

Simple 2.4 GHz Receive Pre-Amplifier

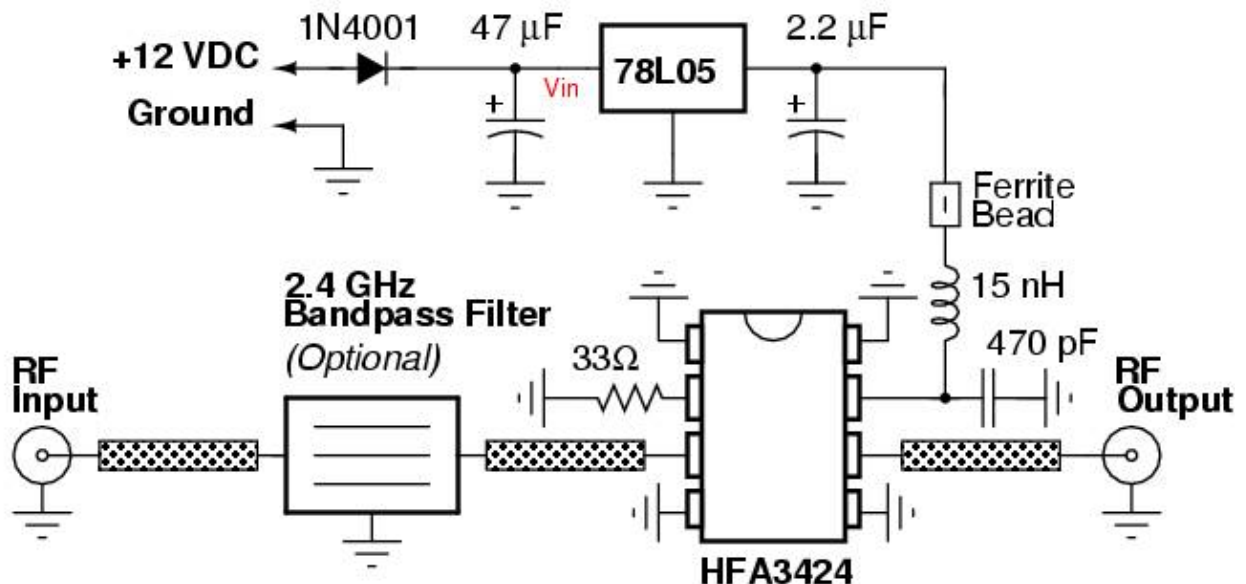
Overview

Old wireless networking cards based on the Harris/Intersil PRISM chipset from the early 1990s are starting to show up from time-to-time at swap fests. These are the older models, while still using Direct Sequence Spread Spectrum (DSSS) in the 2.4 GHz ISM/Part 15 band, only had a maximum data rate of around 2 Mbps. One nice feature of the older PRISM chipset was their use of an external receive pre-amplifier. Most cards used the Harris/Intersil HFA3424 low-noise pre-amplifier chip which gives around 14 dB of gain at 2.4 GHz and, more importantly, doesn't require any complex external impedance matching networks. 50 ohms in, 50 ohms out, just add +5 VDC power and a few bypass caps. This also makes the HFA3424 the perfect choice for extending the range of other devices which need to receive a fairly weak signal in the 2.4 GHz region.

For this project, we'll be using a salvaged HFA3424 to help extend the range of the 2.4 GHz 'warspying' device covered in *GBPPR 'Zine*, Issue #67. One optional addition to the final circuit will be a 2.4 GHz bandpass filter on the HFA3424's RF input. This helps to knock down any out-of-band interference, but will prevent the device from tuning in video signals which are outside of the filter's bandpass frequency range. Mouser and Digi-Key both sell SAW bandpass filters for the 2.4 GHz band, but they're in packages which are horribly small and very difficult to work with. You can sometimes salvage "easier to solder" bandpass filters from older 2.4 GHz wireless network devices. The addition of a 33 ohm bias resistor to pin 2 of the HFA3424 increases the overall RF gain to 16 dB and will also lower the input noise figure, but at the expense of increasing the current draw to around 20 mA. Without the bias resistor, the HFA3424 draws around 5 mA.

Schematic

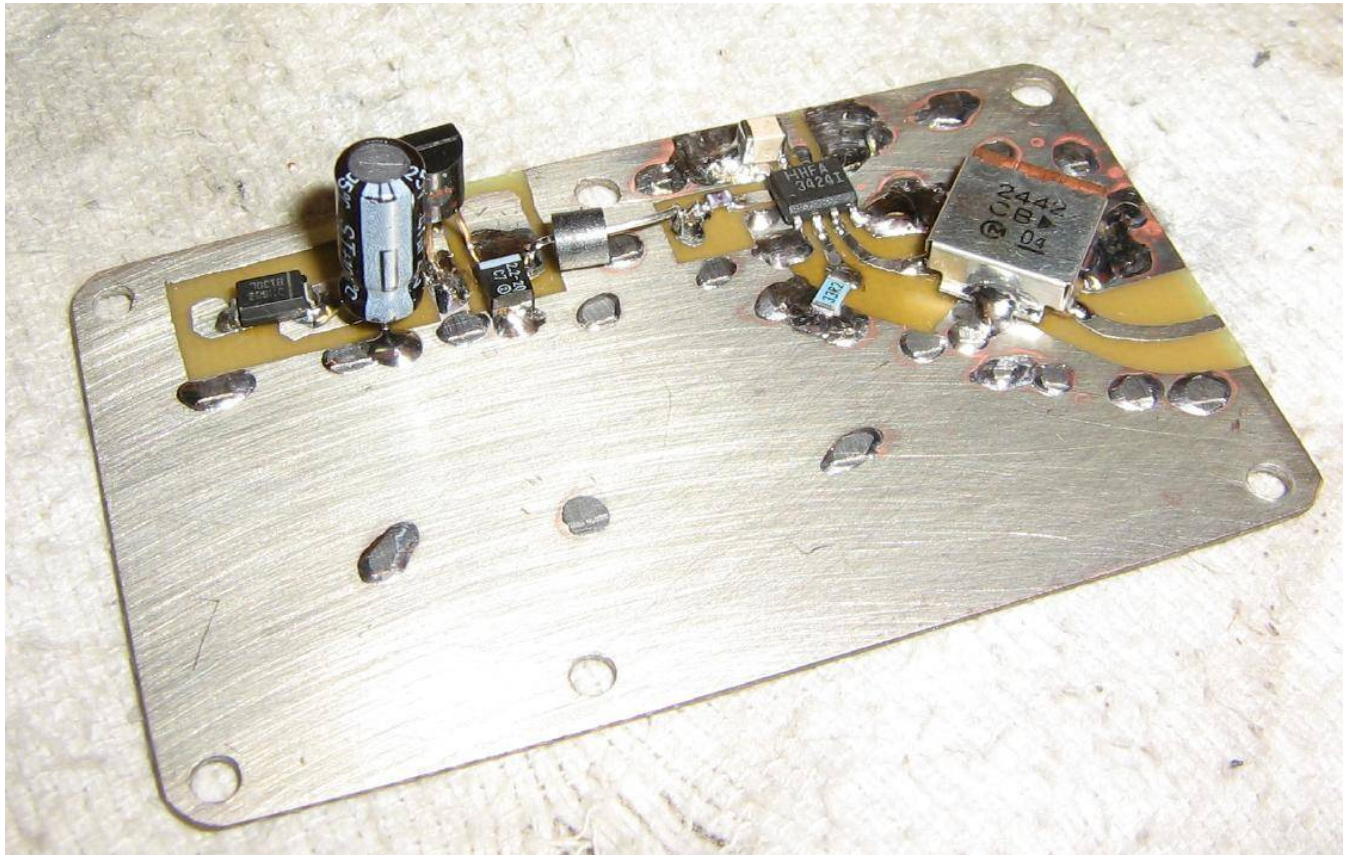
2.4 GHz Receive Pre-Amplifier



 50Ω microstripline

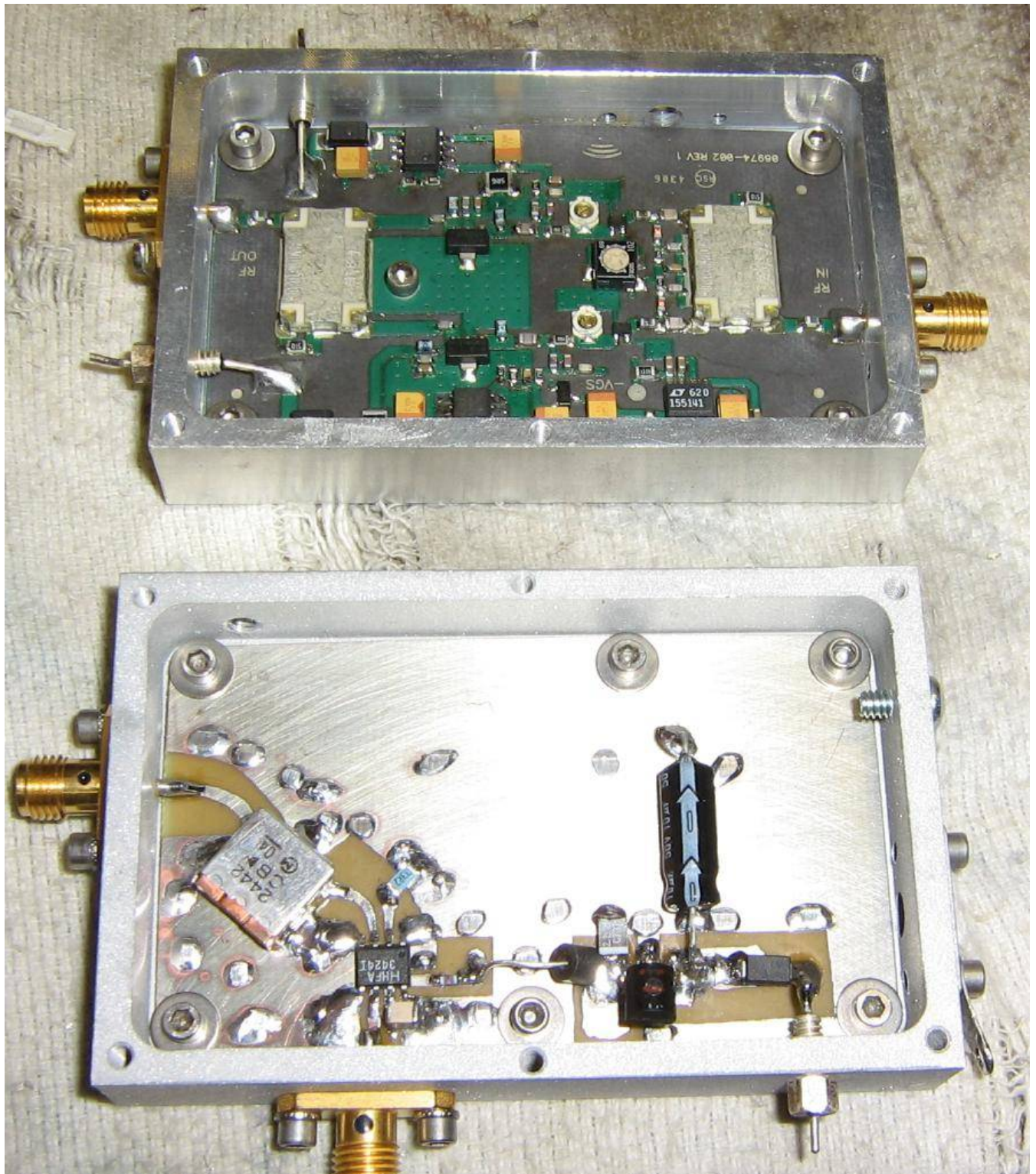
The optional 33Ω resistor increases the HFA3424 RF gain

Pictures & Construction Notes



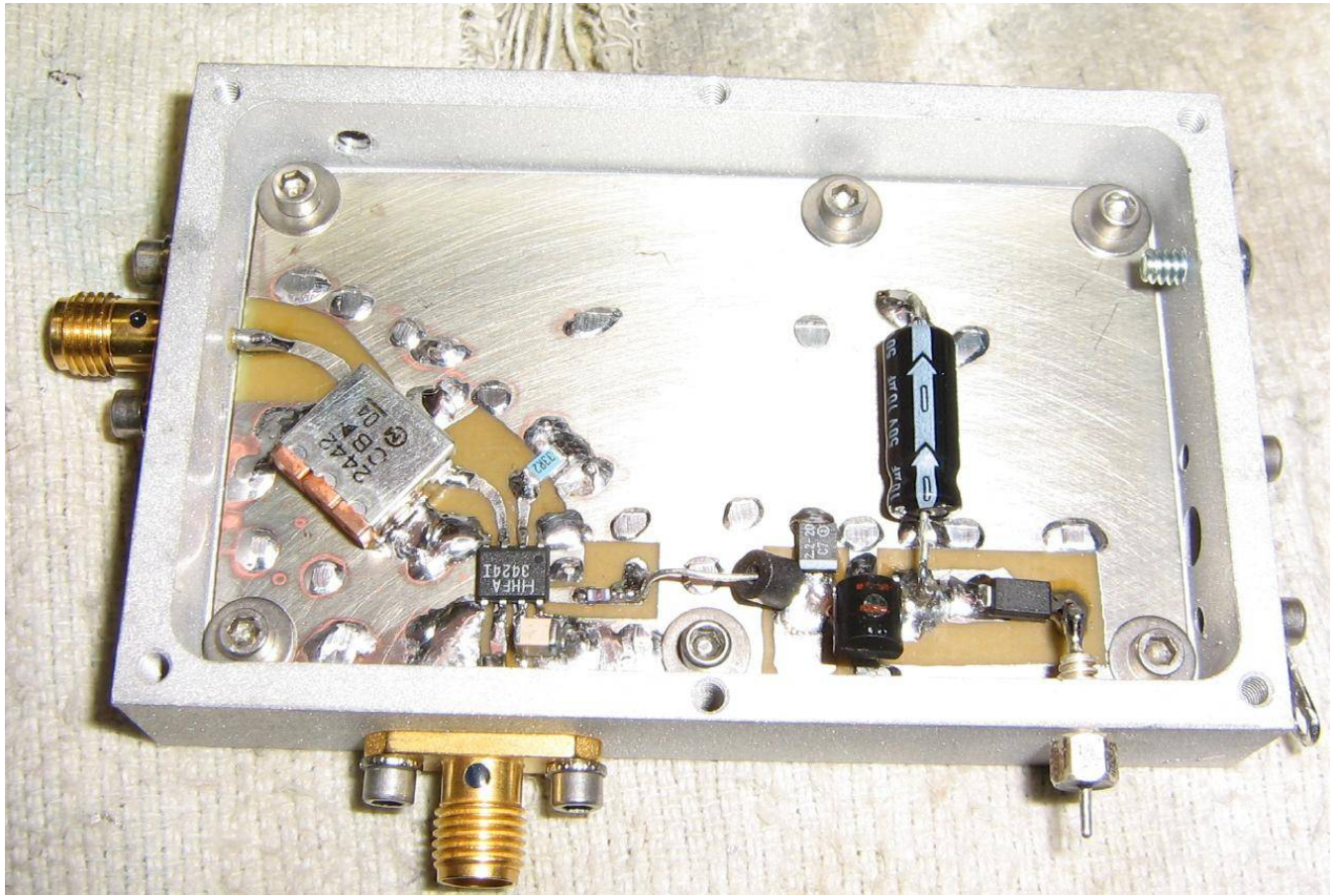
2.4 GHz receive pre-amplifier circuit board.

The 78L05 voltage regulator is on the left. The HFA3424 is on the upper-right. The right-side RF input passes through a 3-pole Murata 2.4 GHz bandpass filter.



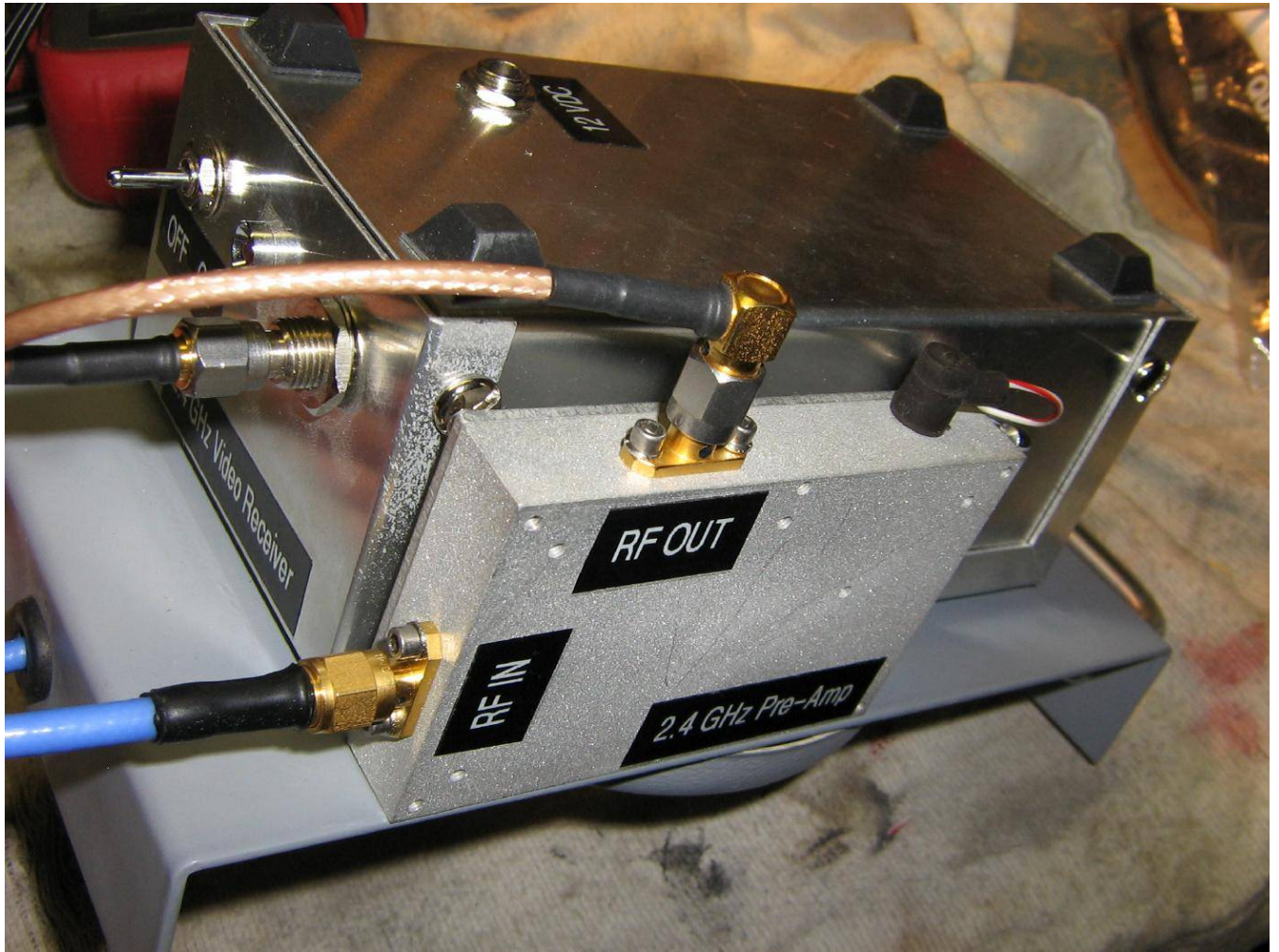
Mounting the new 2.4 GHz receive pre-amplifier circuit board in a cellular pre-amplifier project case I found at a hamfest.

+12 VDC into the voltage regulator is on the lower-right. RF input and output are via panel-mount SMA connectors.



Closeup overview of the completed 2.4 GHz receive pre-amplifier circuit.

The surface-mount 15 nH inductor on the HFA3424's Vdd power line should have a self-resonant frequency above 2.5 GHz.



Installing the 2.4 GHz receive pre-amplifier on the side of the project box holding the original 'warspying' circuits.

The 2.4 GHz antenna connection is on the left-side with the pre-amplifier's output via the top SMA connector.