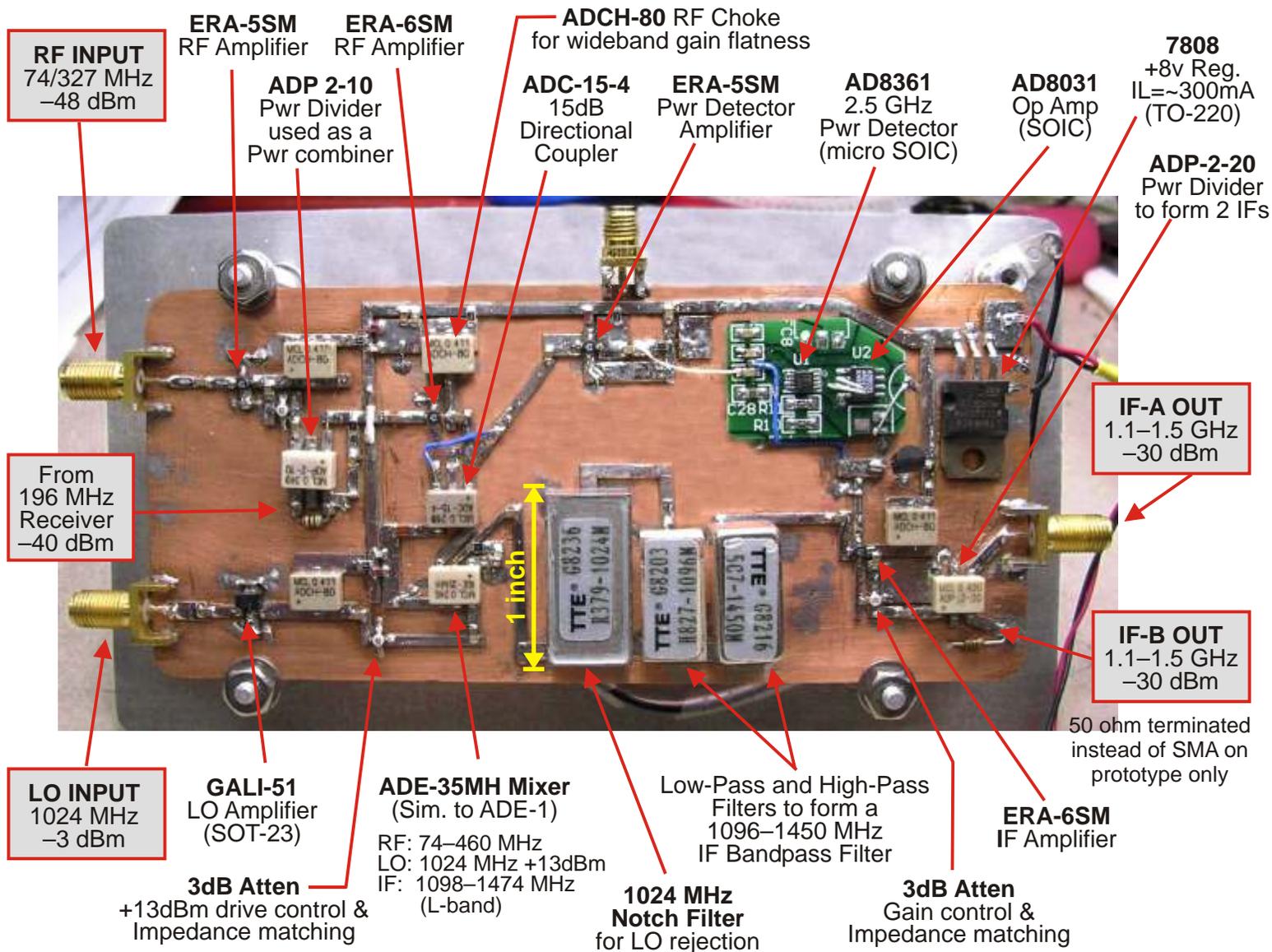


The 4/P Converter: A 74–460 MHz to 1.1–1.5 GHz Upconverter (Prototype build)



This is a prototype of a multi-frequency upconverter built *manhattan style* for a new circuit evaluation, and was used for laying out the PCB. The circuit accepts the inputs from the 74, 196 and 327 MHz receivers, combines their total noise power, and upconverts it to a composite L-band IF (about 1.1–1.5 GHz). These are the lowest frequencies used at the VLA radio-telescope for science, using dipole antennas stretched between the quadrapod legs supporting the subreflector over the 88-ft. dish. 74MHz is used for solar and central galactic observations; 327 MHz is used to measure water vapor absorption in our atmosphere and other science; 196 MHz is a new receiver just added to hopefully map the hydrogen recombination left over from the big bang. (the hydrogen spectral line at 1.4 GHz appears at 196 MHz due to the redshift of the big bang remnant - now THAT is a red shift!).

The directional coupler samples the RF just before the mixer, then applied to an amplifier and an RF power detector circuit. This is used to monitor the total input power from the receivers for normal observing, *and* to detect interfering signal (like visitors using a cell phone that can't read the "No Cell Phones" signs everywhere) or a receiver that went into compression or something. Also, the receiver alternates between the real signal and a calibrated noise source several times a second so we can constantly calibrate phase and gains through the system. This power detector is also used for sensing this switched power.

Construction: I used .031 copper clad vs. the standard .062. The .031 is much easier for trimming into small pieces for the tiny SMC pins and 0805 resistors and caps used throughout. The circuit tested well at 1.5 GHz with no excessive leakage, proper powers, and maintaining good port-to-port isolation on all components and I/O lines. All *manhattan pads* and *runs* were completely soldered covered – only because the other fellas around here couldn't figure out how it worked without highlighting the traces. They were intrigued with the technique and how well it worked as a prototype method, but I doubt it will become a company standard -hi.

It was a fun (manhattan style) project to design and build at work. I called it my "ham radio" project, as it was the closest thing to HF I've done for work in years. The other converters I've designed are for L,S and C band (1–8 GHz) and Ku, K, Ka and Q band (12–40 GHz) to our 8-12 GHz IF. The only ham radio/QRP application for this circuit I can think of is it might make a neat 2M, 220 and 440 MHz upconverter to 1096 MHz moonbounce. Hmmm.

— Paul Harden, NA5N