Application for Certification
For an RF Power Amplifier

EMR Corporation
22402 N. 19th Ave
Phoenix, AZ 85207

RF Power Amplifier:

Part # 150-60

FCC ID: M7G-VHF150-60

REPORT # RC054740/00047

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

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 2.981 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.

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

2.983(a) Request for Type Acceptance

Name of Applicant:		EMR Corporation 22402 N. 19th Ave Phoenix, AZ 85027
Applicant is:	X	Manufacturer Vendor Licensee Prospective Licensee Other
Name of Manufacturer:		EMR Corporation

2.983(b) Equipment Description

The EUT is an RF Power Amplifier

Part Number: 150-60

FCC ID: M7G-VHF150-60

2.983(c) Anticipated Production Quantity

	One Unit
X	Multiple Units

2.983(d) Technical Description

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

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

F3E

2.983(d)(2) Frequency Range

150 MHz to 170 MHz

2.983(d)(3) Operating Power Level

60 Watts

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

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

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

1 - 6 Watts

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

Please Refer to Appendix B.

2.983(d)(7) Circuit Diagram

Refer to Figure in Appendix B.

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

Refer to Appendix B.

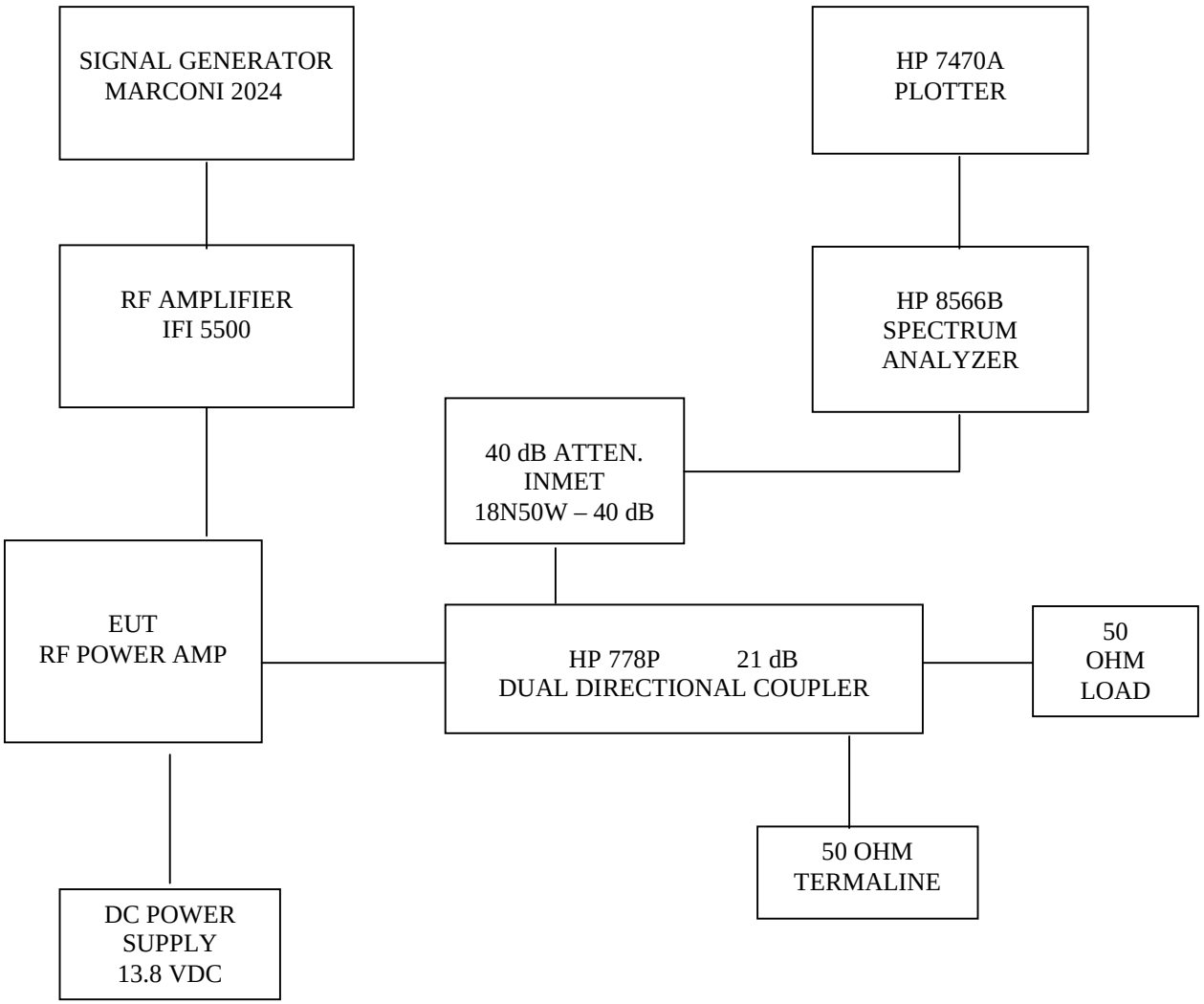
2.983(d)(9) Tune-Up Procedure

Refer to Appendix B.

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

SEE FIGURE IN APPENDIX B.

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



2.983(e) Test Data

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

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

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 13.8 VDC	85% VOLTAGE 11.73 VDC	115% VOLTAGE 15.87 VDC
160 MHz	60 Watts	43 Watts	69 Watts

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

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

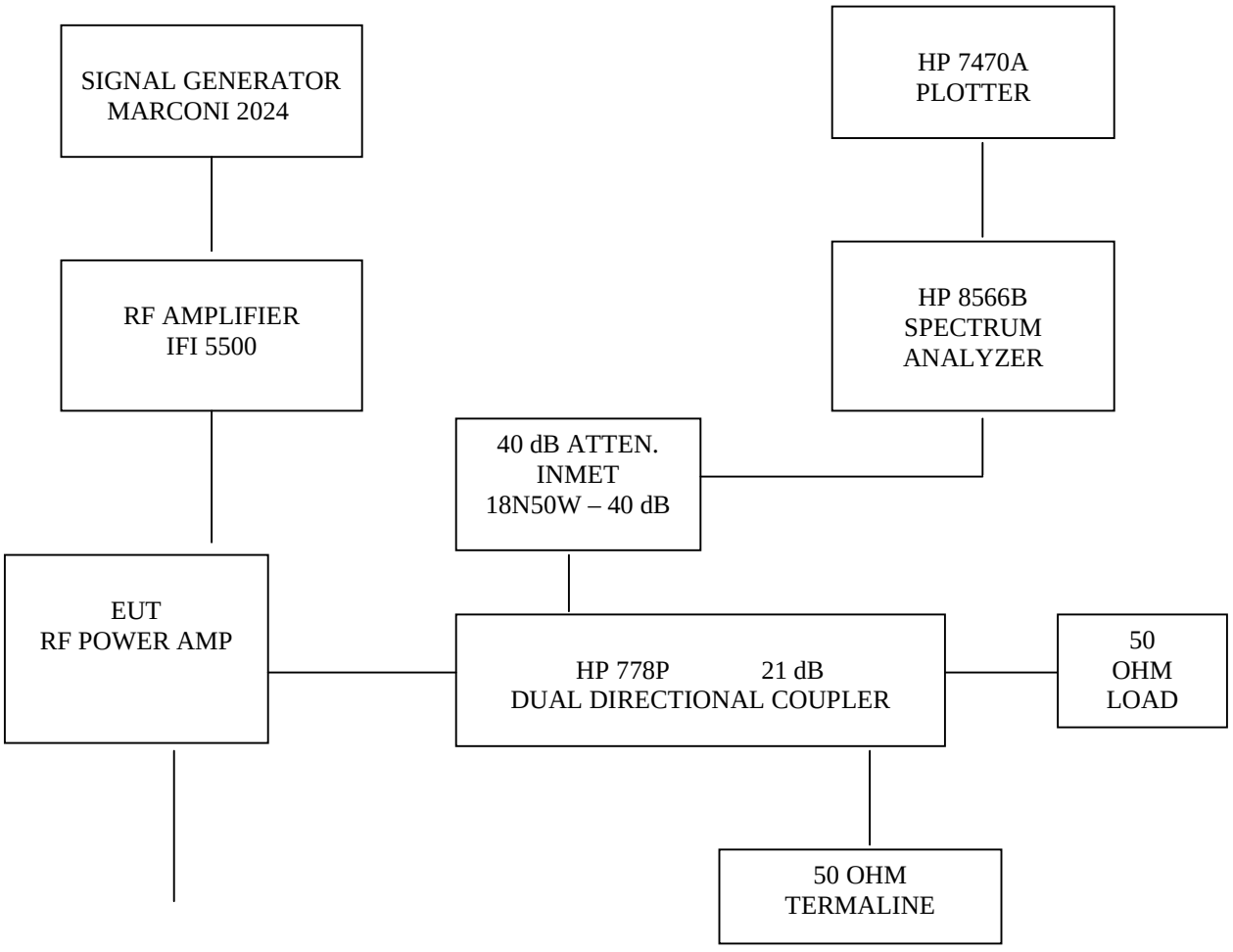
Definition:
Occupied Bandwidth, that is the frequency bandwidth such that, below its upper frequency limits, the mean power radiated by a given emission.

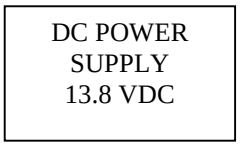
Test Method: Connect the Equipment per FIGURE 3.
Measurements were made with the modulating signal at 2.5 kHz with 5 kHz of FM deviation.

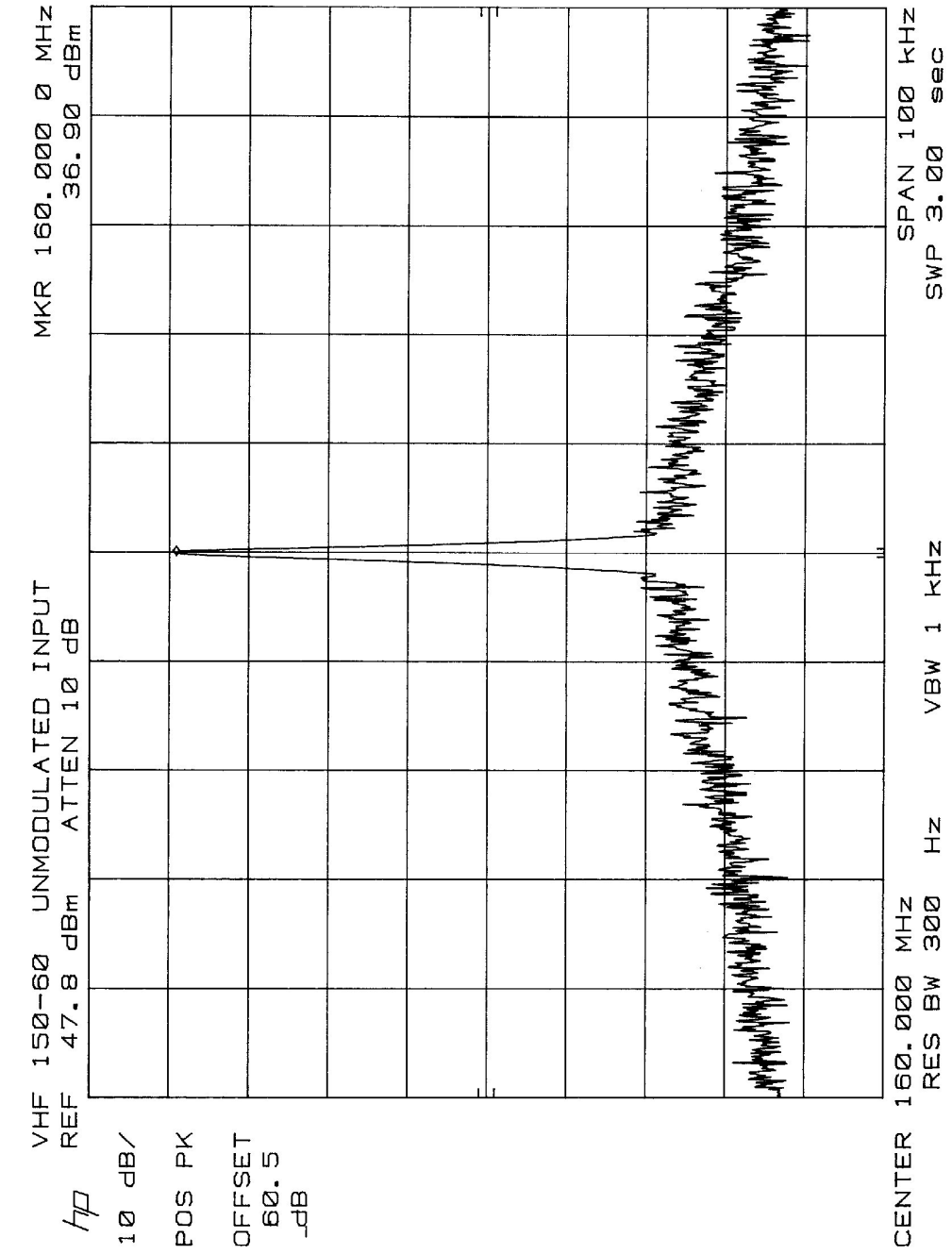
Test Results: See Plots following FIGURE 3.

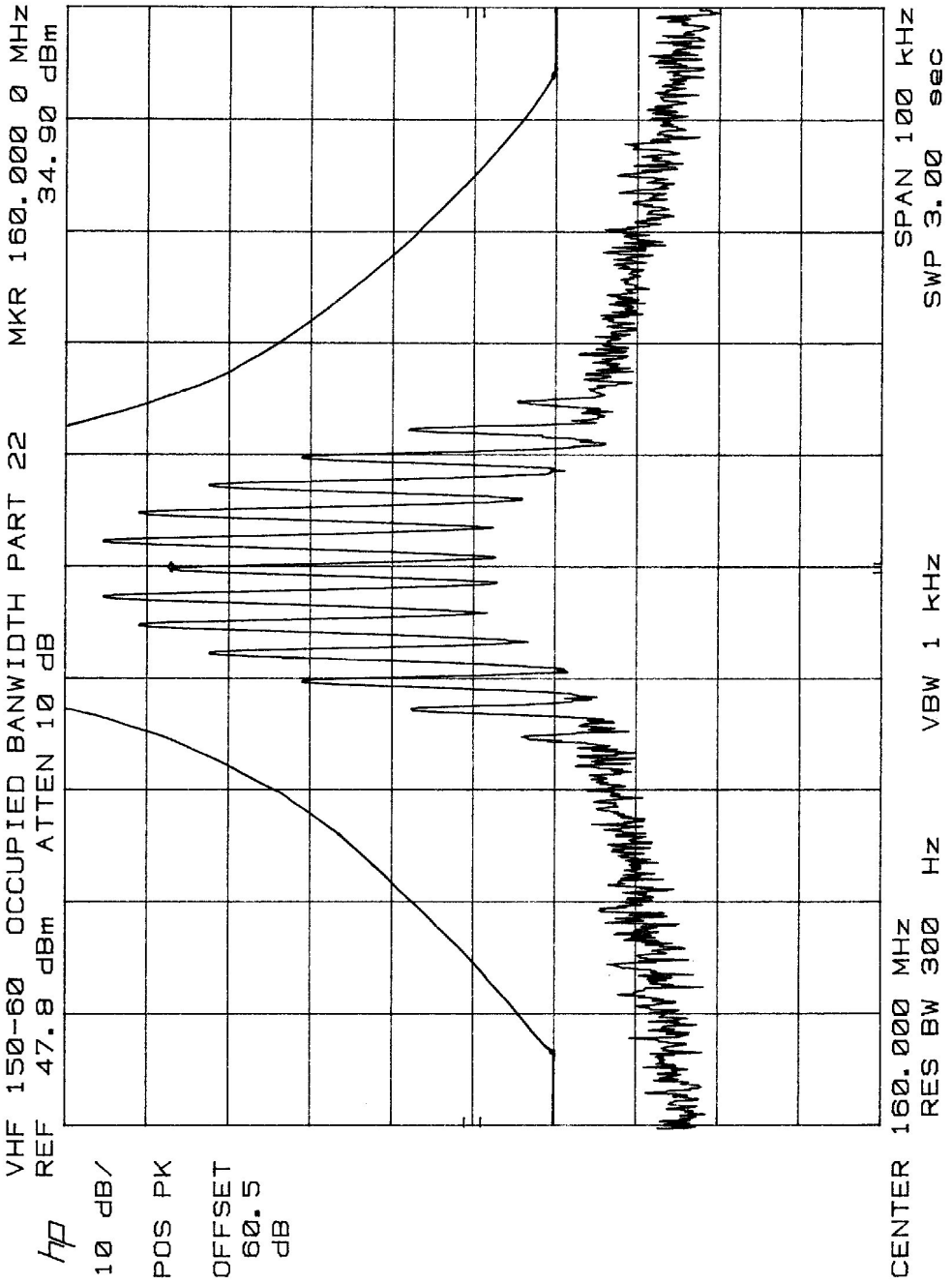
The center frequency of the signal did not shift with modulation. The Spectrum Bandwidth was well within the limits specified in the FCC Regulations.

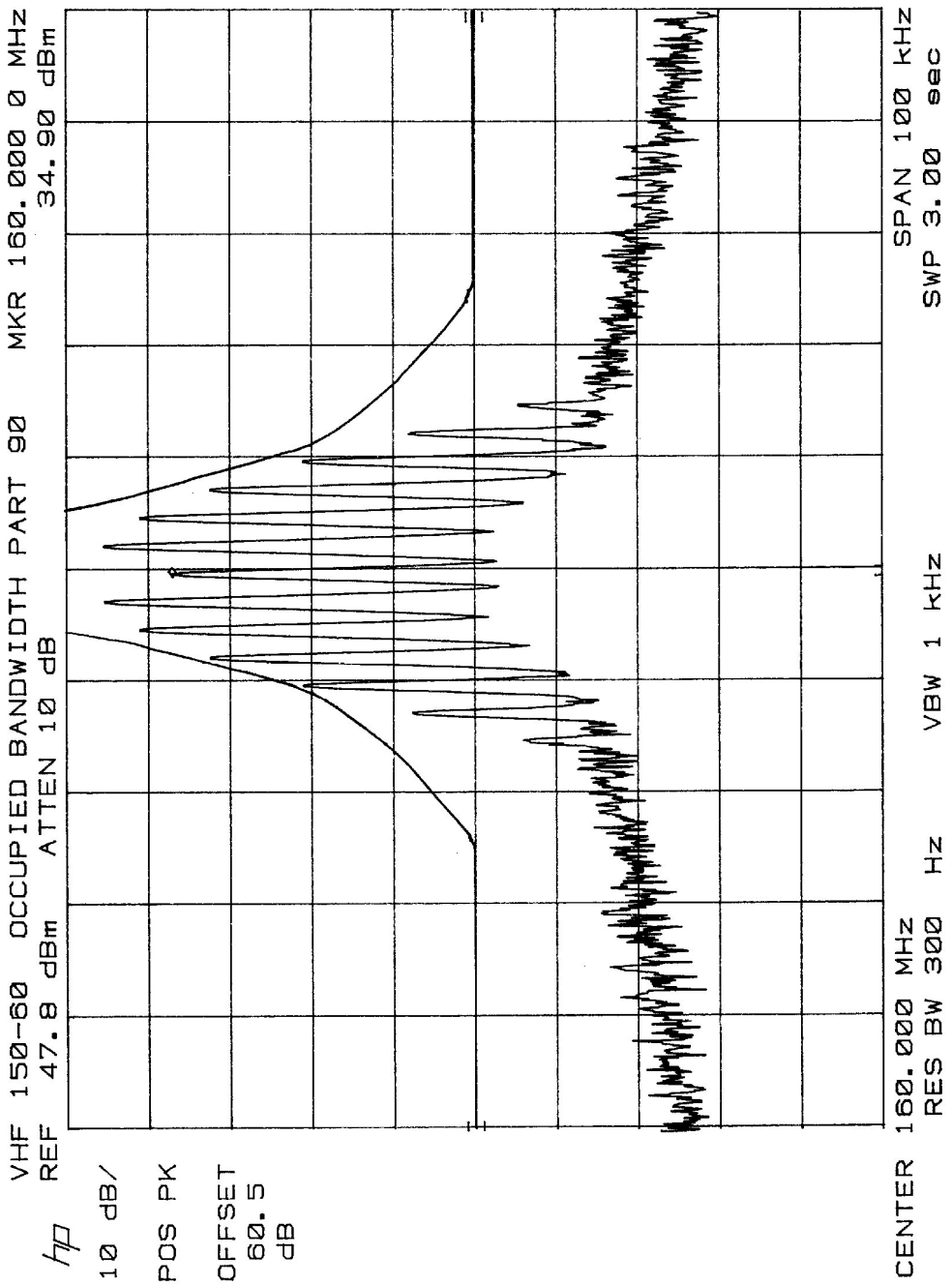
FIGURE 3: Block Diagram
(Occupied Bandwidth tests)




DC POWER
SUPPLY
13.8 VDC


VHF 150-60 UNMODULATED INPUT
REF 47.8 dBm ATTEN 10 dB
MKR 160.000 0 MHz
36.90 dBm
10 dB/
POS PK
OFFSET
60.5
dB
CENTER 160.000 MHz
RES BW 300 Hz
VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec


VHF 150-60 OCCUPIED BANWIDTH PART 22
REF 47.8 dBm ATTEN 10 dB
MKR 160.000 0 MHz
34.90 dBm
10 dB/
POS PK
OFFSET
60.5
dB
CENTER 160.000 MHz
RES BW 300 Hz
VBW 1 kHz
SPAN 100 kHz
SWP 3.00 sec



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:

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

Where Po = Output in Watts

= $43 + 10 \log_{10} (60)$

= 60.8 dB

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

Connect the equipment as shown in FIGURE 4.

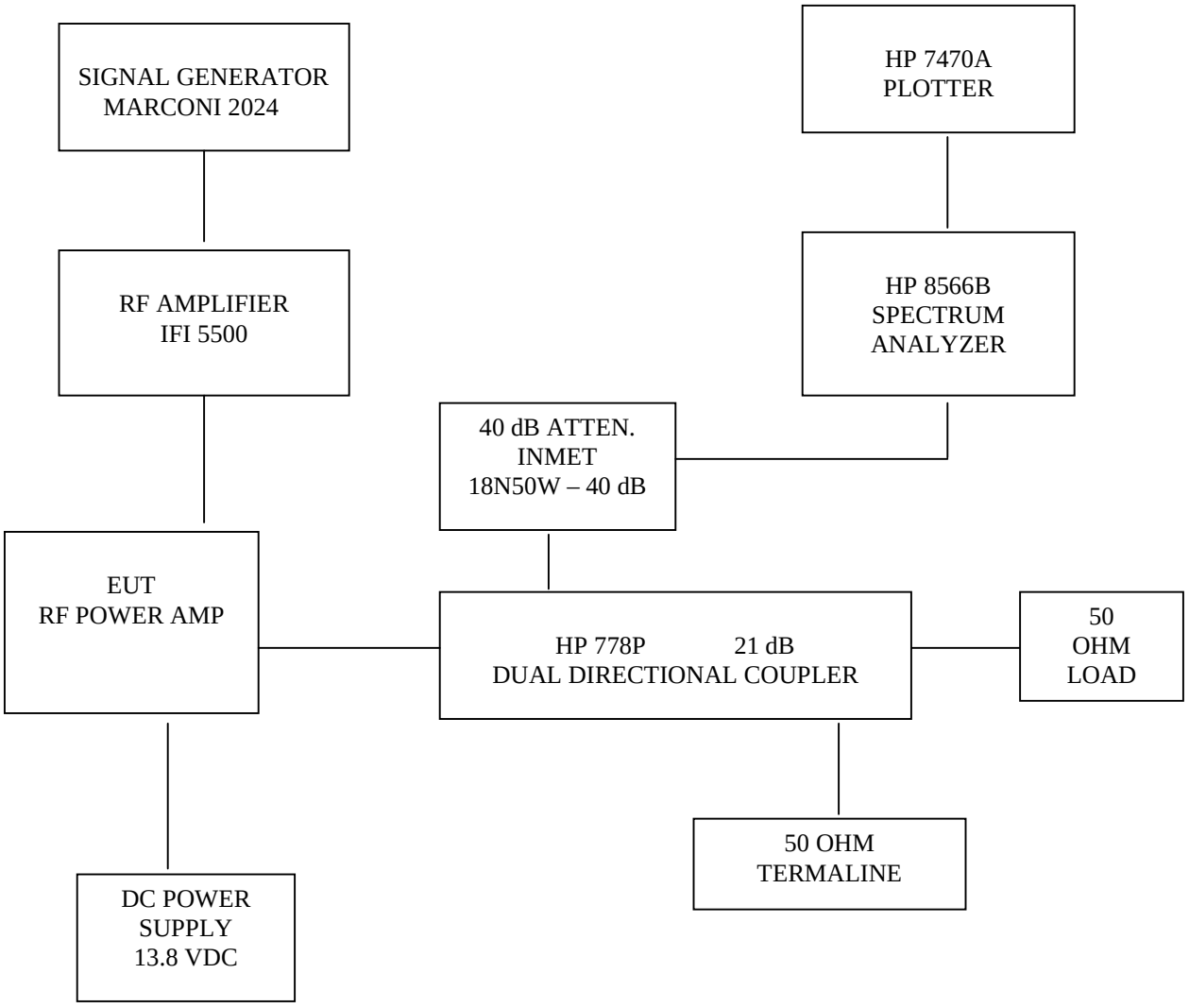
Adjust the Audio Oscillator so that the frequency deviation of the transmitter is a 5 kHz at a modulation frequency of 2.5 kHz. Adjust the Spectrum Analyzer to display the Modulated Carrier.

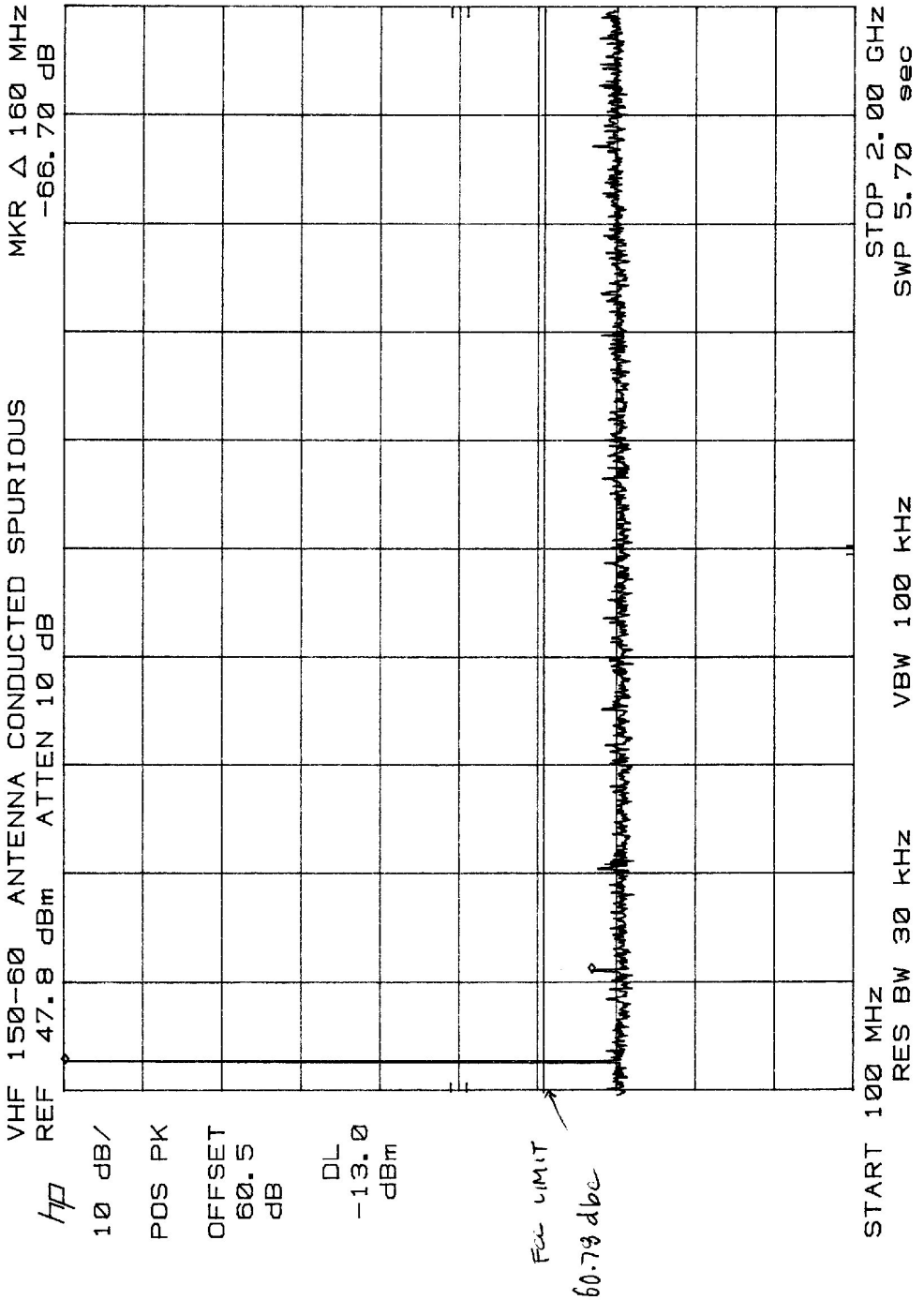
Scan the frequency spectrum from the lowest radio frequency generated in the equipment through the 10^{th} harmonic of the carrier frequency.

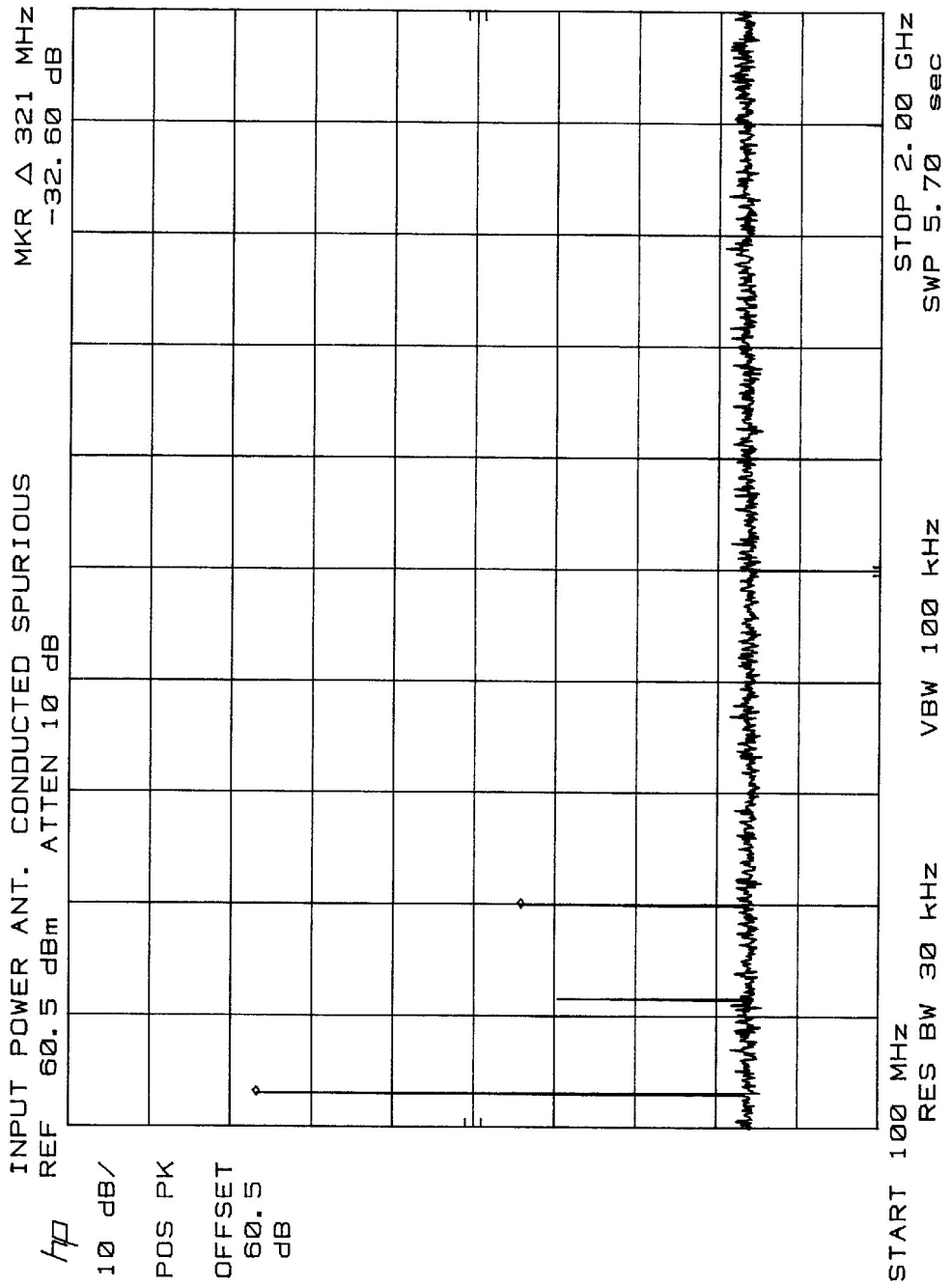
Test Results: See Plots following FIGURE 4.

All spurious antenna conducted emissions are below the FCC Specifications.

FIGURE 4: Block Diagram
(Spurious Emissions tests)


SIGNAL GENERATOR
MARCONI 2024
HP 7470A
PLOTTER
RF AMPLIFIER
IFI 5500
HP 8566B
SPECTRUM
ANALYZER
40 dB ATTEN.
INMET
18N50W – 40 dB
EUT
RF POWER AMP
HP 778P 21 dB
DUAL DIRECTIONAL COUPLER
50
OHM
LOAD
50 OHM
TERMALINE
DC POWER
SUPPLY
13.8 VDC


VHF 150-60 ANTENNA CONDUCTED SPURIOUS
MKR Δ 160 MHz
-66.70 dB
REF 47.8 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
60.5
dB
DL
-13.0
dBm
FCC LIMIT
60.79 dBc
START 100 MHz
RES BW 30 kHz
VBW 100 kHz
STOP 2.00 GHz
SWP 5.70 sec


INPUT POWER ANT. CONDUCTED SPURIOUS
MKR Δ 321 MHz
-32.60 dB
REF 60.5 dBm
ATTEN 10 dB
10 dB/
POS PK
OFFSET
60.5
dB
START 100 MHz
RES BW 30 kHz
VBW 100 kHz
STOP 2.00 GHz
SWP 5.70 sec

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

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 I on following Page.

All radiated spurious emissions are below the FCC Specifications.

SPURIOUS RADIATED SIGNAL MEASUREMENTS

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

DATE 01/06/200 TEST PROCEDURE _____

EUT RF Power Amplifier PARAGRAPH _____

MODEL# VHF 150-60 OPERATION MODE _____

SERIAL# _____ TEST ENGINEER Fred Gurule

PASS X FAIL _____ (AT FREQUENCY _____)

FREQUENCY TUNED TO 160 MHz

ANT POS.	FREQ. (MHz)	SPECTRUM ANALYZER (dBµV)	ANT. FACTOR (dB)	CABLE LOSS (dB)	AMP. GAIN (dB)	FIELD STRENGTH (dBµV/m)	FUND. FIELD STRENGTH (DbµV/m)	SPURIOUS BELOW CARRIER (dBC)
V	320	50.8	14.8	1.8	22	45.4	145.2	99.82
H	480	32	17.6	2.2	22	29.8	145.2	115.42
V	640	28.4	19.5	2.5	22	28.4	145.2	116.82
V	800	15.1	21.5	3	22	17.6	145.2	127.62
V	960	22.6	23	3.3	22	26.9	145.2	118.32
V	1120	27.1	25.3	3.6	22	34	145.2	111.22
V	1280	33	26.8	3.9	22	41.7	145.2	103.52
V	1440	20.7	28	4.3	22	31	145.2	114.22
V	1600	22.1	29.7	4.7	22	34.5	145.2	110.72

FUNDAMENTAL FIELD STRENGTH (V/m) = 1/3 (Ro x Po)½ $\frac{1}{3}(50 \times 60)^{1/2} = 18.2$ V/m

Ro = AMPLIFIER OUTPUT IMPEDANCE (Ohm) 50

Po = AMPLIFIER OUTPUT POWER (WATTS) 60

FCC LIMIT = 43 + 10 LOG (Po) = (dBC) $43 + 10\log(60) = 60.8$ dBc

CONVERSION FROM µV/m TO dBµV/m : dBµV/m = 20 LOG (µV/m) $120 + 20\log(18.2) = 145.2$ dBuV/m

FCC RE

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

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.

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

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

2.983(f) FCC ID: Label

RF POWER AMPLIFIER	
MODEL NO.	**FREQ**
VOLTAGE	**OUTPUT PWR**
FCC ID: M7G-VHF150-60	**SERIAL NO.**

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

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)

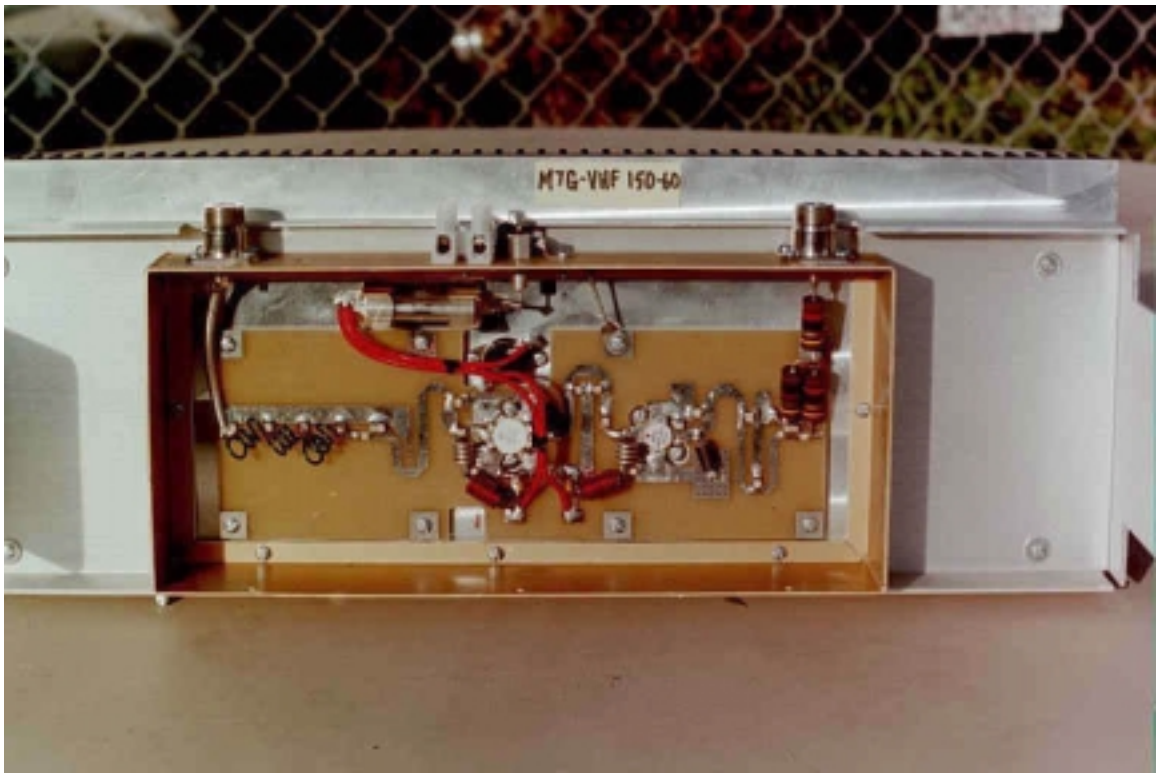


Photo 2 Main Circuit Board (Detail)

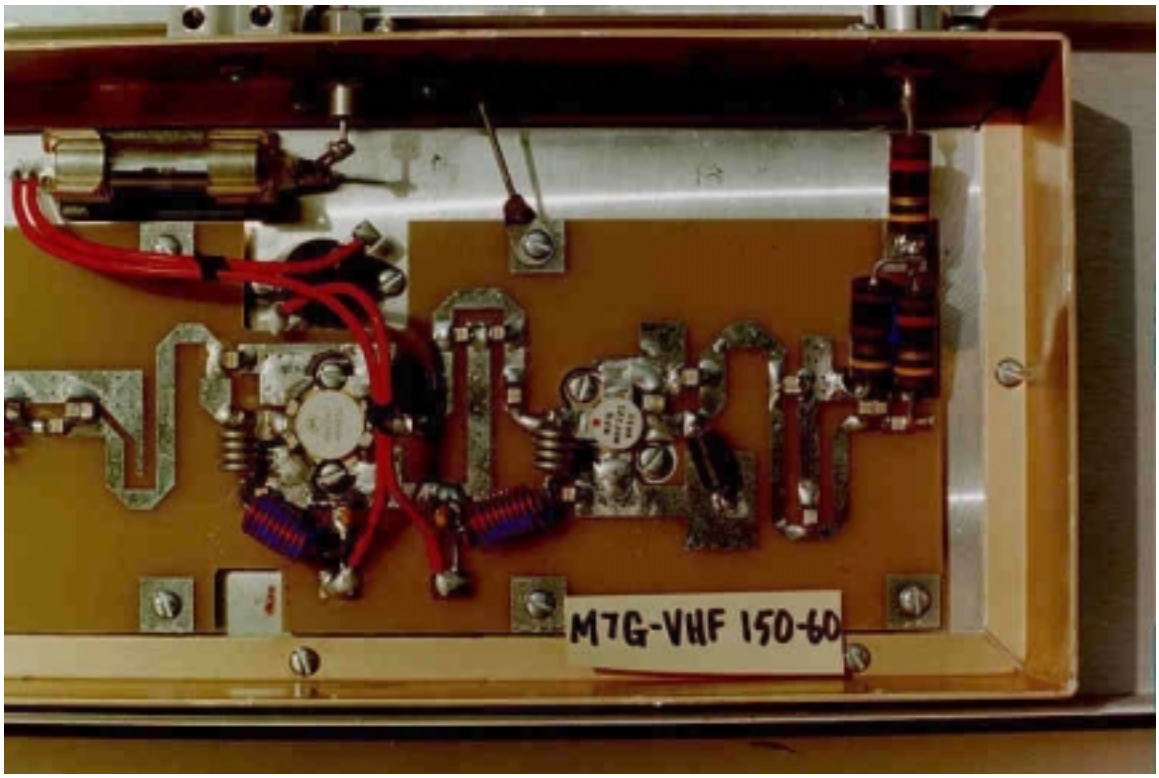
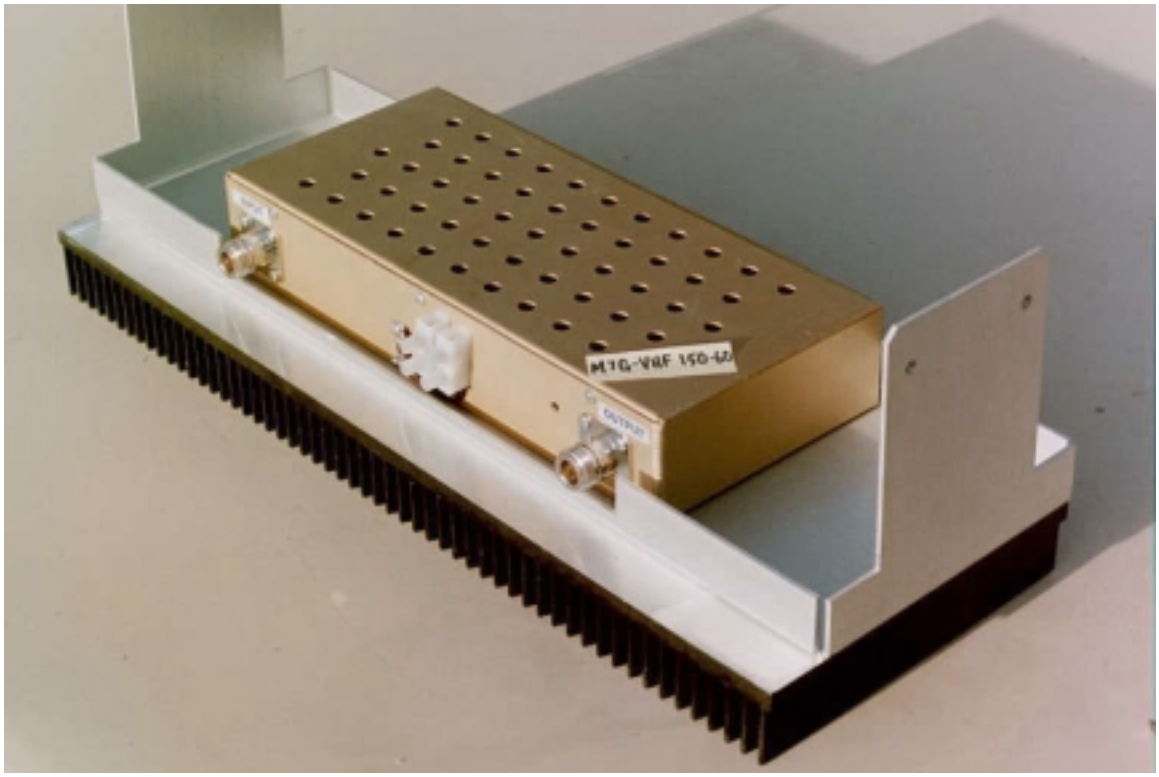


Photo 3 External Front View

Photo 4 External ¾ View



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

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

This section does not apply to the EUT.

APPENDIX A
TEST EQUIPMENT

TEST EQUIPMENT LOG

TYPE OF TEST: FCC CERTIFICATION

Date: 01/06/2000 Test Procedure: Part: 2, 22,90

EUT: RF Power Amplifier Other:

Model # / Serial #: VHF150-60 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