

FILTER EXAMPLE 4:

Low-Pass Filter Design using impedance steps.

Design a low-pass filter for fabrication using microstrip lines.

The specifications are:

- cutoff frequency of 5 GHz
- fifth order
- impedance of 50Ω
- 0.5 dB equal-ripple characteristic (Chebyshev).
- $\epsilon_r = 9.8$
- Thickness of dielectric = 25 mill

Solution

Start up the **rf & microwave toolbox** and select the **low pass filter tool**.

Then select filter type **Chebyshev** and g-values as output.

Choose the shunt filter configuration.

Fill in the filter specifications and tab the Calculate button.

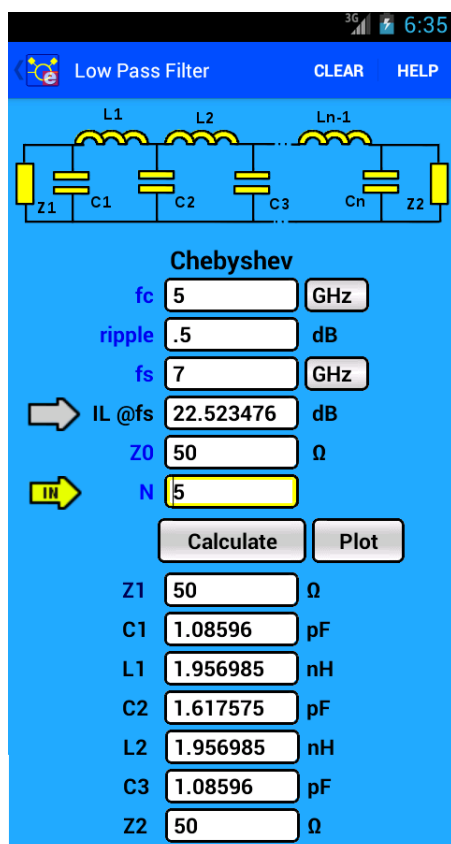


Figure 1: Lc-values low pass filter dialog.

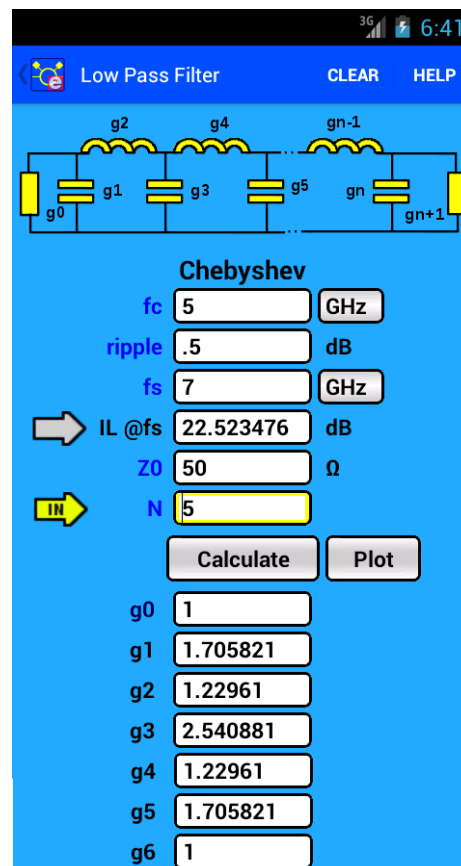


Figure 2: g-values low pass filter dialog (Normalized values)

Now select **Filter Design** tool and the tab button **Stepped Impedance** and convert the capacitors and inductors to low cq high impedance transmission lines. The best result you get when the Z_{low} is as low as possible and Z_{high} is as high as possible. (This will result in line lengths which are sort as possible.)

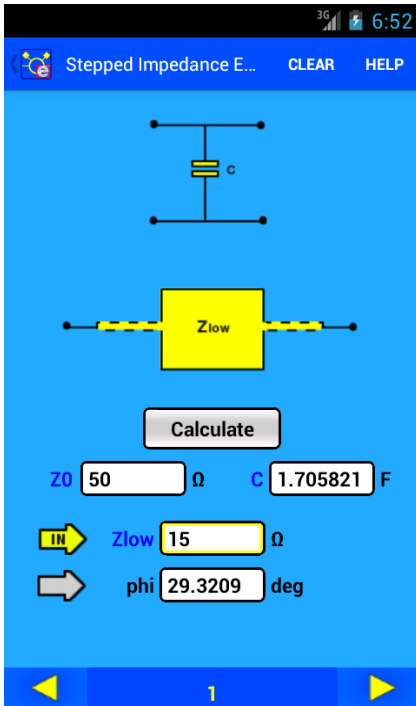


Figure 3: Conversion of C to microstrip with low impedance

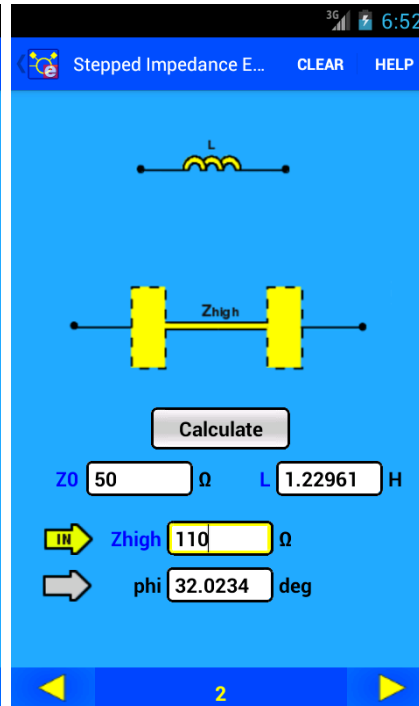


Figure 4: Conversion of C to microstrip with high impedance

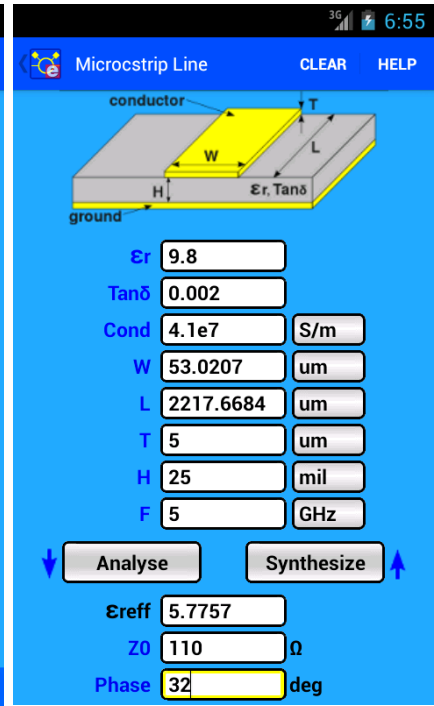


Figure 5: Calculation of line width and length.

With use of the **microstrip line** calculator the line width and length are calculated.

	Z (Ohm)	Phi (deg)	Width (um)	Length (um)
Z0	50	--	610 um	--
Zlow1	15	29.3	3925	1694
Zlow2	15	43.7	3925	2526
Zhigh	110	32.0	53	2218

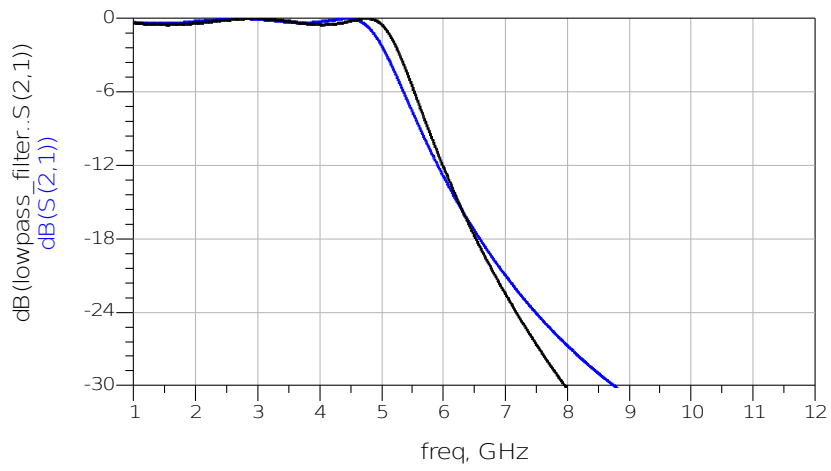


Figure 6 ADS simulation. Black: Prototype filter (lc-values) Blue:Low pass filter using microstrip lines

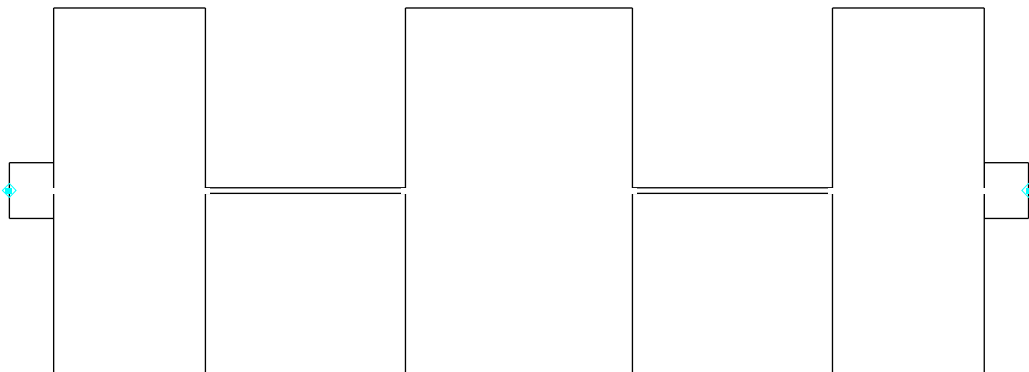


Figure 7 Layout of the low pass filter.