COLLINS

instruction book

Collins Radio Company | Dallas, Texas

830B-1A
250-Watt FM Broadcast Transmitter

GUARANTEE

The equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to design, workmanship or material, and which are returned to Collins at its factory, transportation prepaid, provided

(a) Notice of the claimed defect is given Collins within two (2) year from date of delivery and goods are returned in accordance with Collins' instructions.

(b) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins' designs are subject to only such adjustments as Collins may obtain from the supplier thereof.

(c) No equipment or accessory shall be deemed to be defective if, due to exposure or excessive moisture in the atmosphere or otherwise after delivery, it shall fail to operate in a normal or proper manner.

Collins further guarantees that any radio transmitter described herein will deliver full radio frequency power output at the antenna lead when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range of said apparatus.

The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins or its authorized service center.

No other warranties, expressed or implied, shall be applicable to any equipment sold hereunder, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements in this paragraph contained. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause.

HOW TO RETURN MATERIAL OR EQUIPMENT.

If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. (With respect to tubes we suggest that your adjustments can be speeded up if you give notice of defect directly to the tube manufacturer.) Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Service Parts Department
Dallas, Texas 75207

INFORMATION NEEDED:

(A) Type number, name, and serial number of equipment
(B) Date of delivery of equipment
(C) Date placed in service
(D) Number of hours of service
(E) Nature of trouble
(F) Cause of trouble if known
(G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
(H) Item or symbol number of same obtained from parts list or schematic
(I) Collins' number (and name) of unit sub-assemblies involved in trouble
(J) Remarks

HOW TO ORDER REPLACEMENT PARTS.

When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable. To enable us to give you better replacement service, please be sure to give us complete information.

ADDRESS:

Collins Radio Company
Service Parts Department
Dallas, Texas 75207

INFORMATION NEEDED:

(A) Quantity required
(B) Collins' part number (9 or 10 digit number) and description
(C) Item or symbol number obtained from parts list or schematic
(D) Collins' type number, name, and serial number of principal equipment
(E) Unit sub-assembly number (where applicable)

523-0166000-00243A
2nd Edition, 1 January 1967

COLLINS

instruction book

830B-1A
250-Watt FM Broadcast Transmitter

This manual includes:

SP-183 830B-1A 250-Watt FM Broadcast Transmitter	523-0755439
TD-536 A830-2 10-Watt Wide-Band FM Broadcast Exciter	523-0755303
TD-537 786M-1 Stereo Generator (optional)	523-0755304
TD-538 B830-1 250-Watt FM Power Amplifier	523-0755596

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SP-183
523-0755439-002439
2nd Edition, 1 January 1967

COLLINS

system instructions

830B-1A
250-Watt FM Broadcast Transmitter

Collins Radio Company | Dallas, Texas
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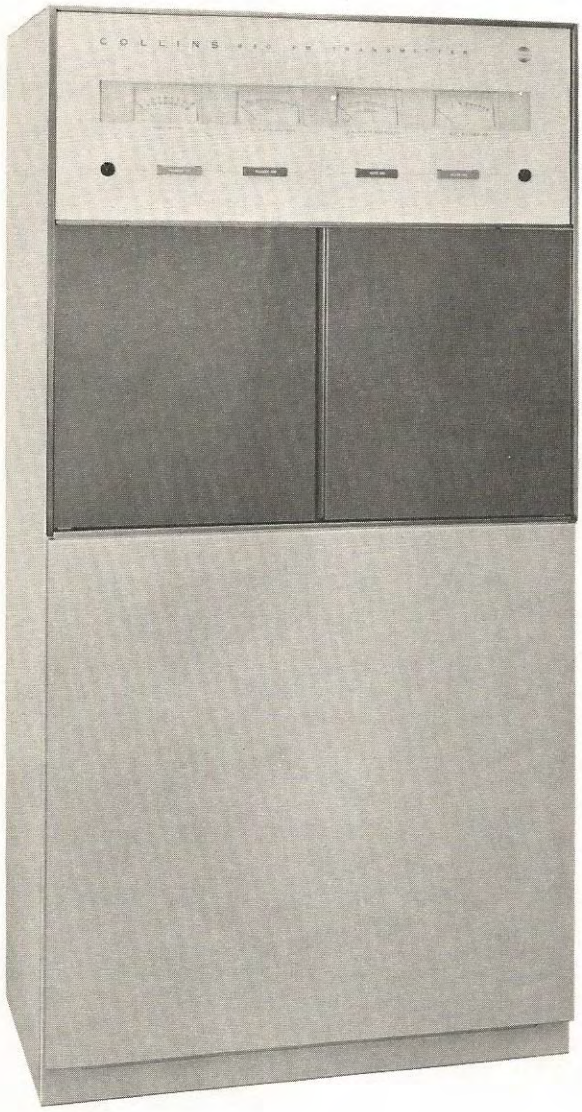


Figure 1-1. Overall View, 830B-1A 250-Watt FM Broadcast Transmitter

section 1

general description

1.1 PURPOSE OF INSTRUCTION BOOK.

This instruction book is a guide for installing, adjusting, operating, and maintaining 830B-1A 250-Watt FM Broadcast Transmitter.

1.2 PURPOSE OF EQUIPMENT.

The 830B-1A 250-Watt FM Broadcast Transmitter is used for continuous monophonic or optional stereophonic FM broadcast service on a single frequency in the range from 88 to 108 megahertz with an output power of 250 watts.

1.3 DESCRIPTION OF EQUIPMENT.

1.3.1 PHYSICAL DESCRIPTION.

The 830B-1A 250-Watt FM Broadcast Transmitter, shown in figure 1-1, is contained in a single cabinet that is 38 inches wide, 76 inches high, 27 inches deep, and weighs approximately 638 pounds. All transmitter operating controls are located behind the doors on the front of the cabinet. The filament and plate on-off controls and four monitoring meters are located at the top front of the cabinet. The meters may be observed easily while operating the tuning controls. The transmitter uses eight tubes and 20 transistors, all of which are accessible from the front of the transmitter. The bottom front of the transmitter cabinet is removable to allow access to components on the bottom of the inside panel.

Large doors at the upper rear of the cabinet allow access to the upper part of the transmitter for servicing and maintenance. The lower rear half of the transmitter cabinet is covered by a removable panel that contains a ventilating fan and a permanent-type air filter. Operating personnel are protected by both electrical and mechanical interlocks on the rear doors and panel. These interlocks ground the transmitter high-voltage circuits when the doors are opened or the panel is removed. The power amplifier plate-tuning cavity is located in an interlocked compartment at the front of the transmitter.

Inside the transmitter, heavy iron-core components are at the bottom of the cabinet. The exciter portion of the transmitter is mounted on a 19-inch rack on one side of the cabinet. A harmonic filter that is connected to the transmitter output is suspended from the top of the cabinet.

Cooling air for the transmitter is drawn through a permanent-type air filter at the rear of the cabinet by a low-speed, high-volume fan, and exhausted through a shielded opening in the top of the cabinet. An individual pressure blower supplies cooling air directly to the power amplifier tube.

1.3.2 ELECTRICAL DESCRIPTION.

The 830B-1A 250-Watt FM Broadcast Transmitter is composed of two electrically-connected subunits: (1) a wide-band exciter that furnishes a 10-watt FM output to drive (2) a 250-watt power amplifier. Unit instructions covering the exciter and power amplifier used in the transmitter are listed in table 1-1. They are supplied following section V of this system instruction book. The unit instructions contain detailed descriptions of the two transmitter units.

1.4 EQUIPMENT SUPPLIED.

Table 1-2 lists equipment that is supplied as part of 830B-1A 250-Watt FM Broadcast Transmitter.

1.5 ACCESSORY EQUIPMENT.

Table 1-3 lists accessory equipment that is available for use with 830B-1A 250-Watt FM Broadcast Transmitter. Information on 786M-1 Stereo Generator is contained in Unit Instructions TD-537 (CPN 523-0755304).

TABLE 1-1. UNIT INSTRUCTIONS

PUBLICATION	PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	TD-536 523-0755303
B830-1 250-Watt FM Power Amplifier	TD-538 523-0755596

TABLE 1-2. EQUIPMENT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
A830-2 10 W Wide Band FM Broadcast Exciter	522-2714-000
B830-1 250-Watt FM Power Amplifier	549-2008-000
250-Watt/1Kw Harmonic Filter	549-2010-000

TABLE 1-3. ACCESSORY EQUIPMENT

EQUIPMENT	COLLINS PART NO.
786M-1 Stereo Generator	522-2914-000

1.6 EQUIPMENT SPECIFICATIONS.

1.6.1 MECHANICAL.

Weight:
638 pounds (approximate)

Size:
38 inches wide, 76 inches high, 27 inches deep

Ventilation:
One ventilating fan, one blower

Ambient Temperature Range:
+10°C (50°F) to +55°C (131°F)

Ambient Humidity Range:
Up to 95 percent relative humidity

Altitude:
Up to 6000 feet

Shock and Vibration:
Normal handling and transportation

1.6.2 ELECTRICAL.

Power Source:
200 to 250 volts, 60-hertz, single-phase

Maximum Power Requirements:
900 watts

Power Output:
250 watts

Output Impedance:
50 ohms, unbalanced
Maximum swr 2:1

Frequency Range:
88 to 108 MHz
Exact operating frequency determined by frequency of crystal in heterodyning oscillator.

Excitation Source:
Crystal-controlled high-stability oscillator using plated, nontemperature-controlled crystal, controlling an LC modulation oscillator to provide automatic frequency control. The modulation oscillator is then heterodyned up to the station operating frequency by a second high-stability crystal-controlled oscillator.

Carrier-Frequency Stability:
Within ±1000 Hz of specified carrier frequency over ambient temperature range from +10°C (55°F) to +55°C (131°F) and line-voltage variations of ±15 percent.

Harmonic and Spurious Radiation:
Any emission appearing on a frequency removed from the carrier by between 120 kHz and 240 kHz inclusive, is at least 30 db below the level of the unmodulated carrier.

Any emission appearing on a frequency removed from the carrier by between 240 kHz and 600 kHz inclusive is at least 40 db below the level of the unmodulated carrier.

Any emission appearing on a frequency removed from the carrier by more than 600 kHz is at least 67 db below the level of the unmodulated carrier.

Modulation Characteristics:
Wide-band direct FM modulation
Standard audio pre-emphasis is incorporated in modulator.

Audio Input Impedance:
600 ohms, balanced

Audio Input Level:
+10 dbm ±2 db

Audio Frequency Response:
Complies with standard FCC 75-microsecond pre-emphasis curve.

Audio Frequency Distortion:
50 to 100 Hz, 1.5 percent maximum
100 to 7500 Hz, 1.0 percent maximum
7500 to 15,000 Hz, 1.5 percent maximum

FM Noise Level:
Not less than 65 db below 100 percent modulation (±75 kHz)

AM Noise Level (rms):
Not less than 55 db below equivalent 100 percent AM.

section 2

installation

2.1 UNPACKING AND INSPECTING.

Be careful when uncrating the transmitter and components to avoid damaging the equipment. Inspect the transmitter carefully for scratches, dents, or other physical damage. Check for loose screws and bolts. Inspect all controls, such as switches, for proper operation as far as can be determined without applying power to the transmitter. Examine cables and wiring, making sure that all connections are tight and clear of each other and the chassis. File any damage claims promptly with the transportation company. If such claims are to be filed, retain all packing material.

Note

Before installation check all transistors for proper placement. The transistor location tab must be pointing to the transistor socket locating mark placed adjacent to the transistor socket.

2.2 TRANSMITTER LOCATION.

Plan transmitter and wiring placement carefully before starting installation work. Refer to figure 2-1, the transmitter installation diagram. This diagram shows the location of all wiring openings in the transmitter cabinet. As will be noted, several alternate wiring arrangements can be used. Select the combination that best meets the station requirements.

Allow adequate clearance both in front and back of the transmitter. There should be a minimum clearance of 3-1/2 feet behind the transmitter to provide sufficient room for service work.

2.3 EXTERNAL CONNECTIONS.

Refer to figure 2-1 for assistance in making the following external connections.

WARNING

Disconnect the transmitter 230-volt ac power from the fused cut-out box before making any connections to or within the transmitter.

a. Connect the audio input to the transmitter. Bring the audio signal through the bottom of the cabinet on a shielded twisted pair. Connect the two audio leads to terminals 1 and 2 of TB305. If the optional stereophonic operation is employed, the left audio leads are connected to TB305-1 and 2 and the right audio leads to TB305-4 and 5. TB305 is located about half way up the cabinet on the left side as viewed from the rear of the cabinet. Connect the shields to terminal 3 of TB305.

b. Connect the FM monitor to the monitor output on the top of the cabinet. Refer to figure 2-1. Use type RG-58U coaxial cable to make this connection.

CAUTION

Before making the antenna connection, be sure that the transmission line and antenna present a nominal impedance of 50 ohms and an swr of not more than 2:1 at the transmitter operating frequency. If the transmitter output is improperly matched, the transmitter will not operate properly and may be damaged. THIS IS IMPORTANT.

c. Connect the antenna transmission line to the rf output connector on top of the 830B-1A cabinet.

d. Make sure that the PLATE circuit breaker on the front panel is set to OFF before making the power connections. Connect the power input cable to the transmitter. This power cable should be brought from an external fused cut-out box rated for 10 amperes. Use AWG #12 wire or larger to make this connection. Connect the power wires to terminals 1 and 2 of TB301, located at the lower left corner of the transmitter cabinet as viewed from the rear. Connect the neutral wire to terminal 3 of TB301. The power cable may be brought into the transmitter through holes in either the top or bottom of the cabinet.

2.4 INTERNAL CONNECTIONS.

The 830B-1A 250-Watt FM Broadcast Transmitter plate and control circuit power transformers are fitted with adjustable taps to compensate for line voltage variations. These taps compensate for line

variations from 200 to 250 volts in 10-volt steps. To adjust transformers T301 and T303 for line voltage variations perform the following steps.

a. Measure the line voltage at the transmitter fused cut-out box.

b. Remove the solder lug from T301, terminal 4, and move it to the transformer terminal labeled nearest the voltage measured in step a. Do not move the solder lug from transformer terminal 5, because this terminal supplies 230 volts to the cabinet fan for all line input connections. See figure 2-2 for transformer terminal numbers versus input voltage.

c. Remove the solder lug from T303, terminal 5, and move it to the transformer terminal labeled nearest the voltage measured in step a. See figure 2-2 for transformer terminal numbers versus input voltage.

d. Tighten all transformer terminal connections.

The following connections on TB304 should be checked to ensure that the plate on and filament off functions will operate; TB304-1 to TB304-2, TB304-3 to TB304-4, TB304-10 to TB304-11.

If the optional stereo generator is installed in the field, the 18-db audio pad will have to be removed from the audio circuitry of the exciter.

2.5 REMOTE CONTROL.

Wired remote control of 830B-1A 250-Watt FM Broadcast Transmitter can be accomplished by connection to terminal boards. Figure 2-3 shows the terminal board connections and remote functions. Remote ON switches should be the normally open, momentary type. Remote OFF switches should be operation, set the LOCAL-REMOTE switch, in the transmitter cabinet, to REMOTE. With the LOCAL-REMOTE switch in the REMOTE position, the transmitter may be controlled from the wired remote control panel or the transmitter panel switches.

For simplified operation, the FILAMENT ON and PLATE OFF switches may be eliminated. The PLATE ON switch starts a sequence of operation which turns the filaments on and the plate voltage on after the filament time delay has been completed. The FILAMENT OFF switch shuts down all transmitter functions.

If an optional stereo generator is employed in the 830B-1A, remote control of the stereo mode may be accomplished by a ground on TB302-7. If the ground is present, the transmitter will be in the stereo mode. If the ground is removed, the transmitter will be in the monaural mode. Local control of the stereo mode is also available at the transmitter.

Equipment is available that will completely control and monitor transmitter operation from a remote location through standard telephone pairs. When such remote control equipment is used, necessary installation and connection information will be supplied with the remote equipment.

2.6 FREQUENCY CHANGE.

If the transmitter operating frequency is changed, the following components will have to be changed or adjusted. These components are (1) the exciter power amplifier heterodyning oscillator crystal (2) and the plate cavity slider.

Table 2-1 lists the channel frequency versus crystal frequency and the Collins part number for each crystal. Figure 2-4 shows the distance the plate cavity slider should be positioned from the deck plate (tube socket mounting plate) for each frequency within the 88- to 108-MHz range.

2.7 STARTING THE TRANSMITTER IN A NEW INSTALLATION.

Before starting the transmitter for the first time, read section II of the unit instruction books to become familiar with the location and function of the various transmitter controls. Then, perform the following procedure:

WARNING

Voltages are present in this transmitter that are dangerous to life. Observe safety precautions when making any transmitter adjustments. Do not reach inside the rear of the transmitter cabinets whenever high voltages are applied. Do not depend on door interlocks. Always shut off transmitter power at the external cutout box and ground all capacitors with the shorting stick in the transmitter cabinet before doing any work inside the rear of the cabinets. When working in the power amplifier cavity, remember that 115 volts ac is present on one side of the cavity compartment interlock. Keep metal tools away from all transistor cases.

a. Complete the entire transmitter installation procedure as directed in this instruction book.

b. Close the doors at the rear of the cabinet. Open the doors at the front of the cabinet and remove the lower front panel so that the entire inside panel is exposed. Check that the plate cavity slider conforms to the distance specified in figure 2-4 for the operating frequency. Close the cover on the plate cavity compartment.

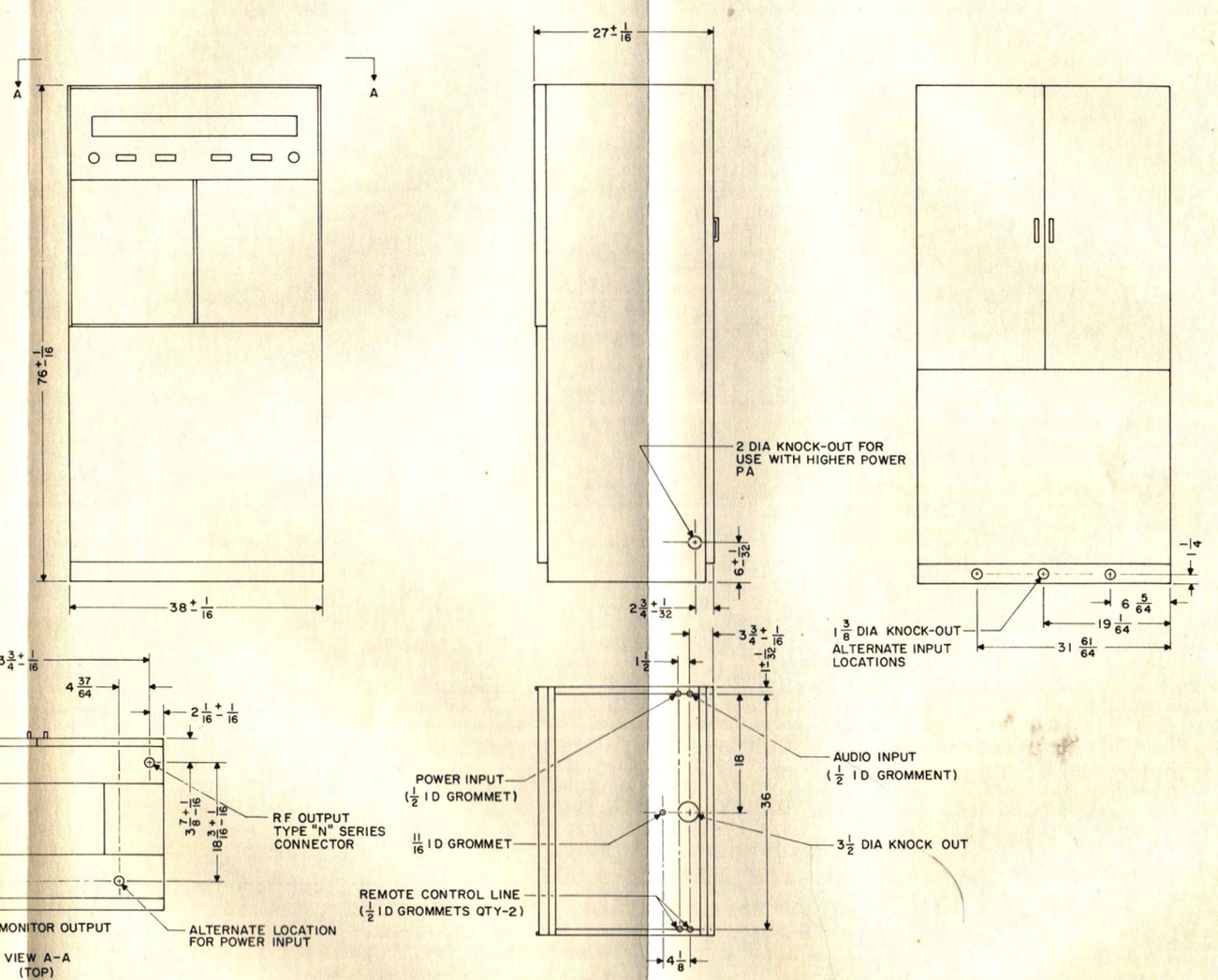


Figure 2-1. Outline and Installation Diagram, 830B-1A 250-Watt FM Broadcast Transmitter

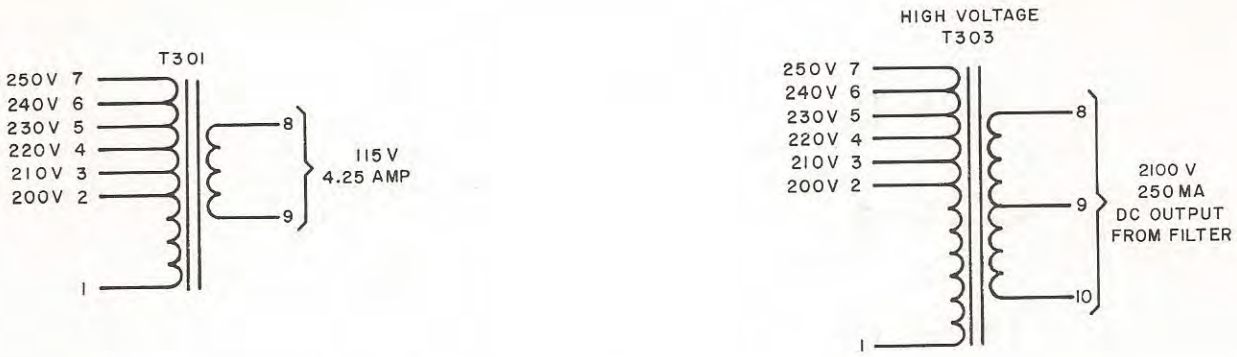


Figure 2-2. Transformer Details

c. Set the PLATE circuit breaker on the front panel to ON.

d. Press the FILAMENT ON switch. (Do not push PLATE ON switch.) The green indicator lamp at the top left of the cabinet should light. This means that all transmitter tube filaments and cooling-air blowers are operating.

e. Connect a VOM to TP301 and TP302. Set PA FIL ADJ resistor R325 for an indication of 6.0 volts on the VOM.

Note

A three (3) percent decrease in filament voltage will extend the life of a cathode fifty (50) percent.

When new, the 4CX250B tube will operate satisfactorily with less than 6.0 volts on the filament. Initially set the filament voltage for 6.0 volts at TP301 and TP302. When the 830B-1A is properly tuned, reduce the filament voltage to the point where power output decreases, then increase it slightly.

As the tube ages, the filament voltage may be increased to more than 6.0 volts.

f. Place the proper crystals into the exciter sockets. The 14-MHz crystal is placed into the Y501 socket. The heterodyning crystal is placed into the Y426 socket. Turn on the exciter and allow it to warm up for at least 15 minutes. The exciter POWER switch should be left in the ON position at all times.

g. Turn S101 to the 14 MC REF B position and check M101 for an indication in the B meter range. Turn S101 to the AFC KEY B position and check M101 for an indication in the B meter range.

Note

When S101 is in the AFC KEY B position the meter pointer will not hold steady but will pulse at the 5-Hz keying generator rate. This pulse is an indication of normal operation.

Turn S101 to the MOD OUTPUT B position and check M101 for an indication in the B meter range. If all meter indications for the three S101 positions fall within the B meter range, proceed with the following power amplifier tuning procedures. If any of the meter indications fall outside of the B meter range, the modulator and afc discriminator are out of adjustment and will have to be adjusted according to the Modulator and AFC Discriminator Adjustment Procedures in the Maintenance section of this instruction book.

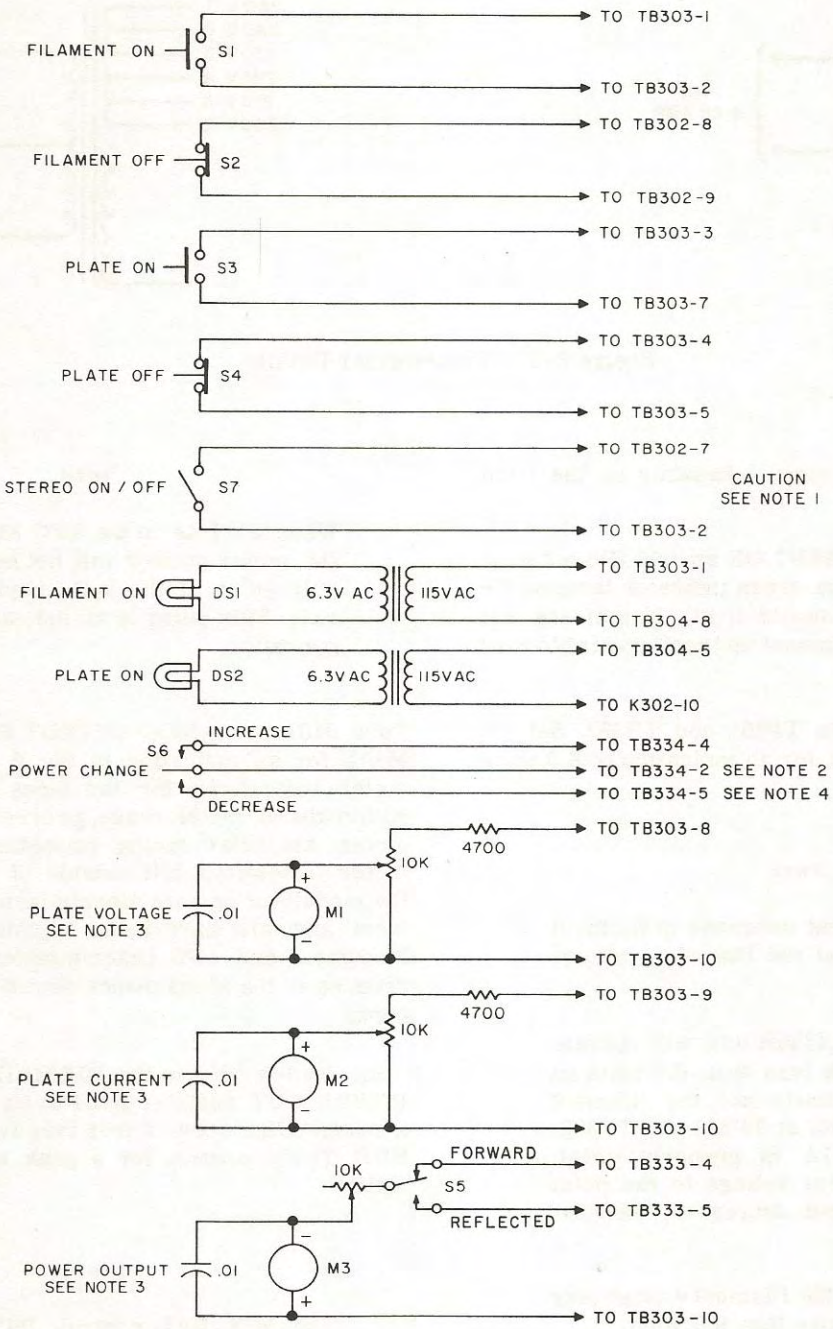
h. Switch S101 to the MIXER GRID A position. Set POWER OUT resistor R454 to its midposition. Using a nonmetallic screwdriver type tuning tool adjust the BUF TUNE control for a peak indication on meter M101.

Note

The MIX BAL control, R438, should be placed in its midrange position. No further adjustment of this control is then necessary unless the transmitting frequency falls within the range of 97 to 100 mc. See step n if the transmitted frequency falls within this range.

i. Switch S101 to the V428B position. Adjust L429 and L430 for a maximum indication on M101.

j. Switch S101 to the V429B position. Adjust L431 and L432 for a maximum indication on M101.



NOTES :

1. CONNECT S7 ONLY IF STEREO GENERATOR 786M-1 IS USED. IF CONNECTED TO A830-2, TURNING S7 ON WILL SHORT THE 27 VOLT SUPPLY
2. IN THE B830-1, JUMPER TB334-3 TO TB334-1
3. M1, USE CPN 099-2323-000
   M2, USE CPN 099-2324-000
   M3, USE CPN 458-0638-000
4. CONNECT S6 ONLY WHEN OPTIONAL OUTPUT POWER ADJUST MOTOR IS INSTALLED

Figure 2-3. Wired Remote Control Panel

TABLE 2-1. CRYSTAL PART NUMBERS

CHANNEL FREQ (MHz)	CRYSTAL FREQ (MHz)	COLLINS PART NUMBER	CHANNEL FREQ (MHz)	CRYSTAL FREQ (MHz)	COLLINS PART NUMBER
88.1	74.10000	289-2744-000	98.1	84.10000	289-2794-000
88.3	74.30000	289-2745-000	98.3	84.30000	289-2795-000
88.5	74.50000	289-2746-000	98.5	84.50000	289-2796-000
88.7	74.70000	289-2747-000	98.7	84.70000	289-2797-000
88.9	74.90000	289-2748-000	98.9	84.90000	289-2798-000
89.1	75.10000	289-2749-000	99.1	85.10000	289-2799-000
89.3	75.30000	289-2750-000	99.3	85.30000	289-2800-000
89.5	75.50000	289-2751-000	99.5	85.50000	289-2801-000
89.7	75.70000	289-2752-000	99.7	85.70000	289-2802-000
89.9	75.90000	289-2753-000	99.9	85.90000	289-2803-000
90.1	76.10000	289-2754-000	100.1	86.10000	289-2804-000
90.3	76.30000	289-2755-000	100.3	86.30000	289-2805-000
90.5	76.50000	289-2756-000	100.5	86.50000	289-2806-000
90.7	76.70000	289-2757-000	100.7	86.70000	289-2807-000
90.9	76.90000	289-2758-000	100.9	86.90000	289-2808-000
91.1	77.10000	289-2759-000	101.1	87.10000	289-2809-000
91.3	77.30000	289-2760-000	101.3	87.30000	289-2810-000
91.5	77.50000	289-2761-000	101.5	87.50000	289-2811-000
91.7	77.70000	289-2762-000	101.7	87.70000	289-2812-000
91.9	77.90000	289-2763-000	101.9	87.90000	289-2813-000
92.1	78.10000	289-2764-000	102.1	88.10000	289-2814-000
92.3	78.30000	289-2765-000	102.3	88.30000	289-2915-000
92.5	78.50000	289-2766-000	102.5	88.50000	289-2816-000
92.7	78.70000	289-2767-000	102.7	88.70000	289-2817-000
92.9	78.90000	289-2768-000	102.9	88.90000	289-2818-000
93.1	79.10000	289-2769-000	103.1	89.10000	289-2819-000
93.3	79.30000	289-2770-000	103.3	89.30000	289-2820-000
93.5	79.50000	289-2771-000	103.5	89.50000	289-2821-000
93.7	79.70000	289-2772-000	103.7	89.70000	289-2822-000
93.9	79.90000	289-2773-000	103.9	89.90000	289-2823-000
94.1	80.10000	289-2774-000	104.1	90.10000	289-2824-000
94.3	80.30000	289-2775-000	104.3	90.30000	289-2825-000
94.5	80.50000	289-2776-000	104.5	90.50000	289-2826-000
94.7	80.70000	289-2777-000	104.7	90.70000	289-2827-000
94.9	80.90000	289-2778-000	104.9	90.90000	289-2828-000
95.1	81.10000	289-2779-000	105.1	91.10000	289-2829-000
95.3	81.30000	289-2780-000	105.3	91.30000	289-2830-000
95.5	81.50000	289-2781-000	105.5	91.50000	289-2831-000
95.7	81.70000	289-2782-000	105.7	91.70000	289-2832-000
95.9	81.90000	289-2783-000	105.9	91.90000	289-2833-000
96.1	82.10000	289-2784-000	106.1	92.10000	289-2834-000
96.3	82.30000	289-2785-000	106.3	92.30000	289-2835-000
96.5	82.50000	289-2786-000	106.5	92.50000	289-2836-000
96.7	82.70000	290-2787-000	106.7	92.70000	289-2837-000
96.9	82.90000	289-2788-000	106.9	92.90000	289-2838-000
97.1	83.10000	289-2789-000	107.1	93.10000	289-2839-000
97.3	83.30000	289-2790-000	107.3	93.30000	289-2840-000
97.5	83.50000	289-2791-000	107.5	93.50000	289-2841-000
97.7	83.70000	289-2792-000	107.7	93.70000	289-2842-000
97.9	83.90000	289-2793-000	107.9	93.90000	289-2843-000

k. Switch S101 to the V430B position. Adjust L433 and L434 for a maximum indication on M101.

l. Switch S101 to the V430C position. Adjust the PA PLATE control for a minimum indication on M101.

m. Set the MULTIMETER switch to GRID FS 40 MA. Adjust first the exciter PA MATCH control, then the power amplifier GRID TUNING control for a peak MULTIMETER indication.

n. If the transmitter frequency falls between 97 and 100 MHz the following step will have to be completed. Place a grid dip meter tuned to 98 MHz near the exciter output. Adjust the MIX BAL control for a minimum output as indicated on the grid dip meter.

o. Set the POWER OUTPUT ADJUST control fully counterclockwise.

p. Press the PLATE ON switch. The red indicator lamp at the top right of the cabinet should light, and the P.A. PLATE VOLTAGE meter should indicate 2100 ±100 volts.

q. Set the MULTIMETER switch to SCREEN VOLTAGE. The MULTIMETER should indicate 300 ±35 volts.

r. Adjust the PLATE TUNING control for a dip in the P.A. PLATE CURRENT meter indication.

s. Set the WATTMETER switch to FORWARD. Adjust the OUTPUT COUPLING control for approximately 5 ma of screen current.

t. Turn the POWER OUTPUT ADJUST control approximately 2/3 of its maximum clockwise rotation.

u. Increase the transmitter coupling a small amount by turning the OUTPUT COUPLING control clockwise until the PA screen current is reduced to approximately 10 ma. Adjust the PLATE TUNING control for a dip in the P.A. PLATE CURRENT meter indication. (The plate tuning capacitor should be near its center position when the dip in power amplifier plate current occurs. If the capacitor is not in this position move the plate slider in the appropriate direction and repeat step u.)

v. Rotate the POWER OUTPUT ADJUST control clockwise a small amount.

w. Repeat steps u. and v. until the P.A. PLATE CURRENT meter indicates the transmitter output is 250 watts as measured by the indirect method. At this time the PA screen current should be not less than 5 ma or more than 20 ma. The indirect method of measuring power output is:

$$\text{Power Output} = I_p E_p K$$

Where K is efficiency, E_p is plate voltage, and I_p is plate current.

Note

It may be necessary to increase the exciter drive to obtain 250 watts from the final. Adjust the exciter POWER OUT control until sufficient grid current is obtained.

x. Turn PA FIL ADJ resistor R325 counterclockwise to the point where power output decreases, then slightly clockwise.

y. Check to be sure that the FM monitor that is connected to the transmitter is properly calibrated. Then, if necessary, adjust the exciter VHF OSC FREQ ADJ control until the monitor indicates that the transmitter operating frequency is within specified operating limits.

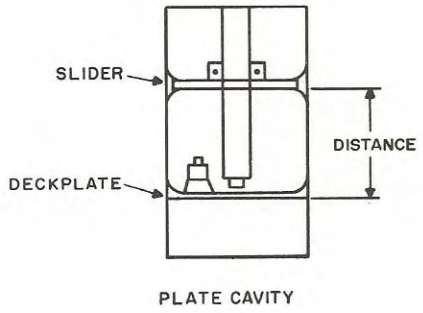
z. Apply a 50-Hz audio tone to the transmitter input. Set the input level to +10 dbm ±2 db at the transmitter audio input terminals.

aa. Adjust the exciter MOD GAIN control until the monitor indicates 100 percent modulation.

ab. Replace the lower front panel on the transmitter cabinet and close the front doors. The transmitter is now ready for standard broadcast use.

Note

At this point it is suggested that a record be made of all meter readings for future maintenance and trouble shooting. These meter readings may be recorded in table 5-3.



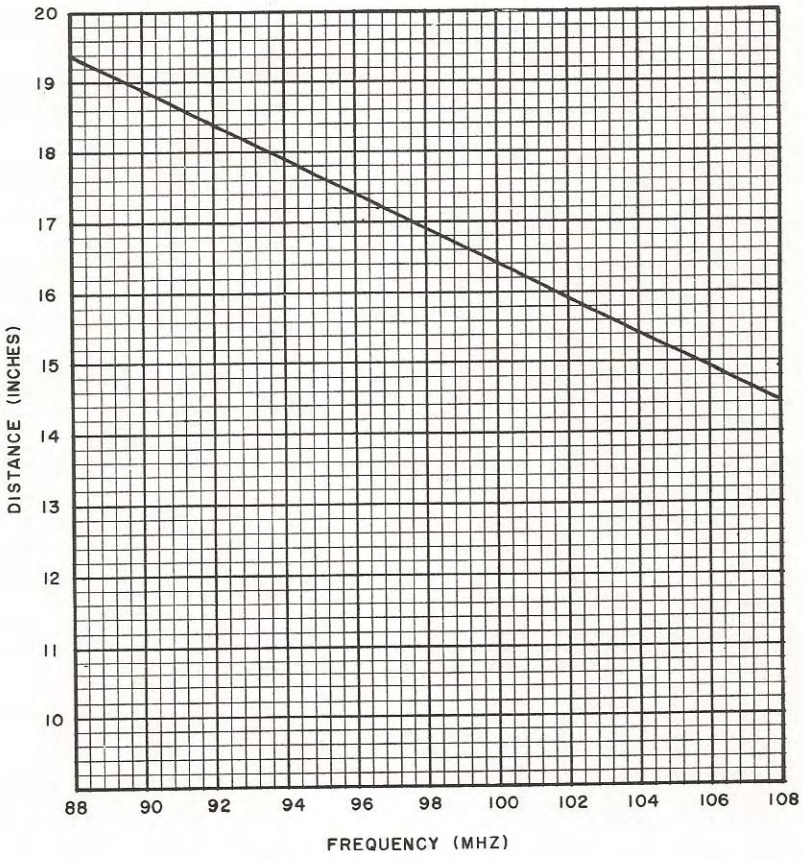


Figure 2-4. Plate Cavity Tuning Chart

section 3

operation

3.1 GENERAL.

Refer to the unit instruction books to become familiar with the operation and function of controls on both the power amplifier and the exciter.

After the transmitter has been placed in operation it will only be necessary from time to time to check meter indications to be sure the transmitter is operating properly and to occasionally touch-up the power amplifier loading and tuning.

3.2 STARTING THE TRANSMITTER IN NORMAL OPERATION.

The transmitter may be put into operation by two different methods, depending upon the circumstances. For normal operation, press the FILAMENT ON switch to start the power amplifier filament and to warm up the exciter (the exciter POWER switch should be left in the ON position at all times). Check the power amplifier grid current to be sure the exciter is presenting sufficient drive to the power amplifier before applying plate power. Approximately 30 seconds after filament power is applied, the PLATE ON switch may be pressed, starting the transmitter.

The alternate method of starting the transmitter consists of pressing the PLATE ON switch only. The power amplifier filament and the exciter will immediately start to warm up. As soon as the power amplifier time delay relay has completed its cycle, the power amplifier plate voltage will come on automatically, starting the transmitter.

To shut down the transmitter it is recommended, but not necessary, to press the PLATE OFF switch, wait a few seconds, and then shut off the filament and exciter power by pressing the FILAMENT OFF switch. It is also possible to press the FILAMENT OFF switch only, which removes plate, filament, and exciter power. Pressing the PLATE OFF switch first allows the plate power supply voltage to discharge through the power amplifier while the filament is at normal operating temperature and, in addition, cools the power amplifier components.

section 4

principles of operation

4.1 GENERAL.

Refer to figure 4-1, a block diagram of 830B-1A 250-Watt FM Broadcast Transmitter. The transmitter can be broken down into three main subassemblies, an exciter, a power amplifier, and a harmonic filter. Refer to section II of the unit instruction books for a complete explanation of the exciter and the power amplifier.

4.2 A830-2 10 W WIDE-BAND FM BROADCAST EXCITER.

Refer to figure 4-1. The baseband audio is coupled to the A830-2 through a pre-emphasis network, and through an 18-db pad to J101 and two baseband amplifiers. The baseband output is coupled to a voltage-sensitive capacitor, C654. C654 is a diode which varies in capacity in proportion to the voltage across it. The FM oscillator is tuned to 14 MHz. The capacity of C654 varies in proportion to the baseband audio and therefore the output is a 14-MHz signal frequency modulated by the baseband audio. The deviation of the 14-MHz signal is ±75 kHz for 100 percent modulation. The oscillator output is coupled through two limiters to remove any amplitude modulation. The limited 14-MHz signal is then amplified and coupled to the rate correction frequency discriminator and to the output amplifier. The output of the frequency discriminator is simply the baseband audio detected from the modulated 14-MHz signal. This detected audio is coupled back to the baseband input to correct for any nonlinearity in C654.

The output amplifier amplifies the modulated 14-MHz signal to a level sufficient to mix with the 74- to 94-MHz signal (per customer requirement) in the balanced mixer. A portion of the limiter output is coupled to the afc buffer stage. The afc buffer output, the modulated 14-MHz signal, is coupled to the reference oscillator and afc limiters through a diode switch. The output of the 14-MHz reference oscillator, is also coupled to the reference oscillator and afc limiters through a diode switch. The diode switch is operated by a 5-Hz keying generator. The 5-Hz generator is a unijunction transistor operating as a relaxation oscillator keying a multivibrator.

The diode switch alternately connects the modulated 14-MHz signal (afc buffer output) and the 14-MHz reference signal. The limiter output is coupled to the afc discriminator. The afc discriminator detects the difference between the 14-MHz reference signal and the modulated 14-MHz signal. The modulated 14-MHz signal will cause a baseband audio output at the discriminator. This is not an error in frequency, so a portion of the baseband audio input is amplified by the baseband canceling amplifier and fed into the output of the frequency discriminator through a diode switch. This diode switch is keyed by the same 5-Hz signal which switched the reference oscillator and afc limiter input. When the modulated 14-MHz signal is connected to the reference oscillator and afc limiter input, the baseband canceling signal is switched into the output of the frequency discriminator to cancel the baseband output from the discriminator.

The input signal to the four error signal amplifiers is a 5-Hz square wave. The amplitude of this square wave is proportional to the frequency error in the FM oscillator. The error signal amplifier square wave output is converted to a dc control signal in the synchronous detector. The synchronous detector is keyed by the 5-Hz keying signal. The dc error signal is coupled to C654 to correct the frequency modulation oscillator.

The modulated 14-MHz signal from the output amplifier is heterodyned up to the operating frequency in a balanced mixer. The injection frequency is generated in a crystal oscillator. The crystal frequency is 14-MHz below the customer's operating frequency. The crystal oscillator output is coupled to a buffer stage and is mixed with the modulated 14-MHz signal in the balanced mixer. The balanced mixer output is limited and amplified to the 10-watt rf output level. The output impedance of the A830-2 is between 50 and 70 ohms.

The power supply for the A830-2 is of conventional design and supplies operating voltages for the vacuum tubes and transistors in the A830-2.

4.3 B830-1 250-WATT FM POWER AMPLIFIER.

The final power amplifier consists of a single ceramic-type tetrode tube. The tube is operated as a class C amplifier with a tuned-cavity plate circuit. The output from the power amplifier is fed, through a harmonic filter, to the antenna.

4.4 HARMONIC FILTER.

The harmonic filter consists of two series resonant M-derived low pass end sections and a constant-k T center section. The harmonic filter starts to attenuate above 110-MHz and reaches maximum attenuation at the carrier second harmonic. The attenuation pattern then tapers off slowly as the frequency rises. The over-all result of the harmonic filter is in keeping the harmonics attenuated at least 67 db below the carrier frequency.

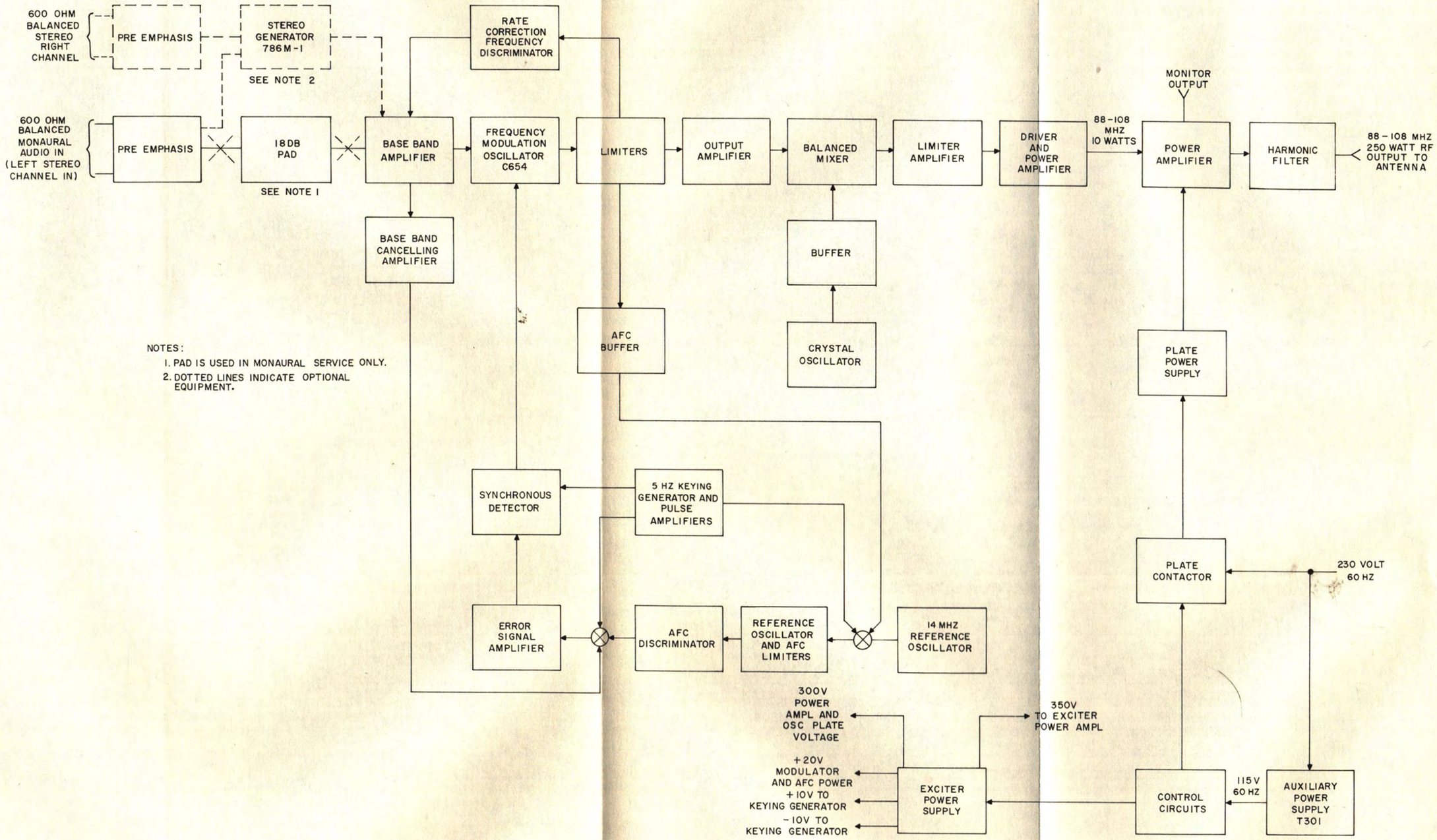
4.5 CONTROL CIRCUITS.

The 230-volt ac single-phase power input is stepped down to 115 volts ac by transformer T301. This lower voltage is used to activate relays in the transmitter control circuits and is also fed to the exciter as its primary power source. The control circuits allow power to be applied to the transmitter only in the proper sequence to prevent damage to the final amplifier. These circuits also contain protective devices to prevent damage to components from accidental overloads.

4.6 PLATE CONTACTOR AND PLATE POWER SUPPLY.

The plate contactor consists of a heavy-duty relay which controls the 230-volt ac primary power to the plate power supply. The plate contactor is actuated by the PLATE ON switch through the control circuitry.

The plate power supply consists of a step-up transformer, a full-wave rectifier, and a filter. The power supply is capable of delivering 2100 volts dc at 250 ma to the power amplifier plate circuit.



NOTES:

1. PAD IS USED IN MONAURAL SERVICE ONLY.
2. DOTTED LINES INDICATE OPTIONAL EQUIPMENT.

Figure 4-1. Block Diagram, 830B-1A 250-Watt FM Broadcast Transmitter

section 5

maintenance

5.1 GENERAL.

The following paragraphs contain information concerning maintenance of 830B-1A 250-Watt FM Broadcast Transmitter.

WARNING

Voltages are present in this transmitter that are dangerous to life. Observe safety precautions when performing any maintenance. Do not reach inside the transmitter cabinet whenever high voltage is applied. Do not depend on door interlocks. Always shut down the transmitter before doing any work inside the transmitter cabinet. Immediately upon opening the rear cabinet doors short out capacitors C301 and C302 (located in the lower right portion of the transmitter cabinet) with the shorting stick provided with the transmitter.

Refer to the applicable unit instructions for specific maintenance procedures for each subassembly.

5.2 NORMAL TUNING PROCEDURES.

The following are tuning procedures which should be observed after the transmitter has been installed and tuned according to the installation procedures given in section II. Table 5-1 presents abbreviated tuning instructions to be used with the following procedures. Table 5-1 can be used separately when the operator becomes familiar with the transmitter.

a. Open the doors at the front of the cabinet.

b. Press the FILAMENT ON switch and allow the exciter to warm up for 15 minutes.

c. Connect a VOM to TP301 and TP302. Set PA FIL ADJ resistor R325 for an indication of 6.0 volts on the VOM.

Note

A three (3) percent decrease in filament voltage will extend the life of a cathode fifty (50) percent.

When new, the 4CX250B tube will operate satisfactorily with less than 6.0 volts on the filament. Initially set the filament voltage for 6.0 volts at TP301 and TP302. When the 830B-1A is properly tuned, reduce the filament voltage to the point where power output decreases.

As the tube ages, the filament voltage may be increased to more than 6.0 volts.

d. Set S101 on the exciter to MIXER GRID A. Adjust BUF TUNE control for a peak on M101.

e. Set S101 to V428B and adjust L429 and L430 for a peak on M101.

f. Set S101 to V429 B and adjust L431 and L432 for a peak on M101.

g. Set S101 to V430 B and adjust L433 and L434 for a peak on M101.

h. Set S101 to V430C B and adjust the PA PLATE control for a minimum indication on M101.

Note

Convenient marked ranges are available on the meter which correspond to switch positions. These ranges give an approximate requirement for min-max readings on the particular switch position.

i. Tune the exciter coupling by setting the MULTIMETER switch to GRID FS 40 MA and adjusting the exciter PA MATCH control for maximum coupling. Tune the power amplifier GRID TUNING control for a peak MULTIMETER indication.

j. Set the WATTMETER to FORWARD.

k. Press the PLATE ON switch. In turn, adjust the PLATE TUNING control for minimum indications and increase the OUTPUT COUPLING control and the POWER OUTPUT ADJUST control, by small amounts, until the transmitter output power is 250 watts as measured by the indirect method.

$$\text{Power output} = I_p E_p K$$

The power amplifier screen current should not be less than 5 ma nor more than 20 ma when the transmitter is properly tuned. Maximum efficiency can be achieved when the WATTMETER indication is maximum for a rated power amplifier plate current.

l. Turn PA FIL ADJ resistor R325 counterclockwise to the point where power output decreases, then slightly clockwise.

m. Adjust the VHF OSC FREQ ADJ control until the FM monitor indicates the transmitter is operating within the specified operating limits.

5.3 MODULATOR AND AFC DISCRIMINATOR ADJUSTMENT PROCEDURES.

The wide-band exciter is designed to be exceptionally stable and will require few adjustments over a long period of time. The following adjustment procedures should only be followed if the exciter is not operating within limits upon installation, or if any of the transistors (Q503 or Q511, Q601, or Q604) are replaced. Replacement of other components should not normally require a change in the adjustments given in this section. The transmitter will have to be energized when performing steps c and e. Use an ac vtvm such as a Ballantine Model 310A when making adjustments. A dc vtvm such as a Heath type may be used in step f.

Note

When adjusting the modulator and afc section of the exciter, use a nonmetallic hex type adjusting tool. Keep all metallic tools and the hands or other parts of the body away from transistor cases. When disabling the afc, and the complete transmitter is in operation, check the station monitor to be sure the center frequency stays within the FCC requirements.

a. Remove transistor Q509 and place a vtvm from TP501 to ground. Tune L505 for a peak indication on the vtvm and tune L504 for a peak indication. Be sure to tune the inductances in the order given to minimize the limiting effect. Check that each stage is limiting when making these adjustments. Limiting will show up as a broad flat peak on the vtvm when tuning. Set the controls midway between the limiter fall of points shown on the vtvm. Do not replace Q509.

b. Tune the afc discriminator by placing a vtvm from TP501 to ground and tune the DISCR PRI control, C515, for a maximum indication. Place the vtvm from TP502 to ground and adjust the DISCR SEC control, C518, for 0 on the vtvm.

c. Disable the afc by pressing the AFC DISABLE switch and adjust the OSC FREQ control until the station monitor indicates that the exciter is on frequency. Replace Q509.

d. Remove Q607. Place a vtvm between TP602 and ground. Tune L606 and L603 for a maximum indication on the vtvm. Tune the inductors in the order shown to minimize the effects of the limiter.

e. Remove afc by holding down the AFC DISABLE switch. With the vtvm from TP602 and ground, tune the DISCR PRI control, C639, for a maximum indication on the vtvm. Move the vtvm to TP601 and tune the DISCR SEC control, C644, for a 0 indication when the modulation monitor indicates the exciter is approximately on frequency. Repeat the tuning of the DISCR PRI and DISCR SEC controls. Replace Q607.

f. Place a dc vtvm between TP603 and ground. Set the AMP BIAS control for a 7.5-volt indication on the vtvm.

g. Place a vtvm between TP504 and ground. Remove Q510. Tune L611 and L608 for a maximum indication on the vtvm. Replace Q510.

h. With a vtvm on TP504 adjust the REF LEVEL control for an equal indication on the vtvm with first Q510 removed and then Q509 removed. This equalizes the modulator oscillator voltage and the 14-MHz reference voltage. Replace the transistors.

i. Place an oscilloscope between TP503 and ground. Apply a 150-Hz audio signal on J601. Adjust the MOD BAL control for a minimum 150-Hz indication as shown on the oscilloscope.

Note

The MOD BAL control must be adjusted slowly to allow the error signal amplifiers to stabilize between adjustments.

5.4 DISTORTION TESTING PROCEDURE.

a. Refer to figure 5-1. Connect an audio frequency signal generator, such as a Barker & Williamson Model 210, to the exciter audio input, terminals 1 and 2 of TB305. (Disconnect the station console audio input leads when making this connection.) Connect a distortion and noise meter, such as a Barker & Williamson Model 410, to the broadcast monitor. Connect a

TABLE 5-1. ABBREVIATED TUNING PROCEDURES

CONTROL	POSITION	ADJUSTMENT	INDICATING METER	INDICATION	NOTES Allow transmitter to warm up at least 15 minutes before tuning.
R325	-	-	VOM	6.0 volts	Set as low as possible, but maintain 250 watts output power.
S101	MIXER GRID A	BUF TUNE	M101	Maximum	
S101	V428 B	*L429, L430	M101	Maximum	
S101	V429 B	*L431, L432	M101	Maximum	
S101	V430 B	*L433, L434	M101	Minimum	
S101	V430C B	PA (exciter) PLATE	M101	Minimum	
MULTIMETER	GRID FS 40 MA	PA MATCH GRID TUNING	MULTIMETER	Maximum	
WATTMETER	FORWARD	PLATE TUNING OUTPUT COUPLING POWER OUTPUT ADJUST	P.A. PLATE CURRENT R.F. WATTMETER R.F. WATTMETER	Near minimum Near 250-watt indication	Repeat the adjustment of PLATE TUNING, OUTPUT COUPLING and POWER OUTPUT ADJUST controls until 250 watts is achieved by the indirect power measuring method. $P = I_p E_p K$

*Use slotted nonmetallic screwdriver on these adjustments.

50-ohm artificial load to the rf output connector located on top of the transmitter cabinet. Turn on the transmitter.

b. Apply a 50-Hz audio tone to the transmitter input. Set the input level to +10 dbm ±2 db at the transmitter audio input terminals.

c. Adjust the exciter MOD GAIN control until the monitor indicates 100 percent modulation (±75-kHz deviation).

d. Measure the distortion at the frequencies and modulation levels given in table 5-2. The distortion shall be less than 1.5 percent for frequencies between 50 and 100 Hz, less than 1.0 percent for frequencies between 100 and 7500 Hz, and less than 1.5 percent for frequencies between 7500 and 15,000 Hz.

5.5 AUDIO FREQUENCY RESPONSE MEASUREMENTS.

a. Refer to figure 5-2. Connect an audio frequency signal generator, such as a Barker & Williamson Model 210, to terminals 1 and 2 of terminal board TB305. (Disconnect the station console audio input leads when making these measurements.) Connect a vacuum-tube voltmeter, such as a Ballantine Model 310A, to the audio output terminals of the audio frequency generator. Connect a 50-ohm artificial load to the rf output connector located on top of the transmitter cabinet. Turn on the transmitter.

b. Check the audio frequency response of the transmitter by modulating the transmitter at 50, 100, 400, 1000, 5000, 7500, 10,000, and 15,000 Hz for 25 percent,

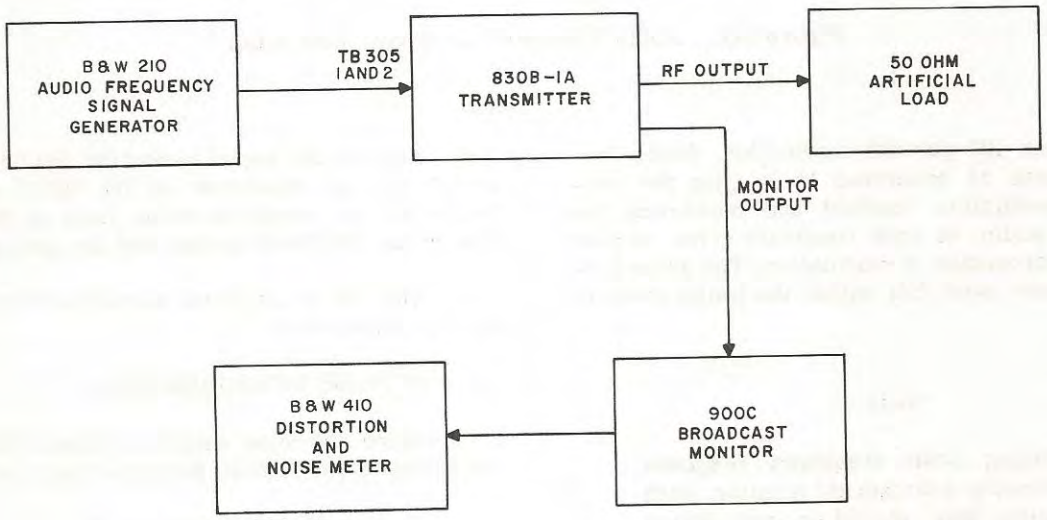


Figure 5-1. Distortion Test Setup

TABLE 5-2. DISTORTION CHECKS

FREQUENCY Hz	DISTORTION IN PERCENT		
	25% MODULATION	50% MODULATION	100% MODULATION
50			
100			
400			
1000			
5000			
7500			
10,000			
15,000			

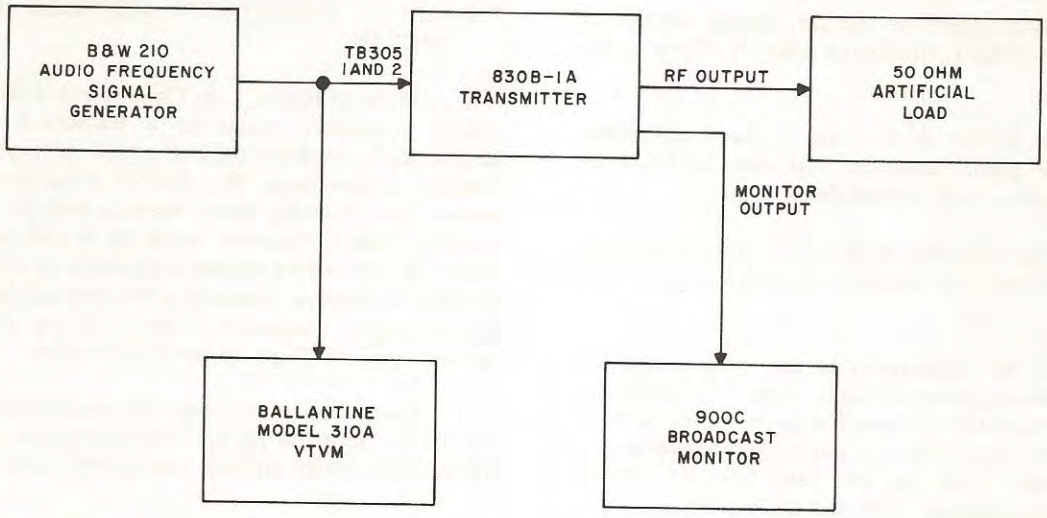


Figure 5-2. Audio Frequency Response Test Setup

50 percent, and 100 percent modulation. Audio frequency response is measured by keeping the percentage of modulation constant and measuring the magnitude of audio, at each frequency given, to give the desired percentage of modulation. The audio frequency response must fall within the limits given in figure 5-3.

Note

When taking audio frequency response measurements a broadcast monitor, such as a Collins 900C, should be used. Do not use an instrument where audio deemphasis might give a false indication of peak modulation.

5.6 FM NOISE MEASUREMENT.

To measure FM noise (monaural signal-to-noise ratio) with the Collins Modulation Monitor 900C perform the following procedure. Refer to figure 5-4.

a. On the 900C, set the METER switch to the TOTAL MOD position and the DECIBELS switch to the 0 position.

b. Connect the Barker and Williamson Model 210 signal generator output to audio input terminals TB305-1 and TB305-2. Set the signal generator to 400 Hz and modulate the transmitter 100 percent.

c. On the 900C, set the DE-EMPHASIS switch to the IN position and the METER switch to the MAIN CHAN AUDIO position. Set the METER ADJUST control for an indication of 0 db on the 900C meter.

d. Remove the signal generator. Set the DECIBELS switch for an indication on the 900C meter. The monaural, fm, signal-to-noise ratio is the algebraic sum of the DECIMAL switch and the meter indication.

e. The FM noise level should be 65 db below 100 percent modulation.

5.7 AM NOISE MEASUREMENTS.

To measure AM noise with the Collins 900C, perform the following procedure. Refer to figure 5-5.

a. Connect TB305-1 to TB305-2 on the transmitter.

b. Connect a vtvm to the AM NOISE jack on the 900C.

c. Turn on the transmitter.

d. On the 900C, set the METER switch to the RF LEVEL position. Adjust the RF LEVEL control for an indication of 100 percent on the 900C meter.

e. Record the AM noise voltage indicated on the vtvm. The AM noise voltage should be referenced to a carrier level of 1 volt rms. The AM noise level should be 55 db below the carrier level.

5.8 TROUBLE SHOOTING.

Standard trouble-shooting procedures should be used in finding malfunctions in the transmitter. As is suggested in TB-536 and TD-538, meter indications for all functions should be recorded when the transmitter is installed and operating properly. Table 5-3 is supplied for recording these readings. If some malfunction should occur after the normal meter

readings are recorded, it is a simple matter to compare the meter readings of the malfunctioning equipment with the normal meter readings. When troubleshooting and comparing the meter readings it is advisable to start with the final stage and proceed backwards until normal readings are encountered. The malfunctioning stage will then be the one immediately ahead of the normal meter indications.

As most cases of trouble will be traced to tubes or transistors, it is advisable to first of all replace the tube (or transistor) in the stage in which the trouble is suspected. If the trouble does not clear with tube or transistor replacement, it will become necessary to take resistance or voltage measurements, within the suspected circuit, to determine which component has failed.

When tracing trouble within the power amplifier it will be helpful to use the "from-to" information given in unit instructions TD-538. The "from-to" information gives the actual location of the individual wires within the power amplifier cabinet. When used in conjunction with the schematic, the "from-to" information can be very helpful.

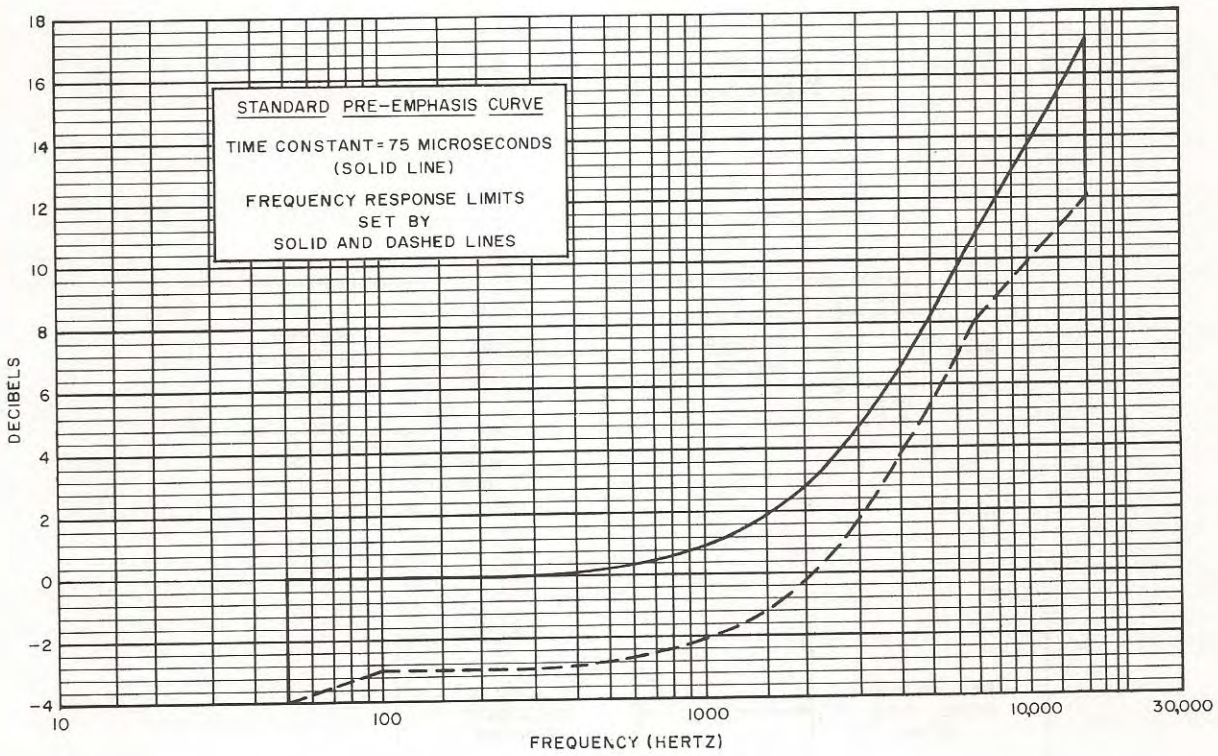


Figure 5-3. Audio Frequency Response Limits

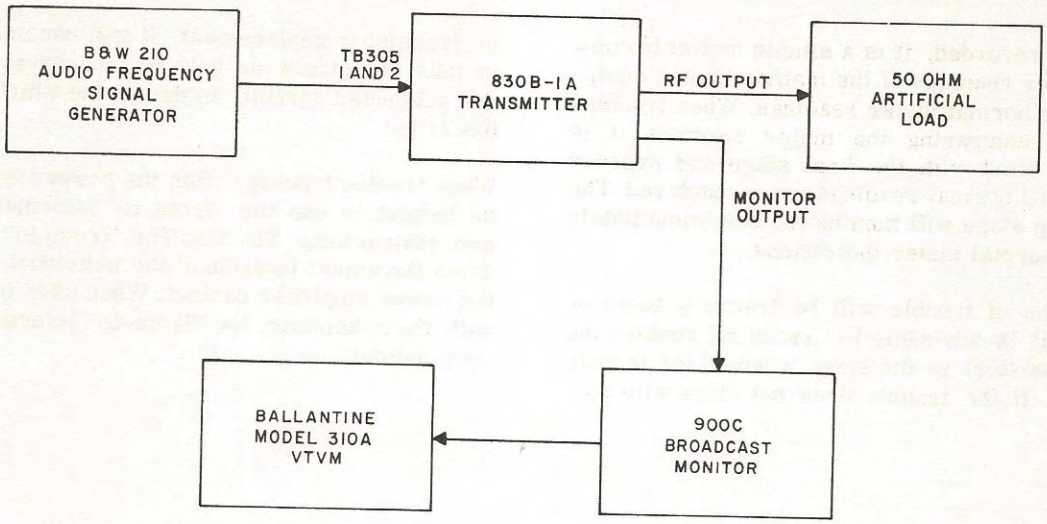


Figure 5-4. FM Noise Test Setup

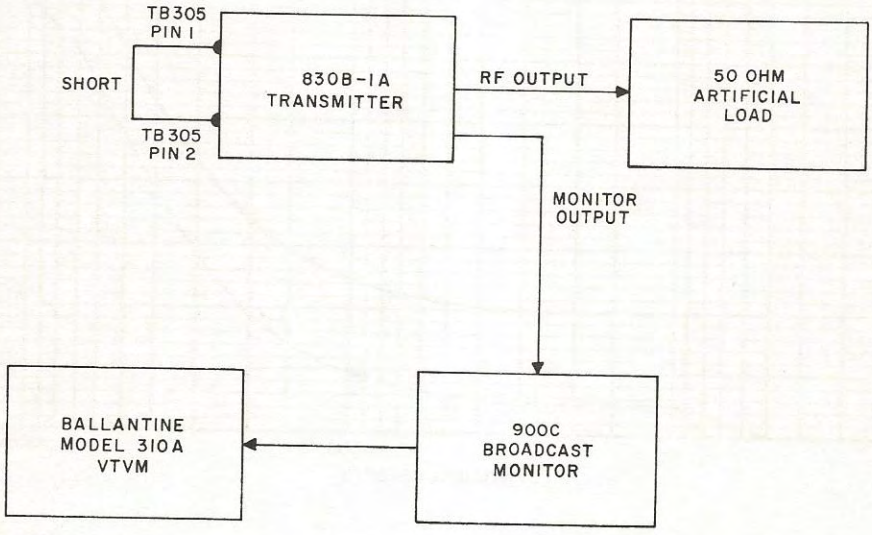


Figure 5-5. AM Noise Test Setup

TABLE 5-3. NORMAL TRANSMITTER METER INDICATIONS

CONTROL	POSITION	METER	INDICATION
S101	BUFFER GRID A	M101	
S101	MIXER GRID A	M101	
S101	V428 B	M101	
S101	V429 B	M101	
S101	V430 B	M101	
S101	V430C B	M101	
S101	MOD OUTPUT B	M101	
S101	AFC KEY B	M101	
S101	14 MC REF B	M101	
MULTIMETER	SCREEN FS 400 VDC	MULTIMETER	
MULTIMETER	SCREEN FS 40 MA	MULTIMETER	
MULTIMETER	GRID FS 40 MA	MULTIMETER	
		P.A. PLATE VOLTAGE	
		P.A. PLATE CURRENT	
		R.F. WATTMETER	

TD-536
523-0755303-101418
1 May 1962
1st Revision, 15 April 1964

COLLINS

unit instructions

A830-2
10W Wide-Band FM Broadcast Exciter

Cedar Rapids Division | Collins Radio Company, Cedar Rapids, Iowa
Printed in U.S.A.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION I
GENERAL DESCRIPTION

1.1 GENERAL.

This instruction book contains information for operation and maintenance of A830-2 10 W Wide-Band FM Broadcast Exciter. See figure 1-1. The A830-2 is manufactured by Collins Radio Company, Cedar Rapids, Iowa.

1.2 PURPOSE OF EQUIPMENT.

The A830-2 10 W Wide-Band FM Broadcast Exciter is a direct FM exciter designed specifically to meet the stringent requirements of stereophonic FM broadcasting. The A830-2 may be used in monaural broadcasting, Storecasting (SCA), or with Collins 786M-1

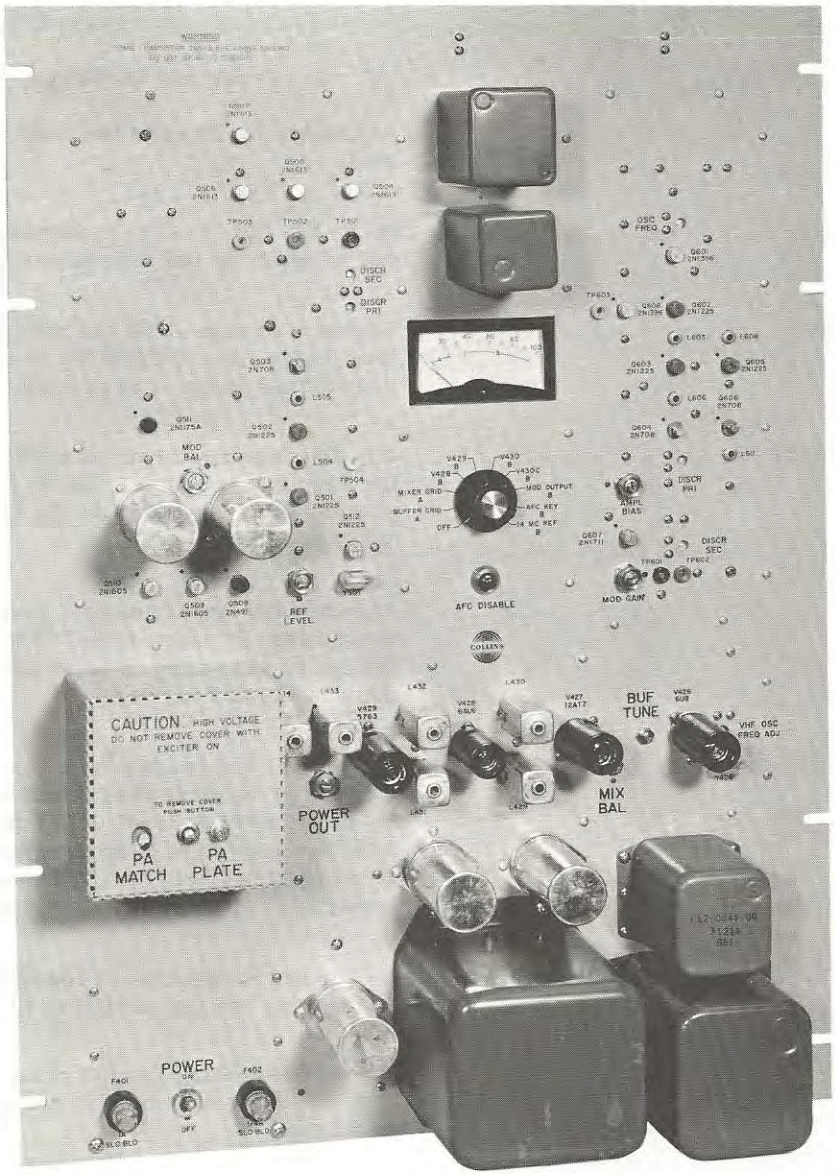


Figure 1-1. A830-2 10 W Wide-Band FM Broadcast Exciter, Over-all View

Stereo Generator (optional) for stereophonic broadcasting. The A830-2 is used to drive higher power amplifiers in the FM broadcast service.

1.3 EQUIPMENT SUPPLIED.

The A830-2 is normally supplied as a part of a Collins FM transmitter (830B-1A. 830D-1A, 830E-1A, etc.). The A830-2 mounts in the same cabinet as the first stage of amplification (250 or 1000 watts) in the transmitter. A rear view of the A830-2 is shown in figure 1-2.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

The A830-2 is supplied with all required equipment.

1.5 TECHNICAL SUMMARY.

Ambient temperature range	+10°C(+50°F) to +55°C(+131°F).
Ambient humidity range	0 to 95 percent relative.
Altitude	7500 feet, maximum.
Shock and vibration	Normal handling and transportation.
Power source	117 volts ±5 percent, 50/60 cps, single phase.
R-f power output	Adjustable to 10 watts into a 50- to 70-ohm resistive load.
Frequency range	88 to 108 mc. Customer frequency is determined by one crystal in the heterodyning oscillator circuit.
Carrier frequency stability	Varies less than ±1000 cps with an ambient temperature range of +10°C(+50°F) to +55°C(+131°F), and a line-voltage range of ±5 percent.
Harmonic and spurious radiation	Any emission appearing on a frequency removed from the carrier by between 120 kc and 240 kc, inclusive, is attenuated at least 30 db below the level of the unmodulated carrier. Any emission appearing on a frequency removed from the carrier by more than 240 kc up to and including 600 kc is attenuated at least 40 db below the level of the unmodulated carrier. Any emission appearing on a frequency removed from the carrier by more than 600 kc is attenuated at least 80 db below the level of the unmodulated carrier, with the exception of harmonics of the r-f carrier which complies with the requirements of the particular transmitter in which the A830-2 is installed.
Type of modulation	Frequency modulation. 100 percent modulation is defined as ±75-kc deviation of the main carrier.
Exciter inputs	Stereophonic channel: 600 ohms, unbalanced. Input of 0.1 volt (approximately) required for 100 percent modulation. Monophonic channel: 600 ohms, balanced. Input of 10 dbm ±2 db (approximately 2.45 volts) required for 100 percent modulation.

SCA channel: 600 ohms, balanced. Input of 0.35 volt (approximately) required for 10 percent modulation.

Frequency and phase response . . . . . The frequency and phase response of the A830-2 is such that when used with a suitable stereophonic generator such as the 786M-1, stereophonic separation between left and right stereophonic channels shall be better than 35 db at audio modulating frequencies between 30 and 15,000 cps.

Distortion . . . . . Does not exceed 0.5 percent in the 30- to 15,000-cps frequency range and 1.0 percent in the 15,000- to 75,000-cps frequency range.

Pre-emphasis . . . . . Standard 75-microsecond pre-emphasis.

FM noise level . . . . . 65 db below 100 percent modulation.

AM noise level . . . . . 55 db below 100 percent AM level.

1.6 VACUUM-TUBE, FUSE, AND SEMICONDUCTOR COMPLEMENT.

Table 1-1 lists all of the vacuum tubes, fuses, and semiconductors used in the A830-2.

TABLE 1-1. VACUUM-TUBE, FUSE, AND SEMICONDUCTOR COMPLEMENT

SYMBOL	TYPE	FUNCTION
V426	6U8A	Oscillator and buffer
V427	12AT7	Balanced mixer
V428	6AU6	Limiter-amplifier
V429	5763	Driver
V430	2E26	Power amplifier
Q501	2N1225	First afc limiter
Q502	2N1225	Second afc limiter
Q503	2N708	Afc discriminator driver
Q504	2N1613	First error signal amplifier
Q505	2N1613	Second error signal amplifier
Q506	2N1613	Third error signal amplifier
Q507	2N1613	Fourth error signal amplifier
Q508	2N491	Keying generator
Q509	2N1605	Multivibrator
Q510	2N1605	Multivibrator
Q511	2N1175A	Baseband cancellation amplifier
Q601	2N1396	Frequency modulated oscillator
Q602	2N1225	First limiter
Q603	2N1225	Second limiter
Q604	2N708	Discriminator driver
Q605	2N1225	Afc buffer
Q606	2N708	Modulator output amplifier
Q607	2N1711	First baseband amplifier
Q608	2N1396	Second baseband amplifier
CR401	1N1492	B+ rectifier
CR402	1N1492	B+ rectifier
CR403	1N1492	B+ rectifier
CR404	1N1492	B+ rectifier
CR405	1N1492	B+ rectifier

TABLE 1-1. VACUUM-TUBE, FUSE, AND SEMICONDUCTOR COMPLEMENT (Cont)

SYMBOL	TYPE	FUNCTION
CR406	1N1492	B+ rectifier
CR407	1N1492	B+ rectifier
CR408	1N1492	B+ rectifier
CR409	1N538	+20-volt rectifier
CR410	1N538	+20-volt rectifier
CR411	10M10ZB1	+20-volt regulator
CR412	1Z10V01	+10-volt regulator
CR413	1N538	-10-volt rectifier
CR414	1N538	-10-volt rectifier
CR415	1Z10V01	-10-volt regulator
CR426	1N977A	Oscillator plate voltage regulator
CR501	1N270	Gate
CR502	1N270	Gate
CR503	1N270	Afc limiter
CR504	1N270	Afc limiter
CR505	1N270	Afc limiter
CR506	1N270	Afc limiter
CR507	1N198	Afc discriminator
CR508	1N198	Afc discriminator
CR509	FA-4000	Synchronous detector
CR510	FA-4000	Synchronous detector
CR511	FA-4000	Gate
CR512	1N198	Meter rectifier
CR513	1N198	Meter rectifier
CR514	1N718	Voltage regulator
CR601	1N626	Temperature compensation
CR602	SV3173	Voltage regulator
CR603	1N270	Limiter
CR604	1N270	Limiter
CR605	1N270	Limiter
CR606	1N270	Limiter
CR607	1N198	Modulation discriminator
CR608	1N198	Modulation discriminator
CR609	1N751A	Voltage regulator
CR610	1N198	Meter rectifier
F401	1 amp	Protect T401
F402	1/4 amp	Protect T402

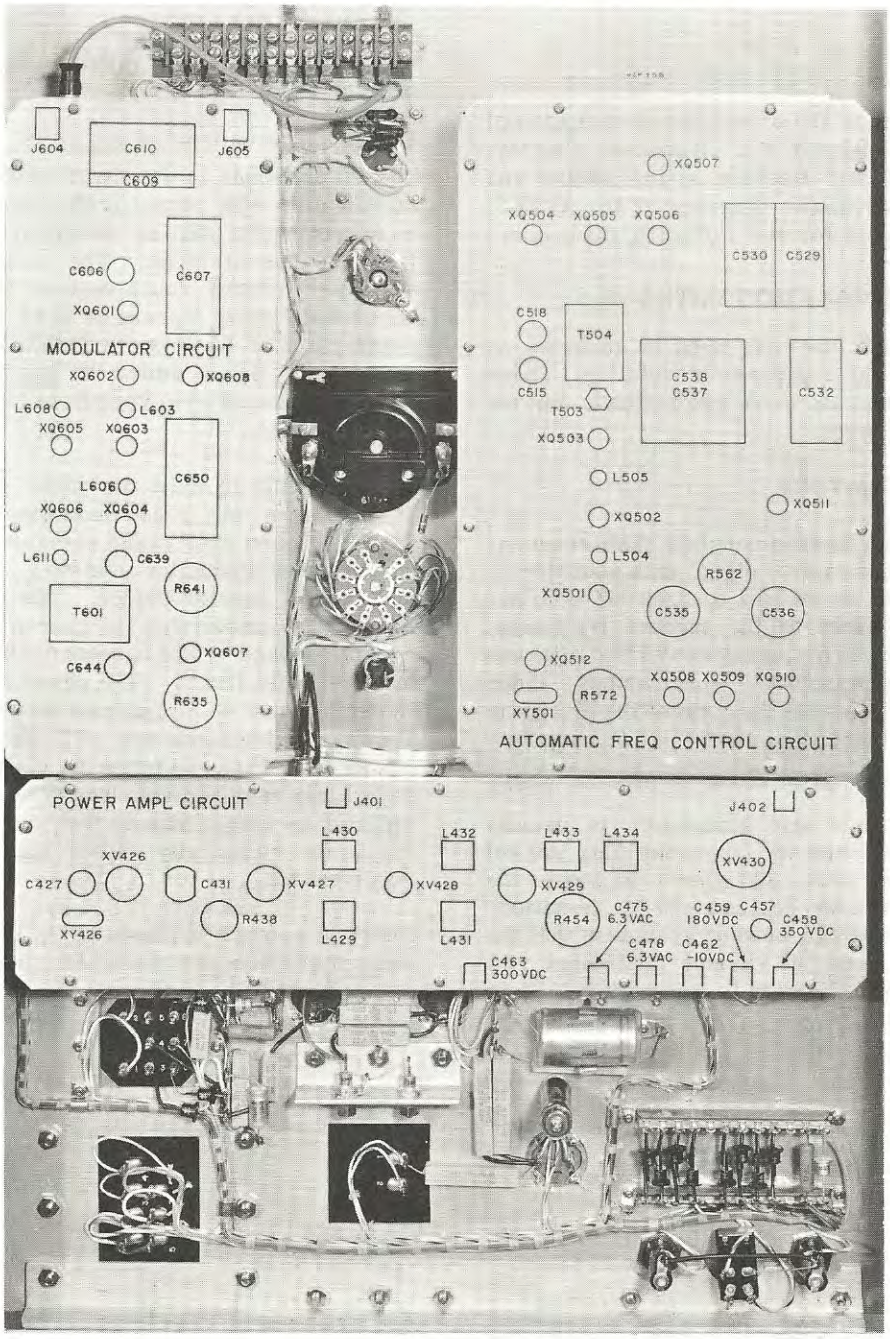


Figure 1-2. A830-2 10 W Wide-Band FM Broadcast Exciter, Rear View

SECTION II
PRINCIPLES OF OPERATION

2.1 GENERAL.

This section describes the principles of operation of A830-2 10 W Wide-Band FM Broadcast Exciter. Figure 2-2 is a block diagram of the A830-2 and figure 5-1 is the schematic diagram of the A830-2. Refer to these figures for the following discussion.

2.2 FREQUENCY MODULATION METHODS.

There are two basic methods used to generate an FM signal, direct FM and phase modulation. There are variations of each of these two methods, but the end results are the same.

2.2.1 PHASE MODULATORS.

The phase modulation method consists of phase modulating a CW (continuous wave) signal with audio tones. The audio response is shaped to drop off 6 db per octave from the lowest to the highest frequency. The resultant signal is frequency modulated although produced by a phase modulator. The modulation index of an FM signal is defined as the ratio of the change in carrier frequency (deviation) to the modulating frequency, $\frac{\nabla f}{f_m}$. The modulation index of present phase modulators is so low that modulation is usually performed at a low frequency (approximately 100 kc) and then multiplied about 800 times to obtain the output frequency with the desired ±75-kc deviation. The outstanding advantage of this system is that the 100-kc oscillator may be crystal controlled and further frequency stabilization is not required. This system has been used widely in broadcast FM transmitters in the past.

The arrival of stereophonic FM broadcasting has caused problems in the phase modulator. A composite stereo plus SCA signal (referred to hereafter as the baseband audio signal) occupies a frequency band from 50 cps to 75 kc. The audio response shaping (6 db per octave) would require that 50-cps signals be 65.5 db above signals at 75 kc. When a signal-to-noise ratio of 65 db and a dynamic range of approximately 60 db is added to this, it is obvious that baseband amplifiers cannot be built to meet these requirements.

It is possible to split the phase modulation into two steps where one phase modulator accepts only the L + R (left and right audio signals) audio spectrum and a subsequent modulator adds the L - R double-sideband suppressed carrier signal. The audio bandwidth for each phase modulator is thereby reduced and the dynamic range of the baseband amplifiers is reduced to acceptable limits. The phase and amplitude relationships must be maintained between the two signals. These requirements are ±0.3-db gain variation and ±3-degree phase variation to meet the 30-db stereo separation requirement. These requirements would be difficult to obtain without frequent on-the-air adjustment to continually meet the stereo separation requirement.

There are other methods of splitting the signal and using more than one modulator, but all have the phase and gain stability problem.

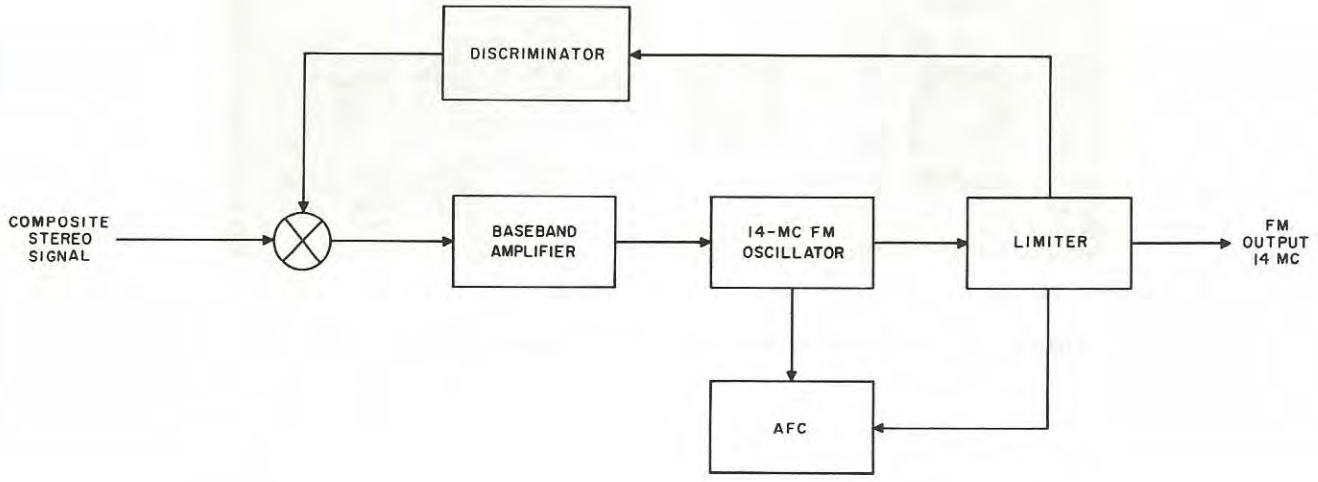


Figure 2-1. Direct FM Modulation, Simplified Block Diagram

2.2.2 DIRECT FREQUENCY MODULATION.

The direct method of generating a frequency modulated signal is shown in figure 2-1. The complete stereo signal (and SCA signal if used) is fed through a baseband amplifier to a frequency-modulated oscillator. The discriminator completes an audio feedback loop which suppresses FM oscillator distortion, incidental FM noise, transient carrier offset, and gain/phase variation in the baseband amplifier and modulator. The center frequency of the oscillator is not sufficiently stable so an automatic frequency control (afc) circuit is required to maintain frequency stability. The output of the modulator is a 14-mc FM signal with ±75-kc peak deviation. The output frequency is obtained by translating this signal with a stable vhf oscillator. The use of the direct FM system removes the requirement for double modulators, phase delay lines, and baseband amplifiers with a response which changes with frequency.

2.3 BLOCK DIAGRAM.

Refer to figure 2-2, a block diagram of the A830-2.

2.3.1 MODULATOR.

The A830-2 uses the direct FM method of generating an FM signal. The baseband input (and SCA input, if used) is connected to baseband amplifiers Q607 and Q608. The response of these amplifiers is flat.

The gain of the baseband amplifiers is adjustable with AMPL BIAS control R641. Refer to figure 5-1. The emitter voltage on Q608 is regulated to +15 volts by a silicon breakdown diode, CR609. The output of Q608 is coupled to frequency-modulated oscillator Q601. Q601 is an LC oscillator which has a center frequency of 14 mc. The tuned circuit in the base of Q601 contains a voltage-sensitive capacitor, C654. Refer to figure 5-1. The capacitance of C654 varies proportionately with the voltage across it. The change in capacity of C654 makes a corresponding change in the frequency of oscillations in Q601. Thus, the frequency deviation of the output of Q601 is directly proportional to the amplitude of the modulating signal and the peak deviation is ±75 kc.

The output of Q601 is coupled to two limiters, Q602 and Q603. The limiters remove any amplitude modulation from the FM signal. This amplitude modulation is caused by variation of the tuned circuit capacity by the baseband signal. The transistors do not do any limiting. The limiting takes place in the diodes connected to the collectors. This method provides symmetrical limiting (positive and negative) which avoids the phase modulation that occurs when unsymmetrical clipping followed by filtering is used. The limiters are set up so that as the input level is raised, the second limiter operates first; just before it becomes nonlinear, the first limiter starts limiting. The limiting range is approximately 31 db.

The output of the second limiter is coupled to discriminator driver Q604. One output of the discriminator driver is connected to modulator discriminator T601 and the other output goes to output amplifier Q606.

Modulator discriminator T601 converts the frequency-modulated 14-mc signal to an AM signal which is detected by diodes CR607 and CR608. The detected audio is mixed with the input baseband audio at the input to the baseband amplifiers. This feedback loop suppresses distortion from the FM oscillator, incidental FM noise, transient carrier offset, and gain/phase variation in the baseband amplifier and modulator.

Output amplifier Q606 provides a signal output of 1.0 volt rms for the balanced mixer in the power amplifier compartment. This output is matched to 50 ohms by an L-section impedance, L611 and C634. A low-pass filter, C632, C633, and L610, attenuates harmonics of the 14-mc signal. A portion of this output is rectified and connected to meter switch S101 for monitoring purposes.

The second output from Q606 is coupled to afc buffer amplifier Q605. This amplifier, as well as the limiters and amplifiers preceding it, reduces oscillator frequency change caused by variation of loading on the output. The output of Q605 is 0.1 volt rms across 50 ohms.

2.3.2 AUTOMATIC FREQUENCY CONTROL.

The A830-2 requires automatic frequency control to maintain the center frequency of the modulated oscillator at 14 mc. The error in frequency of this oscillator may be caused by temperature drift, carrier shift due to distortion in the modulator, etc. The afc circuits correct these errors to bring the stability of the output frequency to ±1000 cycles per second over a temperature range of +10°C(+50°F) to +55°C(+131°F) and a line voltage range of ±5 percent.

The afc correction voltage is obtained by comparing the modulator output signal with the output of a crystal-controlled reference oscillator, and deriving a d-c voltage which is proportional in magnitude and polarity to the magnitude and direction of the difference in frequency of these two signals.

The reference oscillator is a conventional crystal-controlled oscillator using a fundamental 14-mc series-resonant crystal. The temperature drift of this crystal contributes only ±70 cycles per second to the output frequency drift over temperature.

The signal from afc buffer Q605 and the output from the reference oscillator are connected to a diode switch, CR501 and CR502. The diode switch is simply two diodes which are alternately switched on and off by the 5-cps square wave. The diode switch is controlled by a signal from keying generator Q508. This

signal, a square wave with a frequency of approximately 5 cps, alternately couples the reference signal, then the modulated carrier, to the input to first limiter Q501.

The two limiters, Q501 and Q502, and discriminator driver Q503 are identical to the limiters and driver (Q602, Q603, and Q604) used in the modulator. The limiters remove any amplitude difference which might exist between the two signals. The level of the reference signal is adjustable with REF LEVEL control R572. Q503 amplifies the limited signal to a level sufficient to drive the afc discriminator. Assume that there is no modulation applied. In this case, the output from the discriminator will be a 5-cps square wave with an amplitude proportional to the frequency error in the FM oscillator.

The 5-cps error signal is amplified and applied to the synchronous detector which develops the d-c correction voltage. This d-c voltage is coupled through a low-pass filter to the voltage-sensitive capacitor in the frequency-modulated oscillator to tune the FM oscillator back on frequency.

The operation of the afc circuitry is only slightly different when modulation is applied at ±75-kc deviation. Assume now that modulation is applied and an error of 100 cps exists in the FM oscillator. The output of the afc discriminator due to the 100-cps signal would be 100 K_d where K_d is the gain of the discriminator in volts per cps. The output of the discriminator due to the modulation on the carrier would be 150,000 K_d. This means that the undesired signal is 1500 times greater than the desired signal. The undesired signal is removed by the modulation canceling circuit consisting of baseband cancel amplifier Q511 and diode switch CR511. Whenever the modulated carrier is connected to the first limiter diode switch, CR501 and CR502, the baseband audio input is connected to the discriminator output by diode switch CR511. This baseband audio is 180 degrees out of phase with the discriminator output, and when MOD BAL control R652 is properly adjusted, the output of the afc discriminator due to modulation is completely canceled. The 5-cps error signal due to the frequency error in the FM oscillator is then amplified and detected as if modulation were not applied.

Note that the afc discriminator is used as a comparator rather than as a reference. The exact center frequency of the discriminator is not important since the output voltage need only be proportional to the difference in the two frequencies rather than to the absolute value of these frequencies. Therefore, the center frequency stability of the discriminator does not effect the operation of the afc system.

The last stage of the error signal amplifiers, Q507, is a phase splitter to provide a push-pull output to the synchronous detector. The synchronous detector is keyed by the 5-cps square-wave keying signal from the keying generator.

The synchronous detector recovers the information contained in the amplitude and phase of the 5-cps error signal. The circuit used in the A830-2 is actually two synchronous detectors operating from opposite half cycles of the 5-cps square-wave keying signal so that the 5-cps square-wave keying signal is balanced out in the output. This is analogous to a double-sideband balanced modulator in which neither input signal is present in the output.

Figures 2-3 through 2-5 illustrate the operation of the two diode switches and the synchronous detector. The electronic circuit and a mechanical analog for each of the circuits is shown. The resistances marked R_f represent the forward resistance of the diodes.

The output of the synchronous detector may be disabled for test and adjustment by depressing AFC DISABLE switch S102 on the front panel.

2.3.3 POWER AMPLIFIER.

The 14-mc FM signal from the modulator is coupled to a balanced mixer, V427. The other input to V427 is the amplified output of a vhf crystal oscillator, V426A. The crystal oscillator operates with a fifth-overtone series-resonant crystal in the 74- to 94-mc frequency range. The specific frequency of the crystal is 14 mc below the station's assigned output frequency. The exact frequency is adjustable over a small range by VHF OSC FREQ ADJ control C427. This adjustment is required to compensate for the finishing tolerance and aging in crystals Y426 and Y501. The output of V426A is amplified in V426B and coupled to V427. The two input signals are balanced out of the output of V427 and the sum of the two signals is the operating frequency. The MIX BAL control compensates for unbalance between the sections of V427.

The output of V427 is coupled to limiter amplifier V428. The limiter amplifier removes any amplitude modulation resulting from mixing and couples this signal to driver stage V429. The signal is amplified by V429 to a level sufficient to drive power amplifier stage V430. The power output is adjustable with POWER OUT control R454. The tuning and loading of the output stage is accomplished with C461 and C456.

2.3.4 POWER SUPPLY.

The power supply in the A830-2 provides all operating voltages for the A830-2 and 786M-1 Stereo Generator, if used. The primary power may be 115 or 230 volts, 60 cps. The power supply is of conventional design using a bridge rectifier and a voltage divider for the high voltages. The low voltages are obtained from full-wave rectifiers. Voltage breakdown diodes are used for regulating the +20-volt, +10-volt, and -10-volt outputs to ±5 percent.

NOTES:
1. Z101 IS CONNECTED IN SERIES WITH FL102 AND J604 WHEN THE A830-2 IS USED IN MONOPHONIC SERVICE. Z101 IS NOT USED IN STEREOPHONIC SERVICE.
2. THE EXACT FREQUENCY OF Y426 IS 14 MEGACYCLES BELOW THE ASSIGNED FREQUENCY OF OPERATION.

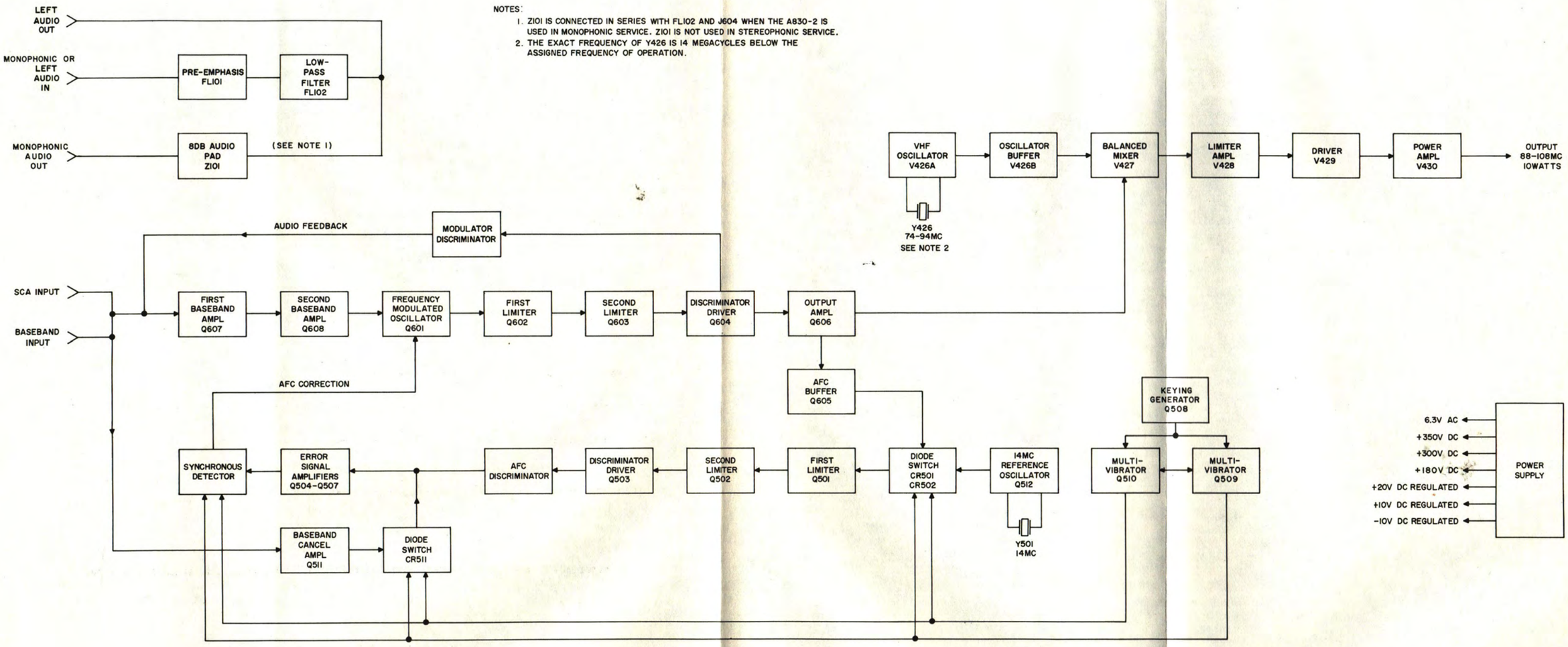


Figure 2-2. A830-2 10 W Wide-Band FM Broadcast Exciter, Block Diagram

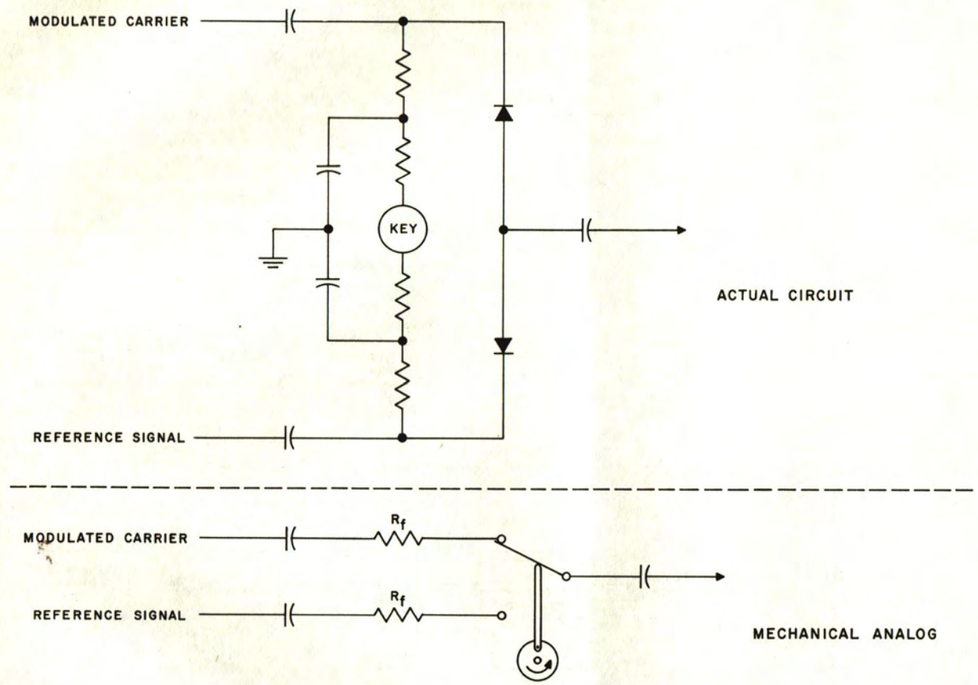


Figure 2-3. Reference Switch, Simplified Schematic and Mechanical Analog Diagram

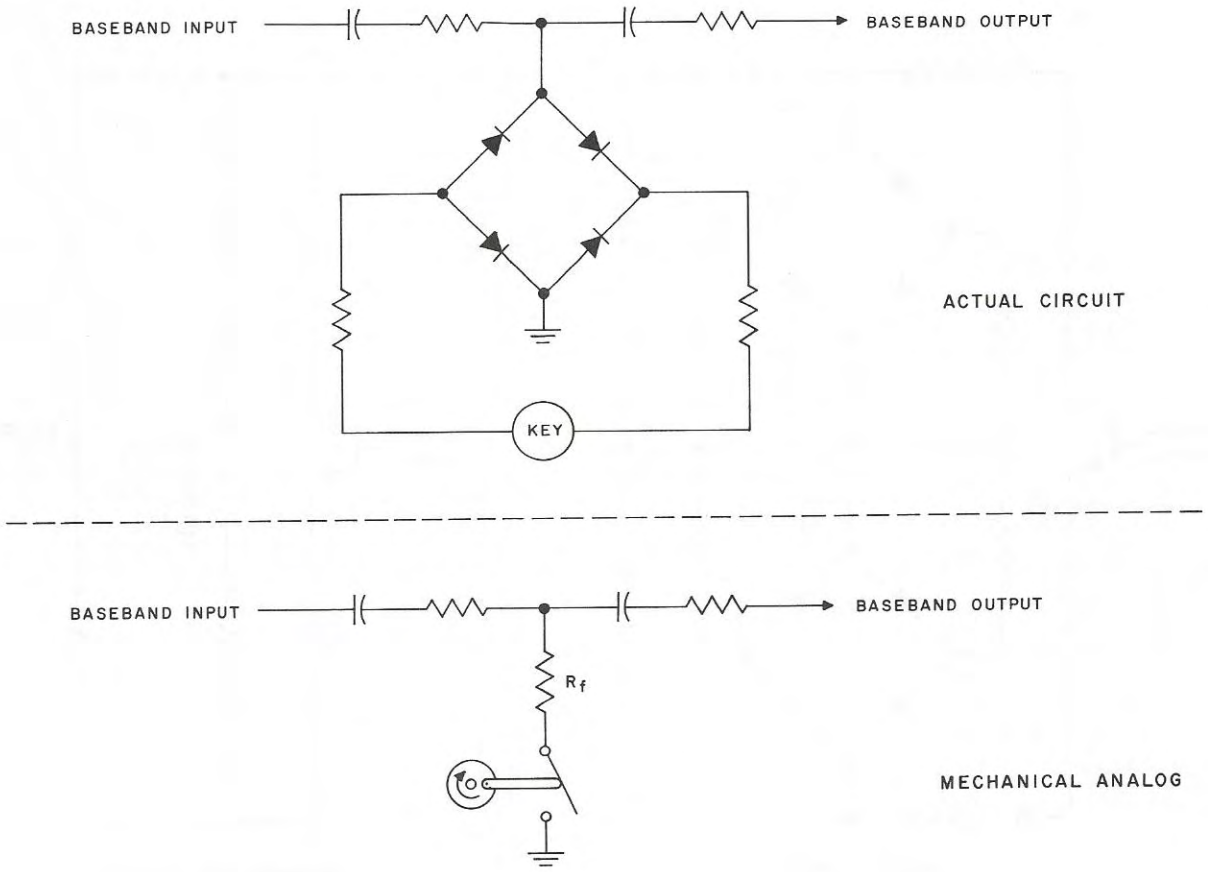


Figure 2-4. Baseband Cancel Switch, Simplified Schematic and Mechanical Analog Diagram

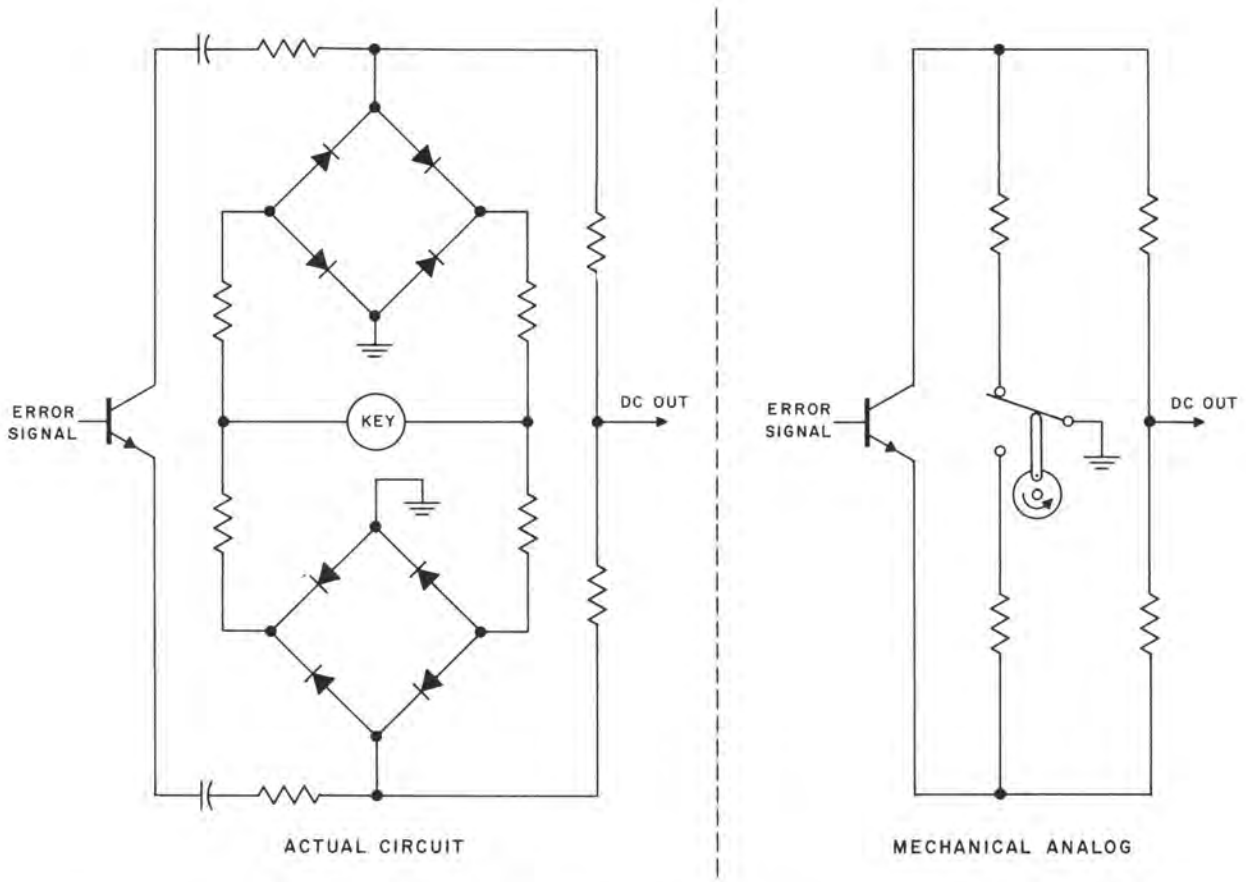


Figure 2-5. Synchronous Detector, Simplified Schematic and Mechanical Analog Diagram

SECTION III
MAINTENANCE

3.1 GENERAL.

This section contains alignment instructions, adjustment procedures, and minimum performance standards for the A830-2.

3.2 TEST EQUIPMENT REQUIRED.

The test equipment in table 3-1, or its equivalent, is required to perform the procedures given in this section.

TABLE 3-1
TEST EQUIPMENT REQUIRED

ITEM	MANUFACTURER'S DESIGNATION
Audio oscillator	Hewlett-Packard 200AB
Distortion and noise meter	Hewlett-Packard 330D
A-c vtvm	Hewlett-Packard 410B
R-f vtvm*	Bird 91C
Communications receiver	Capable of receiving 14 mc
10-db pad	Microlab AD-10N
Oscilloscope	
FM monitor	Hewlett-Packard 335B
50-ohm load	
*The 91C is not required if a Tektronix 541 oscilloscope is available. See paragraph 3.3.10.	

3.3 ALIGNMENT AND ADJUSTMENT.

CAUTION

Do not make any adjustment in the modulator or automatic frequency control sections of the A830-2 unless trouble has definitely been traced to misadjustment.

3.3.1 PRELIMINARY ADJUSTMENTS.

Perform the following procedure prior to performing any of the alignment procedures.

a. Set the meter switch on the A830-2 to the OFF position.
b. Short AFC DISABLE switch S102 on the A830-2 with a clip lead.
c. Connect the 50-ohm load to RF OUTPUT jack J402.
d. Operate POWER switch S401 to the ON position. Allow 10 minutes for equipment warm up.

3.3.2 MODULATOR LIMITER-DISCRIMINATOR ALIGNMENT.

a. Remove Q601 from its socket.
b. Rotate REF LEVEL control R572 fully counterclockwise.
c. Connect a 0.01-uf capacitor and clip lead between the movable arm of REF LEVEL control R572 and the emitter pin on the socket for Q601. This supplies an accurate 14-mc signal for alignment of the A830-2.
d. Connect the HP-410B to TP602 and set it to the lowest d-c scale.
e. Rotate R572 clockwise until an indication is observed on the HP-410B.

NOTE

During this adjustment, maintain the 14-mc signal at a level below limiting. Limiting causes the tuning peaks to be very broad.

f. Adjust C639, L606, and L603 for maximum indication on the HP-410B.
g. Remove the 0.01-uf capacitor and clip lead from XQ601 and R572. Replace Q601 into XQ601.
h. Connect the 91C to TP504.

NOTE

Refer to note in paragraph 3.3.10.

i. Remove Q509 from its socket.
j. Adjust R572 for an indication of 30 millivolts.
k. Replace Q509.

3.3.3 MODULATOR OUTPUT AMPLIFIER TUNING.

a. Set the meter selector switch on the front panel of the A830-2 to the MOD OUTPUT B position.
b. Tune L611 for maximum indication on the front panel meter.

3.3.4 AFC BUFFER TUNING.

a. Connect the 91C (or Tektronix oscilloscope) to TP504.
b. Remove Q510 from its socket.
c. Tune L608 for maximum indication on the 91C (or oscilloscope).
d. Replace Q510 into its socket.

3.3.5 FM OSCILLATOR ADJUSTMENT.

a. Loosely couple the communications receiver to FM oscillator Q601 and to the 14-mc reference oscillator. If the receiver has a bfo, turn it off.
b. Adjust OSC FREQ control C606 for a zero beat on the communication receiver.
c. Remove the communications receiver.

3.3.6 MODULATION DISCRIMINATOR.

a. Connect the HP-410B to TP601.
b. Adjust DISCR SEC control C644 for a zero indication on the HP-410B.
c. Check adjustment of DISCR PRI control C639. It should be set for a maximum indication, and C644 set for a minimum indication.

3.3.7 AMPLIFIER BIAS ADJUSTMENT.

a. Connect the HP-410B to TP603.
b. Adjust R641 for an indication of +7.5 volts d-c.

3.3.8 MODULATOR GAIN ADJUSTMENT.

a. Remove the 50-ohms load and connect the HP-335B to the output of the A830-2 through the 10-db pad.
b. Connect the HP-200AB to baseband input jack J604.
c. Set the output level of the HP-200AB to 0.1 volt rms at 1000 cps.
d. Adjust MOD GAIN control R635 for an indication of 100 percent modulation (±75-kc deviation) on the HP-335B.

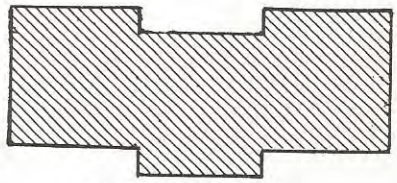
3.3.9 AFC LIMITER-DISCRIMINATOR ALIGNMENT.

a. Connect the HP-410B to TP501 and set to 10-volt scale.
b. Remove Q509 from its socket.
c. Adjust REF LEVEL control R572 fully counterclockwise.
d. Adjust L504, L505, and C515 (DISCR PRI control) for maximum indication on the HP-410B.
e. Connect the 91C to TP504.
f. Adjust R572 for an indication of 30 millivolts on the 91C.
g. Connect the HP-410B to TP502 and adjust DISCR SEC control C518 for a minimum indication on the HP-410B when set to its lowest range.
h. Replace Q509 in its socket.
i. Reset R572 as specified in paragraph 3.3.10.

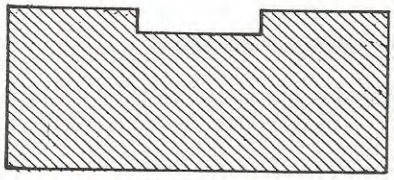
3.3.10 REFERENCE LEVEL ADJUSTMENT.

NOTE

The following procedure may be accomplished with the 91C or with a Tektronix 541 oscilloscope. Steps a through f describe the procedure for using the 91C and steps g and h describe the procedure for using the 541 oscilloscope.



IMPROPER ADJUSTMENT



PROPER ADJUSTMENT

Figure 3-1. Reference Level Adjustment, Oscilloscope Patterns

a. Connect the 91C to TP504.
b. Remove Q510 from its socket.
c. Tune L608 for maximum indication on the 91C. Record the reading on the 91C.
d. Replace Q510 and remove Q509 from its socket.
e. Adjust R572 for the same indication recorded in step c.
f. Replace Q509 in its socket.
g. Connect the Tektronix oscilloscope to TP504.
h. Adjust R572 for alignment of base lines of alternate signals. See figure 3-1.
i. Set meter switch S101 on the A830-2 front panel to the 14 MC REF B position. The meter should indicate in the B range.

3.3.11 BASEBAND CANCELING ADJUSTMENT.

a. Remove Q510 from its socket.
b. Make certain that AFC DISABLE switch S102 is still jumpered.
c. Rotate R562 to its maximum counterclockwise position.
d. Connect the oscilloscope to TP503.
e. Connect the HP-200AB to baseband input jack J604.
f. Set the HP-200AB to 50 cps.
g. Set the level of the HP-200AB to produce a 2-volt peak-to-peak waveform on the oscilloscope.
h. Adjust the oscilloscope to display the 50-cps waveform.
i. Slowly adjust R562 to cancel the signal on the oscilloscope. Gradually increase the input signal from the HP-200AB to 0.1 volt while maintaining the null by adjustment of R562. The waveform on the oscilloscope should be less than 1 volt peak-to-peak when the input signal is 0.1 volt.
j. Replace Q510.

3.3.12 AFC LOOP CHECK.

a. Remove the jumper from across AFC DISABLE SWITCH S102.
b. Observe the deviation meter on the HP-335B and depress the AFC DISABLE switch. The frequency should slowly drift off and come back quickly when the AFC DISABLE switch is released.

3.3.13 POWER AMPLIFIER ADJUSTMENT AND TUNING.

a. Set meter switch S101 on the A830-2 to the MIXER GRID A position.
b. Adjust C431 for maximum indication on front panel meter M101.
c. Adjust VHF OSC FREQ ADJ control C427 so that the HP-335B indicates on frequency.
d. Switch S101 to BUFFER GRID A and observe meter. It should indicate approximately 1 unit.
e. Switch S101 to V428 B.
f. Adjust L429, L430, and MIX BAL control R438 for maximum indication on the front panel meter.
g. Switch S101 to V429 B.
h. Adjust L431 and L432 for maximum indication on the front panel meter.
i. Remove all connections to J402 and connect the 50-ohm load to J402.
j. Connect the HP-410B across the 50-ohm load.
k. Switch S101 to V430C B.
l. Adjust PA PLATE control C461 for minimum indication on the front panel.
m. Adjust PA MATCH control C456 for a maximum indication on the HP-410B.
n. Adjust POWER OUT control R454 for an indication of 22.5 volts.

3.4 MINIMUM PERFORMANCE STANDARDS.

The A830-2 should be tested in accordance with the following procedures after alignment and adjustment. The following tests may be used to determine if the A830-2 is operating properly.

3.4.1 PRELIMINARY ADJUSTMENTS.

a. Connect the HP-200AB to J604 on the A830-2.
b. Connect the HP-335B through the 10-db pad to J402.
c. Connect the HP-330D to the modulation output of the HP-335B.

3.4.2 FREQUENCY RESPONSE.

a. Perform the preliminary procedures of paragraph 3.4.1.
b. Set the HP-200AB for an output of 0.100 volt on a frequency of 400 cps.
c. Adjust the HP-330D for an indication of 0 db.
d. Set the HP-200AB to 50 cps and reset output level to 0.100 volt. The HP-330D indication should be 0 ±0.3 db.
e. Repeat step d for a frequency setting of 15,000 cps.

3.4.3 HARMONIC DISTORTION.

a. Perform the preliminary procedures of paragraph 3.4.1.
b. Set the HP-200B frequency to 50 cps and the output level to 0.01 volt. Measure the harmonic distortion on the HP-330D. It should be 1.0 percent or less.
c. Repeat step b for frequencies of 400 and 15,000 cps.

3.4.4 RESIDUAL FM NOISE.

a. Perform the preliminary procedures of paragraph 3.4.1.
b. Set the HP-200AB to 400 cps at an output level of 0.100 volt.
c. Measure the level across terminals 1 and 2 of the HP-335B with the HP-330D. Record the reading.
d. Turn off the HP-200AB and record the indication on the HP-330D. Record this reading.
e. Compute the s+n/n ratio using the readings recorded in steps c and d. The ratio should not be less than 60 db.

3.4.5 CARRIER FREQUENCY SHIFT.

a. Perform the preliminary procedures of paragraph 3.4.1.
b. Remove the audio input from J604.
c. Connect the output of the HP-200AB to terminals 3 and 4 of TB101.
d. Adjust the output of the HP-200AB to a frequency of 1000 cps and to a level sufficient to modulate the carrier 100 percent.
e. Remove the audio connections from terminals 3 and 4.
f. Adjust the HP-335B to indicate 0 frequency deviation.
g. Touch the audio connections from the HP-200AB to terminals 3 and 4 of TB101 and note the carrier deviation on the HP-335B. It should be less than 500 cps.

3.4.6 AM NOISE MEASUREMENT.

a. Perform the preliminary procedures of paragraph 3.4.1.
b. Set the HP-335B function switch to CARRIER LEVEL and read the carrier output voltage on the modulation meter. An indication of 100 percent modulation equals 10 volts, 90 percent modulation equals 9 volts, etc.
c. Connect the 91C to J3 on the HP-335B and measure the noise output. Compute the carrier-to-AM noise ratio using the following formula:

$$\frac{\text{Carrier}}{\text{AM Noise}} = 20 \log_{10} \frac{\text{Carrier Voltage}}{\text{AM Noise Voltage}}$$

The ratio should not be less than 50 db.

SECTION IV
PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	A830-2 10 W WIDE-BAND FM BROADCAST EXCITER	549-1588-00
	PANEL	
FL101	ATTENUATOR, FIXED: pre-emphasis network for use in FM commercial broadcast equipment; 600 ohms balanced, w/ center tap; ±1 to ±1.5 db frequency response	379-0426-00
FL102	FILTER, HIGH PASS: metal encased, hermetically sealed, input 600 ohms, output 600 ohms, 4 solder type terminals; continuous duty cycle; A. D. C. part no. D10390	673-0869-00
M101	METER, ARBITRARY SCALE: permanent magnet moving coil d-c microammeter, 500 ua, 100 ohms resistance; 2 scales, A scale, 10-90 ua, B scale, 175-500 ua; Assembly Products, Inc. part no. 361	458-0650-00
R101	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w	745-1352-00
R102	RESISTOR, FIXED, FILM: 562 ohms ±1%, 1/4 w	705-7084-00
R103	RESISTOR, FIXED, FILM: 261 ohms ±1%, 1/4 w	705-7068-00
R104	RESISTOR, FIXED, FILM: same as R103	705-7068-00
S101	SWITCH, ROTARY: 2 circuit, 2 pole, 10 position, 2 section; 2 moving, 22 fixed contacts	259-1567-00
S102	SWITCH, PUSH: spst; momentary; 125 v a-c, 0.75 amp, 250 v a-c, 0.25 amp; Cutler-Hammer part no. 8411-K6	266-6169-00
TB101	TERMINAL BOARD: barrier type w/ double row front connection of 12 screw terminals; 13/32 in. by 7/8 in. by 5-11/64 in.; Howard B. Jones, Div. Cinch Mfg. Co. part no. 12-140-D	367-0518-00
TB102	TERMINAL BOARD: Bakelite, 4 terminals, 1 grounded, 3 insulated; 21/32 in. w by 1-1/2 in. lg; Cinch Mfg. Corp. part no. 1534-A	306-2240-00
XFL101	SOCKET, ELECTRON TUBE: 8 prong octal tube socket w/ steel mtg plate; Amphenol-Borg Electronics part no. 88-8TM	220-1005-00
	POWER AMPLIFIER AND POWER SUPPLY	
C401	CAPACITOR, FIXED, CERAMIC: 1000 uuf ±20%, 500 vdcw	913-1186-00
C402 thru C408	CAPACITOR, FIXED, CERAMIC: same as C401	913-1186-00
C409 A & B	CAPACITOR, FIXED, ELECTROLYTIC: dual section, 40 uf ea section; -10% +50%, 450 vdcw; Sprague Electric part no. Y27674	183-1259-00
C410	CAPACITOR, FIXED, ELECTROLYTIC: 1000 uf -10% +100%, 50 vdcw	183-1403-00
C411	CAPACITOR, FIXED, ELECTROLYTIC: same as C410	183-1403-00
C412	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf -10% +100%, 50 vdcw	183-1575-00
C413	CAPACITOR, FIXED, ELECTROLYTIC: 4 uf -10% +100%, 50 vdcw	183-1389-00
C414 thru C425	NOT USED	
C426	CAPACITOR, FIXED, MICA: 5 uuf ±5%, 500 vdcw; Electro Motive part no. DM15C050J01	912-2750-00
C427	CAPACITOR, VARIABLE, CERAMIC: 3.0 uuf min to 12.0 uuf max, 350 vdcw	917-1072-00
C428	CAPACITOR, FIXED, MICA: 470 uuf ±5%, 300 vdcw; Electro Motive part no. DM15F471J01	912-2864-00
C429	CAPACITOR, FIXED, CERAMIC: 1.5 uuf ±5%, 500 vdcw; Stackpole Carbon Co. part no. GA-1.5uufPORM5	913-2981-00
C430	CAPACITOR, FIXED, CERAMIC: 4700 uuf ±20%, 500 vdcw	913-1187-00
C431	CAPACITOR, VARIABLE, AIR: 3.0-9.8 uuf, 1250 vdcw; E. F. Johnson part no. 160-211	922-0046-00
C432	CAPACITOR, FIXED, CERAMIC: 7.5 uuf ±5%, 500 vdcw; Stackpole Carbon Co. part no. GA-7.5uufPORM5	913-2997-00
C433	CAPACITOR, FIXED, MICA: same as C426	912-2774-00
C434	CAPACITOR, FIXED, MICA: same as C426	912-2774-00
C435	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C436	CAPACITOR, FIXED, MICA: 10 uuf ±5%, 500 vdcw; Electro Motive part no. DM15C100J01	912-2753-00
C437	CAPACITOR, FIXED, MICA: same as C436	912-2753-00
C438	CAPACITOR, FIXED, CERAMIC: same as C429	913-2981-00
C439 thru C444	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C445	CAPACITOR, FIXED, CERAMIC: same as C429	913-2981-00
C446 thru C449	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C450	CAPACITOR, FIXED, CERAMIC: 1000 uuf -20% +80%, 500 vdcw; Erie Resistor part no. 327-029X5T0102Z	913-1292-00
C451	CAPACITOR, FIXED, CERAMIC: same as C429	913-2981-00
C452	CAPACITOR, FIXED, MICA: 33 uuf ±5%, 500 vdcw; Electro Motive part no. DM15E330J01	912-2780-00
C453	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C454	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C455	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C456	CAPACITOR, VARIABLE, CERAMIC: 4.5 uuf min to 25 uuf max, 500 vdcw	917-1026-00
C457	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C458	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C459	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C460	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C461	CAPACITOR, VARIABLE, AIR: 3.0 uuf min to 18.7 uuf max; 1250 v a-c; E. F. Johnson Co. part no. 160-110-3	922-0033-00
C462	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C463	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C464	CAPACITOR, FIXED, MICA: same as C428	912-2864-00
C465 thru C468	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C469	NOT USED	
C470	NOT USED	
C471 thru C474	CAPACITOR, FIXED, CERAMIC: same as C430	913-1187-00
C475 thru C480	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C481	CAPACITOR, FIXED, CERAMIC: 1.0 uuf ±5%, 500 vdcw; Stackpole Carbon Co. part no. GA-1.0uufPORM5	913-2977-00
C482	CAPACITOR, FIXED, MICA: same as C428	912-2864-00
C483	CAPACITOR, FIXED, MICA: same as C428	912-2864-00
C484	CAPACITOR, FIXED, MICA: same as C428	912-2864-00
C485	CAPACITOR, FIXED, CERAMIC: same as C450	913-1292-00
C486	CAPACITOR, FIXED, MICA: same as C426	912-2750-00
C487	CAPACITOR, FIXED, MICA: same as C426	912-2750-00
C488	CAPACITOR, FIXED, MICA: same as C426	912-2750-00
C489	CAPACITOR, FIXED, MICA: 150 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F151J01	912-2828-00
C490	CAPACITOR, FIXED, MICA: same as C489	912-2828-00
C491	CAPACITOR, FIXED, MICA: 20 uuf ±5%, 500 vdcw; Electro Motive part no. DM15C200J01	912-2765-00
CR401	SEMICONDUCTOR DEVICE, DIODE: silicon; Motorola part no. 1N1492	353-1661-00
CR402 thru CR408	SEMICONDUCTOR DEVICE, DIODE: same as CR401	353-1661-00
CR409	SEMICONDUCTOR DEVICE, DIODE: silicon, single phase, half-wave; General Electric part no. 1N538	353-1526-00
CR410	SEMICONDUCTOR DEVICE, DIODE: same as CR409	353-1526-00
CR411 A & B	SEMICONDUCTOR DEVICE, SET: two hermetically sealed silicon voltage reference diodes; Motorola part no. 10M10ZB1	353-1238-00
CR412	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed; International Rect. Corp part no. 1Z10V01	353-1208-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
CR413	SEMICONDUCTOR DEVICE, DIODE: same as CR409	353-1526-00
CR414	SEMICONDUCTOR DEVICE, DIODE: same as CR409	353-1526-00
CR415	SEMICONDUCTOR DEVICE, DIODE: same as CR412	353-1208-00
CR416 thru CR425	NOT USED	
CR426	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed, diffused-junction type; Motorola part no. 1N977A	353-3237-00
F401	FUSE, CARTRIDGE: 1.00 amp current rating, 250 v, glass body, ferrule terminals; Bussmann part no. MDL 1	264-4280-00
F402	FUSE, CARTRIDGE: 0.250 amp current rating, 250 v d-c, glass body, ferrule terminals	264-4240-00
J401	JACK, TELEPHONE: steel, miniature, panel mtg; Switchcraft, Inc. part no. 3501FP	360-0148-00
J402	CONNECTOR, RECEPTACLE, ELECTRICAL: single round female contact, right angle shape; Amphenol part no. 31-213	357-9258-00
L401	REACTOR: 7.2 henrys min. 0.300 amp d-c; 60 ohms; 4-37/64 in. by 5-5/16 in. overall; Stancor Elec. Inc. part no. RS-8300	668-0015-00
L402 thru L425	NOT USED	
L426	COIL, RADIO FREQUENCY: 0.68 uh ±3%, 250 mc, 0.12 ohm, 1750 ma; 3/16 in. dia by 7/16 in. lg; Delevon part no. 1840	240-1844-00
L427	COIL, RADIO FREQUENCY: 0.25 uh ±3%, 400 mc, 0.04 ohm, 2850 ma; 3/16 in. dia by 7/16 in. lg	240-1843-00
L428	COIL, RADIO FREQUENCY, NO. 1: single layer wound #14 wire, 1/2 in. ID of coil, 7/8 in. lg overall	549-1605-003
L429	COIL, RADIO FREQUENCY: variable; 88 to 108 mc, +15°C to +55°C temp range; 850 v d-c dielectric strength	278-0730-00
L430 thru L434	COIL, RADIO FREQUENCY: same as L429	278-0730-00
L435	COIL, RADIO FREQUENCY, NO. 2: single layer wound #16 wire; 3/4 in. ID of coil, 2-7/8 in. lg overall	549-1606-003
L436	COIL, RADIO FREQUENCY: single layer wound; 5.6 uh, 860 ma current, 0.95 ohm; Jeffers Electronics Div. of Speer Carbon Co. part no. 10402-34	240-0179-00
L437	COIL, RADIO FREQUENCY: same as L436	240-0179-00
L438	COIL, RADIO FREQUENCY: single layer wound, 0.47 uh nom inductance, 0.09 ohm max dc resistance, 1600 ma max current rating; Jeffers Electronics, Div. of Speer Carbon Co. part no. 10100-126	240-0060-00
L439	COIL, RADIO FREQUENCY, NO. 3: single layer wound #14 wire, 3/4 in. ID of coil, 1-3/8 in. h; approx 1-11/16 in. lg overall	549-1607-003
L440	COIL, RADIO FREQUENCY: 1.00 uh ±10%, 0.30 ohm d-c resistance; 850 ma d-c; Jeffers Electronics part no. 10100-128	240-0062-00
L441	COIL, RADIO FREQUENCY, NO. 4: single layer wound #18 wire, 3/16 in. ID of coil, 5/16 in. lg	553-5671-002
R401	RESISTOR, FIXED, WIREWOUND: 100 ohms ±10%, 10 w	710-9053-00
R402	RESISTOR, FIXED, WIREWOUND: 16,000 ohms ±5%, 25 w	710-0369-00
R403	NOT USED	
R404	RESISTOR, FIXED, WIREWOUND: 600 ohms ±10%, 10 w	710-9081-00
R405	RESISTOR, FIXED, WIREWOUND: 12,000 ohms ±10%, 10 w	710-9070-00
R406	RESISTOR, FIXED, WIREWOUND: 25,000 ohms ±10%, 10 w	710-9068-00
R407	RESISTOR, FIXED, WIREWOUND: 5.0 ohms ±10%, 5 w	710-9105-00
R408	RESISTOR, FIXED, WIREWOUND: 25 ohms ±10%, 7 w	710-9019-00
R409	RESISTOR, FIXED, WIREWOUND: same as R408	710-9019-00
R410	RESISTOR, FIXED, COMPOSITION: 160.0 ohms ±5%, 5 w	747-5444-00
R411	RESISTOR, FIXED, COMPOSITION: same as R407	710-9105-00
R412	RESISTOR, FIXED, COMPOSITION: same as R410	747-5444-00
R413	RESISTOR, FIXED, WIREWOUND: 100 ohms ±10%, 7 w	710-9005-00
R414 thru R425	NOT USED	
R426	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1/2 w	745-1394-00
R427	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w	745-1352-00
R428	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%, 1/2 w	745-1324-00
R429	RESISTOR, FIXED, COMPOSITION: 2700 ohms ±10%, 1/2 w	745-1370-00
R430	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%, 1/2 w	745-1422-00
R431	RESISTOR, FIXED, COMPOSITION: 1500 ohms ±10%, 1/2 w	745-1359-00
R432	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%, 1/2 w	745-1419-00
R433	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%, 1/2 w	745-1366-00
R434	RESISTOR, FIXED, COMPOSITION: 0.10 megohm ±10%, 1/2 w	745-1436-00
R435	RESISTOR, FIXED, COMPOSITION: same as R434	745-1436-00
R436	RESISTOR, FIXED, COMPOSITION: same as R431	745-1359-00
R437	RESISTOR, FIXED, COMPOSITION: same as R433	745-1366-00
R438	RESISTOR, VARIABLE: COMPOSITION; 500 ohms ±20%, 0.2 w	376-0202-00
R439	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%, 2 w	745-5673-00
R440	RESISTOR, FIXED, COMPOSITION: same as R439	745-5673-00
R441	RESISTOR, FIXED, COMPOSITION: same as R434	745-1436-00
R442	RESISTOR, FIXED, COMPOSITION: same as R426	745-1394-00
R443	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%, 1/2 w	745-1303-00
R444	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%, 1 w	745-3419-00
R445	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1 w	745-3380-00
R446	RESISTOR, FIXED, COMPOSITION: same as R434	745-1436-00
R447	RESISTOR, FIXED, COMPOSITION: same as R426	745-1394-00
R448	RESISTOR, FIXED, COMPOSTION: 270 ohms ±10%, 1 w	745-3328-00
R449	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1 w	745-3394-00
R450	RESISTOR, FIXED, COMPOSITION: 820 ohms ±10%, 2 w	745-5649-00
R451	RESISTOR, FIXED, COMPOSITION: 10 ohms ±10%, 1/2 w	745-1268-00
R452	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%, 1/2 w	745-1373-00
R453	RESISTOR, FIXED, COMPOSITION: same as R432	745-1419-00
R454	RESISTOR, VARIABLE, WIREWOUND: 250 ohms ±10%, 2 w	377-0621-00
R455	RESISTOR, FIXED, COMPOSITION: 180 ohms ±10%, 2 w	745-5621-00
R456	RESISTOR, FIXED, COMPOSITION: 8200 ohms ±10%, 1/2 w	745-1391-00
R457	RESISTOR, FIXED, COMPOSITION: 33 ohms ±10%, 1/2 w	745-1289-00
R458	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%, 1/2 w	745-1310-00
R459	RESISTOR, FIXED, COMPOSITION: same as R451	745-1268-00
R460	NOT USED	
R461	RESISTOR, FIXED, FILM: 51,000 ohms ±10%, 5 w	714-2973-00
R462	RESISTOR, FIXED, COMPOSITION: same as R443	745-1303-00
R463	RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±10%, 1/2 w	745-1408-00
R464	RESISTOR, FIXED, COMPOSITION: same as R458	745-1310-00
R465	RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%, 1/2 w	745-1412-00
R466	RESISTOR, FIXED, WIREWOUND: 20,000 ohms ±10%, 10 w	710-9067-00
R467	RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±10%, 2 w	745-5708-00
S401	SWITCH, TOGGLE: dpst; 125 v a-c, 15 amp, 250 v a-c, 10 amp; Cutler-Hammer, Inc. part no. 7561K4	266-0099-00
T401	TRANSFORMER, POWER, STEP-UP, STEP-DOWN: pri 120 v; sec. #1, 438 v, sec. #2, 6.3 v, ct; 50/60 cps; continuous duty cycle; Stancor Electric part no. 31215	662-0046-00
T402	TRANSFORMER, POWER, STEP-DOWN: pri 120 v rms; sec. #1, 77 v, ct; sec. #2, 41.5 ct; 50/60 cps; continuous duty cycle; Stancor Electric part no. 31214	662-0048-00
T403 thru T425	NOT USED	

ITEM	DESCRIPTION	COLLINS PART NUMBER
T426	TRANSFORMER, RADIO FREQUENCY: pri 14 turns #26 wire, close wound; sec. 13 turns #26 wire, close wound	549-1590-00
TB401	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1520-A	306-9033-00
TB402	TERMINAL BOARD: Baklite, 2 terminals; 21/32 in. by 3/4 in. lg; Cinch Mfg. Co. part no. 1513-A	306-2220-00
TB403	TERMINAL BOARD: laminated phenolic w/ 4 solder-lug terminals; 27/32 in. w by 1-1/2 in. lg overall; Cinch Mfg. Co. part no. 1909	306-0838-00
TB404	TERMINAL BOARD: same as TB401	306-9033-00
TB405	TERMINAL BOARD: phenolic; steel mounting base, brass lugs, 12 terminals; H. B. Jones part no. 2012	367-0905-00
TB406	TERMINAL BOARD: same as TB405	367-0905-00
TB407 thru TB425	NOT USED	
TB426	TERMINAL BOARD: phenolic, 4 brass solder-lug terminals; 1/16 in. by 3/8 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1532-A	306-9032-00
TB427	TERMINAL BOARD: same as TB403	306-0838-00
TB428	TERMINAL BOARD: phenolic, 5 brass solder-lug terminals; 1/16 in. by 3/8 in. by 1-7/8 in.; Cinch Mfg. Corp. part no. 1542-A-FV	306-0951-00
TB429	TERMINAL BOARD: same as TB428	306-0951-00
TB430	TERMINAL BOARD: same as TB402	306-2220-00
TB431	TERMINAL BOARD: same as TB428	306-0951-00
V401 thru V425	NOT USED	
V426	ELECTRON TUBE: triode-pentode; Radio Corp. of America part no. 6U8A	255-0328-00
V427	ELECTRON TUBE: glass envelope; twin triode; Radio Corp. of America part no. 12AT7	255-0205-00
V428	ELECTRON TUBE: pentode; Radio Corp. of America part no. 6AU6	255-0202-00
V429	ELECTRON TUBE: glass envelope; vhf beam power; Radio Corp. of America part no. 5763	257-0059-00
V430	ELECTRON TUBE: glass envelope; Radio Corp. of America part no. 2E26	256-0084-00
XF401	FUSE HOLDER: extractor post type, for use w/ 3 AG fuses; 0-20 amp, 100-125 v; clear knob; neon lamp type	265-1072-00
XF402	FUSE HOLDER: same as XF401	265-1072-00
XV401 thru XV425	NOT USED	
XV426	SOCKET, ELECTRON TUBE: 9 contact miniature; copper nonmagnetic alloy contacts; phenolic insulation; Sylvania Electric Products, Inc. part no. 7490-0100	220-1244-00
XV427	SOCKET, ELECTRON TUBE: same as XV426	220-1244-00
XV428	SOCKET, ELECTRON TUBE: 7 contact miniature for uhf application; phenolic insulation; Sylvania Electric Products, Inc. part no. 7470-0125	220-1203-00
XV429	SOCKET, ELECTRON TUBE: same as XV426	220-1244-00
XV430	SOCKET, ELECTRON TUBE: 8 prong octal tube socket w/ steel mtg plate; Amphenol-Borg Electronics part no. 88-8TM	220-1005-00
	AUTOMATIC FREQUENCY CONTROL	
C501	CAPACITOR, FIXED, CERAMIC: 1000 uuf ±20%, 500 vdcw	913-1186-00
C502	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C503	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C504	CAPACITOR, FIXED, CERAMIC: 0.01 uf -0% +100% temp range; 100 vdcw; Erie Resistor Corp. part no. 855-502-X550-103P	913-3680-00
C505	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C506	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C507	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C508	CAPACITOR, FIXED, MICA: 10 uuf ±5%, 500 vdcw; Electro Motive part no. DM15C100J01	912-2753-00
C509	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C510	CAPACITOR, FIXED, MICA: 82 uuf ±5%, 500 vdcw; Electro Motive part no. DM15E820J01	912-2810-00
C511	CAPACITOR, FIXED, CERAMIC: 0.1 uf -20% +80%, 50 vdcw; Sprague Electric part no. 33C41	913-3886-00
C512	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C513	CAPACITOR, FIXED, CERAMIC: same as C504	913-3680-00
C514	CAPACITOR, FIXED, MICA: 100 uuf ±5% 500 wvdc	912-2816-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C515	CAPACITOR, VARIABLE, CERAMIC: 5.0 uuf min to 37.5 uuf max, 350 vdcw; Erie Resistor part no. 557018C0P039R	917-1073-00
C516	CAPACITOR, FIXED, MICA: 220 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F221J01	912-2840-00
C517	CAPACITOR, FIXED, MICA: 30 uuf ±2%, 500 vdcw; Electro Motive part no. DM15E300G01	912-2776-00
C518	CAPACITOR, VARIABLE, CERAMIC: 3.0 uuf min to 12.0 uuf max, 350 vdcw	917-1072-00
C519	CAPACITOR, FIXED, MICA: 470 uuf ±5%, 300 vdcw; Electro Motive part no. DM15F471J01	912-2864-00
C520	CAPACITOR, FIXED, MICA: same as C519	912-2864-00
C521	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf -10% +100%, 10 vdcw; Sprague Electric part no. S13691	183-2151-00
C522	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf -10%, +100%, 25 vdcw; Sprague Electric part no. 30D188A1	183-1192-00
C523	CAPACITOR, FIXED, CERAMIC: 0.68 uf -20% +80%, 25 vdcw; Sprague Electric part no. 5C12A	913-3809-00
C524	CAPACITOR, FIXED, ELECTROLYTIC: same as C522	183-1192-00
C525	CAPACITOR, FIXED, CERAMIC: same as C523	913-3809-00
C526	CAPACITOR, FIXED, ELECTROLYTIC: same as C522	183-1192-00
C527	CAPACITOR, FIXED, CERAMIC: same as C523	913-3809-00
C528	CAPACITOR, FIXED, ELECTROLYTIC: same as C522	183-1192-00
C529	CAPACITOR, FIXED, PAPER: 5.0 uf ±20%, 150 vdcw; Sprague Electric part no. 121P50501R5S2	931-2585-00
C530	CAPACITOR, FIXED, PAPER: same as C529	931-2585-00
C531	CAPACITOR, FIXED, PAPER: 2.0 uf ±20%, 200 vdcw; Aerovox Corp. part no. P8292ZN14	951-0670-00
C532	CAPACITOR, FIXED, PAPER: 20 uf ±20%, 150 vdcw; Sprague Electric part no. 143P101M	951-2004-00
C533	CAPACITOR, FIXED, PAPER: same as C531	951-0670-00
C534	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf -10% +100%, 30 vdcw	183-1565-00
C535	CAPACITOR, FIXED, ELECTROLYTIC: 1000 uf -10% +100%, 50 vdcw	183-1403-00
C536	CAPACITOR, FIXED, ELECTROLYTIC: same as C535	183-1403-00
C537	CAPACITOR, FIXED, PAPER: 35 uf ±20%, 150 vdcw; Sprague Electric part no. 143P4M	951-2003-00
C538	CAPACITOR, FIXED, PAPER: same as C537	951-2003-00
C539	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf -10% +100%, 12 vdcw; Sprague Electric Co. part no. 30D157A1	183-1190-00
C540	CAPACITOR, FIXED, CERAMIC: same as C511	913-3886-00
C541	CAPACITOR, FIXED, MICA: 180 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F181J01	912-2834-00
C542	CAPACITOR, FIXED, CERAMIC: same as C511	913-3886-00
C543	NOT USED	
C544	CAPACITOR, FIXED, MICA: 68 uuf ±5%, 500 vdcw; Electro Motive part no. DM15E680J01	912-2804-00
C545	CAPACITOR, FIXED, MICA: 510 uuf ±5%, 300 vdcw; Electro Motive part no. DM15F511J01	912-2867-00
C546	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C547	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C548	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
C549	CAPACITOR, FIXED, CERAMIC: 3300 uuf ±20%, 500 vdcw	913-1193-00
C550	CAPACITOR, FIXED, MICA: 22 uuf ±5%, 500 vdcw; Electro Motive part no. DM15C220J01	912-2768-00
C551	CAPACITOR, FIXED, ELECTROLYTIC: same as C534	183-1565-00
C552	CAPACITOR, FIXED, CERAMIC: same as C549	913-1193-00
C553	CAPACITOR, FIXED, CERAMIC: same as C501	913-1186-00
CR501	SEMICONDUCTOR DEVICE, DIODE: germanium; Transitron part no. 1N270	353-2018-00
CR502 thru CR506	SEMICONDUCTOR DEVICE, DIODE: same as CR501	353-2018-00
CR507	SEMICONDUCTOR DEVICE, DIODE: germanium; Erie Resistor part no. 1N198	353-0160-00
CR508	SEMICONDUCTOR DEVICE, DIODE: same as CR507	353-0160-00
CR509	SEMICONDUCTOR DEVICE, SET: four matched silicon diodes; encapsulated; Fairchild Semiconductor Corp. part no. FA-4000	353-3271-00
CR510	SEMICONDUCTOR DEVICE, SET: same as CR509	353-3271-00
CR511	SEMICONDUCTOR DEVICE, SET: same as CR509	353-3271-00
CR512	NOT USED	
CR513	SEMICONDUCTOR DEVICE, DIODE: same as CR507	353-0160-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
CR514	SEMICONDUCTOR DEVICE, DIODE: hermetically sealed, silicon; Motorola, Inc. part no. 1N718	353-2734-00
CR515	SEMICONDUCTOR DEVICE, DIODE: quick recovery silicon junction diode; Hughes Aircraft part no. 1N626	353-2857-00
CR516	SEMICONDUCTOR DEVICE, DIODE: same as CR515	353-2857-00
J501	JACK, TIP: insulated tip u/w standard 0.080 in. test probes; brown; E. F. Johnson Co. part no. 105-208-200	360-0152-00
J502	JACK, TIP: insulated tip u/w standard 0.080 in. test probes; red; E. F. Johnson Co. part no. 105-202-200	360-0150-00
J503	JACK, TIP: insulated tip u/w standard 0.080 in. test probes; orange; E. F. Johnson Co. part no. 105-206-200	360-0154-00
J504	JACK, TIP: insulated tip u/w standard 0.080 in. test probes; yellow; E. F. Johnson Co. part no. 105-207-200	360-0156-00
L501	COIL, RADIO FREQUENCY: single layer wound, 100 uh nom inductance, 3.2 ohms d-c resistance, 530 ma current rating; Jeffers Electronics, Div. of Speer Carbon Co. part no. 10404-34	240-0193-00
L502	COIL, RADIO FREQUENCY: single layer wound, 3.30 uh nom inductance, 0.15 ohm d-c resistance, 1150 ma current rating; Jeffers Electronics, Div. of Speer Carbon Co. part no. 10102-110	240-0065-00
L503	COIL, RADIO FREQUENCY: single layer wound, 4.7 uh inductance; 0.22 ohm max d-c resistance, 950 ma current rating; Jeffers Electronics, Div. of Speer Carbon Co. part no. 10102-115	240-0145-00
L504	COIL, RADIO FREQUENCY: variable; +15°C to +55°C temp range; 100 v d-c dielectric strength	278-0733-00
L505	COIL, RADIO FREQUENCY: same as L504	278-0733-00
Q501	TRANSISTOR: germanium; RCA part no. 2N1225	352-0135-00
Q502	TRANSISTOR: same as Q501	352-0135-00
Q503	TRANSISTOR: hermetically sealed, NPN silicon; Fairchild Semi Conductor Co. part no. 2N708	352-0322-00
Q504	TRANSISTOR: hermetically sealed, NPN diffused silicon planar transistor; Fairchild Semiconductor Corp. part no. 2N1613	352-0349-00
Q505	TRANSISTOR: same as Q504	352-0349-00
Q506	TRANSISTOR: same as Q504	352-0349-00
Q507	TRANSISTOR: same as Q504	352-0349-00
Q508	TRANSISTOR: silicon; General Electric part no. 2N491	352-0116-00
Q509	TRANSISTOR: germanium; hermetically sealed; Sylvania Electric part no. 2N1605	352-0348-00
Q510	TRANSISTOR: same as Q509	352-0348-00
Q511	TRANSISTOR: hermetically sealed; PNP germanium; General Electric part no. 2N1175A	352-0315-00
Q512	TRANSISTOR: same as Q501	352-0135-00
R501	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%, 1/2 w	745-1303-00
R502	RESISTOR, FIXED, COMPOSITION: 2700 ohms ±10%, 1/2 w	745-1370-00
R503	RESISTOR, FIXED, COMPOSITION: same as R502	745-1370-00
R504	RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%, 1/2 w	745-1345-00
R505	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1/2 w	745-1380-00
R506	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1/2 w	745-1394-00
R507	RESISTOR, FIXED, COMPOSITION: same as R505	745-1380-00
R508	RESISTOR, FIXED, FILM: 42.2 ohms ±1%, 1/4 w	705-7030-00
R509	RESISTOR, FIXED, FILM: 51.1 ohms ±1%, 1/4 w	705-7034-00
R510	RESISTOR, FIXED, COMPOSITION: same as R506	745-1394-00
R511	RESISTOR, FIXED, COMPOSITION: same as R506	745-1394-00
R512	RESISTOR, FIXED, COMPOSITION: same as R505	745-1380-00
R513	RESISTOR, FIXED, FILM: 261 ohms ±1%, 1/4 w	705-7068-00
R514	RESISTOR, FIXED, COMPOSITION: 1800 ohms ±10%, 1/2 w	745-1363-00
R515	RESISTOR, FIXED, COMPOSITION: same as R514	745-1363-00
R516	RESISTOR, FIXED, COMPOSITION: 150 ohms ±10%, 1/2 w	745-1317-00
R517	RESISTOR, FIXED, FILM: 110 ohms ±1%, 1/4 w	705-7050-00
R518	RESISTOR, FIXED, FILM: 6810 ohms ±1%, 1/4 w	705-7136-00
R519	RESISTOR, FIXED, FILM: same as R518	705-7136-00
R520	RESISTOR, FIXED, FILM: same as R517	705-7050-00
R521	RESISTOR, FIXED, FILM: 34,800 ohms ±1%, 1/4 w	705-7170-00
R522	RESISTOR, FIXED, FILM: 10,000 ohms ±1%, 1/4 w	705-7144-00
R523	RESISTOR, FIXED, FILM: 178,000 ohms ±1%, 1/4 w	705-7204-00
R524	RESISTOR, FIXED, FILM: 14,700 ohms ±1%, 1/4 w	705-7152-00
R525	RESISTOR, FIXED, FILM: 7500 ohms ±1%, 1/4 w	705-7138-00
R526	RESISTOR, FIXED, FILM: 422 ohms ±1%, 1/4 w	705-7078-00
R527	RESISTOR, FIXED, FILM: 196,000 ohms ±1%, 1/4 w	705-7206-00
R528	RESISTOR, FIXED, FILM: same as R524	705-7152-00
R529	RESISTOR, FIXED, FILM: same as R525	705-7138-00
R530	RESISTOR, FIXED, FILM: same as R526	705-7078-00
R531	RESISTOR, FIXED, FILM: same as R527	705-7206-00
R532	RESISTOR, FIXED, FILM: same as R524	705-7152-00
R533	RESISTOR, FIXED, FILM: same as R525	705-7138-00
R534	RESISTOR, FIXED, FILM: same as R526	705-7078-00
R535	RESISTOR, FIXED, FILM: 38,300 ohms ±1%, 1/4 w	705-7172-00
R536	RESISTOR, FIXED, FILM: 19,600 ohms ±1%, 1/4 w	705-7158-00
R537	RESISTOR, FIXED, FILM: 1470 ohms ±1%, 1/4 w	705-7104-00
R538	RESISTOR, FIXED, FILM: same as R537	705-7104-00
R539	RESISTOR, FIXED, FILM: 2870 ohms ±1%, 1/4 w	705-7118-00
R540	RESISTOR, FIXED, FILM: same as R539	705-7118-00
R541	RESISTOR, FIXED, FILM: 100,000 ohms ±1%, 1/4 w	705-7192-00
R542	RESISTOR, FIXED, FILM: same as R541	705-7192-00
R543	RESISTOR, FIXED, COMPOSITION: 0.12 megohm ±10%, 1/2 w	745-1440-00
R544	RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%, 1/2 w	745-1412-00
R545	RESISTOR, FIXED, COMPOSITION: 0.18 megohm ±10%, 1/2 w	745-1447-00
R546	RESISTOR, FIXED, FILM: 5620 ohms ±1%, 1/4 w	705-7132-00
R547	RESISTOR, FIXED, FILM: 9090 ohms ±1%, 1/4 w	705-7142-00
R548	RESISTOR, FIXED, FILM: same as R547	705-7142-00
R549	RESISTOR, FIXED, FILM: 8250 ohms ±1%, 1/4 w	705-7140-00
R550	RESISTOR, FIXED, FILM: 1330 ohms ±1%, 1/4 w	705-7102-00
R551	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%, 1/2 w	745-1401-00
R552	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%, 1/2 w	745-1373-00
R553	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w	745-1352-00
R554	RESISTOR, FIXED, COMPOSITION: same as R551	745-1401-00
R555	RESISTOR, FIXED, FILM: 75,000 ohms ±1%, 1/4 w	705-7186-00
R556	RESISTOR, FIXED, COMPOSITION: 10 ohms ±10%, 1/2 w	745-1268-00
R557	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%, 1/2 w	745-1324-00
R558	RESISTOR, FIXED, FILM: 56,200 ohms ±1%, 1/4 w	705-7180-00
R559	RESISTOR, FIXED, FILM: 2610 ohms ±1%, 1/4 w	705-7116-00
R560	RESISTOR, FIXED, FILM: 3160 ohms ±1%, 1/4 w	705-7120-00
R561	RESISTOR, FIXED, COMPOSITION: same as R553	745-1352-00
R562	RESISTOR, VARIABLE: COMPOSITION; 1000 ohms ±20%, 1/4 w	376-4727-00
R563	RESISTOR, FIXED, COMPOSITION: same as R506	745-1394-00
R564	RESISTOR, FIXED, FILM: 3480 ohms ±1%, 1/4 w	705-7122-00
R565	RESISTOR, FIXED, FILM: 4640 ohms ±1%, 1/4 w	705-7128-00
R566	RESISTOR, FIXED, FILM: same as R521	705-7170-00
R567	RESISTOR, FIXED, FILM: same as R521	705-7170-00
R568	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%, 1/2 w	745-1310-00
R569	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%, 1/2 w	745-1387-00
R570	RESISTOR, FIXED, COMPOSTION: 8200 ohms ±10%, 1/2 w	745-1391-00
R571	RESISTOR, FIXED, COMPOSITION: 18,000 ohms ±5%, 1/2 w	745-1404-00
R572	RESISTOR, VARIABLE: COMPOSITION; 500 ohms ±20%, 1/4 w	376-4726-00
R573	RESISTOR, FIXED, COMPOSITION: same as R502	745-1370-00
R574	RESISTOR, FIXED, COMPOSITION: same as R502	745-1370-00
R575	RESISTOR, FIXED, COMPOSITION: same as R505	745-1380-00
R576	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%, 1/2 w	745-1384-00
R577	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%, 1/2 w	745-1419-00
R578	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%, 1/2 w	745-1422-00
R579	RESISTOR, FIXED, COMPOSITION: 2150 ohms ±1%, 1/4 w	705-7112-00
R580	RESISTOR, FIXED, COMPOSITION: 820 ohms ±10%, 1/2 w	745-1349-00
R581	RESISTOR, FIXED, COMPOSITION: same as R552	745-1373-00
T501	NOT USED	
T502	NOT USED	
T503	TRANSFORMER, RADIO FREQUENCY: 20 turns #30 AWG, close wound tapped at 10 turns; 43.5 uh inductance; ferrite core; 0.250 in. w by 0.500 in. dia	549-1589-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
T504	TRANSFORMER, RADIO FREQUENCY: 5 terminals, primary ct; 5/8 in. h by 1-1/8 in. w by 1-1/2 in. lg	549-1617-003
TB501	TERMINAL BOARD: phenolic, 1-7/8 in. lg by 3/8 in. w by 1/16 in. thk; 5 brass solder-lug terminals; Cinch Mfg. Corp. part no. 1542-A-FV	306-0951-00
TB502	TERMINAL BOARD: same as TB501	306-0951-00
TB503	TERMINAL BOARD: same as TB501	306-0951-00
TB504	TERMINAL BOARD: Bakelite, 4 terminals, 1 grounded, 3 insulated; 21/32 in. w by 1-1/2 in. lg; Cinch Mfg. Corp. part no. 1534-A	306-2240-00
TB505	TERMINAL BOARD: same as TB501	306-0951-00
TB506	TERMINAL BOARD: same as TB501	306-0951-00
TB507	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1520-A	306-9033-00
TB508	TERMINAL BOARD: same as TB501	306-0951-00
TB509	TERMINAL BOARD: phenolic, 1/16 in. by 3/8 in. by 1-1/2 in.; 4 brass solder-lug terminals; Cinch Mfg. Corp. part no. 1532-A	306-9032-00
TB510	TERMINAL BOARD: same as TB507	306-9033-00
TB511	TERMINAL BOARD: same as TB501	306-0951-00
TB512	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals, 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1525-A	306-0001-00
TB513	TERMINAL BOARD: same as TB509	306-9032-00
TB514	TERMINAL BOARD: same as TB507	306-9033-00
TB515	TERMINAL BOARD: same as TB501	306-0951-00
TB516	TERMINAL BOARD: same as TB501	306-0951-00
TB517	TERMINAL BOARD: same as TB501	306-0951-00
TB518	TERMINAL BOARD: phenolic, 12 solder-lug terminals; Vector Mfg. Co. part no. 6H-12	306-0909-00
TB519	TERMINAL BOARD: same as TB501	306-0951-00
TB520	TERMINAL BOARD: phenolic w/ 4 solder lug terminals; 27/32 in. w by 1-1/2 in. lg; Cinch Mfg. Corp. part no. 1909	306-0838-00
TB521	TERMINAL BOARD: phenolic, 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg	306-0587-00
Y501	CRYSTAL UNIT, QUARTZ: 14.0 mc; type HC-27/U holder	289-2743-00
	MODULATOR	
C601	CAPACITOR, FIXED, CERAMIC: 20.0 uuf ±2%, 500 vdcw	916-0362-00
C602	CAPACITOR, FIXED, CERAMIC: same as C601	916-0362-00
C603	CAPACITOR, FIXED, CERAMIC: uninsulated, 10.0 uuf ±1/2 uuf, 500 vdcw	916-0412-00
C604	CAPACITOR, FIXED, MICA: 100 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F101J01	912-2816-00
C605	CAPACITOR, FIXED, CERAMIC: 0.01 uf -0% +100%, 100 vdcw; Erie Resistor Corp. part no. 855-502-X550-103P	913-3680-00
C606	CAPACITOR, VARIABLE, CERAMIC: 5.0 uuf min to 37.5 uuf max, 350 vdcw; Erie Resistor Corp. part no. 557018C0P039R	917-1073-00
C607	CAPACITOR, FIXED, PAPER: 1.0 uf -10% +20%, 200 vdcw	931-0170-00
C608	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf -10% +100%, 12 vdcw; Sprague Electric Co. part no. 30D157A1	183-1190-00
C609	CAPACITOR, FIXED, PAPER: 0.5 uf -10% +20%, 200 vdcw	931-0169-00
C610	CAPACITOR, FIXED, PAPER: 20 uf ±20%, 150 vdcw; Sprague Electric part no. 143P101M	951-2004-00
C611	CAPACITOR, FIXED, MICA: same as C604	912-2816-00
C612	CAPACITOR, FIXED, MICA: same as C604	912-2816-00
C613	CAPACITOR, FIXED, CERAMIC: same as C605	913-3680-00
C614	CAPACITOR, FIXED, MICA: 330 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F331J01	912-2852-00
C615	CAPACITOR, FIXED, CERAMIC: 0.1 uf -20% +80%, 50 vdcw; Sprague Electric part no. 33C41	913-3886-00
C616	CAPACITOR, FIXED, CERAMIC: same as C615	913-3886-00
C617	CAPACITOR, FIXED, CERAMIC: same as C605	913-3680-00
C618	CAPACITOR, FIXED, CERAMIC: 100 uuf ±20%, 500 vdcw	913-1186-00
C619	CAPACITOR, FIXED, MICA: 10 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F100J01	912-2753-00
C620	CAPACITOR, FIXED, MICA: 82 uuf ±5%, 500 vdcw; Electro Motive part no. DM15E820J01	912-2810-00
C621	CAPACITOR, FIXED, CERAMIC: same as C615	913-3886-00
C622	CAPACITOR, FIXED, CERAMIC: same as C615	913-3886-00
C623	CAPACITOR, FIXED, CERAMIC: same as C605	913-3680-00
C624	NOT USED	
C625	CAPACITOR, FIXED, MICA: 22 uuf ±5%, 500 vdcw; Electro Motive part no. DM15C220J01	912-2768-00
C626	CAPACITOR, FIXED, CERAMIC: same as C615	913-3886-00
C627	CAPACITOR, FIXED, CERAMIC: same as C605	913-2680-00
C628	CAPACITOR, FIXED, CERAMIC: same as C605	913-2680-00
C629	CAPACITOR, FIXED, MICA: same as C625	912-2768-00
C630	CAPACITOR, FIXED, CERAMIC: same as C615	913-3886-00
C631	CAPACITOR, FIXED, CERAMIC: same as C615	913-3886-00
C632	CAPACITOR, FIXED, MICA: 150 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F151J01	912-2828-00
C633	CAPACITOR, FIXED, MICA: same as C632	912-2828-00
C634	CAPACITOR, FIXED, MICA: 39 uuf ±5%, 500 vdcw; Electro Motive part no. DM15E390J01	912-2786-00
C635	CAPACITOR, FIXED, CERAMIC: same as C605	913-3680-00
C636	CAPACITOR, FIXED, CERAMIC: same as C605	913-3680-00
C637	CAPACITOR, FIXED, CERAMIC: same as C605	913-3680-00
C638	CAPACITOR, FIXED, CERAMIC: same as C605	913-3680-00
C639	CAPACITOR, VARIABLE, CERAMIC: same as C606	917-1073-00
C640	CAPACITOR, FIXED, CERAMIC: same as C618	913-1186-00
C641	CAPACITOR, FIXED, MICA: 68 uuf ±5%, 500 vdcw; Electro Motive part no. DM15E680J01	912-2804-00
C642	CAPACITOR, FIXED, MICA: 220 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F221J01	912-2840-00
C643	CAPACITOR, FIXED, CERAMIC: same as C601	916-0362-00
C644	CAPACITOR, VARIABLE, CERAMIC: 3.0 uuf min to 12.0 uuf max, 350 vdcw	917-1072-00
C645	CAPACITOR, FIXED, MICA: 33 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F330J01	912-2780-00
C646	CAPACITOR, FIXED, MICA: same as C645	912-2780-00
C647	CAPACITOR, FIXED, MICA: 560 uuf ±5%, 500 vdcw; Electro Motive part no. DM19F561J	912-2983-00
C648	CAPACITOR, FIXED, MICA: 1800 uuf ±5%, 500 vdcw; Electro Motive part no. DM20F182J	912-3333-00
C649	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf -15% +75%, 25 vdcw; Sprague Electric part no. 109D107C7025T2	184-7802-00
C650	CAPACITOR, FIXED, PAPER: same as C607	931-0170-00
C651	CAPACITOR, FIXED, CERAMIC: same as C615	913-3886-00
C652	CAPACITOR, FIXED, CERAMIC: 10.0 uuf ±1/4 uuf, 500 vdcw	916-0203-00
C653	CAPACITOR, FIXED, MICA: 270 uuf ±5%, 500 vdcw; Electro Motive part no. DM15F271J01	912-2846-00
C654	CAPACITOR, DIODE: 35 uuf ±20%, at -4 v d-c voltage, max 130 v d-c; total capacity range 6 to 88 uuf, 130 v d-c to 0.1 v d-c	922-6002-00
CR601	SEMICONDUCTOR DEVICE, DIODE: quick recovery silicon junction diode; Hughes Aircraft part no. 1N626	353-2857-00
CR602	SEMICONDUCTOR DEVICE, DIODE: silicon, hermetically sealed; Transitron Elect. Corp. part no. SV3173	353-3304-00
CR603	SEMICONDUCTOR DEVICE, DIODE: germanium, Transitron part no. 1N270	353-2018-00
CR604	SEMICONDUCTOR DEVICE, DIODE: same as CR603	353-2018-00
CR605	SEMICONDUCTOR DEVICE, DIODE: same as CR603	353-2018-00
CR606	SEMICONDUCTOR DEVICE, DIODE: same as CR603	353-2018-00
CR607	SEMICONDUCTOR DEVICE, DIODE: germanium; Erie Resistor part no. 1N198	353-0160-00
CR608	SEMICONDUCTOR DEVICE, DIODE: same as CR607	353-0160-00
CR609	SEMICONDUCTOR DEVICE, DIODE: silicon; Texas Instruments part no. 1N751A	353-2710-00
CR610	SEMICONDUCTOR DEVICE, DIODE: same as CR607	353-0160-00
J601	JACK, TIP: insulated tip u/w standard 0.080 in. test probes; brown; E. F. Johnson Co. part no. 105-208-200	360-0152-00
J602	JACK, TIP: insulated tip u/w standard 0.080 in. test probes; red; E. F. Johnson Co. part no. 105-202-200	360-0150-00
J603	JACK, TIP: insulated tip u/w standard 0.080 in. test probes; orange; E. F. Johnson Co. part no. 105-206-200	360-0154-00
J604	JACK, TELEPHONE: steel, miniature; panel mtg; Switchcraft, Inc. part no. 3501FP	360-0148-00
J605	JACK, TELEPHONE: same as J604	360-0148-00
L601	COIL, RADIO FREQUENCY: 82 uh ±10%, 2.3 ohms max d-c resistance, 570 ma current rating; Jeffers Electronics part no. 10404-112	240-0192-00
L602	INDUCTOR, RADIO FREQUENCY: toroidal, single layer wound, approx 22 turns #28 double formvar; 2.4 uh ±2%, at 2.6 mc	240-1529-00
L603	COIL, RADIO FREQUENCY: variable; +15°C to +55°C temp range; 100 v d-c dielectric strength	278-0733-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
L604	COIL, RADIO FREQUENCY: universal wound, 3 pi; 72 turns ea section, #36 AWG wire; 220 uh inductance; 100 ma current; Delevan Electric part no. BS-217	240-0198-00
L605	COIL, RADIO FREQUENCY: same as L604	240-0198-00
L606	COIL, RADIO FREQUENCY: same as L603	278-0733-00
L607	COIL, RADIO FREQUENCY: same as L604	240-0198-00
L608	COIL, RADIO FREQUENCY: same as L603	278-0733-00
L609	COIL, RADIO FREQUENCY: same as L604	240-0198-00
L610	COIL, RADIO FREQUENCY: 1.00 uh ±10%, 0.30 ohm d-c resistance; 850 ma dc; Jeffers Electronics part no. 10100-128	240-0062-00
L611	COIL, RADIO FREQUENCY: same as L603	278-0733-00
L612	COIL, RADIO FREQUENCY: same as L604	240-0198-00
L613	NOT USED	
L614	COIL, RADIO FREQUENCY: single layer wound, 56 uh inductance, 750 ma current; 1.30 ohms d-c; Jeffers Electronics Div. of Speer Carbon Co. part no. 10404-30	240-0191-00
L615	COIL, RADIO FREQUENCY: same as L601	240-0192-00
L616	COIL, RADIO FREQUENCY: same as L604	240-0198-00
P601	PLUG, TELEPHONE: brass; phenolic insulation, w/ solder-lug terminal; Switchcraft part no. 3501MC	361-0062-00
P602, P603	NOT USED	
P604	PHONO, PLUG: w/ solder-lug terminals, phenolic insulation; Switchcraft, Inc. part no. 3501MC	361-0062-00
Q601	TRANSISTOR: germanium; hermetically sealed; Radio Corp. of America part no. 2N1396	352-0376-00
Q602	TRANSISTOR: germanium; Radio Corp. of America part no. 2N1225	352-0135-00
Q603	TRANSISTOR: same as Q602	352-0135-00
Q604	TRANSISTOR: hermetically sealed, NPN silicon; Fairchild Semiconductor Corp. part no. 2N708	352-0322-00
Q605	TRANSISTOR: same as Q602	352-0135-00
Q606	TRANSISTOR: same as Q604	352-0322-00
Q607	TRANSISTOR: silicon planar; hermetically sealed; Fairchild Semiconductor Corp. part no. S4639	352-0373-00
Q608	TRANSISTOR: same as Q601	352-0376-00
R601	RESISTOR, FIXED, FILM: 21,500 ohms ±1%, 1/4 w	705-7160-00
R602	RESISTOR, FIXED, FILM: 12,100 ohms ±1%, 1/4 w	705-7148-00
R603	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w	745-1352-00
R604	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%, 1/2 w	745-1422-00
*R605	RESISTOR, FIXED, FILM: 1470 ohms ±1%, 1/4 w	705-7104-00
*R605	RESISTOR, FIXED, FILM: 1960 ohms ±1%, 1/4 w	705-7110-00
*R605	RESISTOR, FIXED, FILM: 4220 ohms ±1%, 1/4 w	705-7126-00
*R605	RESISTOR, FIXED, FILM: 1000 ohms ±1%, 1/4 w	705-7096-00
R606	RESISTOR, FIXED, FILM: 19,600 ohms ±1%, 1/4 w	705-7158-00
R607	RESISTOR, FIXED, FILM: 2610 ohms ±1%, 1/4 w	705-7116-00
R608	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1/2 w	745-1394-00
R609	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%, 1/2 w	745-1384-00
R610	RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%, 1/2 w	745-1412-00
R611	RESISTOR, FIXED, COMPOSITION: 1500 ohms ±10%, 1/2 w	745-1359-00
R612	RESISTOR, FIXED, COMPOSITION: 1800 ohms ±10%, 1/2 w	745-1363-00
R613	RESISTOR, FIXED, FILM: 42.2 ohms ±1%, 1/4 w	705-7030-00
R614	RESISTOR, FIXED, FILM: 51.1 ohms ±1%, 1/4 w	705-7034-00
R615	RESISTOR, FIXED, COMPOSITION: same as R608	745-1394-00
R616	RESISTOR, FIXED, COMPOSITION: same as R608	745-1394-00
R617	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1/2 w	745-1380-00
R618	RESISTOR, FIXED, FILM: 261 ohms ±1%, 1/4 w	705-7068-00
R619	RESISTOR, FIXED, COMPOSITION: same as R612	745-1363-00
R620	RESISTOR, FIXED, COMPOSITION: same as R612	745-1363-00
R621	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%, 1/2 w	745-1387-00
R622	RESISTOR, FIXED, COMPOSITION: same as R617	745-1380-00
R623	RESISTOR, FIXED, COMPOSITION: same as R621	745-1387-00
R624	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%, 1/2 w	745-1324-00
R625	RESISTOR, FIXED, COMPOSITION: same as R612	745-1363-00
R626	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%, 1/2 w	745-1366-00
R627	RESISTOR, FIXED, COMPOSITION: 390 ohms ±10%, 1/2 w	745-1335-00
R628	RESISTOR, FIXED, FILM: 1960 ohms ±1%, 1/4 w	705-7110-00
R629	RESISTOR, FIXED, FILM: same as R628	705-7110-00
R630	RESISTOR, FIXED, FILM: 8250 ohms ±1%, 1/4 w	705-7140-00
R631	RESISTOR, FIXED, FILM: 1100 ohms ±1%, 1/4 w	705-7098-00
R632	RESISTOR, FIXED, FILM: same as R631	705-7098-00
*R633	RESISTOR, FIXED, FILM: 3480 ohms ±1%, 1/4 w	705-7122-00
*R633	RESISTOR, FIXED, FILM: 4220 ohms ±1%, 1/4 w	705-7126-00
*R633	RESISTOR, FIXED, FILM: 5110 ohms ±1%, 1/4 w	705-7130-00
*R633	RESISTOR, FIXED, FILM: 10,000 ohms ±1%, 1/4 w	705-7144-00
R634	RESISTOR, FIXED, FILM: 348 ohms ±1%, 1/4 w	705-7074-00
R635	RESISTOR, VARIABLE: COMPOSITION; 50,000 ohms ±30%, 1/4 w	376-4737-00
R636	RESISTOR, FIXED, FILM: 1000 ohms ±1%, 1/4 w	705-7096-00
R637	RESISTOR, FIXED, FILM: 7500 ohms ±1%, 1/4 w	705-7138-00
R638	RESISTOR, FIXED, FILM: 100,000 ohms ±1%, 1/4 w	705-7192-00
R639	RESISTOR, FIXED, FILM: 316 ohms ±1%, 1/4 w	705-7072-00
R640	RESISTOR, FIXED, FILM: 5110 ohms ±1%, 1/4 w	705-7130-00
R641	RESISTOR, VARIABLE: COMPOSITION; 50,000 ohms ±30%, 1/4 w	376-4732-00
R642	RESISTOR, FIXED, FILM: 13,300 ohms ±1%, 1/4 w	705-7150-00
R643	RESISTOR, FIXED, FILM: 2870 ohms ±1%, 1/4 w	705-7118-00
R644	RESISTOR, FIXED, COMPOSITION: 0.10 megohm ±10%, 1/2 w	745-1436-00
R645	RESISTOR, FIXED, COMPOSITION: same as R644	745-1436-00
R646	RESISTOR, FIXED, COMPOSITION: same as R644	745-1436-00
R647	RESISTOR, FIXED, COMPOSITION: 150 ohms ±10%, 1/2 w	745-1317-00
R648	RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%, 1/2 w	745-1345-00
R649	RESISTOR, FIXED, COMPOSITION: same as R608	745-1394-00
R650	RESISTOR, FIXED, COMPOSITION: same as R626	745-1366-00
R651	RESISTOR, FIXED, COMPOSITION: 22 ohms ±10%, 1/2 w	745-1282-00
T601	TRANSFORMER, RADIO FREQUENCY: 5 terminals primary, ct; 5/8 in. h by 1-1/8 in. w by 1-1/2 in. lg; Collins Radio Co.	549-1617-003
TB601	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1520-A	306-9033-00
TB602	TERMINAL BOARD: phenolic, 1/16 in. by 3/8 in. by 1-1/2 in.; 4 brass solder lug terminals; Cinch Mfg. Corp. part no. 1532-A	306-9032-00
TB603	TERMINAL BOARD: same as TB602	306-9032-00
TB604	TERMINAL BOARD: same as TB601	306-9033-00
TB605	TERMINAL BOARD: same as TB601	306-9033-00
TB606	TERMINAL BOARD: same as TB601	306-9033-00
TB607	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1525-A	306-0001-00
TB608	TERMINAL BOARD: phenolic, 1-7/8 in. by 3/8 in. by 1/16 in.; 5 brass solder-lug terminals; Cinch Mfg. Corp. part no. 1542-A-FV	306-0951-00
TB609	TERMINAL BOARD: same as TB608	306-0951-00
TB610	TERMINAL BOARD: laminated phenolic w/ 4 solder lug terminals; 27/32 in. w by 1-1/12 in. lg overall; Cinch Mfg. Corp. part no. 1909	306-0838-00
TB611	TERMINAL BOARD: same as TB610	306-0838-00
TB612	TERMINAL BOARD: same as TB601	306-9033-00
TB613	TERMINAL BOARD: same as TB601	306-9033-00
TB614	TERMINAL BOARD: phenolic, 12 solder lug terminals; Vector Mfg. Co. part no. 6H-12	306-0909-00
TB615	TERMINAL BOARD: same as TB608	306-0951-00
TB616	TERMINAL BOARD: phenolic, 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg	306-0587-00

*Chosen per operational requirement.

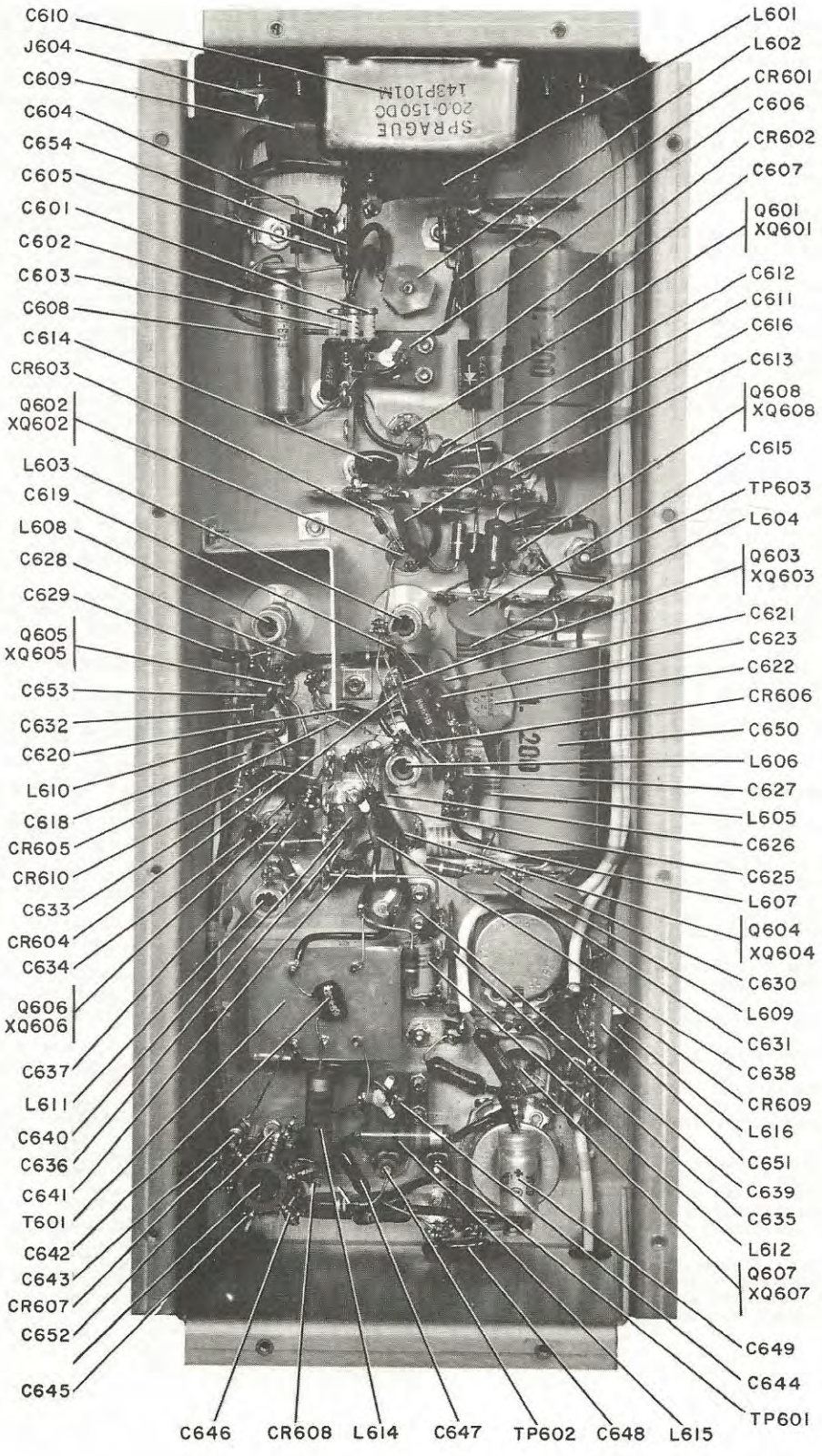


Figure 4-1. Modulator Compartment, Component (Except Resistors) Identification

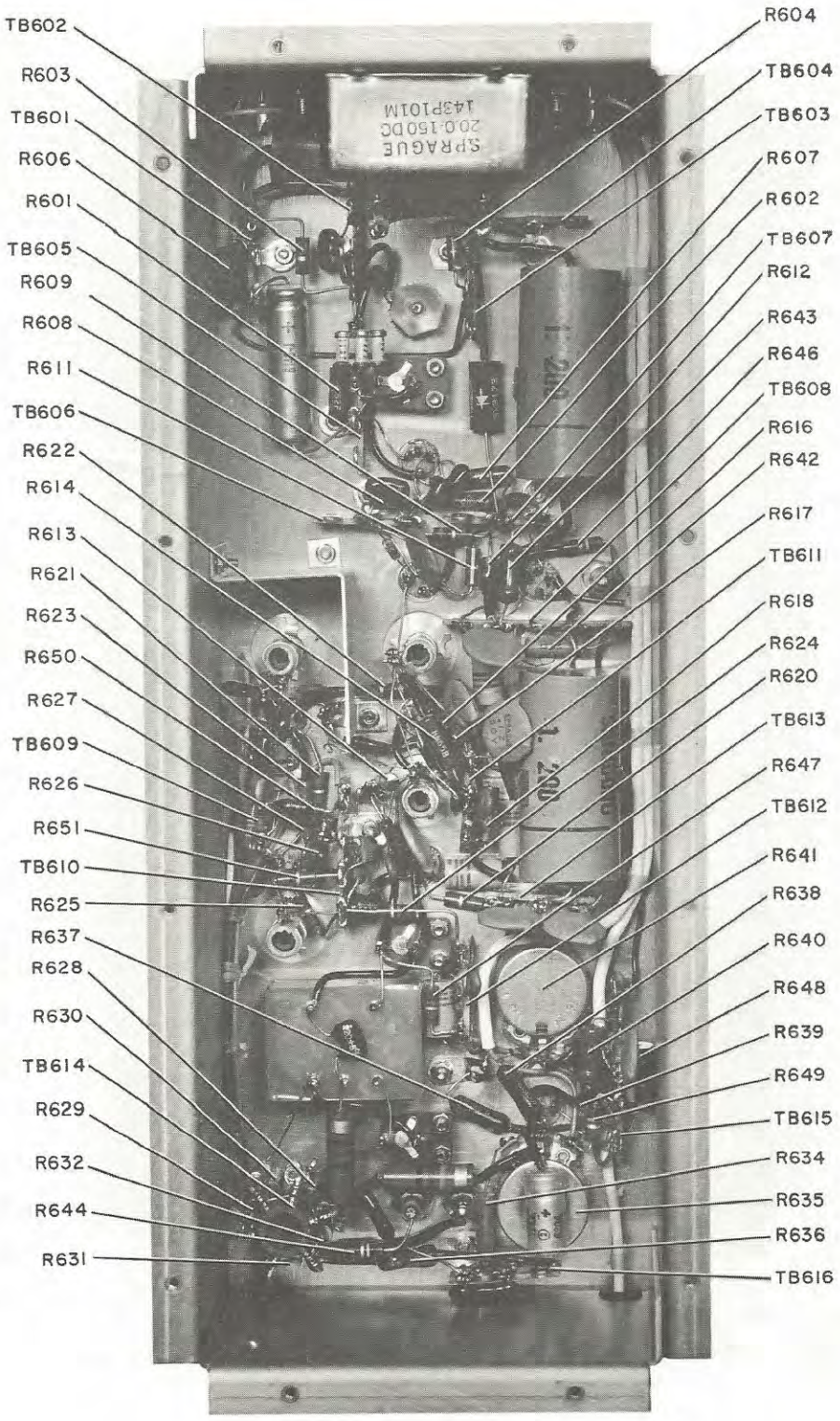


Figure 4-2. Modulator Compartment, Resistor Identification

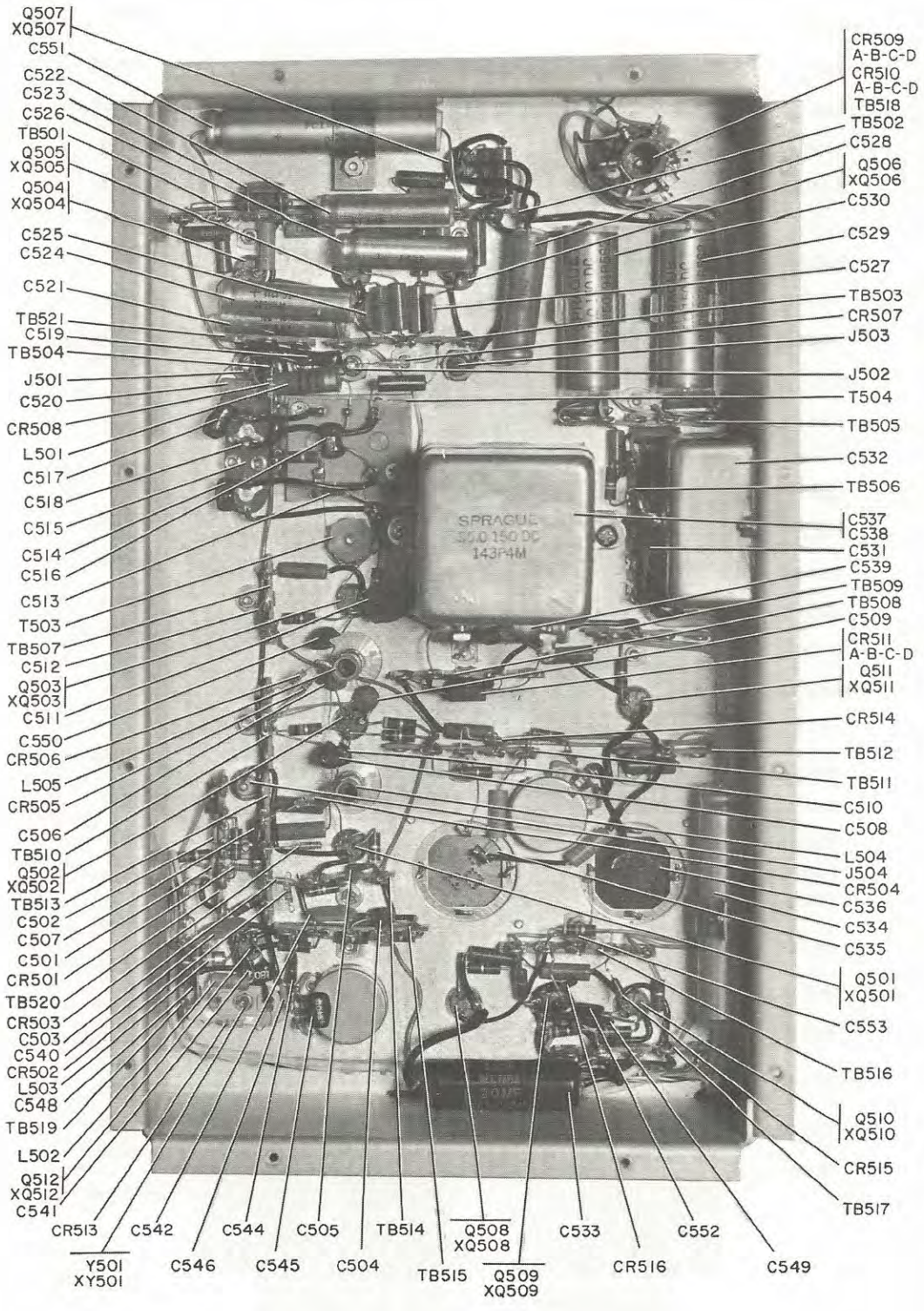


Figure 4-3. AFC Compartment, Component (Except Resistors) Identification

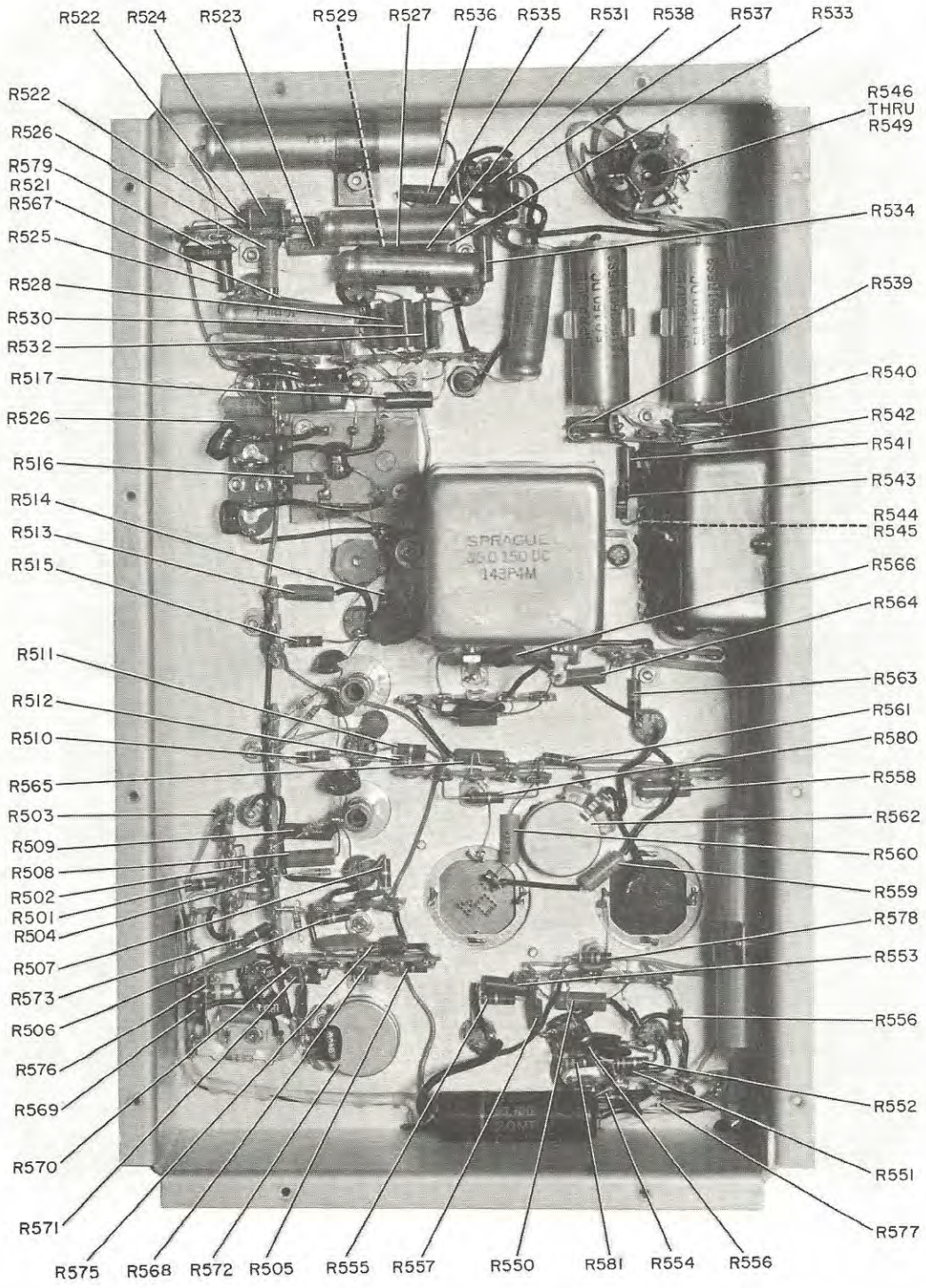


Figure 4-4. AFC Compartment, Resistor Identification

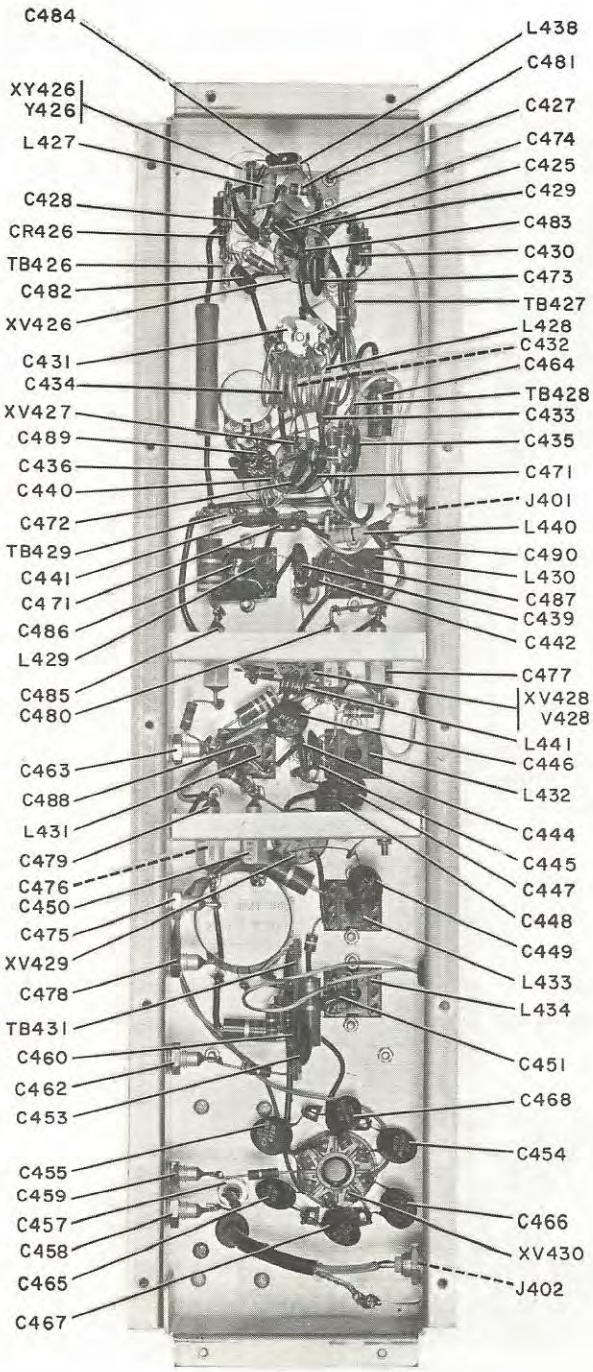


Figure 4-5. Power Amplifier Compartment, Component (Except Resistors) Identification

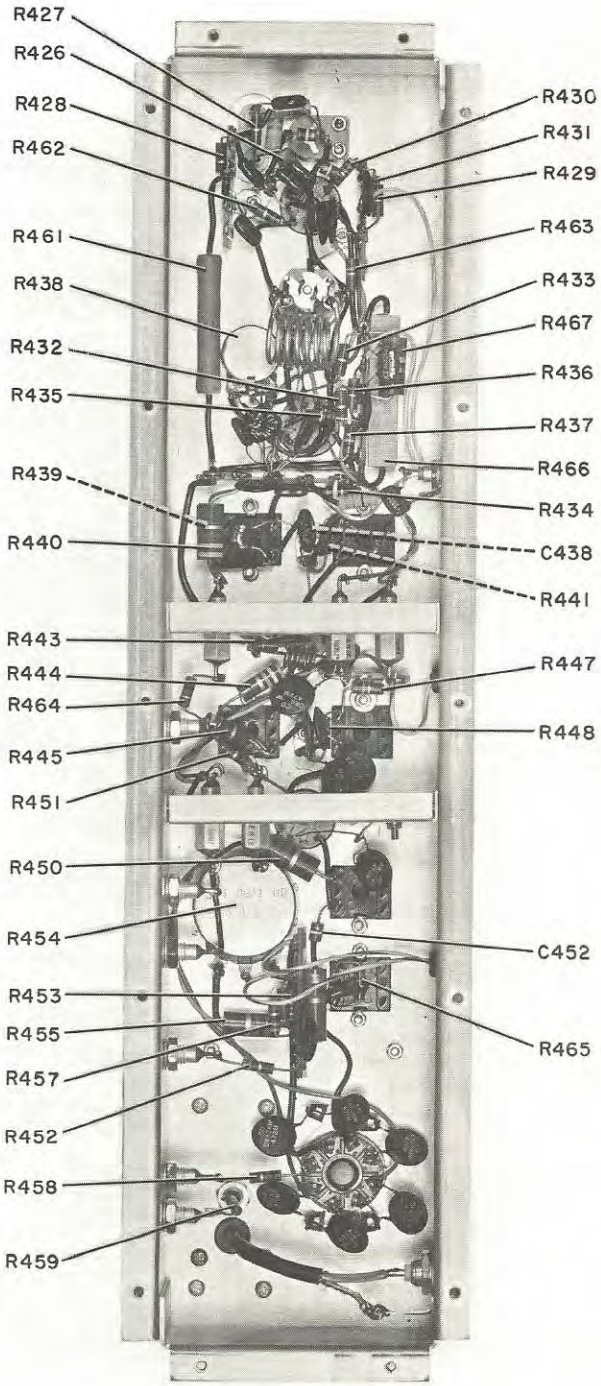


Figure 4-6. Power Amplifier Compartment, Resistor Identification

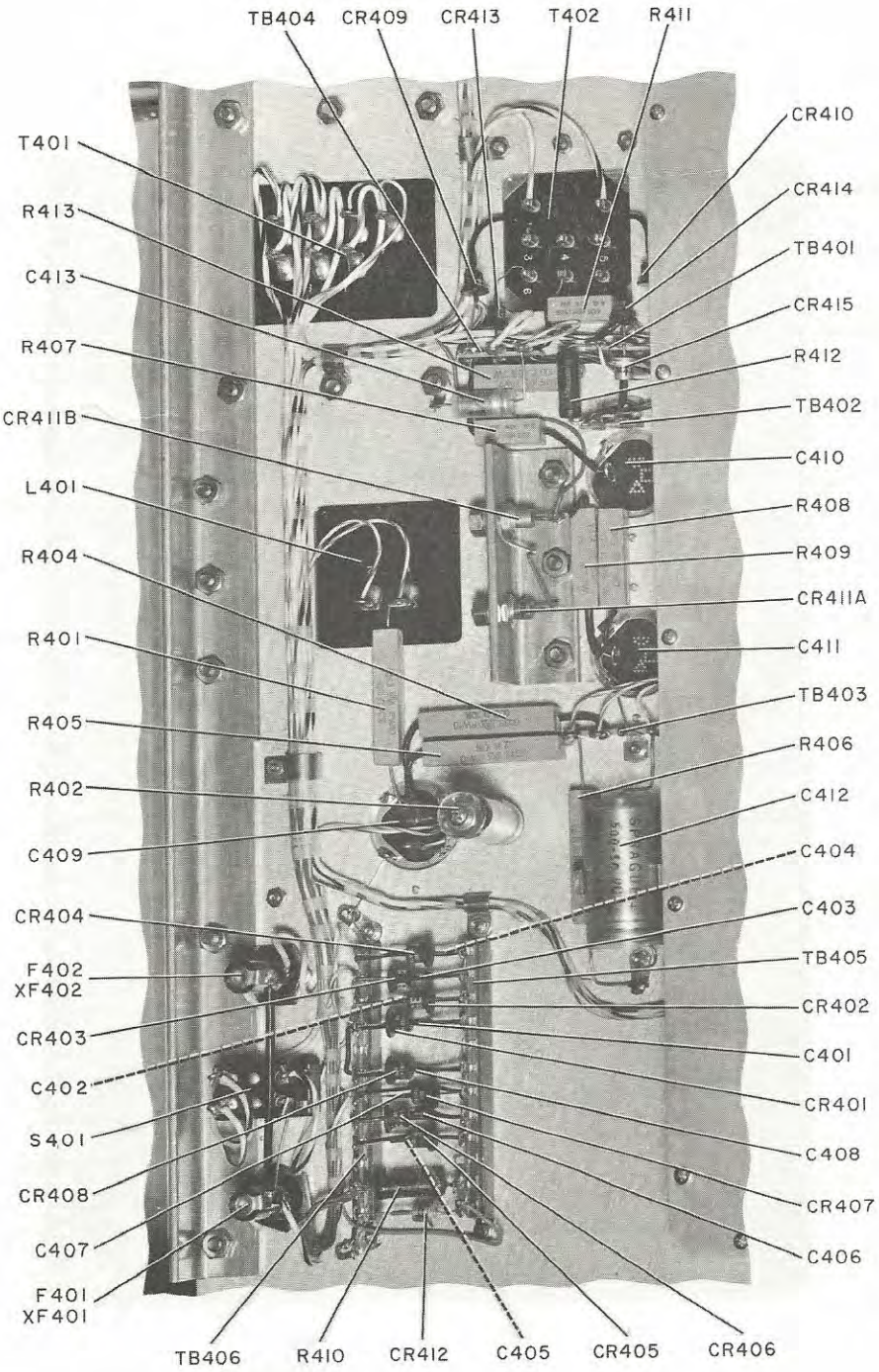


Figure 4-7. Power Supply, Component Identification

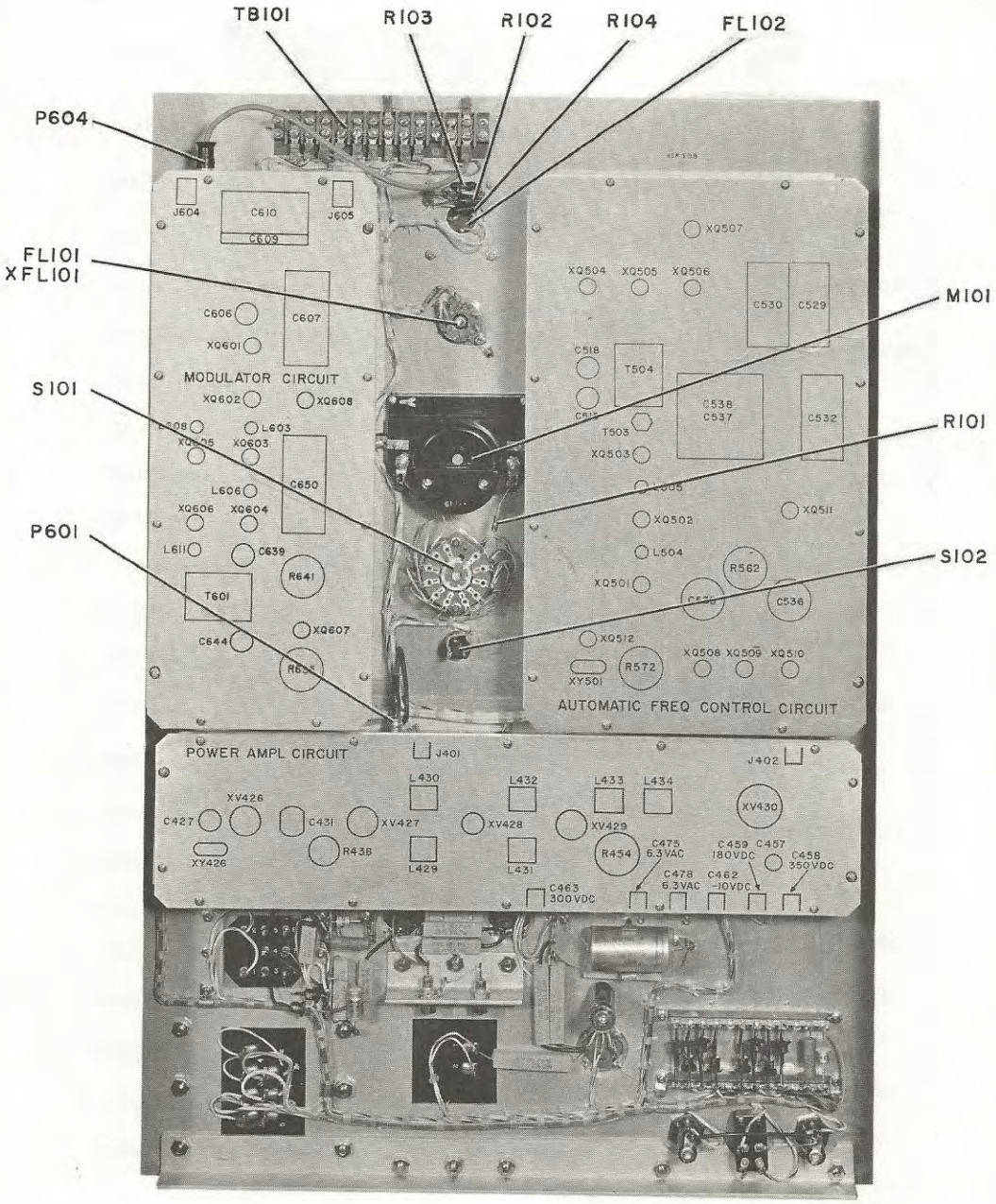


Figure 4-8. Chassis, Component Identification

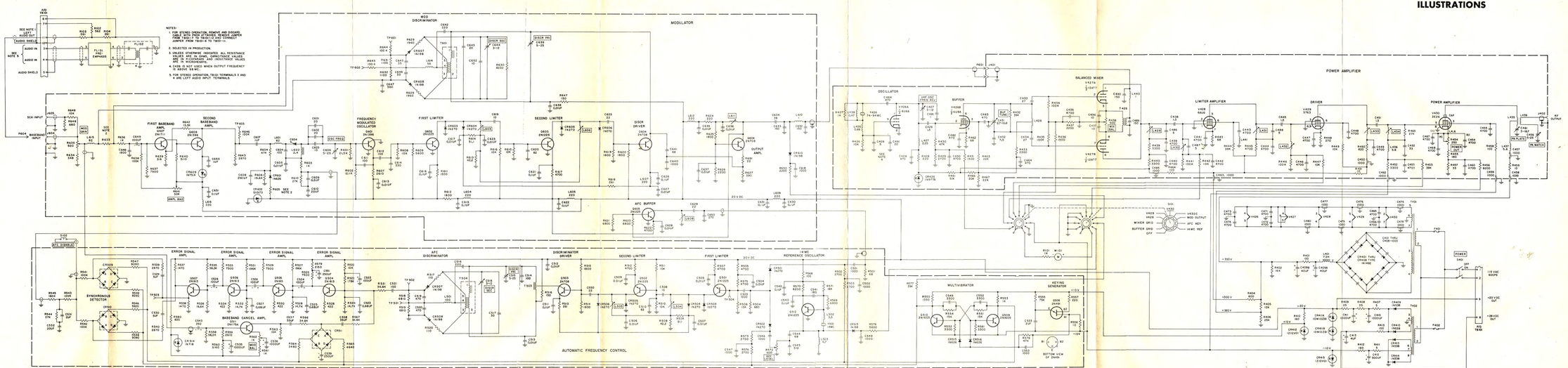


Figure 5-1. A830-2 10 W Wide-Band FM Broadcast Exciter, Schematic Diagram

786M-1
Stereo Generator

COLLINS

unit instructions

Collins Radio Company | Dallas, Texas

TD-537
523-0755304-102438
2nd Edition, 15 October 1963
1st Revision, 1 January 1967

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SECTION I
GENERAL DESCRIPTION

1.1 PURPOSE OF INSTRUCTION BOOK.

Unit Instructions TD-537 provides information about 786M-1 Stereo Generator, Collins part number 522-2914-00. Information which is furnished includes a general description of the equipment, principles of operation, maintenance procedures, and a parts list.

1.2 PURPOSE OF THE EQUIPMENT.

The 786M-1 Stereo Generator is used to convert stereophonic audio input signals into main and stereophonic subchannel signals and to generate a pilot subcarrier. The resultant signal is suitable for modulation of wideband FM broadcast exciters.

1.3 DESCRIPTION OF EQUIPMENT.

1.3.1 PHYSICAL DESCRIPTION.

The 786M-1 Stereo Generator, shown in figure 1-1, is constructed on a standard 19-inch rack-mounted panel. This panel is 19 inches wide, 10-1/2 inches high, 7 inches deep, and weighs approximately 14 pounds. All operating controls are located on the front panel with seldom-used adjustments located inside the back panel. A meter is placed conveniently on the lower left portion of the front panel for monitoring of input and output signals. All transistors and the 38-kc crystal are placed on the front panel for convenient access. Bulky components are grouped in the upper right-hand corner of the front panel leaving the remaining portion of the panel free of obstacles for ease of maintenance and adjustment. All components located in the rear of the unit are protected in a dust-resistant enclosure.

1.3.2 ELECTRICAL DESCRIPTION.

The 786M-1 Stereo Generator is an all transistorized unit consisting of the following circuits; a crystal controlled 38-kilocycle oscillator, a 19-kilocycle locked oscillator, a meter amplifier, two audio amplifiers, and a balanced modulator. All components for operation of the time division stereo generator are

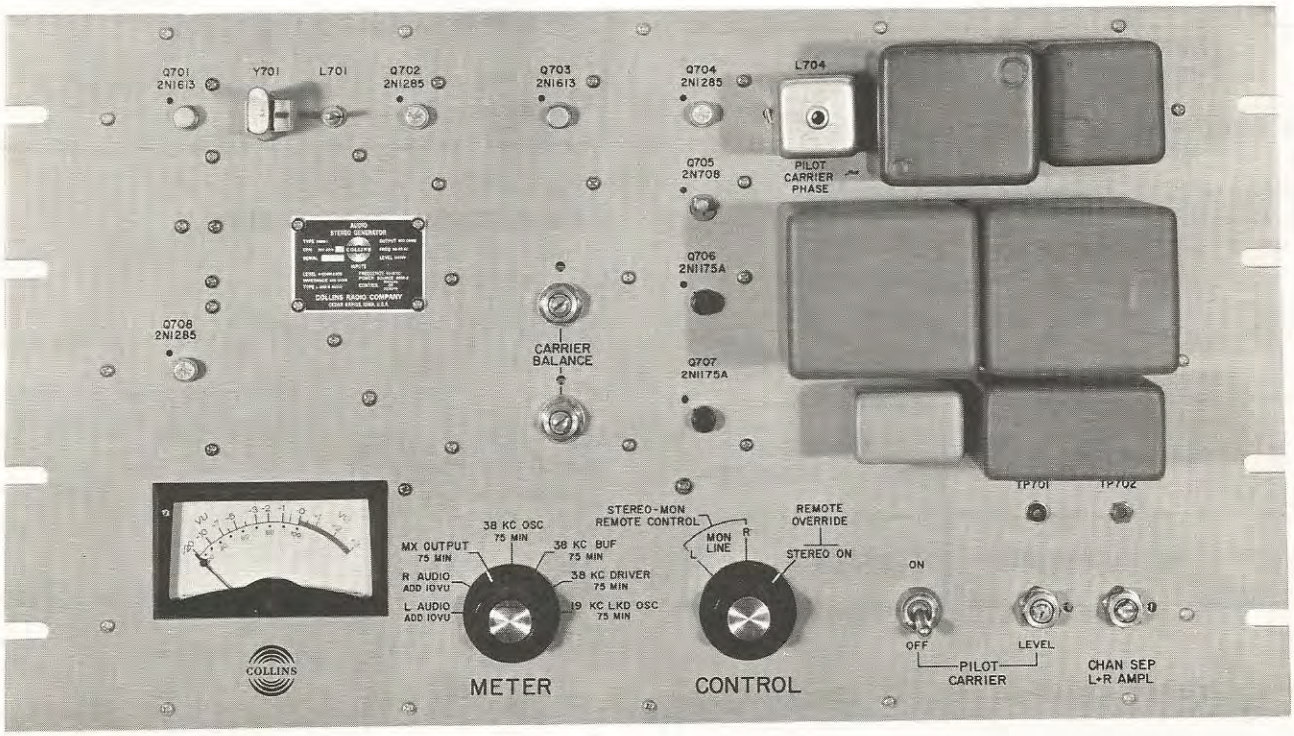


Figure 1-1. 786M-1 Stereo Generator, Over-all View

contained within the 19-inch rack-mounted panel with the exception of a left audio channel pre-emphasis network. This function must be supplied externally and is available in the Collins A830-2 10 W Wide-Band FM Broadcast Exciter.

Power input required is 20 ±0.1 volts d-c which is supplied by the A830-2. Remote control can be exercised over the stereophonic and monophonic modes. Power required for operation of remote control is 28 ±2.8 volts d-c. Instruction books covering the exciter and power amplifiers, used in conjunction with the 786M-1, are listed in table 1-1.

TABLE 1-1
ASSOCIATED EQUIPMENT INSTRUCTION BOOKS

ASSOCIATED EQUIPMENT	INSTRUCTION BOOK PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	TD-536
B830-1 250-Watt FM Power Amplifier	TD-538
D830-1 1000-Watt FM Power Amplifier	TD-567
E830-1 5-Kw FM Power Amplifier	TD-539

1.4 EQUIPMENT SUPPLIED.

Table 1-2 lists equipment that is supplied as part of the 786M-1 Stereo Generator.

TABLE 1-2
EQUIPMENT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
786M-1 Stereo Generator	522-2914-00

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Table 1-3 lists equipment that is required for operation of the 786M-1 Stereo Generator but not supplied as part of the 786M-1.

TABLE 1-3
EQUIPMENT REQUIRED BUT NOT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	522-2714-00

1.6 ACCESSORY EQUIPMENT.

Table 1-4 lists accessory equipment that is available for use with 786M-1 Stereo Generator.

TABLE 1-4
ACCESSORY EQUIPMENT

EQUIPMENT	COLLINS PART NUMBER
B830-1 250-Watt FM Power Amplifier	549-2008-00
D830-1 1000-Watt FM Power Amplifier	522-2948-00
E830-1 5-Kw FM Power Amplifier	549-2009-00
250-Watt/1-Kw Harmonic Filter	549-2010-00

1.7 EQUIPMENT SPECIFICATIONS.

1.7.1 MECHANICAL.

Weight	14 pounds approximately.
Size	19 inches wide, 10-1/2 inches high, 7 inches deep.
Ambient temperature range	+15°C (59°F) to 45°C (113°F).
Ambient humidity range	0 to 95% relative humidity.
Altitude	0 to 7500 feet.

1.7.2 ELECTRICAL.

Power source	20 ±0.1 volts d-c.
	28 ±2.8 volts d-c (for remote operation).

Input . . . . . Balanced 600 ohms, left and right channels.

Input level . . . . . 10 ±2 dbm for 100% composite modulation.

Frequency range . . . 30 to 15,000 cps for each channel.

Output level . . . . . 280 ±50 mv peak to peak.

Pilot carrier frequency . . . . . 19 kc ±2 cps.

Pilot carrier level . . Equivalent to 9% ±1% modulation of the main carrier.

Channel separation . . Greater than 30 db, 50 cps to 15,000 cps.

Crosstalk . . . . . More than 40 db below single channel level.

Distortion . . . . . Less than 0.5% over the frequency range of 30 to 15,000 cps.

38-kc subcarrier suppression . . . . . 40 db below output with 10-dbm input level.

Main channel and stereophonic subcarrier phase relationship. . . ±3 degrees for audio frequencies from 50 to 15,000 cps.

Audio-frequency response . . . . . Complies with FCC standard 75-microsecond pre-emphasis curve (right channel only, left channel pre-emphasis is obtained from exciter).

1.8 SEMICONDUCTOR COMPLEMENT.

Table 1-5 lists the semiconductor complement supplied as part of 786M-1 Stereo Generator.

TABLE 1-5. SEMICONDUCTOR COMPLEMENT

SYMBOL	QUANTITY	TYPE	FUNCTION
Q701	1	2N1613	38-kc oscillator
Q702	1	2N1285	38-kc buffer
Q703	1	2N1613	38-kc driver
Q704	1	2N1285	38-kc isolation amplifier
Q705	1	2N708	19-kc locked oscillator
Q706	1	2N1175A	Left audio amplifier
Q707	1	2N1175A	Right audio amplifier
Q708	1	2N1285	Meter amplifier
CR702	4	1N270	Balanced modulator diode switches

SECTION II
PRINCIPLES OF OPERATION

2.1 GENERAL.

The 786M-1 Stereo Generator provides facilities for the conversion of stereophonic input signals to an output which conforms to the standards approved by the FCC for the transmission of stereophonic signals. The following paragraphs discuss stereophonic principles and the operation of the 786M-1 Stereo Generator.

2.2 PRINCIPLES OF FM STEREO.

2.2.1 STEREOPHONIC SOUND SYSTEMS.

An elementary stereophonic sound system consists of two directional microphones placed to the right and left of a sound source. See figure 2-1. Each microphone in turn is connected to an amplifier and speaker system. When the listener is situated between the speakers, the left channel will be received by the left ear and the right channel will be received by the right ear. The effect upon the listener of such a system is to simulate placing the listener at a point midway between the two microphones and receiving a true representation of the originating sound source.

To provide a realistic stereo effect, the difference in time delay and signal amplitude from the sound source to each of the microphones must be maintained through the entire stereo system. If the time delay or amplitude difference is changed in one of the amplifier or speaker systems, the effect to the listener will be a change in direction of the sound source, when in reality no change has occurred. A change in time delay of the left or right channel is referred to as a phase relationship change. This phase relationship change between the channels must be held, in stereo transmitting equipment, to within ±3 degrees.

If the amplitude difference and time delay in each system is identical (as when the sound source is centered between the microphones), the sound source will

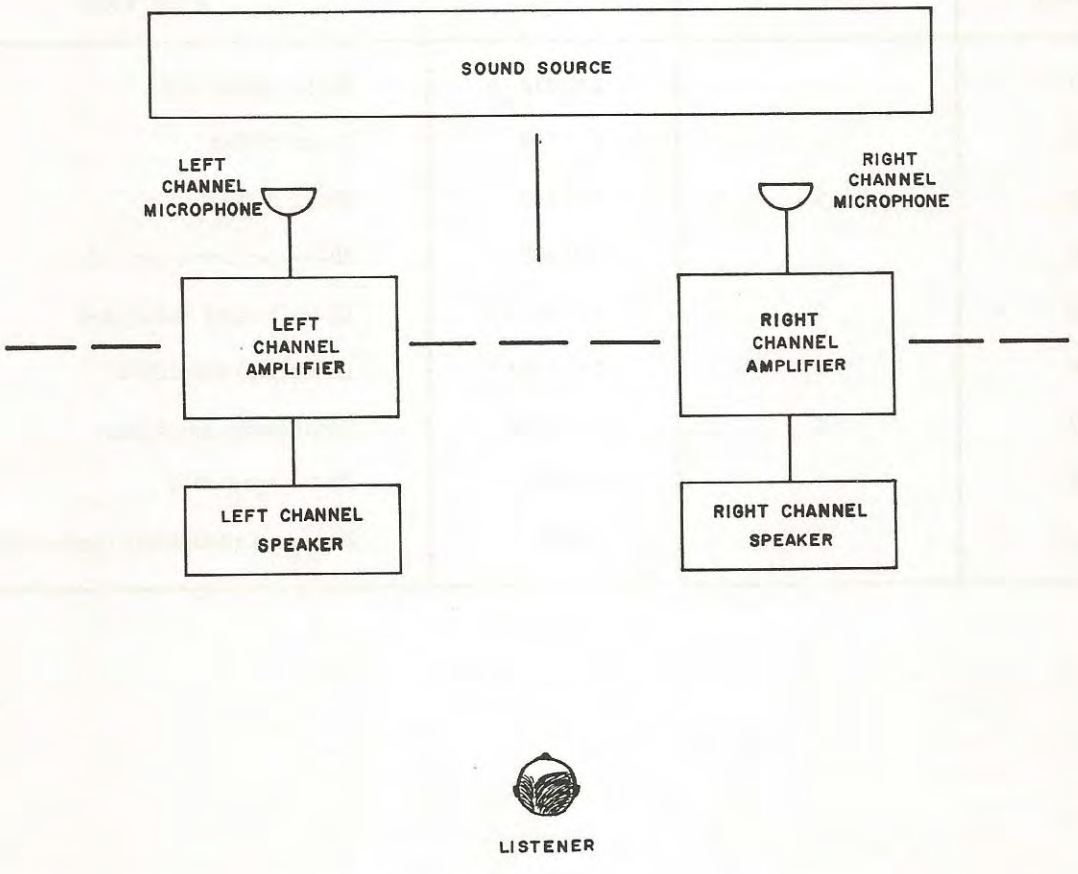


Figure 2-1. Elementary Stereophonic System

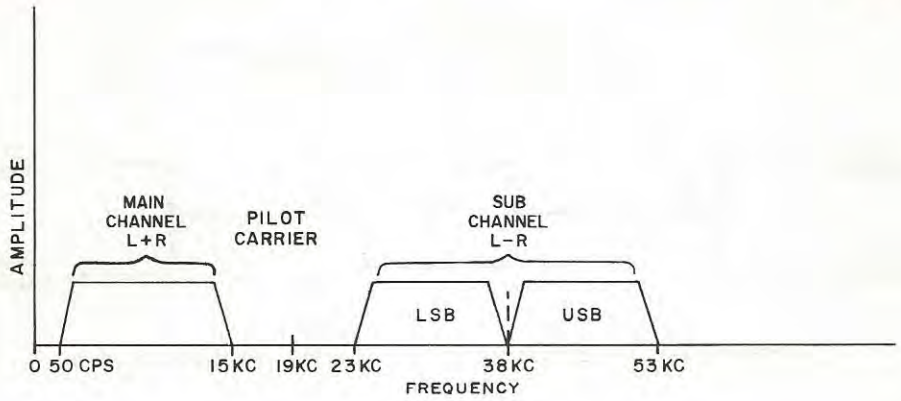


Figure 2-2. Spectrum of Signals in Baseband Audio

appear to the listener to be centered between the speakers. This is actually the true relationship of the microphones and the sound source.

To enhance the stereo effect to the listener, it is desirable for each microphone to be directional, as stated previously, so that sounds originating directly in front of the right microphone will be received by the right microphone, and as little as possible by the left microphone, and vice versa. If too much of the right sound source is picked up by the left microphone or vice versa, the effect to the listener will be to move the sound source to the center. This isolation between the two sound systems is known as channel separation and must be held greater than 29.7 db in stereo transmitting equipment.

If proper isolation of the amplifiers is not obtained, and there is an interchange of signals, the sound source will again appear to move toward the center. If the channel separation is reduced to zero, the effect would be to replace the two microphones with a single microphone feeding the same information to both amplifier and speaker systems. It is then understood that monophonic operation can be obtained by paralleling (adding) the left and right microphone outputs. This monophonic component is referred to as L+R.

An interchange of information between channels (main and subchannel) is referred to as crosstalk. Crosstalk will deteriorate the stereo signals by adding noise to the signal. In stereo transmitting systems, crosstalk must remain at least 40 db below a single channel level.

2.2.2 METHODS OF GENERATING FCC STEREO.

Signals which are prescribed by the FCC for the transmission of stereophonic intelligence is shown in figure 2-2. This band of frequencies must be generated and transmitted in order that both monaural and stereophonic receivers will be able to detect the FM signal. For monaural receivers, only the L+R (left plus right) channel is received, with the pilot carrier and L-R (left minus right) signals rejected by the pass band of the monaural receiver. Stereophonic FM receivers detect the complete band of frequencies in a discriminator and will process the signals into left and right stereophonic channels. The 19-kc pilot carrier is used in this process. The method of generating the signals shown in figure 2-2 depends upon the method chosen for modulating an FM signal.

The methods of modulating an FM signal may be broken down into two groups, a direct and an indirect method. These two general categories may be broken down further into various methods of obtaining the end result. Phase modulation is the most generally used method of generating an FM signal by the indirect method. If this system is used to modulate the composite stereo signal, various problems are encountered. The most serious problem is that of frequency response of the phase modulator. As the phase modulator audio response exhibits nonlinear modulation characteristics (rises 6 db per octave from the lowest to the highest frequency), predistortion is employed to compensate for this trait. In a stereo FM phase modulator this predistortion would amount to 65.5 db over the entire modulating frequency range of 50 cps to 75 kc (SCA added to stereo signal). When a 65-db signal to noise ratio and a 60-db dynamic range is added to this, it is apparent that baseband amplifiers cannot be built to give this characteristic.

It is possible to split the phase modulation into two steps and modulate one phase modulator with the L+R signal and the second phase modulator with the L-R and pilot carrier signals. This type of stereophonic phase modulation is not desirable because of the required phase linearity of ±3 degrees and the gain requirements of stereophonic transmission systems. These requirements are difficult, if not impossible, to maintain.

Another method of FM stereophonic modulation which could be employed is a combination of direct and indirect modulation. With this method the L+R signal directly FM modulates an oscillator, while the L-R signal phase modulates the signal produced in the oscillator, in a later stage. As in phase modulation of the stereophonic signal, it is difficult to maintain phase linearity and gain characteristics.

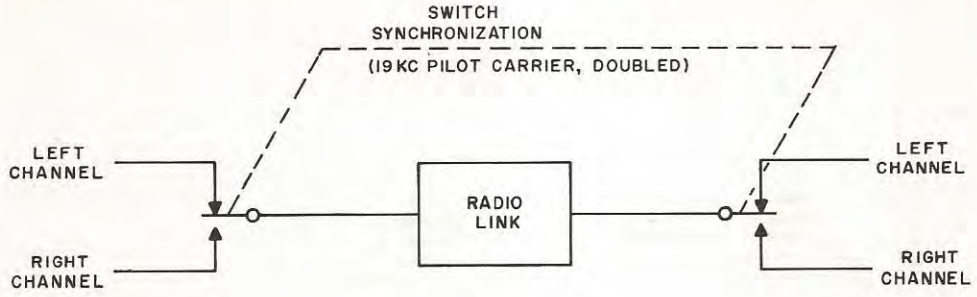


Figure 2-3. An Elementary Time Division Multiplex System

A third method of generating a stereophonic FM signal is by the use of direct modulation over the entire stereophonic generator frequency range. Phase relationship and gain characteristics are then easy to maintain because of the point input source. Until recently, it has been difficult to directly modulate an FM signal with a wide bandwidth of signals. With the advent of solid state components and specifically the production of the variable capacity diode, this wide-band type of modulation is possible. This is the type of modulation used in the Collins A830-2 10 W Wide-Band FM Broadcast Exciter. The development of the wide-band type of modulator made possible the development of 786M-1 Stereo Generator which is discussed in paragraph 2.3.

2.3 PRINCIPLES OF OPERATION OF 786M-1.

The 786M-1 Stereo Generator generates the spectrum of signals shown in figure 2-2 by the time division multiplex method. By this method, shown simplified in figure 2-3, the left and the right channels are switched alternately at a 38-kc rate. If the receiver switching rate is synchronized with the transmitter switching rate, the original left and right audio signals will be detected. In the receiver, the 19-kc pilot carrier is doubled to synchronize the receiver to the transmitter. It is important that the switching frequency in both the stereo generator and the receiver be of the same phase to retain the identity of the left and right audio signals.

The mathematical analysis of two audio signals being switched alternately by a square wave shows that the resultant signal is made up of two components of interest. One component is directly proportional to the sum of the two audio signals (L+R) and the other is a double-sideband (DSB) signal centered on a frequency equal to the switching frequency (38 kc). The modulation appearing on this DSB signal is directly proportional to the difference of the two audio channels (L-R). If L is defined as the audio signal in the left channel, R is defined as the audio signal in the right channel, and f_c is defined as the switching frequency, the composite signal is equal to:

$$\frac{L+R}{2} + \frac{2}{\pi}(L-R)\cos 2\pi f_c t - \frac{2}{3\pi}(L-R)\cos 6\pi f_c t + \frac{2}{5\pi}(L-R)\cos 10\pi f_c t \text{ etc.}$$

The first term of this expansion is the main channel component, the second term is the stereophonic subchannel component, and the remaining terms are higher frequency terms which are undesired.

The following is a block diagram explanation of the 786M-1 Stereo Generator which generates the signals just mentioned. Refer to figure 2-4. It is noted on the block diagram that the left audio channel is fed through the pre-emphasis network and high-pass filter of the A830-2 wide-band exciter and then to the 786M-1.

The right audio channel utilizes the pre-emphasis network and the high-pass filter located in the 786M-1. The outputs of the high-pass filters are fed through 15-kc low-pass filters where audio components above 15 kc are attenuated sharply. The 15-kc filter outputs are then fed to emitter follower amplifiers where isolation of the two channels from the balanced modulator is obtained. The two-channel audio output is then fed to a balanced modulator whose action resembles that of a switch. The balanced modulator utilizes the signal generated in the 38-kc oscillator to alternately switch on and off each audio channel. The balanced modulator consists of the composite spectrum which includes both desired and undesired components. The fundamental 38-kc modulating signal and all even order harmonics are balanced out.

The balanced modulator output is mixed with a small amount of direct L+R signal which equalizes the peak amplitude of the main and subchannel signals. The modulator output is then fed through a 50-cps to 53-kc low-pass linear phase filter where all odd harmonics above 53 kc are attenuated. The filter output is mixed with a 19-kc signal from the pilot carrier phase locked oscillator and is fed to the 786M-1 output. All FCC phasing, channel separation, crosstalk, and amplitude specifications are satisfied within the 786M-1 Stereo Generator.

2.3.1 DETAILED DESCRIPTION OF 786M-1 STEREO GENERATOR.

Refer to figure 5-1, a schematic diagram of the 786M-1. The right audio channel is identical to the left audio channel except that the pre-emphasis network and the 15-kc filter for the left channel are located within the A830-2 exciter. Only the right channel is discussed in the following paragraphs.

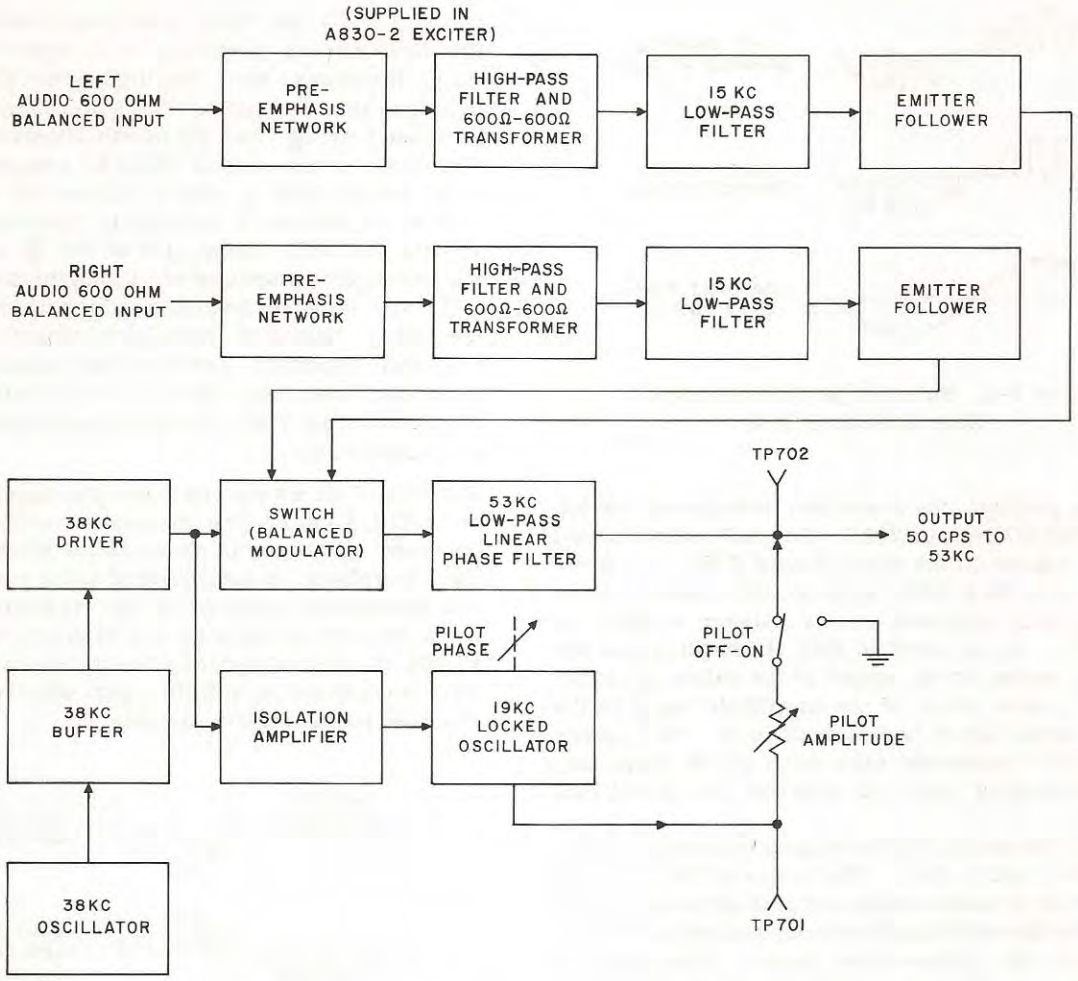


Figure 2-4. 786M-1 Stereo Generator, Block Diagram

The 600-ohm balanced right audio channel is fed into a pre-emphasis network, FL701. Due to the inherently low level of high-frequency audio components in program material, pre-emphasis is employed to overcome the effects of noise which is often found in home receivers. The 786M-1 follows the standard 75-microsecond pre-emphasis curve established by the FCC. The output of pre-emphasis filter FL701 is fed into a 30-cps high-pass filter, FL702, which sharply attenuates audio components below 30 cps. This is necessary to prevent 5-cps audio components from interfering with the 5-cps sampling circuits within the A830-2 exciter. Filter FL702 also transforms the 600-ohm balanced input into a 600-ohm single-ended output.

The output of FL702 is connected to relay K701 which remotely selects either the stereo mode for transmission, or the left or right audio channels for monaural operation. Relay K701 operates by applying 28 volts d-c across the solenoid. This 28-volt d-c source is supplied by the A830-2 exciter. Selection of either the left or right monaural channel is determined by the position of S701. At this point, if either the left or right channel is selected for monaural operation, the single 50-cps to 15-kc audio signal is fed through an 8-db loss pad to the output of the 786M-1 Stereo Generator. The 8-db loss pad is made up of R750, R751, and R752. The resulting audio input to the A830-2 is the same as that obtained without the stereo generator. Switch S701 will also override the remote relay if desired.

If the stereo mode is selected by S701, the audio component is fed to a 15-kc low-pass filter, FL704. FL704 attenuates all frequencies over 15 kc to prevent their interfering with adjacent channels. The output of FL704 is fed to the base of emitter follower Q707, which isolates the audio circuits from the balanced modulator.

The function of the balanced modulator is to generate the L+R and the L-R components shown in figure 2-2. The balanced modulator resembles a switch which samples the left audio channel and the right audio channel in turn. The 38-kc switching frequency and all even order harmonics are balanced out in the modulator output. The 38-kc switching frequency is obtained from the 38-kc driver and is impressed across transformer T701. If the primary switching voltage is negative, the secondary voltage will switch on diodes CR702D and CR702A. Thus, right audio will appear at the secondary center tap. If the primary switching

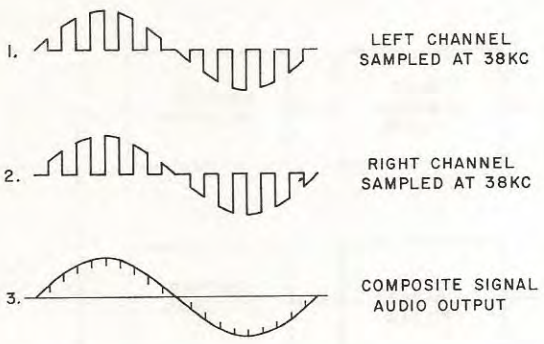


Figure 2-5. Balanced Modulator Output When L+R=2, L-R=0

voltage is positive, the secondary voltage will switch on diodes CR702B and CR702C. The left audio channel will then appear on the secondary of T701. A representation of a sine wave input in each channel (L=R, L+R=2, L-R=0) switched in this manner is shown in figure 2-5. It is seen in this illustration that the composite signal at the output of the balanced modulator is a sine wave of an amplitude equal to the original signal level in each channel. The spikes shown on the composite sine wave result from imperfect switching and are filtered out in FL705.

Figure 2-6 shows the balanced modulator output when R=0, L+R=1, and L-R=1. The output of the balanced modulator is an audio component plus DSB components centered on the switching frequency and odd harmonics which form the square wave shape. When the odd harmonics are filtered out by the 53-kc harmonic filter, FL705, the third waveform results. Because the fundamental component of a square wave is $\frac{4}{\pi}$ times the square wave amplitude, the DSB component is larger than the audio. The audio component is then increased by $\frac{4}{\pi}$ and the fourth illustration results. The audio component is added by resistors R724 and R730 which leak a small portion of L+R directly around the balanced modulator. Potentiometer R755 adjusts the audio component so the $\frac{4}{\pi}$ loss in filtering is exactly compensated. Capacitors C736 through C739 are selected capacitor values which balance out the stray balanced modulator capacitance. This balanced condition reduces the suppressed 38-kc switching frequency level to well below the 40 db required by the FCC. On some units these capacitors are unnecessary.

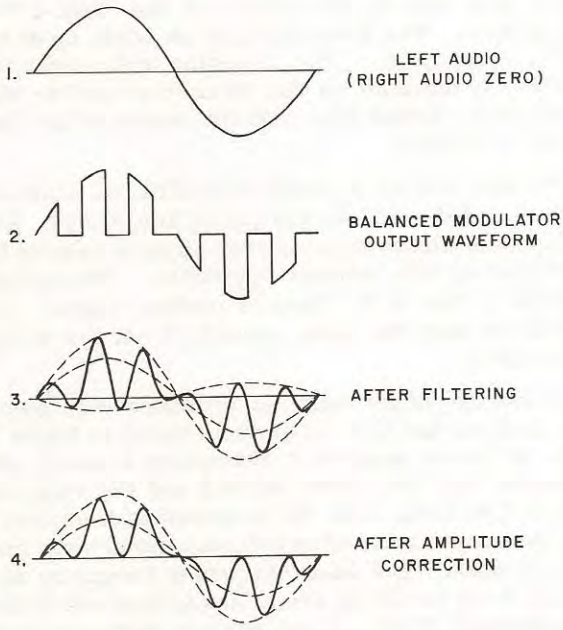


Figure 2-6. Balanced Modulator Output When L+R=1 and L-R=1

Figure 2-7 shows the time division signal when L=-R, or L+R=0, L-R=2. The composite waveform from the balanced modulator is shown in the third illustration. This waveform is composed of audio components and odd harmonics centered on the switching frequency. When the odd harmonics are removed by filtering in FL705, the waveshape in the fourth illustration results. This waveshape is a DSB signal which equals L-R as required by the matrix process.

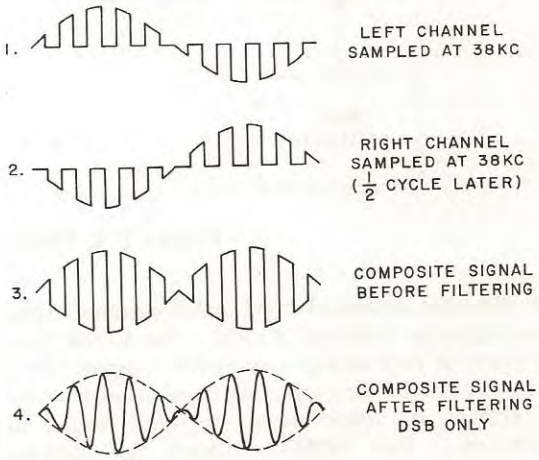


Figure 2-7. Balanced Modulator Output When L+R=0 and L-R=2

The output of the balanced modulator and L+R mixing is fed to a low-pass 53-kc filter, FL705. Filter FL705 removes all harmonics and noise above 53 kc to form the DSB waveshape as shown in figures 2-6 and 2-7. The output from FL705 is mixed with a 19-kc pilot carrier and fed to the stereo override switch, S701, and the remote relay, K701. Operation at this point is similar to audio switching which was discussed earlier. If relay K701 is energized and S701 is in the STEREO ON position, the composite stereo is fed to J701 for connection to the A830-2 10 W Wide-Band FM Exciter.

The balanced modulator switching frequency is obtained from crystal-controlled oscillator Q701. Oscillations are sustained by taking the output of L701

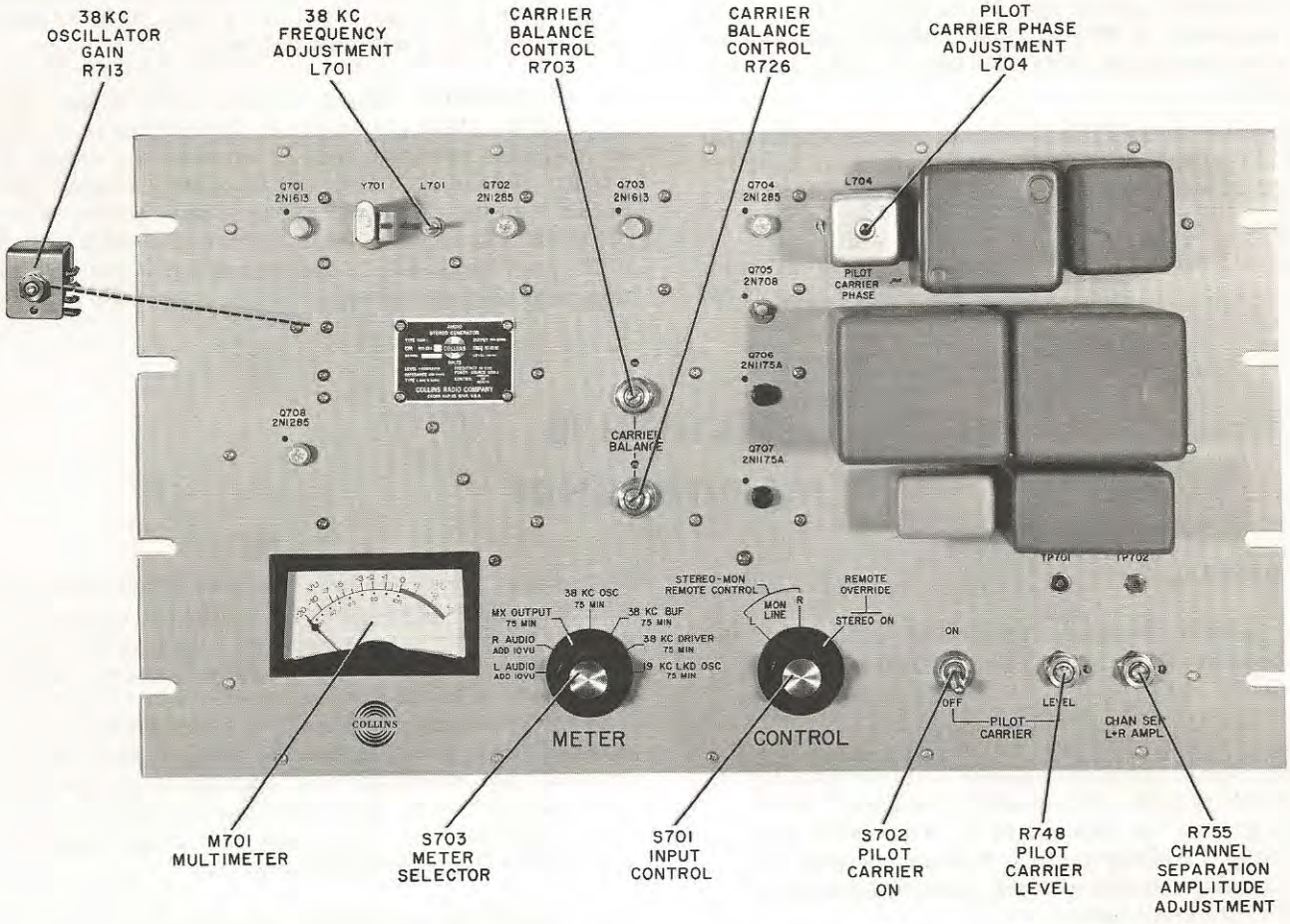


Figure 2-8. 786M-1 Control and Adjustment Locations

and feeding it into the base of Q701. The 38-kc output of L701 is also capacitively coupled into the 38-kc buffer amplifier, Q702. The output of Q702 is tuned to 38 kc by C714 and L702. The output of buffer amplifier Q702 is further amplified to approximately 4 volts peak to peak by driver amplifier Q703. The gains of Q701, Q702, and Q703 are stabilized by emitter degeneration to reduce gain variations between transistors. The output of Q703 is capacitively coupled to the primary of T701 (balanced modulator switching transformer) and to the 19-kc pilot carrier locked oscillator through an isolation stage, Q704.

The pilot carrier oscillator, Q705, is basically a grounded base oscillator which is synchronized by injecting a 38-kc signal into the base. The oscillator output is a 19-kc resonant tank placed across the base to emitter junction by means of a capacity voltage divider. The 19-kc output is taken from the emitter circuit and is injected into the output of FL705. The pilot carrier phase, which must be maintained in phase with the output of FL705, is adjusted by varying the inductance of L704. Pilot carrier level is adjusted with R748.

Metering circuits are provided within the 786M-1 to assist in trouble shooting. Meter amplifier Q705 provides isolation of the matrixing and oscillator circuits from the metering circuits. The right audio and left audio channels are fed directly from the 600-ohm balanced input through meter multiplying resistors R711 and R710 to meter M701.

2.3.2 CONTROL FUNCTIONS.

The following paragraphs describe the functions of all controls in the 786M-1 Stereo Generator. Refer to figure 2-8 for control locations.

Meter selector S703 connects meter M701 into various circuits for monitoring purposes. The metering positions are as follows; L AUDIO (left audio), R AUDIO (right audio), MX OUTPUT (multiplex output), R AUDIO OSC (38-kc oscillator), 38 KC BUF (38-kc buffer amplifier), 38 KC DRIVER, and 19 KC LKD OSC (19-kc locked oscillator output).

Audio input switch S701 selects one of three possible audio inputs; left audio, right audio, and stereo. If switch S701 is placed in the left audio or right audio positions, remote relay K701 is able to provide remote control over the monaural or stereo modes. When S701 is in the stereo mode, relay K701 is disabled and has no effect on stereo generator inputs.

CARRIER BALANCE controls R703 and R726 balance out the 38-kc carrier and 76-kc second harmonic in the secondary of T701. These controls are adjusted for zero indication at TP701 with no audio in either channel.

Channel separation L+R amplitude control (CHAN SEP L+R AMPL) R755 adjusts the amount of L+R fed around the balanced modulator to raise the L+R level by $\frac{4}{\pi}$.

Inductor L701 adjusts the frequency of the 38-kc oscillator. Resistor R713 adjusts the level of the 38-kc driver output into the balanced modulator. This level is set for 6 volts peak to peak at TP701 at the factory and should never need readjustment.

PILOT CARRIER PHASE control L704 adjusts the phase of the 19-kc pilot carrier. The control is set for an in-phase condition with relation to the output of FL705. PILOT CARRIER LEVEL control R748 adjusts the level of the 19-kc pilot carrier. This control is set for 0.009 volt rms at TP701. PILOT CARRIER switch S702 turns the 19-kc pilot carrier off and on for adjustment and testing purposes.

SECTION III
MAINTENANCE

3.1 GENERAL.

This section contains information concerning the maintenance of the 786M-1 Stereo Generator.

NOTE

As some transistor cases are electrically above ground, do not short transistor cases to ground or damage to the transistor may result. Always replace transistors with the transistor locating mark placed adjacent to the transistor socket.

3.2 SERVICING TRANSISTOR CIRCUITS.

Servicing procedures and test equipments that have been used in the past with other types of electronic equipment, for the most part, may be used with transistor circuits. Some special precautions which must be used are listed below.

3.2.1 TEST EQUIPMENT.

Damage to transistors by test equipment is usually the result of accidentally applying too much voltage to the transistor elements. Common causes of damage from test equipment are as follows:

a. Test equipment with a transformerless power supply is one source of such voltage. This type of test equipment can be used by employing an isolation transformer in the power line.

b. It is still possible to damage transistors from line voltage even though the test equipment has a power transformer in the power supply, if the test equipment is equipped with a line filter. This filter may act like a voltage divider and apply 55 volts a-c to the transistor. To eliminate trouble from this situation, connect a ground wire from the chassis of the test equipment to the chassis of the equipment under test before making any other connections.

c. Another cause of transistor damage is a multimeter that requires excessive current for adequate indications. Multimeters that have sensitivities of less than 5000 ohms per volt should not be used. A multimeter with lower sensitivity will draw too much current through many types of transistors and damage them. Use of 20,000-ohm-per-volt meters or vacuum-tube volt meters is recommended. Check the ohmmeter circuits (even those in vtvm's) on all scales with an external, low-resistance milliammeter in series with the ohmmeter leads. If the ohmmeter draws more than one milliampere on any range, this range cannot be used safely on small transistors.

3.2.2 ELECTRIC SOLDERING IRONS.

The following are possible causes of transistor damage from soldering irons:

a. Electric soldering irons may damage transistors through leakage current. To check a soldering iron for leakage current, connect an a-c volt meter between the tip of the iron and a ground connection, allow the iron to heat, then check for a-c voltage with the meter. Reverse the plug in the a-c receptacle and again check for voltage. If there is any indication on the meter, isolate the iron from the a-c line with a transformer. The iron may be used without the isolation transformer if the iron is plugged in and brought to temperature then unplugged for the soldering operation. It is also possible to use a ground wire between the tip of the iron and the chassis of the equipment being repaired to prevent damage from leakage current.

b. Light-duty soldering irons of 20 to 25 watts capacity are adequate for transistor work and should be used. If it is necessary to use a heavier duty iron, wrap a piece of number 10 copper wire around the tip of the iron and make it extend beyond the tip of the iron. Tin the end of the piece of copper wire and use it as the soldering tip.

3.2.3 SERVICING PRACTICES.

a. If a transistor is to be evaluated in an external test circuit, be sure that no more voltage is applied

to the transistor than normally is used in the circuit from which it came.

b. Test prods should be clean and sharp. Because many of the resistors used in transistorized equipments have low values, any additional resistance produced by a dirty test prod will make a good resistor appear to be out of tolerance.

3.2.4 TROUBLE SHOOTING.

The usual trouble-shooting practices apply to transistors. Be sure the test equipment and tools meet the requirements outlined in the above paragraphs. It is recommended that transistor testers be used to evaluate the transistor.

If a transistor tester is not available, a good ohmmeter may be used for testing. Be sure the ohmmeter meets the requirements as set forth in the paragraph on test equipment, above. To check a PNP transistor, connect the positive lead of the ohmmeter to base and the negative lead to the emitter. (The red lead is not necessarily the positive lead on all ohmmeters.) Generally, a resistance reading of 50,000 ohms or more should be obtained. Connect the negative lead to the collector; again a reading of 50,000 ohms or more should be obtained. Reconnect the circuit with the negative lead of the ohmmeter to the base. With the positive lead connected to the emitter, a value of resistance in the order of 500 ohms or less should be obtained. Likewise, with the positive lead connected to the collector, a value of 500 ohms or less should be obtained.

Similar tests made on an NPN transistor produce results as follows: With the negative ohmmeter lead connected to the base, the value of resistance between the base and the emitter and between the base and the collector should be high. With the positive lead of the ohmmeter connected to the base, the value of resistance between the base and the emitter and between the base and collector should be low. If the readings do not check out as indicated, the transistor probably is defective and should be replaced.

CAUTION

If a defective transistor is found, make sure that the circuit is in good operating order before inserting the replacement transistor.

Make sure that the value of the bias resistors in series with the various transistor elements are as shown on the schematic diagram. The transistor is very sensitive to improper bias voltages; therefore, a short or open circuit in the bias resistors may damage the transistor. For this reason, do not trouble-shoot by shorting various points in the circuit to ground and listening for clicks.

3.3 TROUBLE SHOOTING.

Trouble shooting can best be accomplished by using standard trouble-shooting techniques. Suspected troubles should be isolated to individual stages before components are replaced. The pilot carrier can be turned off with switch S702 as an aid in trouble shooting and testing.

3.4 ADJUSTMENTS AND TESTS.

The 786M-1 is fitted with adjustments which adjust 38-kc oscillator tuning, carrier balance, pilot carrier level, and pilot carrier phase.

NOTE

Do not attempt the following adjustments without using the proper test equipment as serious deterioration of the 786M-1 output quality may result from the use of inferior test equipment.

The test equipments or their equivalents required to perform the specified tests are listed in table 3-1.

TABLE 3-1
TEST EQUIPMENT REQUIRED

EQUIPMENT	MANUFACTURER AND TYPE
Oscilloscope	Tektronix Model 545A with Type 53/54C plug-in unit and a Type D plug-in unit
Oscillator	Hewlett-Packard Model 200AB
Distortion and noise meter	Hewlett-Packard Model 330D
Vtvm	Hewlett-Packard Model 400H (or equivalent)

Figure 3-1 is a standard transistor base, viewed from the bottom, which provides a transistor element reference.

3.4.1 38-KC OSCILLATOR TUNING.

Turn on the A830-2 10 W Wide-Band FM Exciter. Connect an a-c vtvm to the collector of Q702. (See figure 3-1.) Turn R713 fully clockwise. Adjust L701 for a maximum indication on the vtvm. The oscillator output at the collector of Q702 should be approximately 1.5 volts.

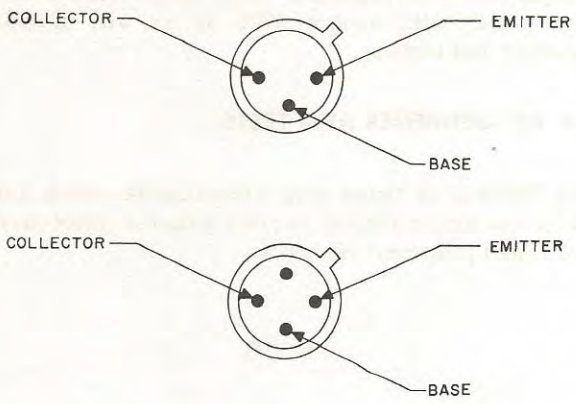


Figure 3-1. Transistor Base Configuration

3.4.2 38-KC AMPLITUDE CHECK.

Connect a calibrated Tektronix oscilloscope, provided with a Type D plug-in unit, across terminals 1 and 2 of T701. The voltage at this point should be 6 volts peak to peak as read on the oscilloscope. Adjust R713 if necessary to obtain 6 volts.

3.4.3 CARRIER BALANCE.

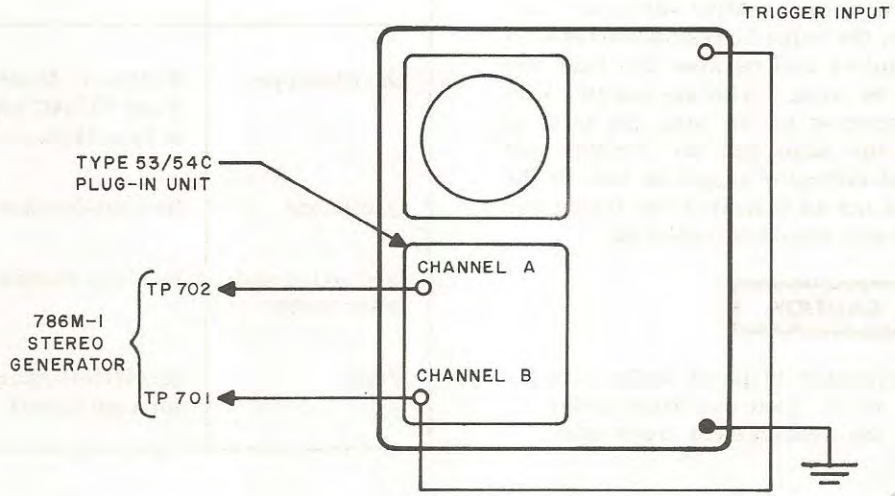
Turn the PILOT CARRIER switch to OFF. Remove any audio from the left and right audio channels. Connect the Tektronix oscilloscope with the Type D plug-in unit to TP702 and ground. Adjust in turn R703 and R726 in small steps for a minimum indication on the oscilloscope. The final indication on the oscilloscope must be more than 40 db below 100 millivolts (10 millivolts).

3.4.4 PILOT CARRIER PHASE.

Connect the Tektronix oscilloscope to the 786M-1 Stereo Generator as shown in figure 3-2. Connect the audio oscillator into the 786M-1 through 10-db pads to give an L= -R signal (right audio channel 180 degrees out of phase with the left audio channel) into the audio input terminals at a frequency of 1000 cps and a level of 7.8 volts rms. Set the PILOT CARRIER switch to OFF. Switch the CONTROL switch to STEREO ON. Adjust the PILOT CARRIER PHASE control until both traces on the oscilloscope are stationary and an exact coincidence of the zero crossings of the 19-kc pilot carrier and the L-R signal is obtained as shown in figure 3-3. Expand the sweep to 5X, and adjust the horizontal position knob to check the two points of coincident zero crossing.

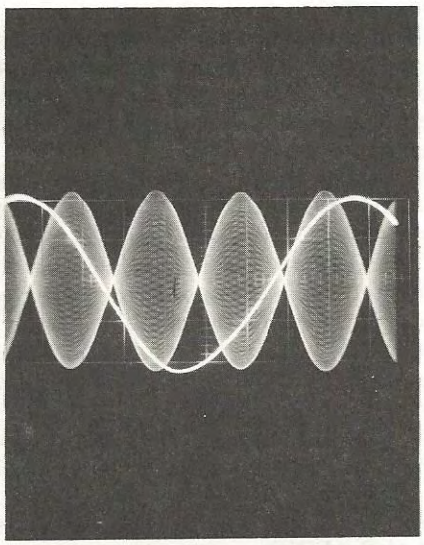
3.4.5 PILOT CARRIER LEVEL.

Remove any audio from the 786M-1 audio input channels and connect a vtvm to TP702. Set the PILOT CARRIER switch to ON, and adjust the PILOT CARRIER LEVEL control for a reading of 0.009 volt rms as read on the vtvm.

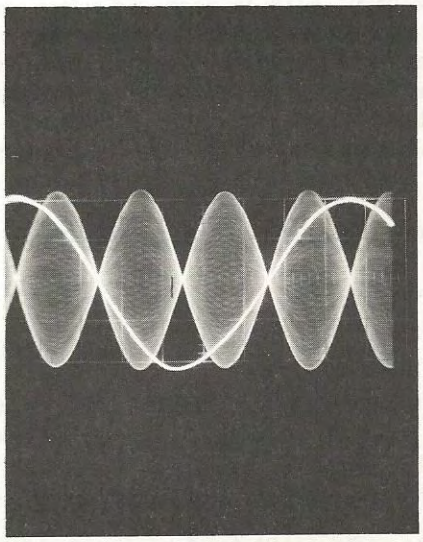


CONTROL SETTINGS	
1. CHANNEL A	0.05 V/CM, TP702
2. CHANNEL B	0.05 V/CM, TP701
3. MODE – ALTERNATE	
4. TRIGGERING MODE – AUTOMATIC TRIGGER SLOPE – + EXTERNAL	
5. SWEEP TIME/CM 5 USEC	
6. MAGNIFIER	X1, X5

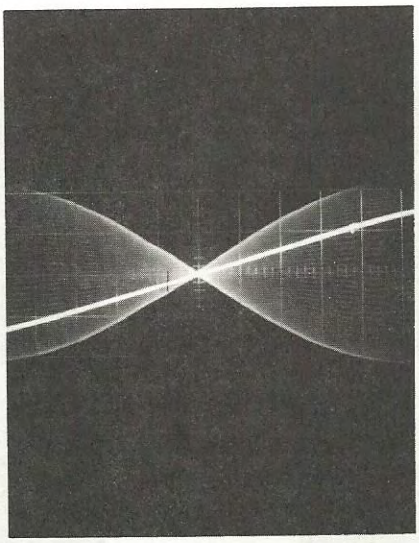
Figure 3-2. Pilot Carrier Phase Test Setup



MALADJUSTMENT OF PILOT CARRIER PHASE CONTROL.



PROPER ADJUSTMENT OF PILOT CARRIER PHASE CONTROL.



PROPER ADJUSTMENT OF PILOT CARRIER PHASE CONTROL, EXPANDED HORIZONTAL DEFLECTION.

Figure 3-3. Pilot Carrier Phase Adjustment, Oscilloscope Pattern

3.4.6 CHANNEL SEPARATION ADJUSTMENT.

Set the audio oscillator to 5000 cps, and connect it to the left audio input of the 786M-1. Connect the Tektronix oscilloscope with the type D plug-in unit to TP702 and ground, and adjust the audio oscillator for a 300-millivolt peak-to-peak indication on the oscilloscope. Adjust the CHAN SEP L+R AMPL control to produce a straight zero axis (within 4 millivolts) as shown in figure 3-4. Repeat with the audio input into the right audio channel. The final adjustment must bring the zero axis to within 4 millivolts of a straight zero axis.

3.5 MINIMUM PERFORMANCE STANDARDS.

3.5.1 OVER-ALL GAIN.

a. Connect the Tektronix oscilloscope to TP702 and ground.

b. Switch the PILOT CARRIER switch to OFF.

c. Connect the audio oscillator through 10-db pads to the 786M-1 in such a way to obtain an L=R signal (left channel equal in amplitude and phase with right channel).

d. Adjust the audio oscillator frequency to 1000 cps, and adjust the audio oscillator output to obtain 0 VU on the 786M-1 VU meter when the METER switch is set to L AUDIO or R AUDIO. The peak-to-peak indication on the oscilloscope shall be from 200 to 300 millivolts.

e. Connect the audio input so L= -R (right channel equal in amplitude but 180 degrees out of phase with the left channel). The peak-to-peak indication shall be from 200 to 300 millivolts.

3.5.2 FREQUENCY RESPONSE.

a. Connect the distortion analyzer between TP702 and ground.

b. Switch the PILOT CARRIER switch to OFF.

c. Connect the audio oscillator through 10-db pads to each channel in such a way to obtain an L=R signal (left channel equal in amplitude and in phase with right channel).

d. Adjust the audio oscillator frequency to 1000 cps, and adjust the audio oscillator output to obtain 0 VU on the 786M-1 VU meter when the METER switch is set to L AUDIO. Set the distortion analyzer to 0 db.

e. Set the audio oscillator to 50 cps, and adjust the audio level from the audio oscillator for 0 VU on the 786M-1 VU meter. The indication on the distortion analyzer shall be within ±0.5 db of the level at 1000 cps.

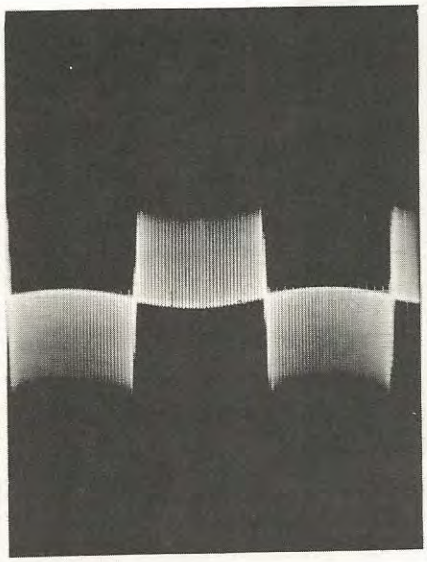
f. Repeat step e at 15,000 cps. The indication on the distortion analyzer shall be within ±1.5 db of the level at 1000 cps.

g. Repeat steps d, e, and f with the METER switch set at R AUDIO.

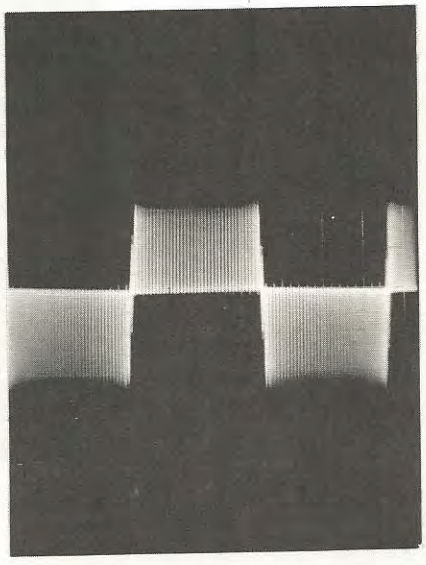
3.5.3 HARMONIC DISTORTION.

a. Connect the test setup as described in paragraph 3.5.2, steps a, b, and c.

b. The distortion at 50, 1000, and 15,000 cps should be not more than one percent.



MALADJUSTMENT OF CHANNEL SEPARATION L AND R AMPL CONTROL.



PROPER ADJUSTMENT OF CHANNEL SEPARATION L AND R AMPL CONTROL.

Figure 3-4. Channel Separation Adjustment, Oscilloscope Pattern

SECTION IV
PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	786M-1 STEREO GENERATOR	522-2914-00
C701	CAPACITOR, FIXED, ELECTROLYTIC: 30 uf -10% +100%, 10 v d-c	183-1377-00
C702	CAPACITOR, FIXED, ELECTROLYTIC: 50 uf -10% +100%, 25 v d-c	183-1379-00
C703	CAPACITOR, FIXED, ELECTROLYTIC: same as C701	183-1377-00
C704	CAPACITOR, FIXED, ELECTROLYTIC: same as C702	183-1379-00
C705	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf -10% +100%, 12 v d-c; Sprague Electric part no. 30D157A1	183-1190-00
C706	CAPACITOR, FIXED, ELECTROLYTIC: same as C705	183-1190-00
C707	CAPACITOR, FIXED, ELECTROLYTIC: 15 uf -10% +100%, 25 v d-c; Sprague Electric part no. 40D180A1	183-1362-00
C708	CAPACITOR, FIXED, MICA: 6800 uuf ±10%, 300 v d-c	935-2110-00
C709	CAPACITOR, FIXED, PAPER: 0.047 uf ±10%, 400 v d-c; Sprague Electric part no. 160P47394	931-0295-00
C710	CAPACITOR, FIXED, PAPER: 0.1 uf ±10%, 400 v d-c; Sprague Electric part no. 160P10494	931-0299-00
C711	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf -10% +100%, 25 v d-c; Sprague Electric part no. 40D181A2	183-1365-00
C712	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C713	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C714	CAPACITOR, FIXED, MICA: 1800 uuf ±5%, 500 v d-c; Electro Motive part no. DM20F182J500WV	912-3333-00
C715	CAPACITOR, FIXED, PAPER: same as C710	931-0299-00
C716 thru C719	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C720	CAPACITOR, FIXED, MICA: 510 uuf ±5%, 500 v d-c; Electro Motive part no. DM19E511J	912-2980-00
C721	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C722	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C723	CAPACITOR, FIXED, PAPER: same as C710	931-0299-00
C724	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C725	CAPACITOR, FIXED, MICA: 10,000 uuf ±2%, 500 v d-c; Electro Motive part no. DM30F103G	912-2734-00
C726	CAPACITOR, FIXED, FILM: 0.1 uf, ±1%, 50V d-c; Sprague Electric Co. part no. 114P1041 R5S4	933-0279-00
C727	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C728	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C729	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C730	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf -10% + 100%, 50 v d-c	183-1369-00
C731	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C732	CAPACITOR, FIXED, CERAMIC: 4700 uuf ±20%, 500 v d-c; MIL type CK62AW472M	913-1187-00
C733 thru C735	CAPACITOR, FIXED, CERAMIC: same as C732	913-1187-00
*C736	CAPACITOR, FIXED, CERAMIC: 5 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH050D	916-0118-00
*C736	CAPACITOR, FIXED, CERAMIC: 10 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH100D	916-0138-00
*C736	CAPACITOR, FIXED, CERAMIC: 15 uuf ±5%, 500 v d-c; MIL type CC20CH150J	916-0671-00
*C736	CAPACITOR, FIXED, CERAMIC: 20.0 uuf ±5%, 500 v d-c; MIL type CC20CH200J	916-0677-00
*C737	CAPACITOR, FIXED, CERAMIC: 5 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH050D	916-0118-00
*C737	CAPACITOR, FIXED, CERAMIC: 10 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH100D	916-0138-00
*C738	CAPACITOR, FIXED, CERAMIC: 1.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CK010D	916-0071-00
*C738	CAPACITOR, FIXED, CERAMIC: 2.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CK020D	916-0076-00
*C738	CAPACITOR, FIXED, CERAMIC: 3.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CJ030D	916-0145-00
*C738	CAPACITOR, FIXED, CERAMIC: 4.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH040D	916-0114-00
*C739	CAPACITOR, FIXED, CERAMIC: 1.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CK010D	916-0071-00
*C739	CAPACITOR, FIXED, CERAMIC: 2.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CK020D	916-0076-00
*C739	CAPACITOR, FIXED, CERAMIC: 3.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CJ030D	916-0145-00
*C739	CAPACITOR, FIXED, CERAMIC: 4.0 uuf ±1/2 uuf, 500 v d-c; MIL type CC20CH040D	916-0114-00
CR701	NOT USED	
CR702 A,B,C, &D	SEMICONDUCTOR DEVICE, SET: four hermetically sealed matched germanium diodes; Hughes Products part no. MQ4032	353-2041-00
FL701	ATTENUATOR, FIXED: pre-emphasis network for u/in FM commercial broadcast equipment; 75 microseconds, 600 ohms input and output	379-0426-00
FL702	FILTER, HIGH PASS: metal encased, hermetically sealed, input 600 ohms, output 600 ohms, 4 solder-type terminals, continuous duty cycle; A.D.C. part no. D10390	673-0869-00
FL703	FILTER, LOW PASS: continuous duty cycle, input 600 ohms ±20%, output 600 ohms ±20%, metal encased, hermetically sealed; C.A.C. part no. 90-1015-00	673-0871-00
FL704	FILTER, LOW PASS: same as FL703	673-0871-00
FL705	FILTER, LOW PASS: linear, continuous duty cycle, input 600 ohms ±20%, output 600 ohms ±20%, metal encased, hermetically sealed, solder-type terminals; C.A.C. part no. 90-1012-00	673-0870-00
J701	JACK, TIP: insulated for u/w 0.080 in. test probes; brown; E.F. Johnson part no. 105-208-200	360-0152-00
J702	JACK, TIP: insulated for u/w 0.080 in. test probes; red; E.F. Johnson part no. 105-202-200	360-0150-00
K701	RELAY, ARMATURE: 4 C contact arrangement; 0.25 amp, 300 v d-c, 1 inductive winding, 250 ohms resistance, 27.5 v d-c; 0.11 amp approx operating current; Aemco, Inc. part no. 94-3473	974-0127-00
L701	COIL, RADIO FREQUENCY: multilayer solenoid type winding; 2.3 ohms; -15°C to +55°C; 0.5 to 3.5 mh; Chicago Standard Transformer Corp. part no. WC-7	278-0734-00
L702	COIL, RADIO FREQUENCY: single layer wound, 10,000 uh, 66.5 ohms d-c, 75 ma current rating; Delevan part no. 2500-76	240-2564-00
L703	COIL, RADIO FREQUENCY: same as L702	240-2564-00
L704	COIL, RADIO FREQUENCY: 8 mh inductance; w/core; 1-5/32 in. by 1-5/32 in. by 2-1/2 in. excl terminals; Communications Coil part no. X-544-2	278-0780-00
M701	METER, AUDIO LEVEL: VU Meter for use in equipments exposed to environments; background color, white	456-0056-00
O701	KNOB: setscrew type; black phenolic body; 1.125 in. dia by 0.843 in. thk w/ skirt	546-1294-003
O702	KNOB: same as O701	546-1294-003
P701	PLUG, TELEPHONE: brass; phenolic insulation, w/solder-lug terminal; Switchcraft part no. 3501MC	361-0062-00
Q701	TRANSISTOR: hermetically sealed NPN diffused silicon planar transistor; Fairchild Semiconductor Corp. part no. 2N1613	352-0349-00
Q702	TRANSISTOR: germanium; RCA part no. 2N1285	352-0243-00
Q703	TRANSISTOR: same as Q701	352-0349-00
Q704	TRANSISTOR: same as Q702	352-0243-00
Q705	TRANSISTOR: hermetically sealed; NPN silicon; Fairchild Semiconductor Corp. part no. 2N708	352-0322-00

*Selected and added by test in the vicinity of TB714, TB718, and T701

ITEM	DESCRIPTION	COLLINS PART NUMBER
Q706	TRANSISTOR: hermetically sealed, PNP germanium; General Electric part no. 2N1175A	352-0315-00
Q707	TRANSISTOR: same as Q706	352-0315-00
Q708	TRANSISTOR: same as Q702	352-0243-00
R701	RESISTOR, FIXED, FILM: 750 ohms ±1%, 1/4 w	705-7090-00
R702	RESISTOR, FIXED, FILM: same as R701	705-7090-00
R703	RESISTOR, VARIABLE, WIREWOUND: 10 ohms ±10%, 2 w	377-0113-00
R704	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%, 1/2 w	745-1377-00
R705	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%, 1/2 w	745-1401-00
R706	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%, 1/2 w	745-1373-00
R707	RESISTOR, FIXED, COMPOSITION: same as R704	745-1377-00
R708	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R709	RESISTOR, FIXED, COMPOSITION: same as R706	745-1373-00
R710	RESISTOR, FIXED, FILM: 1330 ohms ±1%, 1/4 w	705-7102-00
R711	RESISTOR, FIXED, FILM: same as R710	705-7102-00
R712	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%, 1/2 w	745-1415-00
R713	RESISTOR, VARIABLE, COMPOSITION: 5000 ohms ±20%, 0.2 w	376-0205-00
R714	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1/2 w	745-1394-00
R715	RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%, 1/2 w	745-1314-00
R716	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1/2 w	745-1380-00
R717	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w	745-1352-00
R718	RESISTOR, FIXED, COMPOSITION: same as R712	745-1415-00
R719	RESISTOR, FIXED, COMPOSITION: 12,000 ohms ±10%, 1/2 w	745-1398-00
R720	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%, 1/2 w	745-1387-00
R721	RESISTOR, FIXED, COMPOSITION: 180 ohms ±10%, 1/2 w	745-1321-00
R722	RESISTOR, FIXED, COMPOSITION: 2700 ohms ±10%, 1/2 w	745-1370-00
R723	RESISTOR, FIXED, COMPOSITION: 39 ohms ±10%, 1/2 w	745-1293-00
R724	RESISTOR, FIXED, FILM: 1960 ohms ±1%, 1/4 w	705-7110-00
R725	RESISTOR, FIXED, FILM: 464 ohms ±1%, 1/4 w	705-7080-00
R726	RESISTOR, VARIABLE, WIREWOUND: same as R703	377-0113-00
R727	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R728	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R729	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R730	RESISTOR, FIXED, FILM: same as R724	705-7110-00
R731	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R732	RESISTOR, FIXED, COMPOSITION: same as R706	745-1373-00
R733	RESISTOR, FIXED, COMPOSITION: 150 ohms ±10%, 1/2 w	745-1317-00
R734	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R735	RESISTOR, FIXED, FILM: 13,300 ohms ±1%, 1/4 w	705-7150-00
R736	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%, 1/2 w	745-1342-00
R737	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R738	RESISTOR, FIXED, COMPOSITION: same as R733	745-1317-00
R739	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R740	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R741	RESISTOR, FIXED, FILM: 287 ohms ±1%, 1/4 w	705-7070-00
R742	RESISTOR, FIXED, COMPOSITION: same as R720	745-1391-00
R743	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R744	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R745	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R746	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R747	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R748	RESISTOR, VARIABLE: composition; 10,000 ohms ±30%, 1/4 w	376-4730-00
R749	RESISTOR, FIXED, COMPOSITION: same as R712	745-1415-00
R750	RESISTOR, FIXED, FILM: 562 ohms ±1%, 1/4 w	705-7084-00
R751	RESISTOR, FIXED, FILM: 261 ohms ±1%, 1/4 w	705-7068-00
R752	RESISTOR, FIXED, FILM: same as R751	705-7068-00
R753	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R754	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R755	RESISTOR, VARIABLE: composition; 250 ohms ±20%, 1/4 w	376-4725-00
R756	RESISTOR, FIXED, FILM: 619 ohms ±1%, 1/4 w	705-7086-00
R757	RESISTOR, FIXED, COMPOSITION: same as R736	745-1342-00
R758	RESISTOR, FIXED, COMPOSITION: same as R736	745-1342-00
R759	RESISTOR, FIXED, COMPOSITION: same as R723	745-1293-00
R760	RESISTOR, FIXED, COMPOSITION: same as R719	745-1398-00
R761	RESISTOR, FIXED, FILM: same as R724	705-7110-00
R762	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R763	RESISTOR, FIXED, COMPOSITION: 390 ohms ±10%, 1/2 w	745-1335-00
R764	RESISTOR, FIXED, COMPOSITION: 0.12 megohm ±10%, 1/2 w	745-1440-00
R765	RESISTOR, FIXED, FILM: 5110 ohms ±1%, 1/4 w	705-7130-00
R766	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R767	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R768	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R769	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R770	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R771	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R772	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
S701	SWITCH SECTION, ROTARY: 6 circuit, 3 position; 3 section; 4 moving, 16 fixed contacts; Oak Mfg. Co. part no. 222274-AH3	259-1597-00
S702	SWITCH, TOGGLE: spdt; 40 amp continuous; 28 v d-c, 20 amp resistive, 15 amp inductance; 115 v, 400 cps, 10 amp resistance, 10 amp inductance; Hetherington, Inc. part no. T1003-AN	266-3099-00
S703	SWITCH SECTION, ROTARY: 4 circuit, 7 position, 4 section; 3 moving, 24 fixed contacts; Grigsby Allison Co., Inc. part no. A25242-4MLR-4	259-1596-00
T701	TRANSFORMER, RADIO FREQUENCY, BALANCED: c/o plastic fabric base phenolic board 1/16 in. by 1-3/16 in. by 1-3/16 in.; plus 3 coils, 75 turns ea; coil #1, wound ccw, coils #2 and #3, cw; plus plastic rod 0.159 in. w by 0.413 in. dia	549-1639-00
TB701	TERMINAL BOARD: phenolic, barrier type w/ lug for back connection; 12 terminals	367-0020-00
TB702	TERMINAL BOARD: bakelite, 4 terminals, 3/8 in. by 1/2 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1534-A	306-2240-00
TB703	TERMINAL BOARD: same as TB702	306-2240-00
TB704	TERMINAL BOARD: 4 solder-lug terminals, brass; 3/8 in. by 1-1/2 in. overall	306-0698-00
TB705	TERMINAL BOARD: phenolic, 4 brass solder lug terminals; 1/16 in. by 3/8 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1532A	306-9032-00
TB706	TERMINAL BOARD: phenolic, 3 solder-lug terminals; 11/16 in. by 1-1/8 in. lg	306-0587-00
TB707	TERMINAL BOARD: same as TB706	306-0587-00
TB708	TERMINAL BOARD: same as TB702	306-2240-00
TB709	TERMINAL BOARD: phenolic, 5 brass solder lug terminals; 1/16 in. by 3/8 in. by 1-7/8 in.; Cinch Mfg. Corp. part no. 1542-A-FV	306-0951-00
TB710	TERMINAL BOARD: same as TB702	306-2240-00
TB711	TERMINAL BOARD: laminated phenolic w/ 4 solder lug terminals; 27/32 in. w by 1-1/2 in. lg; Cinch Mfg. Corp. part no. 1909	306-0838-00
TB712	TERMINAL BOARD: same as TB702	306-2240-00
TB713	TERMINAL BOARD: same as TB706	306-0587-00
TB714	TERMINAL BOARD: same as TB711	306-0838-00
TB715	TERMINAL BOARD: same as TB711	306-0838-00
TB716	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1520-A	306-9033-00
TB717	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1525A	306-0001-00
TB718	TERMINAL BOARD: same as TB704	306-0698-00
TB719	TERMINAL BOARD: same as TB702	306-2240-00
TB720	TERMINAL BOARD: same as TB717	306-0001-00
TB721	TERMINAL BOARD: same as TB704	306-0698-00
XFL701	SOCKET, ELECTRON TUBE: 8 prong octal tube socket w/ steel mtg plate; Amphenol-Borg Electronics part no. 88-8TM	220-1005-00
XQ701	SOCKET, TRANSISTOR: 3 contacts spaced on 0.200 in. dia circle; Elco Corp. part no. 3307X	352-9903-00
XQ702	SOCKET, TRANSISTOR: 4 contacts spaced on 0.200 in. dia circle; Elco Corp. part no. 3307	352-9902-00
XQ703	SOCKET, TRANSISTOR: same as XQ701	352-9903-00
XQ704	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ705	SOCKET, TRANSISTOR: same as XQ701	352-9903-00
XQ706	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ707	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ708	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XY701	SOCKET, CRYSTAL: 2 regularly spaced contact positions, 0.486 in. c to c ea contact, 0.243 in. from center; cadmium plated phosphor bronze or beryllium copper; Hugh H. Eby part no. 8879	292-0082-00
Y701	CRYSTAL UNIT, QUARTZ: 38.000 kc	289-5392-00

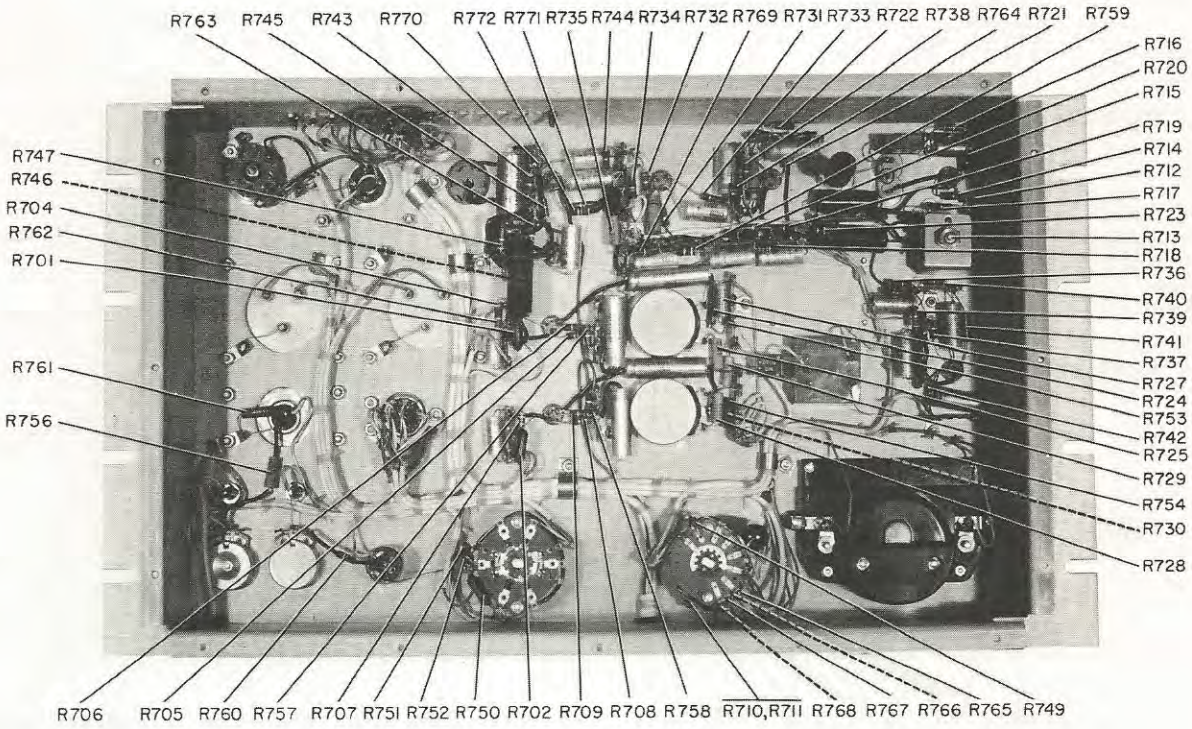


Figure 4-1. 786M-1 Stereo Generator, Rear View, Resistor Location

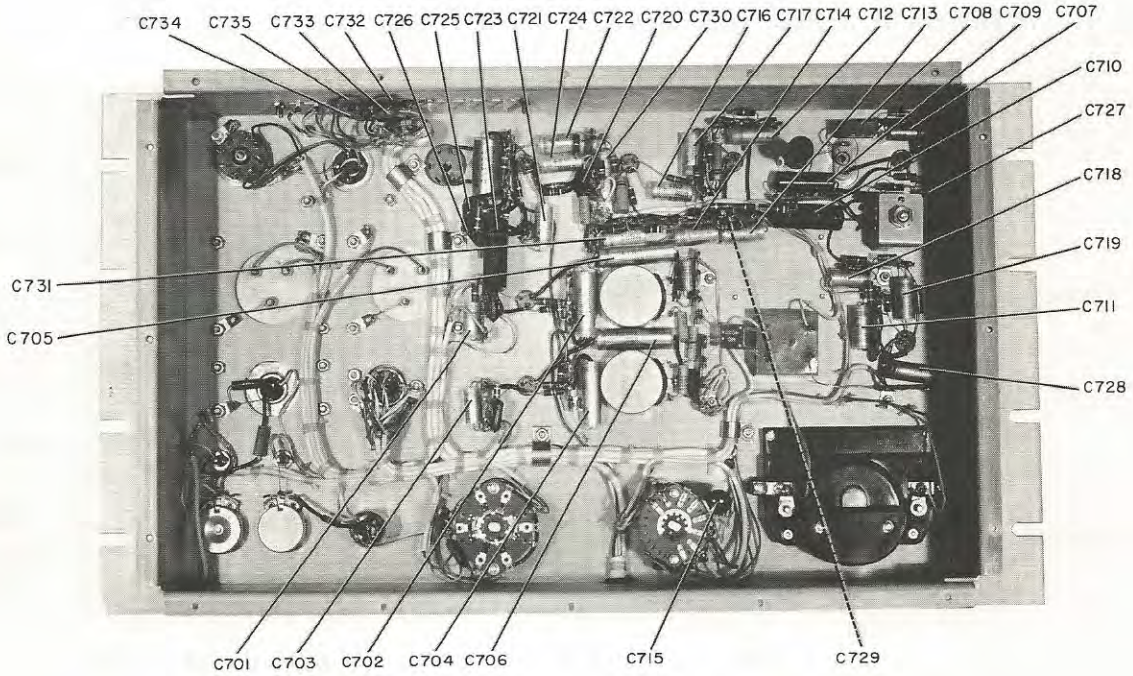


Figure 4-2. 786M-1 Stereo Generator, Rear View, Capacitor Location

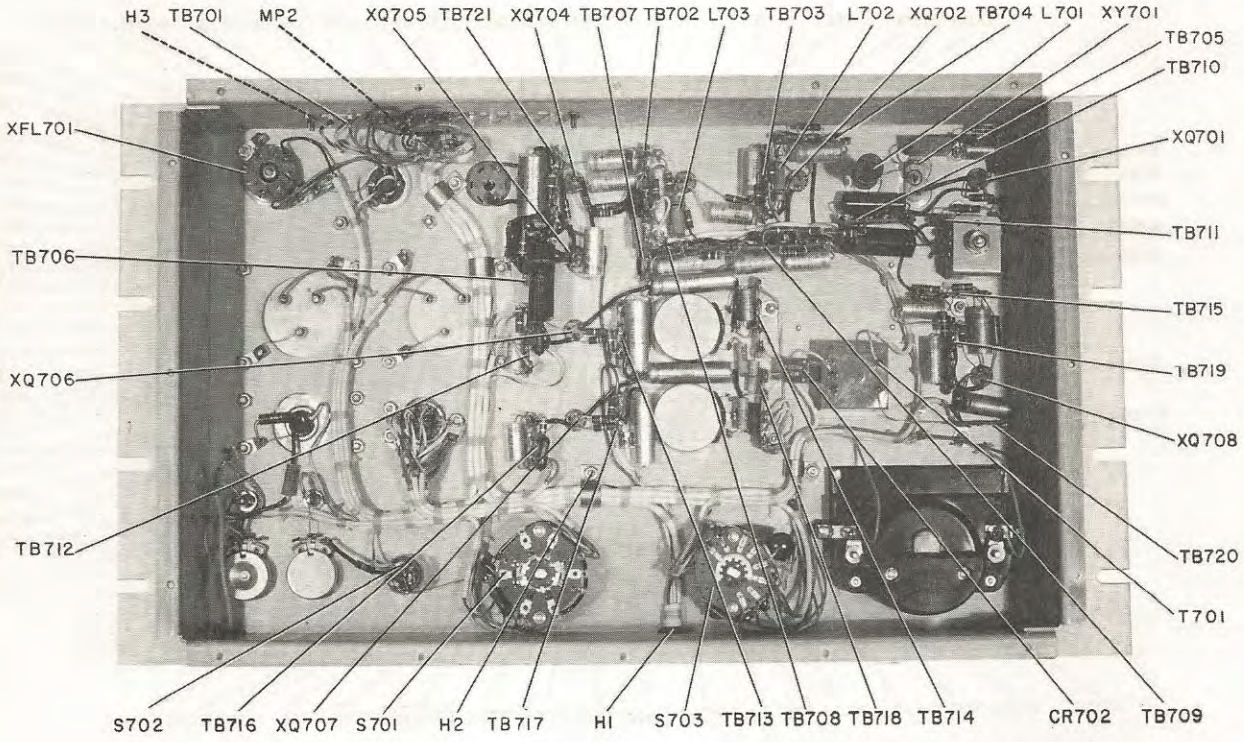


Figure 4-3. 786M-1 Stereo Generator, Rear View, Miscellaneous Parts Location

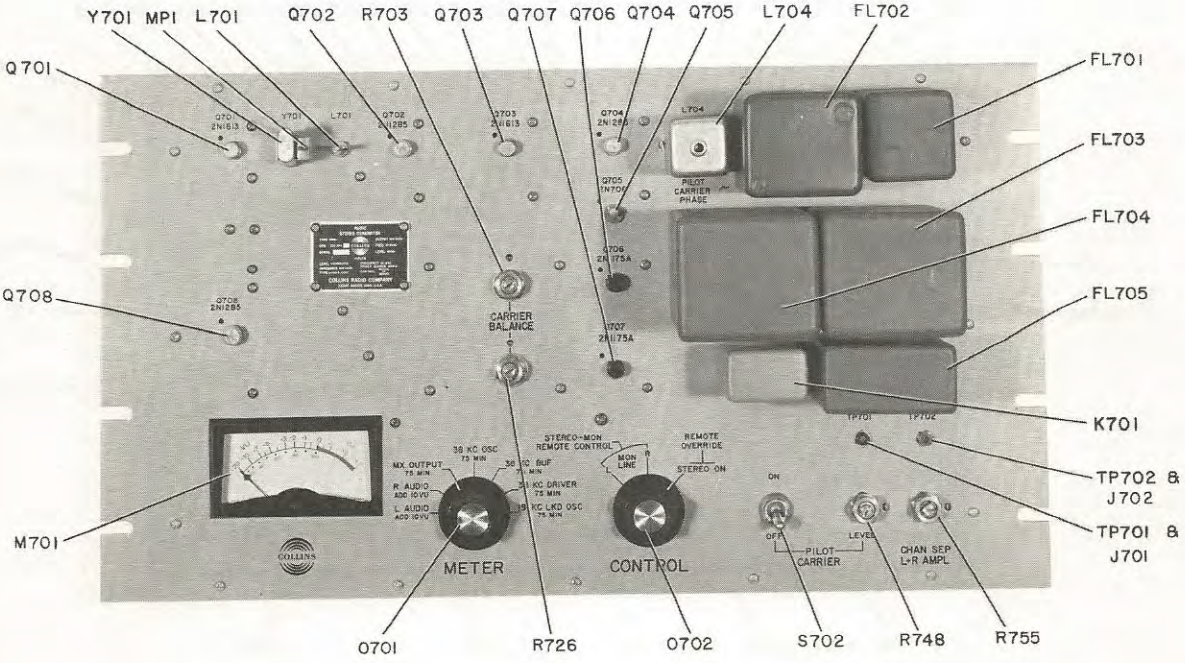
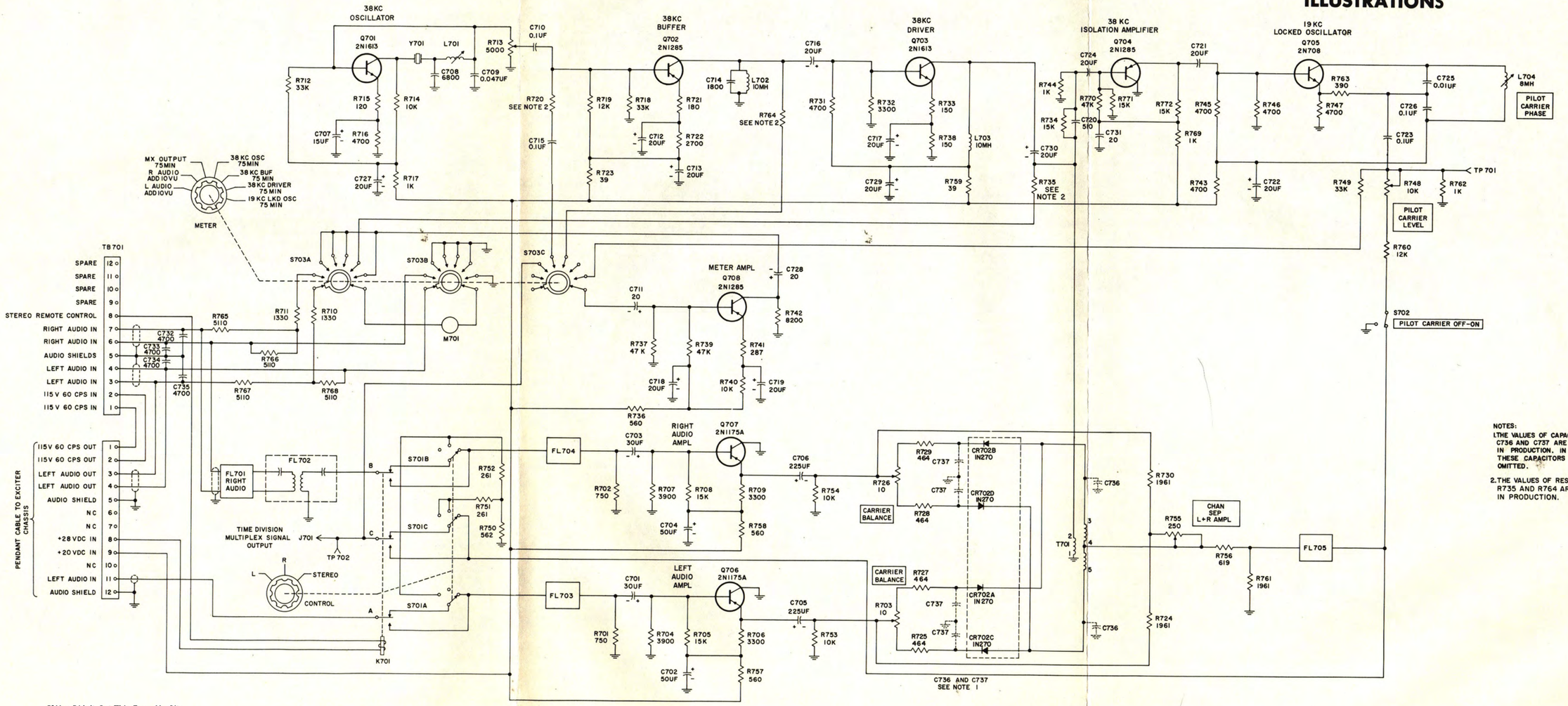


Figure 4-4. 786M-1 Stereo Generator, Front View, Parts Location

SECTION V
ILLUSTRATIONS



NOTES:
1. THE VALUES OF CAPACITORS C736 AND C737 ARE DETERMINED IN PRODUCTION. IN SOME UNITS, THESE CAPACITORS MAY BE OMITTED.
2. THE VALUES OF RESISTORS R720, R735 AND R764 ARE DETERMINED IN PRODUCTION.

Figure 5-1. 786M-1 Stereo Generator, Schematic Diagram

TD-538
523-0755596-101438
1 February 1962
1st Revision, 1 January 1967

COLLINS

unit instructions

B830-1
250-Watt FM
Power Amplifier

Collins Radio Company | Dallas, Texas
Printed in U. S. A.

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Figure 1-1. Overall View, B830-1 250-Watt FM Power Amplifier

section 1

general description

1.1 PURPOSE OF INSTRUCTION BOOK.

Unit Instructions TD-538 provides information about B830-1 250-Watt FM Power Amplifier. Information which is furnished covers a general description of the equipment, principles of operation, maintenance procedures, and a parts list.

1.2 PURPOSE OF EQUIPMENT.

The B830-1 250-Watt FM Power Amplifier can be used for continuous monaural or multiplex and SCA FM broadcast service on a single frequency in the range from 88 to 108 megacycles with an exciter input of 10 watts and an output power of 250 watts.

The B830-1 will drive the 830F 10-KW FM Power Amplifier or the 830E 5-KW FM Power Amplifier to full output.

1.3 DESCRIPTION OF EQUIPMENT.

1.3.1 PHYSICAL DESCRIPTION.

The B830-1 250-Watt FM Power Amplifier, shown in figure 1-1, is contained in a single cabinet that is 38 inches wide, 76 inches high, 27 inches deep, and weighs approximately 596 pounds. All B830-1 operating controls are located behind the doors on the front of the cabinet. The filament and plate on-off controls and four monitoring meters are located at the top front of the cabinet. The meters may be observed easily while operating the tuning controls. The B830-1 uses three tubes, all of which are accessible from the front of the transmitter. The bottom front of the B830-1 cabinet is removable to allow access to components on the bottom of the inside panel.

Large doors at the upper rear of the cabinet allow access to the upper part of the B830-1 for servicing and maintenance. Operating personnel are protected by both electrical and mechanical interlocks on the rear doors and panel. These interlocks remove the B830-1 plate voltage and ground the high-voltage circuits when the doors are opened or the panel is removed. The power amplifier plate-tuning cavity is located in an interlocked compartment at the front of the B830-1.

Inside the B830-1, heavy iron-core components are at the bottom of the cabinet. A standard 19-inch rack is provided for mounting the 10-watt exciter within the confines of the B830-1. Room also is provided on the standard 19-inch rack for the mounting of SCA generators. An optional harmonic filter, which can be connected to the B830-1 output, is suspended from the top of the cabinet.

Cooling air for the B830-1 is drawn through a permanent air filter at the rear of the cabinet by a low-speed, high-volume fan and exhausted through a shielded opening in the top of the cabinet. A single pressure blower supplies cooling air directly to the power amplifier tube.

1.3.2 ELECTRICAL DESCRIPTION.

The B830-1 250-Watt FM Power Amplifier consists of a single, air-cooled, power amplifier tube capable of being driven to full power by a 10-watt exciter. All associated power supply and control circuitry is included for operation of the B830-1. The B830-1 rf input impedance is 50 ohms nominal, unbalanced. The B830-1 output power is at least 250 watts over the frequency range of 88 to 108 megahertz into a 50-ohm load, with an swr not exceeding 2:1.

Line power input required is 50 or 60 hertz, single phase, with primary taps on all power transformers to compensate for line voltage variations from 200 to 250 volts. (For 50-hz operation, a special blower is available on request.) Circuit breakers in the input side of the line are provided for primary circuit protection. The control circuits and the final amplifier filament are fused. A time delay relay provides protection of the power amplifier tube during warmup. Remote control can be exercised over filament-on, filament-off, plate-on, and plate-off functions of the power amplifier. Instruction books covering the exciters and power amplifiers used in conjunction with B830-1 250-Watt FM Power Amplifier are listed in table 1-1.

1.4 EQUIPMENT SUPPLIED.

Table 1-2 lists equipment that is supplied as part of B830-1 250-Watt FM Power Amplifier.

TABLE 1-1. ASSOCIATED EQUIPMENT INSTRUCTION BOOKS

ASSOCIATED EQUIPMENT	INSTRUCTION BOOK NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	TD-536 523-0755303
786M-1 Stereo Generator	TD-537 523-0755304
E830-1 5-Kw FM Power Amplifier	TD-539 523-0755306
F830-1 10-Kw FM Power Amplifier	TD-580 523-0755345

TABLE 1-2. EQUIPMENT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
B830-1 250-Watt FM Power Amplifier	549-2008-000

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Table 1-3 lists equipment that is required for operation of B830-1 250-Watt FM Power Amplifier but not supplied as part of the power amplifier.

1.6 ACCESSORY EQUIPMENT.

Table 1-4 lists accessory equipment that is available for use with B830-1 250-Watt FM Power Amplifier.

1.7 EQUIPMENT SPECIFICATIONS.

1.7.1 MECHANICAL.

Weight:
596 pounds maximum

Size:
38 inches wide, 76 inches high, 27 inches deep

Ventilation:
One ventilating fan, one blower

Ambient Temperature Range:
+10°C (50°F) to +45°C (113°F)

Ambient Humidity Range:
Up to 95 percent relative humidity

Altitude:
Up to 6000 feet. (Blower for higher altitude available on special request.)

1.7.2 ELECTRICAL.

Power Source:
200 to 250 volts, 50 or 60 Hz, single phase (50-Hz blower available on special request).

Maximum Power Requirements:
730 watts

Rf Input Power:
10 watts nominal

Input Impedance:
50 ohms nominal, unbalanced

Power Output:
250 watts nominal

Output Impedance:
50 ohms, resistive, unbalanced
Maximum swr 2:1

Frequency Range:
88 to 108 megahertz
Exact operating frequency determined by frequency exciter (80 to 100 MHz available on special request).

1.8 TUBE AND SEMICONDUCTOR COMPLEMENT.

Table 1-5 lists the tube and semiconductor complement supplied as part of B830-1 250-Watt FM Power Amplifier.

TABLE 1-3. EQUIPMENT REQUIRED BUT NOT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	522-2714-000
786M-1 Stereo Generator (for use with A830-2 only) (optional)	522-2914-000

TABLE 1-4. ACCESSORY EQUIPMENT

EQUIPMENT	COLLINS PART NUMBER
250-Watt/1-Kw Harmonic Filter (used only if the B830-1 is fed directly to an antenna and not to a higher power amplifier)	549-2010-000

TABLE 1-5. TUBE AND SEMICONDUCTOR COMPLEMENT

QUANTITY	TYPE	FUNCTION
1	4CX250B/7203	Rf power amplifier
2	OD3	Voltage regulation
2	4JA421EH20AB1	Plate and screen voltage rectifiers

section 2

principles of operation

2.1 GENERAL.

The B830-1 250-Watt FM Power Amplifier consists of a power amplifier and associated control circuitry for the amplification of 10 watts of exciter drive to 250 watts of rf power. The B830-1 output can drive a higher power amplifier or can be fed through a harmonic filter to an antenna.

Refer to figure 2-1. The 230 volts ac is fed to a control circuit power transformer which reduces the input voltage to 115 volts ac for use by the blower and control circuits. A second transformer located within the control circuitry reduces the 115 volts ac to 6.3 volts for use by the power amplifier filament. The 230 volts ac also is fed to a transformer which supplies the power amplifier plate and screen voltages. The primary power input to the plate power supply is controlled by the plate contactor.

The control circuits provide cabinet interlocks for protection of personnel from all high voltage, local or remote filament-on and filament-off controls, local or remote plate-on and plate-off controls, and time delay to prevent the application of high voltage before the power amplifier filament has heated sufficiently. Provisions also are available within the control circuitry for connection to the control circuitry of a higher power amplifier. The higher power amplifier will then control the B830-1 plate and filament power. Exciter input power is applied directly to the power amplifier where it is raised to 250 watts of rf power. The power amplifier consists of a forced-air-cooled ceramic tetrode, V201. The plate of V201 is connected to a tuned cavity ($\frac{\lambda}{4}$ coaxial line resonator). The output from the tuned cavity then can be fed to a higher power amplifier, or to a harmonic filter and antenna if higher power amplification is not necessary. A sample of the power amplifier output is taken from the plate tuned cavity for monitoring purposes.

Metering circuits are provided for the power amplifier plate current and voltage, screen current and voltage, grid current, and output power.

2.1.1 CONTROL CIRCUITS.

Refer to figure 2-2. The primary purpose of the control circuitry is to provide filament and plate on and off control. The power amplifier filament is turned on in the following manner: When momentary FILAMENT ON switch S112 is pressed, a ground is placed on filament control relay K301. As 115 volts ac is present on terminal 2 of relay K301 from 115-volt ac supply transformer T301 the filament control relay will be energized. This closes contacts 3 and 4, holding the relay in the energized position after momentary FILAMENT ON switch S112 is released. The green filament indicator lamp, DS301, will light. When filament control relay K301 is energized, relay contacts 6 and 7 will close, starting the cabinet fan and power amplifier blower B301 and supplying 115 volts ac to the 10-watt exciter. When blower B301 comes up to speed, air interlock switch S314 will close, applying 115 volts ac to filament transformer T302 and time delay relay K303. After approximately 30 seconds (time for power amplifier filament V201 to warm up), time delay relay K303 will be energized, closing contacts 3 and 4, supplying 115 volts ac to plate contactor relay K304.

The plate supply now can be turned on by pressing the momentary PLATE ON switch (providing all interlocks are closed). Pressing the momentary PLATE ON switch places a ground on plate control relay K302. Relay K302 then will energize, closing contacts 3 and 4, holding K302 in the energized position. Contacts 9 and 10 will also close, energizing plate contactor K304 and lighting the red plate indicator lamp. When the plate contactor closes, the primary ac supply will be applied to plate and screen supply transformer T303. The plate power supply then will furnish approximately 2000 volts dc to power amplifier tube V201.

Momentary FILAMENT OFF switch S111 removes power from the control and power amplifier circuits. It accomplishes this by opening the 115-volt ac lead to filament control relay K301, and plate control relay K302. This deenergizes plate contactor K304 and blower interlock S314, removing filament, plate, and screen voltages. The time delay will immediately reset for the next turn-on procedure.

Momentary PLATE OFF switch S114 removes only plate and screen voltage from power amplifier V201. This is accomplished by momentarily opening the ground lead of plate control relay K302, which deenergizes plate contactor K304, removing 230-volt ac power from the plate supply.

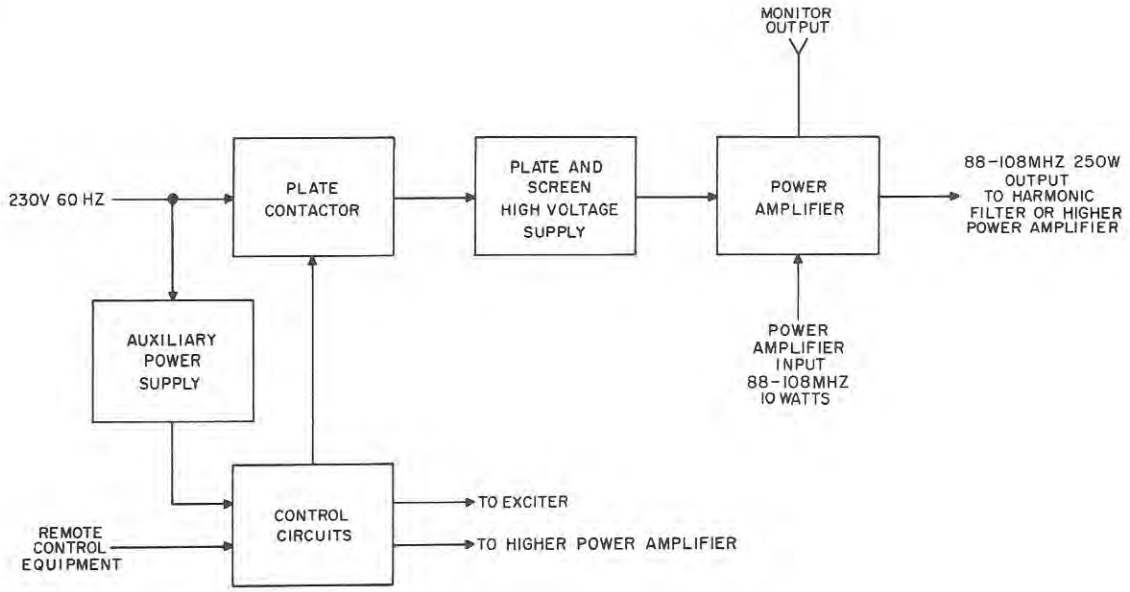


Figure 2-1. Block Diagram, B830-1 250-Watt FM Power Amplifier

Plate overload protection is provided by overload relay K305. As the plate current increases, the voltage across R303 will increase until overload relay K305 energizes, opening the ground lead of plate control relay K302, and removing plate voltage. Potentiometer R304 adjusts the point at which excess plate current will activate overload relay K305.

2.1.2 POWER AMPLIFIER CIRCUITS.

Refer to figure 2-3. The power amplifier consists of a forced-air-cooled tetrode amplifier, working into a tuned cavity over the standard frequency-modulated broadcast band of 88 to 108 megahertz.

The power amplifier plate and screen voltages are obtained from a full-wave, semiconductor, rectifier circuit. Transformer T303 increases the 200- to 250-volt, single-phase, 50- or 60-Hz primary input to approximately 4000 volts rms across terminals 8 and 10 (T303 secondary winding, 2000 volts each side of center tap). The primary winding of transformer T303 has six adjustable taps to compensate for line voltages from 200 to 250 volts. The output voltage from the secondary winding of T303 is fed to a conventional full-wave rectifier consisting of diodes CR301 and CR302, inductors L301 and L302, and capacitors C301 and C302. Resistor R320 and capacitors C303 and C304 form a transient suppressor which eliminates the transient voltages formed when power is first applied to transformer T303, and when power is switched off. The 2000-volt dc output from the power supply is fed through P.A. PLATE CURRENT meter M303 through an rf filter consisting of C210, C217, and L202 to the plate of V201. Plate voltage and plate current are read directly from P.A. PLATE VOLTAGE meter M302 and P.A. PLATE CURRENT meter M303 respectively.

The screen voltage is obtained from the 2000-volt plate supply. The plate supply is fed to a combination bleeder resistor and voltage divider consisting of resistors R305, R308, and R309. Voltage regulator tubes V301 and V302 are placed in parallel with resistors R308 and R309 to form a regulated 300-volt supply which is supplied to the screen grid of V201. Capacitor C212 shunts any rf energy present on the screen grid to ground.

Power amplifier V201 is a cathode and grid leak biased, class C operated tetrode. The control grid circuit of V201 consists of a parallel-tuned resonant tank circuit (L201 and C213) with swamping resistor R201 placed in parallel to provide a low-impedance, broadband load to the control grid. Control grid tuning is accomplished by capacitor C213.

The cathode circuit of V201 contains an output power adjusting potentiometer which raises or lowers the cathode resistance. As V201 is cathode biased, adjusting POWER OUTPUT ADJUST potentiometer R317 changes the cathode bias, as well as the screen potential, which controls the power output of V201. Capacitors C201 through C204 form the cathode bypass.

The plate cavity is formed by a short section of coaxial transmission line resonating with the plate capacity of V201 and plate tuning capacitor C209. The coaxial transmission line is roughly tuned initially by adjusting a shorting plate which lengthens or shortens the coaxial transmission line. Final plate tuning is accomplished by C209. The output coupling network formed by C208 and L203 is connected to the plate transmission line adjacent to the plate of V201 for correct impedance matching. Inductance L203 and capacitor C209 act as an L-section, low-pass

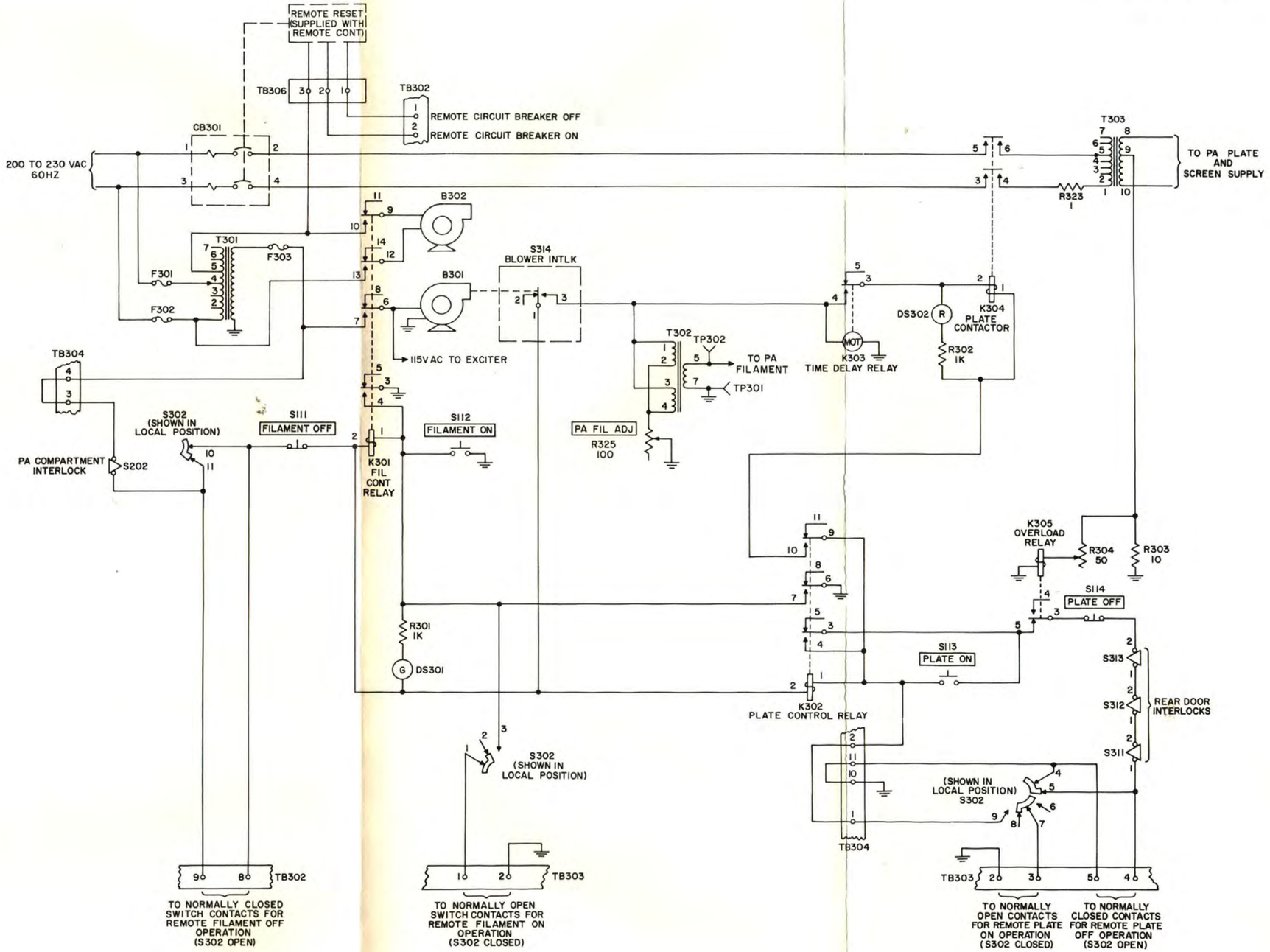
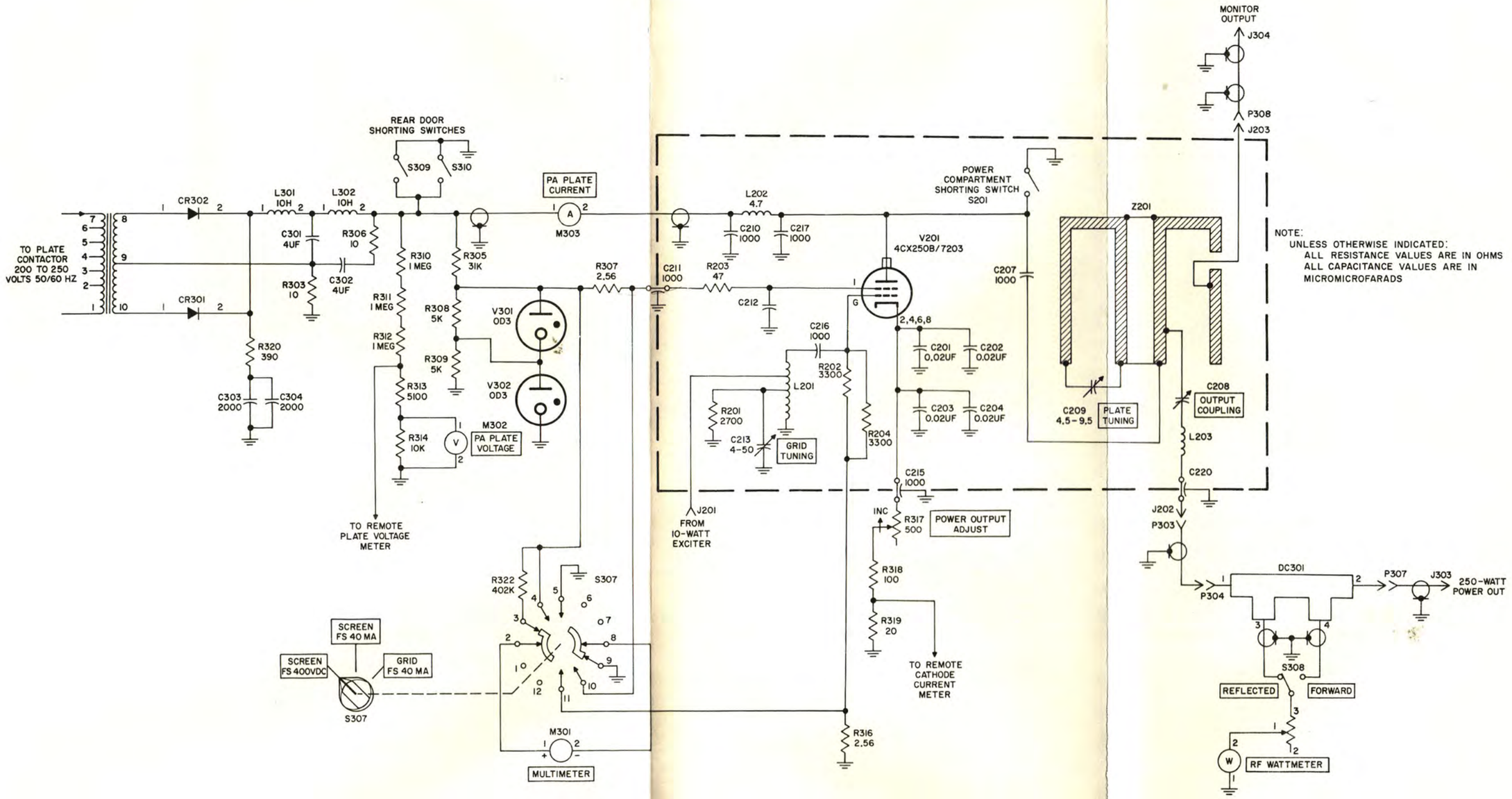


Figure 2-2. Control Circuits Simplified Diagram, B830-1 250-Watt FM Power Amplifier



NOTE:
UNLESS OTHERWISE INDICATED:
ALL RESISTANCE VALUES ARE IN OHMS
ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS

Figure 2-3. Power Amplifier Simplified Diagram, B830-1 250-Watt FM Power Amplifier

filter for frequencies above 130 megahertz to provide additional harmonic suppression. A monitor output is connected directly to the plate cavity for use by the station program monitor.

MULTIMETER M301 is located on the front panel of the power amplifier to enable the station operator to monitor screen voltage, screen current, and grid current. The multimeter functions are selected by the multimeter switch located within the power amplifier cabinet. Screen voltages are determined by connecting MULTIMETER M301 across the regulated screen supply with switch S307. Meter multiplier resistor R322 limits the current through the multimeter for calibration purposes. Screen current is determined by the voltage differential across shunt R307. This voltage is fed to the multimeter when switch S307 is in the proper position. Grid current is determined by the voltage differential across shunt R316. This voltage is also available to the multimeter when S307 is in the proper position.

2.2 CONTROL FUNCTIONS.

The following paragraphs describe all the functions of controls in B830-1 250-Watt FM Power Amplifier. Refer to figure 2-4 for control locations.

The controls located directly on the front panel under the meters include the FILAMENT ON, FILAMENT OFF, PLATE OFF, and PLATE ON switches. The filament indicator and plate indicator lamps are placed in line with the above mentioned controls. The FILAMENT ON switch, S112, energizes the power amplifier filament, the power amplifier, and cabinet blowers, and supplies power to the 10-watt exciter. The FILAMENT OFF switch, S111, deenergizes all transmitter circuits. The PLATE ON switch, S113, energizes the plate power supply, starting the 250-watt power amplifier. The PLATE OFF switch, S114, removes plate and screen voltage. The green filament indicator lamp, DS301, comes on when the FILAMENT ON switch is pressed and indicates that voltage is

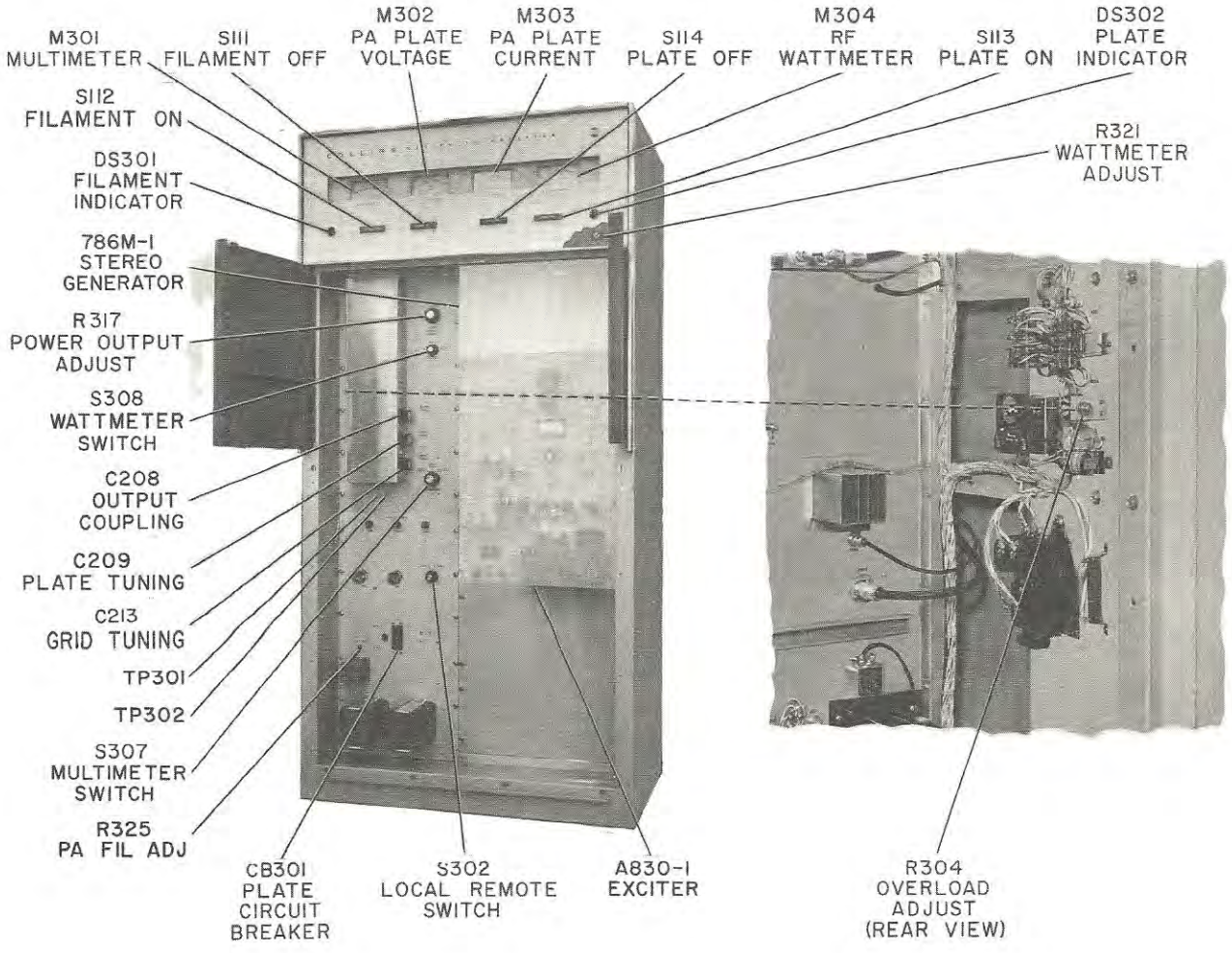


Figure 2-4. Control Locations B830-1 250-Watt FM Power Amplifier

available to the filament control relay and the PA blower. The PA blower will activate the PA blower air interlock which energizes the power amplifier filament. The red plate indicator lamp, DS302, indicates the plate voltage has been applied to the power amplifier.

The following controls are located directly under the left front door on the power amplifier panel. The POWER OUTPUT ADJUST potentiometer, R317, adjusts the power amplifier bias and screen potential, thus changing the output power. The WATTMETER switch, S308, connects the R.F. WATTMETER to either the reflected power or forward power section of the directional coupler. The WATTMETER switch normally is left in the FORWARD 400W position. The MULTIMETER switch, S307, selects either screen voltage, screen current, or grid current for MULTIMETER M301. Table 3-1 lists the MULTIMETER switch positions and typical indications for each of the three meter circuits.

The following controls are located directly behind the left front door on the power amplifier compartment. The OUTPUT COUPLING control, C208, adjusts the coupling of the load to the plate cavity. The PLATE TUNING control, C209, tunes the plate cavity to resonance and is set very near the minimum indication on P.A. PLATE CURRENT meter M303. At this point the power output should be at the peak as indicated on R. F. WATTMETER M304. The GRID TUNING control, C213, tunes the grid tank and is set for maximum indication on MULTIMETER M301 with the MULTIMETER switch, S307, set to GRID FS 40 MA.

The following controls are located on the power panel directly behind the bottom front panel of the power amplifier cabinet. Test points TP301 and TP302 allow measurement of the PA filament voltage from the front panel. PA FIL ADJ, resistor R325, adjusts the PA filament voltage. The LOCAL-REMOTE switch, S302, allows the power amplifier to be operated from a remote position or from the power amplifier. With switch S302 in the REMOTE position, filament-on, filament-off, plate-on, and plate-off functions may be selected from either a remote position or at the power amplifier. With switch S302 in the LOCAL position, filament-on, filament-off, plate-on, and plate-off functions may be selected only at the power amplifier cabinet. The PLATE circuit breaker, CB301, is a protective device which monitors the plate supply transformer primary current. The circuit breaker will activate if the transformer primary current exceeds 5 amperes. The control circuits fuses protect the control circuits from overloads. The two 5-ampere fuses protect the control transformer primary, while the 4-ampere fuse protects the control transformer secondary.

The wattmeter adjusting potentiometer, R321, is located directly below the R.F. WATTMETER when the upper switch and meter panel is raised. The wattmeter adjusting potentiometer is set at the factory and normally does not require adjustment.

The overload adjusting potentiometer, R304, is located inside the right rear door on the relay panel. The overload adjusting potentiometer is set at the factory and normally does not require adjustment.

section 3

maintenance

3.1 GENERAL.

This section contains information concerning the maintenance of B830-1 250-Watt FM Power Amplifier.

WARNING

Voltages present in this equipment are dangerous to life. Observe safety precautions when performing any maintenance. Do not reach inside the B830-1 cabinet whenever high voltage is applied. Do not depend entirely on door interlocks. Always shut down the B830-1 before doing any work inside the B830-1 cabinet. Immediately upon opening the rear doors, short out all high-voltage points using the shorting stick located inside the left rear door.

3.2 PREVENTIVE MAINTENANCE.

Most service interruptions in equipment of this type are caused by dirt and corrosion. Corrosion is accelerated by the presence of moisture and dust. Dust should be removed periodically with a soft brush or a dry, oil-free air jet. Remove dust as often as a perceptible quantity accumulates at any point in the power amplifier.

When the B830-1 is operated near salt water or in other corrosive atmospheres, inspect and clean interlock switches, cable connectors, tube prongs, and other metal parts more frequently to keep the equipment in top operating condition.

3.2.1 AIR FILTER CLEANING.

At least once each month, or more often if needed, clean the air filter according to the following procedure:

a. Remove the air filter from the B830-1 cabinet by loosening the two thumb screws located above the air filter. Slide the air filter to the extreme right, and pull the left side of the air filter out as soon as the filter clears the panel. Slide the air filter to the left and remove.

b. Mark with an arrow the direction of airflow.

c. Wash by passing a fine spray of hot water through the filter in the direction opposite that of the airflow. Gently shake the water out of the filter.

d. Spray the filter with a water-soluble oil, such as Filter-kote "M" available from Collins Radio Company, Service Parts Department, Dallas, Texas, 75207 (Collins part number 005-0609-000).

e. Lay the filter face down until oil ceases to drip from the filter.

f. Replace the filter into the lower rear panel with the airflow arrow (marked when the filter was removed) pointing in the direction of the airflow. Tighten the two thumb screws.

g. Replacement filters are Collins part number 009-1069-000.

3.2.2 PA TUBE CLEANING.

The power amplifier tube depends upon a stream of air passing through the fins to cool the anode. When these fins become dirty, the airflow is reduced and the tube life is shortened. The radiator fins should be cleaned as follows:

CAUTION

Special care must be used in removing or installing the power amplifier tube.

a. Remove the rf amplifier tube as described in paragraph 3.2.2.1.

b. Direct a low-pressure (50 psi) air stream through the fins in the direction opposite to the normal airflow until all dust is removed.

c. Replace the rf amplifier tube as described in paragraph 3.2.2.1.

3.2.2.1 PA TUBE REMOVAL.

WARNING

Voltages present within the plate cavity are dangerous to life. Shut down the B830-1 before doing any work inside the cavity. Short the plate to ground immediately on opening the plate cavity door. Do not depend entirely on the door interlock.

The power tube may be removed as follows:

a. Open the power amplifier cavity, and loosen the anode clamp.

b. Grasp the anode with a tube puller for air-cooled tubes (or with the fingers) and lift. If the anode clamp has not been loosened enough, it will cause binding when the power amplifier tube is removed. Care should be taken not to distort the anode clamp.

c. Replacement is the reversal of the removal procedure.

3.2.3 INSPECTION.

Once each week check and clean the three interlock switches and the two shorting switches at the rear of the B830-1 cabinet to be sure they are in good working order.

Once each month check all connections in the B830-1. Tighten any nuts, bolts, or screws that may be loose. Check cable connections to see that they are clean and mechanically secure. Check moving parts such as tuning controls for excessive wear. Check the plate cavity slider for oxidation around ground springs.

3.2.4 LUBRICATION.

The PA blower is to be lubricated once every six months with two drops of SAE no. 20 oil in each bearing. The cabinet fan has bearings that are lubricated for the life of the equipment. No other lubrication of the B830-1 is required.

3.2.5 TUBE MAINTENANCE.

The power amplifier, V201, should be inspected (tube in place) once each week to ensure that an accumulation of dust does not build up on the radiator fins. If dust is present, clean as described in paragraph 3.2.2. When tuning the B830-1, care should be taken not to exceed the maximum plate current shown in table 3-1.

A 3 percent decrease in filament voltage will extend the tube life 50 percent. Variable resistor R325, PA FIL ADJ, adjusts V201 filament voltage.

When new, the 4CX250B tube will operate satisfactorily with less than 6.0 volts on the filament. Initially set the filament voltage for 6.0 volts at TP301 and TP302. When the transmitter is properly tuned, reduce the filament voltage to the point where power output decreases.

As the tube ages, the filament voltage may be increased to more than 6.0 volts.

3.3 TROUBLESHOOTING.

The most common cause of trouble will probably be traced to tube failure. If a tube is suspected of failure, replace it with a tube of known quality, and note any change in performance. A small loss in emission of V201 can be compensated for by a change in the setting of the POWER OUTPUT ADJUST potentiometer. Voltage regulator tubes V301 and V302 can be assumed to be operating properly if the screen voltage is held between 280 and 320 volts as read on MULTIMETER M301.

Four meters are located on the B830-1 front panel to assist in locating any trouble which may occur. Table 3-1 contains typical meter indications. These average indications are obtained from several production power amplifiers. The indications of some B830-1 may vary slightly outside the given limits without affecting the power amplifier performance. A list of panel meter indications for each individual power amplifier should be taken when the B830-1 is operating properly in its particular installation. Any abnormal deviation from these values will then be apparent during a check of meter indications.

3.4 CABLE CHART.

Table 3-2 contains from-to information for cables installed in B830-1 250-Watt FM Power Amplifier. The table is useful in locating point-to-point wiring within the B830-1 cabinet. The FROM column is listed in alphanumeric order. To find a particular wire, establish the point on the B830-1 from which wire tracing is to be initiated. Find this point in the FROM column of table 3-2, and the TO column will give the location of the other end of that particular wire. The wire code column gives the type and color of wire used in each case. Refer to the back inside cover of this manual for the wire code explanation. When the wire code CBSJ is encountered, the letters SJ mean shield with jacket.

TABLE 3-1. TYPICAL METER INDICATIONS

METER	METER SWITCH POSITION	INDICATION
MULTIMETER	SCREEN FS 400 VDC	280 to 320 volts
MULTIMETER	SCREEN FS 40 MA	5 to 20 ma
MULTIMETER	GRID FS 40 MA	5 to 20 ma
P. A. PLATE VOLTAGE	---	2000 to 2200 volts
P. A. PLATE CURRENT	---	Not more than 250 ma
R. F. WATTMETER	Forward	250 watts
R. F. WATTMETER	Reflected	Less than 40 watts

TABLE 3-2. FROM-TO INFORMATION

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
CB301-1	TB301-1	VG90	E308	K305-5	RC913
CB301-1	XF301-1	VG90	E308	S113-1	RC913
CB301-2	K304-5	RE90	E308	TB304-7	RC913
CB301-3	TB301-2	VG0	E309	E310	VG9
CB301-3	XF302-1	VG0	E310	TB301-3	VG9
CB301-4	K304-3	RE95	E310	TB303-2	RC9
CR301-1	T303-8	KE0	E310	TB308-7	RC9
CR302-1	T303-10	KE0	E310	E309	VG9
CR302-2	L301-1	KE0	E310	E311	RC9
C301-2	C302-2	RC90	E310	E312	RC9
C301-2	R304-3	RC90	E310	T301-9	RC9
C301-2	T303-9	RC90	E311	E310	RC9
C302-2	C301-2	RC90	E312	K303-1	RC9
C301-1	L301-2	KE0	E312	K305-2	RC9
C206-1	TP302	RA91	E312	E310	RC9
C206-1	T302-5	DA91	E313	DC301-3	SHIELD
C210	M303-2	LE9	E313	DC301-4	SHIELD
C211	E303	RC4	E313	E306	SHIELD
C214	S307-11	RC93	E313	TB333-3	SHIELD
C215	R317-3	RC905	E313	TB333-3	SHIELD
C218	S302-11	RC95	E314	TP301	RA90
C219	TB304-3	RC95	E314	T302-7	DA91
DC301-3	S308B-4	CBSJ905	E317	S112-1	RC9
DC301-3	E313	SHIELD	E317	S307-9	RC9
DC301-4	S308A-11	CBSJ903	E317	TB303-10	RC905
DC301-4	E313	SHIELD	E317	TB307-2	RC9
E301	L302-2	KE0	E317	TB309-2	RC9
E301	M303-1	KE0	E322	K301-3	RC9
E301	S309	KE0	E322	K302-6	RC9
E301	TB308-1	KE0	J305-1	K301-12	RC0
E301	R305-1	KE0	J305-2	K301-9	RC90
E303	C211	RC4	K301-1	S112-2	RC96
E303	S307-10	RC1	K301-1	K301-4	RC916
E304	S307-4	RC96	K301-1	S302-3	RC96
E306	E313	SHIELD	K301-2	S111-4	RC902
E306	M304-1	SHIELD	K301-2	K302-2	RC902
E307	K301-6	RC91	K301-2	S314-1	RC91
E307	TB307-1	RC91	K301-3	E322	RC9
E307	TB309-1	RC92	K301-4	K301-1	RC916
E308	K302-3	RC913	K301-4	K302-7	RC916

TABLE 3-2. FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE
K301-6	E307	RC91
K301-7	XF303-2	RC902
K301-9	J305-2	RC90
K301-10	T301-5	RC93
K301-12	J305-1	RC0
K301-13	T301-1	RC92
K302-1	K302-4	RC916
K302-1	K302-9	RC91
K302-1	S113-2	RC916
K302-2	K301-2	RC902
K302-2	TB304-8	RC902
K302-3	E308	RC913
K302-4	K302-1	RC916
K302-6	E322	RC9
K302-7	K301-4	RC916
K302-9	K302-1	RC91
K302-9	TB304-2	RC923
K302-10	K304-1	RC906
K302-10	TB308-11	RC916
K303-1	E312	RC9
K303-3	K304-2	RC925
K303-4	S314-3	RC92
K304-1	K302-10	RC906
K304-2	K303-3	RC925
K304-2	TB304-5	RC925
K304-2	XDS302-1	RC923
K304-3	CB301-4	RE95
K304-4	R323-1	RE92
K304-5	CB301-2	RE90
K304-6	T303-5	RE91
K305-1	R304-1	RC915
K305-2	E312	RC9
K305-3	S114-4	RC916
K305-5	E308	RC913
L301-1	CR302-2	KE0
L301-2	C301-1	KE0
L301-2	L302-1	KE0
L302-1	L301-2	KE0
L302-2	E301	KE0
M301-1	S307-2	RC903
M301-2	S307-8	RC902
M302-1	TB308-5	RC902
M302-2	TB303-8	RC902
M302-2	TB308-6	RC912
M303-1	E301	KE0
M303-2	C210	LE9
M304-1	E306	SHIELD
R304-1	K305-1	RC915
M304-1	TB308-7	RC9
M304-2	R321-1	CBSJ906
R304-3	C301-2	RC90
R305-1	E301	KE0
R305-2	XV301-5	RC5
R308-2	S307-4	RC96
R308-2	XV301-5	RC96
R317-1	R318-1	RC903
R317-3	C215	RC905
R318-1	R317-1	RC903
R321-1	M304-2	CBSJ906
R321-3	S308-2	CBSJ902
R323-1	K304-4	RE92
R323-2	T303-1	RE93
S111-3	TB302-8	RC906
S111-4	K301-2	RC902
S111-4	XDS301-1	RC902
S112-1	E317	RC9
S112-2	K301-1	RC96
S112-2	TB308-9	RC96
S113-1	E308	RC913
S113-2	K302-1	RC916
S114-3	S313-2	RC915
S114-4	K305-3	RC916
S302-1	TB303-1	RC91
S302-3	K301-1	RC96
S302-3	TB304-6	RC96
S302-4	TB303-5	RC912
S302-4	TB304-11	RC912
S302-5	S311-1	RC90
S302-5	TB303-4	RC90
S302-7	TB303-3	RC92
S302-9	TB304-1	RC915
S302-10	TB302-8	RC93
S302-11	C218	RC95
S302-11	TB302-9	RC95
S307-2	M301-1	RC903
S307-4	E304	RC96
S307-4	R308-2	RC96
S307-8	M301-2	RC902
S307-9	E317	RC9
S307-10	E303	RC1
S307-11	C214	RC93
S308-2	R321-3	CBSJ902
S308A-6	TB333-5	RAS90
S308A-11	DC301-4	CBSJ903
S308B-4	DC301-3	CBSJ905
S308B-5	TB333-4	RAS90
S309	E301	KE0
S309	S310	KE0
S310	S309	KE0
S311-1	S302-5	RC90
S311-2	S312-1	RC912
S312-1	S311-2	RC912
S312-2	S313-1	RC913
S313-1	S312-2	RC913
S313-2	S114-3	RC915
S314-1	K301-2	RC91
S314-3	K303-4	RC92
S314-3	T302-1	RC92
TB301-1	CB301-1	VG90
TB301-2	CB301-3	VG0
TB301-3	E310	VG9
TB301-3	TB304-10	RC9
TB302-1	TB306-1	RC90
TB302-2	TB306-2	RC91
TB302-3	T301-1	RC92
TB302-7	TB307-8	RC96
TB302-8	S111-3	RC906
TB302-8	S302-10	RC93
TB302-9	S302-11	RC95
TB303-1	S302-1	RC91
TB303-2	E310	RC9
TB303-2	TB333-3	RA9
TB303-3	S302-7	RC92
TB303-4	S302-5	RC90
TB303-5	S302-4	RC912
TB303-7	TB304-9	RC913
TB303-8	M302-2	RC902
TB303-9	TB323-A	RC903
TB303-9	TB323-4	RC903
TB303-10	E317	RC905
TB304-1	S302-9	RC915
TB304-2	K302-9	RC923
TB304-3	C219	RC95
TB304-4	XF303-2	RC93
TB304-5	K304-2	RC925
TB304-6	S302-3	RC96

TABLE 3-2. FROM-TO INFORMATION (Cont)

FROM	TO	WIRE CODE	FROM	TO	WIRE CODE
TB304-7	E308	RC913	TB333-2	TB324-F	RA92
TB304-8	K302-2	RC902	TB333-3	E313	SHIELD
TB304-9	TB303-7	RC913	TB333-3	E313	SHIELD
TB304-10	TB301-3	RC9	TB333-3	TB303-2	RA9
TB304-10	TB305-3	RC9	TB333-4	S308B-5	RAS90
TB304-11	S302-4	RC912	TB333-5	S308A-6	RAS90
TB305-1	TB307-3	TAS9	T301-1	TB302-3	RC92
TB305-2	TB307-4	TAS0	T301-1	XF302-2	RE92
TB305-3	TB304-10	RC9	T301-1	K301-13	RC92
TB305-3	TB307-5	SHIELD	T301-5	K301-10	RC93
TB305-3	TB307-5	SHIELD	T301-5	TB306-3	RC93
TB305-3	TB307-5	SHIELD	T301-5	XF301-2	RE91
TB305-4	TB307-6	TAS9	T301-8	XF303-1	RC96
TB305-5	TB307-7	TAS2	T301-9	E310	RC9
TB306-1	TB302-1	RC90	T302-1	S314-3	RC92
TB306-2	TB302-2	RC91	T302-1	T304-1	RC92
TB306-3	T301-5	RC93	T302-5	C206-1	DA91
TB307-1	E307	RC91	T302-7	E314	DA91
TB307-2	E317	RC9	T303-1	R323-2	RE93
TB307-3	TB305-1	TAS9	T303-5	K304-6	RE91
TB307-4	TB305-2	TAS0	T303-8	CR301-1	KE0
TB307-5	TB305-3	SHIELD	T303-9	C301-2	RC90
TB307-5	TB305-3	SHIELD	T303-10	CR302-1	KE0
TB307-5	TB305-3	SHIELD	TP301	E314	RA90
TB307-6	TB305-4	TAS9	TP302	C206-1	RA91
TB307-7	TB305-5	TAS2	T304-1	T302-1	RC92
TB307-8	TB302-7	RC96	T304-7	TB333-1	RA90
TB308-1	E301	KE0	XDS301-1	S111-4	RC902
TB308-5	M302-1	RC902	XDS301-2	TB308-8	RC903
TB308-6	M302-2	RC912	XDS302-1	K304-2	RC923
TB308-7	E310	RC9	XDS302-2	TB308-10	RC925
TB308-7	M304-1	RC9	XF301-1	CB301-1	VG90
TB308-8	XDS301-2	RC903	XF301-2	T301-5	RE91
TB308-9	S112-2	RC96	XF302-1	CB301-3	VG0
TB308-10	XDS302-2	RC925	XF302-2	T301-1	RE92
TB308-11	K302-10	RC916	XF303-1	T301-8	RC96
TB309-1	E307	RC92	XF303-2	K301-7	RC902
TB309-2	E317	RC9	XF303-2	TB304-4	RC93
TB323-A	TB303-9	RC903	XV301-2	XV302-5	RC92
TB323-4	TB303-9	RC903	XV301-5	R305-2	RC5
TB324-F	TB333-2	RA92	XV301-5	R308-2	RC96
TB333-1	T304-7	RA90	XV302-5	XV301-2	RC92

section 4

parts list

This section contains a list of all replaceable electrical, electronic, and critical mechanical parts for the B830-1 250-Watt FM Power Amplifier 549-2008-000. The manufacturers' codes appearing in the MFR CODE column of the parts list are listed in numerical order at the end of the parts list. The code list provides manufacturers' names and addresses as shown in the Federal Supply Code for Manufacturers, Handbook H4-1. Manufacturers not listed in Handbook H4-1 are assigned a five-letter code and will appear first in the code list.

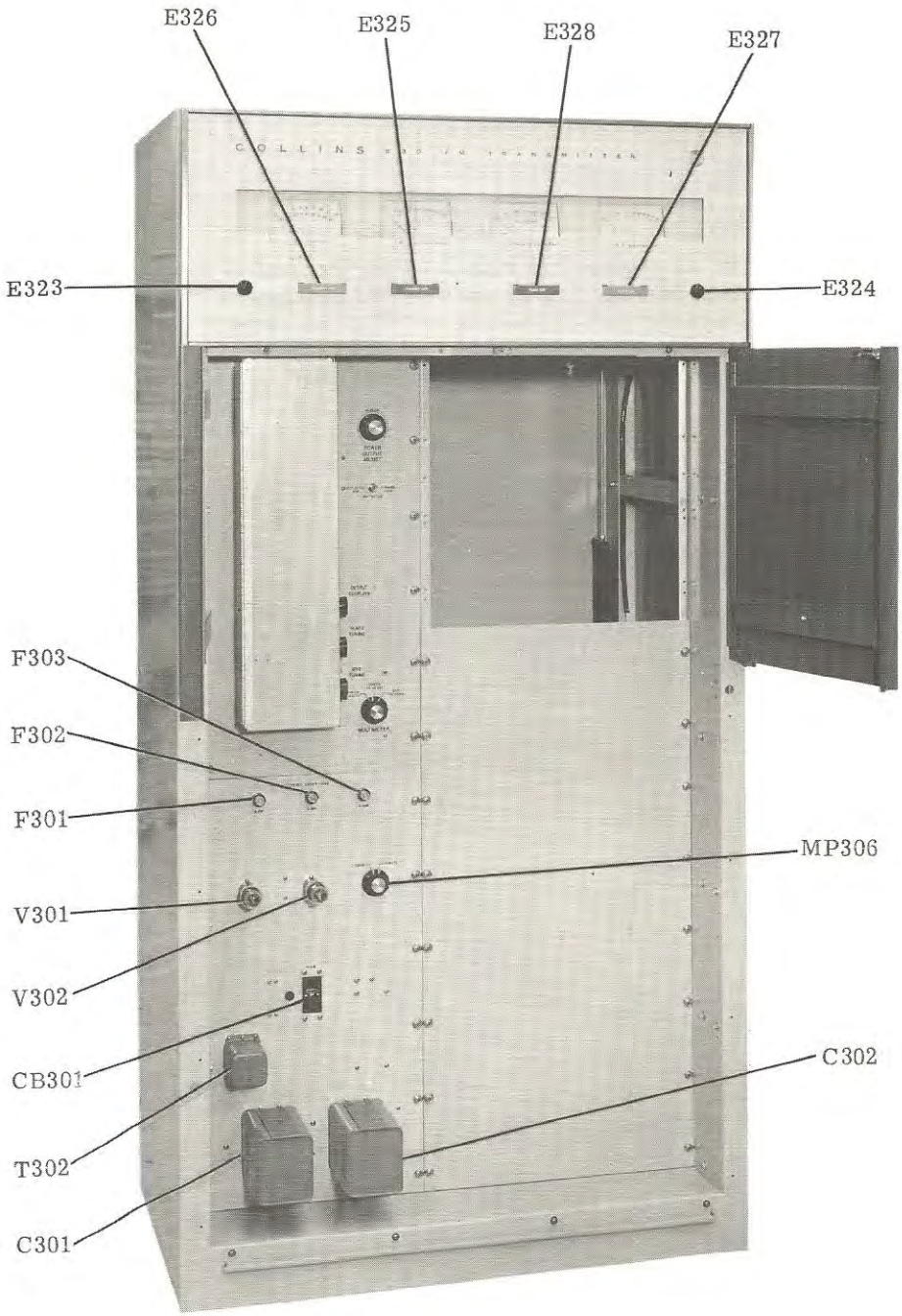


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 1 of 12)

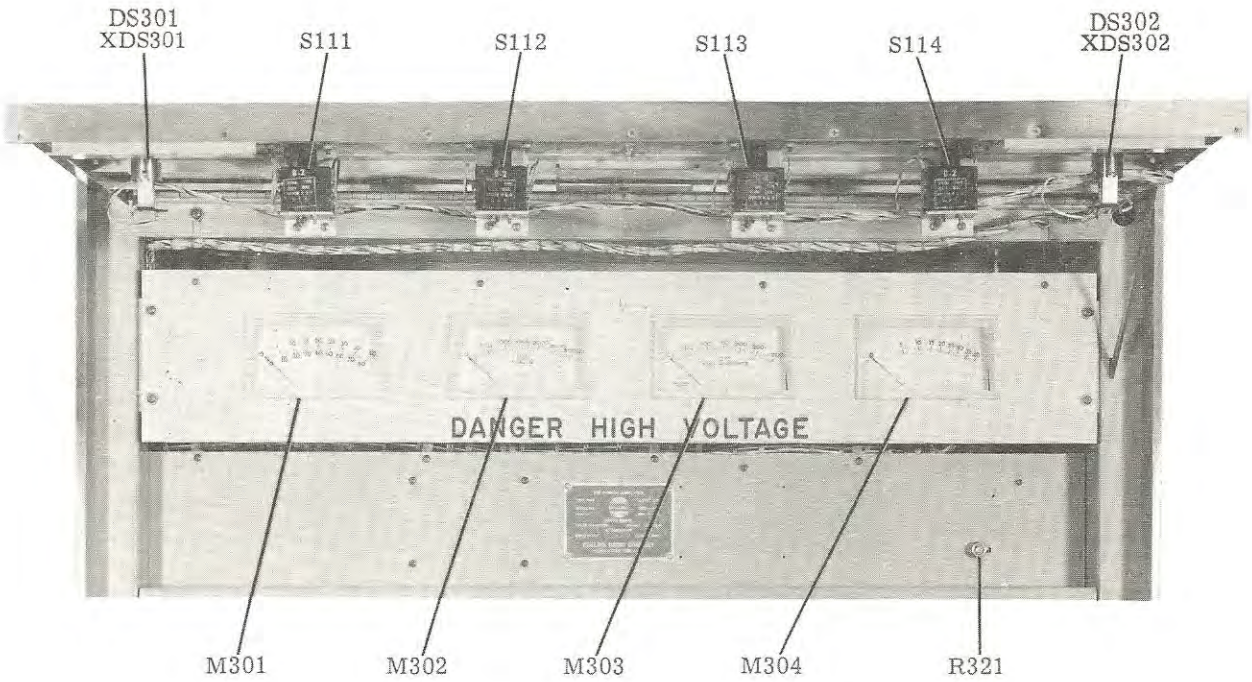


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 2 of 12)

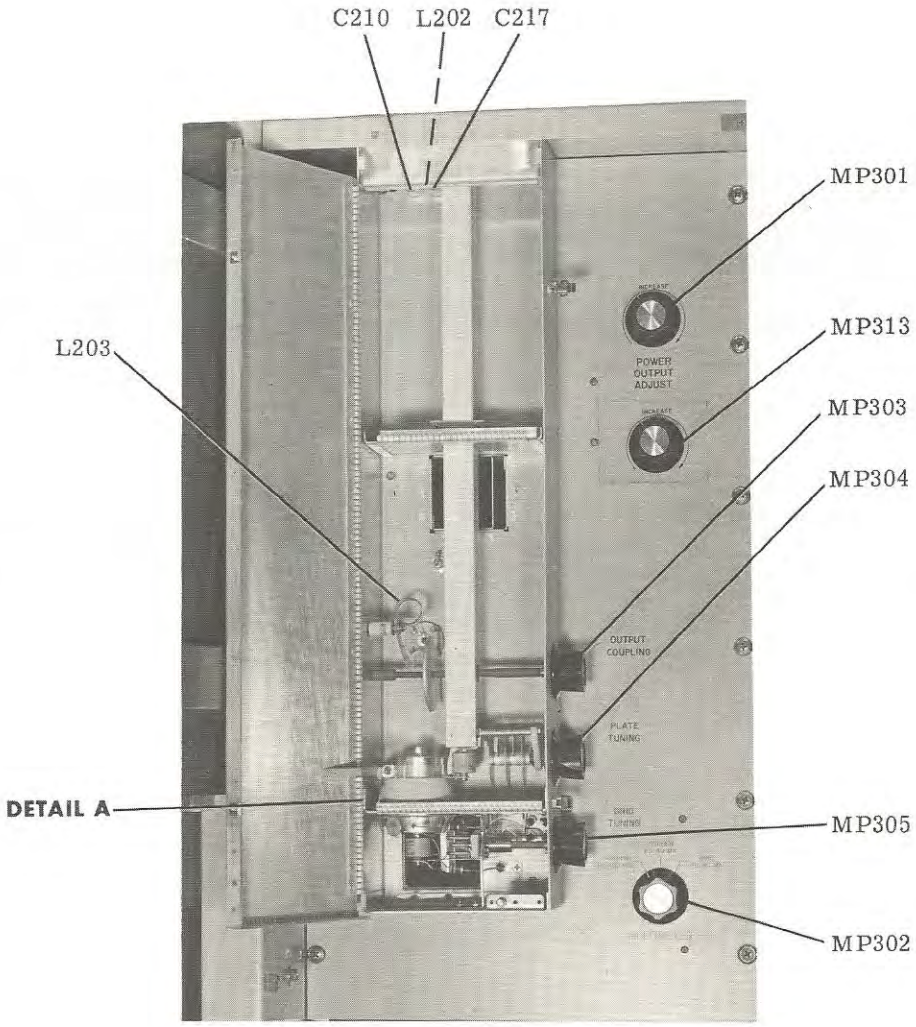


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 3 of 12)

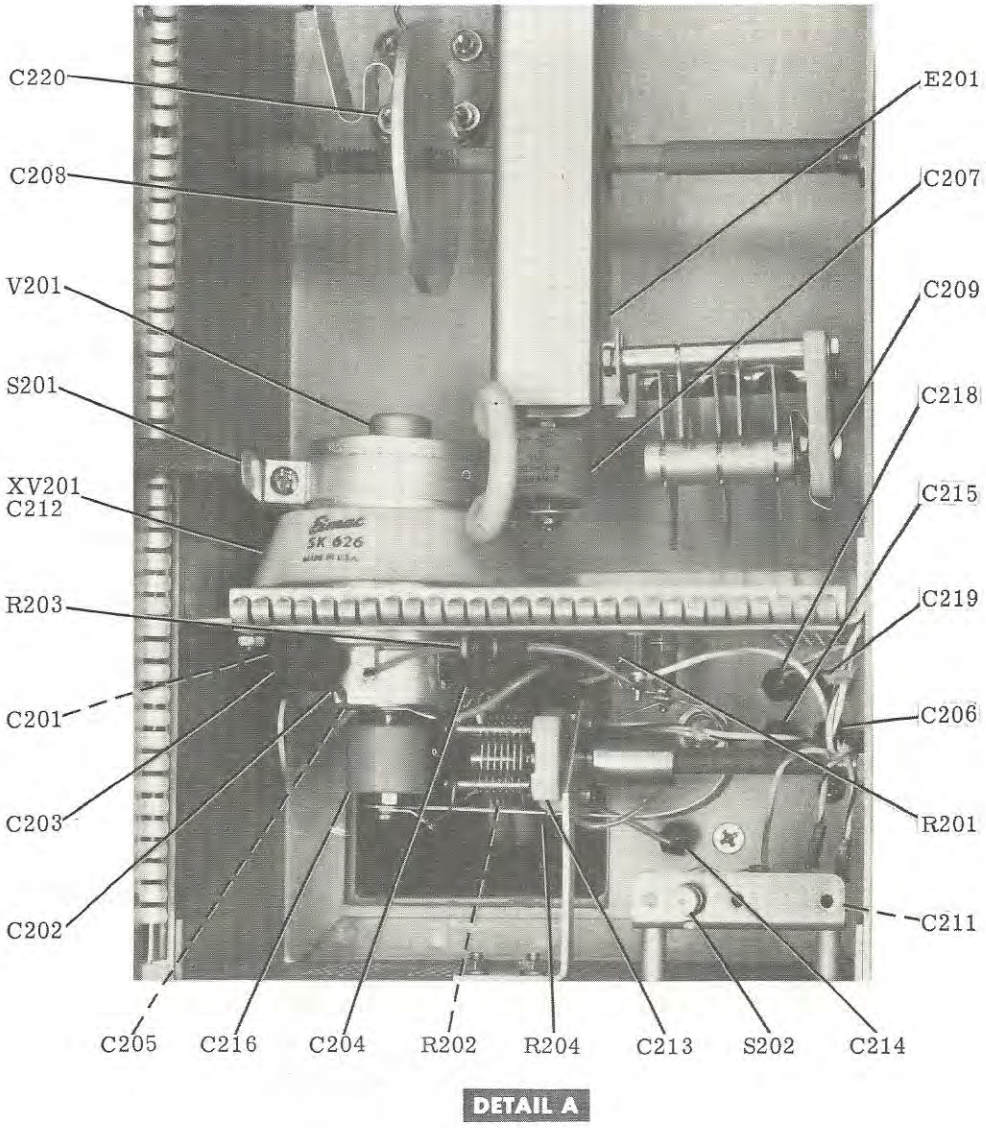


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 4 of 12)

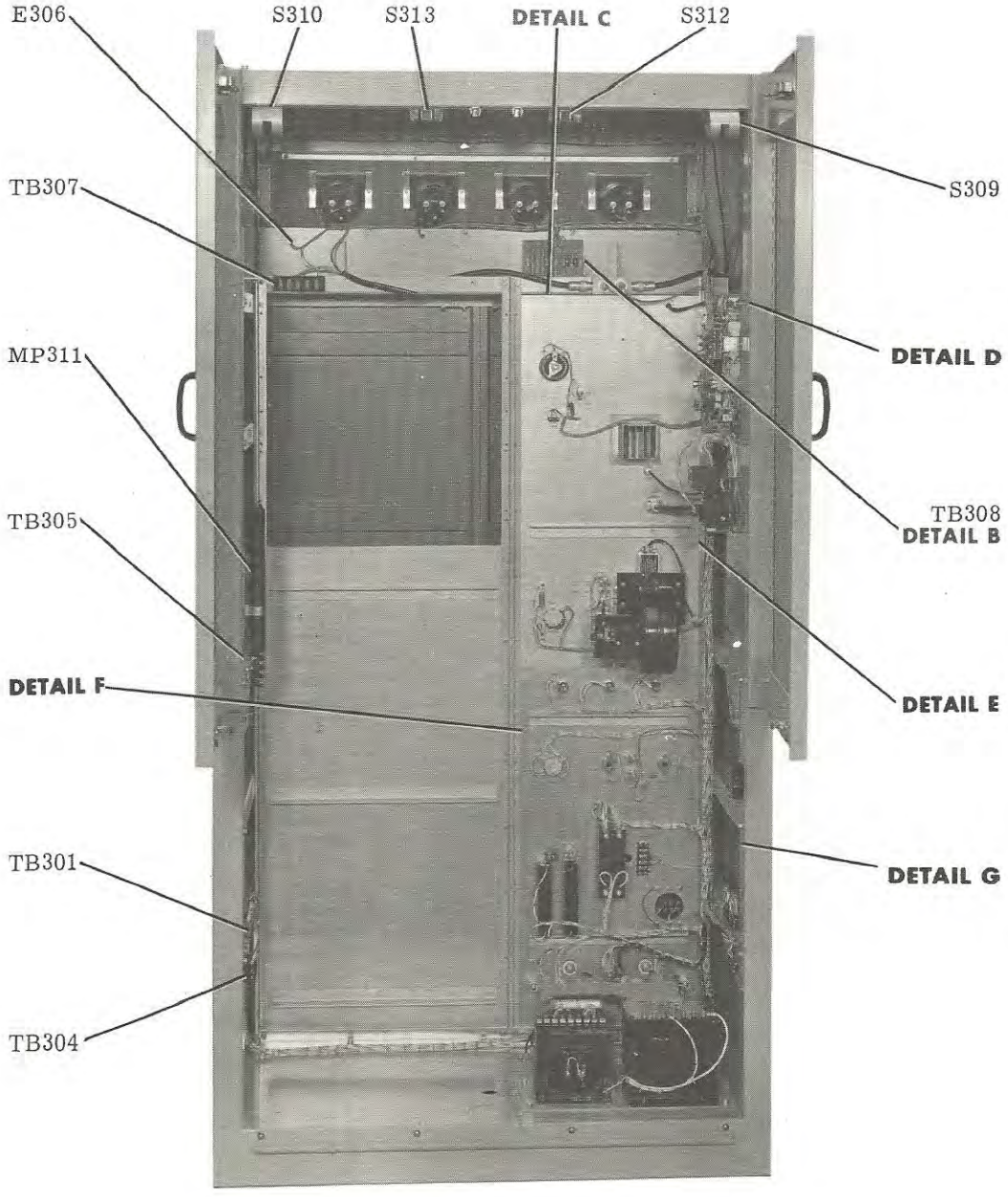


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 5 of 12)

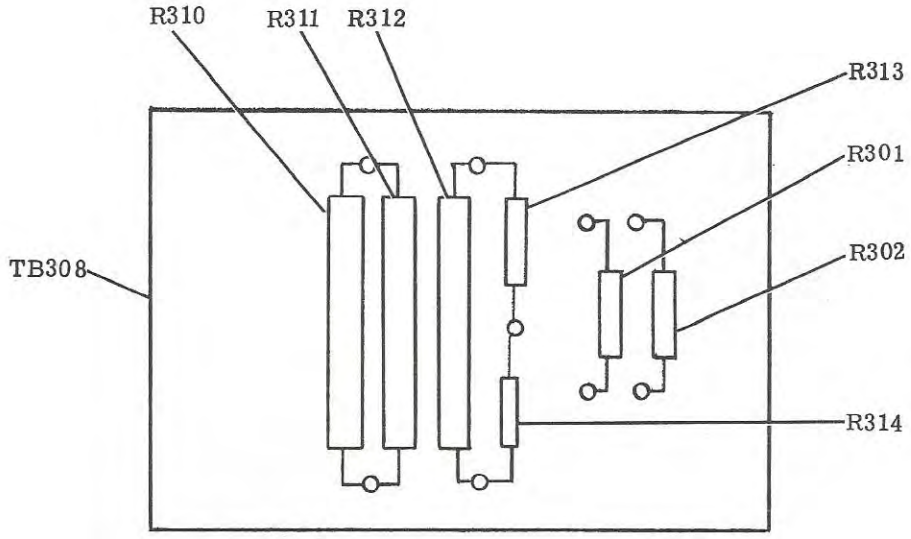


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 6 of 12)

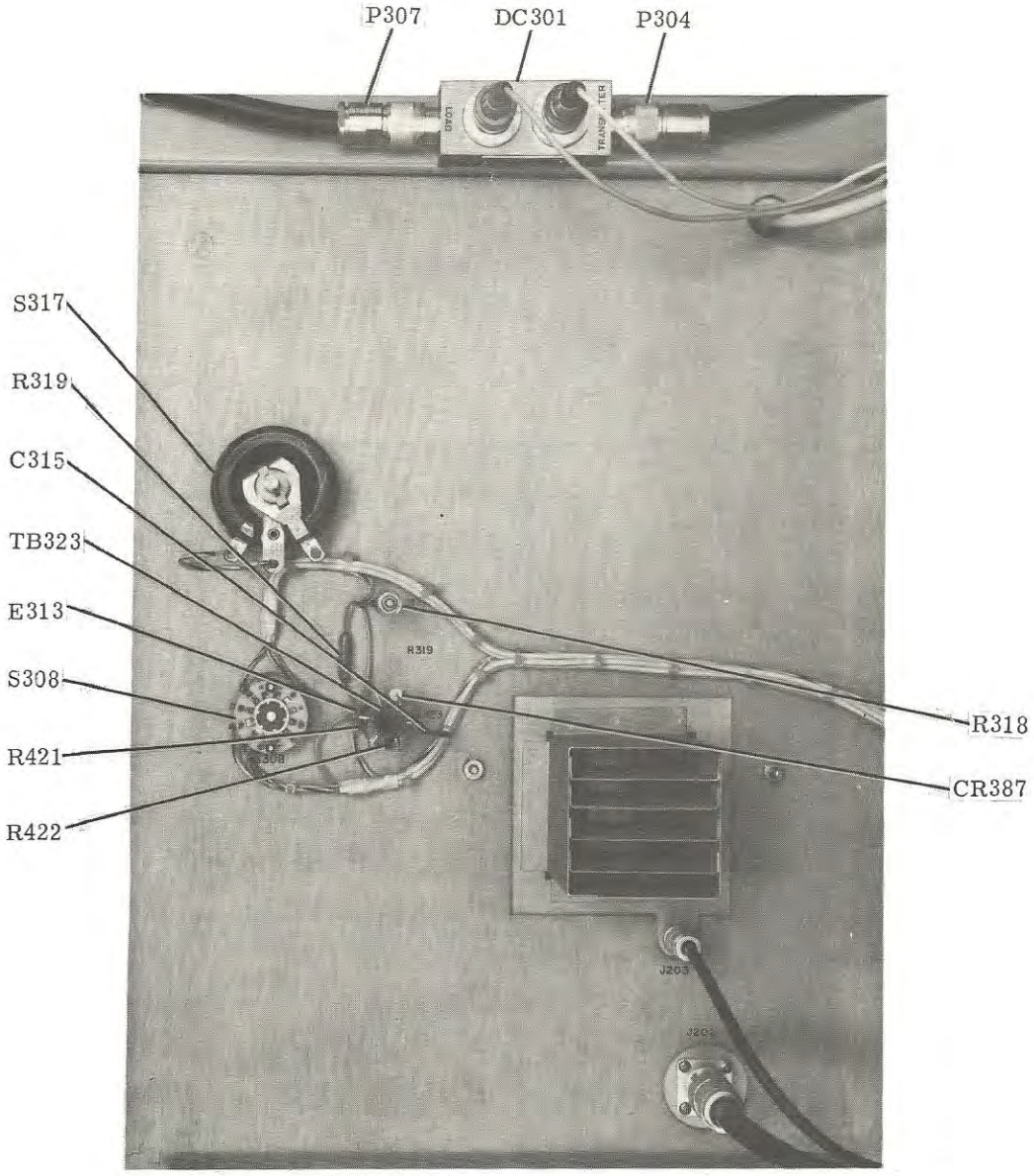


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 7 of 12)

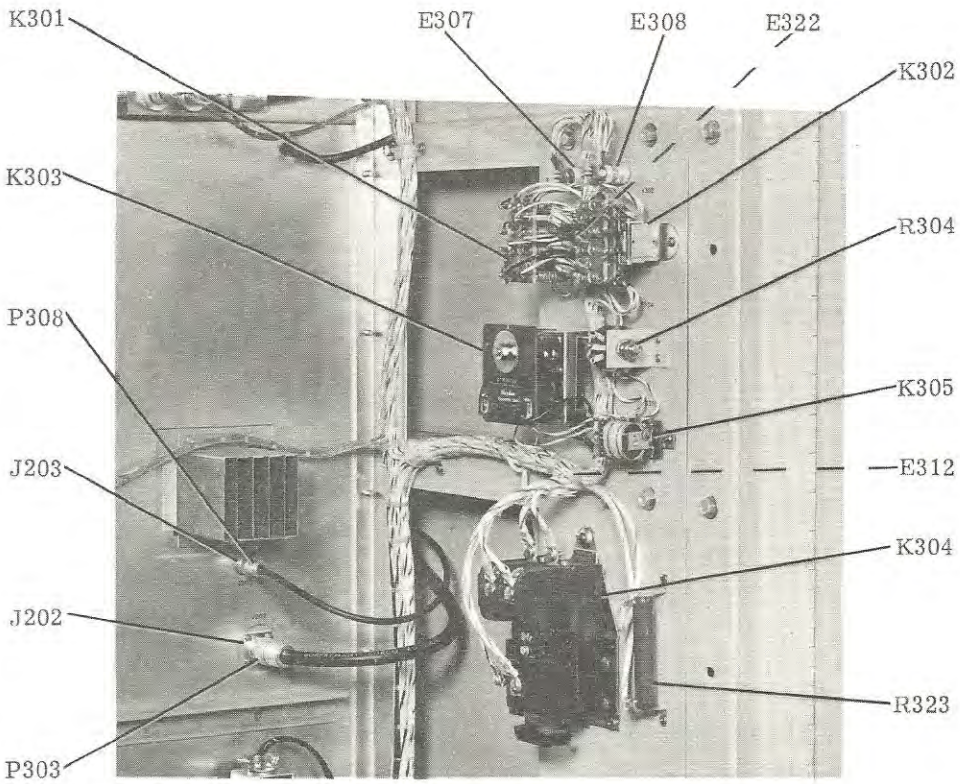
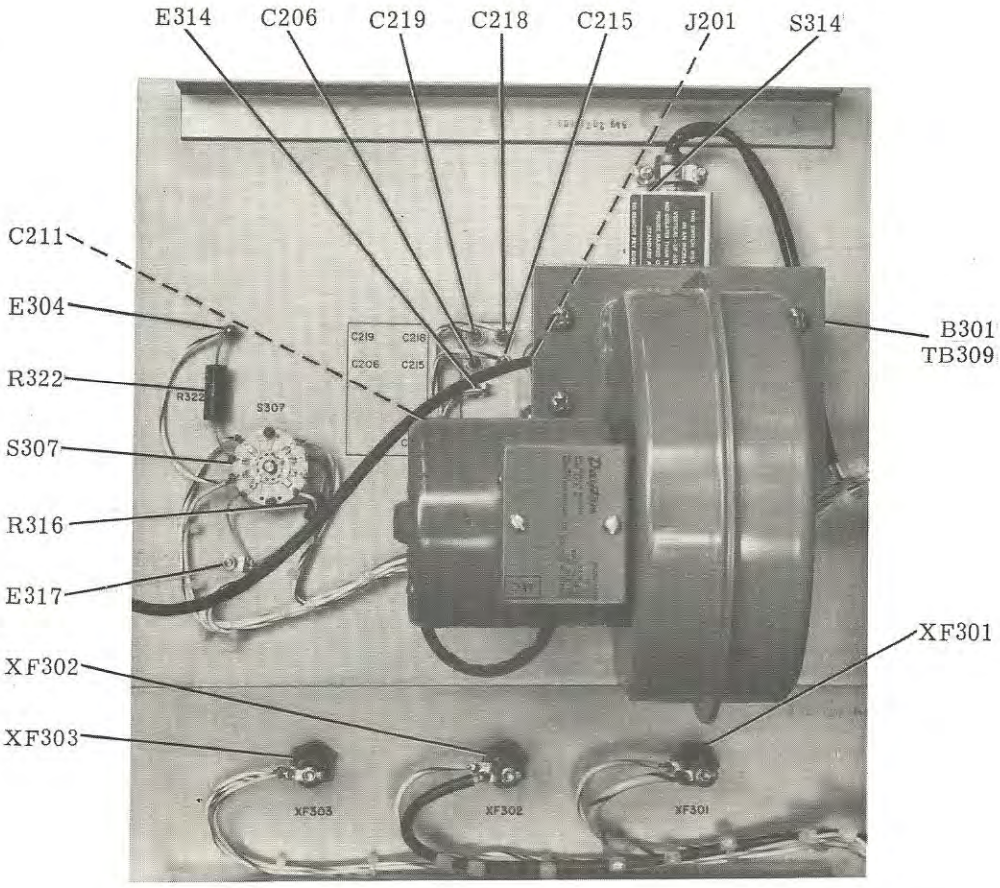


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 8 of 12)



DETAIL E

Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 9 of 12)

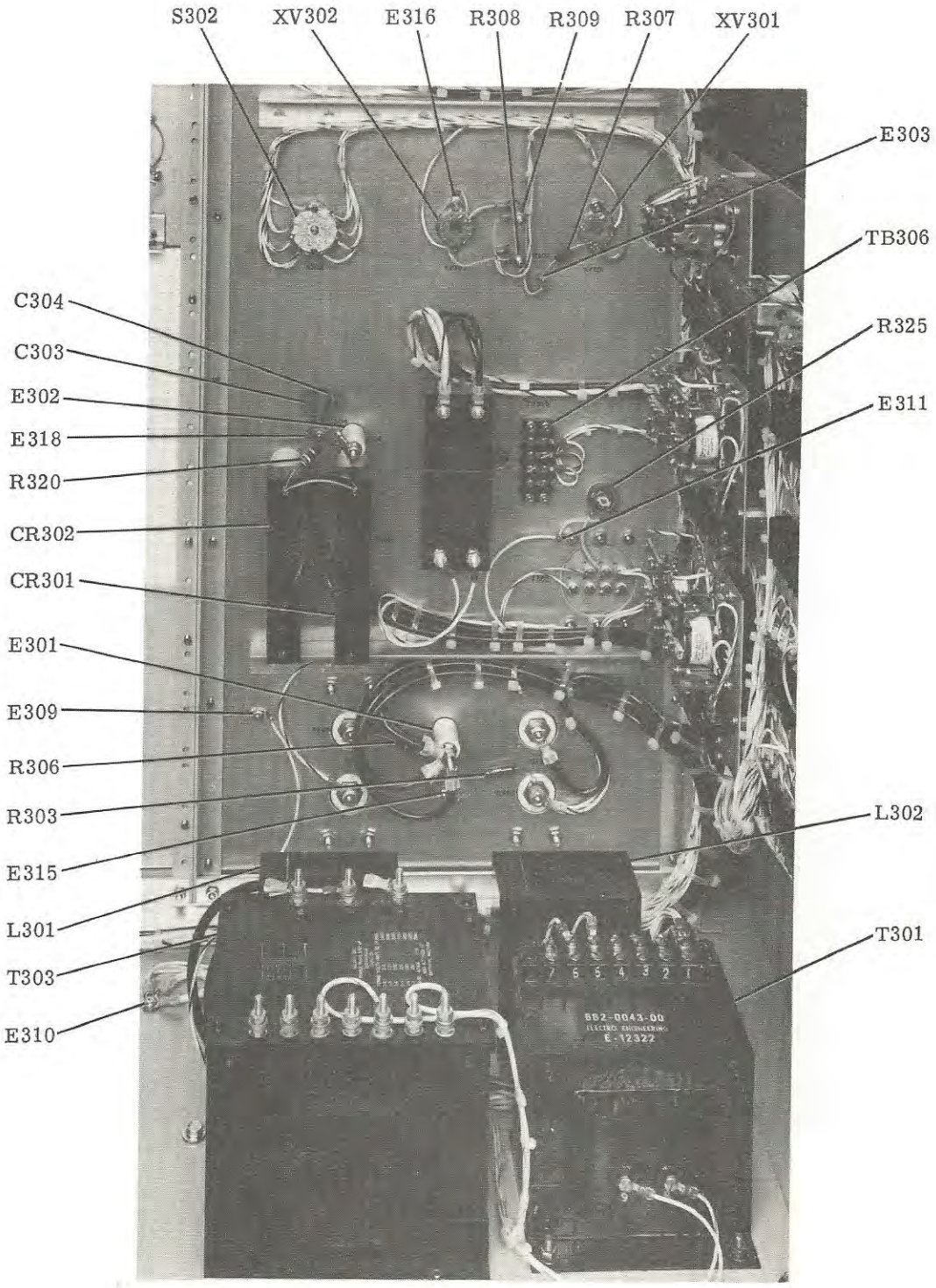


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 10 of 12)

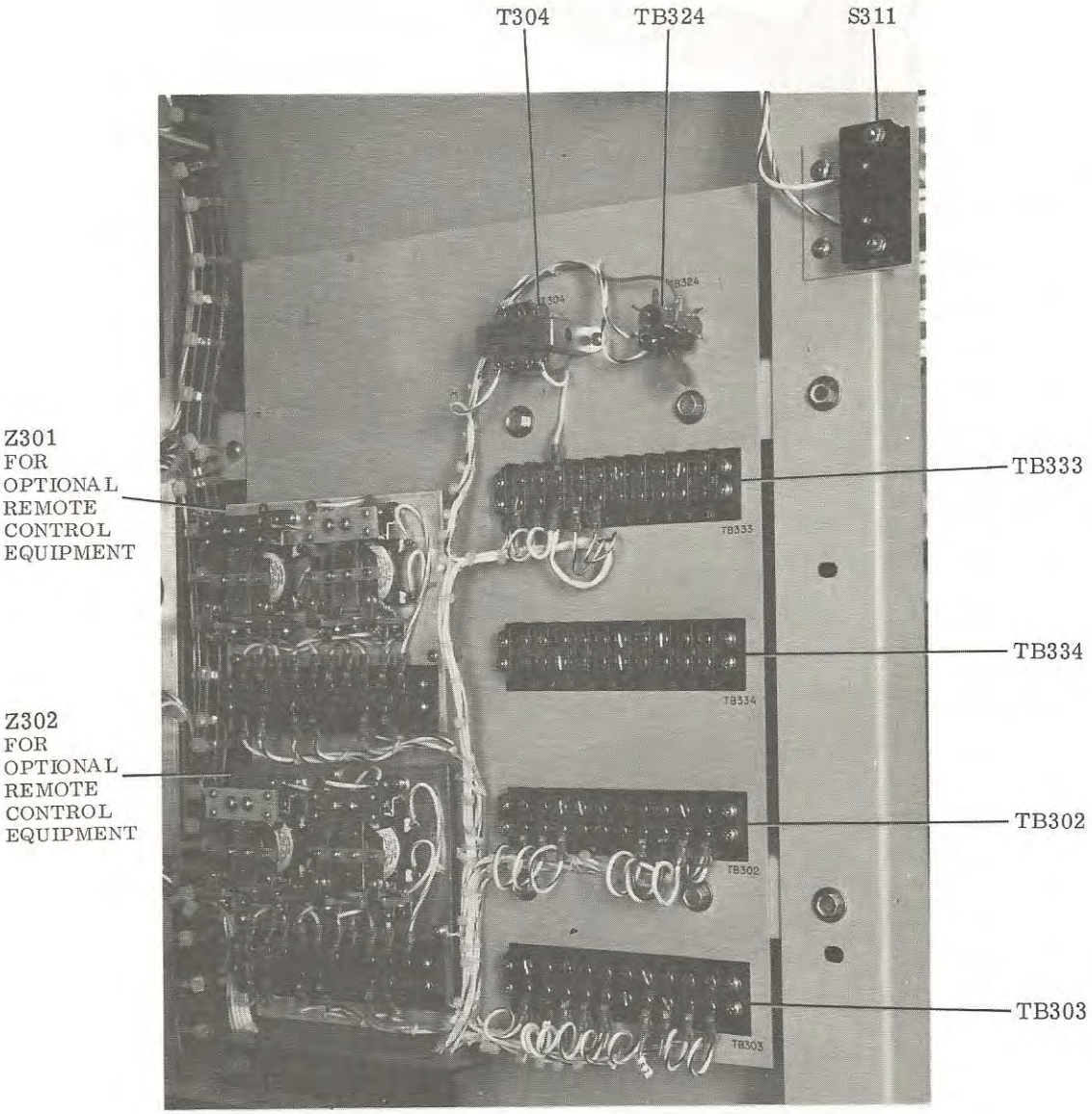


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 11 of 12)

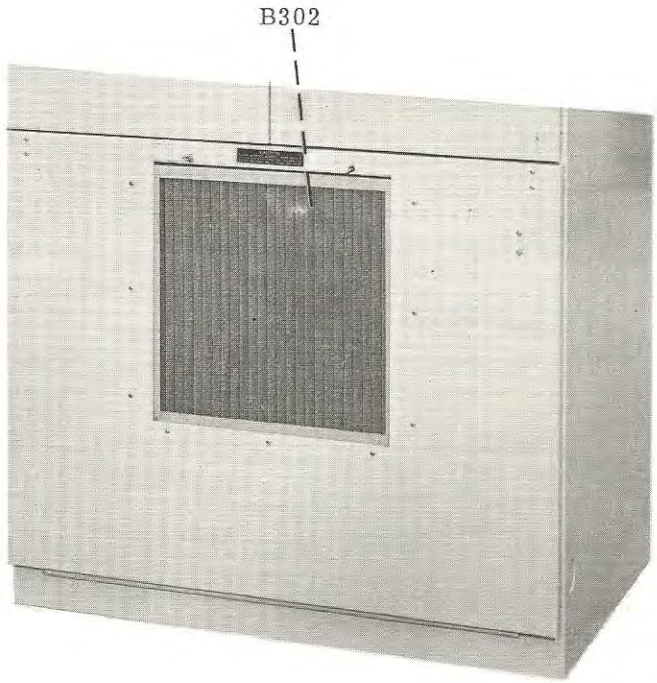


Figure 4-1. B830-1 250-Watt FM Power Amplifier (Sheet 12 of 12)

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	B830-1 250-WATT FM POWER AMPLIFIER			549-2008-000
B301	FAN, CENTRIFUGAL 115 VAC, 60 CPS SINGLE PHASE	2C6010	16327	009-1576-000
B302	MOTOR, ALTERNATING CURRENT 230 VOLTS, 50/60 CPS, 1550 RPM	5KSP51CL17	24446	230-0164-000
C201	CAPACITOR, FXD, CERAMIC 0.02 UF, PLUS 100% MINUS 20%, 500 VDCW	33C2	01939	913-2142-000
C202 THROUGH C205	SAME AS C201			
C206	CAPACITOR, FXD, CERAMIC 1000 UUF, PLUS 80% MINUS 20%, 500 VDCW	327-029X5T0102Z	72982	913-1292-000
C207	CAPACITOR, FXD, CERAMIC 1000 UUF, 20% TOL, 5000 VDCW	DA-858-003	71590	913-0101-000
C208	PLATE, CAPACITOR ALUMINUM, 0.063 INCHES THICK, 2.625 INCHES DIA, 2.625 INCHES WIDE			549-2059-002
C209	CAPACITOR, VARIABLE, AIR 4.5 UUF MIN TO 9.5 UUF MAX, 7000 VOLTS	165-8-2	74970	922-0570-000
C210	SAME AS C207			
C211	SAME AS C206			
C212	PART OF XV201			
C213	CAPACITOR, VARIABLE, AIR 3.9 UUF MIN TO 50 UUF MAX	11726-244	80583	922-0016-000
C214	SAME AS C206			
C215	SAME AS C206			
C216	SAME AS C207			
C217	SAME AS C207			
C218	SAME AS C206			
C219	SAME AS C206			
C220	CAPACITOR, FXD, PLASTIC 35 UUF, 1000 VDCW			549-2126-002
C301	CAPACITOR, FXD, PAPER 4UF, 10% TOL, 4000 VDCW	P47484	56289	930-0705-000
C302	SAME AS C301			
C303	CAPACITOR, FXD, CERAMIC 0.002 UF, 20% TOL, 6000 VDCW	DA172-087CP	71590	913-3540-000
C304	SAME AS C303			
C305	CAPACITOR, FXD, CERAMIC 25 UUF, 10% TOL, 2500 VDCW PART OF HARMONIC FILTER.	850-001	71590	913-4253-000
C306	SAME AS C305			
C307	CAPACITOR, FXD, CERAMIC 33 UUF, 10% TOL, 15,000 VDCW. PART OF HARMONIC FILTER.	857-332	71590	913-1425-000
C308	SAME AS C305-PART OF HARMONIC FILTER.			
C309	SAME AS C305-PART OF HARMONIC FILTER.			
C310 THROUGH C313	SAME AS C305			
C314	CAPACITOR, FXD, CERAMIC 10,000 UUF, 20% TOL, 500 VDCW	CK63AW103M	81349	913-1188-000
C315	SAME AS C314			
C316	SAME AS C314			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
CB301	CIRCUIT BREAKER 50-AMP CURRENT RATING	2263S	74193	260-0239-000
CR301	SEMICONDUCTOR DEVICE, DIODE	4JA421EH2CAB1	24446	353-1794-000
CR302	SAME AS CR301			
CR303				
THROUGH	NOT USED			
CR386				
CR387	SEMICONDUCTOR DEVICE, DIODE	IN3016B	07688	353-3121-000
CR388	SEMICONDUCTOR DEVICE, DIODE	IN963A	07688	353-3220-000
DC301	COUPLER UNIT DOUBLE COUPLER, 50 OHMS IMPEDANCE	576KM	16731	277-0156-000
DS301	LAMP, BULB 0.027 AMP, 125 VOLTS	3S6-5	24446	262-3310-000
DS302	SAME AS DS301			
E201	CHIMNEY, AIR SOCKET SYSTEM CERAMIC	SK-626	06980	220-1466-000
E301	TERMINAL LUG			
E302	INSULATOR, STANDOFF			
E303	INSULATOR, STANDOFF			
E304	INSULATOR, STANDOFF			
E305	NOT USED			
E306	INSULATOR, STANDOFF			
E307	INSULATOR, STANDOFF			
E308	INSULATOR, STANDOFF			
E309	TERMINAL LUG			
E310	GROUND LUG			
E311	TERMINAL LUG			
E312	TERMINAL LUG			
E313	TERMINAL LUG			
E314	TERMINAL LUG			
E315	TERMINAL LUG			
E316	TERMINAL LUG			
E317	GROUND LUG			
E318	TERMINAL LUG			
E319	NOT USED			
E320	NOT USED			
E321	NOT USED			
E322	TERMINAL LUG			
E323	LENS, INDICATOR GREEN	75A101GRN	72765	262-0258-000
E324	LENS, INDICATOR RED	75A101RED	72765	262-0259-000
E325	PUSHBUTTON, FILAMENT OFF			548-3584-003
E326	PUSHBUTTON, FILAMENT ON			548-3586-003
E327	PUSHBUTTON, PLATE ON			548-3588-003
E328	PUSHBUTTON, PLATE OFF			548-3590-003
E329	SHIELD, RADIO FREQUENCY			549-2113-004
F301	FUSE, CARTRIDGE 250 VOLTS, 5.0 AMPS	F03A250V5AS	81349	264-0361-000
F302	SAME AS F301			
F303	FUSE, CARTRIDGE 125 VOLTS, 4 AMPS	313004	75915	264-0217-000
J201	CONNECTOR, ELECTRICAL 1 CONTACT	UG1094U	80058	357-9183-000
J202	CONNECTOR, ELECTRICAL 1 CONTACT	UG58AU	80058	357-9003-000
J203	SAME AS J201			
J301	SAME AS J201-PART OF HARMONIC FILTER.			
J302	SAME AS J201-PART OF HARMONIC FILTER.			
J303	CONNECTOR, ELECTRICAL 500 VDCW, 50 OHMS IMPEDANCE	UG-1187/U	80058	357-9476-000
J304	CONNECTOR, ELECTRICAL	100-83000C-75	94375	357-9248-000
J305	SAME AS J304			
K301	RELAY, ARMATURE	83-3544	04221	970-1933-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	115 VOLTS AC, 330 OHMS RESISTANCE			
K302	SAME AS K301			
K303	RELAY, SWITCH 20 AMPS, 60 CPS, 20 VOLTS	DA2102-002-12060	27780	402-0126-000
K304	RELAY, ARMATURE 2 CONTACTS	702LB0D92	01121	405-0674-000
K305	RELAY, ARMATURE SILVER, 10 OHMS RESISTANCE, 10% TOL	95062	78277	408-1114-000
L201	NOT USED			
L202	COIL, RADIO FREQUENCY 4.7 UH, 10% TOL, 0.60 OHMS RESISTANCE	LT7K194	81349	549-2132-002 240-0178-000
L203	COIL, RADIO FREQUENCY			549-2133-002
L301	CHOKE 10 H, 90 OHMS, 0.350 AMPS	E12321	80008	668-0014-000
L302	SAME AS L301			
M301	METER 100 OHMS, PLUS 5% MINUS 10% METER RESISTANCE	56-0443-0000	80145	458-0649-000
M302	METER COIL TYPE, MOVING	56-0383-0000	80145	458-0640-000
M303	METER COIL TYPE, MOVING	56-7733-0000	80145	458-0639-000
M304	METER COIL TYPE, MOVING	56-4922-0000	80145	458-0638-000
MP301	KNOB BLACK PHENOLIC			546-1293-003
MP302 THROUGH MP305	SAME AS MP301			
MP306	KNOB BLACK PHENOLIC			546-1294-003
MP307	CONTACT ASSY INTERLOCK SWITCH	N4050	85107	260-4050-000
MP308	SAME AS MP307			
MP309	LATCH, MAGNETIC ALUMINUM STRIKER PLATE, STEEL FERRITE MAGNET	ADPL100DCST1	84792	015-0899-000
MP310	SAME AS MP309			
MP311	ROD ASSEMBLY, SHORTING BRASS, PLASTIC HANDLE 24.938 INCHES LONG			549-2186-003
MP312	CATCH, HEAVY DUTY STEEL, CADMIUM PLATE	4-2-57	14608	015-0005-000
MP313	SAME AS MP306			
MP314	SHAFT, STRAIGHT			549-2128-002
MP315	LATCH, TOUCH RELEASE STEEL, CADMIUM PLATE	61-380 CAD-1	42689	015-1398-000
MP316	NOT USED			
MP317	CATCH, DOOR	40F3687-1	01930	015-4090-000
MP318	WINDOW, METER OBSERVATION GLASS, 3/16 INCHES THICK			548-3567-002
MP319	PLATE, SWITCH ACTUATOR			549-2054-002
MP320	COUPLING BRASS	2105	74887	015-0257-000
MP321	SAME AS MP301			
MP322	FILTER, AIR STEEL FRAME			009-1069-000
P301	CONNECTOR, ELECTRICAL 1 CONTACT	MS35168-88E	96906	357-9292-000
P302	SAME AS P301			
P303	CONNECTOR, ELECTRICAL 1 CONTACT-PART OF EXCITATION INPUT.	UG1185A/U	81349	357-9326-000
P304	SAME AS P303			
P305	CONNECTOR USED WITH HARMONIC FILTER.			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
P306	SAME AS P305			
P307	SAME AS P301			
P308	NOT USED			
P309	CONNECTOR 2 CONTACTS-USED WITH CABINET FAN			368-0014-000
R201	RESISTOR, FXD, COMPOSITION 2700 OHMS, 10% TOL, 2 WATTS	RC42GF272K	81349	745-5670-000
R202	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10% TOL, 2 WATTS	RC42GF332K	81349	745-5673-000
R203	RESISTOR, FXD, COMPOSITION 47 OHMS, 10% TOL, 1 WATT	RC32GF470K	81349	745-3296-000
R204	SAME AS R202			
R301	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 2 WATTS	RC42GF102K	81349	745-5652-000
R302	SAME AS R301			
R303	RESISTOR, FXD, WIRE WOUND 10 OHMS RESISTANCE, 5% TOL	78C54F10PCRM5PCT	44655	710-3043-000
R304	RESISTOR ASSEMBLY			549-2016-000
R305	RESISTOR, FXD, WIRE WOUND 31K OHMS, 5% TOL, 210 WATTS	HL-225-31001J	91637	746-6727-000
R306	RESISTOR, FXD, COMPOSITION 10 OHMS, 10% TOL, 2 WATTS	RC42GF100K	81349	745-5568-000
R307	RESISTOR, FXD, WIRE WOUND 2.56 OHMS, 1% TOL, 2.5 WATTS	RS10-10001H	91637	746-9448-000
R308	RESISTOR, FXD, WIRE WOUND 5K OHMS, 5% TOL, 10 WATTS	1 3-4D57F5KPORM-5PCT	44655	710-2913-000
R309	SAME AS R308			
R310	RESISTOR, FXD, FILM 1000K OHMS, 1% TOL, 2 WATTS	RN80B1004F	81349	705-4254-000
R311	SAME AS R310			
R312	SAME AS R310			
R313	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1 WATT	RC32GF103K	81349	745-3394-000
R314	RESISTOR, FXD, FILM 7500 OHMS, 5% TOL, 1 WATT	RL32S752J	81349	745-3994-000
R315	NOT USED			
R316	SAME AS R310			
R317	RESISTOR, VARIABLE POWER TYPE, 500 OHMS, 10% TOL, 50 WATTS	49474	44655	736-0456-000
R318	RESISTOR, FXD, WIRE WOUND 160 OHMS, 5% TOL, 10 WATTS	1 3-4D57F160POR-M5PCT	44655	710-2921-000
R319	RESISTOR, FXD, WIRE WOUND 20 OHMS, 5% TOL, 5 WATTS	7/8C54F20.0PORM-5PCT	44655	710-3035-000
R320	RESISTOR, FXD, COMPOSITION 390 OHMS, 10% TOL, 2 WATTS	RC42GF391K	81349	745-5635-000
R321	RESISTOR, VAR, WIRE WOUND 10K OHMS, 20% TOL, 2 WATTS	RV4LAYSA103B	81349	380-2757-000
R322	RESISTOR, FXD, FILM 402K OHMS, 1% TOL, 1 WATT	RN75B4023F	81349	705-3287-000
R323	RESISTOR, FXD, WIRE WOUND 1 OHM, 5% TOL, 26 WATTS	RW33V1R0	81349	747-1626-000
R324	NOT USED			
R325	RESISTOR, VARIABLE 100 OHMS, 10% TOL	44968-100	44655	749-4512-000
R326 THROUGH R420	NOT USED			
R421	RESISTOR, FXD, FILM 1800 OHMS, 5% TOL, 1 WATT	RL32S182J	81349	745-3956-000
R422	RESISTOR, FXD, FILM 4700 OHMS, 5% TOL, 1 WATT	RL32S472J	81349	745-3981-000
S111	SWITCH, PUSH	B2BL	04009	260-2020-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	DPST CONTACT ARRANGEMENT			
S112	SAME AS S111			
S113	SAME AS S111			
S114	SAME AS S111			
S202	SWITCH, INTERLOCK SPDT CONTACT ARRANGEMENT	3AC5	91929	266-8013-000
S301	NOT USED			
S302	SWITCH, ROTARY ROTARY WAFER SWITCH	4MLRC	82104	259-1564-000
S303 THROUGH S306	NOT USED			
S307	SWITCH, ROTARY 8 CONTACTS	4MLRC	82104	259-1565-000
S308	SWITCH, ROTARY ROTARY WAFER SWITCH	228556-F1E	76854	259-1808-000
S309	SPRING, INTERLOCK			549-2315-003
S310	SAME AS S309			
S311	CONTACT ASSEMBLY INTERLOCK SWITCH	N4040	85107	260-4040-000
S311A	PART OF CABINET DOOR			
S311B	CONTACT ASSEMBLY 2 CONTACTS	N4040	85107	260-4040-000
S312	SAME AS S311			
S313	SAME AS S311			
S314	SWITCH, AIRFLOW SPDT CONTACT ARRANGEMENT	4000	82877	266-8307-000
T301	TRANSFORMER, POWER, STEP-DOWN 250 VOLTS, 50 TO 60 CPS	E12322	80008	662-0043-000
T302	TRANSFORMER, POWER, STEP-UP	292-578-3G1	49956	662-0041-000
T303	SAME AS T302			
TB301	TERMINAL BOARD 4 TERMINALS	4-142	71785	367-5040-000
TB302	TERMINAL BOARD 10 TERMINALS	10-140	71785	367-3100-000
TB303	SAME AS TB302			
TB304	TERMINAL BOARD 12 TERMINALS	600-12M	71785	367-0518-000
TB305	SAME AS TB304			
TB306	TERMINAL BOARD 4 TERMINALS	18A18697	71785	367-4040-000
TB307	TERMINAL BOARD 14 TERMINALS	14-162A-R	75173	367-0300-000
TB308	TERMINAL BOARD 11 TERMINALS			549-2102-003
TB309	TERMINAL BOARD			549-2103-003
TB310 THROUGH TB322	NOT USED			
TB323	TERMINAL BOARD 12 TERMINALS	6H12	00534	306-0909-000
TP301	JACK TIP YELLOW	MS16108-8A	96906	360-0156-000
TP302	JACK TIP BLUE	MS16108-7A	96906	360-0155-000
V201	TUBE, ELECTRON	7203/4CX250B	49671	256-0138-000
V301	TUBE, ELECTRON	0D3-VR150	49671	257-0001-000
V302	SAME AS V301			
XDS301	LAMPHOLDER	75 LESSLENS	72765	262-0255-000
XDS302	SAME AS XDS301			
XF301	FUSEHOLDER 20 AMP CURRENT RATING	HKLJRWZZ	71400	265-1040-000
XF302	SAME AS XF301			
XF303	SAME AS XF301			
XV201	SOCKET, ELECTRON TUBE INSULATED, 1000 VDCW	124-115-2	74970	220-1294-000
XV301	SOCKET, ELECTRON TUBE 8 CONTACTS	88-8TM	02660	220-1005-000
XV302	SAME AS XV301			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	MANUFACTURERS CODES			
CODE	MANUFACTURER			
00213	SAGE ELECTRONICS CORP P.O. BOX 3926 ROCHESTER, N.Y.			
00534	VECTOR MFG. CO. 5616 LAWNDALE HOUSTON, TEXAS			
01121	ALLEN-BRADLEY CO. 1201 SOUTH 2ND STREET MILWAUKEE, WIS.			
01930	AMEROCK CORP 4000 AUBURN ST ROCKFORD, ILL.			
01939	SPRAGUE ELECTRIC CO. OF WIS. GRAFTON			
02660	AMPHENOL-BORG ELECTRONICS CORP 25TH AND CERMACK RD MAYWOOD, ILL.			
03508	GENERAL ELECTRIC CO. SEMI-CONDUCTOR PRODUCTS DEPT. SYRACUSE, N.Y.			
03511	GENERAL ELECTRIC CO. SPECIALTY MOTOR DEPT. FORT WAYNE, IND.			
04009	ARROW-HART AND HEGEMAN ELECTRIC CO. HARTFORD, CONN.			
04221	TELEX-AEMCO MANKATO, MINN.			
04713	MOTOROLA INC. SEMICONDUCTOR PRODUCTS DIVISION 5005 EAST MC DOWELL ROAD PHOENIX, ARIZONA			
06980	EITEL-MCCULOUGH INC. 301 INDUSTRIAL WAY SAN CARLOS, CALIF.			
07688	JOINT ELECTRON DEVICE ENGINEERING COUNCIL WASHINGTON, D.C.			
09922	BURNDY CORPORATION NORWALK, CONN.			
10646	CARBORUNDUM CO. BUFFALO AVE. NIAGARA FALLS, N.Y.			
14608	CORBIN CABINET LOCK DIVISION OF EMHART CORP 102 WASHINGTON ST. NEW BRITAIN, CONN.			
15605	CUTLER-HAMMER INC. MILWAUKEE, WIS.			
16327	DAYTON ELECTRIC MFG CO. 5959 W HOWARD ST. CHICAGO, ILL.			
16731	MICROWAVE DEVICES INC. INDUSTRIAL PK FARMINGTON, CONN.			
16973	DENVER FIRE CLAY CO. 3033 BLAKE STREET DENVER, COLO.			
24446	GENERAL ELECTRIC CO. SCHENECTADY, N.Y.			
24455	GENERAL ELECTRIC CO. LAMP DIVISION OF CONSUMER			

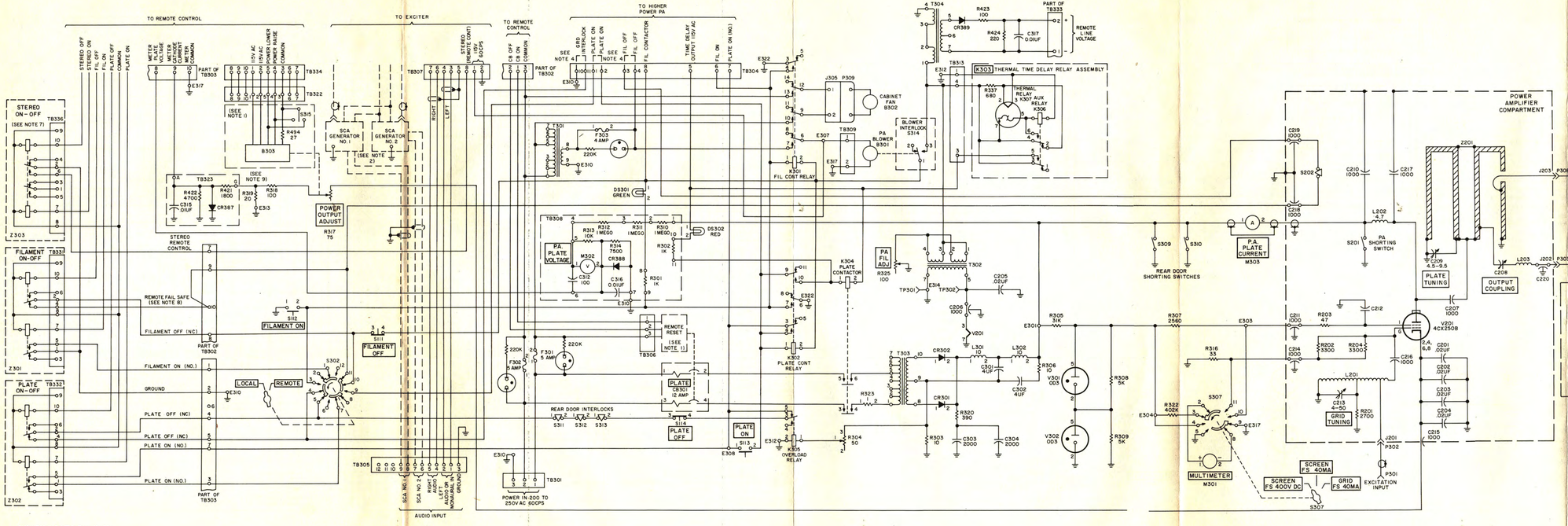
SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	PRODUCTS GROUP NELA PARK CLEVELAND, OHIO			
27780	HAYDON DIVISION OF GENERAL TIME CORP 245 E ELM TORRINGTON, CONN.			
42689	NATIONAL LOCK CO. 1902 SEVENTH ST. ROCKFORD, ILL.			
44655	OHMITE MFG. CO. 3601 HOWARD STREET SKOKIE, ILL.			
49671	RADIO CORPORATION OF AMERICA NEW YORK, N.Y.			
49956	RAYTHEON CO.-MICROWAVE AND POWER TUBE DIVISION ADMINISTRATION BLDG. WALTHAM, MASS.			
56289	SPRAGUE ELECTRIC CO. NORTH ADAMS, MASS.			
70892	BEAD CHAIN MFG CO. 64 MOUNTAIN GROVE ST. BRIDGEPORT, CONN.			
71313	CARDWELL CONDENSER CORP. 80 EAST MONTAUK HIGHWAY LINDENHURST LONG ISLAND, NEW YORK			
71400	BUSSMANN MFG. DIVISION OF MCGRAW-EDISON CO. 2538 WEST UNIVERSITY ST. ST. LOUIS, MO.			
71590	CENTRALAB DIVISION OF GLOBE-UNION INC. 932 EAST KEEFE AVE. MILWAUKEE, WIS.			
71785	CINCH MFG. CO. AND HOWARD B. JONES DIVISION 1026 SOUTH HOMAN AVE. CHICAGO, ILL.			
72619	DIALIGHT CORP. BROOKLYN, N.Y.			
72765	DRAKE MFG. CO. 4626 NORTH OLCOTT AVE. CHICAGO, ILL.			
72982	ERIE TECHNOLOGICAL PRODUCTS INC. 644 WEST 12TH STREET ERIE, PA.			
74193	HEINEMANN ELECTRIC CO. 2612 BRUNSWICK PIKE TRENTON, N.J.			
74545	HUBBELL HARVEY INC. BRIDGEPORT, CONN.			
74887	INSULINE CORP OF AMERICA MANCHESTER, N.H.			
74970	E.F. JOHNSON CO. 297 TENTH AVE. S.W. WASECA, MINN.			
75173	CANCELLED CODE-USE CODE 71785-CINCH MFG CO. DIVISION OF UNITED-CARR FASTENER CORP CHICAGO, ILL.			
75382	KULKA ELECTRIC CORP. MT. VERNON, N.Y.			
75543	LAVELLE RUBBER CO. 424 N. WOOD, CHICAGO, ILL. ZIP CODE 60622			
75915	LITTLEFUSE INC.			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	800 E NORTHWEST HWY DES PLAINES, ILL. ZIP CODE 60016			
76005	LORD MFG. CO. 1635 WEST 12TH STREET ERIE, PA			
76487	MILLEN JAMES MFG CO. INC. 150 EXCHANGE ST. MALDEN, MASS. ZIP CODE 02148			
76854	OAK MFG. CO. SOUTH MAIN CRYSTAL LAKE, ILL.			
77554	REDMAN TRAILER CO. ALMA, MICH.			
78277	SIGMA INSTRUMENTS INC. 170 PEARL ST. SOUTH BRAINTREE, MASS.			
80008	ELECTRO ENGINEERING WORKS OAKLAND, CALIF.			
80058	JOINT ELECTRONIC TYPE DESIGNATION SYSTEM			
80145	ASSEMBLY PRODUCTS INC. 7100 WILSON MILLS ROAD CHESTERLAND, OHIO			
80147	BIGGS STEEL FOUNDRY AND FABRICATING CO. AKRON, OHIO			
80583	HAMMARLUND CO. INC NEW YORK, N.Y.			
81349	MILITARY SPECIFICATIONS PROMULGATED BY STANDARDIZATION DIVISION DIRECTORATE OF LOGISTIC SERVICES DSA			
81350	JOINT ARMY-NAVY SPECIFICATIONS PROMULGATED BY STANDARDIZATION DIVISION DIRECTORATE OF LOGISTIC SERVICES DSA			
81483	INTERNATIONAL RECTIFIER CORP. 1523 EAST GRAND AVE. EL SEGUNDO, CALIF.			
81487	SQUARE D CO. INDUSTRIAL CONTROLLER DIVISION 4041 NORTH RICHARDS ST. MILWAUKEE, WIS.			
82104	STANDARD GRIGSBY INC. 2085 N HAWTHORNE AVENUE MELROSE PARK, ILL. ZIP CODE 60160			
82877	ROTRON MFG. CO. INC. 7-9 HASBROUCK LANE WOODSTOCK, N.Y.			
84792	HEPPNER MFG. CO. P.O. BOX Q ROUND LAKE, ILL.			
85107	NEPTUNE ELECTRONICS CO. 30 WEST 15TH STREET NEW YORK, N.Y.			
90211	SQUARE D CO. 9405 RIVER CHICAGO, ILL			
91637	DALE ELECTRONICS INC. COLUMBUS, NEBR			
91929	HONEYWELL INC.-MICRO SWITCH			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	DIVISION FREEPORT, ILL.			
92702	IMC MAGNETICS CORP. EASTERN DIVISION 570 MAIN STREET WESTBURY LONG ISLAND, N.Y.			
94310	TRU-OHM PRODUCTS MEMCOR COMPONETS DIVISION P.O. BOX 890 HUNTINGTON, IND.			
94375	AUTOMATIC METAL PRODUCTS CO. 315 BERRY BROOKLYN, N.Y.			
96214	TEXAS INSTRUMENTS INC. APPARATUS DIVISION DALLAS, TEXAS			
96906	MILITARY STANDARD PROMULGATED BY STANDIZA- TION DIVISION DIRECTORATE			
97488	UNITED STATES RUBBER CO. OF LOGISTIC SERVICES DSA CONSUMER INDUSTRIAL AND PLASTICS PRODUCTS DIVISION CHICAGO, ILL.			
97965	STANCON ELECTRONICS INC CHICAGO, ILL.			

section 5

illustrations



NOTES:
1. SUPPLIED WITH REMOTE CONTROL ONLY. R494 MAY CHANGE PER CUSTOMER REQUIREMENTS
2. SCA GENERATORS OPTIONAL FOR STEREO OR MULTIPLEX
3. ALL GROUNDS UNLESS OTHERWISE SPECIFIED ARE CONNECTED TO BASE PLATE OF CABINET CHASSIS
4. JUMPER WHEN USED AS 250 WATT TRANSMITTER.
5. HARMONIC FILTER NOT PART OF B830-1, USED ONLY WHEN B830-1 IS CONNECTED TO ANTENNA. WHEN NOT USED, CONNECT J202 TO DC301-1.
6. UNLESS OTHERWISE INDICATED:
   ALL RESISTANCE VALUES ARE IN OHMS
   ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
   ALL INDUCTANCE VALUES ARE IN MICROHENRYS
7. LATCHING RELAY (Z303) SUPPLIED WITH REMOTE STEREO ONLY
8. FOR REMOTE CONTROL REMOVE JUMPER BETWEEN TERMINALS 9 AND 10 OF TB302
9. R318 AND R319 RESISTOR VALUES MAY CHANGE PER CUSTOMER REQUIREMENTS.

Figure 5-1. Overall Schematic, B830-1 250-Watt FM Power Amplifier