# BENCH ALIGNMENT PROCEDURE FOR MODEL 4ET21A13 EXCITER

This instruction is provided for completely aligning or changing the frequency of the Model 4ET21A13 Exciter. Instructions are also included for modulation adjustment. Place the EXC-TRANS Switch (S101) in the EXC position. The TRANS position of this switch should be used only when the exciter is to be used as a transmitter.

## ALIGNMENT PROCEDURE

### TEST EQUIPMENT

The Model 4ET21A13 Exciter may be completely aligned using a 20,000 ohms-per-volt voltmeter which covers the 0 to 3 volt range. The voltage values given in the following procedure are the values which should be read on such a meter.

1. A 20,000 ohms-per-volt voltmeter, 0 to 3 volt range.
2. A frequency measuring device such as Lampkin Type 105B or Gertsch Model FM-3.
3. An absorption wavemeter which will tune to 2, 6, 12 and 24 times the crystal frequency.
4. A suitable wattmeter for providing a 50 ohm load to the exciter.
5. A non-metallic screwdriver.

### PROCEDURE

Refer to the SERVICE OUTLINE (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 the CHANNEL A crystal is plugged into pins 4 and 8 of the crystal oven and that the CHANNEL B crystal is plugged into pins 2 and 6 of the crystal oven.
2. Select the oscillator with the lowest frequency by grounding its cathode (ground P101-3 if CHANNEL A is desired; ground P101-4 if CHANNEL B is desired). If the greatest frequency separation between channels is more than 0.4% of the operating frequency, a crystal having a frequency which is the average of the crystal frequencies for the highest and lowest channels should be used to align the exciter.

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3. Connect the 50 ohm wattmeter to the output of the exciter.

4. Set the EXC-TRANS Switch (S101) in the EXC position. Rotate the Drive Control (R193) to the extreme CCW position.

5. Rotate the ANT COUPLING control to its extreme CW position (minimum coupling).

6. Turn the power on and allow 30 seconds for the exciter to warm up.

7. A voltage reading of approximately 1.0 volt between the MULT-1 jack (J101 green-negative) and ground when the exciter is keyed indicates proper operation of the oscillator and modulator stages. Use the ground jack located on the exciter power supply chassis.

8. With the meter lead moved to the MULT-2 jack (J102 green-negative), key the exciter and tune Z101-L1 for a maximum meter reading.

CAUTION

Do not key the exciter for longer than 30 seconds in each minute until the fourth multiplier plate has been tuned.

9. Alternately tune Z102-L1 and Z103-L1 for maximum meter reading at the MULT-3 jack (J103 green-negative).

NOTE: When making a great change in frequency, it may not be possible to see any indication on the meter when Z102 is tuned unless Z103 is tuned near the correct frequency. In this case, pretune Z102 by one of the following methods:

a) With the 300 volt scale of a vacuum tube voltmeter or the 20,000 ohms-per-volt meter connected at the screen of the second multiplier (pin 6 of XV103), tune Z102 for a slight dip in screen voltage.

b) Hold an absorption wavemeter close to the bottom of Z102 and tune for resonance.

NOTE: It is possible to tune Z102 and Z103 to the wrong harmonic of the crystal frequency. These controls will be correctly tuned if their slugs are first turned all the way out and then turned in to the first indication of resonance. Check with a wavemeter.

10. Alternately peak Z104 and Z105 while metering at the MULT-4 jack (J104 green-negative). Fixed bias on the MULT-4 grid will appear as a small initial reading at J104 whether or not Z104 and Z105 are correctly tuned. A slight dip at J103 may be used as an indication of resonance of Z104 if both Z104 and Z105 are badly misaligned.

11. Peak the MULT-4 PLATE control while metering at the PA GRID jack (J105 green-negative). Fixed bias on the exciter power amplifier grid will appear as a small initial reading at J105 whether or not the MULT-4 PLATE is correctly tuned.

12. L106, the power amplifier grid tank coil (located in front of the "printed circuit" Faraday shield and between the power amplifier tube sockets) may also need to be adjusted for a maximum reading at the PA GRID jack when making a great change in frequency.

**WARNING**

HIGH VOLTAGE is present under the exciter chassis. Disconnect all power from the exciter before proceding.

For a frequency between 165 and 174 megacycles, the turns should be spread as far apart as possible. The spacing between coils L105 and L106 should also be adjusted for maximum meter reading. At this point, with the exciter set on EXC and the power amplifier plate untuned, the meter should read:

152 MC - 2.8 volts
162 MC - 2.6 volts
174 MC - 2.2 volts

These are minimum readings and the operator should try to exceed them.

13. Repeat the MULT-4 PLATE and L106.

14. DISCONNECT ALL POWER FROM THE EXCITER. Remove the power amplifier tuner shield and ground one of the power amplifier tube plate caps with an insulated screwdriver. Adjust the power amplifier plate shorting bar on L113 for the correct frequency. At 152 megacycles, the bar should be 1/8 inch above the bend in L113. At 174 megacycles, the bar should be about level with the lower end of the shaft on the ANT COUPLING control. For other frequencies, adjust the bar proportionately between these extremes. Replace the PA shield and restore power to the exciter.

15. Connect the meter leads between the CATH PA jack (J106 red-positive) and ground. Key the exciter and tune the PA PLATE control (C150) for a minimum meter reading.

16. Alternately tune the PA PLATE and ANT TUNING controls for minimum CATH PA current.

17. Tune ANT TUNING control for a maximum meter indication at the CATH PA jack. If no peak is observed, increase Drive Control (R193) or ANT COUPLING control slightly until ANT TUNING control may be tuned for a peak.

18. With wattmeter connected to ANT jack (J111), advance Drive Control to its maximum CW position and adjust ANT COUPLING control for maximum power output.

19. Alternately adjust PA PLATE, ANT TUNING, and ANT COUPLING controls until no further increase in power can be obtained.

20. Check the frequency of each channel. Adjust the FREQ ADJ A control to set CHANNEL A on frequency. Adjust FREQ ADJ B control to set CHANNEL B on frequency.

NOTE: For FCC purposes, the plate current of the power amplifier stage may be accurately calculated in milliamperes by multiplying the reading at the CATH PA jack by the following conversion factor:

1 volt = 200 milliamperes

## MODULATION LEVEL ADJUSTMENT

The modulation level control R186 was adjusted to the proper setting before shipment and should require no further adjustment. This setting permits approximately 60 per cent modulation for the average voice level. The occasional voice peaks which could cause overmodulation are limited by the modulation limiter V109. Should readjustment be required, the procedure outlined below should be followed:

### TEST EQUIPMENT

1. An audio oscillator
2. A frequency modulation monitor
3. An output meter or 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 and key the transmitter by grounding pin 3 of the microphone jack.

4. Set R186 (MOD control) for a 5 KC swing as indicated on the frequency modulation monitor.

Because of the high selectivity of General Electric Mobile Equipment, excessively high swings of audio modulation voltage can impair communication effectiveness as well as excessively low swings. In general, more problems arise from excessively high-swing settings than low; for this reason, the modulation control should be set for ±5 KC.

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