The operational control circuits of Amplifier, Radio Frequency AM-3349/GRC-106 provide the following control functions: detection of phase difference between the rf output voltage and current for fine tuning, detection of magnitude difference between the rf output voltage and current for fine tuning; generation of the operate alc signal; generation of the tune alc signal; coding required to rough-tune the impedance-matching networks in antenna coupler assembly 2A3; and metering to monitor the important parameters of the circuits.

The two discriminator circuits enable the AM-3349/GRC-106 to be fine-tuned to provide a 50 ohm pure resistive load for the output transformers of power amplifier 2A1A1V1, 2A1A1V2. This provides maximum rf power and maximum efficiency to prevent overdissipation.

first section: TUNE DISCRIMINATOR 2A4A1.
When the AM-3349/GRC-106 is correctly tuned (resistive load), the rf output VoLtage and current are in phase with each other. When the output load is reactive, tune discriminator 2A4A1 (figure FO-34) detects the resulting phase angle between the rf output voltage and current and produces a dc voltage proportional to the phase difference. This dc voltage is applied to meter 2A1A5M2 on the front panel to provide a relative indication of the magnitude of phase difference for fine tuning.

NOTE Prefix all reference designators in the following subparagraphs with phase discriminator reference designator 2A4A1 unless otherwise specified.

The rf output from power amplifier 2A1A1V1, 2A1A1V2 is applied to connector 2A1A1P1, from which it is applied through connectors 2A4J1 and 2A4P1 to connector J1 (figure FO-34). This cable passes through toroidal transformer T1. Since toroidal transformer T1 is center-tapped, the rf output current will induce a voltage in each half of the winding. These voltage, designated El and E2, will be of equal magnitude, 90° out of phase with the rf output current, and 180° out of phase with each other. The rf output voltage is sampled across a capacitance voltage divider consisting of capacitors C4 and Cl. This voltage, which is vectorially in phase with the rf output voltage, is applied to the center tap of toroidal transformer T1. The vectoral summation of the sampled voltage (Es) and induced voltage El is detected by diode CR1, producing a dc voltage El' at the cathode of diode CR1. Similarly, the vectoral summation of Es and E2 is detected by diode CR2, producing a dc voltage E2' at the cathode of diode CR2. Voltage El' is applied 2A1A1P2, pin 28 of connectors 2A1XA5 and 2A1A5J1, and resistor 2A1A15A5R8 to one side of ANT. TUNE meter 2A1A5M2. Voltage E2' is applied through pin 7 of connectors 2A4J2 and 2A1A1P2 and pin 29 of connectors 2A2SA5 and 2A1A5J1 to the other side of ANT. TUNE meter 2A4M2.

If the impedance of the rf output line is resistive, the rf output voltage and current will be in phase. Therefore, the two vectoral summations will result in El' and E2' being equal , and there will be no difference in voltage across ANT. TUNE meter 2A1A5M2. The meter will then indicate center scale, 0° phase difference between the rf output voltage and current. If the impedance of the rf output line is inductive, the rf output current will

lag the rf output voltage by some angle 0. Therefore El' will be greater than E2', causing ANT. TUNE meter 2A1A5M2 to deflect to the left of center. The degree of deflection will be proportional to the phase difference between the rf output current and voltage. If the impedance of the rf output line is capacitive, the rf output current will lead the rf output voltage by some angle Ø. Therefore El' will be less than E2' causing ANT. TUNE meter 2A1A5M2 to deflect to the right of center. The degree of deflection will be proportional to the phase difference between the rf output voltage and current. The phase angle is corrected by varying the value of capacitor 2A3C26, when TUNE-OPERATE switch 2A1A5S6 is set at TUNE. When TUNE-OPERATE switch 2A1A5S6 is set at TUNE, El' is applied through contacts C2 and 4 of switch 2MA5S6. This path changes the sensitivity of meter 2A1A5M2 by bypassing resistor 2A1A5A5R6.

((Phase Discriminator 2A4A1, Vector Diagram (not shown but this is the typical vector diagram)))

Inductor L1 provides a dc return for capacitors C1 and C4. The values of these components are such that they are not frequency-sensitive within the operating passband of the AM-3349/GRC-106. Capacitors C2 and C3 are rf bypasses Resistors R1 and R2 provide a dc path for diodes CR1 and CR2, respectively. Resistor R3 is an equalizing resistor to make the dc output from the phase discriminator the same as the output from the load discriminator. Capacitor 2A1A5C5 bypasses any rf present in the meter voltage around meter 2A1A5M2.

second section: LOAD DISCRIMINATOR 2A4A2.
When Amplifier, Radio Frequency AM-3M9/GRC-106 is correctly loaded (50 ohm impedance), the rf output voltage and current are of the correct magntude to produce an output of 400 w pep. If the load for the AM-3349/GRC-106 is greater or less than 50 ohms, the rf output voltage and current will no longer be of the correct magnitude to produce a 400-w pep output. This difference in magnitude is detected by the load discriminator, which produces a dc output proportional to the difference. The resulting dc voltage is applied to ANT. LOAD meter 2A1A5M3 on the front panel to provide a relative indication of this difference in magnitude for fine tuning.

NOTE Prefix all reference designators in this paragraph with load discriminator reference designator 2A4A2, unless otherwise specified.

The rf output from power amplifier 2A1A1V1, 2A1A1V2 is applied through tune discriminator 2A4A1 to connector 2A4A1J4. From this point the power output is connected through connector P1 and the load discriminator to connector J1. The current flow in this line induces a voltage in toroidal transformer T1. This induced voltage is detected by diode CR2, producing a dc voltage, which is applied through pin 2 of connectors 2A4J2 and 2A1A1P2, pin 30 of connectors 2A1A1XA5 and 2A1A5J1, to one side of ANT. LOAD meter 2A1A5M3. The rf output voltage is sampled by capacitive divider C 1, C2 and detected by diode CR1 to produce a dc voltage, which is applied through pin 8 of connectors 2A4J2 and 2A1A1P2, pin 31 of connectors 2A1A1XA5 and 2A1A5J1, and resistor 2A1A5A5R7 to the other side of ANT. LOAD meter 2A1A5M3.

When the impedance of the rf output line equals 50 ohms, capacitor Cl is adjusted so that the VOltage at pin 8 of connector 2A4J2 is equal in magnitude to the voltage at pin 2 of connector 2A4J2. If the load impedance differs from the desired 50 ohms, the voltages at pins 8 and 2 of connector 2A4J2 till differ. The amount of difference will be proportional to the degree of variation from 50 ohms. Them two voltages will cause ANT. LOAD meter 2A1A5M3 to deflect either right or left from center scale, indicating that the load must be decreased or increased to reach the 50 ohm balance point. The load is varied by varying the value of inductor 2A3L1, when TUNE-OPERATE switch 2A1A5S6 is set at TUNE. When TUNE-OPERATE switch 2A1A5S6 is set at TUNE, the voltage at pin 2 of connector 2A4J2 is applied through contacts C3 and 6 of switch 2A1A5S6. This new path changes the sensitivity of ANT. LOAD meter 2A1A5M3 by bypassing resistor 2A1A5A5R7.

Resistor R1 provides a dc return for capacitors Cl and C2. Resistor R3 is a swamping resistor for toroidal transformer T1 to minimize the effects of frequency variations. Capacitors C3 and C4 are rf bypasses. Resistors R2 and R4 provide a dc path for diodes CR1 and CR2, respectively. Capacitor 2A1A5C6 bypasses any rf present in the voltage applied to meter 2A1A5M3.