MOBILE RADIO

DESCRIPTION AND MAINTENANCE

806–825 MHz CUSTOM MVP TRANSMITTER

TABLE OF CONTENTS

DESCRIPTION

CUSTOM MVP transmitters are crystal controlled, frequency modulated transmitters designed for multi-frequency operation in the 806-825 MHz frequency band. This solid state, high reliability transmitter uses an FM ICOM module and discrete components to provide 10 watts of transmitted RF power. The transmitter consists of:

- Exciter Board with audio processor, oscillator board, FM ICOMS and frequency multiplier/amplifier stages.
- Power Amplifier Assembly; with amplifier, driver, PA final, power adjust circuits and low pass filter assembly.

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

In addition to providing 65 milliwatts of RF power to the PA in the transmit mode, the exciter also provides 15 milliwatts RF injection to the receiver 1st mixer in the receive mode.

The exciter contains the audio processor

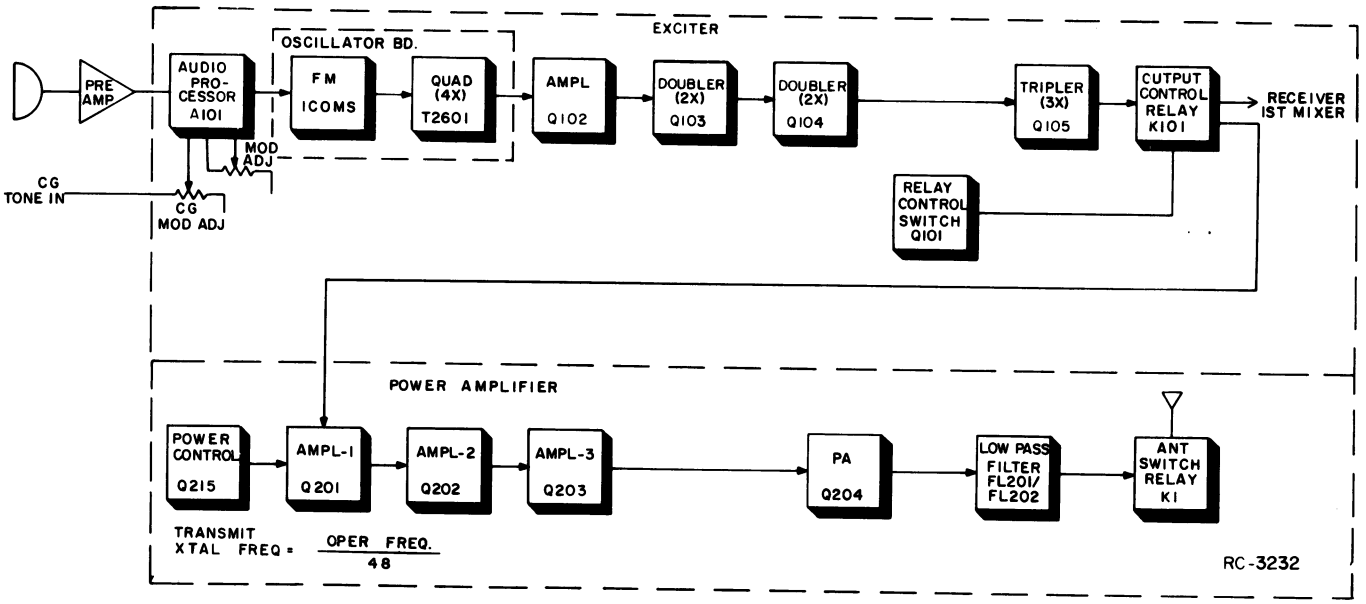


Figure 1 - Block Diagram

and the frequency multiplier/amplifier necessary to generate the transmitted RF carrier frequency. (This same frequency is always used to generate the receiver lst IF frequency). The FM ICOMS are located on a separate oscillator board located adjacent to the exciter board. The oscillator board plugs into J104 on the exciter.

The power amplifier assembly utilizes four transistors to provide rated output power, a low pass filter and a power adjust circuit to set the output power level for rated output.

The radio operates in vehicles with negative ground only.

MAINTENANCE

DISASSEMBLY

To service the transmitter remove the wing nut at the rear of the radio and pull the radio out of case assembly.

The oscillator board must be removed before removing the exciter board.

1. Unplug W6 (frequency select cable) from the oscillator board(s).
2. Remove two 6-32 x 1/4 inch Phillips head screws from oscillator board and then lift board up from exciter jack J104.

NOTE

In radios equipped with 3 or 4 channels a second oscillator board is used. In this configuration remove the two spacers (now exposed) and lift the second oscillator board up from exciter jack J104.

EXCITER BOARD

1. Remove 6-32 x 3/8 thread forming screw holding the Exciter cover to the shield and remove cover.
2. Unplug cables W201 and W5 (exciter output cables), W6 (multi-frequency cable) and P902 (part of RCVR/XMTR Harness W3).
3. Remove the five (5) screws, one spacer holding the exciter board to the mounting frame and gently lift exciter board out of radio.

PA MAINTENANCE

NOTE

Component placement (chip capacitors within 5/1000th inch) and PWB connections are very critical on the fixed tuned PA.

Since the chassis is an integral part of the PA assembly and the removal, replacement and transhipment of the PA board itself is undesirable due to its inherent flexability, it is recommended that field repair not be attempted, but instead that the entire radio be returned to the factory for repairs.

CAUTION

Before bench testing the CUSTOM MVP 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 (no load or non-resistive load): 15.5 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 the 16 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.8 VDC for loads of 0 to 6 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 723 may be unable when operated in parallel with a 12-Volt automotive storage battery.

TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. Deviation meter
3. A 20,000 ohms-per-volt voltmeter, AC Voltmeter
4. GE Test Set Models 4EX3A11 or 4EX8K12
5. Wattmeter
6. Frequency Counter

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST Control 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.

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 P902-4 (Wire High) through a 0.5 microfarad (or larger) DC blocking capacitor, and P902-5 (Wire-Low) on the exciter 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-kilohertz swing with the deviation polarity that provides the highest reading as indicated on the deviation meter. If deviation reading varies more than ±0.5 kHz, recheck Step 1 under Transmitter Alignment.
4. For transmitters with Channel Guard, set Channel Guard MOD ADJUST for zero tone deviation. Next, with the 1-Volt signal at 1000 Hz applied, set MOD ADJUST R103 for a 3.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST for 0.75 kHz tone deviation.
5. For multi-frequency transmitters, set the deviation as described in Step 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 using a multimeter (on VTVM) with a minimum input resistance of 20,000 ohms-per-volt.

PA current is measured with the Test Set in Position F in the Test 1 position, and with the HIGH SENSITIVITY button pressed (10 amperes full scale).

Example:

P_i = 13.8 Volts x 4.5 amperes = 62 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 3 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).

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 27.5°C (81.5°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) at any temperature within the ranges of +30°C to -5°C (+22°F to +23°F) or +55°C to +60°C (+131°F to +140°F).

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

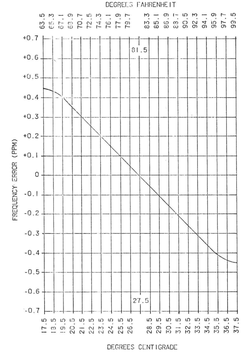
If the radio is not at an ambient temperature of 27.5°C, setting errors can be minimized as follows:

A. To hold the setting error to ±.2 PPM (which is considered reasonable for 2 PPM ICOMS)

1. Maintain the radio at 27.5°C (±10°C) and offset the oscillator, as a function of actual temperature, by the amount shown in Figure 2.

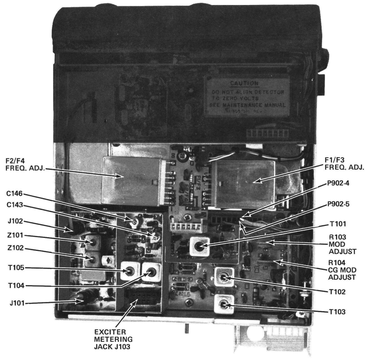
For example: Assume the ambient temperature of the radio is 23.5°C (74.3°F). At that temperature, the curve shows a correction factor of 0.2 PPM. (At 806 MHz, 1 PPM is 806 Hz. At 825 MHz, 1 PPM is 825 Hz).

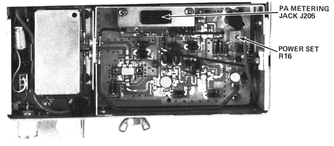
With an operating frequency of 806 MHz, set the oscillator for a reading of 162 Hz (0.2 x 806 Hz) higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 27.5°C) set the oscillator for the indicated PPM lower than the licensed operating frequency.



RC-3164

Figure 2 - Frequency Offset Chart





TRANSMITTER ALIGNMENT

EQUIPMENT

1. GE Test Set Model 4EX3A11 or Test Kit 4EX8K12.
2. A 50-ohm wattmeter connected to antenna jack J2.
3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place all FM ICOMs on oscillator Boards, (crystal frequency = operating frequency ÷ 48).
2. For a large change in frequency or a badly mis-aligned transmitter, preset all slugs (including Z101 and Z102) to the top of the coil form.
3. Set C157 and C159 to minimum capacity (not meshed).

NOTE

The tuning frequency for multi-frequency transmitters is determined by the operating frequency and the frequency spread between transmitters. Refer to the table below for maximum frequency spread.

4. For multi-frequency transmitters with a frequency spread less than 1.5 MHz tune the transmitters to the lowest frequency. For a frequency spread from 1.5 - 2.0 MHz, tune the transmitters using a center frequency tune up ICOM.
5. Connect the red plug on the GE Test Set to the SAS 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 PA metering jack, the voltage reading at position "F" with the HIGH SENSITIVITY button pressed may be converted to PA collector current by reading the current as 10 amperes full scale.

NOTE

The transmitter must be keyed only when tuning Z101 and Z102.

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 (MULT-1)	T101, T102	See Procedure	Tune T101 for maximum meter reading. Then tune T102 for a dip (small) in meter reading.
2.	C (MULT-2)	T103, T104	See Procedure	Tune T103 for maximum meter reading and then tune T104 for a dip in meter reading.
3.	D (MULT-2)	T101 - T103	See Procedure	Tune T101, T102 and T103 for maximum meter reading.
4.	F (MULT-3)	T105, C143	See Procedure	Tune T105 for maximum meter reading and then tune C143 for a dip in meter reading.
5.	F (MULT-3)	T104, T105	See Procedure	Tune T104 and T105 for maximum meter reading.
6.	G (MULT-4)	C146, Z101	See Procedure	Tune C146 for maximum meter reading, then key transmitter and tune Z101 for a dip in meter reading.
7.	G (MULT-4)	C142, C146	Maximum	Tune C143 and C146 for maximum meter reading.
8.	D (WATTMETER)	Z102, Z101	Maximum	Disconnect black metering plug from exciter and connect to PA metering jack. Key transmitter and tune R101 and Z102 for maximum meter reading.
9.	D (WATTMETER)	Z101, Z102	Maximum	Alternately tune Z101 and Z102 for maximum meter reading.
10.	D (MULT-2)	T101 - T103	Maximum	Disconnect black metering plug from PA and connect to exciter metering jack. Alternately tune T101, T102 and T103 for maximum meter reading.
11.	F (MULT-3)	T104, T105	See Procedure	Alternately tune T104 and T105 for maximum meter reading.
12.	D (WATTMETER)	C142, C146 Z101, Z102	See Procedure	Disconnect black metering plug from exciter and connect to PA metering jack. Key transmitter and tune C142 and C146 for maximum meter reading, then alternately tune Z101 and Z102 for maximum meter reading.
13.	WATTMETERS	R16		With the battery voltage at 13.6 Volts set Power Adjust potentiometer R16 on the PA board for 10-Watts output.

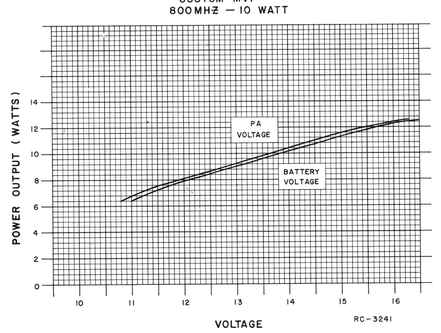
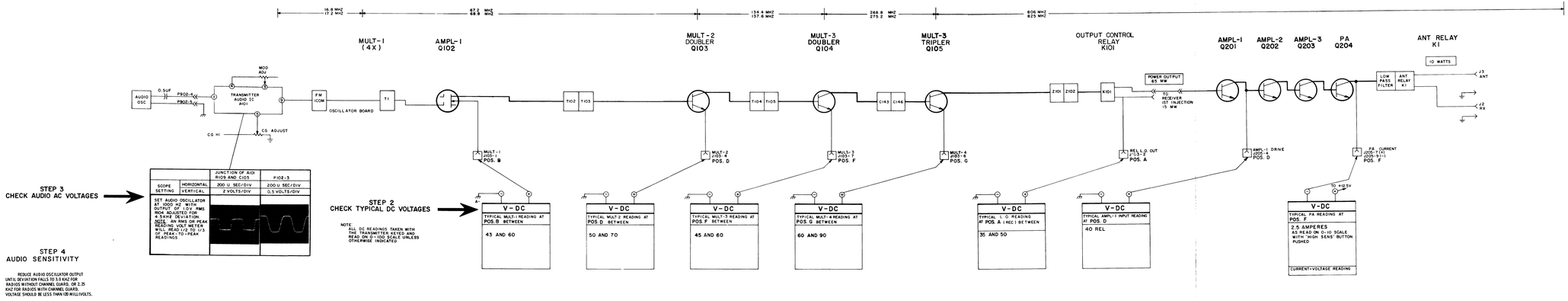


Figure 3 - Power Output Adjustment

STEP 1 - QUICK CHECKS

Connect GE TEST SET to Exciter or Power Amplifier Metering Jack as required.

METER POSITION GE TEST SET	PROBABLE DEFECTIVE STAGE		
	HIGH METER READING	LOW METER READING	ZERO METER READING
EXCITER			
A (REL PWR)		Q104, Q105	Q102-Q104, CR102, R138, R139, C162, C161
B (MULT-1)	Q102, T102 10-Volt Regulator	T101 (Osc. Mod) Q102	T101 (Osc. Mod), T102, Q102
C (MULT-2)	Q103, T104	Q103, T102, T103	T104, T102, T103, Q103
F (MULT-3)	Q104, C139	Q104, T104, T105	T104, T105, L103, Q104
G (MULT-4)	Q105, Z101, Z102	Q105, C143, C146	Q105, C143, C146, Z101, Z102
POWER AMPLIFIER			
"C" (POWER CONTROL)		Q1, Q215, VR1, R16	Q1, Q215, VR1, R16
"D" (AMPL-1 INPUT)		Low Output from Exciter, CR1, C1	No Output from Exciter, CR1, C1
"F" (PA CURRENT)	Q204, L23, L23, R11	Q203, Q204, Low Output from Exciter	No Output from Exciter, Q201-Q204 Check POS. C & D (K101, Q101, CR101 in Exciter)



RC-3239

TROUBLESHOOTING PROCEDURE

806—825 MHz, 10-WATT TRANSMITTER

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