

HAMTRONICS® LPA 3-15R REPEATER POWER AMPLIFIER: INSTALLATION, & MAINTENANCE

GENERAL INFORMATION.

The LPA 3-15R Power Amplifier is a class C device designed to be installed as an integral part of a transmitter enclosure in a repeater installation with a 2.5 Watt 220MHz exciter module. Output power is approx 12-15W at 13.6Vdc.

The Power Amplifier operates on +13.6 Vdc at about 2 to 2.5 Amp, depending on output power level. It has a 50-ohm input and output impedance and is designed for continuous duty. A low-pass filter reduces harmonic output to very low levels.

CONSTRUCTION.

General.

Most of the pertinent construction details are given in the component location and schematic diagrams and parts list.

All parts are tack soldered to the pc board; so it is necessary to cut and form leads so that they seat properly on the board and be sure to keep leads as short and direct as possible. This is especially true of the disc capacitors. Figure 1 shows how to trim and form the leads of capacitors.

Mounting the board.

Note: This series of power amplifiers is designed to be mounted in an rf tight enclosure with the exciter in a separate rf tight box to avoid feedback into the exciter. The unit is supplied less heatsink since the enclosure acts as a heatsink. It is important to mount the unit carefully to avoid damage to the transistor by pulling the leads off the ceramic case. The PA is designed to have the thickness of two thin #4 flat washers (about 0.050 inch total) as a spacer between the pc board and the chassis which the transistor is mounted on.

a. Mark and drill four clearance holes for mounting the board with 4-40 screws and one 8-32 clearance hole to mount the transistor in the center of the cutout in the board. The latter hole must be close to the diameter of the xstr stud to provide maximum surface for the shoulder of the transistor to contact the chassis for heatsinking; so do not make this hole oversize.

b. Carefully open the package of heatsink compound with scissors. Use the toothpick to apply a small amount of compound to the shoulder of the transistor where it contacts the heatsink. Only a light coating is needed.

c. Install four 4-40 x 3/8 inch screws from the bottom of the enclosure. Place two flat washers as spacers over each of the screws, as previously described.

d. Set pc board over screws, and align so transistor is centered over hole in enclosure.

Secure the board with 4-40 nuts and lock-washers.

e. Secure transistor with #8 lockwasher and 8-32 nut. Do not overtighten nut; tighten with a nut driver only to the point of being snug. **Caution: Since heatsink compound is used, it is unnecessary to use a lot of torque, which could break the stud.**

Coil Forming and Placement.

Figures 5 & 6 show exactly how coils are formed. You need to form the coils exactly as specified, using #18 bus wire supplied. Tack solder them to the board in the positions shown.

L1 and L3 actually are jumpers formed with legs so that the top of the jumpers are 1/8 inch above the board, as shown in figure 6. L4 is 1-3/4 turns on 1/4 inch i.d. L5 is 1-1/4 turns on 1/8 inch i.d. Spacing between turns of the coils should be minimal, with turns separated just enough to prevent shorting together. The feet are formed on L5 just so the bottom wire of the coil doesn't short to the ground plane. (Note that L1 and L3 are shown in figure 5 at a smaller scale than the rest of the coils.)

RF INPUT/OUTPUT CONNECTIONS.

The input and output connections are made with RG-174/u or similar 50-ohm coax cable connected to the appropriate input and output pads and ground plane of the pc board. See diagram. Connect cables by stripping as illustrated and tack-soldering to board. Note that stripped length of coax is inductive; so keep leads short and neat.

Avoid melting polyethelene insulation on cable by pretinning board and cable and then tacking them together quickly.

POWER CONNECTIONS.

+13.6Vdc should be connected to the B+ pad at the top of the pc board through the ferrite bead provided. A hookup wire should be attached to the ferrite bead's lead or the bead can be removed and installed directly on hookup wire tack soldered in place of the lead the bead is on (as shown in Fig. 5). The ground return normally is connected to the pc board through the mounting hardware.

Note that the output capability of the PA drops rapidly as the voltage is reduced below 13.6Vdc; therefore, you should try to use a power source of sufficient voltage and minimize cable losses so that you have full B+ available at the PA.

CAUTIONS TO PROTECT TRANSISTORS.

Because it is so easy to damage rf power transistors in the field due to accidents and abuse, transistor manufacturers do not provide any warranty to cover replacements once a transistor is installed in the unit. They test them thoroughly at the factory because they are expensive parts. Therefore, they do not honor claims that "the transistor must have been bad from the factory". ☹ *For your protection, please be sure to observe the following precautions:*

1. Sometimes, transistors may be destroyed by parasitic oscillations occurring during tuning because of the extremes of capacitor settings, or due to accidental shorting of components. To protect against such damage as much as possible, turn power supply voltage down to about 10 Volts when you first apply power until the unit is tuned. Then, turn up to full 13.6Vdc. Of course, final tuning should be done at full 13.6V.

2. Never exceed 14Vdc, as even a small over-voltage causes strain on transistors because of additional heat.

3. Be sure you have a low impedance connection to the power supply, i.e., short, heavy cable.

4. Do not attempt to operate PA until exciter has been properly aligned by itself, operating into a 50-ohm load.

ALIGNMENT.

Alignment is very simple. Connect the input to an exciter which has already been tuned into a 50-ohm dummy load. Connect the output to a 50-ohm load of sufficient power rating. Use an in-line power meter.

Apply B+ and rf drive. Alternately tune the four variable capacitors for maximum output. Continue re-peaking capacitors until maximum output is achieved and all interactions between capacitors are worked out. Note that C8 normally tunes near or at minimum capacitance (piston up near top).

Caution: Do not retune exciter with PA connected. Once the exciter is tuned into a 50Ω load, it should not be retuned. Tuning the input of the PA takes care of matching the PA to the exciter.

With 13.6Vdc power applied and 2.5W drive, the 220 MHz unit should put out about 12-15W, and the current drain should be about 2 - 2.5A.

OPERATION.

Operation is quite simple. B+ can be applied all the time if desired. Merely apply an rf signal to the PA when you want to transmit. Being class C, the pa only draws current when driven.

TROUBLESHOOTING.

Since the unit has only one simple amplifier stage, there isn't much which can go wrong. The circuitry is straightforward. The first things to suspect should there be no output are shorted coax cables or incorrect or shorted pc board component connections.

Should it be necessary to replace rf power transistor Q1, be sure to use an exact replacement. There are other transistors rated at similar output level, but they may have lower gain or different impedance characteristics.

To replace the transistor, carefully peel each lead away from the pc board while melting the solder. Then, remove the mounting hardware and gently push the old transistor out of the heatsink. Clean all the old solder off the pc board and remove the old heatsink compound. Add new heatsink compound, and install new transistor with collector lead in correct location. Carefully tighten nut on transistor without over-torquing. Then, flatten leads against the board, and sweat solder them to the board. Remember to resolder any components removed for access to the transistor leads.

PARTS LIST.

Note: Some design changes have been made since the diagrams were made. Text and parts list take preference.

Ref Desig	Description
C1	20pf disc
C2	30 pf (grn) ceramic var.
C3	100pf disc capacitor
C4	mica variable (C4203/08)
C5-C7	not used
C8	11pf piston trimmer
C9	mica variable (C4203/08)
C10	.001 uf + 100pf chip caps
C11	0.1 uf chip capacitor
C12	47 uf electrolytic cap
C13-C14	33 pf disc capacitor
C15	not used
L1, L3-L5	wind per text
L2	0.22 uh rf choke marked red-red-silver-red
Q1	M25C18
R1	3.3Ω, ¼W resistor
R2	10Ω, ¼W resistor
R3	not used
Z1-Z2	ferrite bead

