222 MHz Receiver Protection Filter

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This is a simple single pole filter using a resonant piece of transmission line somewhat less than a half-wavelength long, grounded at both ends, tuned with a capacitor in the middle and with in- and output coupling near the shorted ends. It resembles the filters described in ARRL publications of the 1960s-80s, except that the transmission line is bent to save space (like the ARRL 6 m filter) and the coupling is by directly tapping onto the resonant line. My intent was to produce a filter for protecting the front end of a 222 MHz transverter from overload and damage due to RF coupled from antennas operating on the other VHF/UHF bands. It has been used at the 20 watt transverter output power level.

It is built in a 5 inch by 7 inch aluminum chassis, 2 inches deep, with the two N-type connectors mounted opposite each other on the long sides, 1.53 inches (measured inside) from the end of the box. The transmission line is a 0.7 inch wide strip of scrap copper sheet which runs about 0.3 inches from the walls of the box and is bent and bolted to the end wall of the chassis at the grounded ends. This forms a sort of microstrip line with about 80 ohms characteristic impedance. The pins of the connectors just protrude through the strip, via 1/8" diameter holes, and are soldered to the strip. A 10 pF trimmer capacitor is mounted on the "top" of the chassis for tuning and soldered to the centre point of the copper strip. This was found to be not quite enough capacitance to reach 222 MHz, so a bent brass tab was soldered to the line to produce some extra capacitance in parallel with the tuning capacitor. The open bottom of the chassis is covered with a sheet of aluminum held by 10 screws.

The theoretical (SPICE model) rejection at 50 MHz is 38 dB, at 144 MHz 24 dB and at 432 MHz 20 dB. The insertion loss at 222 MHz was measured to be about 0.65 dB, a bit higher than I would have liked, but usable. Very rough insertion loss measurements at 144 MHz and 432 MHz gave values of about 22 dB and 18 dB, respectively.