

**Application for Certification  
For an RF Power Amplifier**

**EMR Corporation  
22402 N. 19<sup>th</sup> Ave  
Phoenix, AZ 85207**

**RF Power Amplifier:**

**Part # 150-30**

**FCC ID: M7G-VHF150-30**

**REPORT # RC054739/00047**

This report was prepared in accordance with the requirements of the FCC Rules and Regulations Part 2, Subpart J, 2.981 through 2.1005, Part 22, Part 90 and other applicable sections of the rules as indicated herein.

**Prepared By:**

**Jake Tynes**

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

14 JANUARY 2000  
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## 1.0 ADMINISTRATIVE DATA

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### 1.1 Certifications and Qualifications

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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

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The test data presented in this report has been acquired using the guidelines set forth in FCC Part 2.981 through 2.1005, Part 22, 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. 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.



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**2.983(a) Request for Type Acceptance**

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Name of Applicant: EMR Corporation  
22402 N. 19<sup>th</sup> Ave  
Phoenix, AZ 85027

Applicant is:  Manufacturer  
 Vendor  
 Licensee  
 Prospective Licensee  
 Other

Name of Manufacturer: EMR Corporation

**2.983(b) Equipment Description**

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The EUT is a RF Power Amplifier

Part Number: 150-30

FCC ID: M7G-VHF150-30

**2.983(c) Anticipated Production Quantity**

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One Unit  
 Multiple Units

**2.983(d) Technical Description**

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See the Service Manual Included in Appendix B herein for the complete description.

**2.983(d)(1) Type(s) of Emissions**

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F3E

**2.983(d)(2) Frequency Range**

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150 MHz to 170 MHz

**2.983(d)(3) Operating Power Level**

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30 Watts

**2.983(d)(4) Maximum Power Allowed in Applicable Part(s) of the Rules**

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RULES PART	MAXIMUM POWER (WATTS)
Part 22.757	500 Watts
Part 90.35	500 Watts

**2.983(d)(5) Final RF Amplifier Input Power**

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1 - 6 Watts

**2.983(d)(6) Function of all Active Circuit Devices**

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Please Refer to Appendix B.

**2.983(d)(7) Circuit Diagram**

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Refer to Figure in Appendix B.

**2.983(d)(8) Instruction Book(s)**

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Refer to Appendix B.

**2.983(d)(9) Tune-Up Procedure**

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Refer to Appendix B.

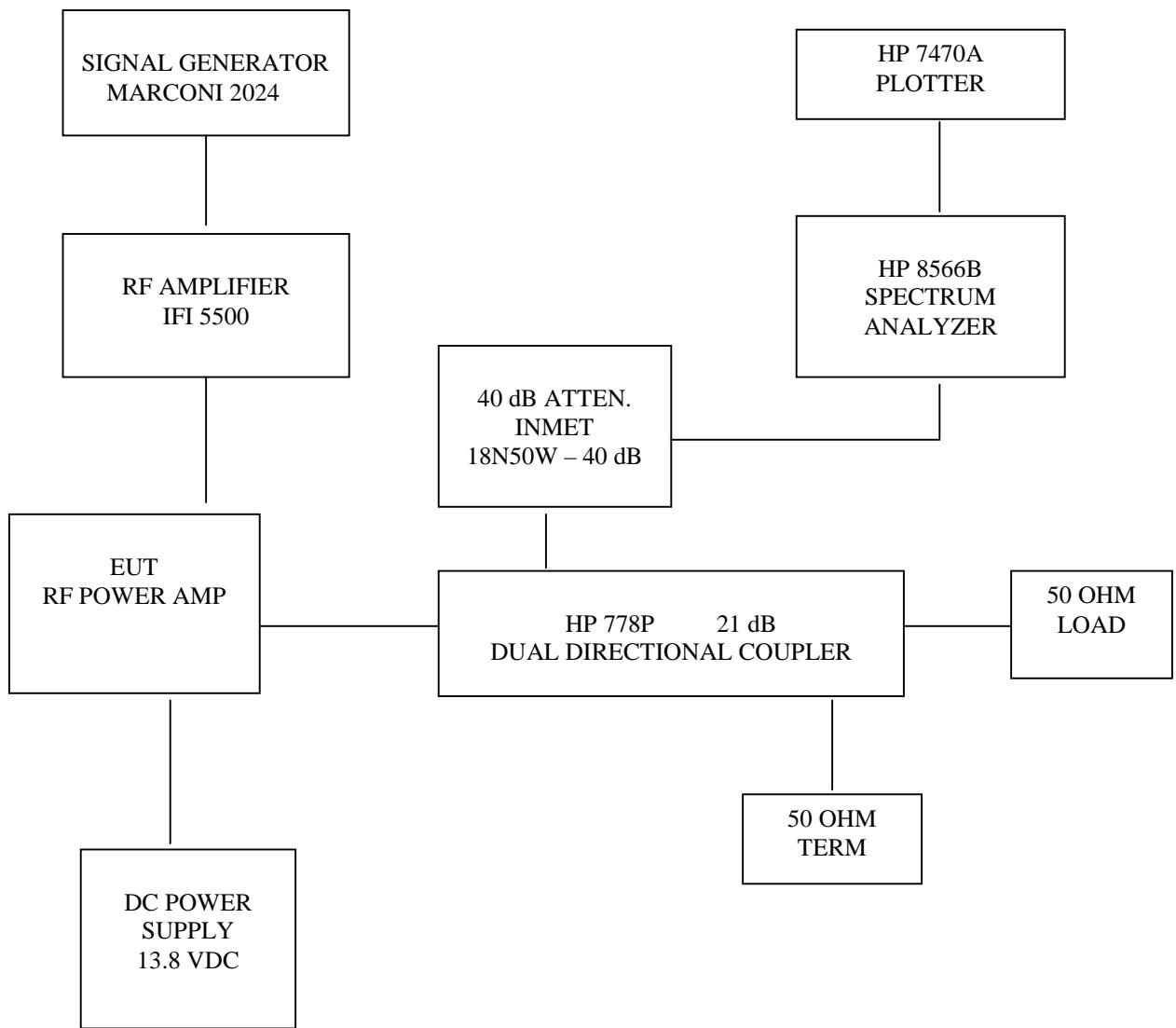
**FIGURE 1: Circuit Diagram 2.983(d) (7)**

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**SEE FIGURE IN APPENDIX B.**

**FIGURE 2: Block Diagram  
(Power Input/Output tests)**

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## 2.983(e) Test Data

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Refer to 2.983(e) (1) through 2.983(e) (7).

### 2.983(e)(1) Measurement of RF Power Output per 2.985

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Definition: For RF Power Amplifiers.

Test Method: See FIGURE 2.

Output Power Is measured across a precision 50 ohm load with a wide band sampling RF Voltmeter.

Test Results:

#### POWER OUTPUT

FREQUENCY	NOMINAL VOLTAGE	85% VOLTAGE	115% VOLTAGE
	13.8 VDC	11.73 VDC	15.87 VDC
159 MHz	30 Watts	24 Watts	33 Watts

**2.983(e)(2) Measurement of Modulation Characteristics per 2.987(b)  
(1)**

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This EUT is a Power Amplifier and contains no circuitry to modify the RF signal provided by the driver except to raise the power level.

## 2.983(e)(3) Measurement of Occupied Bandwidth per 2.989

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### Definition:

Occupied Bandwidth, that is the frequency bandwidth such that, below its upper frequency limits, the mean power radiated by a given emission.

### Test Method: Connect the Equipment per FIGURE 3.

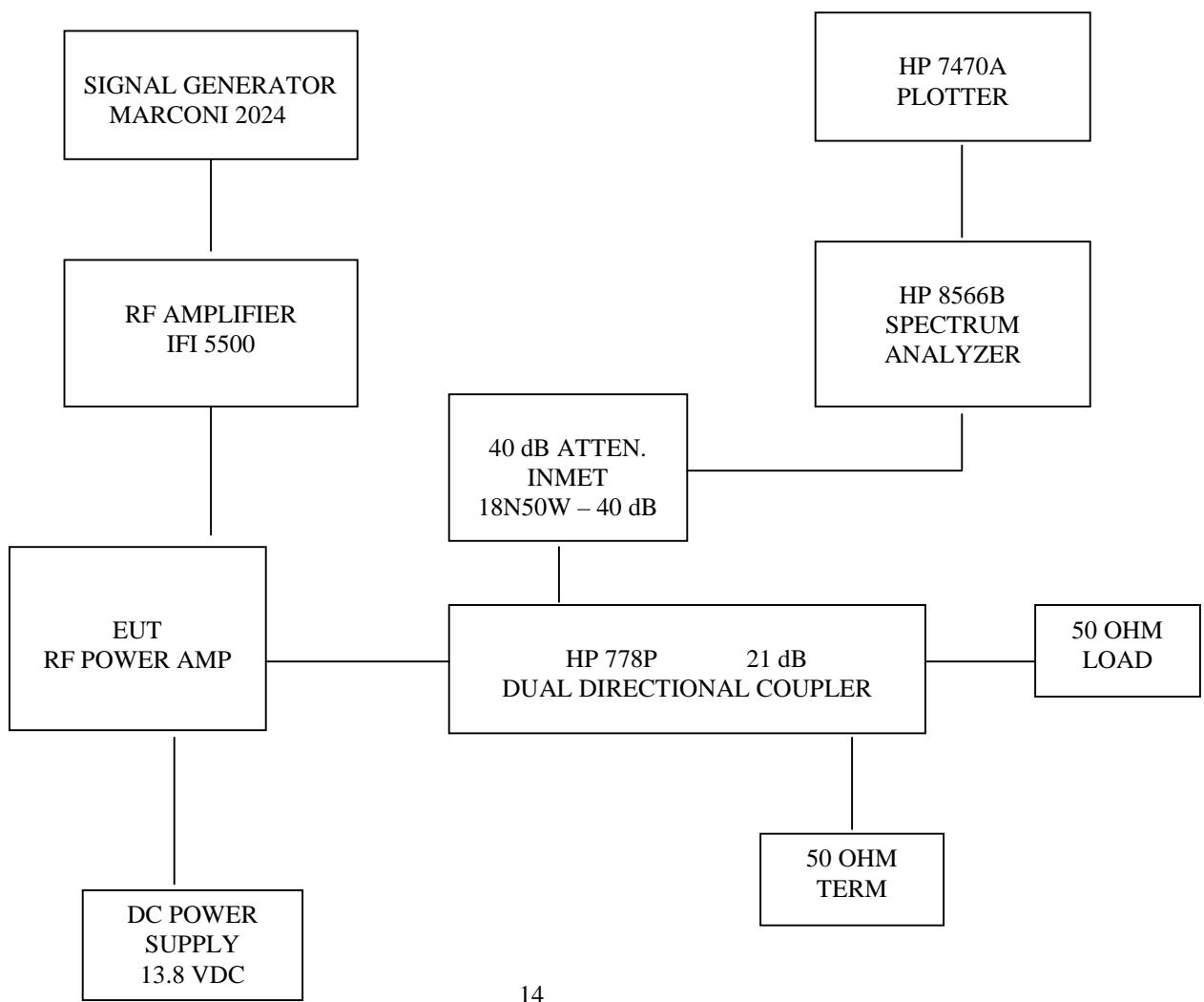
Measurements were made with the modulating signal at 2.5 kHz with 5 kHz of FM deviation.

### Test Results: See Plots following FIGURE 3.

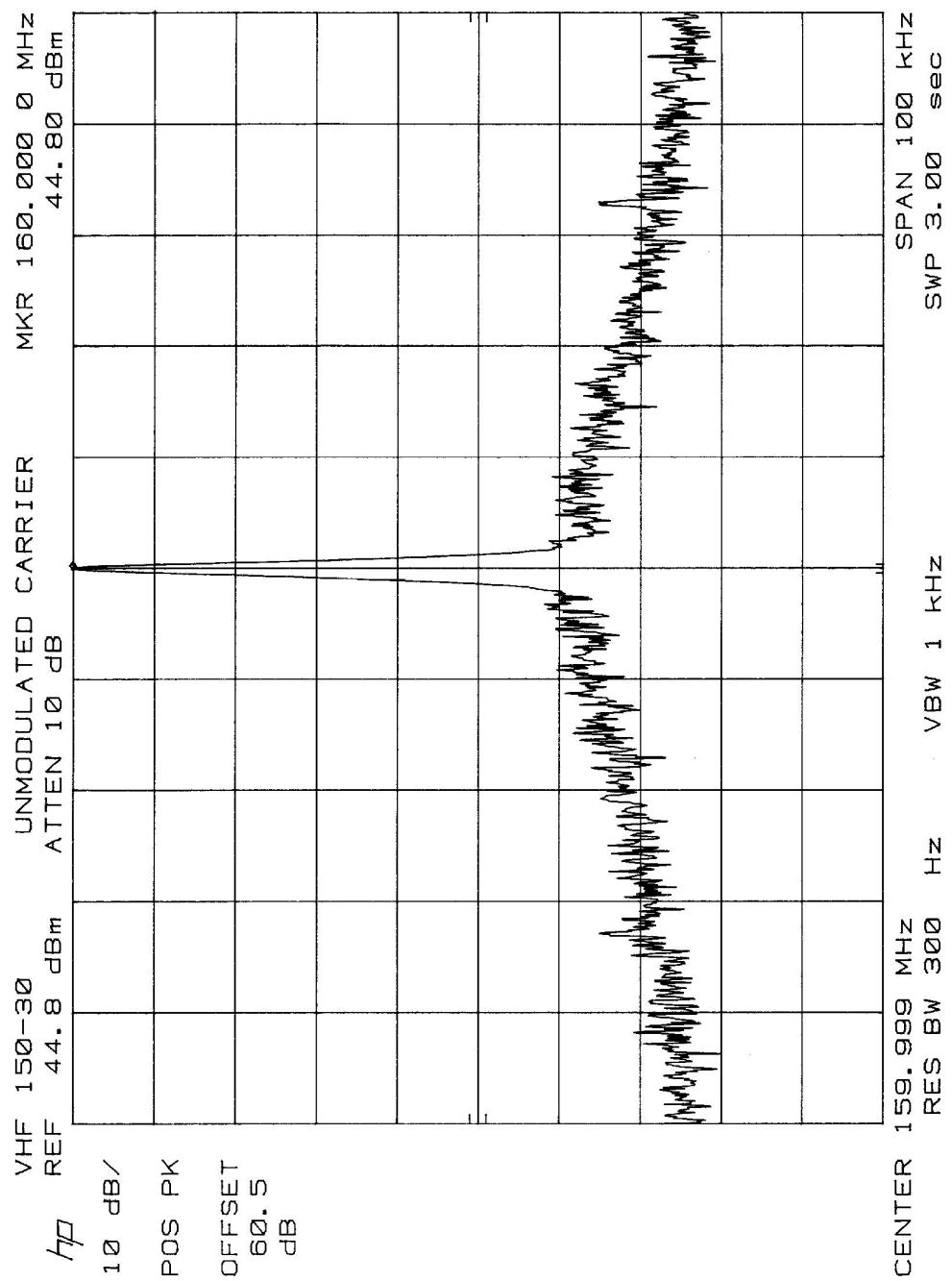
The center frequency of the signal did not shift with modulation. The Spectrum Bandwidth was well within the limits specified in the FCC Regulations.

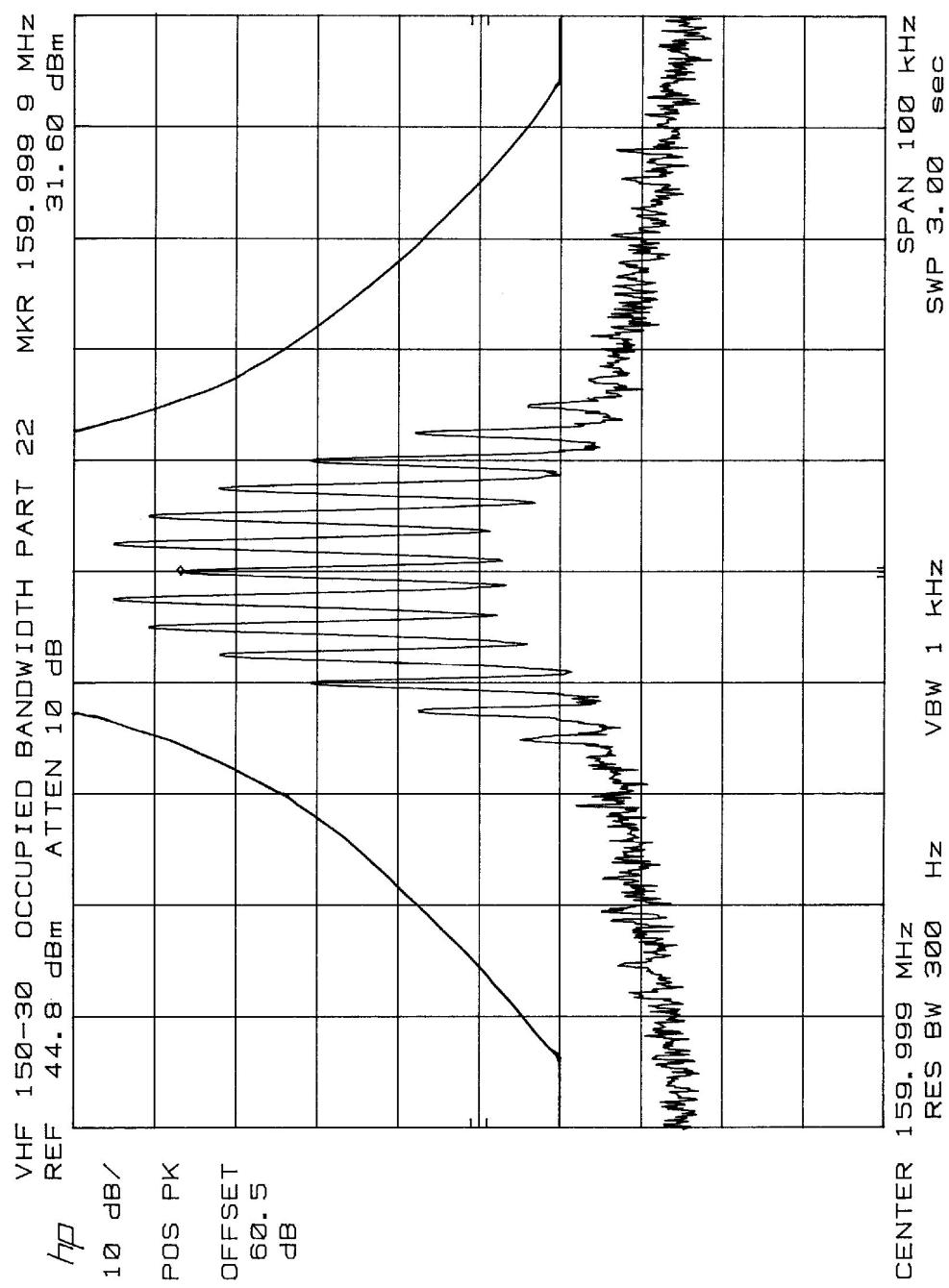
**FIGURE 3: Block Diagram  
(Occupied Bandwidth tests)**

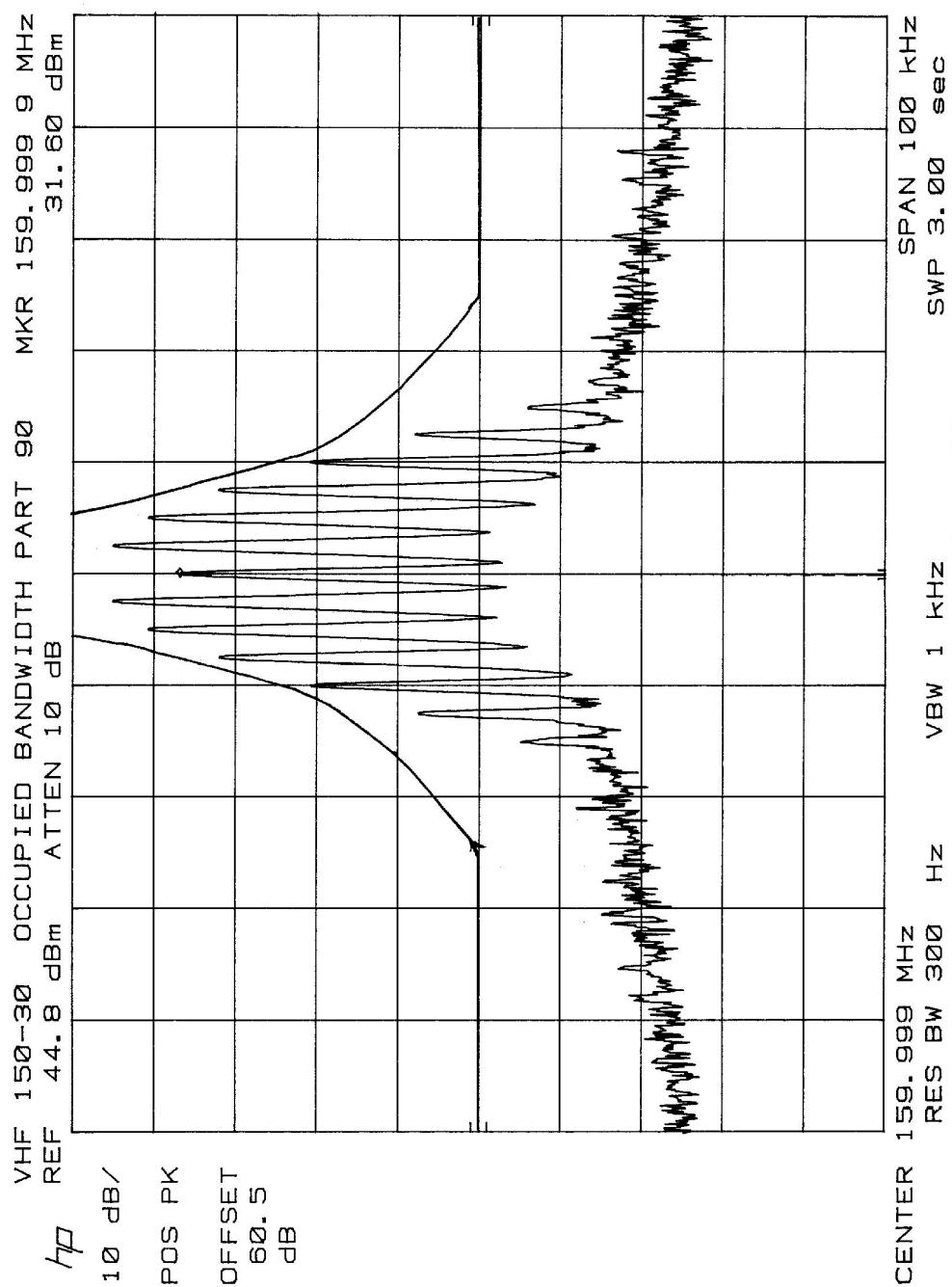
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FCC ID: M7G-VHF150-30







2.983(e)(4) Measurement of Antenna Conducted Spurious Emissions  
per 2.991

**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:

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

Where  $P_o$  = Output in Watts

$$= 43 + 10 \log_{10} (30)$$

$$= 57.8 \text{ dB}$$

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

Connect the equipment as shown in FIGURE 4.

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.

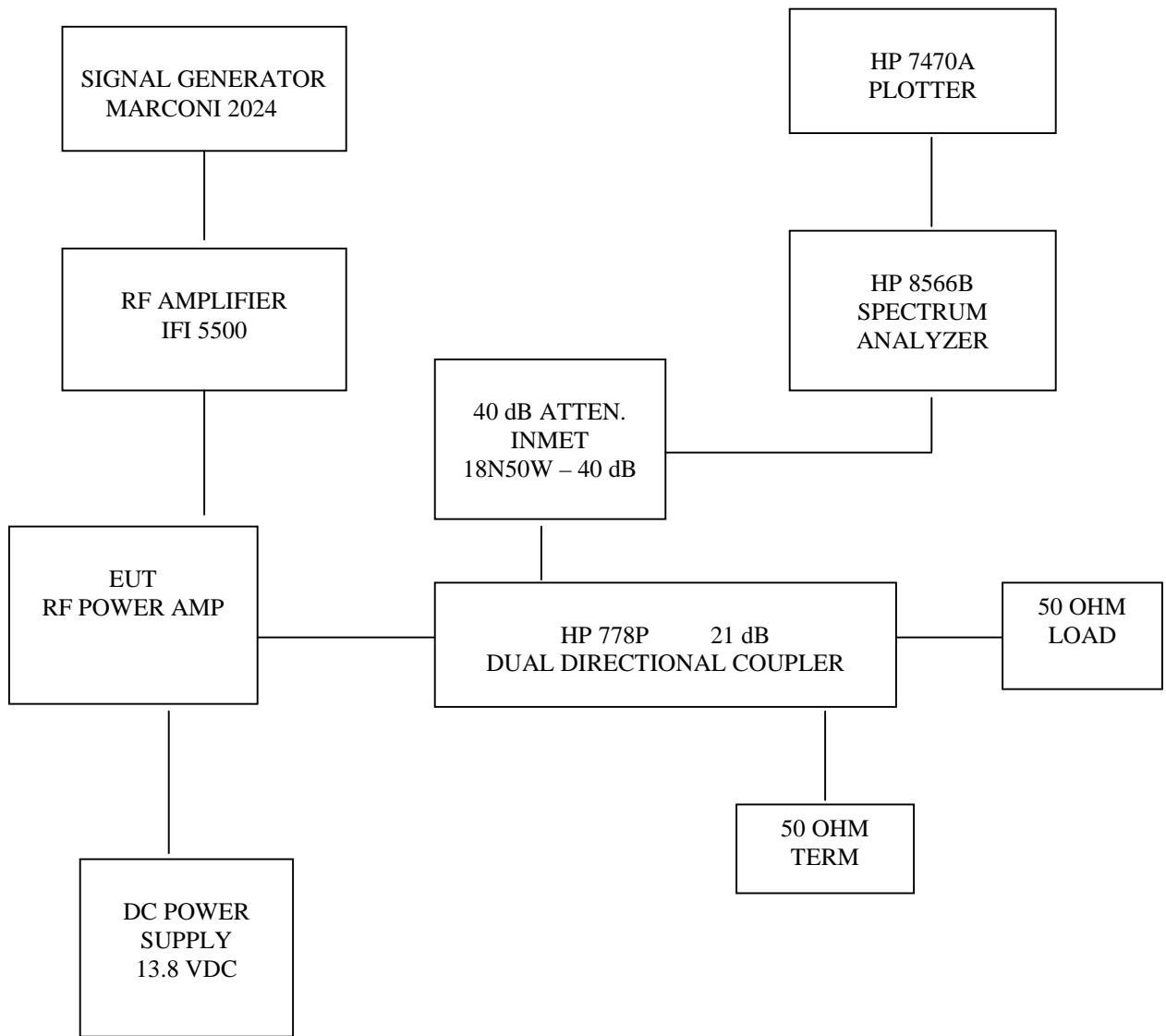
Scan the frequency spectrum from the lowest radio frequency generated in the equipment through the 10<sup>th</sup> harmonic of the carrier frequency.

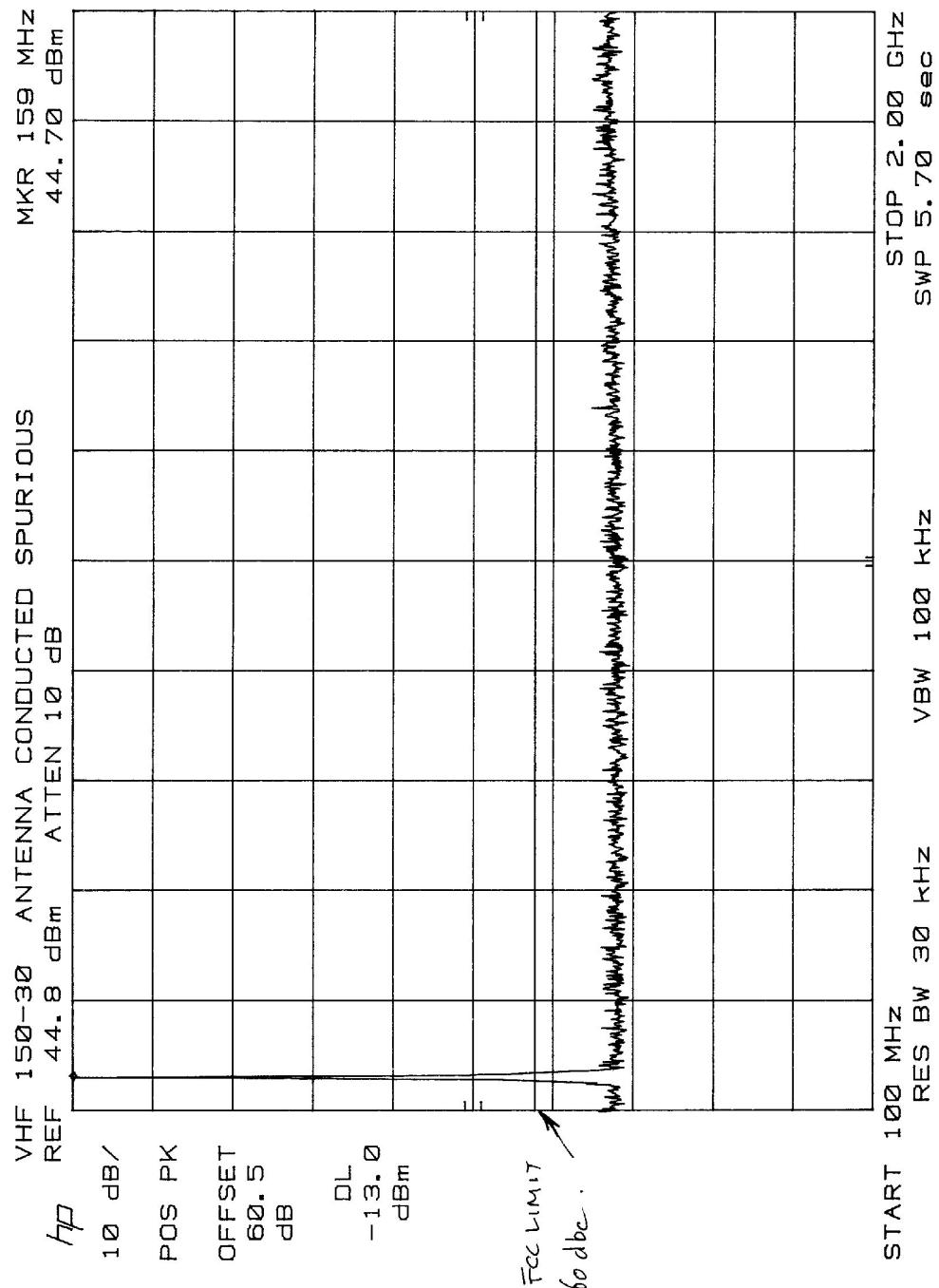
**Test Results:** See Plots following FIGURE 4.

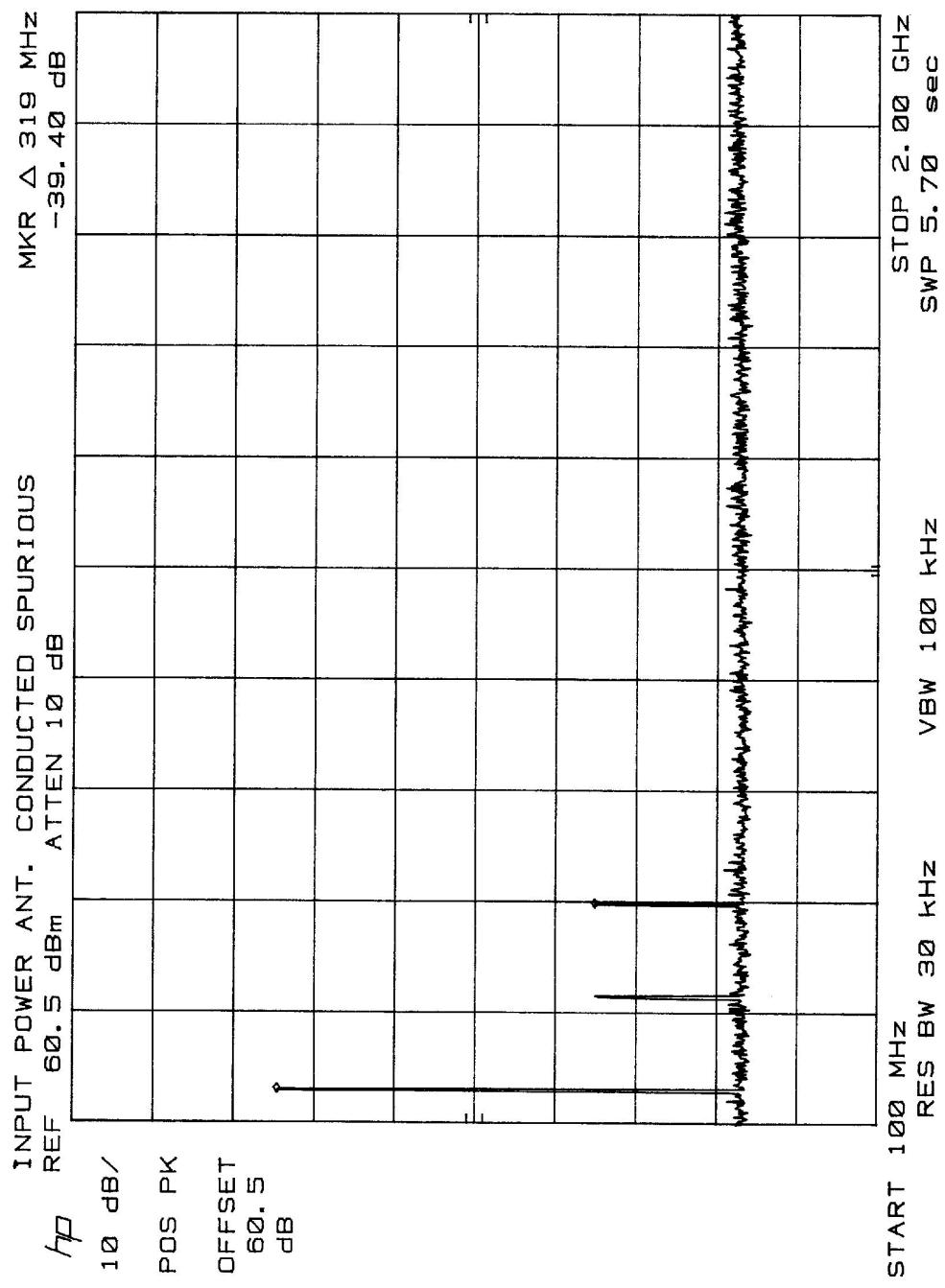
All spurious antenna conducted emissions are below the FCC Specifications.

**FIGURE 4: Block Diagram**

## (Spurious Emissions tests)







**2.983(e)(5) Measurement of Radiated Spurious Emissions per 2.993**

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**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<sup>th</sup> 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 I on following Page.

All radiated spurious emissions are below the FCC Specifications.

## SPURIOUS RADIATED SIGNAL MEASUREMENTS

(Ref: part 2, Subpart j, 2.991 &amp; 2.993)

DATE 01/06/2000 TEST PROCEDURE \_\_\_\_\_  
 EUT RF Power Amplifier PARAGRAPH \_\_\_\_\_  
 MODEL# VHF 150-30 OPERATION MODE \_\_\_\_\_  
 SERIAL# \_\_\_\_\_ TEST ENGINEER Fred Gurule  
 PASS X FAIL \_\_\_\_\_ (AT FREQUENCY \_\_\_\_\_)

FREQUENCY TUNED TO 1600 MHz

ANT POS.	FREQ. (MHz)	SPECTRUM ANALYZER (dB $\mu$ V)	ANT. FACTOR (dB)	CABLE LOSS (dB)	AMP. GAIN (dB)	FIELD STRENGTH (dB $\mu$ V/m)	FUND. FIELD STRENGTH (dB $\mu$ V/m)	SPURIOUS BELOW CARRIER (dBc)
H	320	42.8	14.8	1.8	22	37.4	142.2	104.81
H	480	40.1	17.6	2.2	22	37.9	142.2	104.31
H	640	28.6	19.5	2.5	22	28.6	142.2	113.61
V	800	22.9	21.5	3	22	25.4	142.2	116.81
H	960	19.3	23	3.3	22	23.6	142.2	118.61
V	1120	35.4	25.3	3.6	22	42.3	142.2	99.91
V	1280	49.9	26.8	3.9	22	58.6	142.2	83.61
V	1440	51.2	28	4.3	22	61.5	142.2	80.71
V	1600	40.8	29.7	4.7	22	53.2	142.2	89.01

$$\text{FUNDAMENTAL FIELD STRENGTH (V/m)} = 1/3 (R_o \times P_o)^{1/2} \quad 1/3 (50 \times 30)^{1/2} = 12.9 \text{ V/m}$$

$R_o$  = AMPLIFIER OUTPUT IMPEDANCE (Ohm) 50

$P_o$  = AMPLIFIER OUTPUT POWER (WATTS) 30

$$\text{FCC LIMIT} = 43 + 10 \log(P_o) = (\text{dBc}) \quad 43 + 10 \log(30) = 57.8 \text{ dBc}$$

$$\text{CONVERSION FROM } \mu\text{V/m TO dB}\mu\text{V/m} : \text{dB}\mu\text{V/m} = 20 \log(\mu\text{V/m}) \quad 120 + 20 \log(12.9) = 142.2 \text{ dB}\mu\text{V/m}$$

FCC RE

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**2.983(e)(6) Measurement of Frequency Stability per 2.995**

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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.

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**2.983(e)(7) Frequency Spectrum to be investigated per 2.997**

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The Frequency was searched from the lowest radio frequency generated in the equipment through the 10<sup>th</sup> harmonic of the carrier frequency.

2.983(f) FCC ID: Label

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<b>RF POWER AMPLIFIER</b>	
<b>MODEL NO.</b>	<b>FREQ</b>
<b>VOLTAGE</b>	<b>OUTPUT PWR</b>
<b>FCC ID: M7G-VHF150-30</b>	<b>SERIAL NO.</b>

**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.

**2.983(g) Photographs and/or Drawings showing equipment construction techniques**

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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 View

Photo 4      External ¾ View

Photo 1 Main Circuit Board (Overall View)

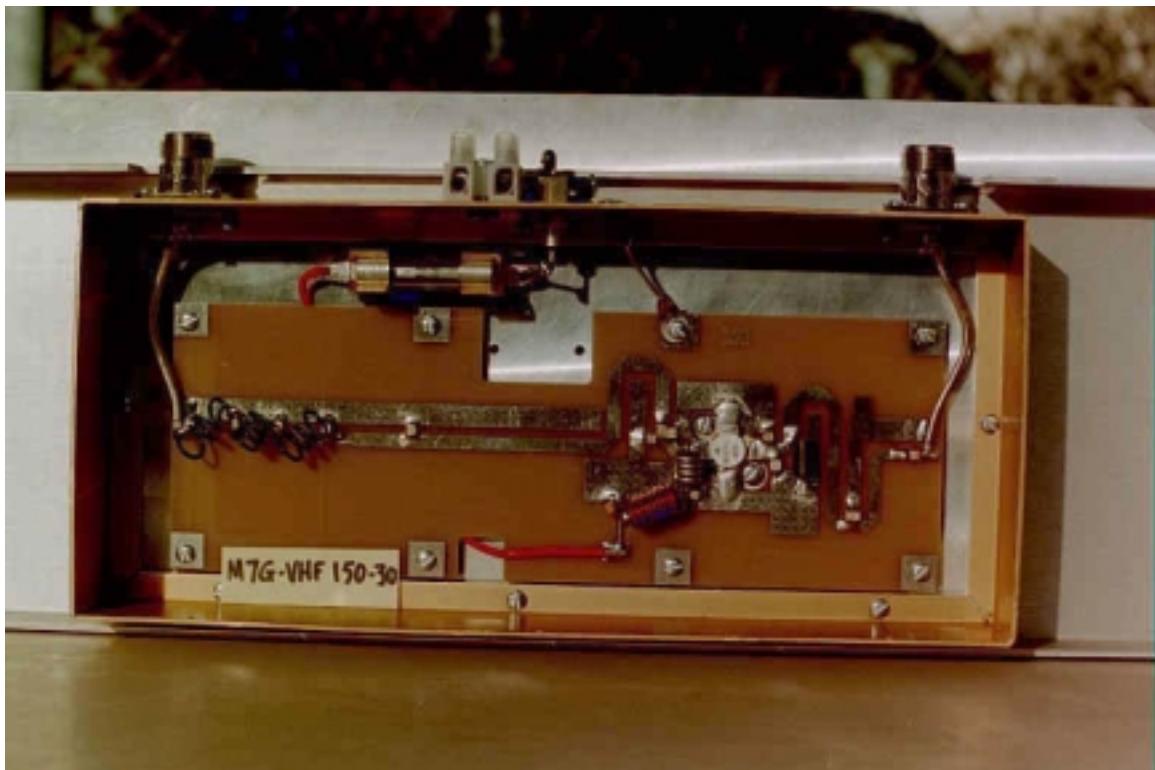
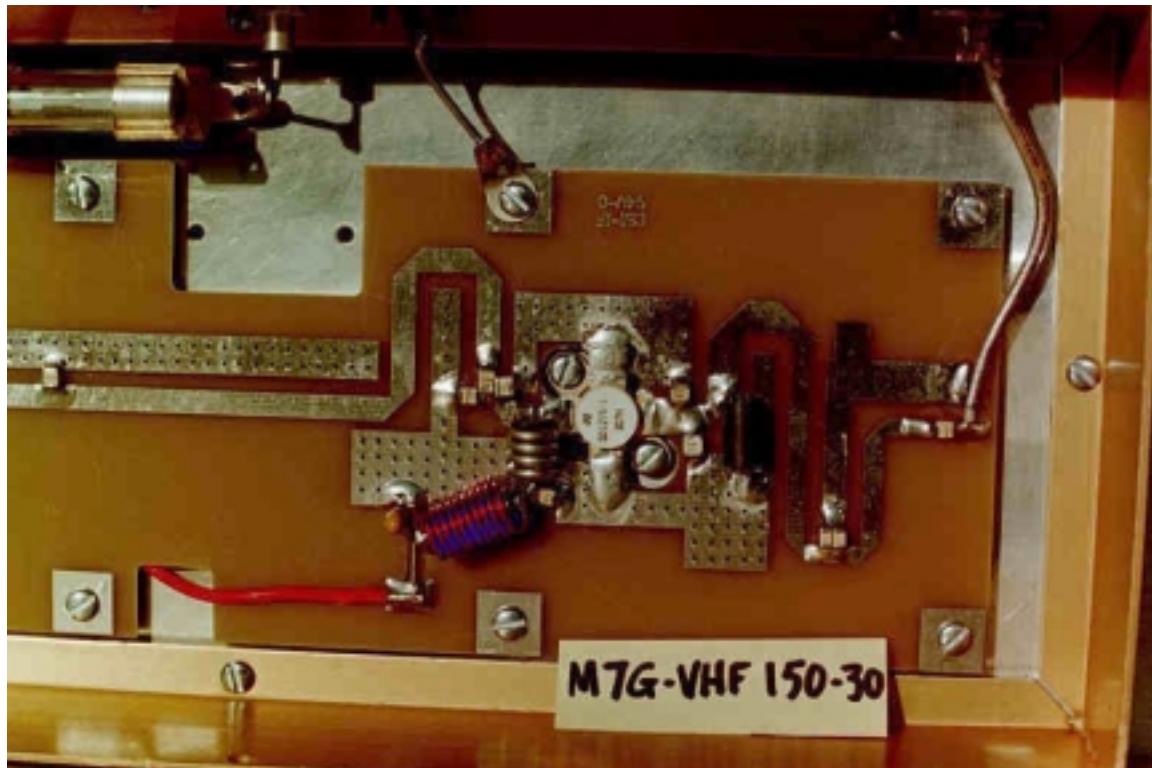


Photo 2 Main Circuit Board (Detail)



**Photo 3      External Front View**

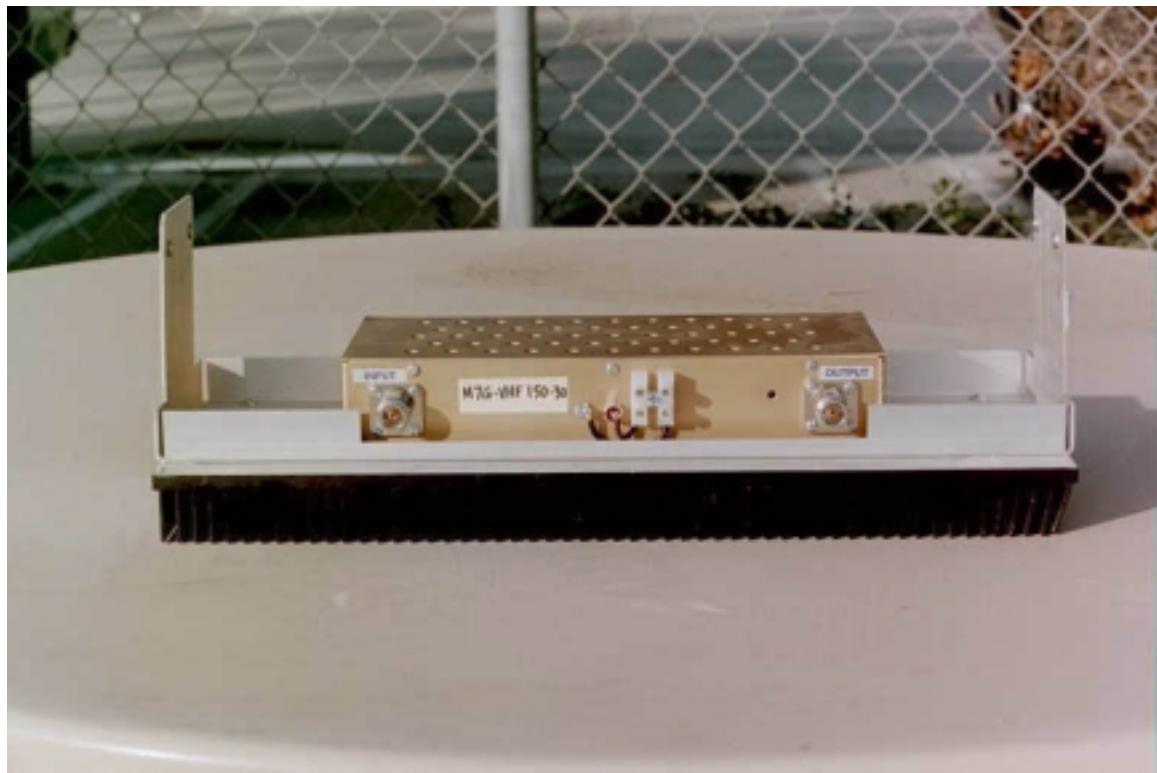
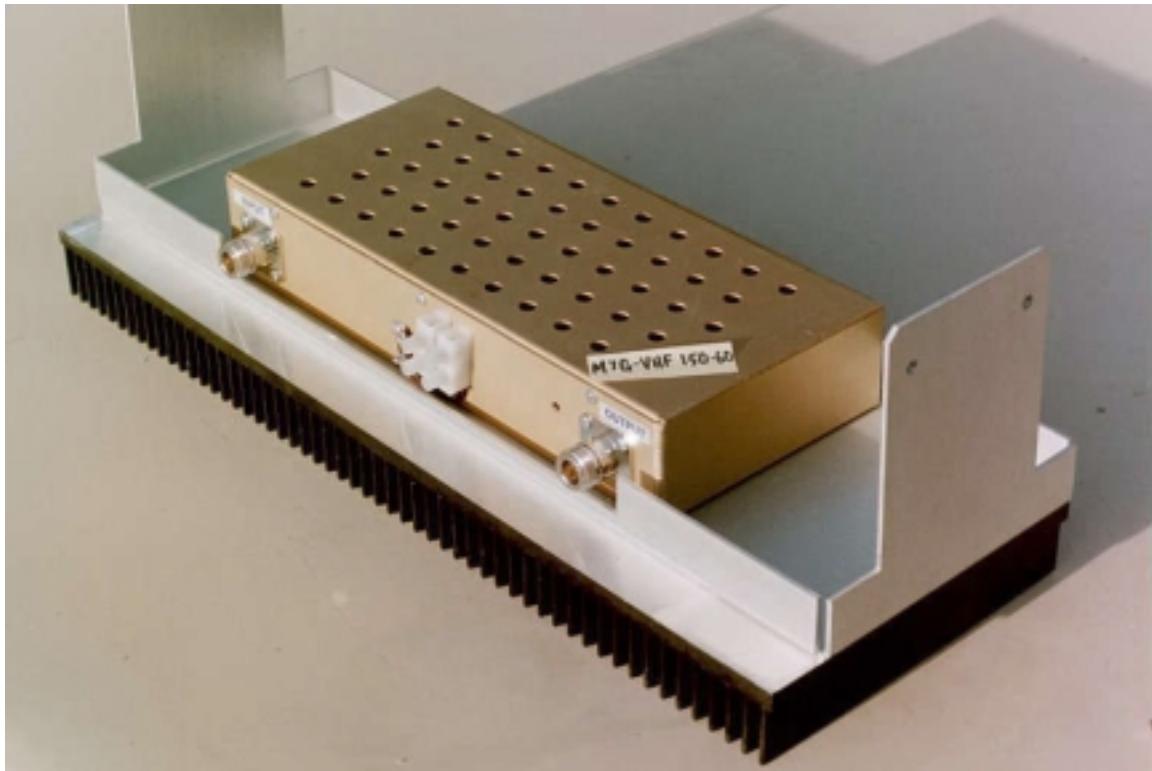


Photo 4      External 3/4 View



**2.983(h) Description and Test Data for Encoding Device(s)**

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This section does not apply to the EUT.

**2.983(i) Type Acceptance Data for an External Power  
Amplifier used in Amateur Radio Service – Part 97**

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This section does not apply to the EUT.

FCC ID: M7G-VHF150-30

**APPENDIX A**  
**TEST EQUIPMENT**

## TEST EQUIPMENT LOG

### TYPE OF TEST: FCC CERTIFICATION

Date: 01/06/2000

Test Procedure: Part 2, 22,90

EUT: RF Amplifier

Other:

Model # / Serial #: VHF150-30

Test Engineer: Fred Gurule

Description	Manufacturer	Model # /Serial #	Cal. Due Date
Signal Generator	Marconi	2024 / 112236-002	03-17-2000
Spec Analyzer	HP	8566B/2403A06307	02-10-2000
Log Periodic Ant.	A.H. Systems	SAA-200-512 / 347	07-14-2001
Biconical Ant.	A.H. Systems	BIA-25 / 2085	12-28-2001
Pre-Amp.	Mini-Circuits	ZFL-2000 / 01	05-7-2000
Pre-Amp	Mini-Circuits	TF100002	03-31-2000
Plotter	HP	7070A	N/R
Dual Dir. Coupler	HP	778D	Cal @ Time of Test
50 OHM Load	Termaline	8053 / 8945	Cal @ Time of Test
40 dB Atten.	Inmet	18N50W-40Db	Cal @ Time of Test
Power Supply	Acopian	28PTY10AFHP / 6	N/R