ADL5324 Power Amplifier
for Cheap and Simple Microwave Transverters

Paul Wade W1GHZ ©2012
w1ghz@arrl.net

I recently described a Modest Power Amplifier for my Cheap and Simple Transverters for the Rover. The simple untuned amplifier, using a Minicircuits GVA-84 MMIC, provides upwards of 100 milliwatts on any of the transverter bands.

Since then, Analog Devices announced a new MMIC, the ADL5324, capable of perhaps ½ watt. They come in the same package style as the GVA-84, so the same PCB might work. I found them available at Digi-Key and ordered a few to play with.

The transverters typically produce only a few milliwatts, enough for many rover contacts. Higher power amplifiers are available, but not always cheap, and often requiring significant DC power. If we could provide a bit more power without significant difficulty, expense, or DC power expenditure, it might enable more DX for the rover. Increasing the power to 100 mW is a significant step up, but getting up to ½ watt is moving into the serious rover category, if not too much battery power is required.

The ADL5324 is does require some tuning, but it looks pretty simple, just chip capacitors placed at different locations along the input and output transmission lines for different frequency bands. Like the GVA-84, bias is 5 volts through a chip inductor – easily provided by a 7805 three-terminal regulator.

I looked at the tuning suggestions on the data sheet, and decided that tuning for 1296 MHz might best fit on the PC board I had made for the GVA-84, since I had a few boards left. The data sheet tuning suggestions skip from 960 MHz to 1880 MHz, but I guesstimated the values for 1296. Also, the estimated capacitor values were close enough to what I had on hand, so instant gratification was possible. I also ignored the data sheet recommendation for microwave capacitors and used ordinary cheap chip caps. After about an hour with X-Acto knife and soldering iron, the amplifier was ready to go, and worked immediately. Figure 1 is a photo of the amplifier, and Figure 2 is the schematic diagram.

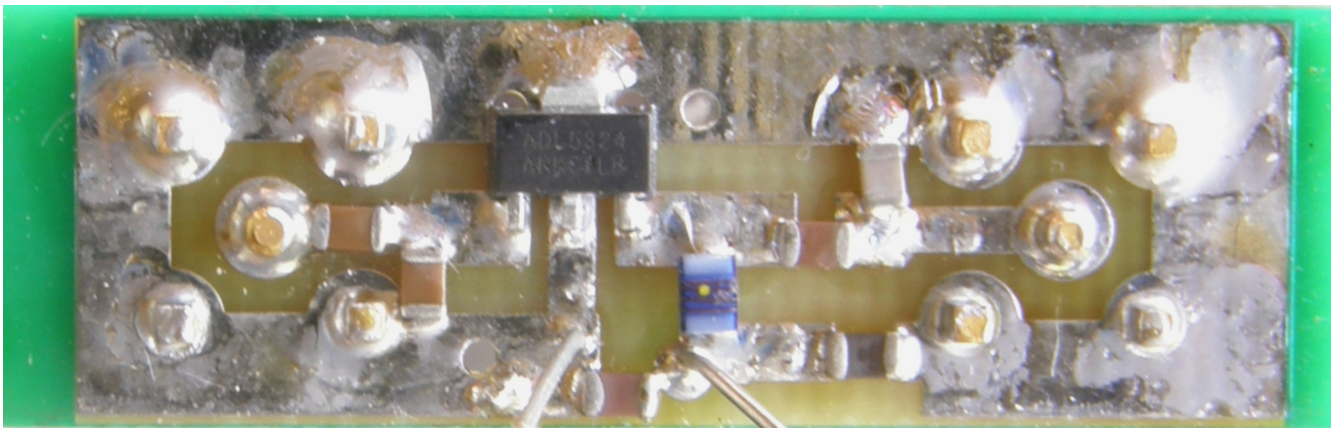

Figure 1 - ADL5324 1296 MHz Amplifier

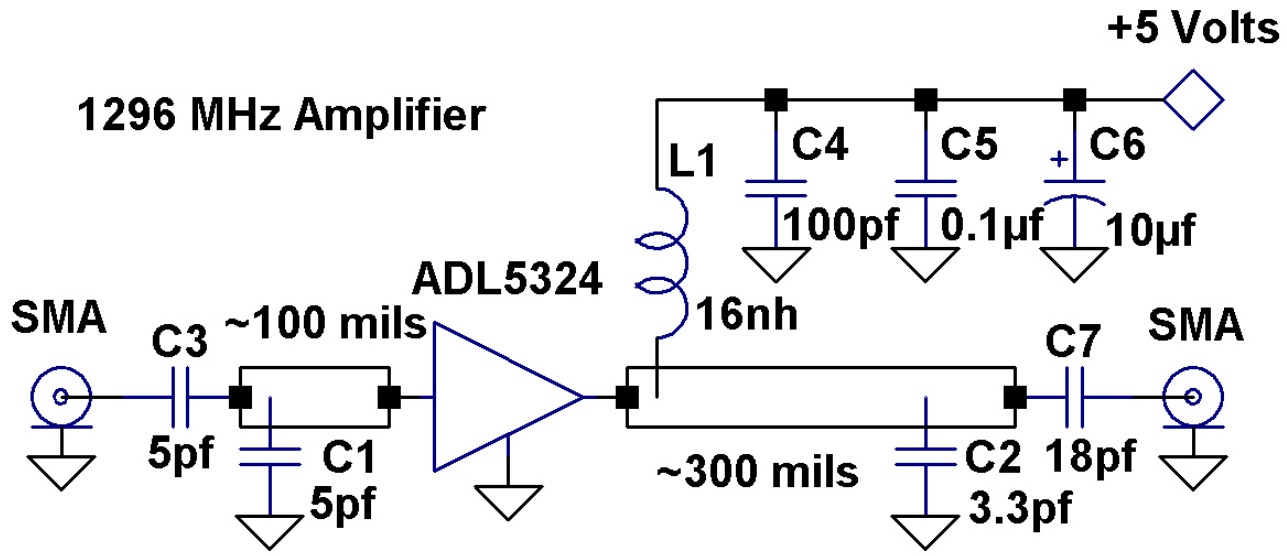

Figure 2 – ADL5324 1296 MHz Amplifier Schematic

I first tried the amplifier without the 3.3 pf capacitor at the output – with 10 milliwatts of drive at 1296 MHz, the output was165 mW, about 12 dB gain. Then I added the capacitor, and the output jumped to 325 mW, enough power to be interesting, with about 15 dB gain.

My sweeper only puts out 10 mW, +10 dBm, so I added the GVA-84 amplifier as a driver to push the power up. With -6 dBm into the GVA-84, the output from the ADL5324 is 520 mW. Increasing the drive to -3 dBm yields about 780 mW, about a dB less gain, so this is somewhere near the 1-dB gain compression point. Pushing the drive up to 0 dBm, 1 mW, produces 900 mW, pretty much saturated. At this power, it probably isn't very linear, but great for CW.

Another feature for rover use is that the devices operates like a Class-AB amplifier – idling current is about 100 mA, increasing to 350 mA or so at full power. This reduces the battery drain and heat-sinking requirements. I also gave it a quick test at 902 MHz. Gain is down about 3 dB, and the output saturates at about 450 mW. So this amp is definitely tuned for 1296. Input return loss for the ADL5324 stage is at least 13 dB at 1296 and about 5 dB at 902 MHz.

The data sheet shows good power up to 4 GHz, so I will be making some amps for the higher bands. The PCB will probably require some modification to allow for more tuning freedom and better heat sinking. When I get it worked out, the boards will be available.

This should be a good homebrew project – simple and inexpensive, but with a chance to do some tuning and fiddling without much danger of disaster. It might even inspire you to try building a high-power amplifier with more expensive and fragile devices.

Finally, remember that these amplifiers are broadband, and the filtering in the simple transverters is barely adequate for a QRP signal. Please add a real metal filter between the transverter and a power amplifier.