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Important Information for your Service Department

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Servicing Varactor FM Tuners

This Service Tip is designed to present the service technician with "quick check" procedures to aid in troubleshooting the varactor FM tuners. A more detailed circuit explanation can be found in the "1973 Product Technical Manual."

The service procedures in this tip are presented in such a way that the technician can troubleshoot a specific symptom by using the appropriate section of the tip. For example: Assume the symptom to be "No AM With Normal FM Operation." The technician can go immediately to the AM section of the tip and begin the correct service procedures for this problem. The symptom chart lists specific symptoms, the general circuit area in which that symptom could be developed, and the components to be checked first.

This Service Tip also includes simplified setup adjustments and alignment procedures. Consult the RCA Service Data for more detailed procedures.

A minimum complement of test equipment is required to perform these service procedures. In most instances only a voltmeter (RCA WV 510A or equivalent) is used. Some measured voltages may vary from those shown depending on test conditions. Output amplification and B+ voltage are supplied for the RC 1245 by a separate power amplifier chassis. It is necessary when servicing this tuner to either use the power amplifier from the instrument being serviced, or have an appropriate power amplifier set up for servicing purposes.

The schematic diagrams and text refer to the RC 1245 tuner. However, the procedures in this Service Tip can be applied to the RC 1246 and RC 1247 tuners.

RC 1245 FM RF Circuits

FM tuning is accomplished by varying the reverse bias applied to varactor diodes in the antenna, RF amplifier, and oscillator tuned circuits. The tuning voltage (reverse bias) is developed by a voltage-divider network (which includes the FM tuning control) that is connected from the tuner B+ supply to ground. The FM RF circuits (RF amplifier, oscillator, and mixer) use discrete components fully accessible for servicing.

The AGC voltage, being dependent on signal strength, can sometimes be used as an indicator to aid the technician in problem isolation. In the RC 1245 tuner a delayed AGC voltage is applied to the base of the RF amplifier. Exceptionally strong signals are attenuated by an overload diode connected in the base-emitter circuit of the RF amplifier.

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FM RF Tuning Control Adjustments

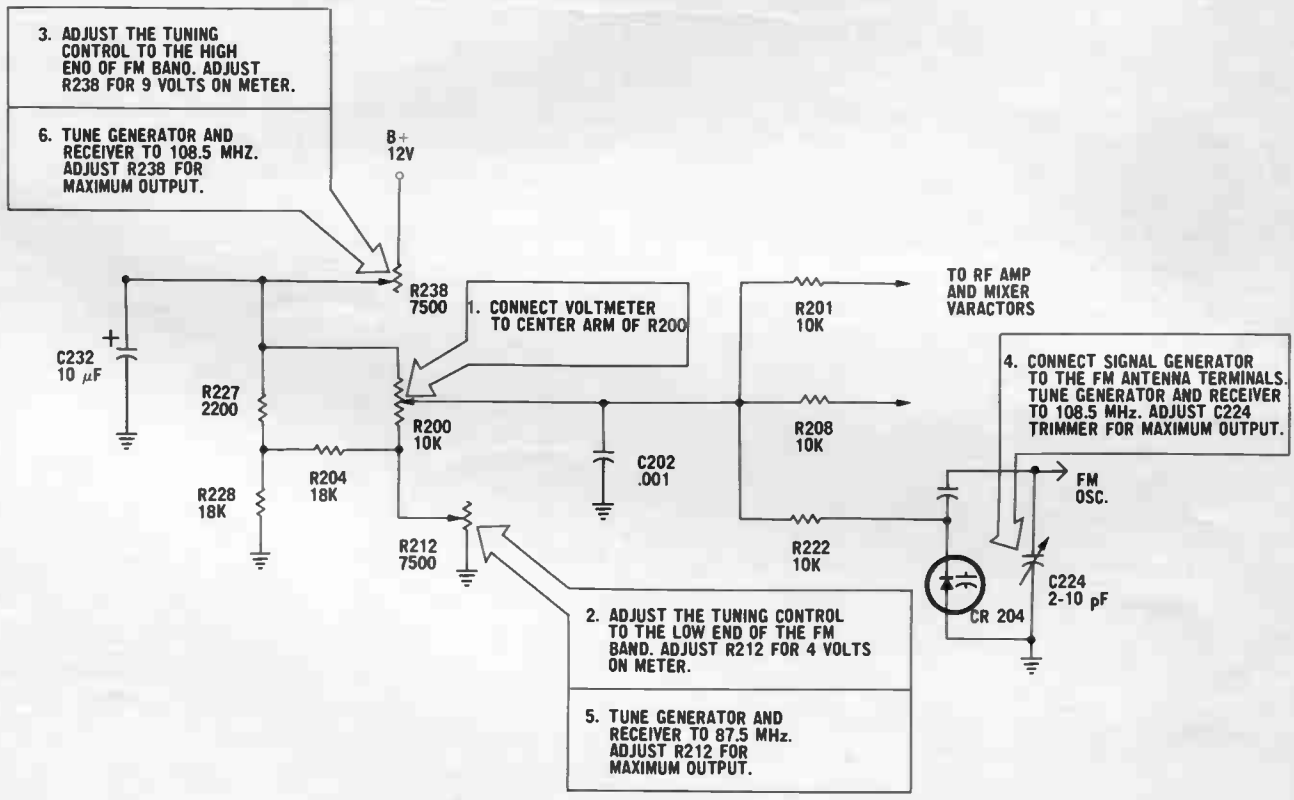
It is unlikely that complete FM sweep alignment will become necessary unless the RF inductors are accidentally deformed. In most cases the simplified procedures shown here correct any tuning problems. These procedures are primarily adjustments to make the antenna, RF amplifier, and oscillator tank circuits track across the FM band.

TEST EQUIPMENT: Electronic Voltmeter (RCA WV 510 or equivalent). Marker Generator (RCA WR 99 or equivalent)

PRELIMINARY: Set receiver function switch to FM position. Turn test equipment on and allow several minutes for warm up.

1. Set E.V.M. to 15-volt DC range. Connect probe to wiper of R200, the FM tuning control.
2. Turn tuning control to 87.5 MHz. Adjust R212, low-end tracking control, for 4-volt indication on voltmeter.
3. Turn tuning control to 108.5 MHz. Adjust R238, high-end tracking control, for 9-volt indication on voltmeter.
4. Connect marker generator to FM antenna terminals. Turn band select switch to FM band. Switch Cal/Mod switch to 600 Hz Mod position. (It is realized that the WR 99 marker generator is not designed for frequency modulation. However, the 600 Hz modulated signal does produce an audible tone from the FM receiver). Tune marker generator and receiver to 108.5 MHz. Adjust trimmer capacitor, C224, for maximum audible output.
5. Tune marker generator and receiver to 87.5 MHz. Adjust R212, low-end tracking control, for maximum audio output.
6. Set generator and receiver to 108.5 MHz. Adjust R238, high-end tracking control, for maximum audio output.

It may be necessary to repeat Steps 5 and 6 for optimum performance due to interaction of the tracking controls.



RF Tuning Control Adjustments

Troubleshooting FM RF Stages

The following procedures offer the technician a means of checking the operation of the FM tuning stages.

TEST EQUIPMENT: Electronic Voltmeter (WV 510 or equivalent).

PRELIMINARY: Apply power to tuner chassis. Set function switch to FM position.

1. Connect E.V.M. to wiper of R200, FM tuning control. Adjust tuning control across FM band. The voltage should vary between 4 and 9 volts from the low-end to high-end of band.

If the tuning voltage range is incorrect perform tracking adjustment procedures as described in the previous discussion. If this fails to correct the problem investigate a possible resistor failure in the control circuitry or B+ supply line.

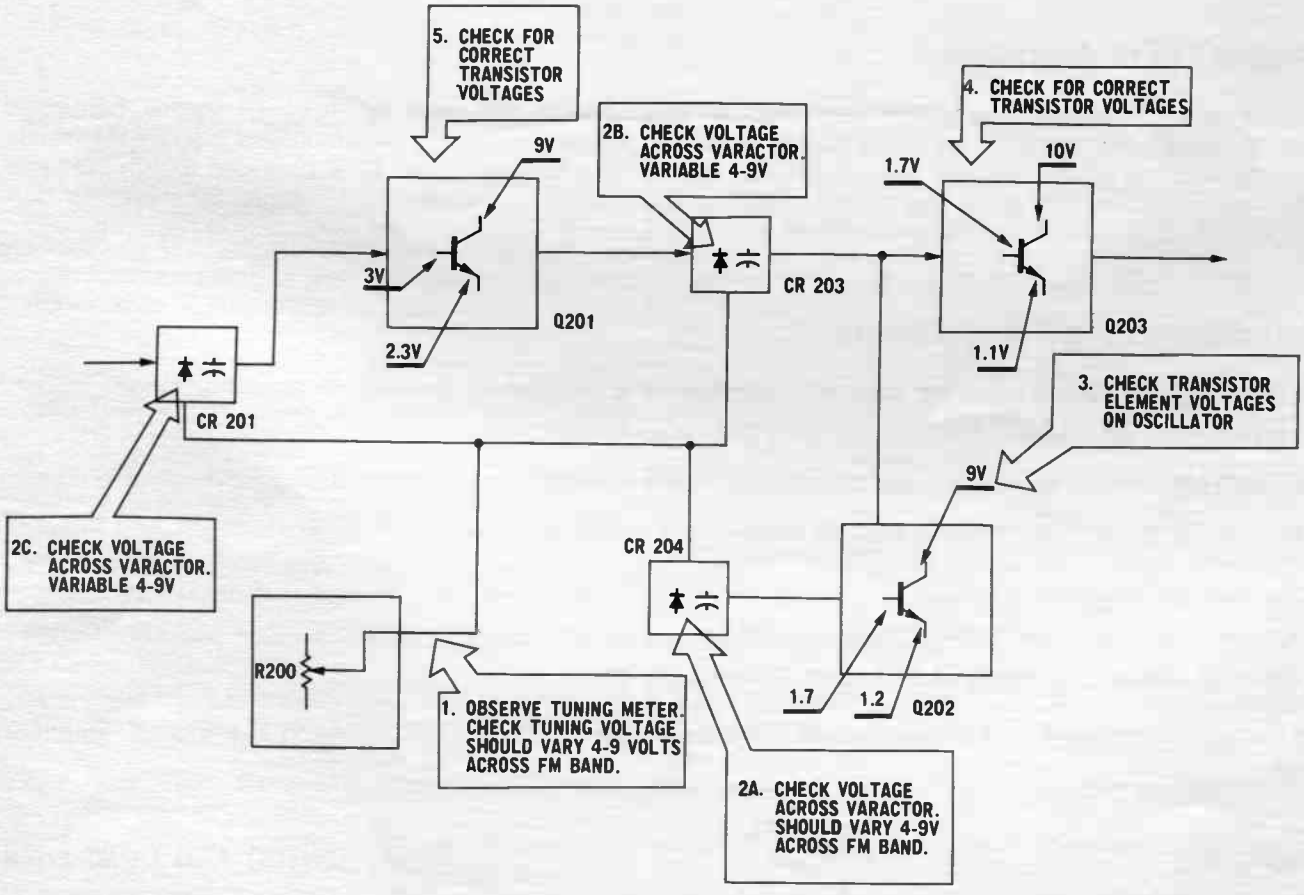
2. Check voltages at cathode of CR 201, CR 203, and CR 204. These voltages should vary between 4 and 9 volts as the receiver is tuned across the FM band.

Should a varactor diode prove to be defective, a matched set of three diodes must be installed.

3. Measure oscillator transistor, (Q202) element voltages.

4. Repeat Step-3 as applied to RF amplifier transistor, Q201.

5. Measure transistor element voltages of mixer transistor (Q203).



Troubleshooting the FM RF Stages

The symptom chart below describes the symptom which will develop as a result of a specific component failure. The symptoms listed in this chart are applicable to FM problems only and assume that the other receiver functions are operating normally.

SYMPTOM	GENERAL CIRCUIT	COMPONENT(S) AND COMMENTS
No FM	FM Tuning Control Circuit	R200, FM tuning control R212, Low-end tracking R238, High-end tracking
	FM RF Amplifier	Q201, RF amp transistor
	FM Mixer	Q203, FM mixer transistor
	FM Oscillator	Q202, FM oscillator transistor CR 204, varactor diode C219, feedback capacitor
Reduced FM Sensitivity	FM RF Amplifier	FM antenna, CR 201 or CR 203 varactor diodes open
Overdriven on strong signal		CR 202, open
Improper Tracking	FM Tuning Control Circuit	R200, R212, R238, misadjusted CR 201, CR 203 shorted

RC 1245 FM IF Amplifier

The first stage of the FM IF amplifier uses discrete components followed by three IF stages contained within an integrated circuit. The mixer output signal is coupled to the first IF amplifier stage by a ceramic filter which is equivalent to two double-tuned circuits. The ceramic input filter provides a high "Q" and a flat response. The output of the first IF stage is coupled to the remaining IF stages by a second ceramic filter. The use of ceramic filters provide a service feature in that no FM IF alignment is required.

Troubleshooting FM IF Circuit

The following procedures can be used for isolation of a problem in the first IF amplifier stage.

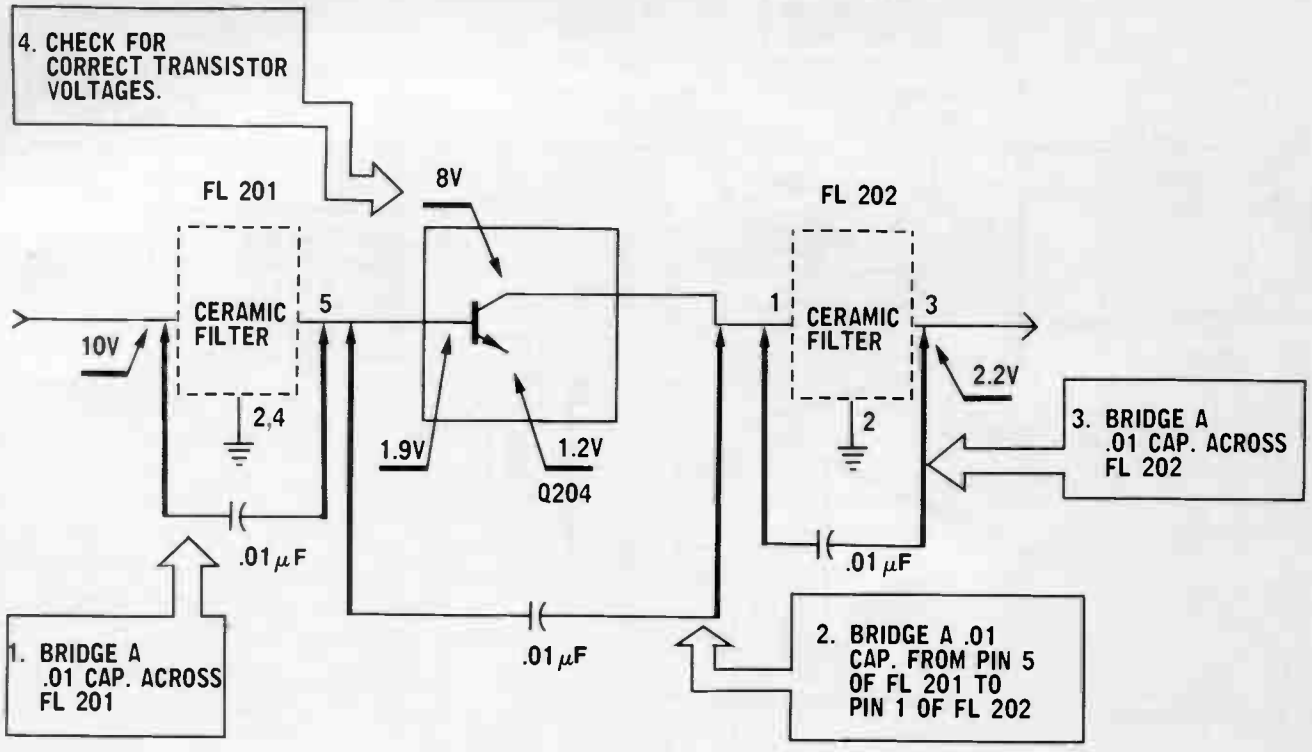
TEST EQUIPMENT: Electronic Voltmeter (WV 510 or equivalent).

PRELIMINARY: Apply power to tuner chassis. Set function switch to FM position.

1. Bypass input ceramic filter FL 201, by temporarily bridging a .01 μF capacitor from pin 1 to pin 5 of the filter.
2. Connect .01 μF capacitor from pin 5 of FL 201, to pin 1 of FL 202. This bypasses IF transistor Q204.
3. Jumper output filter FL 202 by bridging a .01 μF capacitor from pin 1 to pin 3.
4. Measure element voltages of IF amplifier transistor Q204.

The symptoms outlined in the chart below are developed as a result of failure in the first IF amplifier stage.

SYMPTOM	GENERAL CIRCUIT	COMPONENT(S) AND COMMENTS
No or weak FM	1st IF amp	Q204, FL 201, FL 202



Troubleshooting the First IF Stage

RC 1245 FM Detector

FM detection is accomplished in a doubly-balanced quadrature detector. The detector output is an audio signal, or composite stereo signal depending on the mode of transmission. Several other functions are served by the detector circuits such as, the development of AGC, signal meter drive, and AFC voltages. Interstation muting is accomplished in the detector stage by a DC voltage which cuts off interstation noise when tuning between stations.

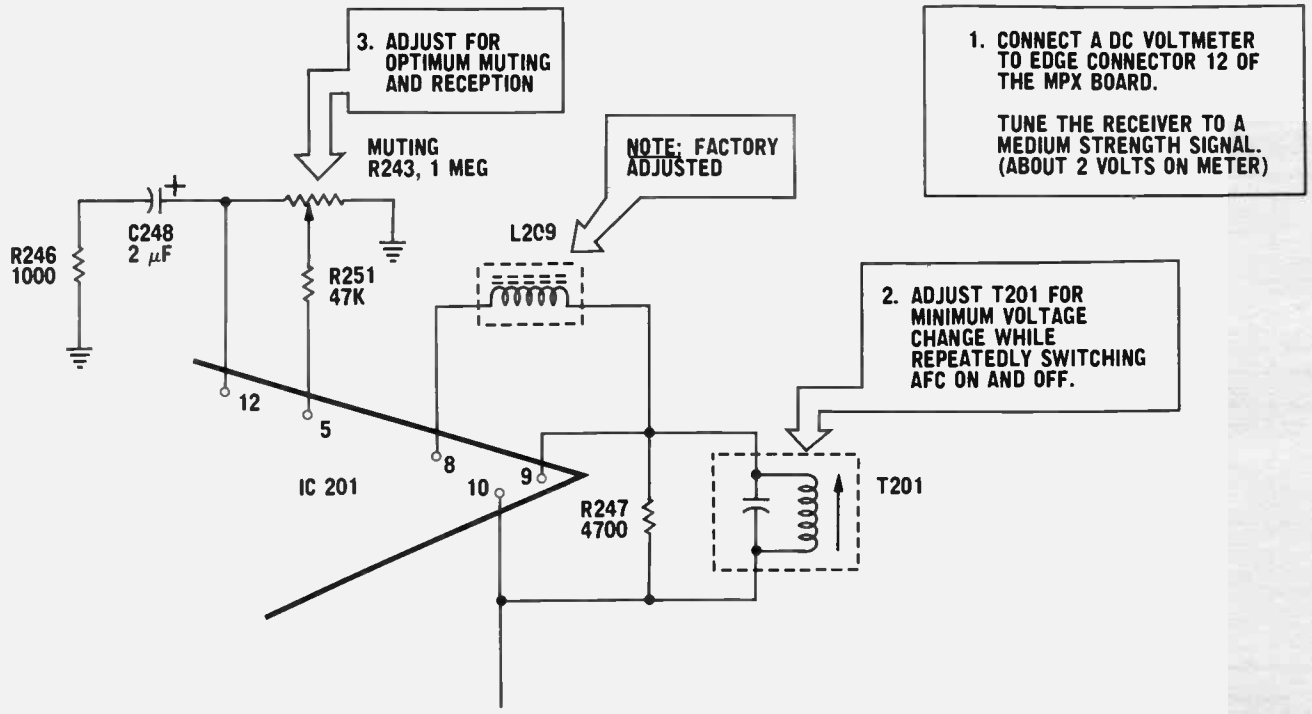
FM Detector Alignment Procedures

Only one adjustment is required for alignment of the FM detector. The following procedures require minimum test equipment and hook-up.

TEST EQUIPMENT: Electronic Voltmeter (WV 510 or equivalent).

PRELIMINARY: Apply power to receiver. Turn function switch to FM position.

1. Connect E.V.M. to pin 13 of IC 201 (Edge connector 12 of MPX board). Set E.V.M. on 5-volt DC range. Tune receiver to medium strength signal (about 2 volts on meter).
2. Adjust T201 for minimum voltage change while repeatedly switching AFC "on" and "off."
3. Adjust muting control R243 for optimum muting. As control is rotated in a clockwise direction interstation noise is reduced. It is possible to reach a point where only very strong signals will develop an output. Consequently, in areas of abnormal signal reception it will be necessary to adjust the muting control for best reception.



FM Detector Adjustments

Troubleshooting FM Detector

Since the integrated circuit IC 201 has several functions, the symptoms developed by an IC failure can be varied. The following procedures will aid the technician in localizing a problem in the FM detector circuit.

TEST EQUIPMENT: Electronic Voltmeter (WV 510 or equivalent).

PRELIMINARY: Apply power to receiver. Set function switch to FM position.

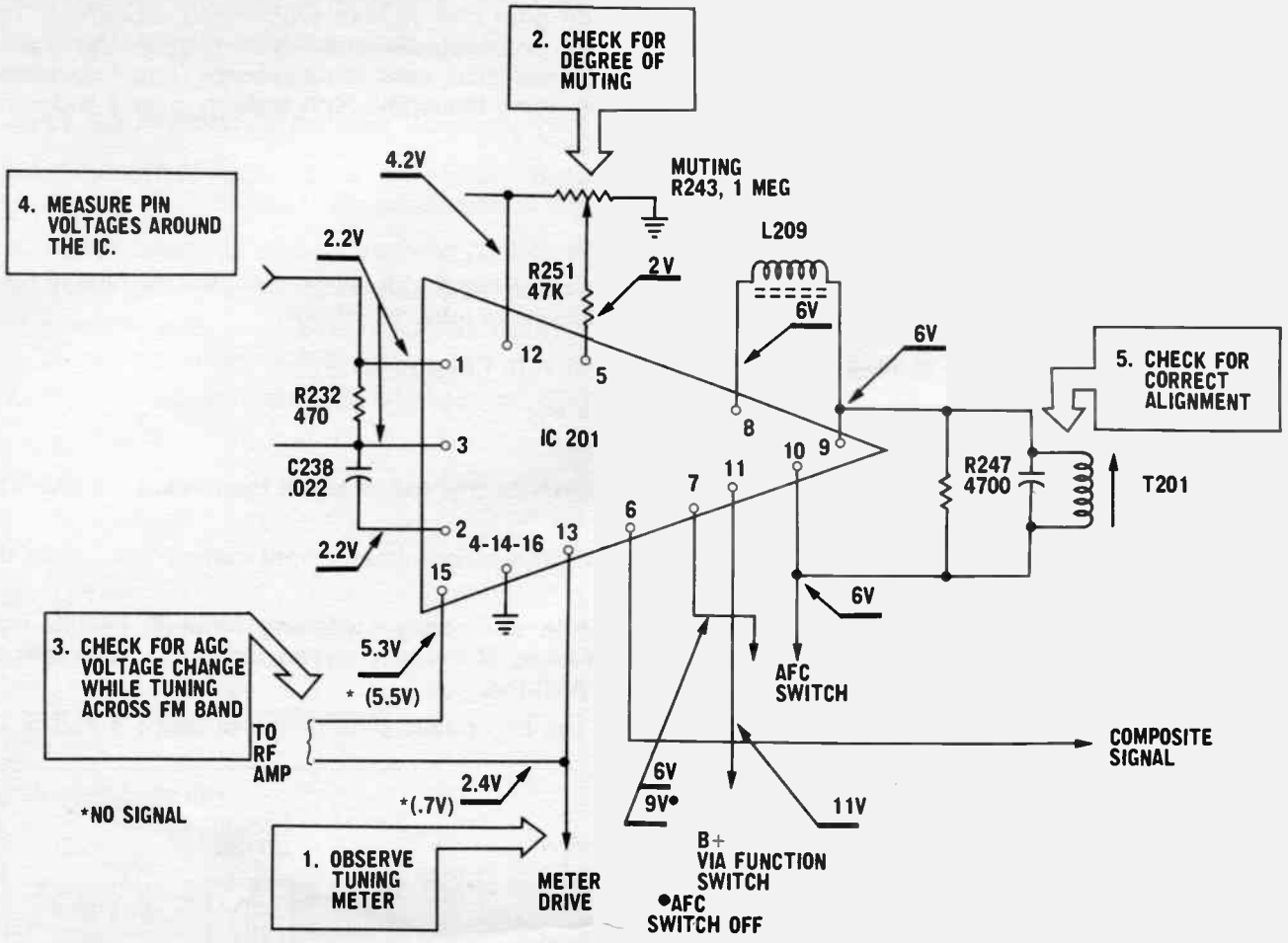
1. Observe tuning meter while tuning across FM band. (A voltmeter connected at point AD, on the FM board, will serve the same purpose for versions not using a tuning meter.) Since the meter drive voltage is dependent on signal strength, the tuning meter indication can be used as an aid to localize a problem to circuitry before or after the FM detector. If no meter deflection occurs, the problem is likely ahead of the detector. A normal meter indication indicates possible trouble with the detector or circuits following this stage.

2. Check muting action. Voltage at the wiper of muting control R243 should read approximately 2 volts between stations and zero volts with signal. A voltage in excess of 2.6 volts at this point mutes even strong signals.

3. The RF amplifier AGC voltages are supplied from pins 13 and 15 of IC 201. The AGC voltage should vary from no signal to strong signal. The voltage at pin 15 varies approximately from 5.3 volts for a strong signal to 5.5 volts for no signal. The pin 13 voltage variation is about 2.4 volts strong signal to .7 volt no signal. These voltage swings can be used as an indicator of where a loss of signal occurs.

4. AFC voltage is supplied to the AFC switch from pin 7 of IC 201. The voltage at pin 7 is about 6 volts with the AFC switch "off", increasing to 9 volts with the AFC switch "on."
Measure remaining IC 201 pin voltages.

5. Check T201 for correct alignment of the quadrature detector as described in the previous discussion of detector alignment procedures.



Troubleshooting the FM Detector Circuit

The following chart lists several of the more pronounced symptoms and which components to check first.

SYMPTOM	GENERAL CIRCUIT	COMPONENT(S) AND COMMENTS
No FM	Muting	R243-Muting Control, IC 201
	FM IF	IC 201
	FM Detector	IC 201, T201 misaligned.
No AFC		IC 201, AFC switch.
No Meter Drive		IC 201

RC 1245 Multiplex Decoder

The multiplex decoder uses an integrated circuit which includes a phase-locked loop consisting of a voltage controlled oscillator (VCO), three frequency dividers, and a phase comparator circuit. The VCO output (76 kHz) is applied to a frequency divider which produces a 38 kHz output. The 38 kHz signal is applied to the L-R detector, and to a pair of frequency dividers, each producing a 19 kHz output. The 19 kHz output of one divider is coupled to a phase-lock detector which makes a phase comparison with the transmitted 19 kHz pilot tone. Any deviation in phase between the two signals will generate correction voltage which is applied to the VCO to adjust its frequency and phase such that locally generated

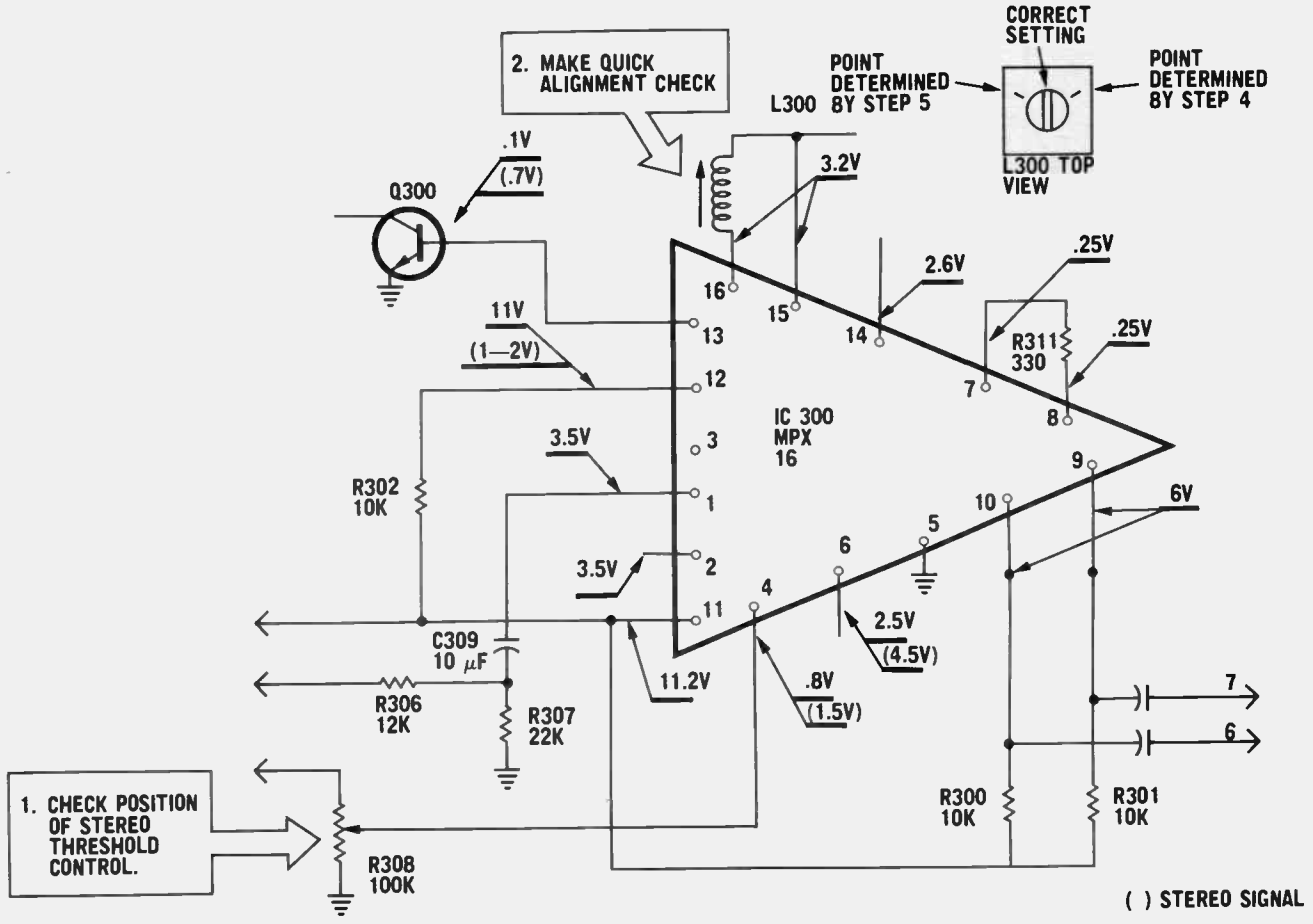
19 kHz and 38 kHz signals are synchronized with the station pilot and 38 kHz suppressed subcarrier. The 19 kHz signal from the second divider is applied to a pilot presence-detector which enables the stereo-switching circuits. Advantages of this system include: its small size, ease of adjustment (only one adjustment for alignment), automatic stereo switching, excellent noise immunity, high stability over a wide ambient temperature range, and excellent separation.

RC 1245 Multiplex Alignment

As previously stated one of the main features of this circuit is the simplicity of multiplex alignment. Only one adjustment is required, and test equipment is not required in most situations.

PRELIMINARY: Apply power to receiver. Set function switch to FM position.

1. Tune receiver to station known to be broadcasting stereo.
2. Turn core of multiplex coil L300 to mechanical bottom.
3. Unlock VCO by momentarily switching the function switch to the AM position then return to FM. The stereo indicator light will now be "off."
4. Very carefully turn core of L300 counterclockwise until the stereo indicator light comes "on." Note the mechanical position of the core slot.
5. Resume turning core in counterclockwise direction while alternately switching function switch from "FM" to "AM" positions. Note mechanical position of core slot when stereo indicator lamp fails to come "on" as function switch is returned to the FM position.
6. Adjust the core slot for mechanical center between the two points determined in Steps 4 and 5.



Alignment and Troubleshooting the Multiplex Circuit

Troubleshooting Multiplex Circuits

The following servicing hints will assist the technician in localizing symptoms to a problem in the multiplex circuit.

TEST EQUIPMENT: Electronic Voltmeter (WV 510 or equivalent).

PRELIMINARY: Apply power to receiver. Set function switch to FM position. Tune receiver to a station known to be broadcasting stereo signal.

1. Check setting of stereo threshold control, R308. Incorrect adjustment can degenerate stereo operation.
2. Check alignment of L300, multiplex coil. (Alignment procedures appeared in the previous discussion).
3. Measure voltage on pins of IC 300. **Note:** In several instances two voltages are given—no stereo and stereo signal conditions.
4. Check transistor element voltages of Q300.

The chart below can be used to determine the general circuit area at fault causing specific symptoms.

SYMPTOM	GENERAL CIRCUIT	COMPONENT(S) AND COMMENTS
No stereo	Multiplex Decoder	R243, IC 300, L300. Edge connector socket
No FM		IC 300
Indicator light out		DS 1, Q300, IC 300. Diode CR 1 (Not shown in schematic)

RC 1245 AM Receiver

The AM portion of the RC 1245 is composed of a discrete component RF amplifier, an integrated circuit, and tuning capacitor.

The RF amplifier uses a common-base configuration with the antenna signal applied to the emitter. The input impedance is regulated by an overload device (diode or collector-base junction of a transistor) connected in the emitter circuit of the RF amplifier. The mixer, oscillator, IF amplifier, and detector functions are provided in the integrated circuit.

AM Receiver Alignment

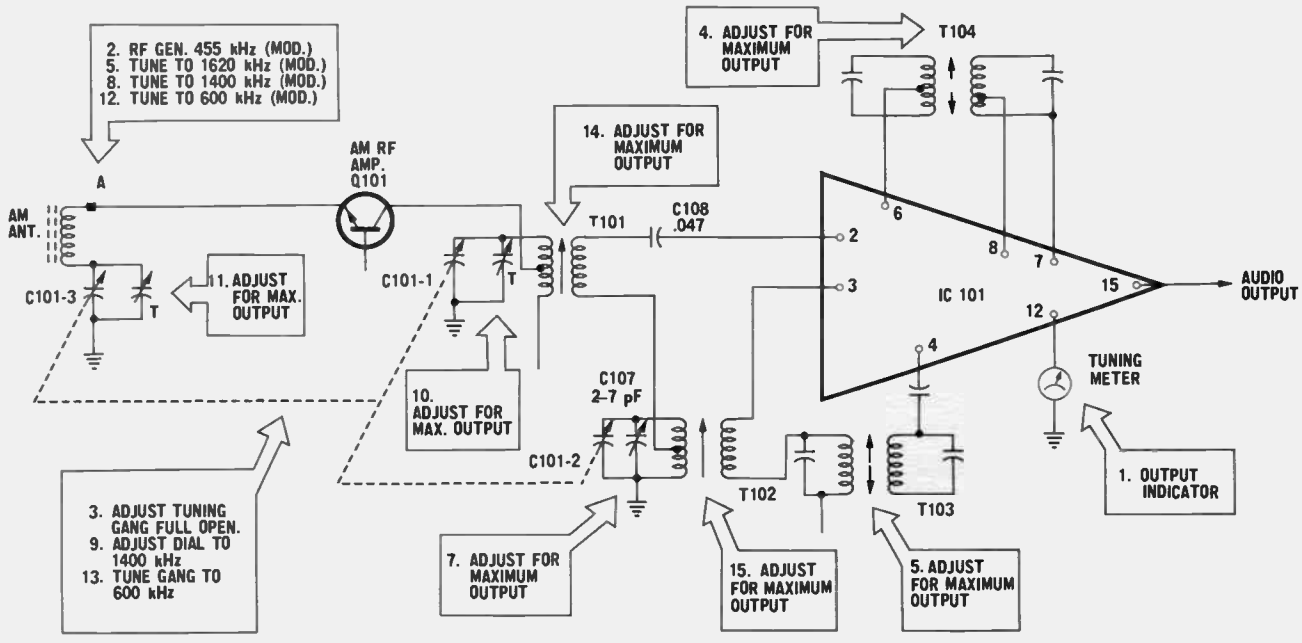
Alignment of the RC 1245 AM section uses standard procedures experienced in tuners of conventional design.

TEST EQUIPMENT: RF Signal/Sweep Generator (RCA WR 50B or equivalent).

PRELIMINARY: Apply power to receiver. Turn function switch to "AM." Connect RF generator to Terminal "A" of PB 37 board (AM antenna lead).

1. Observe tuning meter as an output indicator. (An E.V.M. can be connected to the tape output jacks if preferred).
2. Set RF generator to obtain 455 kHz modulated by audio tone.
3. Adjust AM tuning gang to fully open position.
4. Adjust top and bottom cores of 2nd AM IF transformer T104 for maximum output indication.
5. Adjust top and bottom cores of 1st AM IF transformer T103 for maximum output indication.

6. Tune RF generator to 1620 kHz with modulation. Place RF lead near AM antenna. (Tuning gang remains fully open).
7. Adjust oscillator trimmer capacitor C107 for maximum output indication.
8. Tune RF generator to 1400 kHz modulated.
9. Turn tuning control to 1400 kHz on indicator dial.
10. Adjust RF trimmer capacitor, C101-1T, for maximum output.
11. Adjust antenna trimmer capacitor C101-3T for maximum output.
12. Tune RF generator to 600 kHz modulated.
13. Turn tuning control to 600 kHz on indicator dial.
14. Adjust core of RF transformer T101 for maximum output.
15. Adjust core of oscillator coil T102 for maximum output.



AM Receiver Alignment

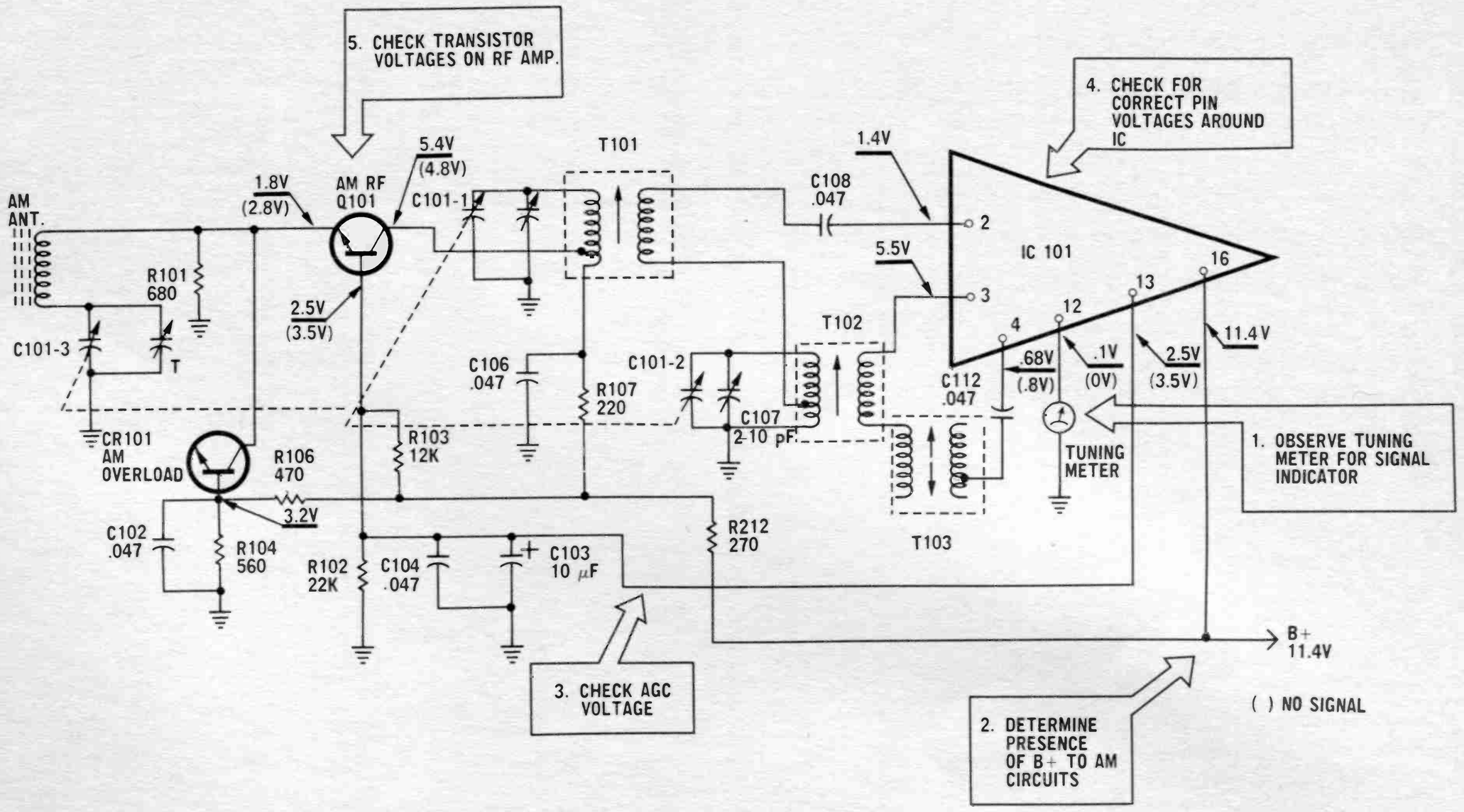
Troubleshooting AM Receiver

Troubleshooting the RC 1245 AM section can be accomplished by making voltage measurements. The procedures described below will guide the technician toward specific circuit areas for particular symptoms.

TEST EQUIPMENT: Electronic Voltmeter (WV 510 or equivalent).

PRELIMINARY: Apply power to receiver. Set function switch to AM position.

1. Observe tuning meter for indication of signal reception and strength. (A voltmeter connected at point C, on the AM board, will serve the same purpose in those versions not using tuning meter.) Check meter drive voltage at pin 12 of IC 101.
2. Check B+ level appearing on AM board, Terminal "D" or pin 16 of IC 101.
3. Measure AGC voltages for potential isolation of problem area. IF AGC is available at pin 4 of IC 101. RF AGC is accessible at pin 13 of IC 101 or the base of Q101.
4. Check pin voltages around IC 101 for isolation to IC or IF Transformers. Audio signal may be injected at pin 14 of IC 101 for isolation to audio amplifier portion of integrated circuit.
5. Check RF amplifier for correct element voltages.



Troubleshooting the AM Receiver

The following chart may be used as a guide to localize a problem to a general circuit area.

SYMPTOM	GENERAL CIRCUIT	COMPONENT(S) AND COMMENTS
No AM	RF amplifier	Q101, CR 101
	Mixer, oscillator IF amplifier Detector	IC 101, T102, T103, T104
Overload on high signals	RF amplifier AGC	CR 101 IC 101-Pins 13

RC 1245 Audio Preamplifier

The PB-38 audio preamplifier board consists of four discrete-component amplifier stages. The tone block, which includes the BASS, TREBLE, BALANCE, and LOUDNESS controls, is also located on the PB-38 board. AM and FM audio plus phono inputs are applied to the first preamplifier stage. When the function switch is in the "Tape" position, the tape jacks serve as input jacks to the preamplifier. With the function switch in the AM, FM, or Phono position, the tape jacks become output jacks making the output of the first preamplifier stage available for recording purposes.

Audio from the preamplifier is coupled via the interconnecting cable to the power amplifier chassis.

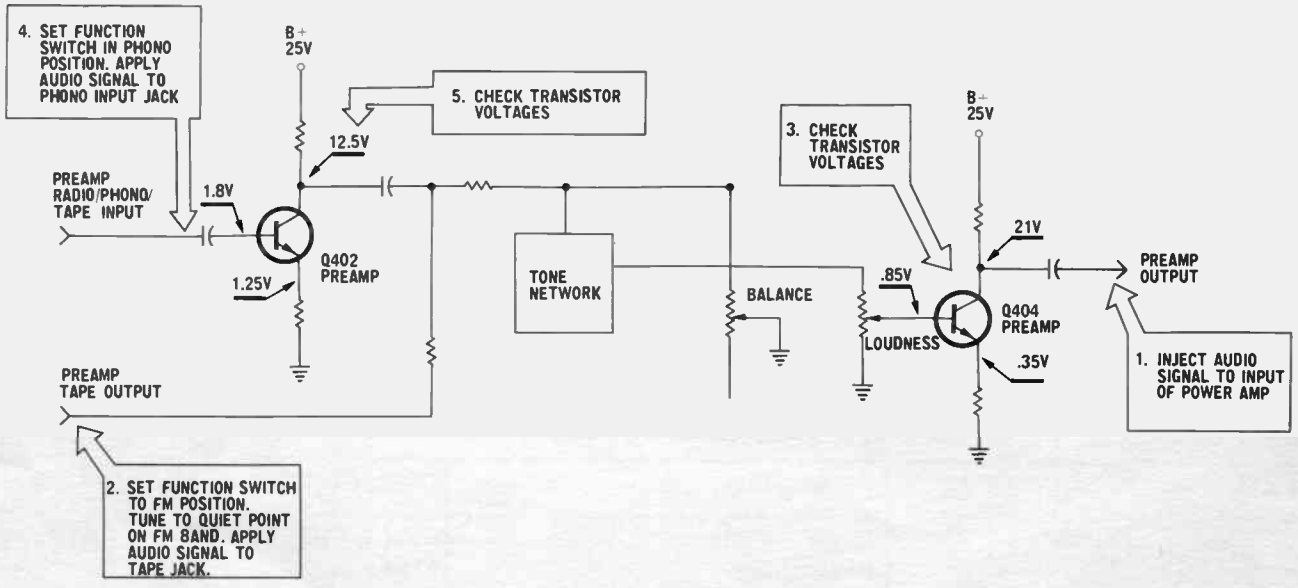
Troubleshooting Audio Preamplifier

Troubleshooting the audio section of the RC 1245 chassis is limited to the preamplifier, since the power amplifier is a separate chassis. The following procedures describe several quick checks which will aid in isolating a problem to a particular circuit area. The diagram illustrates the procedures as related to the right channel preamplifier; obviously the same steps can be applied to the left channel.

TEST EQUIPMENT: Electronic Voltmeter (WV 510 or equivalent).

PRELIMINARY: Apply power to chassis. Check customer controls, Loudness and Balance.

1. Inject audio signal to input of power amplifier. Point "M" for right channel, point "P" for left channel. This step provides isolation to amplifier or power amplifier.
2. Set function switch to "FM" position. Tune to quiet position on dial. Apply audio signal to tape jack. With receiver in "FM" function, the tape jack makes it possible to bypass the first preamplifier stage thus, isolating problem to one stage or other.
3. Measure voltage on transistor Q404 elements. Voltages for normal operation are shown in accompanying diagram.
4. Set function switch in "Phono" position. Apply audio signal to phono input jack. Isolation is provided to first stage of preamplifier or to some point before preamplifier.
5. Measure voltage on elements of transistor Q402. This voltage should be approximately equal to those for normal operation shown in diagram.



Troubleshooting the Preamplifier

The following symptom chart is a guide to lead the technician to problem area for a given symptom.

SYMPTOM	GENERAL CIRCUIT	COMPONENT(S) AND COMMENTS
No output-left channel on all functions	Left channel preamp	Q401, Q403 R418-Balance R438B-Loudness
No output-right channel on all functions	Right channel preamp	Q402, Q404 R418-Balance R438A-Loudness
No output-both channels all functions	Preamp board	B+ line, Output jack