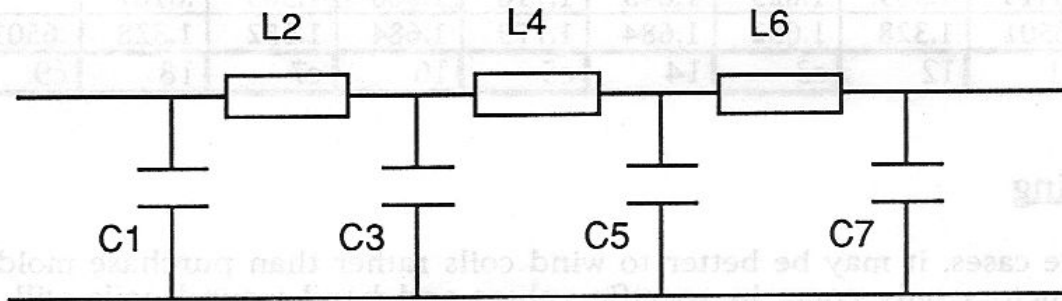Example: Design a 7th order Chebyshev filter tuned for 85.8 MHz and an input/output impedance of 50 ohms.

$R(ref)$ = 50 Ω
$F(ref)$ = 85.8E6 Hz
$L(ref)$ = 50/2 * 3.14159 * 85.8E6 = 9.275E-8 H
$C(ref)$ = 1/2 * 3.14159 * 85.8E6 * 50 = 3.710E-11 F

C1, C7 = .6301*3.710E-11 = 23.4 pF   L2, L6 = 1.282*9.275E-8 = .119 μH
C3, C5 = 1.579*3.710E-11 = 58.6 pF   L4   = 1.575*9.275E-8 = .146 μH
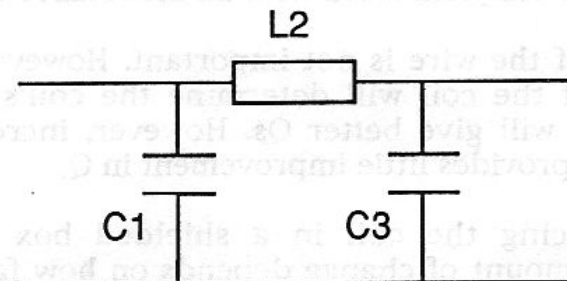

A 7 element Chebyshev Low Pass Filter

These values agree with experimental results published by Mycal Johnson in the 4th addition of the FM-10 FAQ. These experiments showed that values of .12 μH for L2 and L6, .15 μH for L4, and variable caps for C1-C7 yielded a decrease of -45dB on the second harmonic, -55dB on the third harmonic, and -65dB on the fourth harmonic.

In another experiment by a (poor) anonymous contributor, a filtered 3 watt transmitter (FM-10 to 30 mw booster to 800 mw amp to PA-1) was tuned to 104.5 MHz. The distance the second harmonic could be heard on a portable scanner decreased substationally. All coils were made from #14 wire, .4" in diameter, .5" long. L2 and L6 were each 4 turns. L4 was 4.5 turns. Variable capacitors were used for C1-C7. Alignment was accomplished by tuning C1-C7 for maximum output to the antenna and minimum VSWR between the filter and transmitter.

This procedure can also be used to design a simple 3rd order filter. It should be noted that this design corrects errors in the design published in previous issues of the FAQ, This example assumes the transmitter is tuned to 88 MHz.

Simple 3 element Chebyshev Low Pass Filter

$R(ref)$ =50 Ω   C1 = .4520*3.617E-11 = 16 pF
$F(ref)$ =88E6 Hz   C3 = .4520*3.617E-11 = 16 pF
$L(reff)$ =50/2 * 3.14159 * 88E6 = 9.043E-08 H   L2 = .7838*9.043E-8 = .071 μH
$C(reff)$ =1/2 * 3.14159 * 88E6 * 50 = 3.617E-11 F   R1 = 1.000*50 = 50 Ω