Care and feeding of Minicircuits Lab ZHL42 amplifiers

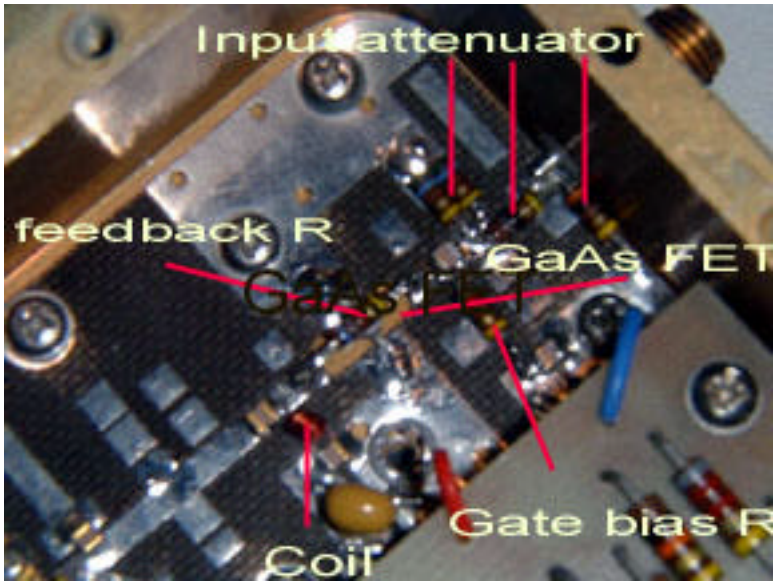
700MHz to 4.2GHz 1Watt output, 30dB gain, 1dB ripple broadband amplifiers.

Minicircuits Lab introduced these amplifiers in the late 1980s as high power, linear gain blocks for commercial and industrial lab use. They were quite expensive and used then new GaAs technology. A wide range of variants have since appeared including 10MHz to 4.2GHz types (ZHL-42W), 40dB gain types (ZHL-4240) and lower gain 100mW output amplifiers (ZHL-1042J). However, the GaAs FET input stage was very prone to being destroyed by too much signal. A very common failure situation was simply turning on signal generators that didn't remember the last set level and that would power up with maximum output of perhaps 50mW. This was almost certain to cause the amplifier to fail.

When they first appeared they were rated at +10dBm maximum input, this was later revised down to +5dBm and my own advice is to ensure the input doesn't exceed 0dBm. The purpose of this article is to show that these amplifiers can easily be made to work again and are (arguably) more useful to the amateur community after this simple repair than in their 'as new' condition. Why? How? Read on!

After trying unsuccessfully to replace the blown input FET I tried the more practical approach of merely strapping out the input stage. First, check this is where the fault is. (You can be better than 90% certain it will be). It is easy to prove this is the stage at fault as the bias condition around the device will be found to be inconsistent with, usually, the negative gate bias voltage on the first stage non existent.

Carefully remove the 820R gate bias feed resistor, 680R feedback resistor together with series chip capacitor, close-wound drain feed inductor and then the GaAs FET device. Cut a 1mm wide, 12mm long strip of thin copper tape to bridge between the gate and drain connection points. That's it!



With this 'repair' the gain of the amplifier will be found to have decreased by about 10dB. However, it is now possible to increase the input signal level significantly without fear of damaging the amplifier. I have applied up to 100mW without damage after making these changes. The great thing about this mod is that the achievable output power from the amplifier is now significantly increased.
The following table shows the results from one such amplifier 'repaired' in this way.

Frequency	432MHz	1.3GHz	2.32GHz	3.4GHz
Output power (sat)	1.4W	2.25W	1.7W	2.0W
For input power	Not measured	10mW	10mW	25mW
700mA at 15V	Rising to 875mA at saturated output power			

You will note that the frequency response is now noticeably less flat than 1dB. However, for amateur purposes this probably doesn't matter too much. Some additional gain can be obtained by removing the input 3dB attenuator and replacing it with another copper strap.

Expect to pay between £50 and £100 for fully working ZHL-42s and around £40 to £60 for a 'repaired unit. The high gain and extended bandwidth types will command a higher price.

These amplifiers are an ideal way to make a multi-band transverter or to boost the output of your PLL Brick oscillator to produce a useful output power for a 23 - 9cm, personal beacon.