

# Simple Down Converter Design

By Bill Pretty  
May 28 2007



**HIGHPOINT SECURITY  
TECHNOLOGIES Inc.**

The purpose of this paper is to outline the design of a simple RF down converter. This design uses off the shelf components available from MiniCircuits Corp.

In any mixer the output consists of the sum, the difference and the two original signals. In this design the most useful signal will probably be the difference signal. Hence the name *down converter*. This is a very simple design, which uses no input or output filtering, so there will be image frequencies produced as well.

I originally built this circuit because I was attempting to measure the percent modulation on a 907MHz carrier. I used the output from a synthesized (low phase noise) signal generator. By setting the signal generator to 906MHz, I was able to mix down the carrier and produce a 1MHz IF signal which I could easily view on a 100MHz oscilloscope.

There are really only three components in this design, including the 12VDC regulator. I used a ZX05-30W coaxial mixer and a MAN-1LN low noise amplifier as the IF amplifier. The ZX05-30W is capable of converting signals from 100 to 4000MHz. The MAN-1LN has a bandwidth of 500KHz to 500MHz. The MAN-1LN is a through hole part and required a PCB. The regulator was also mounted on the PCB. I could have used a different amplifier, but I had this one in stock. The MAN-1LN has a gain of about 30dB across the bandwidth of the device. The noise figure is about 3dB, making it a fairly good IF amplifier.

A block diagram of the circuit is shown in figure 1 below.

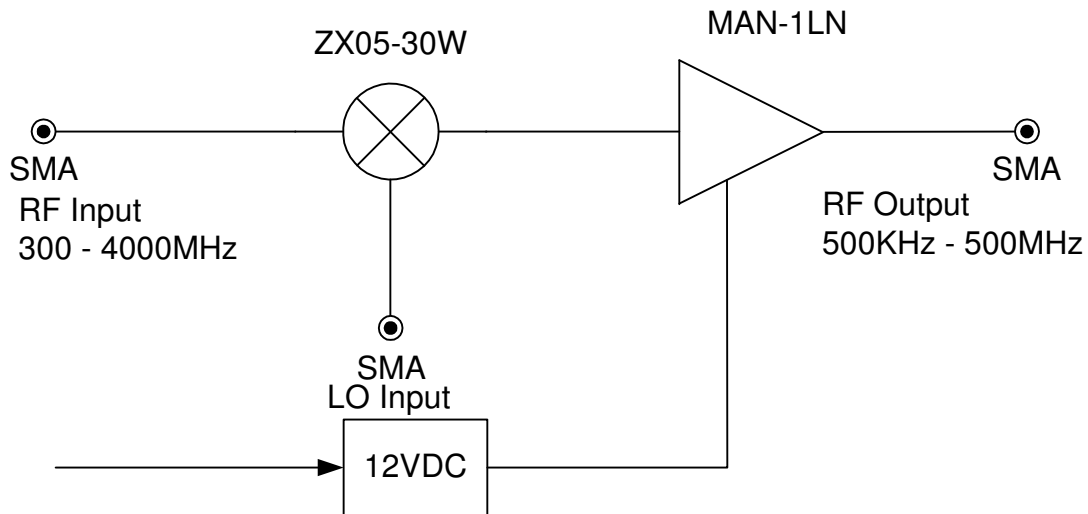


Figure 1 Block Diagram

The photos below, Figures 2 and 3 are of the completed project.

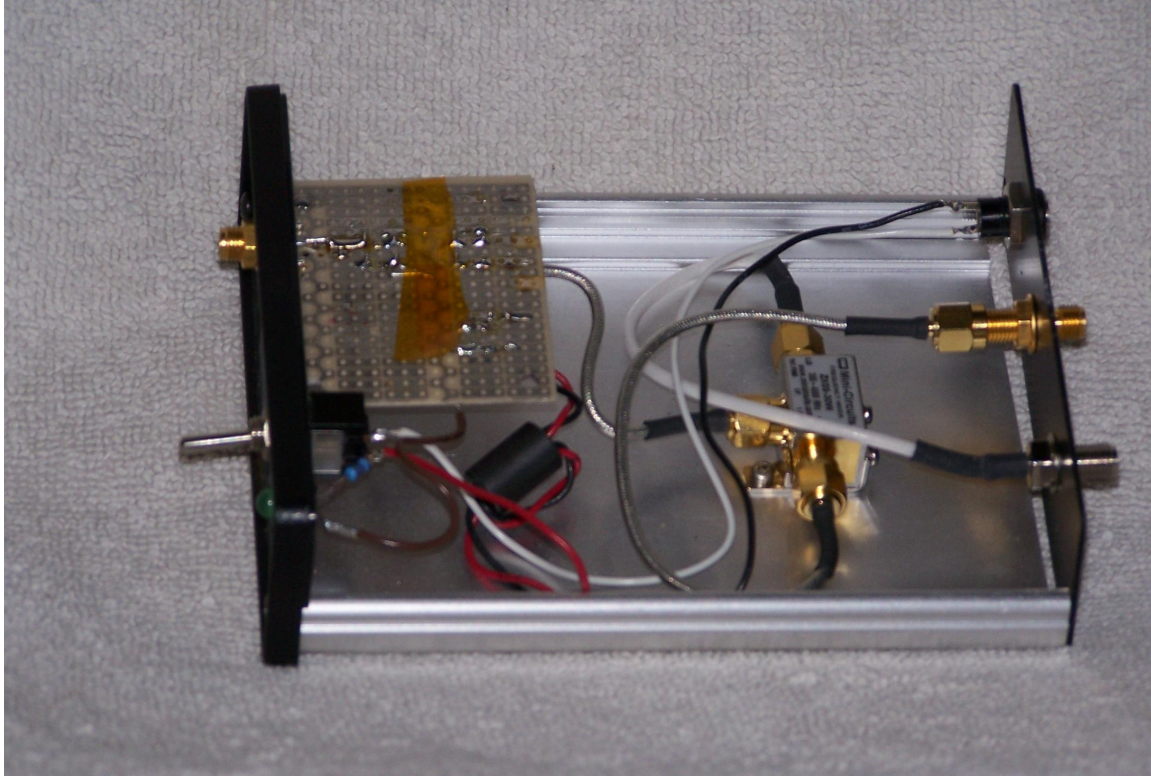


**Figure 2 Front**



**Figure 3 Rear**

The PCB with the MAN-1LN is mounted upside down so as to make trouble shooting easier. The semi-rigid cable was used to keep losses to a minimum. Note the use of the ferrite bead as an RF choke on the power leads.



**Figure 4 Cover Removed**

The whole project is powered by a 12V, 300mA power cube. This is a very basic design. A clever designer could add a broadband amplifier to the input, and possibly a band pass filter to the IF output. MiniCircuits manufactures a number of coaxial filters and amplifiers. It is important to note that the clarity of the output signal will depend largely on the signal source used for the local oscillator. A good quality RF signal generator should be used if at all possible.

This is a simple low cost design that any first year RF Technologist should be able to build. Total cost of the project is about \$60.00 US for the MiniCircuits parts and about another \$30.00 or so for the SMA cables. I used a proto-board with a ground plane on one side, but a proper PCB could be laid out if the facilities were available.