

TABLE OF CONTENTS

	Page
DESCRIPTION .....	2
MAINTENANCE .....	2
Disassembly .....	2
Alignment Procedure .....	5
Troubleshooting Procedure .....	6

ILLUSTRATIONS

Figure 1 - Block Diagram .....	1
Figure 2 - Access to Exciter and Driver, Front View .....	2
Figure 3 - Access to Driver, Rear View .....	3
Figure 4 - Top View of PA Assembly .....	3
Figure 5 - Exciter Output Cable Assembly .....	3

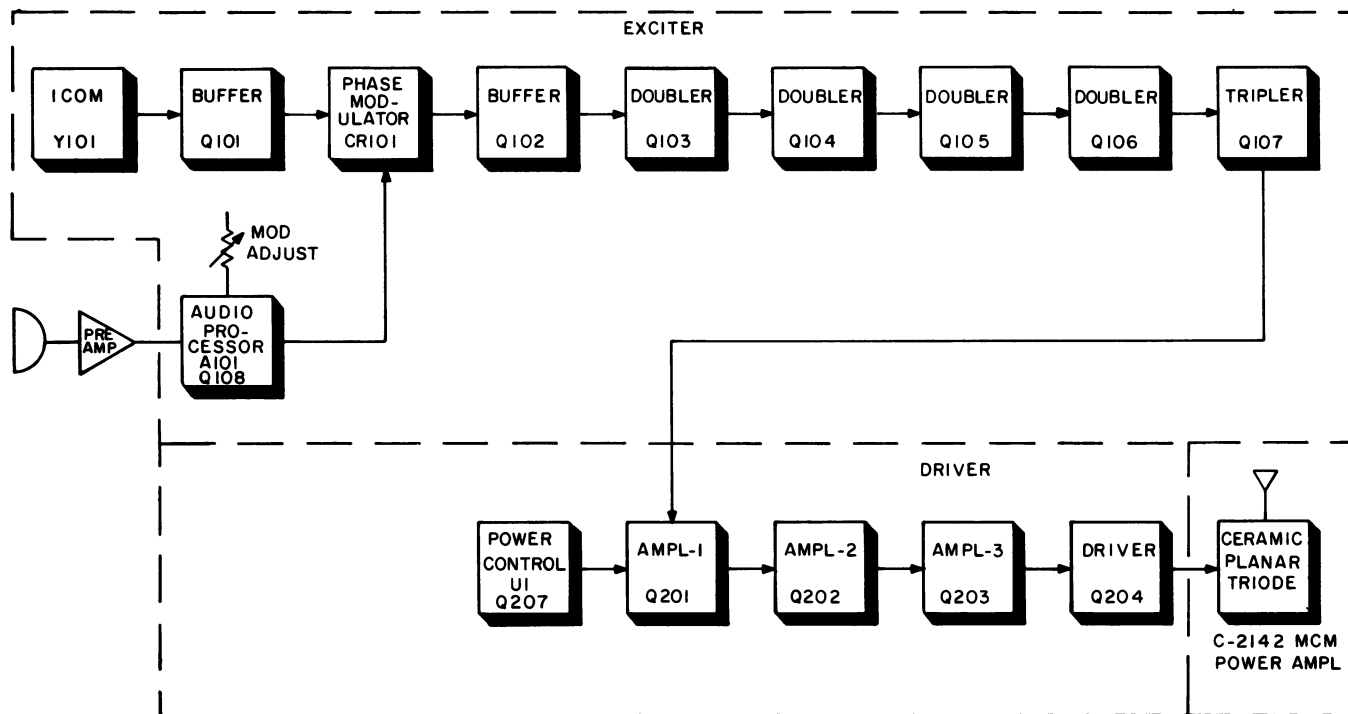


Figure 1 - Transmitter Block Diagram

## DESCRIPTION

The 851-870 MHz, 90-Watt MASTR® II transmitter is a crystal controlled, phase modulated transmitter designed for single frequency operation. The transmitter utilizes both integrated circuits (ICs) and discrete components and consists of the following modules:

- Exciter Board; with audio, modulator, amplifier and multiplier stages.
- Driver Board; with amplifier and power control circuitry.
- Power Amplifier.

Figure 1 is a block diagram of the 851-870 MHz MASTR II transmitter, showing the exciter board, driver board and PA.

The Exciter contains the  $\pm 1$  PPM Integrated Circuit Oscillator Module (ICOM), audio Processor, modulator and multipliers to provide the station operating frequency.

The Driver includes four stages of power amplification to drive the PA stage with a maximum of 12 Watts power. This board also contains the power control circuits of the transmitter.

The station power amplifier is a ceramic planar triode tube mounted in an aluminum cavity assembly. This tube provides 90 Watts output when driven by the rated maximum of 12 Watts.

## MAINTENANCE

### DISASSEMBLY

For a more complete mechanical parts breakdown refer to the station MAINTENANCE MANUAL. To service the transmitter exciter from the front of the station:

1. Turn the two latching knobs on the front of the radio housing counter-clockwise to unlatch the radio housing front door.
2. Swing the door down.
3. Remove cover from the radio housing. See Figure 2.

### CAUTION

The placement of the monolithic chip capacitors on the Driver Board is very critical; therefore it is not recommended that the driver Board be serviced in the field.

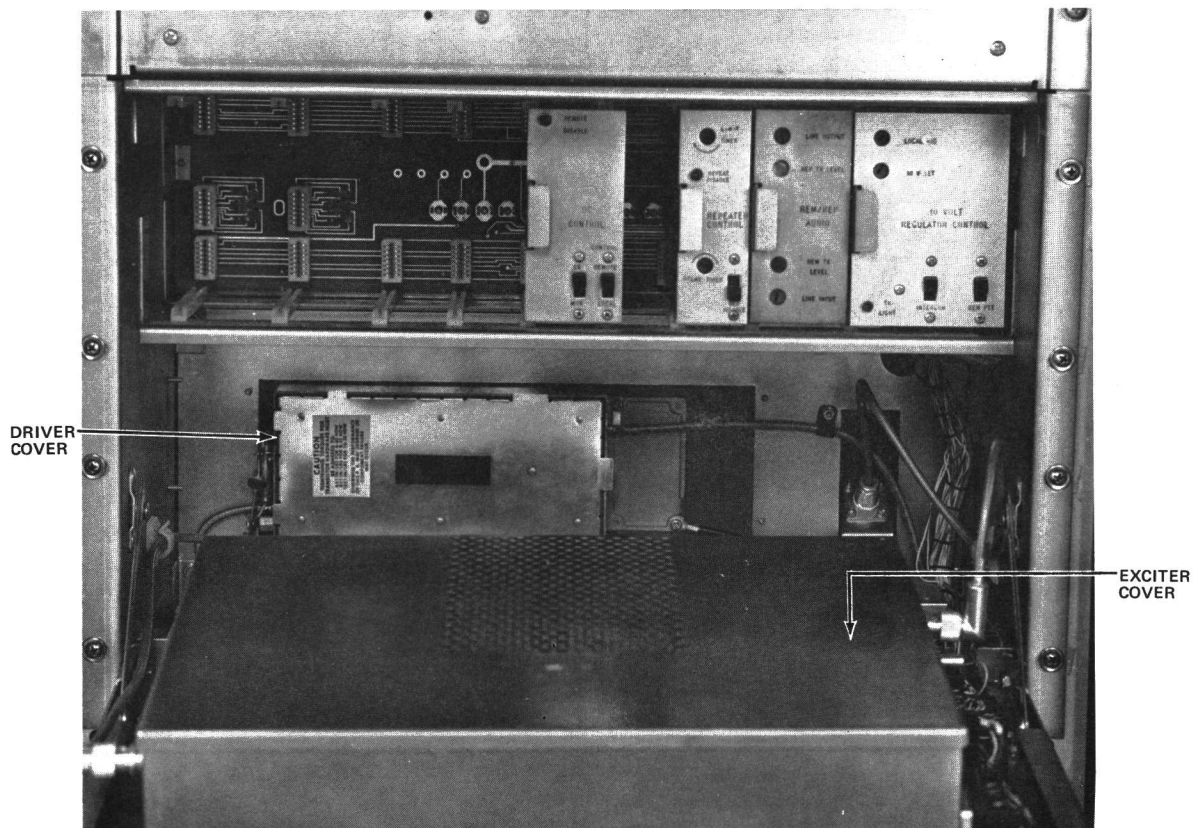


Figure 2 - Access to Exciter and Driver Covers, Front View

To remove the transmitter driver from the rear of the station:

1. Remove the red and black power cables (A) leading to the driver from the fuse block at the station power supply. See Figure 3.
2. Remove the driver output cable (B) at the PA assembly. See Figure 4.
3. Remove the driver input cable (C) at the exciter. See Figure 5. Leave all four cables connected to the driver assembly.
4. Remove top two screws and four bottom screws (D) mounting the driver to the frame and remove the entire driver assembly.

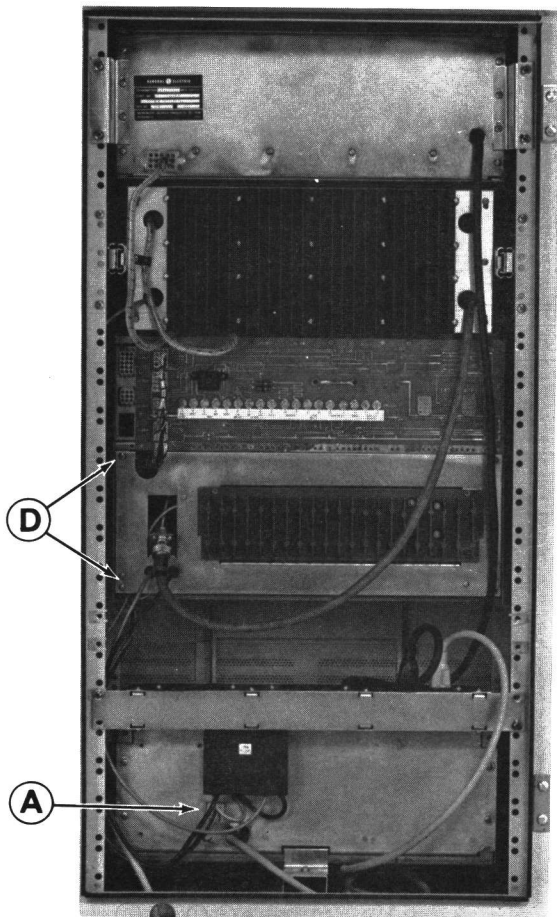


Figure 3 - Access to Driver, Rear View

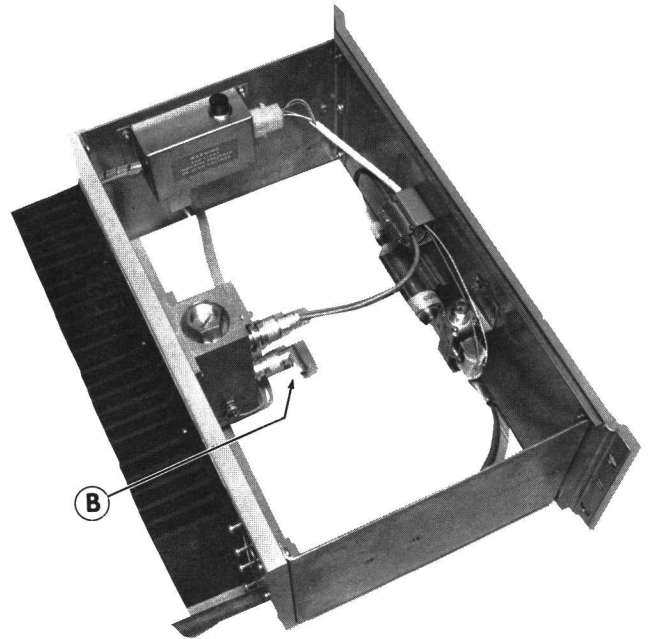


Figure 4 - Top View of PA Assembly

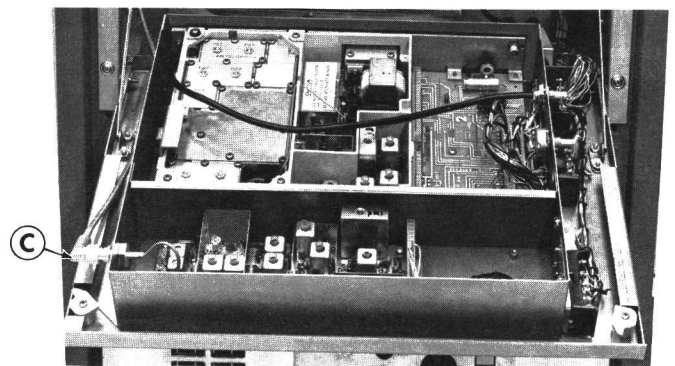


Figure 5 - Exciter Output Cable Location

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R103) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause overmodulation are clipped by the modulation limiter. The limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing overmodulation while preserving intelligibility.

TEST EQUIPMENT

- 1. An audio oscillator (GE Model 4EX6A10)
- 2. A frequency modulation monitor
- 3. Voltmeter
- 4. GE Test Set Model 4EX3A11 or 4EX8K12
- 5. Frequency Counter
- 6. Oscilloscope
- 7. 50-ohm Wattmeter

PROCEDURE

- 1. Connect the audio oscillator and the meter across audio input terminals J10 (Green-Hi) and J11 (Black-Lo) on GE Test Set, and connect red Test Set plug to the System red metering plug. If not using GE Test Set, connect audio oscillator and meter across P902-6 (Mike High) through a 0.5 microfarad (or larger) DC blocking capacitor, and P902-5 (Mike-Low) on the System Board.
- 2. Adjust the audio oscillator for 1-Volt RMS at 1000 Hz.
- 3. For transmitters without Channel Guard, set MOD ADJUST R103 for a 4.5-kHz swing with the deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.
- 4. For transmitters with Channel Guard, set Channel Guard MOD ADJUST R102 for zero tone deviation. Next, with the 1-Volt signal at 1000 Hz applied, set MOD ADJUST R103 for 3.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST R102 for 0.75 kHz tone deviation.

PA POWER INPUT

For FCC purposes, the PA power input can be determined by measuring the PA supply voltage and PA current, and using the following formula:

P<sub>i</sub> = PA voltage x PA cathode current x .85

where:

P<sub>i</sub> is the approximate power input in Watts,

PA voltage is measured with the test meter on the front panel of the PA Power Supply and the switch in the E<sub>p</sub> position.

PA cathode current is measured with the test meter switch in the I<sub>k</sub> position.

Example:

P<sub>i</sub> = 520 Volts x 0.47 Amperes = 208 Watts (DC Plate Power Input)

ICOM FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set with a frequency meter or counter with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained, and with the entire radio as near as possible to an ambient temperature of 27.5°C (81.5°F).

MASTR II ICOMs should be reset only when the frequency shows deviation in excess of the following limits:

- A. ±0.2 PPM, when the radio is at 27.5°C (81.5°F)
- B. ±1 PPM at any other temperature within the range of -30°C to +85°C (-22°F to +185°F).

If an adjustment is required, pry up the cover on the top of the ICOM to expose the trimmer, and use one of the following procedures:

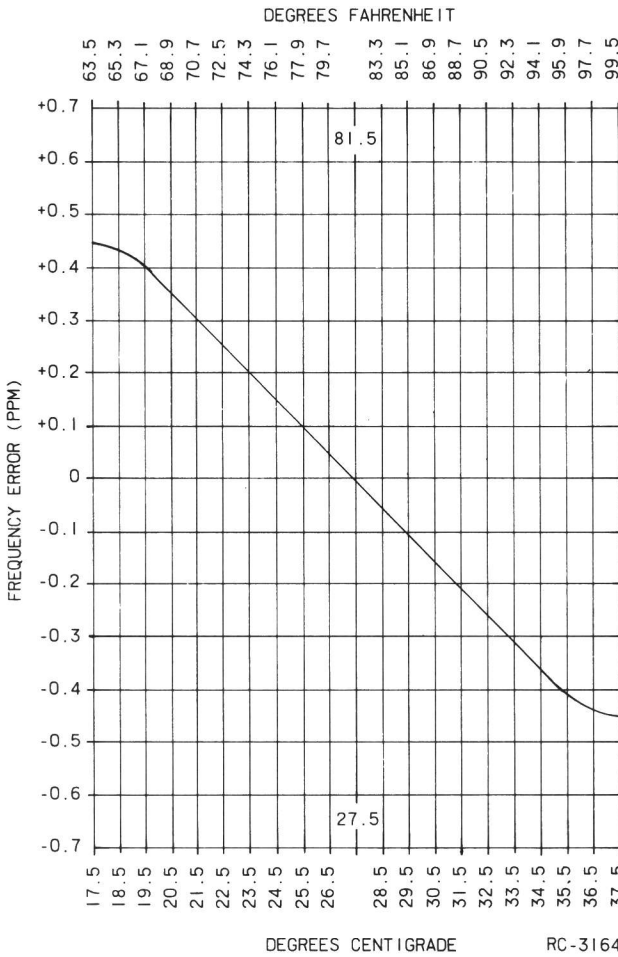
If the radio is at an ambient temperature of 27.5°C (81.5°F), set the oscillator for the correct operating frequency.

If the radio is not at an ambient temperature of 27.5°C, setting errors can be minimized as follows:

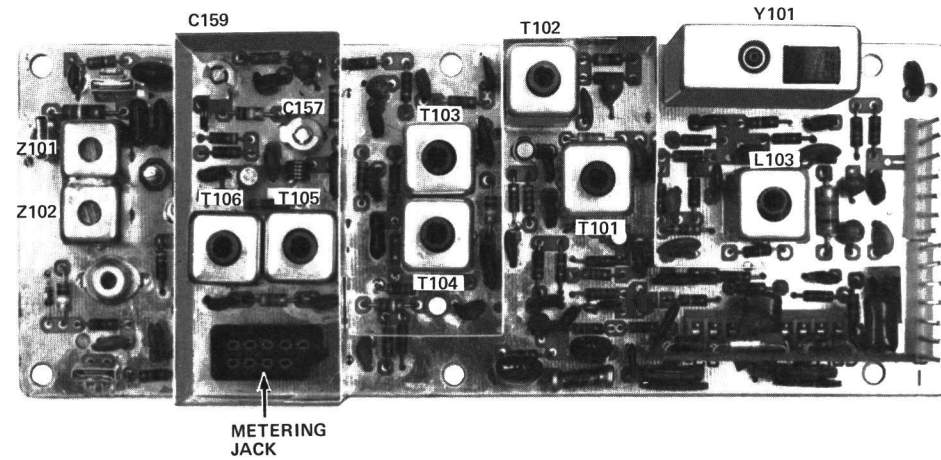
- A. To hold the setting error to ±0.1 PPM (which is considered reasonable for 1 PPM ICOMs):
  - 1. Maintain the radio at 27.5°C (81.5°F) and set the oscillator to desired frequency, or -
  - 2. Maintain the radio at 27.5°C (±10°C) and offset the oscillator, as a function of actual temperature, by the amount shown in the chart below.

For example: Assume the ambient temperature of the radio is 18.5°C (65.4°F). At that temperature, the curve shows a correction factor of 0.44 PPM. (At 851 MHz, 1 PPM is 851 Hz. At 875 MHz, 1 PPM is 875 Hz).

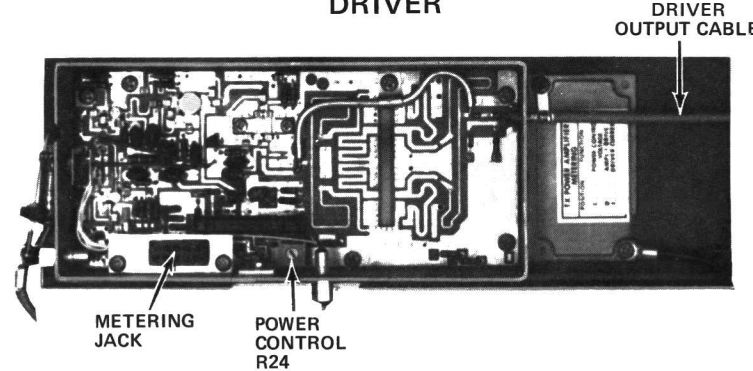
With an operating frequency of 851 MHz, set the oscillator for a reading of 374 Hz (0.44 x 851 Hz) higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 27.5°C), set the oscillator for the indicated PPM lower than the licensed operating frequency.



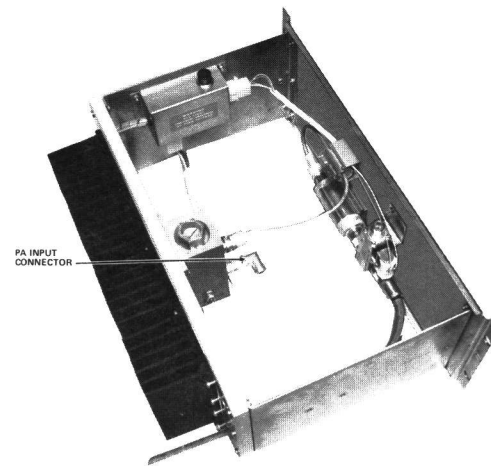
EXCITER



DRIVER



POWER AMPLIFIER



TRANSMITTER ALIGNMENT

LBI30487

EQUIPMENT REQUIRED

- 1. GE Test Set Model 4EX3A11 or Test Kit 4EX8K12.
- 2. A 50-ohm wattmeter connected to Driver Output cable.
- 3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

- 1. Place ICOM on Exciter Board (crystal frequency = operating frequency ÷ 48).
- 2. For a large change in frequency or a badly mis-aligned transmitter, preset all slugs to the top of the coil form.
- 3. Set Z101 and Z102 to top of coil form.
- 4. Set both air variable capacitors to minimum capacity (not meshed).
- 5. Connect the red plug on the GE Test Set to the System Board metering jack, and the black plug to the Exciter metering jack. Set the polarity to +, and set the range to the Test 1 position (1-Volt position for 4EX8K12) for all adjustments.

NOTE: With the Test Set connected to the driver metering jack, the voltage reading at position "F" with the HIGH SENSITIVITY button pressed may be converted to driver collector current by reading the current as 10-amperes full scale.

All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.

ALIGNMENT PROCEDURE

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
NOTE: When aligning transmitter, proceed as instructed below. DO NOT retune a previously tuned control unless specifically directed to do so.				
1.	B (PHASE MOD)	L103, T101	See Procedure	Tune L103 for maximum meter reading. Then tune T101 for a dip (small) in meter reading.
2.	C (MULT-1)	T102 and T103	See Procedure	Tune T102 for maximum meter reading, then tune T103 for a dip in meter reading.
3.	D (MULT-2)	T104 and T105	See Procedure	Tune T104 for maximum meter reading and then tune T105 for a dip in meter reading.
4.	F (MULT-3)	T106 and C157	See Procedure	Tune T106 for maximum meter reading and then tune C157 for a dip in meter reading.
5.	G (MULT-4)	C159 and Z101	See Procedure	Tune C159 for maximum meter reading, and then tune Z101 for a dip in meter reading.
6.	A (REL OUTPUT)	Z102	Maximum	Tune Z102 for maximum meter reading.
7.	B (PHASE MOD)	L103	Maximum	Tune L103 for maximum meter reading.
8.	C (MULT-1)	T101 & T102	Maximum	In order, tune T101 and T102 for maximum meter reading.
9.	D (MULT-2)	T103 & T104	Maximum	Tune T103 and then T104 for maximum meter reading.
10.	F (MULT-3)	T105 & T106	Maximum	Tune T105 and then T106 for maximum meter reading.
11.	G (MULT-4)	C157 & C159	Maximum	Tune C157 and then C159 for maximum meter reading.
12.	A (REL OUTPUT)	Z101 & Z102	Maximum	In order, tune Z101 and Z102 for maximum meter reading.
13.		R24		Move black test plug to Driver black metering jack. Turn Power Control Adjust potentiometer R24 on the Driver fully counterclockwise.
14.	WATTMETER	R24	5 to 8 Watts	Advance Power Control R24 for a reading of 5 to 8 Watts on Wattmeter.
15.	D (MULT-2)	Z101 & Z102	Maximum	In order, tune Z101 and Z102 for maximum meter reading.
16.	WATTMETER	R24	12 Watts	Advance Power Control Adjust potentiometer full clockwise. Wattmeter should read approximately 12 Watts. Unkey transmitter.
17.		R24		Turn R24 to full counterclockwise position. Move Driver Output Cable to Power Amplifier input connector.
18.				Refer to Power Amplifier MAINTENANCE MANUAL for tuning procedure of the Power Amplifier.

ALIGNMENT PROCEDURE

851—870 MHz, 90 WATT TRANSMITTER

STEP 1 - QUICK CHECKS

METER POSITION GE TEST SET	PROBABLE DEFECTIVE STAGE		
	HIGH METER READING	LOW METER READING	ZERO METER READING
EXCITER			
B (PHASE MOD)	Q102, Q103, T101	Q102, Q103, T101, ICOM	Q102, Q103, T101
C (MULT-1)	Q104, T103	T101, T102, Q104	T101, T102, Q104, T103
D (MULT-2)	Q105, T105	T103, T104, Q105	T103, T104, Q105, T105
F (MULT-3)	Q106, C155	Q106, T105, T106	Q106, T105, T106, L105
G (MULT-4)	Q107, Z101, Z102	Q107, C159, C157	Q107, C159, C157, Z101, Z102
A (REL OUTPUT)		Q107	Q107, C174, CR102, R154, R153
POWER AMPLIFIER DRIVER			
C (Power Control)		Q207, R24, U1, Q201	Q207, R24, U1
"D" (AMPL-1 INPUT)		Low Output Exciter, CR1	No Output Exciter, CR1, C1
"F" (DRIVER CURRENT)	Q204, L23	Q204, Low Output, Q203	Q204, No Output, Q203, Q202, Q201, Check Pos. C & D

TROUBLESHOOTING PROCEDURE

851—870 MHz, 90 WATT TRANSMITTER

