GE MOBILE RADIO

DESCRIPTION AND MAINTENANCE

138—174 MHz, 110-WATT MASTR® II TRANSMITTER

TABLE OF CONTENTS

DESCRIPTION

MASTR® II 110 Watt transmitters with phase lock loop exciters are crystal controlled, frequency modulated transmitters designed for wide spaced multi-frequency operation in the 138-174 MHz frequency band. The solid state transmitter utilizes both integrated circuits (ICs) and discrete components, and consists of the following assemblies:

- Exciter Board; with audio, FM ICOMS, Phase Lock Loop, Lock Detector, 10 Volt DC switch, and amplifier stages.
- Power Amplifier Assembly; with amplifiers, driver, PA, power control, low pass filter, and antenna switch.

Figure 1 is a block diagram of the MASTR II transmitter showing the exciter and PA board.

The exciter contains the FM oscillators, audio IC, harmonic amplifier IC, bandpass filter, phase lock loop, RF amplifiers, lock detector, 10-Volt switch, and exciter output control circuitry to provide 250 milliwatts of RF power to the power amplifier. The phase lock loop permits wide spaced transmitter operation with up to 24 MHz frequency separation.

The power amplifier assembly includes seven RF power transistors, a low pass filter, an antenna switch and seven transistors in the power control circuit. The two amplifiers, the driver and the four paralleled power amplifiers provide up to 110 watts output power.

Centralized metering jack J205 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Ampl-1 drive (exciter output), Ampl-1 power control, Driver and PA current.

MAINTENANCE

MOBILE DISASSEMBLY

To service the transmitter from the top:

1. Pull the locking handle down, then pry up the top cover at the front notch and lift off the cover.

To service the transmitter from the bottom:

1. Pull the locking handle down and pull the radio out of the mounting frame.
2. Remove the top cover, then loosen the two bottom cover retaining screws and remove the bottom cover (see Figure 4).

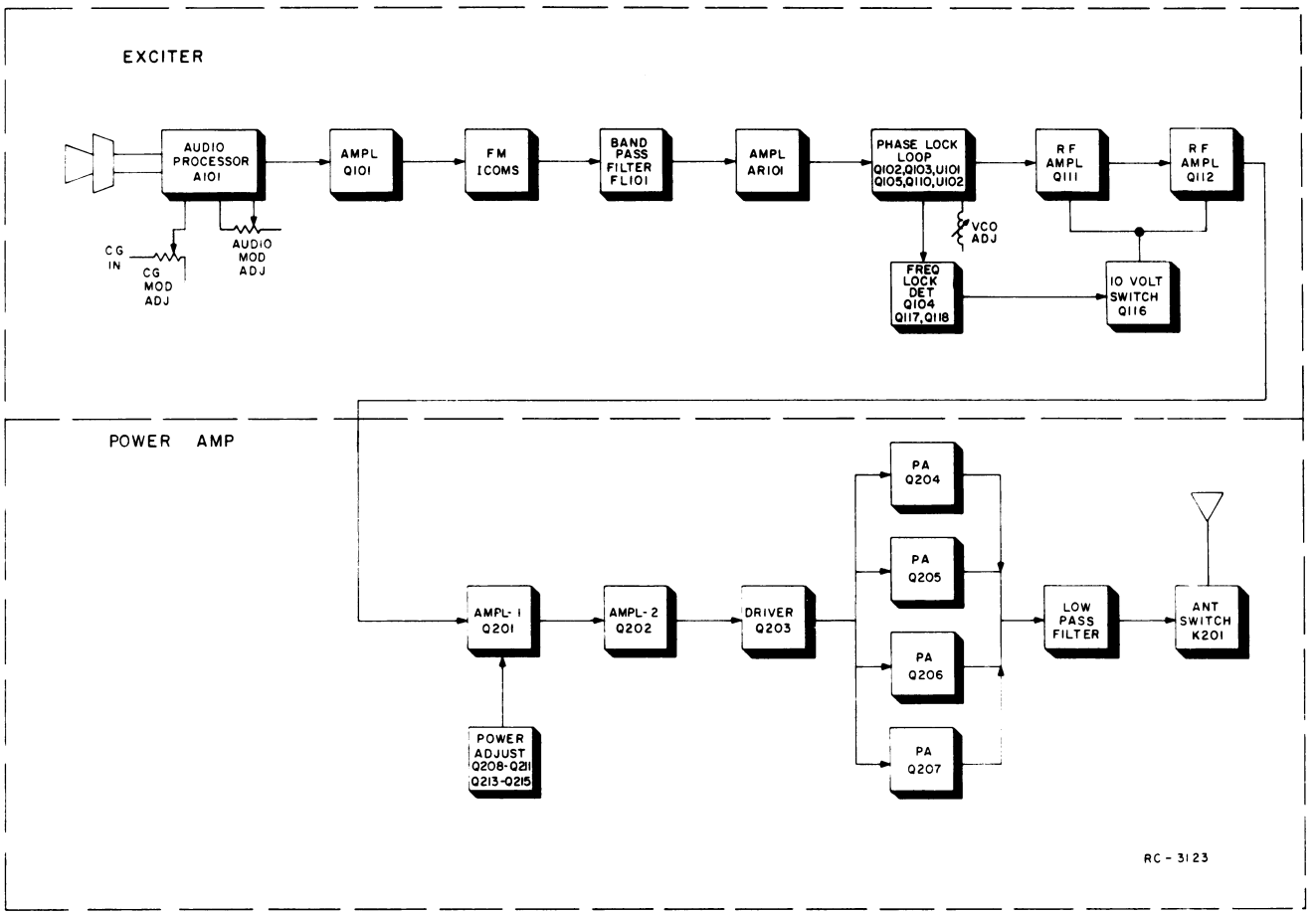


Figure 1 - Block Diagram

3. To gain access to the bottom of the exciter board, remove the six screws (A) holding the exciter board and its bottom cover to the module mounting frame, and remove the bottom cover (see Figure 5).

STATION DISASSEMBLY

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

1. Turn the two latching knobs (A) counterclockwise to unlatch the Radio Panel Front Door. Refer to Figure 2.

2. Swing the Radio Panel Front Door down as shown.

3. Remove covers.

To service the transmitter Power Amplifier from the rear:

1. Remove the top two screws (B) on the Intermittent or Continuous Duty Power Amplifier. Refer to Figure 3.

2. Swing the Power Amplifier down as shown. Remove the top cover of the Power Amplifier.

NOTE

If the heatsink blower option is present, this blower must be removed before the Power Amplifier can be lowered.

EXCITER DISASSEMBLY (See Figures 4 and 5)

To remove the exciter board from the radio:

1. Unplug the exciter/PA cable (B).

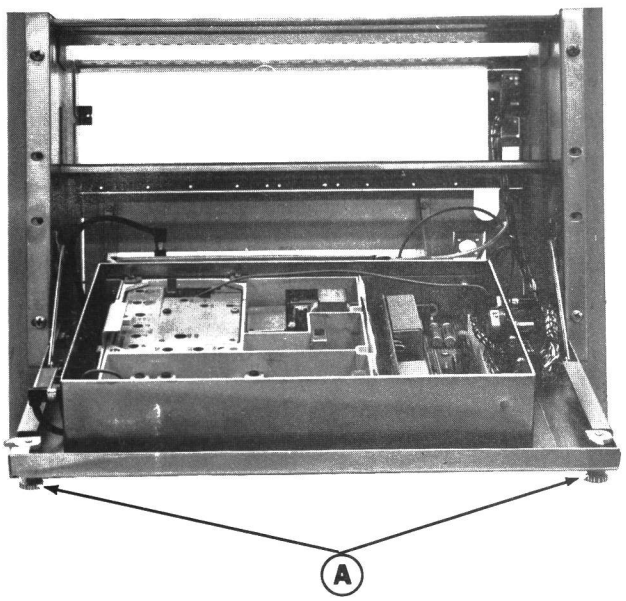


Figure 2 - Access to Exciter Front View

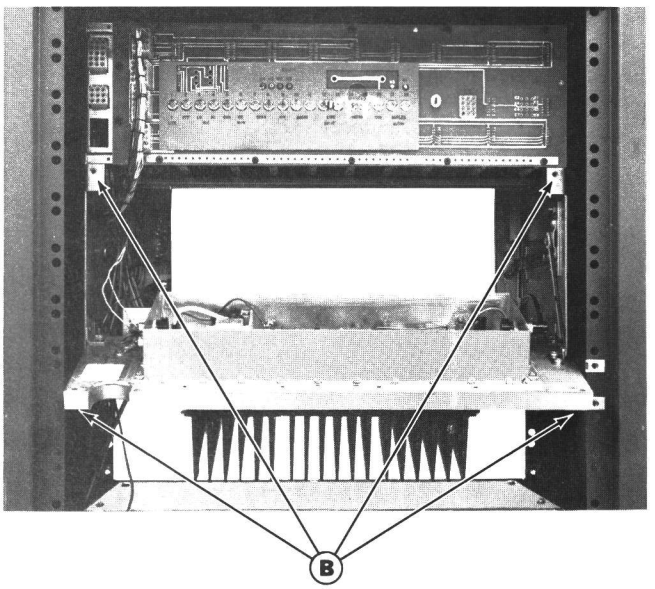


Figure 3 - Access to Power Amplifier Rear View

2. Remove the six screws (A) holding the exciter board and its bottom cover to the module mounting frame.

3. Press straight down on the plug-in exciter from the top to avoid bending the pins when unplugging the board from the system board jack.

PA DISASSEMBLY (See Figures 4 and 5)

To remove the PA assembly:

1. Remove the PA top cover and unplug the exciter/PA cable (B), the antenna, receiver and PTT cables (C).

2. Remove the four side-rail screws (D), and unsolder the power cables from the bottom of the PA assembly if desired.

To remove the PA board:

1. Remove the PA top cover and unplug the exciter/PA cable (B).

2. Unsolder the two feedthrough coils (E) and the thermistor leads (F).

3. Remove the PA transistor hold-down nuts and spring washers on the bottom of the PA assembly.

4. Remove the four PA board mounting screws (G), the five screws in the filter casting (H), and the retaining screw in Q215 (J), and lift the board out.

PA TRANSISTOR REPLACEMENT

WARNING

The stud mounted RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

To replace the PA RF transistors:

1. Unsolder one lead at a time with a 50-Watt soldering iron. Use a scribe or Xacto® knife to hold the lead away from the printed circuit board until the solder cools.

2. Turn the transmitter over.

3. Hold the body of the transistor to prevent it from turning. Remove the transistor hold-down nut and spring washer through the hole in the heat-sink with an 11/32-inch nut-driver for Q201, Q202 and Q203. Lift out the transistor, and remove old solder from the printed circuit board with a de-soldering tool such as a SOLDA PULLT®. Special care should be taken to prevent damage to the printed circuit board runs because part of the matching network is included in the base and collector runs.

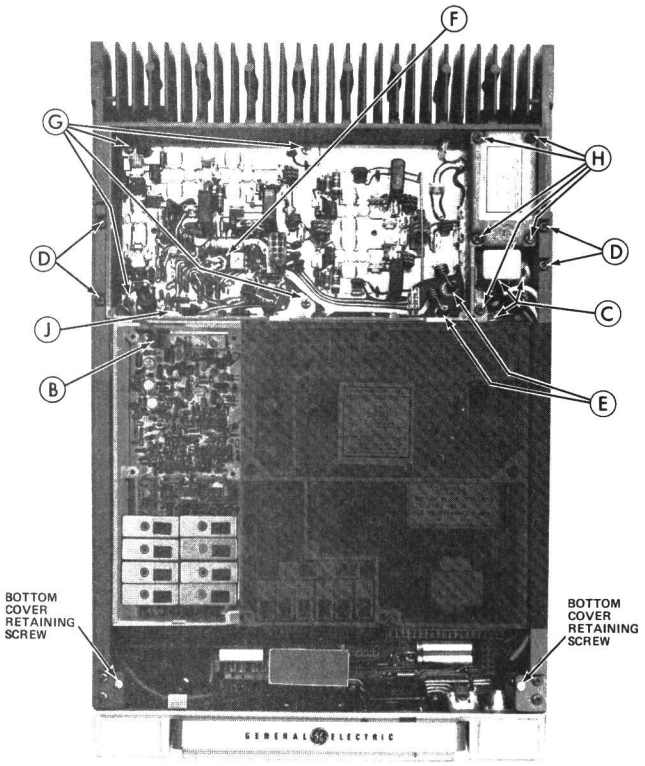


Figure 4 - Disassembly Procedure Top View

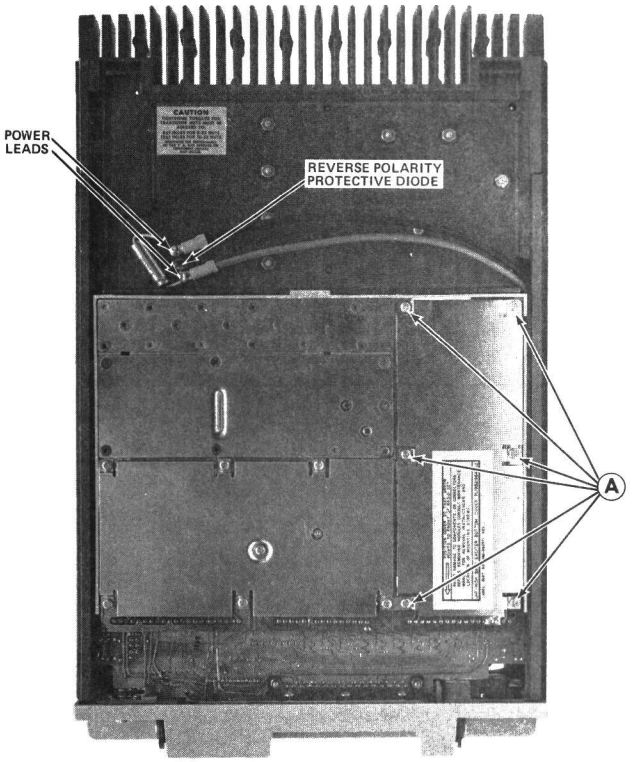


Figure 5 - Disassembly Procedure Bottom View

4. Trim the new transistor leads (if required) to the lead length of the removed transistor. Cut the collector lead at a 45° angle for future identification (see Figure 6). The letter "C" on the top of the transistor also indicates the collector.

5. Apply a coating of silicon grease around the transistor mounting surface, and place the transistor in the mounting hole. Align the leads as shown in the Outline Diagram. Then hold the body of the transistor and replace the hold-down nut and spring-washer, using moderate torque (8 inch-pounds). A torque wrench must be used for this adjustment since transistor damage can result if too little or too much torque is used.

6. Make sure that the transistor leads are formed as shown in Figure 7 so that the leads can be soldered to the printed circuit pattern, starting from the inner edge of the mounting hole.

7. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board. Use care not to use excessive heat that causes the printed wire board runs to lift up from the board. Check for shorts and solder bridges before applying power.

CAUTION

Failure to solder the transistor leads as directed may result in the generation of RF loops that could damage the transistor or may cause low power output.

TROUBLESHOOTING

A Troubleshooting Procedure, including QUICK CHECKS, SYMPTOM CHECKS, and a Trouble Analysis Procedure, permits rapid servicing of the exciter and power amplifier.

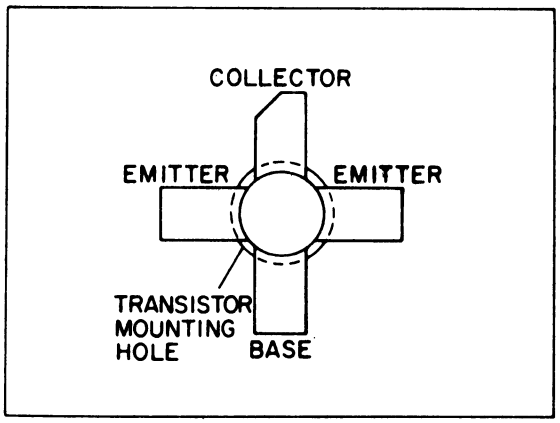


Figure 6 - Lead Identification

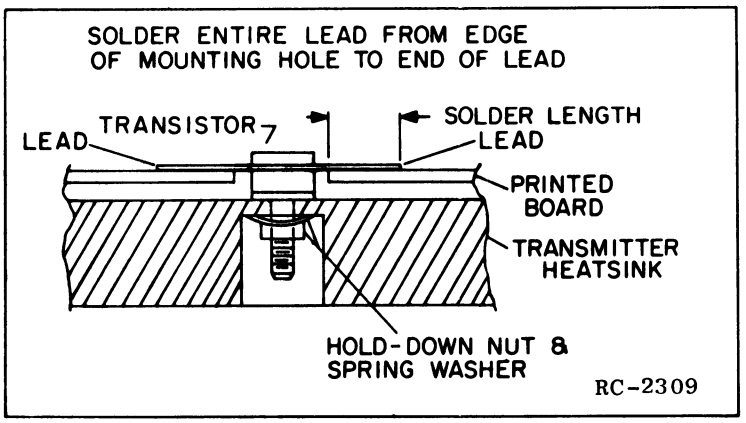


Figure 7 - Lead Forming

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R104) 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 over-modulation while preserving intelligibility.

TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. A frequency modulation monitor
3. An output meter or a VTVM
4. GE Test Set Model 4EX3A11 or 4EX8K12

MOBILE PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J10 (Green-Hi) and J11 (Black-Lo) on GE Test Set, or 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 R104 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 R103 for zero tone deviation. Next, with the 1-Volt signal at 1000 Hz applied, set MOD ADJUST R104 for 3.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST R105 for 0.75 kHz tone deviation.
5. For multi-frequency transmitters, set the deviation as described in Steps 3 or 5 on the channel producing the largest amount of deviation.

STATION 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. Set the Pre-amp level as outlined in the Station Combination Manual.
2. Set the audio generator frequency to 1 kHz.
   A. In all station combinations except Local Control Intermittent Duty combinations, set the audio generator output to 30 millivolts RMS.
   B. In Local Control Intermittent Duty station combinations, set the audio generator output to 1.0 volt RMS.
3. For transmitters without Channel Guard, set MOD ADJUST R104 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 R103 for zero tone deviation. Next, with the audio set as in Step 2, set MOD ADJUST R104 for 3.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST R105 for 0.75 kHz tone deviation.
5. For multi-frequency transmitters, set the deviation as described in Steps 3 or 4 on the channel producing the largest amount of 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:

$$P_i = \text{PA voltage} \times \text{PA current}$$

where:

P_i is the power input in Watts,

PA voltage is measured with Test Set Model 4EX3A11 in Position G on the 15-Volt range (read as 15 Volts full scale), and with the polarity switch in the (-) position. With Test Set Model 4EX8K12, use the B+ position and the 1-Volt range (read as 15 Volts full scale), with the HIGH SENSITIVITY button pressed and the polarity switch in the (-) position.

PA current is measured with the Test Set in Position G in the Test 1 position, and with the HIGH SENSITIVITY button pressed (30 amperes full scale).

Example:

P_i = 12.4 Volts x 20 amperes = 248 Watts

FM ICOM FREQUENCY ADJUSTMENT

NOTE

Always verify correct adjustment of FM ICOMS before setting modulation levels.

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 26.5°C (79.8°F).

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

A. ±0.5 PPM, when the radio is at 26.5°C (79.8°F).

B. ±2 PPM at any other temperature within the range of -5°C to +55°C (+23°F to +131°F).

C. The specification limit (±2 PPM or ±5 PPM) at any temperature within the ranges of -40°C to -5°C (-40°F to +23°F) or +55°C to +70°C (+131°F to +158°F).

If the radio is at an ambient temperature of 26.5°C (79.8°F), set the oscillator for the correct operating frequency.

If the radio is not at an ambient temperature of 26.5°C, setting errors can be minimized as follows:

A. To hold the setting error to ±0.6 PPM (which is considered reasonable for 5 PPM ICOMS):
   1. Maintain the radio at 26.5°C (±5°C) and set the oscillator to desired frequency, or
   2. Maintain the radio at 26.5°C (±10°C) and offset the oscillator, as a function of actual temperature, by the amount shown in Figure 8.

B. To hold setting error to ±0.35 PPM (which is considered reasonable for 2 PPM ICOMs): Maintain unit at 26.5°C (±5°C) and offset the oscillator as a function of actual temperature, by the amount shown in Figure 8.

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 0.3 PPM. (At 138 MHz, 1 PPM is 138 Hz. At 174 MHz, 1 PPM is 174 Hz).

With an operating frequency of 150 MHz, set the oscillator for a reading of 45 Hz (0.3 x 150 Hz) higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 26.5°C) set the oscillator for the indicated PPM lower than the licensed operating frequency.

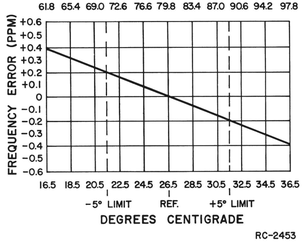
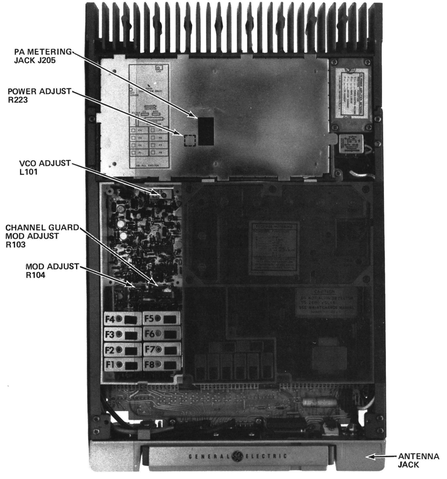


Figure 8 - Frequency Characteristics Vs. Temperature



TRANSMITTER ALIGNMENT

TEST EQUIPMENT REQUIRED

1. GE Test Set Model 4EX3A11 or Test Kit 4EX8K12.
2. A 50-ohm wattmeter connected to antenna jack J906.
3. A frequency counter.
4. VTVM (minimum input impedance is 10 megohms).

NOTE

Set range switch on Test Set to Test 1 Position. With the Test Set connected to the PA 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. The voltage reading at position "G" with the HIGH SENSITIVITY button pressed may be converted to PA collector current by reading the current as 30 amperes full scale.

VCO AND POWER ADJUSTMENTS

NOTE

Before adjusting the VCO, be sure all FM-ICOMS are installed on the exciter in the proper location and are on frequency. (Crystal frequency = Operating frequency ÷ 12). See FM ICOM FREQUENCY ADJUSTMENT.

1. Key the transmitter on the highest frequency and record the DC voltage at TP101.
   - If the voltage at TP101 is less than +5 VDC, adjust L101 for a meter reading of +5 VDC. Go to Step 2.
   - If the DC voltage at TP101 cannot be adjusted to +5 VDC, adjust L101 for maximum meter reading. Key remaining frequencies and verify that "lock" indicator comes on for each frequency and that rated power is available. For this group of frequencies this is the optimum performance setting for L101. Proceed to Step 3.
2. Key the transmitter on the lowest frequency and record the DC voltage at TP101. Using the voltages recorded in Steps 1 and 2, apply the following formula to calculate the optimum voltage setting for L101. Re-key the transmitter on the lowest frequency and adjust L101 to obtain the calculated voltage at TP101.

$$V_{TP101} = 5 - \frac{HF - LF}{2}$$

where

HF = Voltage at highest frequency

LF = Voltage at lowest frequency

3. Check the VCO voltage at TP101 for all remaining frequencies. Voltages should fall within the range obtained for the high and low frequency but never below 3.4 or above 6.4 VDC. The "lock" indicator CR109 should be on for each frequency. Verify that rated power is available.
4. Power Adjustment

   With the battery voltage at 13.4 Volts or the PA collector voltage at 12.4 Volts, set Power Adjust potentiometer R223 on the PA board for the desired power output (from 35 to 110 Watts).

   If the battery voltage is not at 13.4 Volts or the collector voltage at 12.4 Volts and the full rated output is desired (110 Watts at 13.4 Volts), set R223 for the output power according to the battery voltage or collector voltage shown in Figure 9.

NOTE

The PA collector voltage is measured as described in the PA POWER INPUT section.

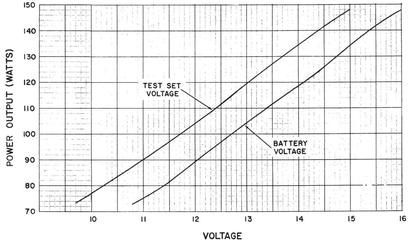


Figure 9 - Power Output Setting Chart

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating--but not properly. Problems encountered could be low power output, tone and voice deviation, defective audio sensitivity, and modulator adjust control set too high. Once a defect is pin-pointed, refer to the "Service Cneck" and the additional corrective measures included in the Transmitter Troubleshooting Procedure. Before starting with the Transmitter Test Procedures, be sure the transmitter is tuned and aligned to the proper operating frequency.

CAUTION

Before bench testing the MASTR II Mobile Radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed: 20 Volts
Transmitter keyed (50 ohm resistive load): 18 Volts
Transmitter keyed (no load or non-resistive load): 14.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limit shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach 18 Volts.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.6 VDC for loads of 6 to 16 amperes; 13.4 VDC for loads of 16 to 36 amperes). Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12-Volt automotive storage battery.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

1. Wattmeter similar to:
   Bird # 43
   Jones # 711N
2. VTVM similar to:
   Triplett # 850
   Heath # IM-21
3. Audio Generator similar to:
   GE Model 4EX6A10
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements # 720
5. Multimeter similar to:
   GE TEST SET MODEL 4EX3A11,
   MODEL 4EX8K12 or
   20,000 ohms-per-Volt voltmeter

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output from the antenna jack to the wattmeter through a 50-ohm coaxial cable. Make sure the wattmeter is terminated into a 50-ohm load.
2. Key the transmitter and check the wattmeter for the desired power output at all frequencies.

SERVICE CHECK

Check the setting of the Power Adjust Control (R223).

Refer to the QUICK CHECKS on the Transmitter Troubleshooting Procedure.

VOICE DEVIATION, SYMMETRY AND AUDIO SENSITIVITY

TEST PROCEDURE

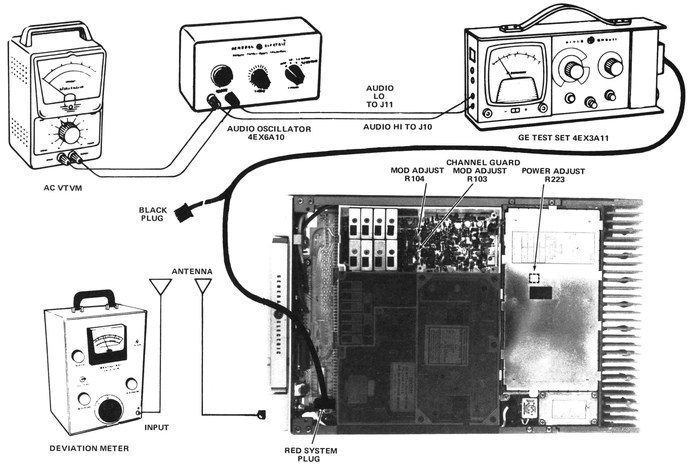
1. Connect the test equipment to the transmitter as shown.
2. In radios with Channel Guard, set Channel Guard Mod Adjust R103 for zero tone deviation.
3. In Mobile and Local Control Intermittent Duty Station combinations only, set the audio generator output to 1.0 Volt RMS and the frequency to 1 kHz.

   In all other Station combinations, set the audio generator output to 30 millivolts RMS and the frequency to 1 kHz.

4. Key the transmitter and adjust Deviation Meter to carrier frequency.
5. Deviation reading should be ±4.5 kHz in radios without Channel Guard, and ±3.75 kHz in radios with Channel Guard.
6. If necessary, adjust MOD ADJUST control R104 for the proper deviation on plus (+) or minus (-) deviation, whichever is greater.

NOTES: -- MASTR II transmitters are adjusted for 4.5 kHz deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz under the worse conditions of frequency, voltage and temperature.

7. If the deviation reading plus (+) or minus (-) differs by more than 0.5 kHz, recheck Steps 1 and 2 as shown in the Transmitter Alignment Chart.
8. Check Audio Sensitivity by reducing generator output until deviation falls to 3.0 kHz for radios without Channel Guard, or 2.25 kHz for radios with Channel Guard. Voltage should be LESS than 120 millivolts. If not, refer to the Transmitter Troubleshooting Procedure.



TONE DEVIATION WITH CHANNEL GUARD

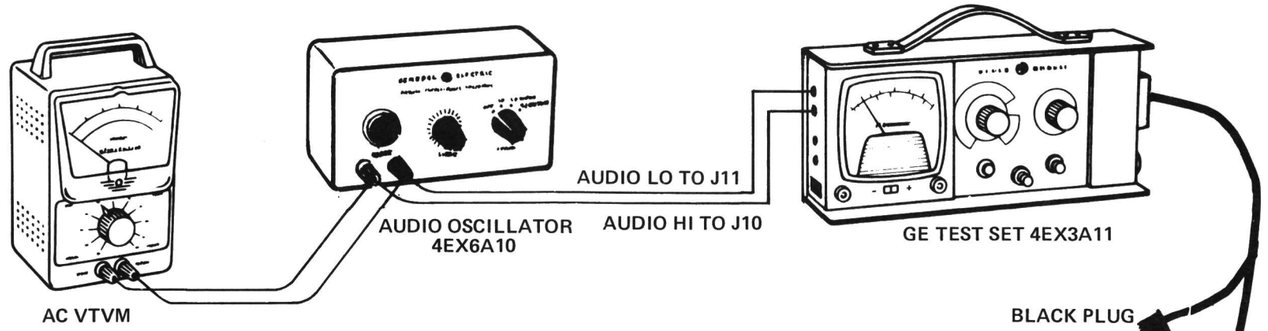
TEST PROCEDURE

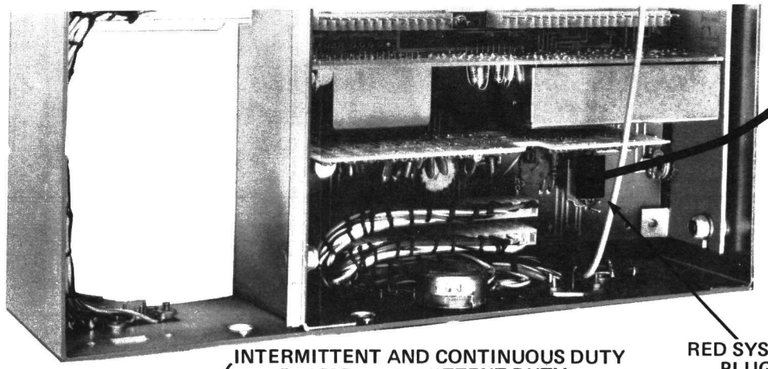
1. Set up the Deviation Meter and monitor the output of the transmitter.
2. Remove the 1000 Hz signal from the audio generator.
3. Key the transmitter and check for 0.75 kHz deviation. If the reading is low or high, adjust Channel Guard MOD ADJUST R103 for a reading of 0.75 kHz.

NOTE

The Tone Deviation Test Procedures should be repeated every time the Tone Frequency is changed.

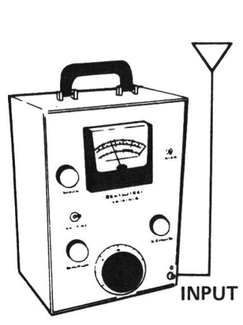
STATION METERING



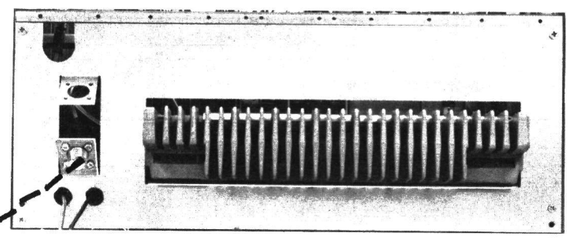


INTERMITTENT AND CONTINUOUS DUTY
(ALL EXCEPT INTERMITTENT DUTY
LOCAL CONTROL) SYSTEM BOARD

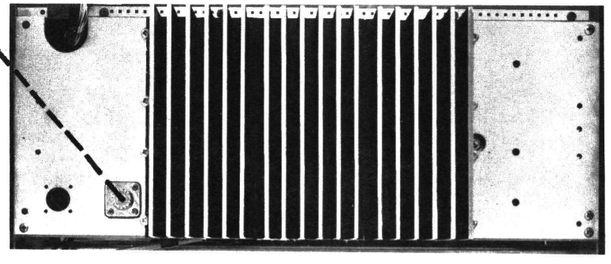
RED SYSTEM
PLUG



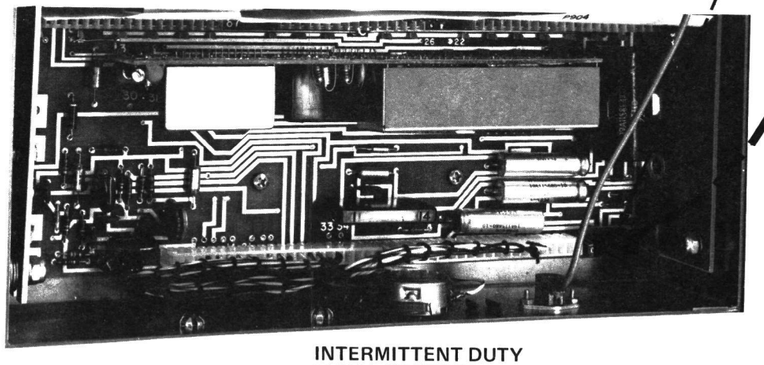
DEVIATION METER



INTERMITTENT DUTY PA



CONTINUOUS DUTY PA



INTERMITTENT DUTY
LOCAL CONTROL
SYSTEM BOARD

STEP 1 - QUICK CHECKS

EXCITER		
TEST POINT	METER READING	PROBABLE DEFECTIVE STAGE
TP101	NOTE: When using a digital voltmeter bypass the input leads using a 150 pf capacitor (nominal). When checking DC voltage at TP101, be sure to use a VTVM with 10 megaohm input impedance. +3.4 - 6.4 VDC (Stable)	Check VCO Adjustment See Alignment Procedure
P902-12	+10 VDC (Tx Keyed)	External to exciter
Q113C	+10 VDC (Tx Keyed)	Q113, Q114, 10 V Regulator
Q115E	+ 5 VDC (Tx Keyed)	Q115, Q114, Q113
XY101-6	+6.1 VDC	R152, R153
XY101-4	+5 VDC	FM-ICOM 5C or 2C

POWER AMPLIFIER

METER POSITION GE TEST SET	TEST POINT	NORMAL METER READING	PROBABLE DEFECTIVE STAGE: HIGH METER READING	LOW METER READING	ZERO METER READING
"D" (AMPL-1 DRIVE)	J205-4	+0.8 VDC		Low Output from Exciter	No output from Exciter, CR201
"C" (AMPL-1 POWER CONTROL VOLTAGE)	J205-3	+4.0 VDC	Q215	Q215	No Exciter output, Q215, Q206, CR201
"F" (DRIVER CURRENT)	J205-7 (+) J205-9 (-)	+0.45 VDC (Note 1)	Q203	Q203, Low Output from Q201, Q202	Q203, Q202, Q201, Check Pos. D & C
"G" (PA CURRENT)	J205-6 (+) J205-5 (-)	+0.6 VDC (Note 2)	Q204, Q205, Q206, Q207	Q201, Q202, Q203, Q204 Q205, Q206 Q207	Q207, Q206, Q205, Q204, Q203, Q202 Q201, Q215

NOTES

1. Current = voltage reading x 10
2. Current = voltage reading ÷ 30

STEP 2 - EXCITER SYMPTOM CHECKS

SYMPTOM	PROCEDURE	PROBABLE DEFECTIVE STAGE
Low or no power OUTPUT Lock Indicator On Lock Indicator Out	NOTE: Check all DC voltages. With test set on position D, monitor exciter output power. Verify voltage at TP101 is within range of 3.4 - 6.4 VDC and stable (no ac component). Output power should be 250 milliwatts.	Q111, Q112, Q116, Q117, Q118, Q104
No power output on some channels	Substitute ICOMS, check for misadjustment of L101.	FM-ICOM
Output frequency unstable. lock indicator on.	Check operation of lock detector circuit. Check for misadjustment of L101. Further trouble indicated. Refer to Phase Lock Loop Troubleshooting Procedure.	CR107, CR108, Q104, Q117, Q118, Q116
No Output Power voltage at TP101 is above 7.0 VDC	Check for presence of FM ICOM and VCO INPUTS to U101. U101-4 - 100 millivolts PP minimum at U101-4 (3rd harmonic of FM ICOM). U101-8 - 800 millivolts PP minimum at 1/4 of operating frequency.	FM ICOM Q101, AR101, FL101 U102, Q109, Q110, Q107, Q108
No output power, voltage at TP101 within limit but unstable.	Refer to Phase Lock Loop Trouble Analysis for detailed procedure.	
Lock indicator does not come on.	Monitor TP101 with a VTVM and tune L101 over entire frequency range. LED should be on between +3.4 VDC and 6.4 VDC.	CR102
Intermittent operation at low temperatures		CR105 and CR106 (Use exact replacements) RT102

TROUBLESHOOTING PROCEDURE

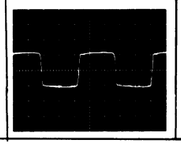
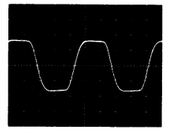
138—174 MHz, 110-WATT TRANSMITTER

STEP 3 - AUDIO AC VOLTAGES

TEST EQUIPMENT REQUIRED

- Audio Oscillator
- AC VTVM
- Oscilloscope

1. Connect audio oscillator output through a 0.5 μf to P902-6. Connect Audio oscillator ground to P902-5.

		JUNCTION OF A101 R109 and C103	XY101-3
SCOPE SETTING	HORIZONTAL	200 U SEC/DIV	200 U SEC/DIV
	VERTICAL	2 VOLTS/DIV	2 VOLTS/DIV
SET AUDIO OSCILLATOR AT 1000 HZ WITH OUTPUT OF 1.0 V RMS. R104 ADJUSTED FOR 4.5 kHz DEVIATION. NOTE: AN RMS OR PEAK READING VOLT METER WILL READ 1/2 TO 1/3 OF PEAK-TO-PEAK READINGS.			

STEP 4 - TROUBLE ANALYSIS PROCEDURE

Equipment Required (or equivalent)

- Oscilloscope - Tecktroniz 435 (or equivalent)
- Electronic Frequency Counter (Capable of 200 MHz)
- VTVM (10 megaohm input impedance)
- 50 ohm wattmeter

Preliminary Procedure

1. Connect wattmeter to J101.
2. All checks assume that transmitter is keyed.
3. Verify accuracy of all DC levels before performing this procedure, DC levels provide a quick indication of defective stage.
4. Force RF Amplifiers on by temporarily soldering a DA jumper wire between Q117C and ground on the solder side of printed wire board.

STEP	TEST POINT	PROCEDURE	PROBABLE DEFECTIVE STAGE
1	U101-4	• Using oscilloscope, observe 100 millivolt PP signal, (DC level 3.2 VDC) at 3 times FM ICOM frequency. If signal is present, proceed to step 4.	
2	J103-1 (FL101)	• Remove bandpass filter FL101 and observe 1 volt PP minimum sawtooth wave form. Select all remaining operating channels. • Verify presence of +8.6 VDC at J103-1. • Replace FL101.	Defective ICOM Q113, Q114
3	AR101-1	• Verify presence of a 400 millivolt PP (nominal) sine wave (Distorted). • If signal is not present.	AR101 FL101
4	U101-8	• Observe presence of 800 millivolt PP minimum square wave (distorted). If present, proceed to step 9.	
5	R139 J101	• Observe sine wave at VCO frequency. • Observe sine wave at VCO frequency. Power meter should read 250 milliwatts minimum.	Q107, Q108 Q111, Q112
6	Q109B	Observe sine wave at VCO frequency.	Q110
7	U102-14	Observe 800 millivolt PP square wave (distorted) at 1/4 VCO frequency. When using frequency counter, connect a nominal 33 pf capacitor in series with probe.	Q109, U102
8	TP101	Using oscilloscope, monitor TP101 and tune L101 through entire range. Voltage should be stable and be variable from 3.4-6.4 VDC minimum. There should be no AC component. A varying DC voltage indicates that the PLL is hunting and won't lock.	CR102, Q102, Q103 Q107, Q108
9	TP101	Remove bandpass filter FL101. Voltage at TP101 should be 8.0 VDC. Replace bandpass filter FL101.	CR102, Q105, Q106, Q102 or Q103
10	U101-4, 8	Verify that FM ICOM frequency (X3) and divided VCO frequency $\frac{(oper)}{4}$ are present.	U101
11	Q102-B	Check for 8.0 VDC ±0.1 (0.2 VAC PP normal).	U101
12	Q102-C	Check for +4.0 VDC (stable with L101 adjusted for +5 VDC at TP101).	Q102
13	Q117-C	NOTE: Remove DA jumper wire soldered between Q117-C and ground. Ground TP101 and check for 0.2 VDC at Q104C. CR109 should be off.	C109, C127 CR107, CR108, Q104
14	Q117C	Check for +10 VDC. Remove ground from TP101.	Q117, Q118
15	Q116C	Check for 9.75 VDC at Q116C. CR109 should be on.	Q116
16	J101	Verify a minimum of 250 milliwatts RF power is available for each operating frequency.	

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A

ECP-824