BENCH ALIGNMENT PROCEDURE FOR 250-WATT POWER AMPLIFIER MODEL 4EF1A2

This Bench Alignment Procedure is provided for completely realigning and loading Power Amplifier Model 4EF1A2, using Transmitter Model 4ET21A1, 2, 11 or 12 as an Exciter unit. To tune and load full power to the antenna, the grid, plate and antenna circuits of the Power Amplifier must be tuned and the antenna coupling must be adjusted as follows.

ALIGNMENT PROCEDURE

Five meters are provided above the front door of the cabinet for tuning the Power Amplifier and its Exciter. The Power Amplifier has four of the meters permanently connected to it to measure PA PLATE CURRENT, PA GRID CURRENT, PA PLATE VOLTAGE and PA FIL VOLTAGE. The fifth meter is a 0 to 3-volt, 20,000 ohm-per-volt meter for tuning the Exciter. The TUNING METER is provided with a meter lead inside the cabinet and with a polarity reversing switch. The metering jacks on the Exciter are shunted within each unit so that the single TUNING METER will be sufficient for all normal tuning needs. By using the polarity-reversing switch, the lead from the meter is used for metering both positive and negative voltages. Note that the positions of the polarity-reversing switch are labeled "GRN-" and "RED+". By setting the switch for the color of the metering jack into which the meter lead is to be plugged, the meter will be deflected up scale.

Before tuning the Power Amplifier, the Exciter multiplier stages must be aligned according to the procedure in the SERVICE OUTLINE or the BENCH ALIGNMENT PROCEDURE for the Exciter.

1. Connect the antenna or some other suitable 50-ohm load to the ANT jack of the Power Amplifier.

2. Be sure that the Channel A crystal and the Channel B crystal (if used) are connected between pins 4 and 6 and between pins 2 and 8 of crystal socket XY101, respectively, in the Exciter.

3. Remove the red jumper between terminals 4 and 5 of terminal board TB481 on the PA Power Supply chassis.

4. Turn the PA Power Supply TUNE-OPERATE switch and the Exciter TUNE-OPERATE switch to TUNE.

5. Rotate the Exciter ANT COUPLING control fully clockwise and rotate the Power Amplifier PLATE LOADING control to zero. Adjust the input loop tuning capacitor (C461), which is accessible with an insulated tuning tool through the hole in the back panel near the RF INPUT jack, so that its screwdriver slot is vertical.

6. Turn the power on and allow 3 or 4 minutes for warmup.

7. Adjust the PA FILAMENT rheostat (R481) on the Pa Power Supply for a reading of 5.0 volts on the PA FIL VOLTAGE meter.

8. Connect a microphone or handset to the microphone jack (J509) on the Exciter Power Supply.

9. With the TUNING METER connected at the CATH PA jack (red-positive), key the transmitter and adjust the Exciter PA PLATE and ANT TUNING controls for minimum meter reading.

10. Tune the Exciter ANT TUNING and the Power Amplifier GRID TUNING controls for maximum PA GRID CURRENT. (If no maximum is observed, rotate the Exciter ANT COUPLING slightly counterclockwise until an indication can be observed while tuning).

11. If a large change in operating frequency has been made, or if the Power Amplifier has not been initially adjusted to the customer's frequency at the factory, it may be necessary to adjust the Power Amplifier grid line length for maximum PA GRID CURRENT. The line length is adjusted by sliding C474-C475 between the two rectangular grid lines in the lower deck of the Power Amplifier.

12. Adjust the grid shorting bar and the GRID TUNING and NEUTRALIZING controls on the Power Amplifier for maximum PA GRID CURRENT, coincident with mid-range tuning (shaft slot vertical) of the GRID TUNING control, as directed below:

(a) Adjust the Power Amplifier PLATE TUNING control to minimum.

(b) Key the transmitter and adjust the Power Amplifier NEUTRALIZING control for maximum PA GRID CURRENT.

(c) Adjust the Power Amplifier GRID TUNING control for maximum PA GRID CURRENT.

(d) Unkey the transmitter and note the position of the GRID TUNING condenser. If the condenser is near midrange, no adjustment of the grid shorting bar is necessary. If the condenser is near minimum capacity, move the shorting bar toward the tube socket. If near maximum, move the shorting bar away.

(e) Repeat Steps 12 (b), (c) and (d), making small adjustments until maximum PA GRID CURRENT is obtained with approximate mid-range tuning of the GRID TUNING control.

13. Turn the Exciter TUNE-OPERATE switch to OPERATE.

14. Adjust the Exciter ANT COUPLING control counterclockwise for 20 to 30 ma of PA GRID CURRENT. Do not load the CATH PA beyond 1.5 volts.

15. Neutralize the Power Amplifier by adjusting the PLATE TUNING, NEUTRALIZING and GRID TUNING controls for a grid current that will be unaffected by the tuning of the PLATE TUNING control as follows:

(a) Tune the Power Amplifier PLATE TUNING control for minimum PA GRID CURRENT. The dip obtained when the plate circuit is in resonance with the grid circuit will usually be quite pronounced. If a dip is not obtained, the length of the power amplifier plate line must be adjusted until a dip is obtained with the Power Amplifier PLATE TUNING adjustment at mid-range (approximately 18 dial units). The shorting bar, located on the plate line on the tube deck of the amplifier, may be adjusted in small increments by loosening the wing nut on the bar.

WARNING

Although the PA Power Supply is fully door-interlocked, the plate line should be grounded while being adjusted, since its normal operating potential is 2000 volts d-c.

If the transmitter is being adjusted to a higher frequency, the shorting bar must be moved towards the power amplifier tubes or, if to a lower frequency, away from the tubes. As soon as the PA GRID CURRENT dip is brought within the range of the PLATE TUNING control, a further small adjustment can be made to cause it to occur at midrange (18 dial units), as desired. If the dip occurs above 18 units, move the shorting bar slightly father away from the tubes or, below 18 units, move it slightly towards the tubes.

(b) Tune the Power Amplifier NEUTRALIZING and GRID TUNING controls for maximum PA GRID CURRENT.

(c) If more than 2 ma of grid current variation is noted as the PLATE TUNING is adjusted through resonance from maximum to minimum, repeat Step (a) and (b) until this condition is reached.

16. Tune the Power Amplifier GRID TUNING control, looking for two distinct peaks of PA GRID CURRENT in one complete rotation. If these are not obtained, readjust the grid shorting bar, as described in Step 12. If the grid line does need to be changed, recheck the neutralization as directed in Step 7 (c).

17. Remove all power from the cabinet and replace the red jumper wire between terminals 4 and 5 of terminal board TB481 on the PA Power Supply chassis.

18. Tune the Power Amplifier PLATE TUNING control for minimum PA PLATE CURRENT.

19. Switch the Power Amplifier TUNE-OPERATE switch to OPERATE.

20. Tune the Power Amplifier PLATE TUNING control for minimum PA PLATE CURRENT.

21. Observe whether a peak in PA GRID CURRENT is obtained simultaneously with a dip in PA PLATE CURRENT. If not, make a very slight adjustment of the NEUTRALIZING control by trial and error until proper "tracking" is obtained.

22. Adjust the Power Amplifier PLATE LOADING control for 160-190 ma of PA PLATE CURRENT.

23. Tune the ANTENNA TUNING control for maximum PA PLATE CURRENT.

24. Redip the PLATE TUNING control.

25. Increase the Power Amplifier PLATE LOADING to 260 ma of PA PLATE CURRENT.

26. Redip the PLATE TUNING control.

27. Readjust the Exciter ANTENNA COUPLING control for 20 to 30 ma of PA GRID CURRENT with less than 1.5 volts of Exciter CATH PA meter reading.

28. Check the Power Amplifier GRID TUNING for maximum PA GRID CURRENT.

29. Readjust the Power Amplifier PLATE LOADING control for 260 ma of PA PLATE CURRENT.

30. Since different power amplifier tubes may have different grid drive requirements for maximum power output, it

will usually be advantageous to repeat Steps 19 through 21, noting the power output on some form of relative power indicator. The PA GRID CURRENT should then be set by this means to the value which produces the highest power output for 260 milliamperes of PA PLATE CURRENT with the lowest Exciter CATH PA meter reading.

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