

SECTION V

MAINTENANCE AND ALIGNMENT

5.1. MAINTENANCE.

5.1.1. GENERAL. This section is written to provide the operator of this equipment with suggestions and procedures for properly maintaining the KWS-1 Transmitter in good operating condition.

Correlative to all electronic equipment, tube failure is the most common cause of trouble.

The maintenance procedures which follow are divided into two categories, electrical and mechanical. Frequent reference should be made to the photograph and diagrams included with the text of this section, and in sections VI and VII.

5.1.2. CLEANLINESS. A common cause of high voltage arcs, consequently of intermittent or permanent equipment failure, is dust and dirt between tuning condenser plates, switch contacts or relay contacts.

For those operators living in a high-humidity locality, or where there is a salt-laden atmosphere, it is possible to experience equipment failure for no apparent reason. Investigation will reveal corrosion of switch and relay contacts or other connections due to the type of climate.

Regardless of the reason, cleanliness in the equipment is essential for reliable operation. Dust may be removed with a small blower or a soft lintless cloth. Contacts may be cleaned with carbon tetrachloride or an equivalent nonabrasive cleaning fluid.

5.1.3. TROUBLE SHOOTING.

5.1.3.1. GENERAL. If the results obtained with the transmitter are in a gradual decline, use the following operational check to evaluate its condition. If a complete failure is experienced go to paragraph 5.1.4., Trouble Shooting Procedure, and follow the procedure there outlined.

5.1.3.2. OPERATIONAL CHECK, CW.

a. Turn FILAMENT switch ON. Blower should start. Be sure blower does start, otherwise the PA tubes may become damaged. Be sure air hose is connected.

b. Adjust PA FILAMENT VOLTAGE to 6 volts. If 6 volts are unobtainable, the a-c supply line may be inadequate or filament transformer T501 may be defective.

c. Set EMISSION switch to CW, CARRIER LEVEL to 0, TUNE-OPERATE to OPERATE, BIAS control to "O".

d. Turn PA PLATE voltage ON. Advance PA BIAS ADJUST control until PA idling current is 100 ma.

e. Turn PA PLATE voltage OFF.

f. Select high 10-meter band with BAND CHANGE switch.

g. Set up on 29 mc with main tuning dial.

h. Place the TUNE-OPERATE switch in the TUNE position.

i. Set the PA TUNING and PA LOADING controls several turns clockwise from the settings given in table 3-1 of section III.

j. Turn PA PLATE voltage ON.

k. Close the TEST KEY. Advance the CARRIER LEVEL control until the MULTIMETER in the PA GRID position shows about midscale.

m. Immediately resonate the PA TUNING control for a dip in plate current. If a dip is not obtainable, the PA LOADING may still be too high or a PA tube may be gassy or otherwise defective.

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- n. Rotate the PA LOADING control clockwise to increase loading.
- o. Load and resonate simultaneously (use both hands) until the PA is loaded to about 150 ma in the TUNE position.
- p. During the loading and tuning process, the grid current will tend to increase. This effect is caused by the action of the PA inverse feedback. Keep reducing the CARRIER LEVEL control so that grid current stays at near midscale.
- q. Switch the TUNE-OPERATE switch to OPERATE. Again adjust the grid current for midscale.
- r. Continue loading to about 400 ma. Note antenna current or power output.

s. Continue loading to 500 ma at resonance while watching both PA plate current and output. However, if output ceases to rise as PA plate current increases, back off PA LOADING control slightly and do not try to load beyond this point. If this point is reached much too soon, check the screen voltage on the PA tubes.

t. The transmitter should now be ready for use on cw.

5.1.3.3. OPERATIONAL CHECK, SSB.

- a. Tune up the transmitter exactly as for cw (paragraph 5.1.3.2. above).
- b. Set AUDIO GAIN at zero and speaker quieting control (inside exciter unit above PA plate meter) to counterclockwise.
- c. Speak into microphone while advancing the VOX SPEECH control. Set the control for a positive action of the carrier control relay. If the vox circuit cannot be made to operate satisfactorily, check the condition of tubes V103 and V107.
- d. Advance the AUDIO GAIN until the MULTIMETER in the ALC position kicks to about midscale on voice peaks.

NOTE

There must be no grid current showing on SSB operation or distortion will be generated.

e. Advance speaker quieting control for minimum feedback. If good action cannot be achieved, check V102, V103, and V107.

f. The transmitter should now operate satisfactorily on SSB. Choice of sidebands is available at the SIDEBAND SELECT switch. If there appears to be an objectionable amount of carrier present, the balanced modulator can be checked as in paragraph 5.1.4.3. (10).

5.1.3.4. OPERATIONAL CHECK, AM.

a. Tune the transmitter exactly as for cw (paragraph 5.1.3.2. above).

b. Switch to AM.

c. Back off the CARRIER LEVEL control until the output power drops to 1/4 the cw value (1/2 antenna current). This corresponds to a plate current of about 275 ma.

d. Advance the AUDIO GAIN control until the ALC current just starts to kick on audio peaks.

e. The transmitter is now ready to use on AM.

5.1.3.5. DIAL CALIBRATION. The following procedure is given to assist with dial calibration.

a. Turn the equipment ON as instructed in the OPERATIONAL CHECK, CW given in paragraph 5.1.3.2.

b. Tune a communications receiver to WWV at 15 mc. The bfo in the receiver should be OFF.

c. Rotate the KWS-1 Exciter BAND CHANGE control to the 20-meter band.

d. Rotate the MAIN TUNING dial to 15.0 mc.

e. Rotate the EMISSION switch to either CAL position.

f. Continue to rotate the MAIN TUNING dial about the 15.0 point until the calibration signal is zero beat with WWV.

g. Adjust the ZERO SET knob until the KILOCYCLES dial fiducial is exactly on 15.0 mc.

5.1.4. TROUBLE SHOOTING PROCEDURE.

With all external connections made, the following checks should be made on the KWS-1 equipment. For mechanical checks listed below, all power should be OFF.

5.1.4.1. TEST EQUIPMENT.

Test equipment for the electrical checks listed below consists of a 1000-ohm-per-volt ohmmeter and a VTVM.

5.1.4.2. MECHANICAL CHECKS.

a. TUNING MECHANISM. Release the DIAL DRAG on the exciter front panel. Rotate the MAIN TUNING dial (KILOCYCLES) and check the following:

(1) SLUG RACK. Raise the cabinet lid and observe the slug rack movement. The rack should move up and down freely when the dial is turned. If there is any tendency to stick or bind, check closely for a bent rack, or for foreign matter in the turning mechanism and travel-path of each tuning slug.

(2) SLIDE RULE DIAL FIDUCIAL. The fiducial should move back and forth freely as the MAIN TUNING (KILOCYCLES) dial is operated. The end limits of the fiducial travel should agree with the mechanical stops on the tuning dial. The stops are located on the tuning shaft adjacent to the backside of the front panel.

(3) GEAR TRAIN. The gear trains of the KILOCYCLES tuning dial and Power Amplifier should operate with no binding or unusual gear tooth noise. Backlash should be mechanically undetectable. The KILOCYCLES tuning dial gear train may be viewed in figure 6-3, and the power amplifier gear train in figure 6-11.

The exciter front panel may be taken off by removal of the BAND CHANGE, KILOCYCLES tuning, SIDEBAND SELECT, PA TUNING and PA LOADING control knobs and six recessed head screws, three on each end of the panel. The

loose panel should be lowered carefully to prevent breakage of the internal wiring interconnections.

If trouble is suspected in the power amplifier gear train, the entire unit should be removed from the exciter cabinet. The power amplifier front cover may then be removed by loosening the PA TUNING and PA LOADING tuning shaft couplers (see figure 6-2) and four recessed head screws on both sides of the front cover. The cover should be removed carefully to prevent disturbance of the gear positions on the gear train. Tip the Power Amplifier back to keep the gears intact as they are manually rotated.

The cause of any gear strain or binding should be determined and eliminated.

b. FRONT PANEL CONTROLS. The following front panel controls should particularly be checked for free movement and proper switch alignment, where applicable.

(1) DIAL LOCK. This knob should have right and left-hand turning limits, and should, in its tight position, hold the KILOCYCLES tuning dial in a secure, immovable position. This knob should never be permitted to remain in its tight position during normal tuning procedures.

(2) ZERO SET. This control will have right and left-hand turning limits, and should move the KILOCYCLES tuning pointer to the left or right for the purpose of zero-setting during calibration procedures. Once the KWS-1 Transmitter is calibrated, the ZERO SET should not require movement until a dial error is noticed.

(3) BAND CHANGE. The BAND CHANGE should move freely to each of its seven positions. If sticking or hesitation of movement is noticed, the exciter bottom plate should be removed to check the movement of all mechanically moving parts associated with the operation of this control.

(4) MULTIMETER SWITCH AND EMISSION SWITCH. These controls should also have free and definite movement through each of their positions. If not, the front panel of the Exciter should be lowered, and the reason for faulty movement determined and eliminated.

(5) SIDEBAND SELECT SWITCH. Operate this control, and, at the same time, raise the top panel to observe the vfo movement to be sure it moves freely and does not rub the chassis at any point. If it does, locate the point of contact and

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perform mechanical adjustments to eliminate the cause.

5.1.4.3. ELECTRICAL CHECKS.

a. FUSES. Remove power line connection.

All fusing circuits are located in the power supply cabinet. (See figure 6-13.) The following checks should be made.

(1) HIGH VOLTAGE PRIMARY. The S504 FILAMENT switch on the power supply front panel should be OFF. Measure the resistance from TB503-41 to the output side of F501. Reference to the power supply schematic in figure 7-2 will be helpful in making this measurement. With the fuse out, there should be an open circuit, and with it in, a short circuit.

Repeat this procedure from TB503-43 to the output side of fuse F502. A fuse replacement table will be found in paragraph 5.2.1.3.

(2) LOW VOLTAGE POWER SUPPLY.

With S504 FILAMENT switch on the power supply front panel ON and the power line disconnected, measure the resistance between TB503-41 and T501-2. An open circuit should be measured when F501 is removed, and a short circuit with it in.

b. SUPPLY CIRCUITS. For these checks, remove high voltage rectifiers V501 and V502, the power amplifier screen grid supply rectifier V503, and the low voltage rectifier V508. These tubes may be found in the power supply cabinet. (See figure 6-13.) Operate the EMISSION switch on the exciter front panel to the STBY position.

(1) BLOWER AND FILAMENT CIRCUITS.

Plug in the external power line cord and operate the FILAMENT switch to the ON position. Make the following observations:

(a) The blower should come on.

WARNING

IF THE BLOWER DOES NOT COME ON WHEN THE FILAMENT SWITCH IS OPERATED, TURN OFF ALL POWER IMMEDIATELY. WITHOUT COOLING, THE 4X250B POWER AMPLIFIER TUBES COULD BE DAMAGED IN VERY SHORT TIME.

If the blower does not come on, and with all power OFF, run a continuity check on the blower circuits, using figure 7-2 as a guide. The blower hose must always be in place if the 4X150A tubes are in their sockets.

(b) Inspect all tubes and dial lights for filament operation. If any tubes do not light, they should be checked for replacement. If the tube checks good, the power should be shut OFF and the filament circuits subjected to continuity checks.

(c) Check the power amplifier filament voltage by operating the MULTIMETER switch to the PA FIL position. Operate the PA FILAMENT VOLTAGE control on the power supply front panel through its positions and observe the readings on the MULTIMETER in the upper left-hand corner of the exciter front panel. This voltage should vary from 5.0 volts to 6.3 volts. If it does not, check out the power amplifier filament circuits. (See figure 7-2.) Adjust the filament voltage for 6.0 volts.

(2) -150 BIAS SUPPLY. The d-c voltage between TB502-19 in the power supply cabinet and ground should measure -150 volts. A faulty measurement here would require a check of the V509 bias rectifier and associated circuitry.

(3) PA BIAS. Check the minus d-c voltage from one of the multimeter (M201) terminals (see figure 6-2) to ground. MULTIMETER switch must be on PA GRID. This measurement should vary from -53 volts to -125 volts when the PA BIAS ADJUST control on the power supply front panel is varied through its entire range. Maximum voltage should be obtained when this control is in its farthest counter-clockwise position. Adjust to -62 volts. A failure to obtain correct readings here would indicate faulty circuit wiring, or trouble involving R513, R514, and R515.

(4) DRIVER BIAS. Operate the EMISSION switch on the exciter front panel to the CW position. Remove the bottom cover from the exciter cabinet and measure the voltage on V206 pin two. This measurement to ground should be -30 volts dc with the cw key up, and -4 volts with the key down. If not, check the keying network mounted between the gear plate and front panel beneath the PA plate current meter, M701.

(5) V201 FIRST MIXER KEYING. The voltage from V201 pin 7 to ground should measure -26 volts with the cw key up and -.04 volts with the key down. If it does not, check the keying network mentioned in the preceding paragraph (4).

(6) LOW VOLTAGE SUPPLY. Return tube V508 to its socket, and measure the voltage from TB502-18 to ground. If this measurement is not 275 volts positive, either the tube is bad or there is component trouble in this circuit. If so, check T506, L502, L504, C509 or R531.

(7) REGULATED SCREEN SUPPLY. Return V503 to its socket and measure the voltage from one of the multimeter (M201) terminals to ground with the MULTIMETER set on PA SCREEN. By varying the PA SCREEN ADJUST control with a screwdriver inside the power supply cabinet (see figure 6-13) set this voltage to plus 350 volts dc (300-V Canada). PA screen-grid voltage adjustments are made with a

screwdriver on the R511 potentiometer located between V501 and V502 in the power supply cabinet. (See figure 6-12, and paragraph 4.2.4.6f. (2).) If it is impossible to make the 350-volt adjustment, check V503 and associated circuitry.

(8) HIGH VOLTAGE SUPPLY. To make this check, perform the following steps:

- (a) Return V501 and V502 to their sockets.
- (b) Replace the rear door to the power supply cabinet and see that the exciter lid is down.
- (c) Operate the PA BIAS ADJUST control on the front panel to a completely counter-clockwise position.
- (d) Operate the MULTIMETER switch on the exciter front panel to the 2000 V dc position.

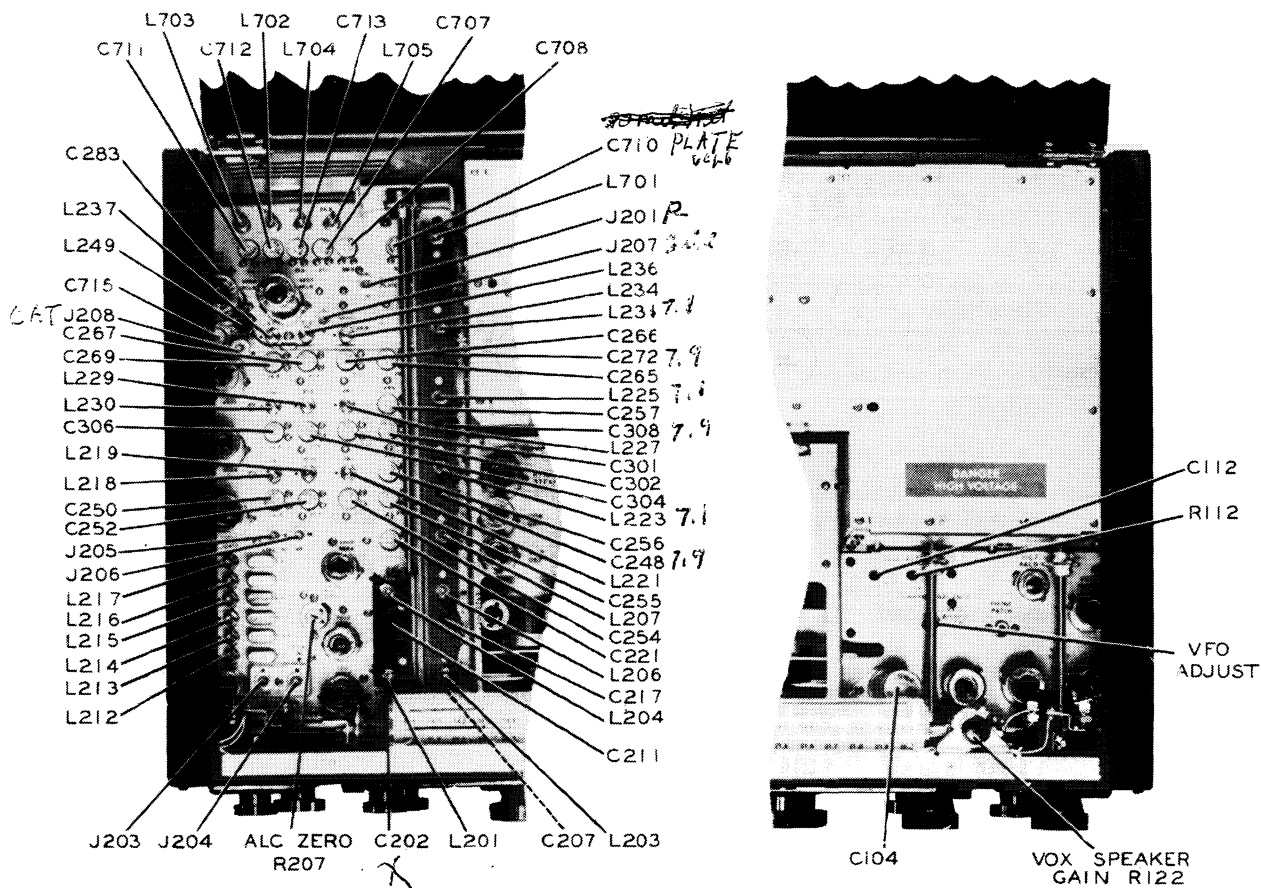


Figure 5-1. Exciter Test Jacks and Points of Tuned Circuit Adjustments

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(e) Operate the EMISSION switch to the CW position. Key must be open.

(f) Operate the PLATE toggle switch on the power supply front panel to the ON position. The red light above the switch should go ON.

(g) The high voltage reading on the multimeter should read approximately 2000 volts.

(9) NEUTRALIZATION CHECK. The following procedure will show whether or not the KWS-1 r-f circuits are properly neutralized.

(a) Operate the EMISSION switch on the exciter front panel to the AM. position.

(b) Operate the MULTIMETER switch to PA GRID.

(c) Operate the CARRIER LEVEL control until grid current begins to show on the meter.

(d) Operate the PA TUNING control through resonance, and observe the meter reaction. If the circuits are neutralized properly, the grid current will dip exactly on resonance, and will rise symmetrically on either side of resonance.

(10) BALANCED MODULATOR CHECK. The following procedure will determine if the ring modulator is in balance.

(a) Operate the EMISSION switch to SSB.

(b) A receiver antenna connection should be made to J201 into the 6CL6 driver plate circuit.

(c) The carrier will be heard if the modulator is not in balance. Adjust R112, and C112 (see figure 5-1) for minimum sound of the carrier.

(11) COLLINS MODEL 35C-2 LOW-PASS FILTER. It is not likely the Collins KWS-1 Transmitter will require precautionary adjustments because of TVI. However, if this problem does arise, for some reason unique to a particular installation area, the 35C-2 Low-Pass Filter may be installed in the KWS-1 antenna lead. In rare cases of extreme difficulty, a high-pass filter may be installed in the TV receiver antenna lead in.

5.2. ELECTRICAL MAINTENANCE.

5.2.1. TEST CONDITIONS.

5.2.1.1. TEST EQUIPMENT REQUIRED. The following test equipment is required to perform the specified procedure.

EQUIPMENT	SPECIFICATIONS
a. Signal Generator	Output to 30 mc.
b. Voltmeter	Hewlett-Packard 400 C or equivalent. (Must have r-f probe).
c. Accurately Calibrated Receiver	75A-4 (or equivalent with "S" meter and Crystal Calibrator).
d. 1 kw, 50 ohm, resistive load	
e. Microphone with locking PTT switch	

5.2.1.2. POWER REQUIREMENTS.

For proper maintenance checks, the KWS-1 Transmitter must have either a 115-volt a-c supply

at 60 cps, or a 230-volt a-c supply at 60 cps. The transmitter must be externally and internally connected to satisfy the power source.

5.2.1.3. FUSES.

TABLE 5-1
FUSE TABLE

SYMBOL	LOCATION	RATING	TYPE
F501	HV PRI.	20 Amp.	Cartridge - 3AG
F502	HV PRI. and Screen (230-V)	10 Amp.	Cartridge - 3AG
F503	Filament and blower	3.2 Amp.	Cartridge - Slow Blow
F504	Filament and LV Supply	3.2 Amp.	Cartridge - Slow Blow
F505	Screen Voltage Output	1/4 Amp.	Cartridge - 3AG
F506	HV Supply Output	1 Amp.	Cartridge - High Voltage

5.2.1.4. TEST POINTS.

Table 5-2 below lists the typical voltage values for the KWS-1 test point jacks.

TABLE 5-2
TEST JACKS
(Refer to figure 5-1)

TEST JACK	VOLTAGE VALUE (RF VOLTS)
666 PLATE J 201	40-50 (with PA on)
VFO I NJ J 203	1.5
25000 I NJ J 204	0.1 (for full output)
X TAL I NJ J 205	1.5 (on bands 40 thru 10m)
VIF J 206	0.1 (for full output)
666 GRID J 207	8-10 (with PA on)
666 CAT J 208	5-6 (with PA on)

5.2.2. EXCITER AND POWER AMPLIFIER.

5.2.2.1. TUBE REPLACEMENT.

a. GENERAL. All tubes are removed by pulling straight up after first removing their shields, if they are so equipped. Special instructions apply to the 4X250B tubes. (See next paragraph.) Should the tube pins become bent, be sure they are straightened

to perfect alignment before attempting to insert them into their sockets. Use a special tube pin straightener available for such purposes.

b. PA TUBES. The top cover of the power amplifier enclosure must be removed to get at the PA tubes (as well as the ALC rectifier V403). Once the cover is off, check by means of a shorting tool to see that there is no charge in the hv filter capacitors.

WARNING

WHENEVER ANY ADJUSTMENTS INVOLVING THE HIGH VOLTAGE OR POWER AMPLIFIER CIRCUITS ARE CONTEMPLATED, DISCONNECT THE TRANSMITTER FROM THE POWER LINES AND SEE THAT ALL FILTER CAPACITORS ARE DISCHARGED.

Grasp the plate connector of the tube to be removed and pull straight up. (The plate connector consists of a large ring with metal fingers running radially in from the ring to provide a pressure fit to the tube plate and a connecting pin which snaps into an adjacent clip.)

Once the plate connector has been removed, the tube can be pulled from its socket.

When replacing the tube connector assembly, see that it is on straight and down as far on the tube as it will go. See figure 2-2.

When replacing the compartment cover, be sure that the cover screws are pulled fully down so that the interlock (S401) operates.

5.2.3. ALIGNMENT OF KWS-1. The following alignment procedure assumes that the KWS-1 is completely out of alignment. Use all of it or any part of it that is necessary to accomplish the desired results.

5.2.3.1. VFO ALIGNMENT.

NOTE

This assumes a vfo in good adjustment. If the vfo is out of frequency adjustment, refer to paragraph 5.2.3.9.

- a. Remove V104 from its socket.
- b. Connect the antenna of a communications receiver to J203. (See figure 5-1.)
- c. Set the KILOCYCLES tuning to 3.5 mc and the BAND CHANGE to 80.
- d. Place the EMISSION switch in the CAL position and turn up the CARRIER LEVEL control to half scale and turn the FILAMENT switch ON.

e. Set the receiver dial to 3250 kc (must be very accurately calibrated - use an external calibrator if necessary).

f. Turn the receiver bfo on and set it to center of i-f passband.

g. Loosen the coupler of the vfo shaft and rotate the shaft until zero beat is obtained in the receiver.

h. Replace V104 in its socket.

i. Calibrate and tune the receiver to 3.5 mc.

j. Leave the KWS-1 KILOCYCLES dial at 3.5 mc and the receiver at 3.5 mc.

k. Manually rotate the vfo shaft until zero beat is obtained.

m. Tighten the coupler.

5.2.3.2. SIDEBAND SELECT ADJUSTMENT.

a. With the KILOCYCLES dial accurately set on 3.5 mc, set up the DIAL DRAG.

b. Set SIDEBAND SELECT at LOWER.

c. Connect the communications receiver antenna input to J203.

d. Set the EMISSION switch to CAL and CARRIER LEVEL to half scale.

e. Tune the receiver for zero beat with the bfo on.

f. Operate the SIDEBAND SELECT switch to "UPPER".

g. Adjust the mechanical limit of the SIDEBAND SELECT switch (available through the top of the audio chassis) for zero beat.

h. Operate the SIDEBAND SELECT switch back and forth a few times to make sure that the zero beat stays.

5.2.3.3. CRYSTAL OSCILLATOR ADJUSTMENT.

a. Connect an r-f voltmeter (vacuum tube voltmeter) from J205 to ground. (Transmitter remains in CAL operation.)

b. Select bands 40 thru 10 and adjust associated crystal oscillator tuning slug for maximum. (See table below.) A value of about 1.5 volts should be obtained on each band. The 10 and 11-meter bands will run slightly lower because the oscillator is used as a doubler on these bands.

BAND	40	20	15	11	10 LO	10 HI
COIL	L217	L216	L215	L214	L213	L212

5.2.3.4. TRAP ADJUSTMENTS.

a. FIRST MIXER PLATE TRAP.

(1) Connect the communications receiver antenna input to J207.

(2) Set the BAND CHANGE switch to "80".

(3) Set the KILOCYCLES dial to 3.5 mc.

(4) Set EMISSION to CAL.

(5) Turn CARRIER LEVEL control fully counterclockwise.

(6) Tune the communications receiver until the transmitter VFO is heard near 3.25 mc.

(7) Adjust C229 for minimum signal at the receiver. (Use "S" meter and bfo off.)

b. 8 MC TRAP.

(1) Connect communications receiver as in 5.2.3.4. above.

(2) Set the KWS-1 BAND CHANGE switch to "40".

(3) Set the KILOCYCLES dial to 7.3 mc.

(4) Tune the communications receiver until the second harmonic of Y206 (8 mc) is heard.

(5) Adjust C249 for minimum signal at the receiver.

5.2.3.5. EXCITER TRACKING.

a. 80-METER TRACKING.

(1) Place the EMISSION switch in the CAL position.

(2) Use the CARRIER LEVEL control to adjust drive.

(3) Connect the communications receiver antenna to J207. BFO OFF.

(4) Short out L701 with a short jumper (put jumper across coil - not to ground), (see NOTE** below).

(5) Set BAND CHANGE switch to "80" position.

(6) Set the KILOCYCLES dial at 3.1 mc and adjust L201, L203, L204, L206 and L207 for maximum indication on the receiver "S" meter (receiver tuned to 3.1 mc).

(7) Tune transmitter and receiver to 3.9 mc and adjust C202, C207, C211, C217 and C221 for maximum indication on receiver "S" meter.

NOTE

It may be necessary to reduce gain in receiver as alignment proceeds to keep the "S" meter in range. Do this by loosening the coupling to the receiver.

(8) Repeat steps (6) and (7) until tracking is accomplished.

b. 40-METER TRACKING.

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above (80-meter tracking).

(2) Set the BAND CHANGE switch to "40" position.

(3) Set the transmitter and receiver tuning dial to 7.1 mc and adjust L223, L225 and L231 for maximum "S" meter readings.

(4) Set the transmitter and receiver dials to 7.9 mc and adjust C272, C308, and C248 for maximum "S" meter readings.

(5) Repeat steps (3) and (4) until tracking is accomplished.

c. 20-METER TRACKING.

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

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(2) Set the BAND CHANGE switch to the 20 position.

(3) Set the transmitter and receiver dials to the 14-mc bands and adjust L218, L230 and L237 for maximum "S" meter readings.

(4) Set the receiver and transmitter dials to 14.3 mc and adjust C250, C306 and C269 for maximum "S" meter readings.

(5) Repeat steps (3) and (4) until tracking is accomplished.

d. 15-METER TRACKING.

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

(2) Set the BAND CHANGE switch to the "15" position.

(3) Set the transmitter and receiver tuning dials to 21.0 mc and adjust L219, L229 and L236 for maximum "S" meter reading.

(4) Set the transmitter and receiver tuning dials to 21.4 mc and adjust C252, C304 and C267 for maximum "S" meter indication.

(5) Repeat steps (3) and (4) until tracking is accomplished.

e. HIGH 10-METER TRACKING. (See NOTE* below.)

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

(2) Set the BAND CHANGE switch to the "10" high position.

(3) Set the transmitter and receiver tuning to 29.4 mc and adjust C256 and C257 for maximum "S" meter indication.

f. LOW 10-METER TRACKING (See NOTE* below.)

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

(2) Set the BAND CHANGE switch to the "10" low position.

(3) Set the transmitter and receiver tuning dials to 28.1 mc and adjust L221, L227 and L234 for maximum "S" meter indication.

(4) Set the transmitter and receiver tuning dials to 28.9 mcs and adjust C255, C301 and C265 for maximum "S" meter readings.

(5) Repeat steps (3) and (4) until tracking is accomplished.

g. 11-METER TRACKING (See NOTE* below.)

(1) Repeat steps (1), (2), (3) and (4) of paragraph 5.2.3.5.a. above.

(2) Set the BAND CHANGE switch to the "11" position.

(3) Set the transmitter and receiver tuning dials to 27.1 mc and adjust C254, C302 and C266 for maximum "S" meter indications.

***NOTE**

The 10 high, 10 low, and 11 bands must be aligned in the order given above.

****NOTE**

The driver stage must be neutralized before tracking of the plate circuit is attempted or the stage will probably oscillate. The tracking procedure will be resumed at paragraph 5.2.3.7. below. If oscillation persists, check to see that screws in shields are tight and check bypass condensers for broken leads.

5.2.3.6. NEUTRALIZING.

a. GENERAL. If the shorting wire is still across L701 from the tracking procedure above, remove the wire. The driver (6CL6) grid-plate neutralizing, and the PA grid-plate neutralizing are done with all filaments energized, the driver plate on but the PA plate voltage off. The driver (6CL6) grid-cathode neutralizing is done with all filaments excited and the driver and PA plate voltage on.

b. DRIVER (6CL6) GRID-PLATE NEUTRALIZATION.

(1) Set the EMISSION to CAL and BAND CHANGE to 15M.

(2) Couple a receiver lightly to 6CL6 GRID test point, J207, and adjust CARRIER LEVEL for about midscale "S" meter reading.

(3) Swing 6CL6 plate tuning capacitor C713 thru resonance and note reaction on "S" meter.

(4) Adjust neutralization capacitor C283 for minimum meter reaction as the plate is tuned thru resonance.

c. PA GRID-PLATE NEUTRALIZATION.

(1) Set EMISSION to CAL and BAND CHANGE to 15M.

(2) Couple a receiver to antenna output jack, J401.

(3) With PA plate off, adjust CARRIER LEVEL until a signal is heard in receiver.

(4) Tune the PA TUNING and PA LOADING controls until the signal is strongest (see tuning chart in section III for approximate settings).

(5) Reduce the CARRIER LEVEL to 1/2 scale on receiver "S" meter.

(6) Loosen screws on PA neutralizing capacitor and slide it in slot until the signal is minimum.

(7) Tighten the neutralizing capacitor screws.

d. DRIVER (6CL6) GRID-CATHODE NEUTRALIZATION.

(1) Couple the PA into a dummy load and load the transmitter to 1 kw input on 15 meters.

(2) Lightly couple a receiver to the 6CL6 GRID test point, J207, and reduce the CARRIER LEVEL to about midscale on the receiver "S" meter.

(3) Rock the PA TUNING control C407 and note reaction on "S" meter.

(4) Adjust cathode neutralizing capacitor, C715, for minimum receiver "S" meter reaction as PA is tuned through resonance.

e. 80-METER NEUTRALIZATION.

(1) Set EMISSION to CAL and BAND CHANGE to 80M (at 3.5 mc).

(2) Lightly couple a receiver into the 6CL6 GRID test point, J207.

(3) Set CARRIER LEVEL for about 1/2 scale on "S" meter (PA PLATE OFF).

(4) Swing the 80-meter 6CL6 plate tuning capacitor, C710, through resonance and note reaction on "S" meter.

(5) Adjust C322, 80-meter neutralizing capacitor, for minimum reaction as the plate is tuned through resonance.

5.2.3.7. DRIVER (V206/V207) TRACKING.

NOTE

The preceding exciter stages should be tracked and all neutralizing procedures completed before the driver plates are tracked, otherwise some instability may be experienced.

a. Connect VTVM set up to read r-f volts to J201.

b. Set EMISSION switch in CAL position.

c. Adjust CARRIER LEVEL for one-fourth scale indication on VTVM.

d. Adjust the following trimmers at the frequencies indicated with the BAND CHANGE switch set at the bands indicated. Adjust for maximum indication on VTVM.

TABLE 5-3

DRIVER PLATE ALIGNMENT

BAND CHANGE (BAND)	COIL	FREQ. (MC)	CAPACITOR	FREQ.
80	L701	3.10	C710	3.90
40	L703	7.0	C711	7.3
20	L702	14.0	C712	14.3
15	L704	21.0	C713	21.4
*High 10	L705	29.5	--	--
*Low 10	--	--	C708	28.5
* 11	--	--	C707	27.5

*NOTE: The high 10, low 10, and 11 meter bands must be aligned in this order.

Section V

Paragraphs 5.2.3.8. - 5.2.3.9.

5.2.3.8. BALANCED MODULATOR ADJUSTMENT.

- a. Set the EMISSION selector switch to SSB.
- b. Connect the communications receiver to J201.
- c. Set the BAND CHANGE switch to 80.
- d. Set the KILOCYCLES dial to 3500 kc.
- e. Set SIDEBAND SELECT to LOWER.
- f. Tune the receiver until the carrier is heard, bfo off, and carrier showing on "S" meter.
- g. Adjust R112 and C112 for minimum indication on "S" meter.
- h. Repeat step g.

5.2.3.9. VFO ALIGNMENT.

a. GENERAL. The vfo is calibrated and sealed at the factory and should require adjustment only at widely separated intervals. If the calibration error becomes excessive for operation or beyond the point where the vernier dial corrector (ZERO SET control) cannot correct, the following procedure should be followed to make correcting adjustments.

b. TEST EQUIPMENT REQUIRED.

(1) Precision frequency measuring gear capable of measuring 2750 kc and 3750 kc (or harmonics thereof) or:

(2) A precisely calibrated receiver capable of receiving 2750 kc and 3750 kc (or harmonics thereof) or:

(3) A Collins 75A-2, 3 or 4 calibrated at 27.5 mc (11-meter band) and at 30 mc (10-meter band).

c. PROCEDURE.

(1) Connect the frequency measuring device to J203. Use loose coupling if listening to the fundamental or low harmonic of the oscillator.

(2) Turn the transmitter to CAL emission and turn on the frequency measuring equipment and allow them to warm up for about 1 hour.

(3) Very carefully calibrate the frequency measuring equipment using WWV as a frequency standard. (If 75A's are used, adjust calibration

oscillator against WWV then calibrate KILOCYCLES dial and bfo.)

(4) Select LOWER sideband with SIDEBAND SELECT control.

(5) Set BAND CHANGE control to 80.

(6) Turn KILOCYCLES dial to 3.0 mc (2750 kc vfo frequency). Tune for zero beat in frequency measuring equipment.

NOTE

If 75A is used, the 10th harmonic (27.5 mc) of 2750 kc should be used here and the 8th harmonic (30 mc) used at the 3750 kc point. (3 and 4 respectively on the transmitter KILOCYCLES dial.)

(7) Set the ZERO SET (fiducial) to 0 on KILOCYCLES dial (3000 kc). Note the dial reading if the fiducial cannot go to 0.

(8) Rotate the KILOCYCLES dial to 4.0 mc (3750 kc vfo frequency) and tune to exact zero beat on frequency measuring equipment (30.0 mc on 75A receivers).

NOTE

If the harmonic at 30 mc is used, it would be well to check on the 80-meter band at 3750 kc to see that a signal is actually there. This prevents the possibility of using the wrong harmonic.

Do not readjust ZERO SET control. The calibration error is then the number of dial divisions more or less than the 10 turns it should take to cover the range between the two test frequencies. Usually, the error tends to be toward more rotation of the KILOCYCLES dial than the 10 turns that should be required. To correct the error, proceed as follows:

(9) Rotate the KILOCYCLES dial towards and through dial zero (4000 kc) until a total of 2 times the dial division error has been counted.

(10) Engage the trimmer adjusting stud with a strong thin wire (such as a straightened-out paper clip) and turn until zero beat in the frequency measuring equipment is restored.

(11) The ZERO SET (fiducial) can now be adjusted until it is set at dial zero (4000 kc).

(12) This completes the procedure in most cases. To check, retune the KILOCYCLES dial and frequency measuring equipment to the 2750 kc end of the range and check the dial division error. If the adjustments have been done carefully, less than 1/2 division error will be found. The above procedure can be repeated until satisfactory results are obtained. This endpoint adjustment restores factory accuracy to the intermediate points, also.

(13) In most cases, the dial reading will again be centered in the window. If this is not so and it is desired to center the dial reading, set the KILOCYCLES dial to zero beat at 3 mc and carefully loosen the setscrews in the mechanical stop side of the flexible coupler and turn the dial so that 3 mc is straight up. Tighten the setscrews.

5.2.3.10 SYNCHRONIZING PA ROLLER COILS AND CAPACITORS.

- a. Set PA TUNING and PA LOADING controls to 0-0.
- b. Set capacitors to full mesh (C407, C408, C409).
- c. Set roller for PA TUNING coil one turn from maximum inductance. The end of the roller coils farthest from the panel is the maximum inductance end.
- d. Set the roller for PA LOADING coil four turns from maximum inductance.

5.3. MECHANICAL MAINTENANCE.

5.3.1. DIAL CORD REPLACEMENT.

a. GENERAL. Two dial cords are used in this equipment - one for the MEGACYCLES dial drum and one for the MEGACYCLES dial pointer. Refer to figure 5-2. In either case the front panel must be removed to gain access to the dial cords.

b. FRONT PANEL REMOVAL.

- (1) Remove the following knobs: BAND CHANGE, KILOCYCLES tuning, PA TUNING, PA LOADING and SIDEBAND SELECT.
- (2) Remove six panel screws (three on each side).
- (3) Pull the panel forward and off the extended control shafts. Allow it to tip forward - being careful to prevent breakage of connecting wires.

c. POINTER CORD. (See figures 5-2 and 6-3.)

- (1) Obtain a type 432 1018 00 Collins dial cord. This cord is cut to correct length and has securing loops already tied in the ends (as does the drum cord).
- (2) Scribe a mark on the KILOCYCLES tuning shaft and the dial hub to mark their relative positions and remove the KILOCYCLES dial.

(3) See figure 5-2. Turn the KILOCYCLES tuning shaft to the clockwise stop.

(4) Start at point X in the drawing with the cord hooked to one end of the spring (Collins Part Number of this spring is 503 1240 001).

(5) Bring cord around pulley C to pulley B.

(6) Wrap around pulley B clockwise, through the deep slot, around the tab, and back through the shallow slot. Wrap around pulley B two times clockwise.

(7) Wrap cord around pulley A and loop the end on the free end of the spring.

(8) Fasten the pointer to the cord.

(9) Replace the KILOCYCLES dial and match the scribe marks (added in step (2)) and tighten the setscrews.

(10) Back the KILOCYCLES dial to where O is straight up.

(11) Slide the pointer to the first major mark at the right-hand edge of the drum.

(12) Check by turning the KILOCYCLES dial shaft through its entire range.

(13) Replace panel - be sure KILOCYCLES dial plate is in the correct position on its shaft so that there is no binding and so that the DIAL DRAG works correctly.

(14) Replace the knobs.

d. DRUM CORD. (See figures 5-2 and 6-3).

(1) Obtain a Collins Type 532 1020 00 dial cord.

(2) Turn the BAND CHANGE to the 3-4 mc band (80 meter).

(3) Turn pulley E approximately one turn and hold tension spring taut. (The front panel must have been removed as in paragraph b. above).

(4) Make approximately 3/4 turn around pulley D and hook cord to tab.

(5) Extend the cord around the inside of the idler pulley F and go around pulley E to the tab and hook the cord to it. Release the tension spring.

(6) Replace the panel and knobs.

(7) Loosen the setscrew in the drum hub opposite the coil tension spring and align the drum calibration to the 80-meter band then tighten the setscrew.

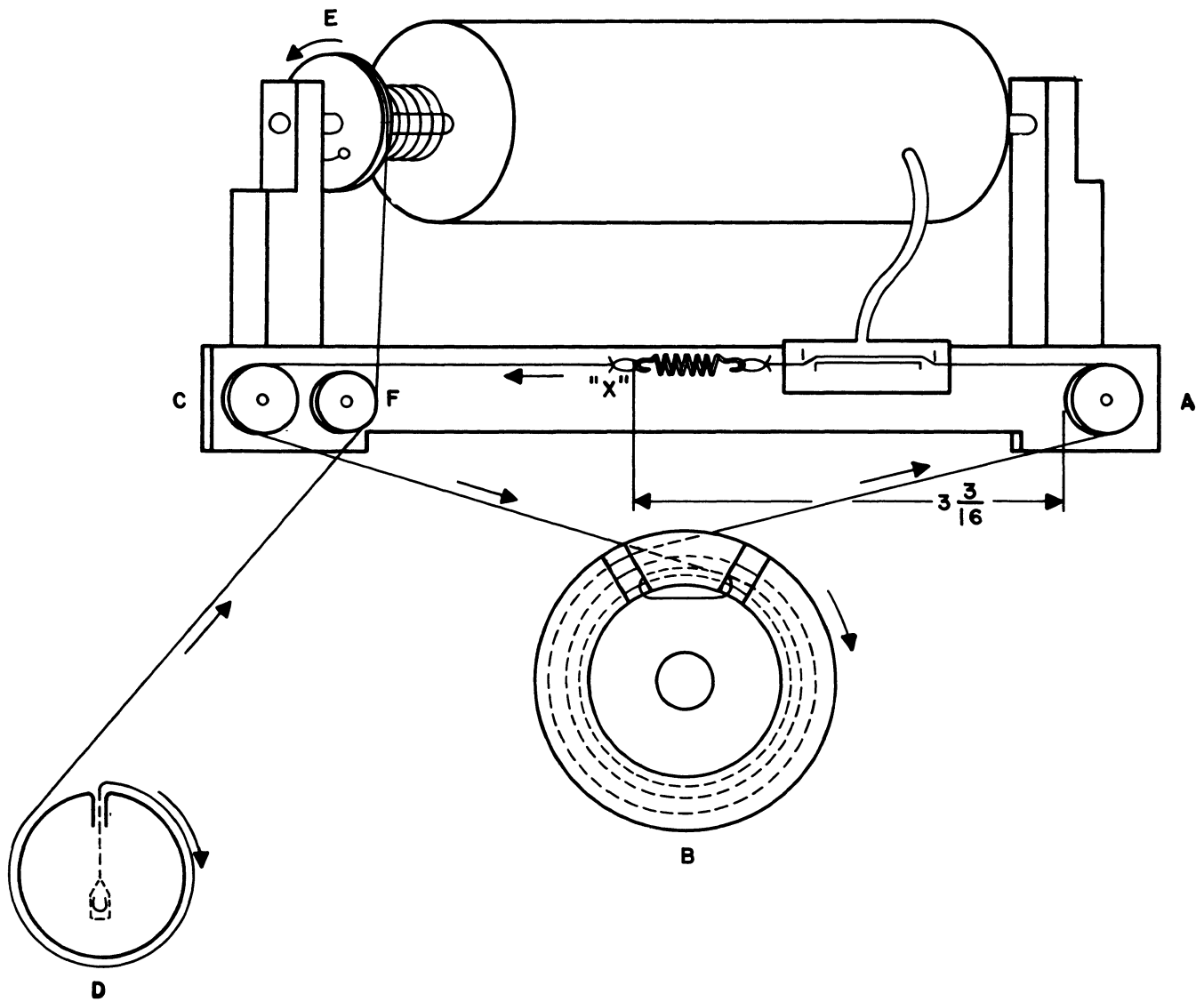


Figure 5-2. Dial Cord Replacement

TABLE 5-4

TUBE PIN VOLTAGE TO GROUND

Readings taken with VTVM
Set in CALIBRATE - No Carrier - 40 Meter Band

PIN TUBE	1	2	3	4	5	6	7	8	9
V001	-3.2	0	+36	+36	+200	+88	0	-	-
V101	+41	0	+0.6	0	0	+125	0	+1.7	6.3 AC
V102	+165	+16.5	+23	0	0	+75	0	+0.75	6.3 AC
V103	+90	-0.12	+0.8	0	0	+285	0	+9.3	6.3 AC
V104	+120	-13	0	0	0	+285	+11	+50	6.3 AC
V105	+108	0	IC	0	+108	IC	0	-	-
V106	+215	+108	IC	+108	+215	IC	+108	-	-
V107	0	0	0	6.3 AC	+0.53	NC	-0.6	-	-
RT101	NC	+36	+36	NC	NC	NC	+36	+36	NC
V201	+200 320	-0.1 -2.5	+2.1	0	0	+200 320	-0.4 -2.5	+2.1	6.3 AC
V202	0.01	2.8-3.3	0	6.3 AC	+270 320	+130 200	2.8-3.3	-	-
V203	0	+3.1	0	6.3 AC	+280	+140	+3.1	-	-
V204	+185 335	0	+2.15 0	0	0	+185 320	0	+2.15 0	6.3 AC
V205	0	+7.8 9.4	0	6.3 AC	+140 163	+140 163	+7.8 9.4	-	-
V206	+1.6	-3.8	+215 320	0	6.3 AC	+285 320	0	+215	-3.8 -2.8
V207	+1.6	-3.8	+215 295	0	6.3 AC	+285 300	0	+215 295	-3.8 -2.8
V208	-1.3	0	0	6.3 AC	+280	+47	0	-	-
V209	0	+5	0	6.3 AC	+280	+160	+5	-	-

TABLE 5-5

TUBE PIN RESISTANCES TO GROUND

Readings taken with VTVM
Set in CALIBRATE - No Carrier - 40 Meter Band

TUBE \ PIN	1	2	3	4	5	6	7	8	9
V001	82K	0	60K	60K	12.6K	62K	0.1 Ω	-	-
V101	240K	100K	680	0	0	85K	470K	1000	.05 Ω
V102	37K	720K	4500	0	0	115K	0-880K	330	.05 Ω
V103	100K	1M	330	0	0	23K	0	680	.05
V104	52K	470K	0	0	0	9K	500K	4900	.05
V105	∞	0	IC	0	∞	IC	0	-	-
V106	11K	∞	IC	∞	11K	IC	∞	-	-
V107	100K	100K	0	.05	860K	NC	860K	-	-
RT101	NC	58K	58K	NC	NC	NC	58K	58K	NC
V201	18.2K	100K	220	0	0	18.2K	60K	220	.05
V202	920K	220-320	0	.05	10K	19K	220-320	-	-
V203	930K	220	0	.05	9.8K	19.8K	220	-	-
V204	19K	100K	220	0	0	19K	100K	220	.05
V205	27	220	0	.05	13K	13K	220	-	-
V206	7.5	22K	13.5K	0	.05	9K	0	13.5K	22K
V207	7.5	22K	13.5K	0	.05	9K	0	13.5K	22K
V208	100K	0	0	.05	13.5K	480K	7.5	-	-
V209	0.3	390	0	.05	9.6K	19.5K	390	-	-

NOTES

