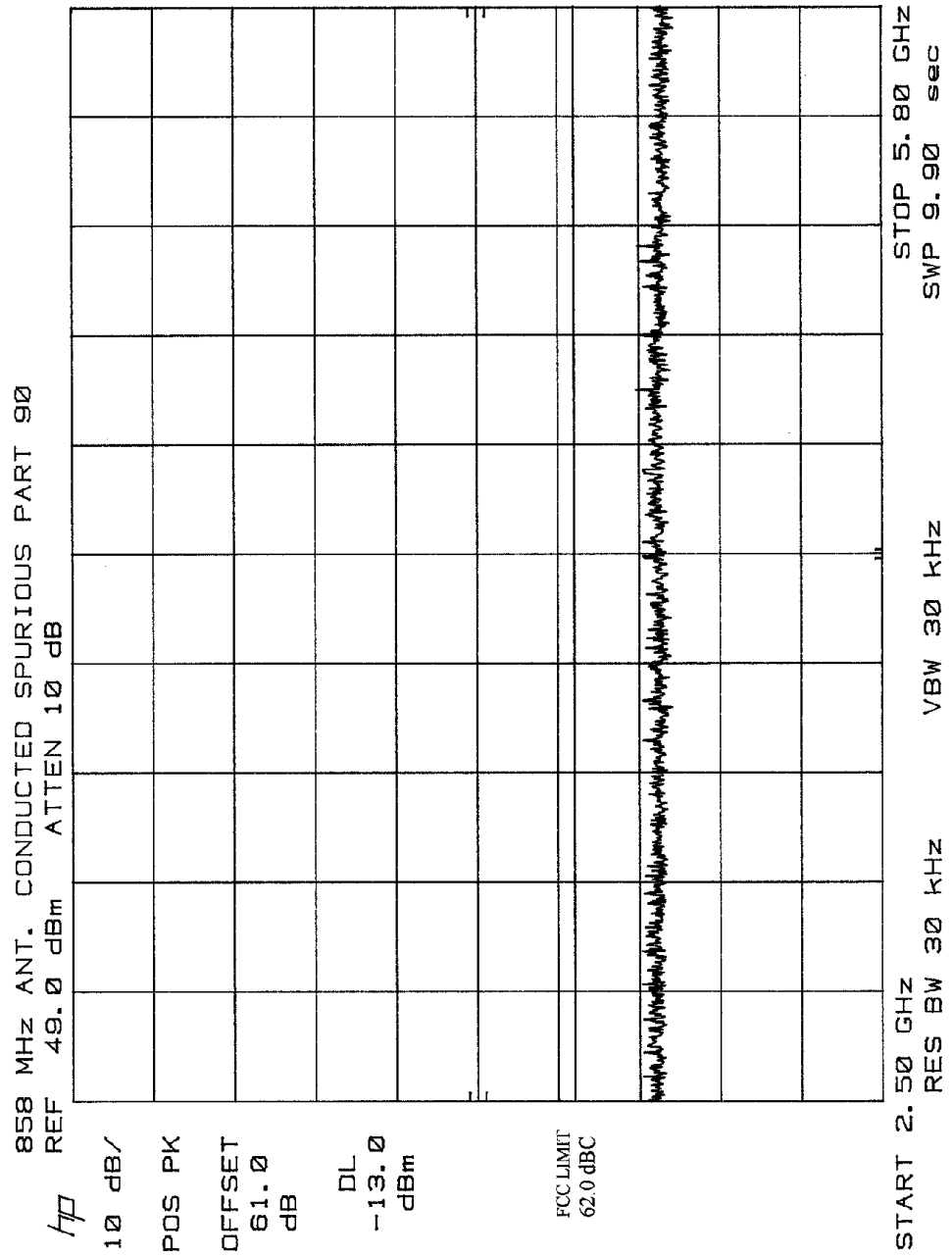
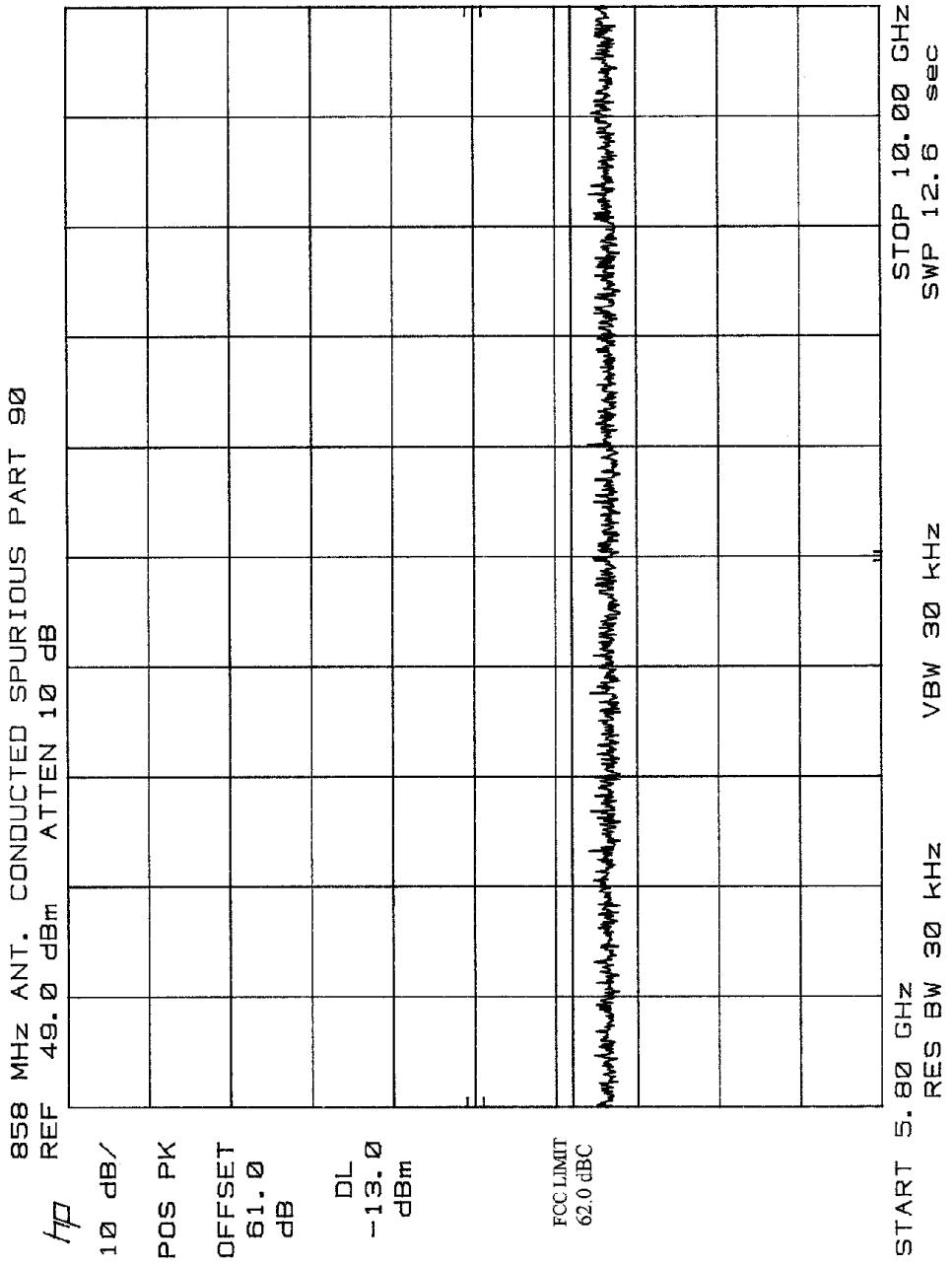

851 MHz ANT. CONDUCTED SPURIOUS
MKR 849 MHz
48.00 dBm
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
START 800 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 2.50 GHz
SWP 5.10 sec

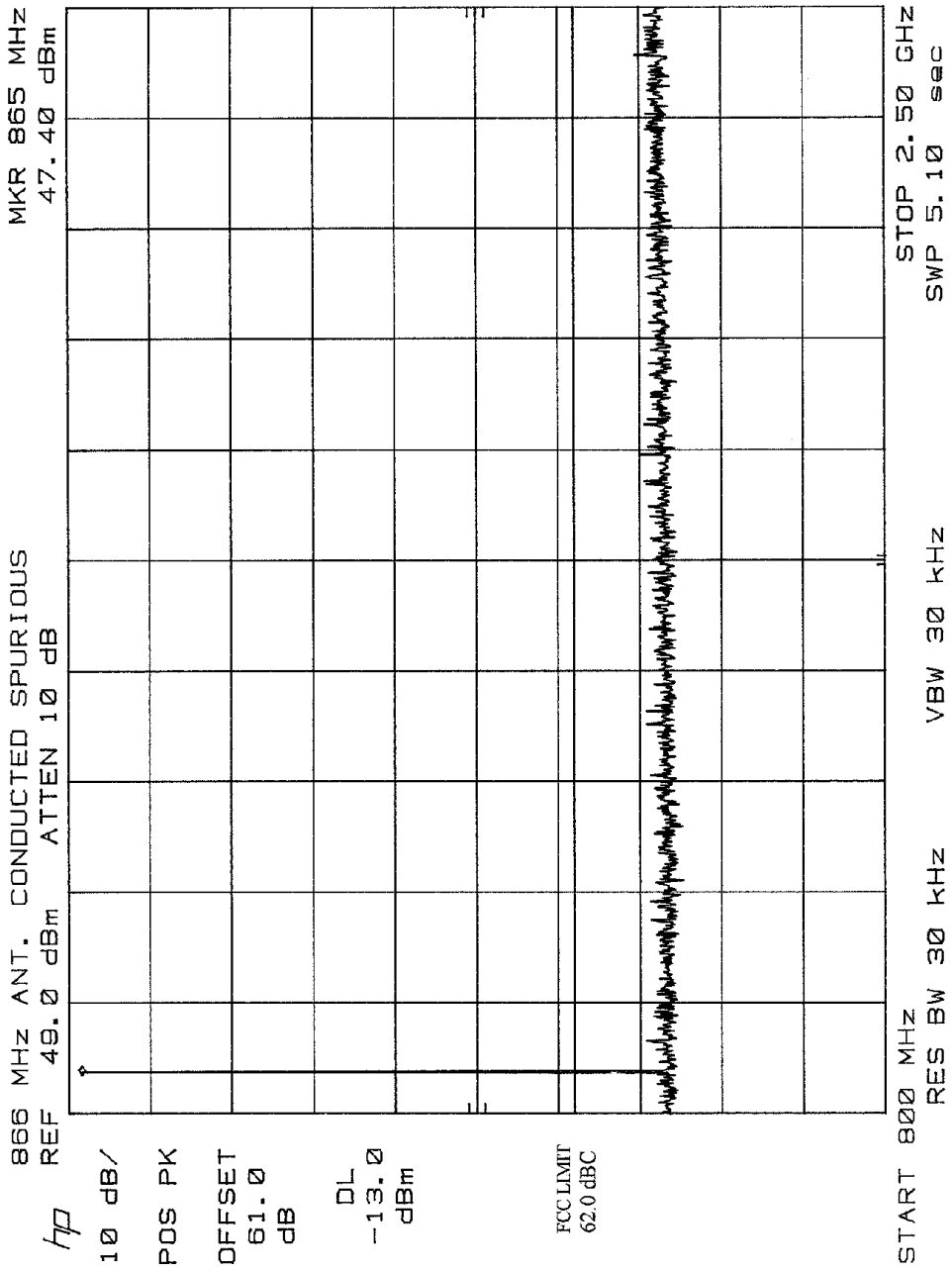

851 MHz ANT. CONDUCTED SPURIOUS
MKR 2.596 GHz
-22.90 dBm
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
START 2.50 GHz
RES BW 30 kHz
VBW 30 kHz
STOP 5.80 GHz
SWP 9.90 sec

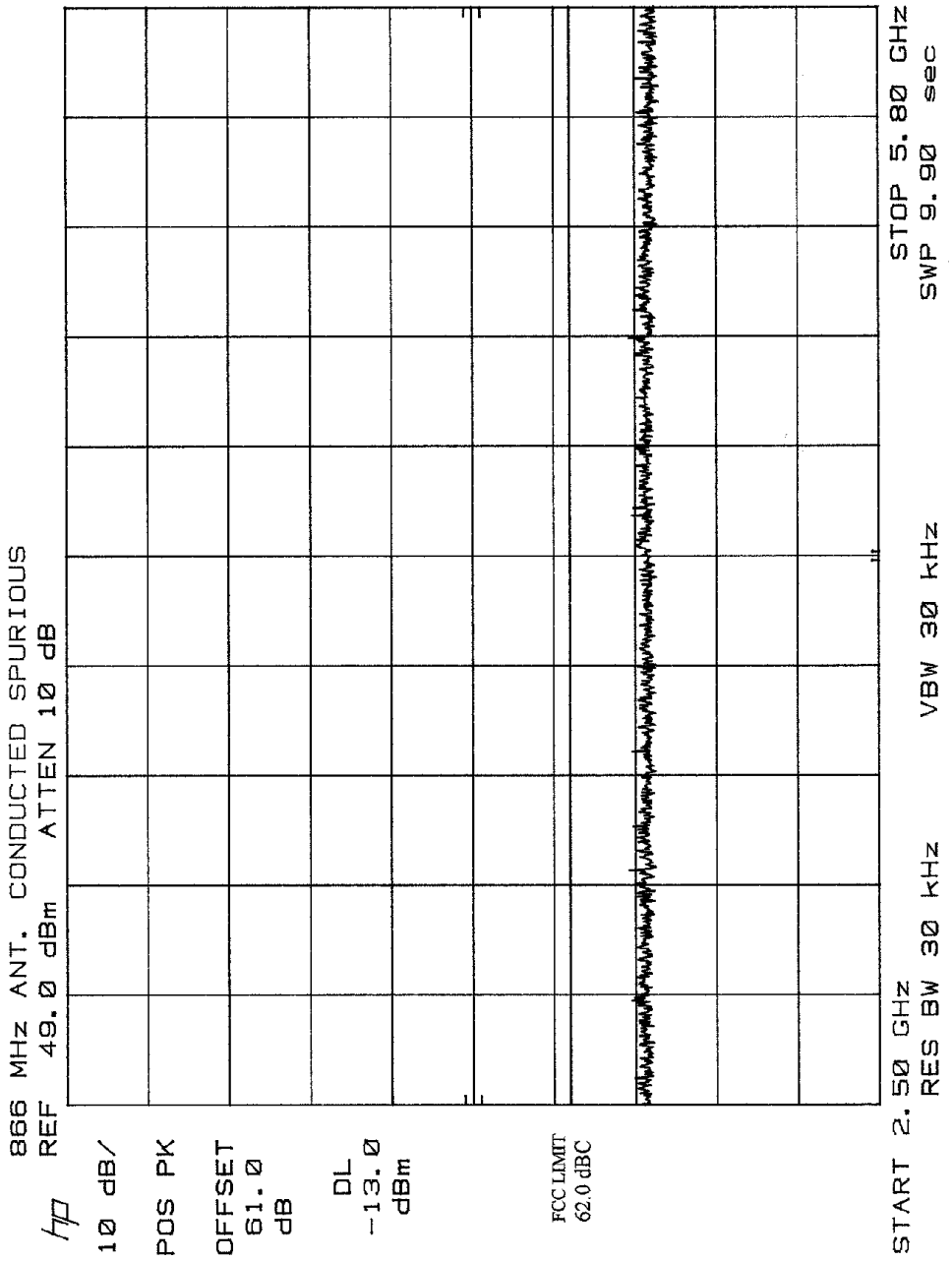

851 MHz ANT. CONDUCTED SPURIOUS
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
START 5.80 GHz
RES BW 30 kHz
VBW 30 kHz
STOP 10.00 GHz
SWP 12.6 sec

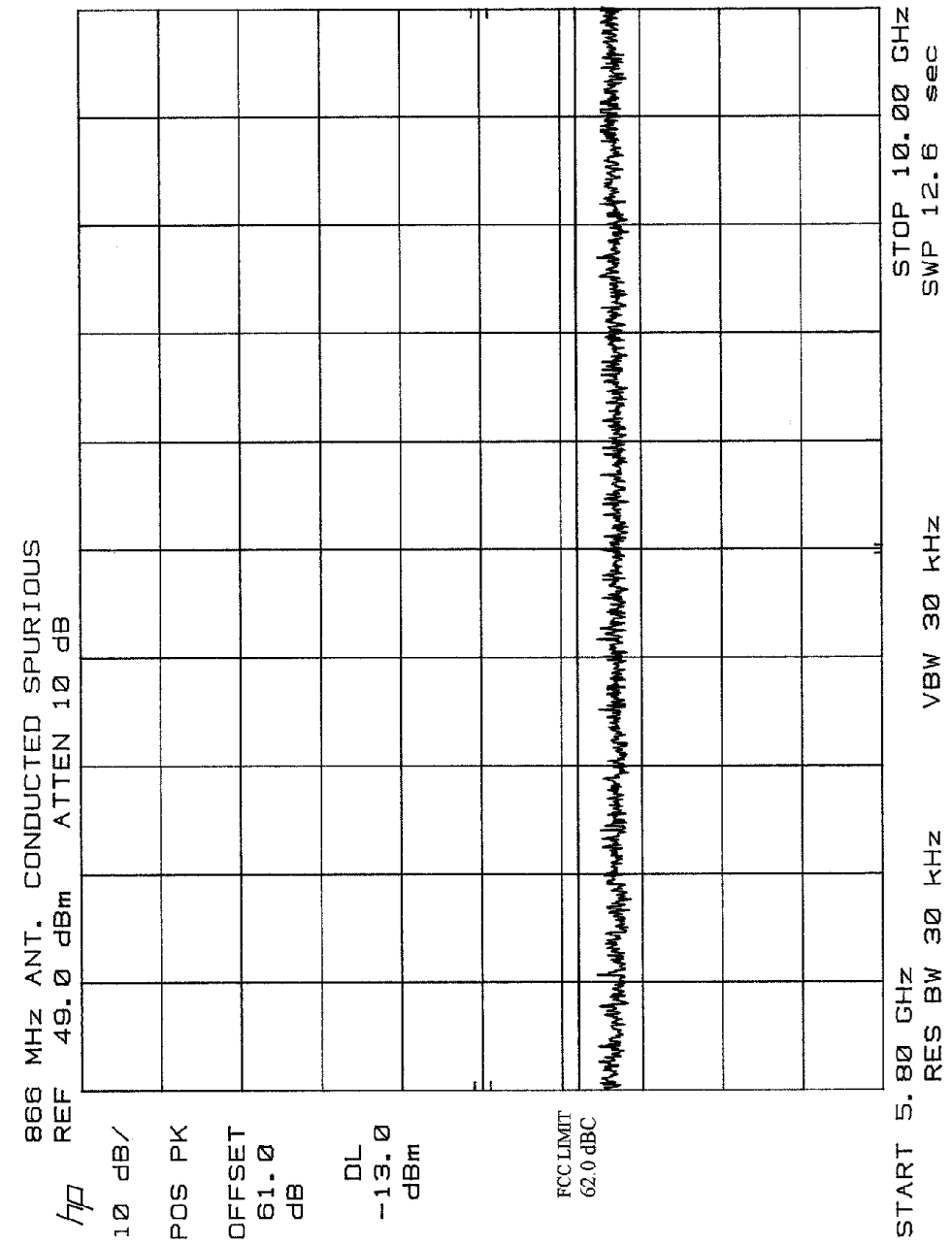

858 MHz ANT. CONDUCTED SPURIOUS PART 90
MKR 856 MHz
47.30 dBm
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
START 800 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 2.50 GHz
SWP 5.10 sec


858 MHz ANT. CONDUCTED SPURIOUS PART 90
REF 49.0 dBm ATTEN 10 dB
10 dB/
POS PK
OFFSET 61.0 dB
DL -13.0 dBm
FCC LIMIT 62.0 dBC
START 2.50 GHz
RES BW 30 kHz
VBW 30 kHz
STOP 5.80 GHz
SWP 9.90 sec


858 MHz ANT. CONDUCTED SPURIOUS PART 90
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
START 5.80 GHz
RES BW 30 kHz
VBW 30 kHz
STOP 10.00 GHz
SWP 12.6 sec


866 MHz ANT. CONDUCTED SPURIOUS
MKR 865 MHz
47.40 dBm
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
START 800 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 2.50 GHz
SWP 5.10 sec


866 MHz ANT. CONDUCTED SPURIOUS
REF 49.0 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
START 2.50 GHz
RES BW 30 kHz
VBW 30 kHz
STOP 5.80 GHz
SWP 9.90 sec


866 MHz ANT. CONDUCTED SPURIOUS
REF 49.0 dBm ATTEN 10 dB
10 dB/
POS PK
OFFSET
61.0
dB
DL
-13.0
dBm
FCC LIMIT
62.0 dBC
START 5.80 GHz
RES BW 30 kHz
VBW 30 kHz
STOP 10.00 GHz
SWP 12.6 sec

2.1053 Field Strength of Spurious Radiation

Definition:
Emissions from the equipment when connected into a non-radiating load on a frequency or 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.

Test Method: Per EIA RS 152-B.

Connect the equipment and follow the procedure described in paragraph 2.2.1.1 and paragraph 5.0. Measure the amplitude of each spurious radiated signal through the 10^{th} harmonic. The level in dBuV/m is calculated on the following page. The spurious signals are then measured on the 3 meter range.

$$\text{Spurious attenuation dB} = 10 \log \frac{\text{Po Watts}}{\text{Calc. Spurious power}}$$

Test Results: See TABLE on following Page.

All radiated spurious emissions are below the FCC Specifications.

RF Exposure

The information contained in "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65; August 1997 is applicable when a radiating antenna is connected to this amplifier. Paging stations that utilize this amplifier authorized under Part 22 (Subpart E) and Part 90 are subject to routine environmental evaluation for RF exposure if an antenna is located on a rooftop and if its ERP exceeds 1000 watts.

This product is certified to meet the RF exposure guidelines of OET-65 as a stand-alone RF power amplifier. The RF spurious emissions recorded when the antenna output connector is terminated into a non-radiating 50 ohm load do not exceed the 27.5 V/m limit specified for General Population/Uncontrolled Exposure in OET Bulletin 65.

TEST EQUIPMENT LOG

Customer: Electrocom Systems
EUT: RF Amplifier
Model / Part #: HPA8
Serial #:

Test Procedure: FCC CFR 47
Test Specification: Radiated Spurious
Test Engineer: Fred Gurule
Customer Rep:

DESCRIPTION	MANUFACTURER	MODEL # / SERIAL #	CAL. DATE
Spectrum Analyzer	HP	8566B / 2407A13212	03/08/01
Signal Generator	Marconi	2024 / 11223-034	Reference
Amplifier	Micro-International	LSA0510-200	Reference
DRG Ant.	EMCO	RGA60 / 630	01/03/02
50 ohm load (500W)	Electro Impulse Labs	DA-242A/U, 79400097	Reference
Coaxial Cable	RG-214/U	Random Lengths	Cal Prior to Use

FORM 0010

DNB Engineering, Inc.
SPURIOUS RADIATED SIGNAL MEASUREMENTS
(Ref. Part 2, Subpart J, 2.1053 and 2.1057)

Date	14-Mar-01
Customer	Electrocom Systems
EUT	RF Amplifier
P/N	HPA8
S/N	N/A
Pass/Fail	Pass
Operating Mode	FM
Test Engineer	Fred Gurule
Fund. Freq.	858 MHz
Output Power	80 W
Output Impedance	50 ohms
Fund. Field Strength	21.1 V/m
Fund. Field Strength	146.5 dBuV/m
FCC Limit	62.0 dBc

Antenna Polarization	Freq (MHz)	Measured Signal (dBuV)	AF (dB/m)	Cable Loss (dB)	Amp Gain (dB)	Corrected Measurement (dBuV)	Fundamental Field Strength (dBuV/m)	Spurious Below Carrier (dBc)	FCC Limit (dBc)
V	1716	57.6	26.7	2.1	22.0	64.4	146.5	82.1	62.0
V	2574	61.6	28.4	2.5	32.2	60.3	146.5	86.2	62.0
H	3432	55.7	29.9	2.8	31.5	56.9	146.5	89.6	62.0
V	4290	49.9	32.8	3.6	28.8	57.5	146.5	89.0	62.0
V	5148	54.7	34.5	4.3	28.1	65.4	146.5	81.1	62.0
V	6006	50.8	35.1	4.5	29.4	61.0	146.5	85.5	62.0
V	6864	48.0	36.8	4.9	28.9	60.8	146.5	85.7	62.0
H	7722	41.4	36.9	5.3	29.4	54.2	146.5	92.3	62.0
H	8580	38.1	37.5	5.4	23.7	57.3	146.5	89.2	62.0

2.1055 Measurement of Frequency Stability

The EUT is a power amplifier and contains no circuitry for generating or stabilizing the RF signal. The driver will be responsible for this task.

2.1057 Frequency Spectrum to be Investigated

The Frequency was searched from the lowest radio frequency generated in the equipment through the 10^{th} harmonic of the carrier frequency.