# BENCH ALIGNMENT PROCEDURE FOR MODEL 4ET48A14 TRANSMITTER

This instruction is provided for completely aligning or changing the frequency of the Model 4ET48A14 Transmitter. Instructions are also included for modulation adjustment.

## ALIGNMENT PROCEDURE

### TEST EQUIPMENT

The Model 4ET48A14 Transmitter may be completely aligned using a 20,000 ohms-per-volt voltmeter which covers the 0 to 3 volt range. The voltage ranges 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 with known ±.00025% accuracy such as Gertsch Model FM-3.
3. An absorption wavemeter which will tune to 2, 6, 12, and 24 times the crystal frequency.
4. A suitable terminating wattmeter for providing a 50 ohm load to the transmitter.
5. A non-metallic screwdriver.

### PROCEDURE

Refer to the Outline Diagram (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 crystal is plugged into pins 4 and 8 of the crystal oven. If provisions have been made for selection of the CHANNEL B oscillator for two-frequency operation, then the crystal for CHANNEL B should be plugged into pins 2 and 6 of the crystal oven.

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2. Connect the 50 ohm wattmeter to the output of the transmitter.
3. Set the TUNE-OPERATE switch (S101) in the TUNE position. Rotate the ANT COUPLING control (L122) to its extreme clockwise position.

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

5. A meter reading of more than 1.0 volt between the MULT-1 jack (J101) and ground when the transmitter is keyed indicates proper operation of the oscillator and modulator stages. Use the ground jack (J508) located on the power supply chassis.

> **CAUTION**
>
> Do not key the transmitter for longer than 30 seconds in each minute until the 4th multiplier plate has been tuned.

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

7. Alternately tune Z103 and Z105 for a maximum meter indication at the MULT-3 jack (J103, green-negative).

NOTE: When making a large change in frequency, it may not be possible to see any indication on the meter when Z103 is tuned unless Z105 is tuned near the correct frequency. In this case, pretune Z103 by one of the following methods:

a) With the 300 volt scale of a VTVM or the 20,000 ohms-per-volt meter connected at the screen of the 2nd multiplier (pin 6 of XV103), tune Z103 for a slight dip in screen voltage.

> **WARNING**
>
> HIGH VOLTAGE is present under this transmitter chassis. Disconnect all power from the transmitter before making the above connection.

b) Hold an absorption wavemeter close to the bottom of Z103 and tune for resonance.

NOTE: It is possible to tune Z103 and Z105 to the wrong harmonic of the crystal frequency. These controls will be correctly set if their slugs are first turned all the way out and then turned in to the first indication of resonance. Check with a wavemeter.

8. Alternately peak Z107 and Z109 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 Z107 and Z109 are correctly tuned. A slight dip at J103 may be used as an indication of resonance of Z107 if both Z107 and Z109 are badly misaligned.

9. Peak the MULT-4 PLATE control (C140) while metering at the PA GRID jack (J105, green-negative). Fixed bias on the power amplifier grid will appear as a small initial reading at J105 whether or not the MULT-4 PLATE control is correctly tuned.

> WARNING
>
> HIGH VOLTAGE is present under the transmitter chassis. Disconnect all power from the transmitter before making the following adjustment.

10. The spacing between coils L111 and L113 should be adjusted for a meter reading of 2.1 to 2.6 volts. Set the PA GRID from 0.1 to 0.2 volts higher than the peak output rating for continuous or long duty cycles. The required grid drive for the PA tube may vary from tube to tube.

11. Place the negative probe of the meter on ground and the positive probe in PA CATH (J106, red-positive). The ANT COUPLING control (L122) should be turned completely clockwise. Key the Transmitter and tune the PA PLATE (C150) for a minimum meter reading.

12. Switch the TUNE-OPERATE switch to the OPERATE position. Key the transmitter and quickly tune the PA PLATE control and ANT TUNING control for a minimum meter reading (less than 1.0 volt) at J106. Repeat until a lower reading cannot be obtained.

13. Tune the ANT TUNING control for a maximum meter indication at J106. If an increase cannot be obtained, rotate ANT COUPLING control slightly counterclockwise until it is possible to observe a slight increase when the ANT TUNING control is tuned through resonance.

14. Rotate the ANT COUPLING control counterclockwise until a reading of approximately 2.4 volts is obtained at J106.

15. Repeat Step 13 and adjust ANT COUPLING again for 2.4 volts at J106.

16. Repeat Steps 8 through 15.

NOTE: It is possible to over-couple the ANT COUPLING control. To avoid this, the ANT TUNING control should be peaked for a maximum load and ANT COUPLING adjusted for 2.4 volts at J106. Repeat until the peak is found for ANT TUNING with minimum ANT COUPLING adjustment.

17. In case the station license will not permit the use of full rated power input to the final amplifier plate circuit, the ANT COUPLING control must not ordinarily be adjusted for a meter reading of 2.4 volts. To find the maximum permissible meter reading at J106, measure the power amplifier plate voltage under load conditions and calculate the meter reading at J106 with the following formula:

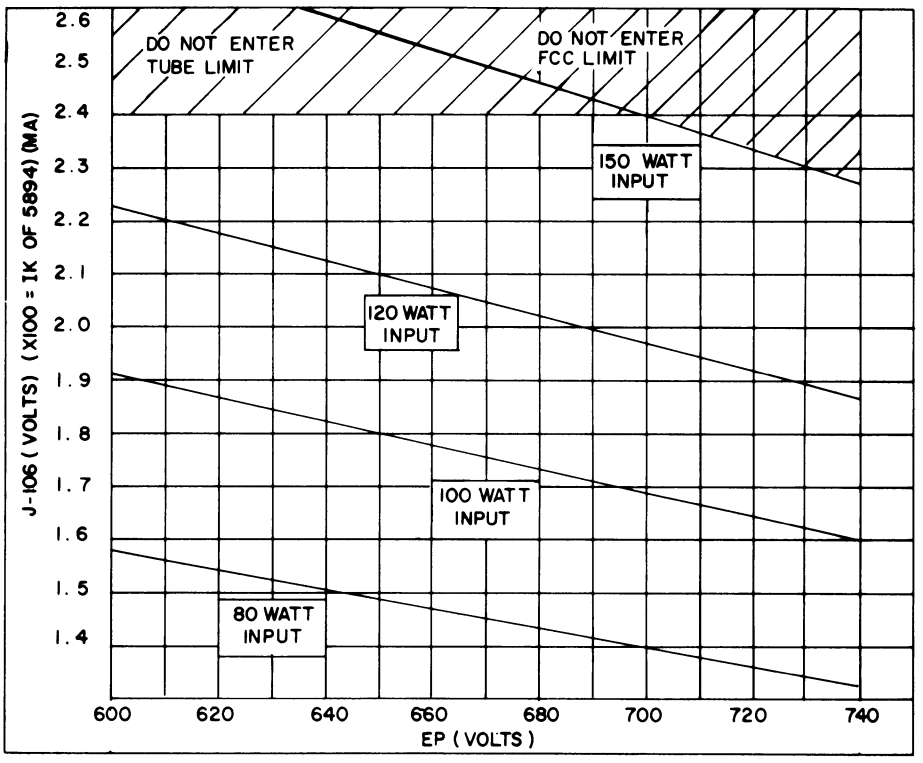
$$\text{J106 meter reading (volts)} = \frac{10\ P}{E}$$

Where P is the maximum permissible power input in watts
E is the power amplifier plate voltage under load
10 is the meter factor relating voltage reading to plate current.

The maximum permissible meter reading at J106 vs plate voltage is shown in the following chart for power inputs of 150 watts, 120 watts, 100 watts, and 80 watts.

IK - (IG + ISG) = IP
(IP) (EP) = PO IN

IG = 8. MA
ISG = 17. MA



## MODULATION LEVEL ADJUSTMENT

The modulation level control R186 adjusts the peak deviation of the transmitter as permitted by the station license. The proper setting permits approximately 60 per cent modulation for the average voice level. The occasional peaks which would cause overmodulation are limited by V109. The limiter instantaneously limits the slope of the audio wave, preventing overmodulation. When R186 is adjusted, the following procedure should be used.

### TEST EQUIPMENT

1. Audio oscillator
2. Frequency modulation monitor
3. Output meter or VTVM

### PROCEDURE

1. Connect the audio oscillator and output meter across pins 1 and 2 of the microphone jack (J509) on the power supply chassis.
2. Apply a 1.0 volt signal at 1000 cps across the microphone terminals.
3. Key the transmitter (by grounding pin 3 of the microphone jack) and set R186 for a 5 KC swing (13 to 15 KC for wide band) as indicated on the FM monitor.

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