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Exhibit V Operational description HO82WUALS606

ALS-606 Technical and Operational Overview

The ALS-606 is an amateur radio multiband radio frequency linear power amplifier. As such, this device requires certification under technical standards in CFR Title 47 part 97.317(a) and (b).

General Operation

This linear amplifier covers the 160, 80, 40, 30, 20, 17, 15, 12, 10, and 6-meter amateur bands. Up to 100-watts exciter power is applied to relay RLY1 on circuit board RLY. With the main power OFF, the STANDBY/OPERATE switch on STANDBY, with a fault warning LED illuminated, or with the rear panel RELAY jack ungrounded, RLY1 bypasses through RLY2 directly to the antenna port.

When power is ON, the STANDBY/OPERATE switch in the operate position, and the rear panel RELAY control line held low (below 1 volt), exciter power is routed through RLY1 to the PD8m attenuator board.

Attenuation

The PD8m attenuator reduces exciter input signal to safe levels for the power amplifier (PA) module. It also provides a stable input termination for the power amplifier module. The PD8m has 50-ohm ports and provides either five or ten dB nominal attenuation.

PAM-606 (power amplifier module)

Power amplification comes from a single 600-watt power amplifier (PA) module. The PAM-606 module uses four matched-transfer MFR-150 field effect transistors. Each MRF-150 has 200 mA to 300 mA quiescent current. Target current is typically 250 mA per transistor in this design. Transistor conduction angle is slightly over 180-degrees, providing linear class-AB operation. While the precise value of quiescent current has little effect on linearity, it is very important to adjust all four FET's to identical quiescent current levels. Normal dc drain operating voltage is approximately 50-volts. Be aware bias control rotation is reversed in CB2 boards, as compared to the previous generation CB1 boards. When servicing any solid state PA, always verify functionality of bias. When inititially setting bias, adjust gate bias to minimum voltage before applying drain voltage.

Unlike standard Motorola based modules, the PAM-606 modules use two diametrically opposed push-pull pairs of 150-watt MOSFET's. The 300-watt push-pull pairs drive balanced VHF striplines. The balanced striplines combine at a matching transformer. The linear RF power FET's mount on a forced-air-cooled aluminum heatsink.

Two dc fans cool the PAM-606 module. Two thermistors (PAM-606 R2) sense power amplifier transistor temperature. Transistor temperature thermistor R2 regulates bias voltage, reducing bias voltage as transistor temperature increases. This bias feedback system keeps transistor quiescent current stable independent of transistor junction temperatures. PAM-606 thermistor R2 also feeds a comparator that removes drive when transistor temperatures approach unsafe levels. Bias voltages for the PAM-606 module comes from the CB-2 control board assembly. Each transistor has an individual bias adjustment, with minimum bias counter-clockwise from the top view. Note: ***The bias adjustment rotation has maximum bias and drain current clockwise. This is opposite older CB1 assemblies.***

A second thermistor (PAM-606 R1) monitors heatsink temperatures. Voltages from thermistors R1 regulate fan speed, increasing fan speed and airflow as the heat sink warms.

The PAM-606 module employs significant negative feedback to reduce gain, improve gain flatness, improve linearity, and ensure stability. The FET's have direct resistive voltage feedback across each individual transistor from drain-to-gate, as well as push-pull transformer (T2) coupled feedback common to the push-pull circuit. Push-pull operation, negative feedback, and linear biasing of FET's provide significant pre-filter harmonic suppression.

Characteristics of linear high-voltage FET's are very much like those of triode vacuum tubes. While this amplifier will run more than 600-watts PEP output, linearity might suffer. Ameritron recommends running 600-watts PEP or less for maximum linearity. Ideally, drive should be adjusted while monitoring linearity. Following these instructions, this amplifier will have IM performance comparable to the best vacuum tube linear amplifiers.

1KWF6 Lowpass Filter Assembly

The PAM-606 module connects directly to the 1KWF6 low-pass circuit board assembly through 50-ohm cables.

The output of the power amplifier enters the filter section through a directional coupler consisting of current transformer T1, capacitors C29-34, and resistors R4, 5, and 6. This directional coupler detects power amplifier termination errors by detection of reflected power levels. A comparator on the CB2 control board monitors a direct current voltage produced by directional coupler termination errors. Any significant reflected power from the filter, which would include any error in and beyond the filter, disables the amplifier. Excessive reflected power from the filter illuminates the front panel PA fault light.

The output of the filter board directional coupler routes through one of seven 5-pole lowpass filter groups. Relays, controlled by CB2 control board logic and the BSW band selection board, select the appropriate lowpass filter components.

CB2 Control Functions and Protection Logic

The CB2 control board contains all fan speed, biasing, transmit relay control, band relay control, band data processing, overload protection, and control logic lockouts. In the event of an operational fault, including out-of-band operation, the CB2 locks out the amplifier and illuminates the proper front panel warning light sequence.

Band Decoding

The CB2 board contains band-decoding systems. It also has a sensitive embedded frequency counter system. The frequency counter system in all ALS-606 amplifiers, regardless of band selection mode, automatically disables operation between 25 and 28 MHz. This embedded logic function cannot be disabled or changed.

Temperature

Temperature sensors the PAM-606 (power amplifier module) monitors heat. Bias voltage and fan speed track FET temperature. The ALS-606 protection circuitry reduces power as transistors approach conservative thermal limits, and disables the amplifier before transistors exceed safe operating temperature limits.

Bias

The CB2 senses voltage from a thermistor-controlled voltage divider system. Bias is normally set for 250 mA at room temperature. As FET temperature increases thermistor voltage decreases, reducing gate voltages.

The PA module jack, J7A, has individual bias supply lines and temperature sensing circuitry. Bias is adjusted with four potentiometers near the PA module connector.

Bias voltage is sequenced with T/R RELAY switching. Bias is applied as the input relay closes. Bias is removed when the input relay reverts to receive mode.

Band

Band data comes from external rear panel connectors, or an internal bandswitch board BSW-3 (same as BSW2 rev 2). External data is compatible with most modern amateur transceivers, such as Elecraft, ICOM, Ten-Tec, and Yaesu. Band data from the appropriate source is decoded. The proper band relaysare selected using decoded band information.

Protection

The CB2 contains protection logic for predetermined levels of antenna reflected power, filter reflected power, PA module balance, and PA transistor temperature. In the event of a safety

fault, the transmit-receive relay is disengaged in a normal receive transfer and a proper warning indicator is given. The normal sequence is remove bias, remove exciter relay, remove antenna relay, and illuminate warning LED.

Reset requires removal of the fault condition and placing the STANDBY-OPERATE switch in the STANDBY position. If faults are cleared, operation will resume upon placing the STANDBY-OPERATE switch in the OPERATE position.

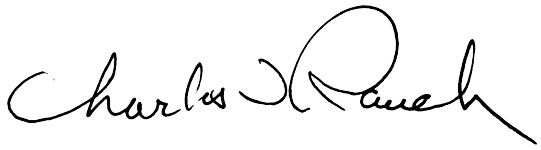
Harmonics

This amplifier is significatly better than FCC requirements. HF harmonic suppression typically 10-15 times better than FCC mandated suppression levels. Harmonics are practically immeasurable on all television channels. There is no reason to use an external low-pass filter with this amplifier.

Harmonic suppression comes from push-pull operation of linear devices, followed by high-quality 5-pole low-pass filters. Many amplifiers use inexpensive ceramic disc or mica capacitors. Lead inductance of mica or disc capacitors reduces high-order harmonic suppression. This amplifier uses quality multi-layer high voltage chip capacitors in inductance critical locations.

SWR

The SWR board is a standard 50-ohm directional coupler. The SWR board samples output connector current and voltage, vector summing voltage and current samples to a dc output voltage. The resultant voltages represent forward and reflected power, or SWR mismatch, to an ideal 50-ohm resistive load.



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