HAMTRONICS HRG-(UHF) HELICAL RESONATOR AMPLIFIERS: INST MANUAL

FUNCTIONAL DESCRIPTION.

The HRG-450 Helical Resonator Amplifiers are a new, GaAsFET version of our popular HRA-( ) series. They consist of a four-section helical resonator and a GaAsFET preamplifier to add sharp selectivity to the front-end of receivers. The effect of the helical resonator is to reduce intermod and cross-band interference in critical receiver locations and in repeater installations.

Typical gain of the unit is about 15 dB. Output 1 dB compression point is +8 dBm. Typical noise figure of the amplifier is about 1 dB.

Note that the 7 to 8 dB insertion loss of the helical resonator ahead of the amplifier does not allow the full potential of the low noise amplifier to be realized. While the preamplifier itself is a low-noise amplifier, the insertion loss of the helical resonator ahead of the amplifier adds to the noise figure; so the overall effect is not a low-noise preamp in the ordinary sense, but rather a filter for reducing intermodulation products. The amplifier is used merely to make up for the loss in gain.

The effect on the sensitivity of the receiver depends on how good the receiver is to begin with. The sensitivity of the receiver with the HRG-450 installed may be slightly higher or lower than the receiver by itself. The primary function of the HRG-450 is to reduce interference; so the useable sensitivity in critical applications will be improved by eliminating desense and crossmod interference.

Limits of tuning for the helical resonators are 420-470 MHz, and the frequency the factory normally tunes them to is 450 MHz

Selectivity curves on page 2 show typical response when tuned at band center. Resonators can be retuned to center at any frequency within the stated range. *There is no easy way to modify the filtersto tune outside of the specified ranges.*

INSTALLATION.

The amplifier is designed to be mounted next to the receiver. Three mounting holes are provided to allow the unit to be mounted with standoffs to a chassis. In repeater service, the HRG-450 should be mounted in the same rf tight box as the receiver.

Antenna and receiver connections are made with RCA plugs to the jacks on the board. We do not recommend that you substitute another type of connector. The connector type was chosen to provide the most direct connection to the pc board, and other types are sure to add inductance. The *input* and *output* jacks are identified on the board. 50 ohm cable should be connected with good phono plugs having cable clamps (see catalog).

B+ for the unit must be filtered +12 to +14 Vdc. Current demand is 5 to 10 mA. Connect B+ by soldering wire to terminal E1 on the board. Either insert in center of pin or wrap pin, and then solder.

CAUTION: The GaAsFET is static sensitive. Use normal static-handling procedures in handling the unit. Solid state low noise amplifiers also can be damaged by large voltage transients and reverse polarity. *Although zener protection is provided in the unit, avoid such conditions as a matter of principle.* Care should be taken especially to install reverse diodes across such inductive devices as relays operating on the same B+ line to absorb transients at the source.

ALIGNMENT.

The unit was factory aligned at the frequency indicated in the table. You should repeak the helical resonator screws and the two variable capacitors after installation, using a weak signal. Alternately tune the four screws on the resonator and the two variable capacitors until all interactions are worked out. *Note that there are small interactions between the four resonator screws and a substantial interaction between the fourth section of the helical resonator and the adjacent variable capacitor.*

The resonators are tuned at the factory with a sweep generator for a flat response at the top. However, if it is to be used only at one frequency, such as in repeater service, all screws can be adjusted for peak at the one frequency.

Be careful not to tune any screw on the helical resonator more than 6 to 8 turns either way, as the metal slug inside the resonator can be unthreaded from the lead screw. (If that happens, you may be able to carefully remove the affected section and reinstall the tuning slug.)

TROUBLESHOOTING.

Troubleshooting is fairly simple. First, be sure that cables are connected properly and not reversed or shorted. Then, check the dc voltages on the GaAsFET.

The drain should measure approx. +9V, gate-2 should be about +4.5V, and the source should be about +1.5Vdc. You can identify the elements by the location of the chip capacitors on the bottom view diagram.

It is possible to damage a GaAsFET in either of two ways. First, despite the zener protection diode, you might damage the FET with a high voltage or reverse voltage transient on the power wiring. You need to be concerned about lightning and about inductive devices like relays operating on the same power source and generating spikes. Such damage probably would show up as a short or open affecting the dc test voltage on the FET. The other general failure mode is from excess rf applied to the input from a transmitter. This causes a burnthrough in the input gate (gate-1) of the FET. Because gate-1 normally is dc grounded in the circuit, this usually does **not** show up as a change in dc test voltages.

If it is necessary to replace the FET, be sure to ground yourself before handling the new one, and use a grounded soldering iron. Also, be careful not to apply excessive heat when soldering. Simply solder each lead quickly to the foil on the pc board, without leaving the iron in place for a long time, and you should not have any problem with overheating. The fet is mounted with the lettering side toward the board, and the drain is the long lead (see diagram.)

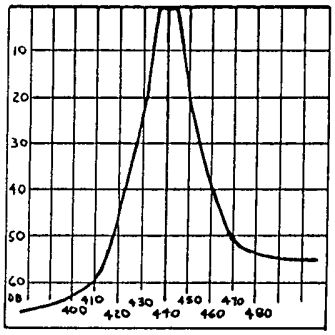
APPEARANCE.

Note that the uhf helical resonators are silver plated, and as such, they are subject to tarnish as any fine silver is. This does not affect operation, but if you are concerned about appearance, you can use ordinary silver polish to restore the finish to like-new condition.

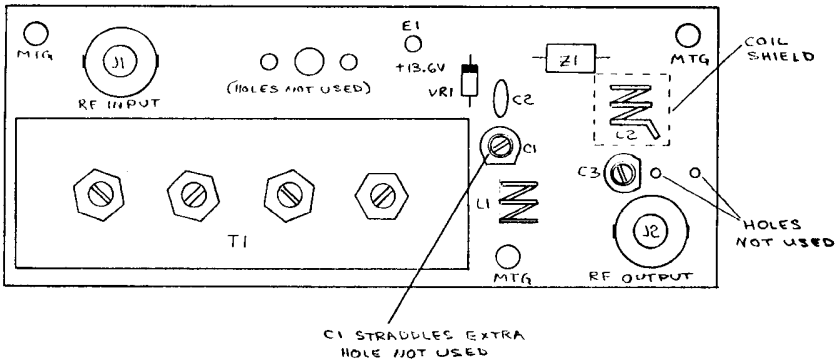
PARTS LIST.

Ref #	Value
C1	4.5 pf variable capacitor
C2	27 pf disc cap
C3	4.5 pf variable capacitor
C4	not assigned
C5-C7	.01 uf chip cap
C8	.047 uf chip cap
J1-J2	RCA jacks
L1-L2	3 turns #22 bus wire space to fill distance between holes on board, 1/8" I.D., 1/16" above board. L2 centered inside shield can to avoid shorting.

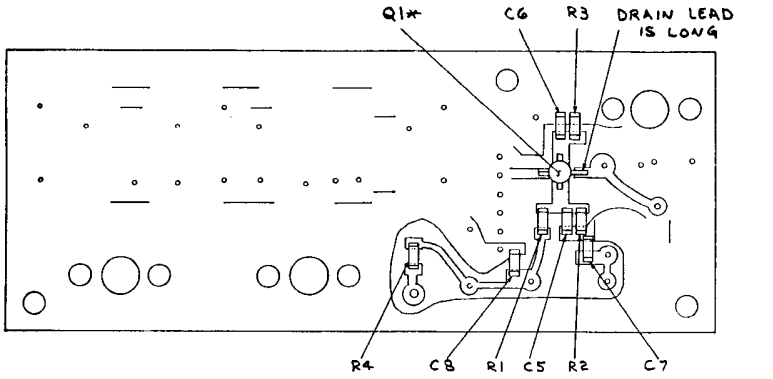
Q1	GaAsFET, NEC #41137 *mounted with lettering toward board.*	R1-R2 R3 R4	86K chip resistor 200 ohm chip resistor 620 ohm chip resistor	T1 VR1 Z1	Helical Resonator #1003A 9.1V zener diode 1N5239B Ferrite bead



TYPICAL RESPONSE CURVE



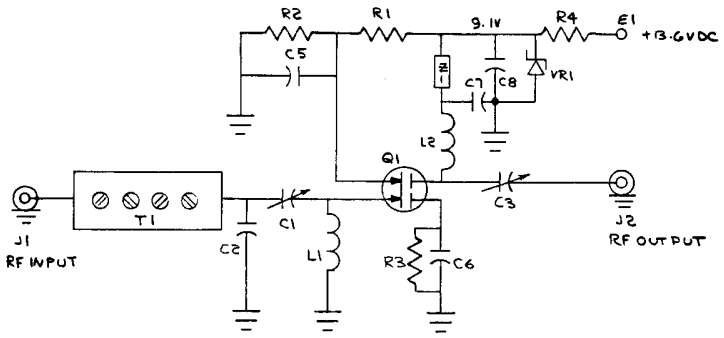
HRG-( ) UHF
TOPSIDE VIEW



* XSTR IS MOUNTED WITH PRINTED SIDE TOWARD BOARD & BLANK SIDE OUT IN VIEW.

UNDERSIDE VIEW

COMPONENT LOCATION DIAGRAMS



SCHEMATIC DIAGRAM