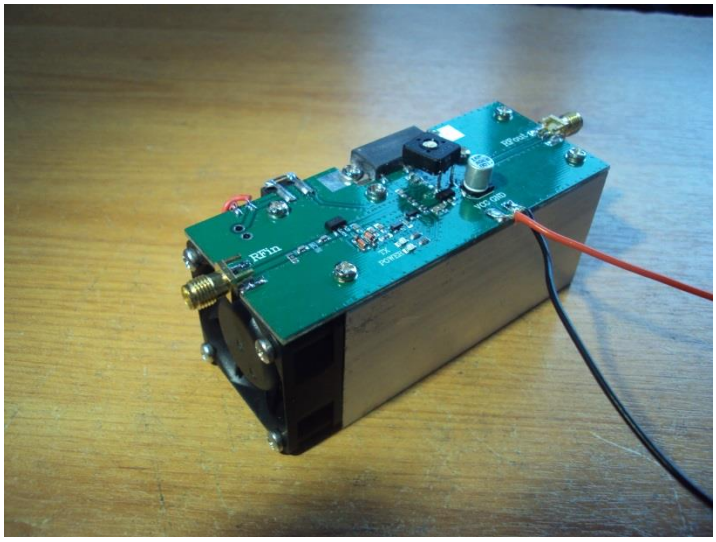
A 10 Watt Linear Amplifier for 70cms DATV or narrowband modes

Jim Smith G7NTG



Some of you may recognise the amplifier as being advertised on Ebay as

"433MHZ 335-480MHz 13W UHF RF Radio Power Amplifier AMP DMR + Heatsink + Fan"

I needed a linear driver amplifier for 70cms and thought that this amplifier ,advertised for about £33 on Ebay, might fit the bill so I ordered one.

Delivery took a few weeks from Hong Kong and, when it arrived, I set about testing it.

The number on the amplifier module had been scratched off but was just readable as an RA07M4047M which I looked up on the internet and found it to be a 7 watt, 7.2 volt module from Mitsubishi and gave the absolute maximum supply voltage as 9.2 volts.

On reading the details from Ebay, they claimed 13 watts on a 13.8 volt supply which is well outside the Mitsubishi ratings! I wonder if this is a very successful copy of the original Mitsubishi device!

I connected the amplifier up to power at 13.8 volts via an ammeter and to my HP432A power meter via a 40dB attenuator and applied input from my signal generator. The amplifier saturated at 18 watts but was not in the slightest linear! The power came on suddenly as the input signal was increased. Only suitable for FM as purchased then.

Looking at the circuit used, it became obvious that the first stage amplifier output was used to drive a detector and amplifier to provide a voltage to drive the Vgg pin 2 on the module so I figured that if I

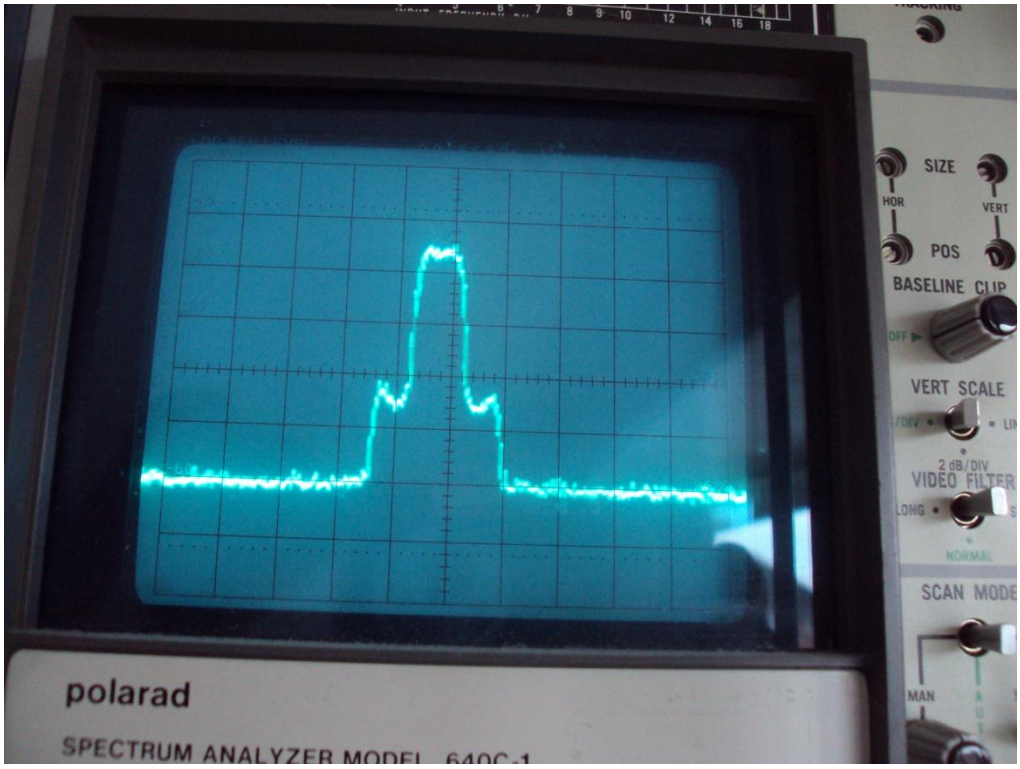
disconnected this amplifier and applied a fixed bias arrangement to drive pin 2 the the device might behave in a linear mode.

(Note that the Ebay picture and the one I received are different so there may be different versions out there!)

I removed the 2 resistors associated with pin 2 and soldered on a 10k preset as shown in the pictures. I then adjusted the pin 2 voltage to 3.2 volts and the amplifier bias current went up to about 1.5 amps.

I again tested the amplifier and found that it was linear up to a P1dB point of about 7 watts and saturated at about 16 watts for 2.6 amps supply. The linear region gain was about 54dB so that for 7 watts output the input level required was about -15dBm or 32 microwatts.

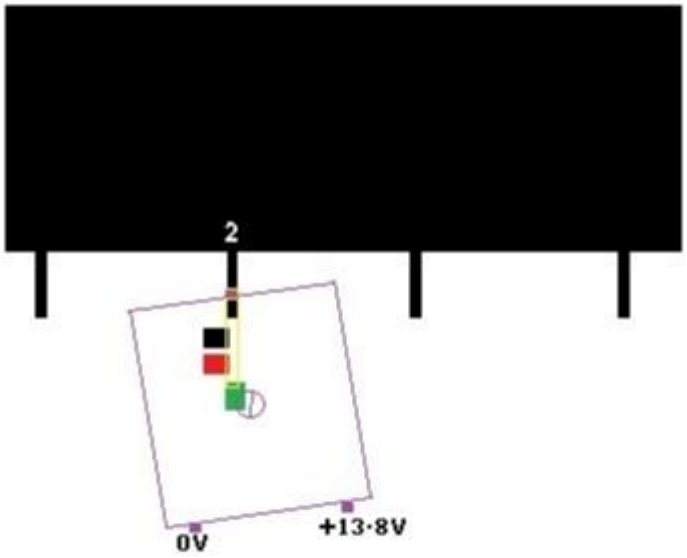
The next stage was to give it a test with DATV so, with an input of 437MHz DVB-S2 at 333ks/s and an average power output of 7 watts the amplifier was left on soak test for several hours with the spectral regrowth shoulders about 28dB down (lower regrowth at lower power). Spectral purity of the Lime Mini I used is not much better than this for spectral regrowth as I am sure many of you are aware.



As the amplifier exhibited no signs of distress and failed to blow up as I though it might, I figured it was a great success and I will detail the modification for others to try.

There are two SMD resistors close to pin 2 of the module, marked red and green on the sketch – these are both removed and the red resistor to ground is replaced with a 100nF ceramic capacitor.

A 10k preset is the fitted so that the slider goes to pin 2 of the module, max cw pin goes to 13.8v supply and max ccw pin goes to ground. These last two connections may need the solder resist to be scraped away so that the copper track underneath can be soldered.



I found the best type of pot to fit is a square Iskra preset 10k ohms as pictured below – they have ling enough pins to give clearance for soldering.

In conclusion, the amplifier will be used to drive a 100 watt power amplifier using an MRF286 (Chinese Ebay kit which works very well) for DATV transmissions in my local area (Kettering,Wellingborough) and I expect to be able to run an average power of around 40 watts.

The amplifier will also be useful for lower power transmissions of up to 4 watts DVB-S2 and for the cost is a good start because it will run off the output of a portsdown or lime mini via a suitable attenuator.