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**TD-3 MICROWAVE RADIO**  
**MAINTENANCE CENTER**  
**TRANSMITTER-RECEIVER BAY COMPONENTS**  
**J68387U IF DRIVER AMPLIFIER—**  
**TRANSMITTER MODULATOR**

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This section provides step-by-step procedures for locating trouble in the J68387U IF driver amplifier—transmitter modulator (Fig. 1).

This section is reissued to correct Steps 1 and 6 of Chart 2 and Steps 3, 11, and 12 of Chart 3. It also corrects the test setup in Fig. 3 and 5.

The step procedure contains both test and trouble-locating steps. The step procedure will bypass the trouble-locating steps if the unit being tested meets the test requirements. The following drawing and sections are related to this section:

SD-50585-01 TD-3 Radio, IF Driver Amplifier—Transmitter Modulator Circuit

411-506-501 TD-3 Microwave Radio, Transmitter-Receiver Bay, Transmitter Tests, Transmission

411-506-503 TD-3 Microwave Radio, Transmitter-Receiver Bay, Transmitter Tests, J68387U IF Driver Amplifier—Transmitter Modulator

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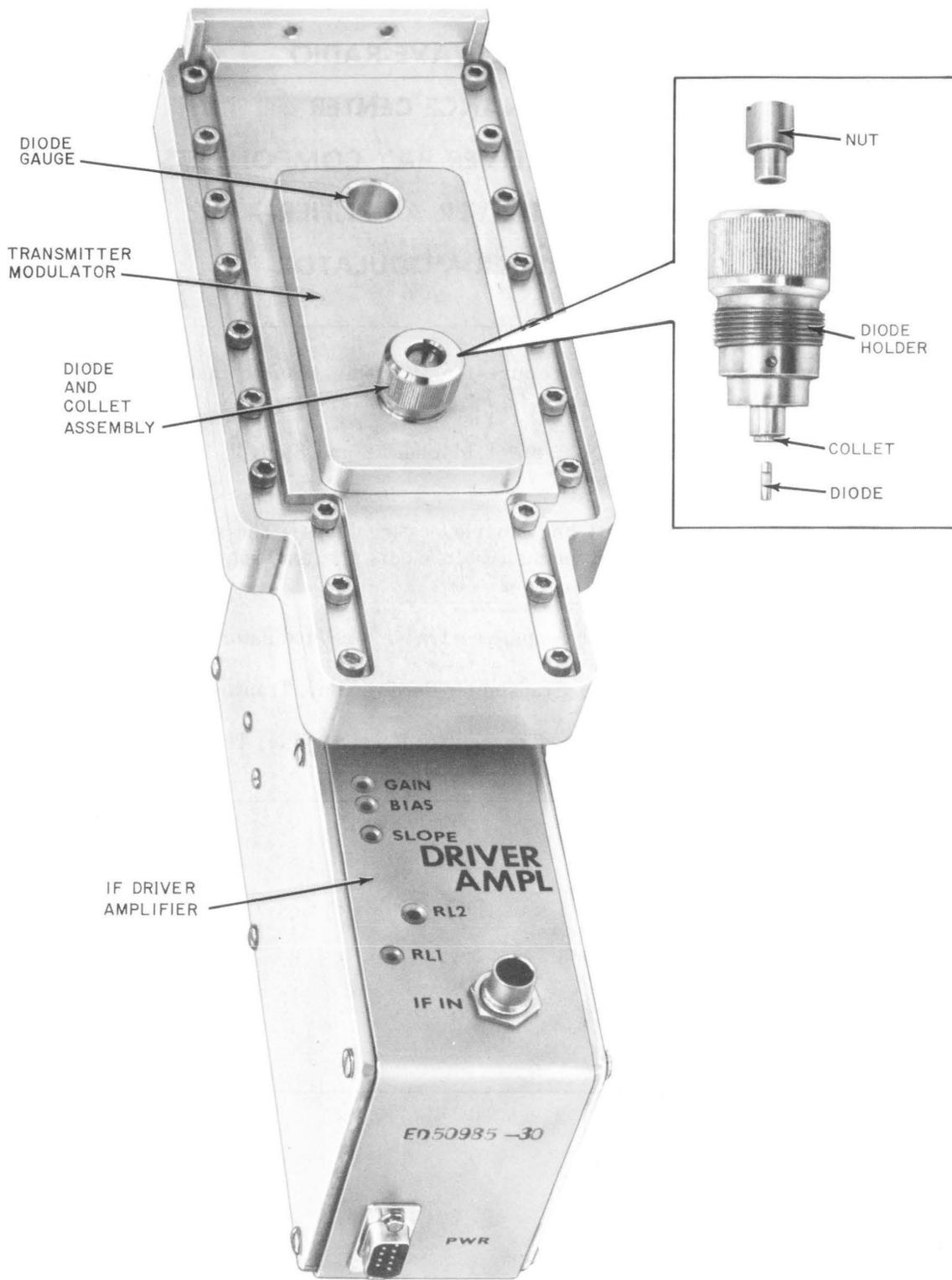


Fig. 1—IF Driver Amplifier and Transmitter Modulator

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**CHART 1****RETURN-LOSS TEST**

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**APPARATUS:**

1—J68396A Test Bench

1—J68392A Transmitter-Receiver Test Set

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**STEP****PROCEDURE**

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- 1 Prepare for the return-loss test in accordance with Fig. 2.
- 2 Measure the return loss at the input to the cable normally connected to the IF driver amplifier IF IN jack as directed in the measurement procedure in Fig. 2. (Use the P49Q681 adapter.)

**Requirement:** Greater than 30 dB between 60 and 80 MHz

If the requirement is met, proceed to Chart 2. If the requirement is not met, adjust RL1 and RL2 for the best return loss. If the requirement still is not met, check the return loss at the IF IN jack. If the requirement is still not met, replace the connecting cable with a new one. If the requirement still is not met, perform Chart 3 and repeat this chart.

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## CHART 2

## GAIN AND AMPLITUDE RESPONSE TESTS

## APPARATUS:

- 1—J68396A Test Bench
- 1—J68392A Transmitter-Receiver Test Set

STEP	PROCEDURE
	If any of the requirements in this chart cannot be met, perform Chart 3 and repeat this chart.
1	Obtain power for the IF driver amplifier—transmitter modulator by means of the ED-51057-30, G10 power extender cord. Connect the cord to the TST PWR jack on the J68396C meter and control unit and the unit under test.
2	Prepare the test set in accordance with Fig. 3, options (Y) and (Z).
3	Adjust the GAIN and SLOPE controls for flatness. Note the setting of ATTEN 2, and then adjust it to coincide the traces at 70 MHz.
	<b>Requirement:</b> The amplitude response shall be flat within 0.05 dB from 60 through 80 MHz.
4	Change to options (W) and (Z). Adjust the GAIN control to determine the output range.
5	Adjust ATTEN 2 to the setting noted in Step 2 (−7 dBm at IF IN), and read the power meter indication.
	<b>Requirement:</b> −9 to −5 dBm (which corresponds to 16 ±2 dBm)
6	Depress pushbutton 13 on the meter and control unit, and note the test bench meter indication.
	<b>Requirement:</b> Between 25 and 95

## CHART 3

## TROUBLE-LOCATING PROCEDURE

## APPARATUS:

1—J68396A Test Bench

1—J68392A Transmitter-Receiver Test Set

STEP	PROCEDURE
<b>IF Driver Amplifier</b>	
1	Remove the IF driver amplifier covers.
2	Visually inspect the unit for trouble symptoms, and check all screws fastening the printed circuit board to the chassis.
3	▶ Obtain power for the IF driver amplifier—transmitter modulator by means of the ED-51057-30, G10 power extender cord. Connect the cord to the TST PWR jack on the J68396C meter and control unit and the unit under test.◀
4	Make voltage measurements at the test points as indicated in Table A of Fig. 4.
5	Remove the power cable connected in Step 3.
6	Make resistance measurements at the test points as indicated in Table A of Fig. 4.
7	Repair or replace components as required to eliminate the trouble condition.
<b>Transmitter Modulator</b>	
8	Prepare the test set in accordance with Fig. 5, option (W); and note the power meter indication.
9	Adjust the diode BIAS control for maximum power output as indicated on the power meter.
10	Adjust the GAIN control to meet the following requirement.
<b>Requirement:</b> 8 to 10 dBm (at 1431M network output)	
11	Depress pushbutton ▶15◀ on the meter and control unit of the test bench, and note the test bench meter indication.

**Requirement:** Below 50

## CHART 3 (Cont)

STEP	PROCEDURE
12	Depress pushbutton <b>13</b> on the meter and control unit of the test bench, and note the test bench meter indication.  <b>Requirement:</b> Between 25 and 95
13	Change to option (Y).
14	Adjust the TEST TRACE controls on the test set control panel to center the trace on the oscilloscope.
15	Adjust the SENSITIVITY-VERNIER and POSITION controls on the oscilloscope time base unit for approximately 10 centimeters horizontal deflection.
16	Adjust the IF MKR FREQ control on the test set control panel for a $70 \pm 0.1$ MHz indication on the counter.
17	Adjust the IF SWEEP WIDTH and IF CENTER FREQ controls on the test set control panel to obtain the oscilloscope display shown in Fig. 5.
18	Set the FUNCTION switch on the test set control panel to the IF-RF position.
19	Adjust the TEST TRACE and REF TRACE controls on the test set control panel to coincide the traces at 70 MHz.
20	Increase the variable 953-3 attenuator by 1 dB, and adjust the SENSITIVITY-VERNIER and POSITION controls on the oscilloscope differential amplifier for 10 centimeters deflection between the traces. Return the 953-3 attenuator to its original setting. This calibrates the oscilloscope for 0.10 dB per centimeter.
21	Measure the amplitude response of the IF driver amplifier—transmitter modulator unit. (Adjust the SLOPE and GAIN controls to meet the following requirements.)  <b>Requirement 1:</b> The amplitude response shall be flat to within 0.20 dB between 60 and 80 MHz.  <b>Requirement 2:</b> The output power shall be $9 \pm 1$ dBm at the 1431M network output.  If the requirements are not met, adjust the diode BIAS control slightly and readjust the SLOPE and GAIN controls to meet the requirements. If the requirements are still not met, replace the 497A diode in accordance with Chart 4 and repeat Steps 8 through 21.

## CHART 4

## DIODE REPLACEMENT

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STEP	PROCEDURE
<i>Caution: The 497A diode is a fragile device susceptible to damage from static electrical discharge or mechanical shock. Extreme care should be exercised in handling the diode and diode mount when they are removed from the modulator assembly.</i>	
1	Unscrew the diode and collet assembly by hand, and remove the collet assembly from the modulator housing.
2	Turn the recessed slotted nut counterclockwise to loosen the collet that holds the diode.
3	Remove the diode from the collet.
4	Insert the replacement diode, colored-dot end first, into the collet leaving as much as possible of the diode exposed. Lightly tighten the collet to the diode by turning the recessed slotted nut clockwise.
5	Touch the collet assembly to the modulator housing to remove any static electrical charge.
6	Insert the diode and collet assembly into the diode gauge machined into the front face of the modulator, and seat the assembly so that the gauge exerts pressure to seat the diode at the correct position in the collet.
7	Turning the slotted nut clockwise, tighten the collet so that the diode is held securely in the collet.
8	Remove the diode and collet assembly from the gauge.
9	Recheck the positioning of the diode by reinserting the diode and collet assembly into the diode gauge and checking that the diode is inserted far enough into the collet. If it is not inserted far enough, loosen the collet and repeat the procedure.
10	Remove the diode and collet assembly from the gauge.
11	Touch the collet assembly to the modulator housing to remove any static electrical charge.
12	Insert the diode and collet assembly into the modulator housing and hand tighten.

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PREPARATION FOR TEST

1. Operate the test set controls to the following positions:

UNIT	CONTROL	POSITION
Control Panel	FUNCTION IF MARKER AMPLITUDE AMPL GAIN CTR	IF-IF Midrange Midrange MKR FREQ
Oscilloscope	INTENSITY	Midrange
Time Base Unit	POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	Midrange X10 EXT Midrange NORMAL
Differential Amplifier Unit	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF (+ INPUT) AC-DC-OFF (- INPUT)	Midrange 4 kHz DC Midrange 10 MV/CM DC OFF
Power Meter	INPUT CHANNEL POWER RANGE DBM	IF (Note 2) 0

- Set ATTEN 1 to 14 dB and ATTEN 2 to 50 dB.
- Establish the test connections using option (U).
- Adjust ATTEN 1 for a power meter indication of  $-4.0 \pm 0.5$  dBm.
- Connect options (V) and (W), and set the power meter POWER RANGE DBM switch to the -5 position.
- Adjust the AMPL GAIN control on the control panel to obtain -7 dBm.
- Change option (W) to option (X).
- Adjust the TEST TRACE and REF TRACE controls to center the trace on the oscilloscope.
- Adjust the SWEEP TIME, VERNIER, and POSITION controls on the oscilloscope time base unit for approximately 10 centimeters horizontal deflection.

10. Adjust the IF MARKER FREQ control for a  $70 \pm 0.2$  MHz indication on the counter.

11. Adjust the IF SWEEP WIDTH and IF CENTER FREQ controls to obtain the oscilloscope display shown in A at right.

*Note:* An extraneous marker will appear at 89 MHz.

12. Adjust the TEST and REF TRACE controls to bring the reference trace into coincidence with the test trace at 70 MHz.

13. Increase the attenuation of ATTEN 2 by 1 dB and adjust the SENSITIVITY, VERNIER, and POSITION controls on the oscilloscope differential amplifier for 2 centimeters deflection between traces. Reduce the attenuation of ATTEN 2 by 1 dB. This calibrates the oscilloscope for 0.5 dB per centimeter.

14. Connect option (Y), and set ATTEN 2 to 0.

*Requirement:* The test trace shall be below the reference trace between 60 and 80 MHz.

*Note:* It may be necessary to move the traces up on the oscilloscope using the differential amplifier POSITION control to ensure that the test trace is below the reference trace.

15. Disconnect option (Y).

MEASUREMENT PROCEDURE

- Connect option (Z) and adjust ATTEN 2 until the uppermost part of the test trace in B shown at right just touches the reference trace at the desired frequency.
- The magnitude of the return loss is determined by subtracting the ATTEN 2 setting from 50 dB.

*Note 1:* A back-to-back adapter (P49Q681) is required between the return-loss bridge and the unit under test whenever the return-loss measurement is made through a connecting cable.

*Note 2:* With the INPUT CHANNEL switch set to the IF position, determine that no input is connected; then zero the power meter by setting the POWER RANGE DBM switch to the 0 position and adjusting the METER ZERO control for an indication of zero on the meter. Return the POWER RANGE DBM switch to the position shown in Step 1.

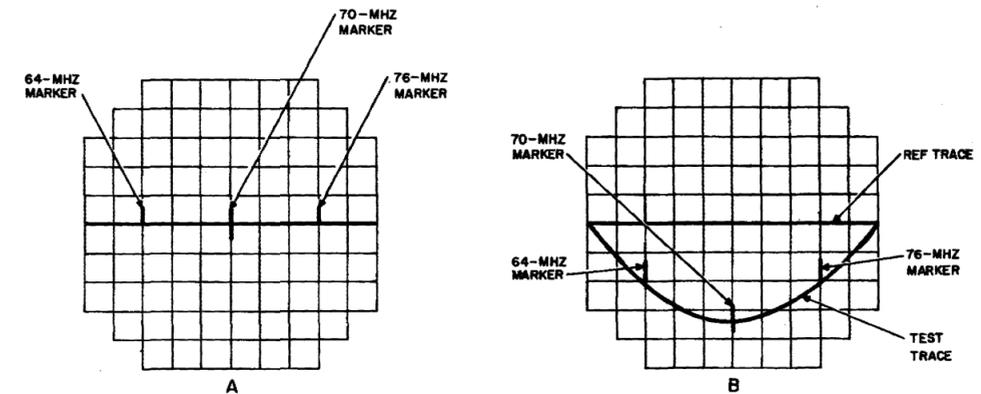
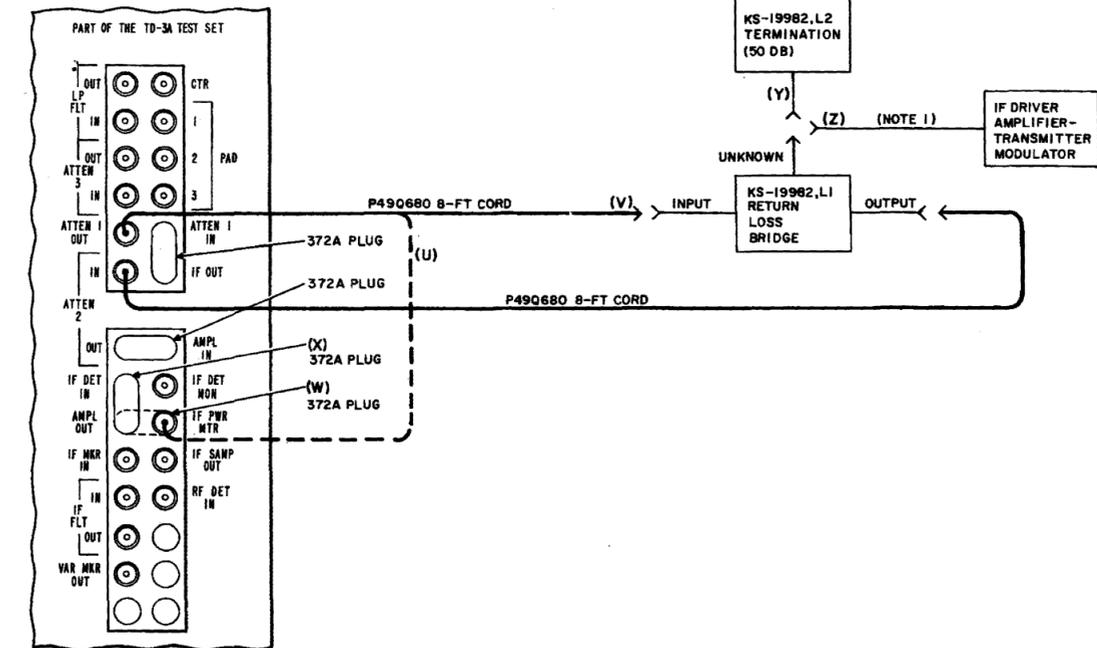


Fig. 2—IF Return-Loss Measurement

PREPARATION FOR TEST

1. Establish the test connections using options (W) and (X).
2. Set the attenuator as indicated.
3. Make the following control settings on the test set:

UNIT	CONTROL	POSITION
Control Panel	FUNCTION	IF-IF
	IF SWEEP WIDTH	Max CCW
	IF CENTER FREQUENCY	Midrange
	IF MARKER AMPLITUDE COUNTER	Midrange MKR FREQ
Oscilloscope Time Base	POSITION	Midrange
	MAGNIFIER	X10
	SWEEP TIME	EXT
	VERNIER SINGLE-NORMAL	Midrange NORMAL
Oscilloscope Differential Amplifier	POSITION	Midrange
	BANDWIDTH	4 kHz
	AMPLIFIER	DC
	VERNIER	Midrange
	SENSITIVITY	2 MV/CM
Power Meter	INPUT CHANNEL	IF
	POWER RANGE DBM	-5

4. Adjust ATTEN 2 for a -7 dBm level on the power meter.
5. Change the connections to options (X) and (Y).
6. Adjust the test trace controls on the control panel to center the trace on the oscilloscope.
7. Adjust the VERNIER control on the oscilloscope time base unit for 10 centimeters horizontal deflection on the oscilloscope.
8. Adjust the IF MARKER FREQ control on the control panel for a  $70 \pm 0.2$  MHz indication on the counter.
9. Adjust the IF SWEEP WIDTH and IF CENTER FREQ controls on the control panel to obtain the oscilloscope display shown at right.

10. Adjust the REF TRACE controls on the control panel to bring the reference trace into coincidence with the test trace at 70 MHz.
11. Increase the attenuation of ATTEN 2 from 0.1 to 0.5 dB, and adjust the VERNIER control on the oscilloscope differential amplifier for 2 centimeters deflection; then return ATTEN 2 to its previous setting. This calibrates the oscilloscope for 0.05 dB per centimeter.

**Requirement:** The test trace shall coincide within 0.01 dB to the reference trace between 60 and 80 MHz.

If this requirement is not met, adjust the IF DET SLOPE control on the control panel for a flat trace; then recoincide the traces with the TEST TRACE controls.

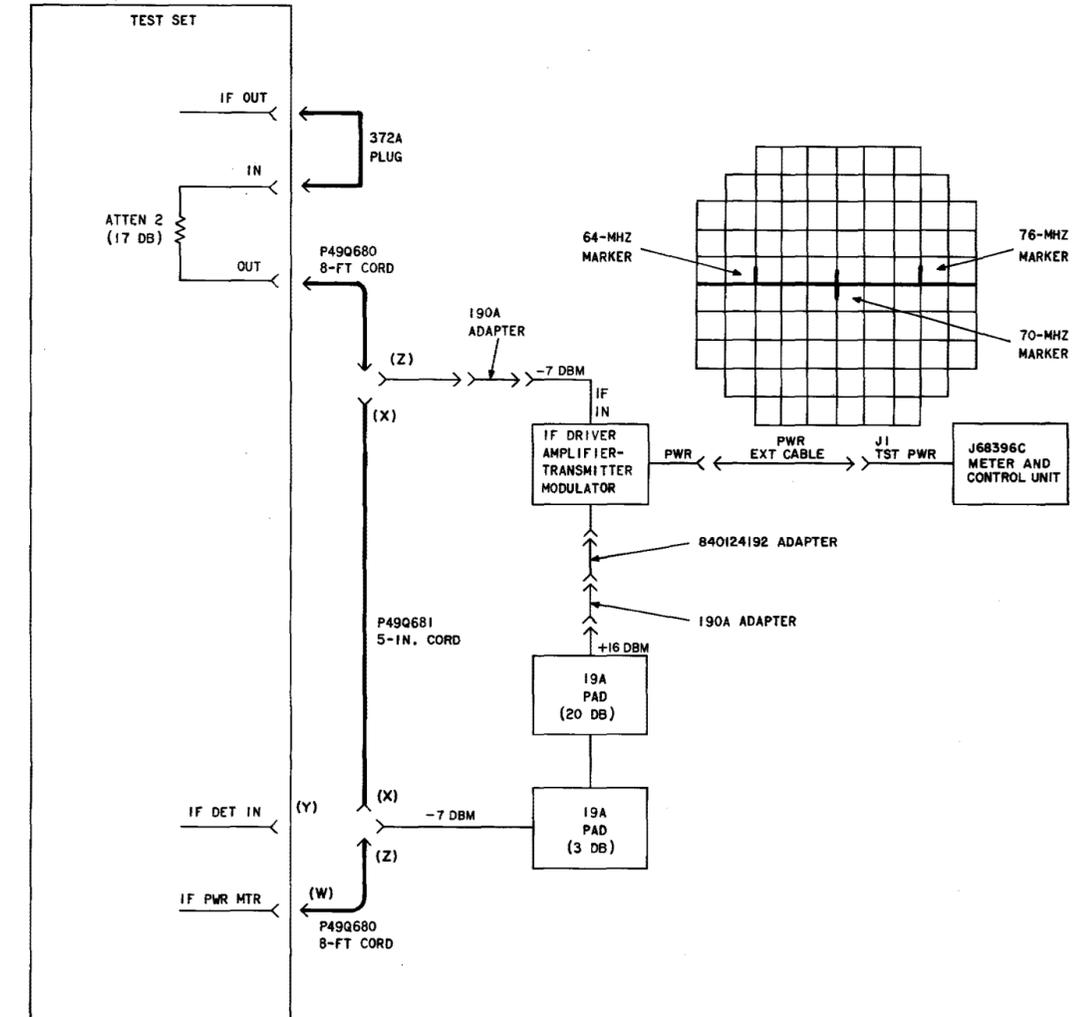


Fig. 3—IF-to-IF Transmission and Gain Test Setup

TABLE A

MEASURE	VOLTAGE AND RESISTANCE MEASUREMENTS																													
	★ 1		★ 2		★ 3		★ 4		★ 5		★ 6		★ 7		★ 8		★ 9		★ 10		★ 11		★ 12		★ 13		★ 14			
FROM	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V
TO	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V	GRD	-19V
VOLTS	-12.2	-	-11.4	-	-6.9	-	-11.9	-	-12.6	-	-6.5	-	-16	-	-16.6	-	-7.8	-	-8.5	-	0	-	-14.5	-	-14.5	-	-4.5	-	-	-
OHMS	1.1K	500	1.6K	1.55K	500	1.2K	1.15K	1K	1K	250	250	950	900	160	800	80	250	950	1K	280	0	750	650	210	750	56	50	800	-	

NOTE:  
WHEN MAKING RESISTANCE MEASUREMENTS,  
CONNECT THE POSITIVE LEAD TO THE -19V POINT  
OR THE GROUND POINT AS REQUIRED.

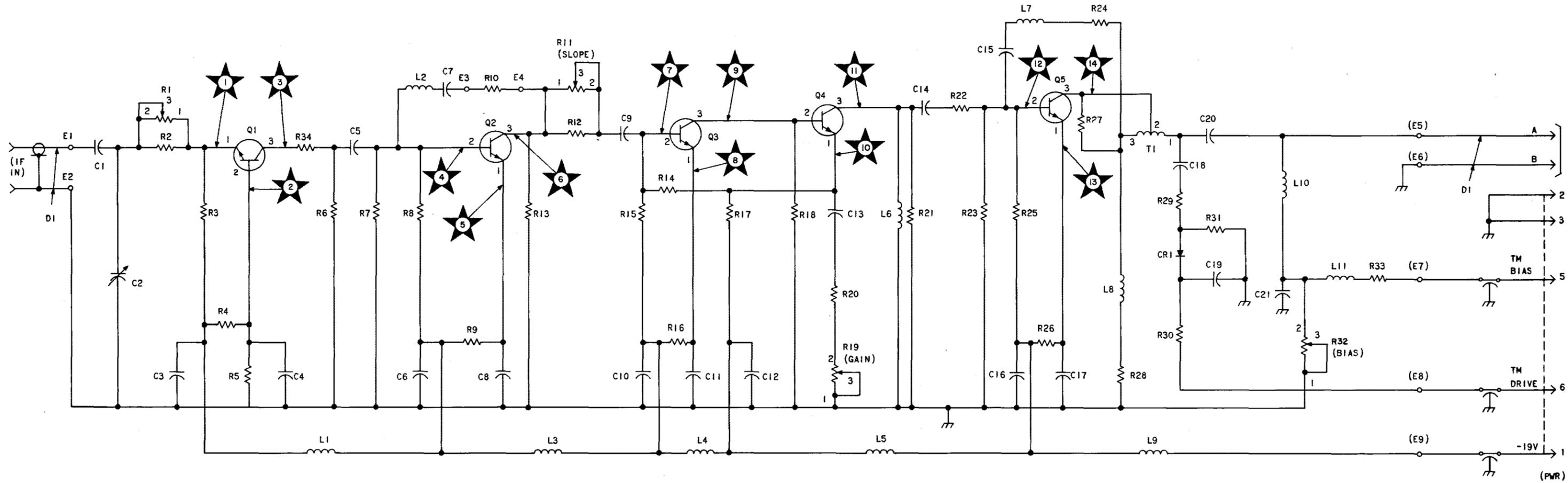


Fig. 4a—IF Driver Amplifier



PREPARATION FOR TEST

1. Set ATTEN 2 of the test set as indicated.
2. Establish the test connections using option (U).
3. Operate the controls on the test set to the following positions:

UNIT	CONTROL	POSITION
Control Panel	FUNCTION CTR IF SWEEP WIDTH	IF-RF EXT Max CCW
Power Meter	INPUT CHANNEL POWER RANGE DBM	IF or RF as required -5 or 0 as required
Oscilloscope Time Base Unit	INTENSITY POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	Midrange Midrange X10 EXT Midrange NORMAL
Differential Amplifier Unit	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF (+ INPUT) AC-DC-OFF (- INPUT)	Midrange 4 kHz DC Midrange 2 MV/CM DC OFF

4. Adjust the IF CENTER FREQ control on the control panel for a  $70 \pm 0.2$  MHz indication on the counter.
5. Change the connections to option (V).
6. Adjust ATTEN 2 for a -2 indication on the power meter (-7 dBm).
7. Operate the input channel control on the power meter to the RF position. Set the POWER RANGE DBM switch to the 0 position.
8. Establish the test connections using option (Z).
9. Adjust the microwave generator for a -3.5 indication on the power meter (+18.0 dBm). The above includes the 1.5-dB loss of the cable.

Note: When the power meter is not being used to measure power, position the POWER RANGE DBM switch to the +10 position.

10. The transmitter modulator is prepared for IF-RF transmission tests.

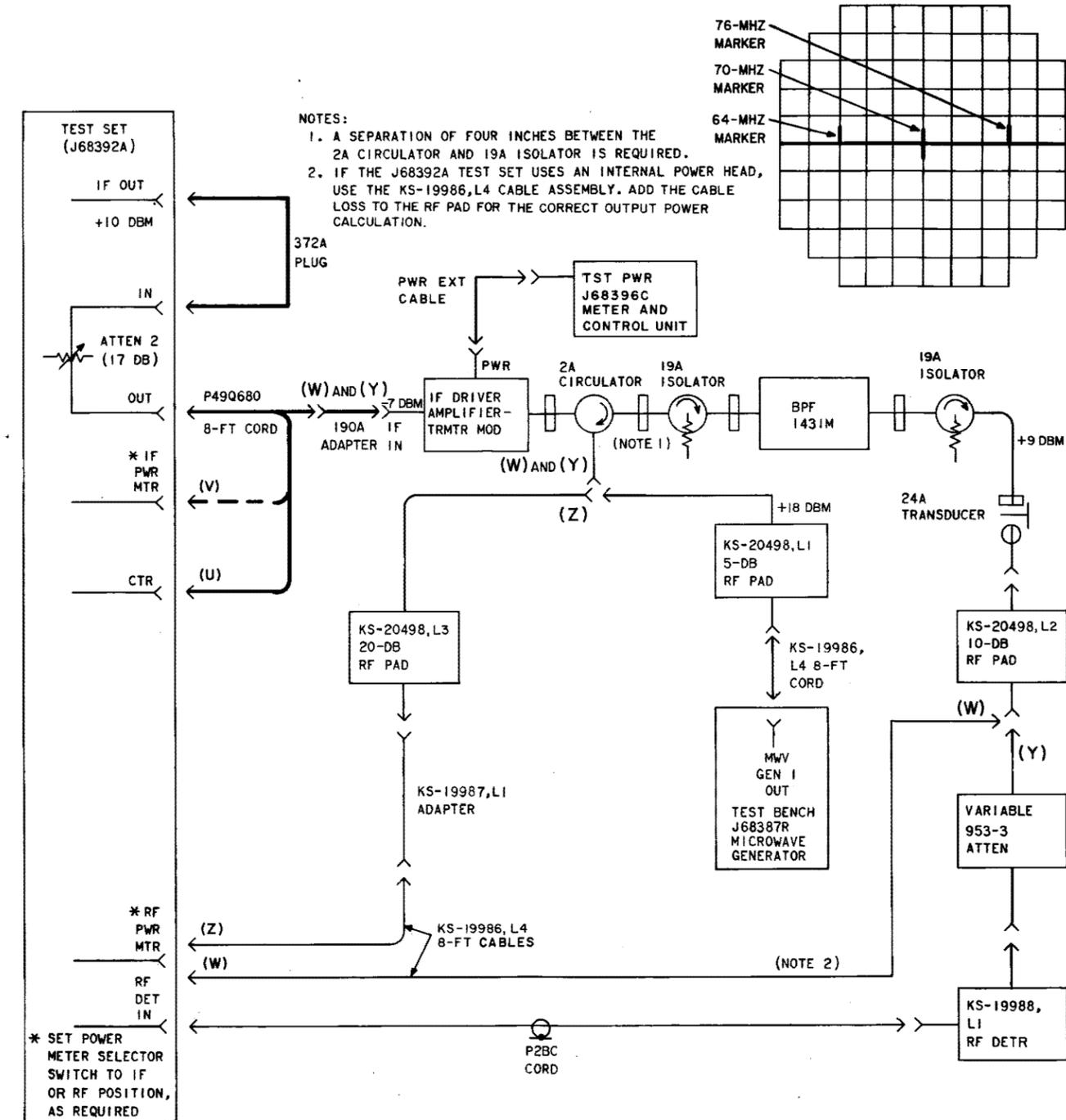


Fig. 5—IF Driver Amplifier and Transmitter Modulator IF-to-RF Test Setup