Circuit Description

Packard-Philco Auto Radio Model P4735 is a custom-built radio, designed exclusively for use in the 1947 Packard cars.

The circuit is an eight-tube superheterodyne, using permeability tuning. Of the six push buttons, five are used for automatic station selection, and one selects manual tuning. The ganged tuning cores of the aerial, r-f, and oscillator circuits are mechanically actuated (by pantograph drive) for either push-button or manual operation.

The tuned-r-f amplifier stage employs a 7A7. The converter, a 7B8, works into a 7A7 i-f amplifier, which operates at 265 kc.

The 7B6 duo-diode, triode tube provides detection and a-v-c voltage in the diode section; the triode section functions as the first audio amplifier. A 7A4 plate-and-cathode-loaded phase inverter drives the two 7C5 push-pull output amplifiers, which, at full output, provide 5.9 watts of audio power to the electrodynamic speaker.

The power-supply circuit incorporates a non-synchronous vibrator and a 7Y4 full-wave rectifier.

A variable sensitivity control, R406, is connected in the common cathode circuit of the converter and i-f tubes. This control is mounted on the chassis as shown in figure 6, and may be adjusted with a screwdriver, inserted through a hole in the back of the radio; in areas where most reception is from local stations, the control should be set for lower sensitivity, to permit quieter operation of the radio.

The tone control is part of a feed-back circuit in which the feedback to the first audio stage is degenerative at high audio frequencies and regenerative at the lower frequencies.

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. The trouble-shooting procedure given for each section includes a simplified test chart and a bottom view of the chassis showing the locations of the test points and the components of that section.

In each chart, the first step is a master check for determining whether trouble exists in that section, without going through the entire test procedure.

Failure to obtain "NORMAL INDICATION" in any given step indicates trouble within the circuit under test.

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.

Preliminary Checks

To avoid possible damage to the radio, the following preliminary checks should be made before turning on the power:

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 sources of trouble.

2. Measure the resistance between B+ (pin 7 of 7Y4 rectifier tube) and the radio chassis, test point C, with the ohmmeter polarity such that the highest resistance reading is obtained. If the reading is lower than 2700 ohms, check condensers C106A and C106B for leakage or shorts. The resistance value above, which is much lower than normal, 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 tests of Section 1 are performed.

If the fuse is open, check the vibrator before installing a new fuse; if the vibrator is defective, check the buffer condenser, C105, for leak or short.

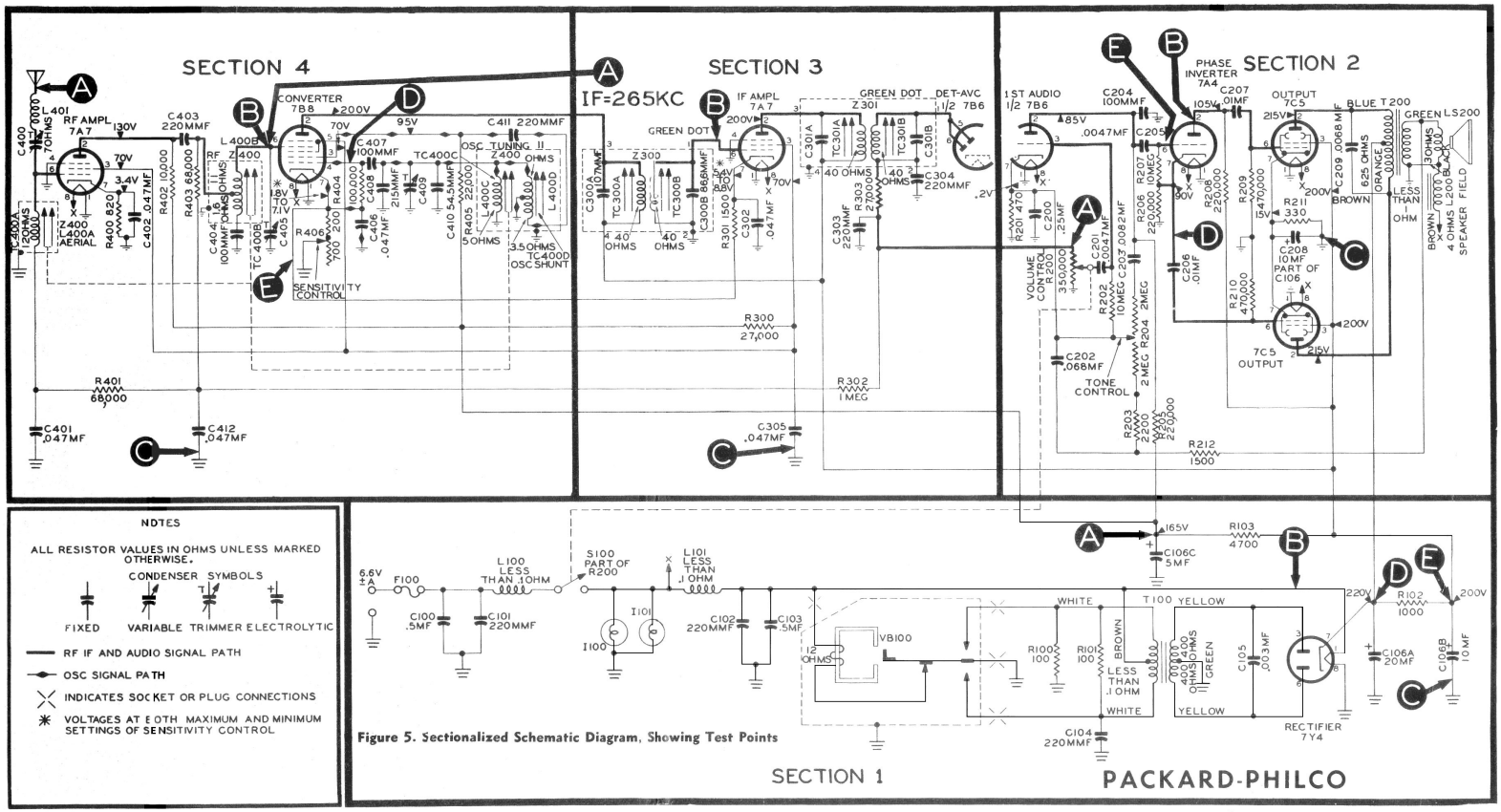


Figure 5. Sectionalized Schematic Diagram, Showing Test Points

1948-49

ALIGNMENT DATA ON SHEET 210
TROUBLE SHOOTING DATA 211 to 214

AUTO RADIO MODEL P4735

PHILCO DATA SHEET 209

ALIGNMENT PROCEDURE

DIAL POINTER—Turn manual tuning knob until pointer stops at high-frequency end of dial; if pointer does not coincide with index mark at 1600 kc., carefully bend it to the correct position.

OUTPUT METER—Connect across voice-coil terminals.

SIGNAL GENERATOR—Connect ground lead to chassis; connect output lead as indicated in chart. Use modulated output.

RADIO CONTROLS—Set volume and sensitivity controls to maximum. Set tone control for maximum signal (approximate center of range).

OUTPUT LEVEL—During alignment, adjust signal-generator output to maintain output-meter indication below 1 volt.

DUMMY AERIAL—For steps 2, 3, and 4, either of two dummy-aerial connections should be used: (1) connect generator output lead through 22-mmf. condenser to shielded aerial lead (Philco Part No. 45-1468-1) plugged into aerial receptacle; (2) connect output lead through 22-mmf. condenser to aerial receptacle, then connect 30-mmf. condenser from receptacle to chassis.

IMPORTANT: The above instructions for the dummy aerial must be carefully followed if the radio is to perform at its best after being reinstalled in the car.

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTIONS TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Through .1-mf. condenser to aerial receptacle.	265 kc.	540 kc.	Adjust trimmers, in order given, for maximum output.	TC301B, TC301A, TC300B, TC300A
2	Through dummy aerial.	1600 kc.	Tune to signal.	Adjust for maximum.	C405
3	Same as step 2.	1400 kc.	1400 kc.	Adjust for maximum.	C409, C404
4	Same as step 2.	580 kc.	Tune to signal.	Adjust for maximum while rocking tuning control.	TC400D
5	Repeat steps 2, 3, and 4 until no further improvement is obtained.				
6	After reinstalling radio in car, with aerial connected, adjust C401 for maximum output from weak station near 1400 kc. If the radio is to be used in an area having local broadcasting stations, the sensitivity control may be adjusted for somewhat lower sensitivity, to permit quieter operation.				

SYMBOLIZATION

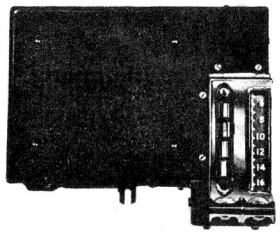
The components in the radio circuit are symbolized according to the types of parts and the sections of the radio in which the parts are located. The prefix letter of the symbol designates the type of part, as follows:

C—condenser
I—pilot lamp
L—choke or coil
LS—loud-speaker
R—resistor
S—switch
T—transformer
VB—vibrator
TC—tuning core
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 aerial, r-f, and oscillator circuits.

A suffix letter identifies the part as a non-replaceable component of the assembly which bears an identical number without a suffix letter, and with perhaps a different prefix letter.



MODEL P4735

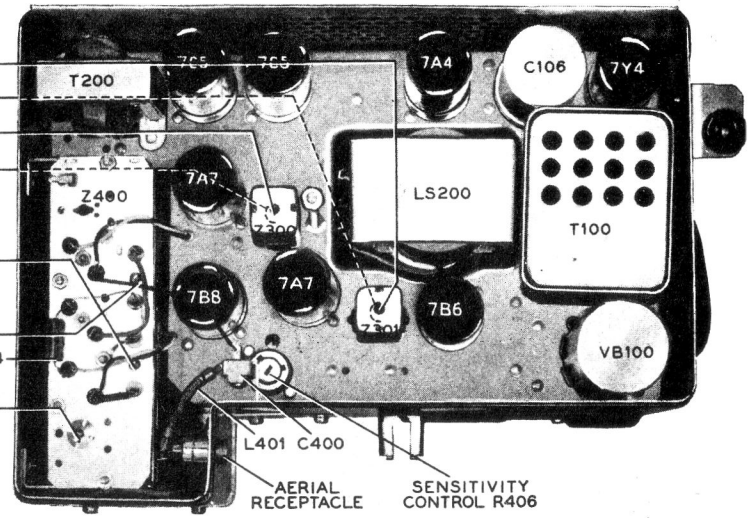
SPECIFICATIONS

CIRCUIT	Eight-tube superheterodyne
FREQUENCY RANGE	540—1600 kc.
PUSH BUTTONS	Six: five for station selection; one for manual tuning
INTERMEDIATE FREQUENCY	265 kc.
AUDIO OUTPUT	5.9 watts
POWER INPUT	8.8 amperes at 6.6 volts, d.c.
AERIAL	Retractable-tip, Philco Part No. 45-1468-1
PHILCO TUBES (8)	7A7 (2), 7B8, 7B6, 7A4, 7C5 (2), 7Y4

SETTING PUSH BUTTONS

Any one of the five station push buttons may be set for any frequency within the broadcast band.

1. Turn on the power, and allow the radio to warm up for fifteen minutes.
2. Pull off the five uppermost push-button knobs (the lower knob selects manual tuning), thus exposing the shafts which operate the tuning mechanism.
3. Depress one of the shafts until it locks in, then rotate the shaft to tune in the desired station; turning the shaft causes the dial pointer to move, indicating the frequency to which the circuits are tuned.
4. Repeat the procedure for each button. Replace the knobs.



AUTO RADIO MODEL P4735

1948-49

CIRCUIT DATA ON SHEET 209
TROUBLE SHOOTING DATA ON SHEETS 211 to 214

PHILCO DATA SHEET 210

TROUBLE SHOOTING

Section 1

Make the tests for this section with a d-c voltmeter, connecting the leads between test point B (B–) and the test points indicated in the chart. The voltage readings given were taken with a 20,000-ohms-per-volt meter, with an "A"-supply voltage of 6.6 volts, d.c.

Turn on the power, and set the sensitivity control to maximum (clockwise).

Turn the volume control to minimum, and the tone control fully counterclockwise.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 2; if not, isolate and correct the trouble in this section.

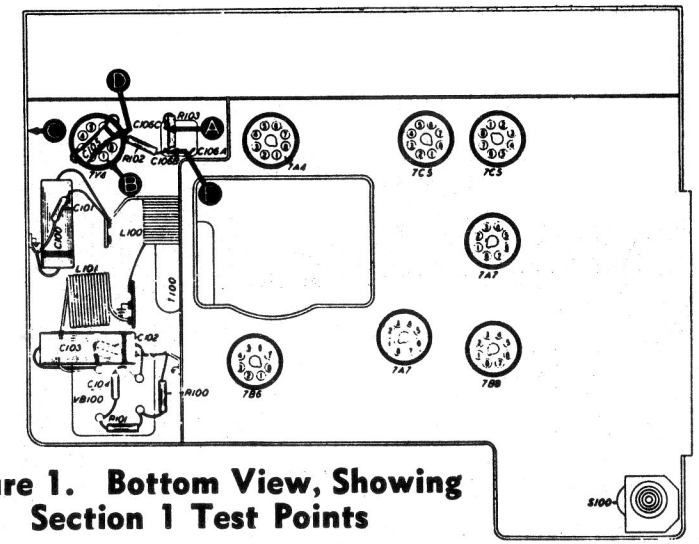


Figure 1. Bottom View, Showing Section 1 Test Points

STEP	TEST POINT	NORMAL INDICATION	ABNORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A B	165v 6.6v		Trouble in this section. Isolate by the following tests.
2	B	6.6v	No voltage	Open: F100, L100, L101, S100. Shorted: C100, C101, C102, C103, C104.
			Low voltage	Weak battery.
3	D	220v	No voltage	Defective: VB100, 7Y4. Shorted: C105, C106A, T100. Open: T100.
			Low voltage	Defective: 7Y4. Open: C106A. Leaky: C105, C106A.
			High voltage	Open: T200*, R102, R211*.
4	E	200v	No voltage	Shorted: C106B, R102.
			Low voltage	Changed value: R102. Leaky: C106B.
5	A	165v	No voltage	Open: R103. Shorted: C106C.
			Low voltage	Leaky: C106C. Changed value: R103.

* This part, located in another section, may cause abnormal indication in this section.

CIRCUIT DATA ON SHEET 209
ALIGNMENT DATA ON SHEET 210
TROUBLE SHOOTING DATA 211 to 214

AUTO RADIO
MODEL
P4735

PHILCO DATA SHEET 211

TROUBLE SHOOTING

Section 2

For the tests in this section, use an audio-frequency signal generator. Connect the generator ground lead to the chassis, test point C; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Turn the volume control to maximum, and the tone control fully counterclockwise. Adjust the signal-generator output as required for each step.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 3. If not, isolate and correct the trouble in this section.

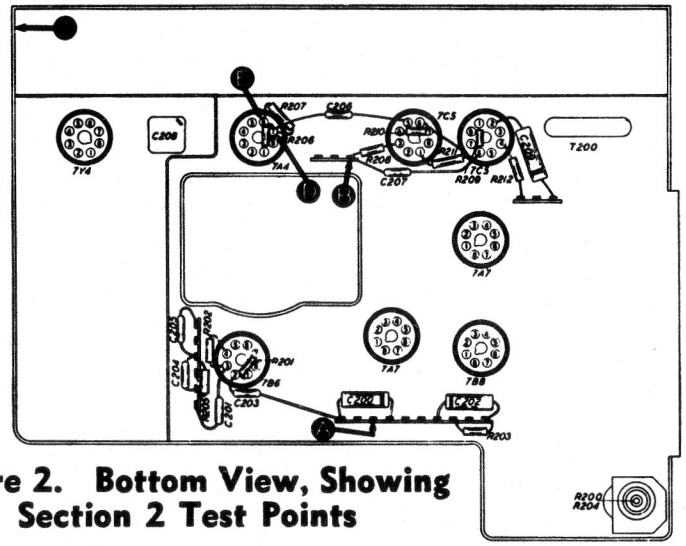


Figure 2. Bottom View, Showing Section 2 Test Points

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	Loud, clear signal with weak signal input.	Trouble in this section. Isolate by the following tests.
2	B (Remove 7A4)	Clear signal with strong signal input.	Defective: 7C5, LS200. Shorted or leaky: C209, T200. Open: R211, R209, T200, C207.
3	D	Same as step 2.	Defective: 7C5. Open: T200. Shorted: T200, C206.
4	E (Replace 7A4)	Loud, clear signal with moderate signal input.	Open: R207, R206, R208. Shorted or leaky: C204, C205, C203 (rotate R204). Defective: 7A4.
5	A	Same as step 1.	Defective: 7B6, R200 (rotate through range). Open: R200, R201, C201, R205.

Listening Test: Rotate tone control, R204, through range; lack of treble attenuation may be caused by open C203 or R204; lack of bass accentuation may be caused by open R212, R204, R203, or C202, or by shorted or leaky C202. Distortion may be caused by leaky C201, C205, C206, or C207.

1948-49

CIRCUIT DATA ON SHEET 209
ALIGNMENT DATA ON SHEET 210
TROUBLE SHOOTING DATA 211 to 214

AUTO RADIO
MODEL
P4735

PHILCO DATA SHEET 212

TROUBLE SHOOTING

Section 3

For the tests in this section, use an r-f signal generator, with modulated output, set at 265 kc. Connect the generator ground lead to the chassis, test point C; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Turn the volume control to maximum, and the tone control fully counterclockwise. Set the sensitivity control to maximum.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 4; if not, isolate and correct the trouble in this section.

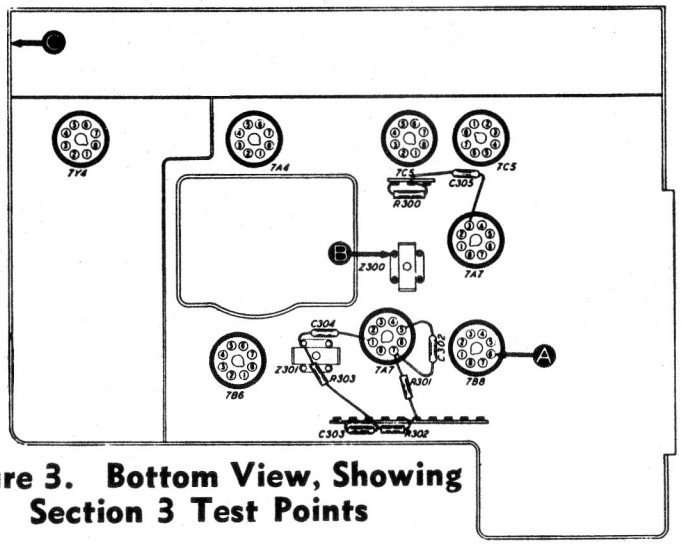


Figure 3. Bottom View, Showing Section 3 Test Points

Since the circuit location of test point A for this section is the same as that of test point B for Section 4, the effectiveness of step 1 as a master check is dependent upon the condition of certain parts in Section 4; these parts are listed under "POSSIBLE CAUSE OF ABNORMAL INDICATION."

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	Loud, clear signal with weak signal input.	Trouble in this section. Isolate by the following tests.
2	B	Loud, clear signal with moderate signal input.	Defective: 7A7, 7B6 (diode section). Misaligned: Z301. Open: Z301 pri. or sec., C301A, C301B, R301, R300, R406* (rotate through range), R303. Shorted: Z301 pri. or sec., C301A, C301B, C300B, C303, C304, C305.
3	C	Loud, clear signal with weak signal input.	Defective: 7B8.* Misaligned: Z300. Open: Z300 pri. or sec., C300A, C300B. Shorted: C405,* Z300 pri., C300A, C300B.

* This part, located in another section, may cause abnormal indication in this section.

1948-49

CIRCUIT DATA ON SHEET 209
ALIGNMENT DATA ON SHEET 210
TROUBLE SHOOTING DATA 211 to 214

AUTO RADIO
MODEL
P4735

DATA SHEET 213

PHILCO

TROUBLE SHOOTING

Section 4

For the tests in this section, with the exception of the oscillator test, use an r-f signal generator, with modulated output. Connect the generator ground lead to the chassis, test point C; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Turn the volume control to maximum, and the tone control fully counterclockwise. Set the sensitivity control to maximum.

If the "NORMAL INDICATION" is not obtained in step 1, isolate the trouble by following the remaining steps.

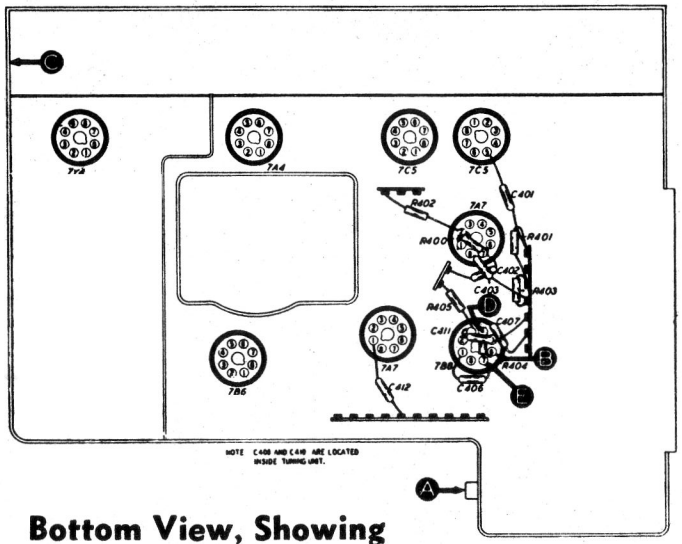


Figure 4. Bottom View, Showing Section 4 Test Points (locations of C404, L401, R406, and Z400 are shown in figure 6)

STEP	TEST POINT	SIG. GEN. FREQ.	RADIO TUNING	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	1000 kc.	Tune to signal.	Loud, clear signal with weak signal input.	Trouble in this section. Isolate by the following tests.
2	B	1000 kc.	Tune to signal.	Loud, clear signal with moderate signal input.	Defective: 7B8. Shorted: L400B, C404, C405. Trouble in oscillator circuit (step 3).
3	D to E Osc. Test (see note below)		Tune through range.	Negative 2 to 4 volts.	Shorted or leaky: C411, C410, C407, C408, C409. Open: C411, L400D, C407, R404, R405, R406, L400C, C408, C410. Shorted: L400C, L400D.
4	A	1000 kc.	Tune to signal.	Loud, clear signal with weak signal input.	Defective: 7A7. Open: L401, R400, R401, R402, C403, R403, L400B, L400A. Shorted or leaky: C403, C412, C404.

OSCILLATOR TEST

Connect positive lead of high-resistance voltmeter to test point E (pin 7, cathode of 7B8); connect prod end of negative lead through 100,000-ohm isolating resistor to test point D (pin 4, osc. grid of 7B8). Use suitable meter range, such as 0—10 volts. Proper operation of oscillator is indicated by negative voltage, 2 to 4 volts (measured with 20,000-ohms-per-volt meter) throughout tuning range.

CIRCUIT DATA ON SHEET 209
ALIGNMENT DATA ON SHEET 210
TROUBLE SHOOTING DATA 211 to 214

AUTO RADIO MODEL P 4735