BENCH ALIGNMENT PROCEDURE FOR TRANSMITTER MODELS 4ET35A10, 11

This Bench Alignment Procedure is provided for completely realigning Transmitter Models 4ET35A10, 11 or for changing their frequency. Instructions for adjusting the modulation level are also included.

Multi-frequency transmitters having a frequency separation between the highest and lowest operating frequencies of 0.4% to 2.0% should be aligned using a mid-frequency alignment crystal. The frequency of the alignment crystal should be the arithmetic mean between the extreme channel frequencies, unless it is moved closer to one of the channels in order to favor its performance. In this case, the frequency spread between the alignment frequency and any channel frequency is limited to 1.0%. Above frequency separations of 1.5%, improved drive and PA plate power dissipation will be noted if the drives are balanced between the extreme channels.

If an alignment crystal is not available for frequency separations of 0.4% to 2.0%, the plate current should be equalized (with the transmitter in the unloaded, dipped condition) and the antenna tuning should be balanced to provide at least 1.5 volts at the PA CATH jack on each channel. Some reduction in tube life may be expected with frequency separations greater than 0.4%.

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-E 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-E which covers the 0- to 3-volt range.

2. A non-metallic screwdriver.

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

4. A frequency measuring device, such as Lampkin PPM Package or Gertsch Model FM-7.

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Procedure

Refer to SERVICE OUTLINE RC-584 (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(s) is (are) correctly connected between the points shown in the following table. The crystal frequency for each channel is 1/18th of the channel frequency.

Crystal	Single-Frequency and Two Frequency Transmitters
CHAN A	XY101-4 and 6
CHAN B	XY101-2 and 8 (2-Freq. only)

2. Turn the Channel-Selector Switch, if present on the Control Unit, to CHAN A.

3. Connect the antenna or some other suitable 50-ohm load to the ANT jack.

4. Set the TUNE-OPERATE switch (S101 on the PA housing) on TUNE.

5. Rotate the ANT COUPLING control to its extreme counterclockwise position.

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

7. A voltage reading greater than 1.0 volt 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.

In two-frequency transmitters, both V101 and V201 should give fairly equal drive to provide equal modulation. This can be checked by switching the Channel-Selector Switch between CHAN A and CHAN B, while metering at the MULT-1 jack (J101). In some cases, it may be necessary to balance these drives by substituting another tube in XV101 or XV201.

8. With the meter lead moved to the MULT-2 jack, J102 (green-negative), key the transmitter and tune Z101 ("1") and Z104 ("2") for maximum meter reading (greater than 1.0 volt).

CAUTION

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

9. Alternately tune Z107 ("3") and Z110 ("4") for maximum meter reading (greater than 1.0 volt) at the MULT-3 jack, J103 (green-negative).

It is sometimes possible to tune the first or second group of multipliers to the wrong harmonic of the crystal frequency. The coils will ordinarily be correctly tuned if the slugs are first screwed and the slugs are then tuned for the first peak encountered.

10. Alternately peak Z134 ("5") and Z135 ("6") while metering at the PA GRID jack, J105 (green-negative). Fixed bias on the PA grid will appear as a small initial reading (0.5-1.0 volt) at J105, whether or not Z113 or Z114 and Z117 are correctly tuned. The meter should read greater than 1.5 volts for proper tuning.

A slight dip at the MULT-3 jack may be used as an indication of resonance of Z134 if both Z134 and Z135 are badly misaligned.

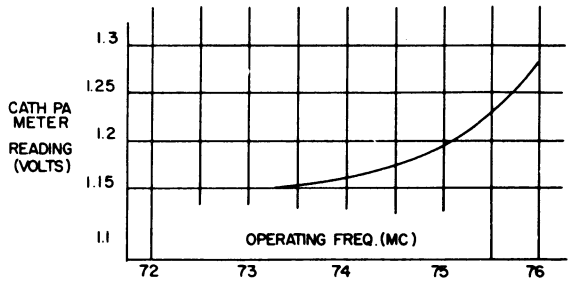
11. Connect the meter at the CATH PA jack, J106 (red-positive), key the transmitter and tune the PA PLATE control (C165) for minimum meter reading. (Be sure that the ANT TUNING control is adjusted so that the lowest possible meter reading can be obtained.)

12. Switch the TUNE-OPERATE switch to OPERATE and retune the PA PLATE for minimum meter reading. The neon lamp should be at minimum brightness.

13. Rotate the ANT COUPLING control slightly clockwise.

14. Tune the ANT TUNING control for maximum brightness of the neon lamp (I101).

15. Key the transmitter and rotate the ANT COUPLING control clockwise for the CATH PA meter reading indicated in the chart which follows. If, in coupling, the neon lamp goes through a maximum before the proper CATH PA meter reading is obtained, tune the ANT COUPLING control for maximum brightness of the lamp.



NOTE: DO NOT EXCEED THE CATH PA METER READING INDICATED IN THE CHART. FCC REGULATIONS PERMIT A POWER OUTPUT OF 50 WATTS; WITH A METER READING IN EXCESS OF THAT INDICATED IN THE CHART, POWER OUTPUT WILL EXCEED THAT PERMITTED.

Blower Kit PL-7146797-G1 must be used if the transmitter is to operate with a duty cycle greater than the RETMA intermittent duty cycle of one minute on and four minutes off.

16. Repeat steps 14 and 15 and lock the ANT COUPLING control.

17. Check the frequency of the transmitter. In single-frequency and two-frequency transmitters adjust the FREQ ADJ A control, if necessary, to set Channel A on frequency. In two-frequency transmitters, check Channel B also and set it on frequency by means of the FREQ ADJ B control.

PA ALIGNMENT USING RF INDICATOR LAMP

The neon flow RF indicator, I101, is located on the chassis near the PA housing. In an emergency, the power amplifier may be aligned using I101 as a tuning indicator. The transmitter must already be roughly aligned through the PA grid.

1. Set the TUNE-OPERATE switch on OPERATE and turn the ANT COUPLING control fully counterclockwise.

2. Key the transmitter and adjust the PA PLATE control for minimum brightness of I101.

3. Tune Z134 ("5") and Z135 ("6") for minimum brightness of the neon lamp.

4. Rotate the ANT COUPLING control slightly clockwise and adjust the ANT TUNING control for maximum brightness of the neon lamp.

5. Rotate the ANT COUPLING control clockwise for maximum brightness of the neon lamp.

6. Check that the ANT TUNING control is adjusted for maximum brightness.

The transmitter is now aligned and delivering maximum power to the antenna. However, since I101 gives no indication of the actual value of plate current being drawn, it is advisable to continue with the next step, to lessen the possibility of exceeding the PA tube ratings or FCC power limitations.

7. Back the ANT COUPLING off counterclockwise until a significant decrease in the brilliance of the neon lamp is noted and lock the control at that position.

MODULATION LEVEL ADJUSTMENT

The modulation level control, R186, 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 (V109). 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 such as Heath AG-9.

2. A frequency modulation monitor such as Lampkin 205-A or equivalent.

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. Disconnect the microphone from the Control Unit.

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

4. Key the transmitter by grounding pin 3 of the microphone jack.

5. Set the MOD control (R186) for a 13- to 15-kilocycle swing* (a 5 to 6-kilocycle swing* in narrow-band systems), as indicated on the frequency modulation monitor.

If no audio oscillator is available, the modulation level control can be set by connecting a microphone to the transmitter, whistling a loud, clear tone into the microphone and setting the MOD control (R186) for a 13- to 15-kilocycle swing* (a 5- to 6-kilocycle swing* in narrow-band systems), as indicated on the modulation monitor.

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*Because of the high selectivity of General Electric Mobile Radio Equipment, excessively high swings can impair communication effectiveness as well as excessively low swings. Within the range of 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 a ±13-kilocycle swing (5-kilocycle swing in narrow-band systems) when the equipment is shipped from the factory.

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