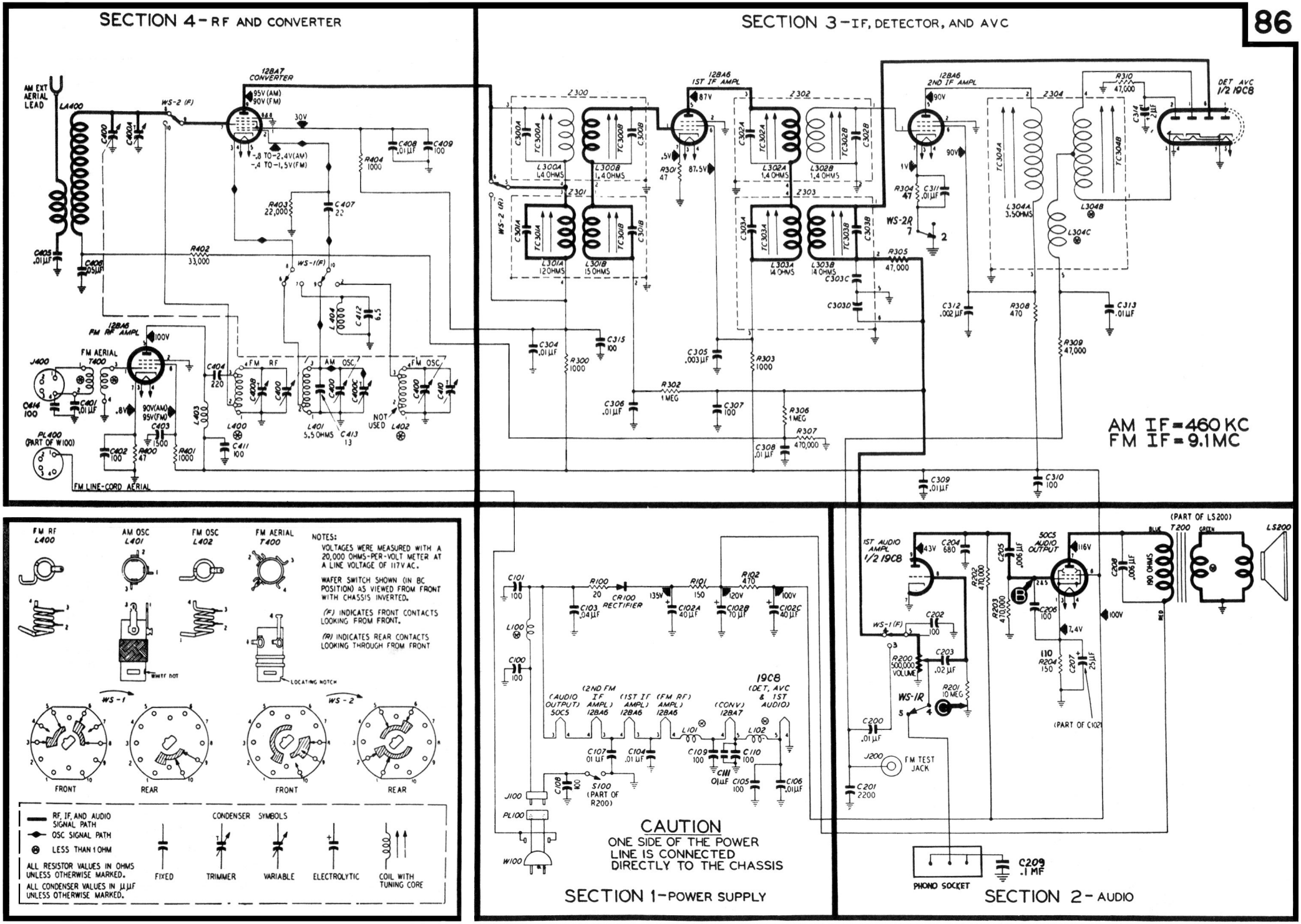


Philco Radio Model 86, Sectionalized Schematic Diagram, Showing Test Points

Circuit Description

Philco Radio Model 86 is a superheterodyne employing six tubes plus a selenium rectifier. Reception is provided in the standard-broadcast and FM bands. A built-in high-impedance loop is used as the aerial for the broadcast band, and the line cord is used as the aerial for the FM band. These aerials normally provide adequate signal pickup; if additional pickup is required on the FM band, Philco Dipole Aerial Part No. 45-1462 may be used.

A 12BA6 pentode is used as an r-f amplifier, for FM only. This stage is capacity-coupled to a 12BA7, which is employed as a mixer and oscillator for both bands, by switching the mixer grid and common cathode to the proper circuits.

For broadcast reception, the i-f signal is transformer-coupled to a 12BA6 i-f amplifier. The output of this stage is transformer-coupled to a diode section of the 19C8, which provides detection and a-v-c action.

For FM reception, an additional i-f amplifier stage, which employs another 12BA6, is used to provide adequate gain and stability. The 12BA6 is transformer-coupled to two diode sections of the 19C8, in a ratio-detector circuit. The proper detector for AM or FM is selected by the band switch at the detector output circuits.

In the i-f circuits, two sets of i-f transformers are used. One set is tuned to 460 kc., for standard broadcast, and the other set is tuned to 9.1 mc., for FM. The use of two sets of transformers makes better shielding possible, so that undesirable beat signals and interaction between transformers are eliminated. In switching bands, the band switch shorts the primary of the 1st i-f transformer for the undesired band.

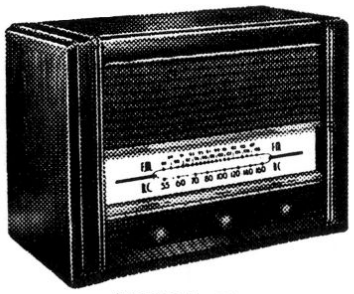
The triode section of the 19C8 is employed as the first audio amplifier; this section is resistance-coupled to the 50C5 output tube, which supplies an audio output of approximately one watt to the permanent-magnet speaker.

The power supply utilizes a selenium rectifier in a half-wave-rectifier circuit, and operates from a line voltage of 105—120 volts, a.c. or d.c.

Philco TROUBLE-SHOOTING Procedure

For rapid trouble shooting, the radio circuit is divided into four sections, with test points specified for each section; these sections and test points are indicated in the schematic diagram.

After isolating the trouble to a single stage, the defect is located by: first, testing the tube; second, measuring tube electrode voltages; third, measuring circuit resistances; fourth, substituting condensers. The trouble revealed should be corrected before testing further.



MODEL 86

SPECIFICATIONS

CABINET	Wood
CIRCUIT	6-tube superheterodyne, plus selenium rectifier
FREQUENCY RANGES	
Broadcast	540—1620 kc.
FM	88—108 mc.
AUDIO OUTPUT	1 watt
OPERATING VOLTAGE	105—120 volts, a.c. or d.c.
POWER CONSUMPTION	35 watts
AERIALS	Built-in high-impedence, loop for AM, line cord for FM; also connector for external aerial
INTERMEDIATE FREQUENCIES	
Broadcast	460 kc.
FM	9.1 mc.
PHILCO TUBES (6)	12BA6(3), 12BA7, 19C8, 50C5

Preliminary Checks

To avoid possible damage to the radio, the following preliminary checks should be made before it is turned on:

1. Inspect both the top and the bottom of the chassis. Make sure that all tubes are secure in the proper sockets, and look for any broken or shorted connections, burned resistors, or other obvious indications of trouble.

2. Measure the resistance between B+ (test point B) and the chassis (test point C). When the ohmmeter test leads are connected in the proper polarity ,the highest resistance reading will be obtained. If the reading is lower than 1500 ohms, check condensers, C102A, C102B, C102C, and C309 for leakage or shorts. The resistance value given is much lower than normal, and is not intended as a quality check of these condensers; the value given is the lowest at which the rectifier will operate safely while the voltage checks of Section 1 (power supply) are performed.

SYMBOLIZATION

The components in the radio circuit are symbolized according to the types of parts and the sections of the radio in which the parts are located. The prefix letter of the symbol designates the type of parts, as follows:

C—Condenser
CR—rectifier
J—jack
L—choke or coil
LA—loop aerial
LS—loud-speaker
PL—plug
R—resistor
S—switch
T—transformer
W—line cord
WS—wafer switch
Z—electrical assembly

The number of the symbol designates the section in which the part is located, as follows:

100-series components are in Section 1—the power supply
200-series components are in Section 2—the audio circuits
300-series components are in Section 3—the i-f, amplifier, detector, and a-v-c circuits
400-series components are in Section 4—the r-f and converter circuits

AM ALIGNMENT PROCEDURE

Make alignment with loop aerial connected to radio. The AM alignment should be completed before the FM alignment is made.

DIAL POINTER — With tuning-condenser plates fully meshed, adjust pointer to coincide with index mark at low-frequency end of scale.

RADIO CONTROLS — Set volume control to maximum, set band switch for broadcast reception, and set tuning control as indicated in chart.

SIGNAL GENERATOR — Use AM r-f signal generator, with modulated output. Connect generator and set frequency as indicated in chart.

OUTPUT METER — Connect across voice-coil terminals.

OUTPUT LEVEL — During alignment, signal-generator output must be attenuated to hold output-meter reading below 1.25 volts.

FM ALIGNMENT PROCEDURE

Make AM alignment first.

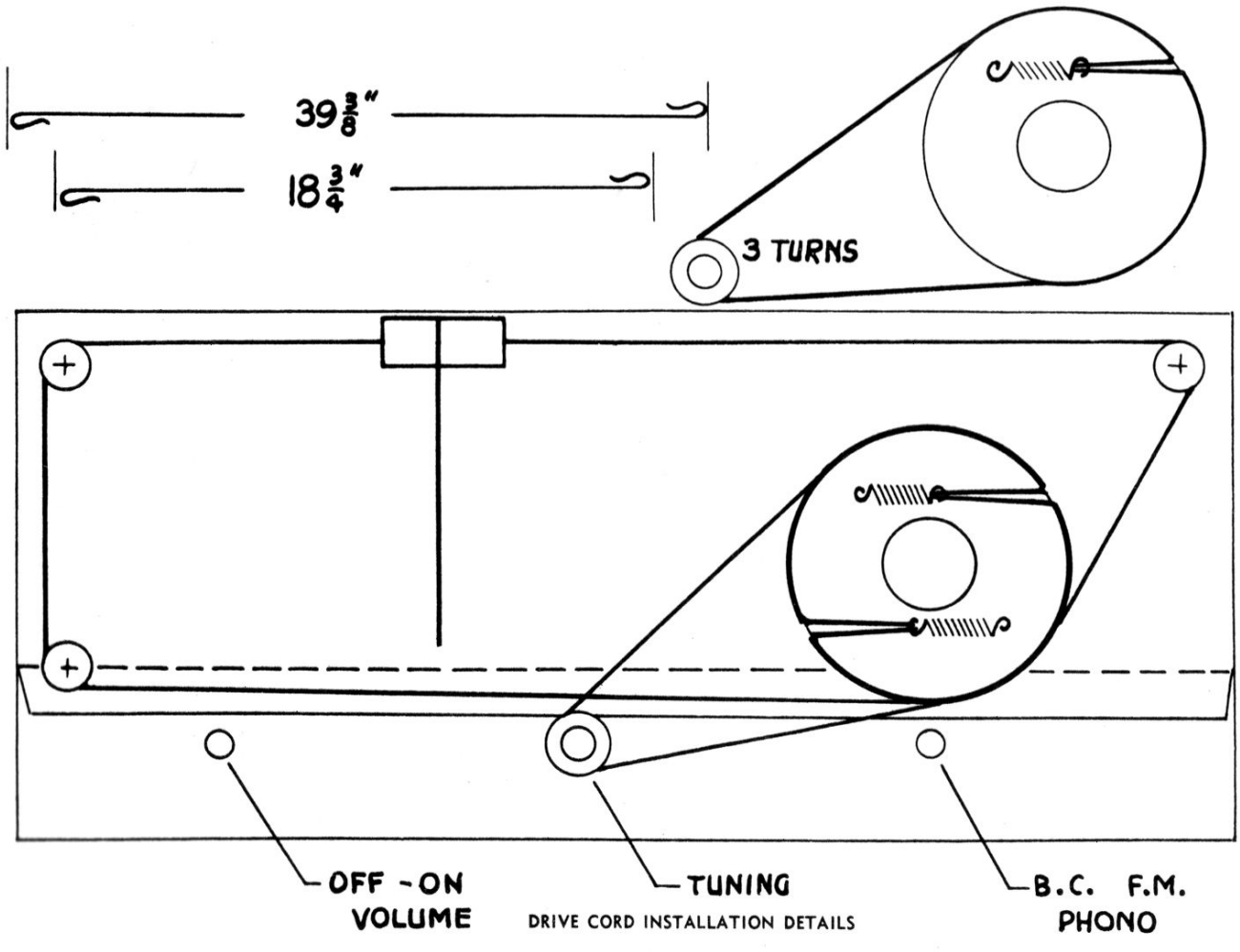
RADIO CONTROLS — Set volume control to maximum, set band switch for FM reception, and set tuning control as indicated in chart.

OUTPUT METER — Connect across voice-coil terminals. (This meter is used only for step 3.)

D-C VOLTMETER — Connect negative lead of d-c voltmeter (resistance of at least 20,000 ohms per volt) to pin 2 of 19C8 tube, and positive lead to chassis. Use 0—10 volt range.

SIGNAL GENERATOR — Use AM r-f signal generator, with modulated output. Connect ground lead to chassis. Connect output lead and set frequency as indicated in chart. Generator must have sufficient output to give reading of approximately 8.5 volts on d-c voltmeter; during alignment, generator output must be attenuated to hold meter reading at this value.

NOTE: Before starting FM alignment, allow radio and signal generator to warm up for 15 minutes.

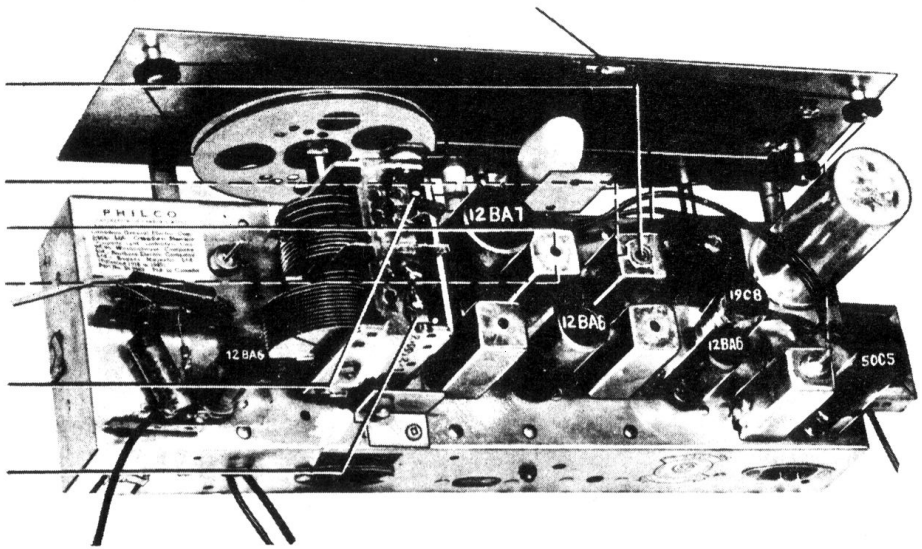


DRIVE CORD INSTALLATION DETAILS

AM ALIGNMENT CHART

STEP	SIGNAL GENERATOR		RADIO		ADJUST TRIMMER
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to chassis. Output lead through a .1-mf. condenser to mixer grid (pin 7) of 12BA7.	460 kc.	540 kc. (gang fully meshed)	Adjust for maximum output.	TC303B—2nd AM i-f sec. TC303A—2nd AM i-f pri. TC301B—1st AM i-f sec. TC301A—1st AM i-f pri.
2	Radiating loop. (See note below.)	1600 kc.	1600 kc.	Adjust for maximum output.	C400C—osc. trimmer
3	Same as step 2.	1500 kc	1500 kc.	Adjust for maximum output.	C400A—aerial trimmer

NOTE:—TC301A and TC303A are located on underside of chassis.

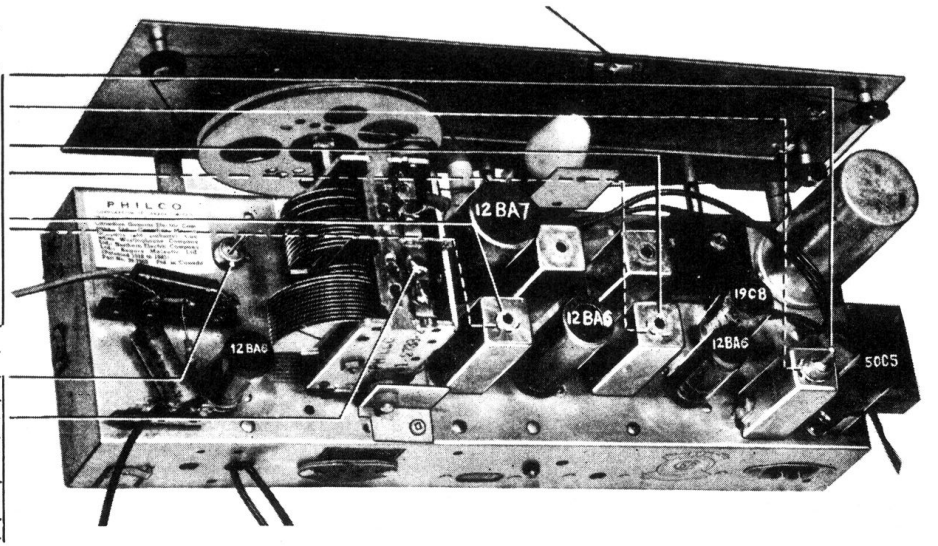


RADIATING LOOP: Make up a six-to-eight-turn, 6-inch-diameter loop from insulated wire; connect to generator terminals, and place near radio loop aerial. Radio loop aerial must be connected.

FM ALIGNMENT CHART

STEP	SIGNAL GENERATOR		RADIO		ADJUST TRIMMER
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Through a .1-mf. condenser to control grid (pin 1) of 12AB6 1st i-f amp.	9.1 mc.	88 mc.	Adjust tuning cores for maximum reading on d-c voltmeter. Attenuate signal generator to maintain a reading of approximately 10 volts. Repeat adjustments until no further improvement is noted. After this step, do not disturb these tuning cores except as directed in step 3.	TC304B—discriminator sec. TC304A—discriminator pri TC302B—FM 2nd i-f sec TC302A—FM 2nd i-f pri.
2	Through .1-mf. condenser to pin 7 of 12BA7.	9.1 mc.	88 mc.	Adjust tuning cores for maximum reading on d-c voltmeter. Repeat adjustments until no further improvement is noted. Do not disturb these tuning cores after this step.	TC300B—FM 1st i-f sec. TC300A—FM 1st i-f pri.
3	Same as step 1.	9.1 mc.	88 mc.	Adjust tuning core for minimum reading on output meter. This adjustment is critical; repeat to make certain it is correct.	TC304B—discriminator sec.
4	To terminal 1 of J400.	105 mc.	105 mc.	Adjust trimmer for maximum reading on d-c voltmeter.	C410—FM osc.
5	Same as step 4.	105 mc.	105 mc.	Same as step 4.	C400B—FM r-f
6	Same as step 4.	92 mc.	92 mc.	Adjust coil for maximum reading on d-c voltmeter.	L402—FM osc. (tracking)*
7	Same as step 4.	92 mc.	92 mc.	Same as step 6.	L400—FM r-f (tracking)*
8	Same as step 4.	105 mc.	105 mc.	Same as step 4.	C410—FM osc.
9	Repeat steps 4 through 8 until no further improvement is noted.				

* Note:—TC300A, TC302A, TC304A, L402 and L400 are located on underside of chassis.



Top View, Showing FM Trimmer Locations