BENCH ALIGNMENT PROCEDURE FOR TRANSMITTER MODEL 4ET24A1

This Bench Alignment Procedure is provided for completely realigning Transmitter Model 4ET24A1 or for changing the frequency. Instructions for adjusting the modulation level are also included.

ALIGNMENT PROCEDURE

TEST EQUIPMENT

The transmitter can be completely realigned, using a 20,000 ohm-per-volt voltmeter which covers the 0 to 3-volt range. The voltage indications given in the following alignment procedure are the values which should be read on such a meter. General Electric Test Set Type EX-1-C is an instrument designed for the many metering applications encountered when tuning Radio Communication and associated equipment and includes a 20,000 ohm-per-volt meter.

If a meter equivalent to the one suggested is not available for tuning purposes, others may be used, but the meter reading obtained must be corrected to account for the shunting effect of the different meter resistance on the metering circuit.

The following test equipment is recommended:

1. A 20,000 ohm-per-volt meter, such as the G-E Test Set Type EX-1-C, which covers the 0 to 3-volt range.

2. A non-metallic screwdriver.

3. A frequency measuring device, such as Lampkin Type 105B or Gertsch Model FM-3.

4. An absorption wavemeter which will tune to 2, 6, 12 and 36 times the crystal frequency.

PROCEDURE

Refer to SERVICE OUTLINE RC-653 (see Table of Contents) to locate the tuning controls referred to in the following alignment procedure. All meter readings are measured between the jack indicated and ground.

1. Be sure that the oscillator crystal is correctly connected between pins 4 and 8 on crystal oven. The crystal frequency is 1/36th of the channel frequency.

NOTE

In changing from 6 to 12-volt or 12 to 6-volt operation, the crystal oven must be reversed. Reversing the crystal oven may change the 1st Oscillator frequency by changing the capacity from the crystal to ground. Check the 1st Oscillator frequency whenever the crystal oven is reversed.

2. Connect the antenna or another load to the transmitter.

3. Set the LOADING control (R135 on the PA housing) to full counterclockwise position. Adjust PA PLATE, FILTER 1 and FILTER 2 controls so that the slots in their shafts are perpendicular to the length of the transmitter chassis.

4. Turn the power on and allow 30 seconds for the transmitter to warm up to operating temperature.

5. A voltage reading of 0.7 to 1.5 volts between the MULT-1 jack, J101 (green-negative), and ground when the transmitter is keyed indicates proper operation of the Oscillator and Modulator stages of the transmitter. Use the ground jack located on the power supply chassis. If the MULT-1 reading is less than 0.7 volt or more than 1.5 volts, the oscillator plate tank should be tuned by adjusting C170. C170 was adjusted at the factory and should not ordinarily require further readjustment. Because of variations in tube characteristics, however, C170 may have to be readjusted when the oscillator tube is replaced.

NOTE

After any readjustment of C170, check the frequency of the transmitter.

6. With the meter lead moved to the MULT-2 jack, J102 (green-negative), key the transmitter and alternately tune Z109 ("2") and Z108 ("1"), in that order for maximum meter reading (approximately 1.0 volt).

CAUTION

Do not key the transmitter for longer than 30 seconds in each minute until the 3rd multiplier plate has been tuned.

When making a great change in frequency, it may not be possible to see any indication on the meter when Z108 is tuned, unless Z109 is tuned near the correct frequency. In this case, pretune Z108 by one of the following methods:

(a) With the 300-volt scale of a vacuum tube voltmeter or a 20,000 ohm-per-volt voltmeter connected at the screen of the 1st Multiplier (pin 3 of XV102), tune Z108 ("1") for a slight dip in screen voltage.

(b) Hold an absorption wavemeter close to the bottom of Z108, and tune for resonance.

7. Alternately tune Z103 ("3") and Z104 ("4") for maximum meter reading (approximately 1.6 volts) at the MULT-3 jack, J103 (green-negative). Fixed bias on the MULT-3 grid will appear as a small initial reading (approximately 0.8 volt) at J103, whether or not Z103 and Z104 are correctly tuned. A slight dip at J102 may be used as an indication of resonance of Z103, if both Z103 and Z104 are badly misaligned.

8. Peak the MULT-3 PLATE control (C126) while metering at the MULT-4 jack, J104 (green-negative). Fixed bias on the MULT-4 grid will appear as a small initial reading (approximately 0.5 volt) at J104, whether or not C126 is correctly tuned. The meter should read approximately 1.8 volts for proper tuning.

9. Peak the MULT-4 Plate control (C129) and the PA GRID control (C171) at the PA GRID jack, J105 (green-negative). There will be four peaks in a 360° rotation of the PA GRID control. Use that peak which gives the greatest reading at the PA GRID jack. Repeat until no further increase in meter reading can be obtained by tuning either control. Fixed bias on the PA grid will appear as a small initial reading at J105 (approximately 1.0 volt), whether or not the MULT-4 PLATE and PA GRID controls are correctly tuned.

If the MULT-4 plate and PA GRID tanks are badly misaligned, resonance of the tanks may be achieved by the following procedure:

(a) Adjust the PA GRID control so that the screw driver slot is perpendicular to the length of the chassis.

(b) Insert the positive probe of the test meter into the PA CATH jack (J106) and the negative lead into the ground jack.

(c) Adjust the MULT-4 PLATE control for a peak in the meter reading.

(d) Adjust the PA GRID control for a peak in the meter reading.

(e) Proceed to the beginning of step 9.

10. Repeat step 8.

11. Connect the meter leads between the PA CATH jack, J106 (red - positive), and ground, key the transmitter and tune the PA PLATE control (C172) and FILTER 1 for maximum meter reading.

12. Repeat step 9.

13. Plug the positive meter probe into the RF OUTPUT meter jack.

14. Key the transmitter and tune the FILTER tuning adjustments 1 and 2, for maximum meter reading.

15. Plug the positive meter probe into the PA CATH jack and adjust the LOADING control for a meter reading of 1.3 volts. For FCC purposes, the cathode current of the power amplifier stage may be accurately calculated in milliamperes by multiplying the reading at the PA CATH jack by 100. Screen and grid currents, totaling 10 milliamperes, should be subtracted from this value to arrive at actual plate current.

16. Repeat steps 13, 14 and 15 alternately, until no further increase in meter reading at the RF OUTPUT jack can be obtained with a reading of 1.3 volts at the PA CATH jack.

NOTE

If the transmitter is to be run delivering power continuously, step 17 should be omitted.

17. Leave the transmitter unkeyed for 5 minutes. At the end of this time, key the transmitter and, within 10 seconds, readjust the PA PLATE control for maximum reading at the RF OUTPUT jack. Readjust the LOADING control for a reading of 1.3 volts at the PA CATH jack.

18. Check the frequency of the transmitter.

PA cathode current (ma) may be determined by multiplying PA CATH meter reading by 100. Subtract 10 ma screen and grid current from this to determine PA plate current.

HV B+ measurement must be made with the battery or AC line voltage at the highest value which will be encountered in the particular installation. In mobile installations, this will occur when the vehicle battery is fully charged, motor is running, and headlights and all other electrical accessories are turned off.

RF OUTPUT METER JACK

The RF OUTPUT meter jack is provided as an aid in tuning the transmitter for maximum output. It is not intended as a means of measuring power output.

The circuit which provides a reading at the RF OUTPUT jack involves the use of a germanium rectifier. Germanium, like all semi-conductors, has characteristics which vary widely with varying temperature. Therefore, the reading obtained at the RF OUTPUT jack will depend not only on the actual power output, but also on the temperature of the germanium rectifier. This temperature is dependent upon the ambient temperature of the transmitter and upon how much the transmitter has been operated in the few minutes before the reading is taken. For this reason, readings may vary widely from day to day, even though the power output may remain constant. Therefore, it is not recommended that the reading at the RF OUTPUT jack be used as an indication of the performance of the transmitter.

MODULATION LEVEL ADJUSTMENT

The modulation level control, R164, was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 60 percent modulation for the average voice level. The occasional audio peaks which would cause overmodulation are limited by the modulation limiter (V108). The limiter instantaneously limits the slope of the audio wave, preventing overmodulation, but preserving the intelligibility of the transmission.

TEST EQUIPMENT

1. An audio oscillator.
2. A frequency modulation monitor.
3. An output meter or a vacuum tube voltmeter.

PROCEDURE

1. Connect the audio oscillator and the meter across pins 1 and 2 of the microphone receptacle on the power supply chassis. (Pin 1 is the audio low).

2. Apply a 1.0-volt signal at 1000 cps across the microphone terminals.

3. Disconnect the microphone from the control unit, and key the transmitter by means of the test switch on mobile transmitters or by grounding pin 3 of the microphone jack in station transmitters.

4. Set the MOD control (R164) for a 13-kilocycle swing for the wide-band transmitter or a 5-kilocycle swing for the narrow-band transmitter*, as indicated on the frequency modulation monitor.

*Because of the high selectivity of General Electric Mobile Radio equipment, excessively high swings can impair communication effectiveness as well as excessively low swings. With the settings recommended, good performance should be obtained. In general, more problems arise from high swing settings than from low; for this reason, the modulation control is set for ± 13-kilocycles for wide-band transmitters and ± 5-kilocycles for narrow-band transmitters, when the equipment is shipped from the factory.

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COMMUNICATION PRODUCTS DEPARTMENT
GENERAL ELECTRIC COMPANY
LYNCHBURG, VIRGINIA

Printed in U.S.A.