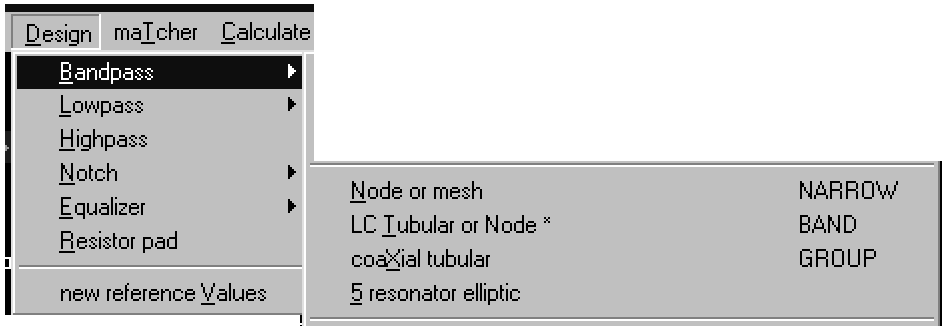
Narrow band approximation bandpass

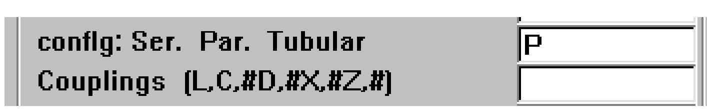


NARROW BAND GROUP

The top two of the narrow band design options that appear on the bandpass menu are actually one module. The "L-C Tubular or Node" option simply sets a flag that causes each occurrence of a capacitive "tee" configuration to be converted to a "Pi" or "delta" circuit. This will allow a shunt "C" coupled mesh filter (with series resonant sections) to be converted to a tubular filter (the topology of a coaxial filter). The "Node or mesh" option must be used to design mesh filters having shunt capacitor couplings.

The design procedure for narrow band filters begins with a direct scaled filter into which impedance inverters are inserted to form mutual coupling reactances. This method is not as accurate as the exact synthesis method used by the pole placer option where zeros of transmission are specified at DC and infinity, but will generate designs that are very usable in far less time. The effects of real world loss factors, distributed effects and component tolerances make the comparison almost academic, especially at narrow bandwidths. At bandwidths over about 25% however, the use of the pole placer should be considered.

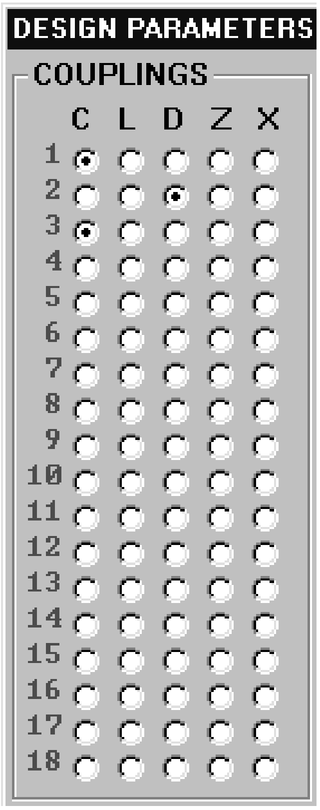
This design module will generate the classic top coupled parallel tuned L-C (node) filter, a shunt coupled series tuned L-C filter (mesh) or any combination of these with either inductor or capacitor couplings as desired. Because the basic design is a direct scaled filter, the inversion process can be stopped at any section leaving the direct scaled design from that section on. It is even capable of combining narrow band couplings with notch sections by using even order elliptic function or free format external reference lowpass filters. A single notch section can also be added using a "trap inverter" in place of a coupling reactance.



The most important items on the parameters menu that control the topology of the final design are the couplings and the input configuration.

The "confIg" specification determines if the first section (at the source end of the filter) is to be a series or parallel resonant circuit. If only L or C couplings are used (no D or X), this will determine if the entire network will be a mesh or a node filter.

Couplings can only be inductors or capacitors, but 3 other letters can show in the coupling window. These are recognized as instructions to control the topology of the final design. They are L, C, X, Z and D.



L - Inductor coupling.

C - Capacitor coupling.

X - Stops inversion process and resumes using Norton transforms.

Z - Locates the position of a single stopband notch. It specifies a "trap inverter" rather than a simple J or K inverter.

D - Dual from this section on - this skips one inverter.

For details on setting these various coupling types, see the section on the parameters menu, but the easiest way is to simply select them with your mouse.

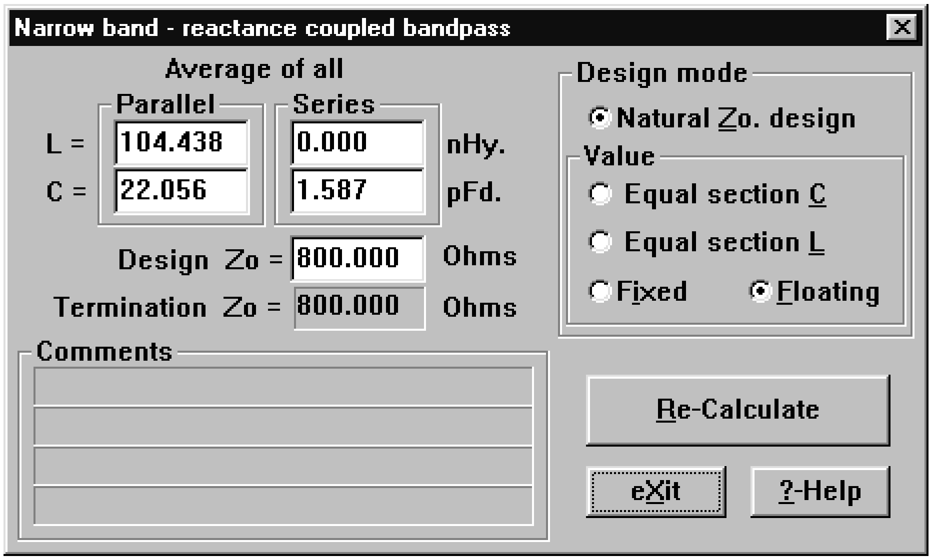
The parameters shown set below will design a simple 4 pole, 10% bandwidth node filter having all capacitive couplings.

```
File name = default
Design = Narrow band bandpass
order N                          4
passband Ripple (0=Butt. dB) 0.05
Define pass / stop      (dB) 3
arithmetic   Fo.        MHz. 100
Bandwidth               MHz. 10
design Zo.                   800
 Source zo.                  50
 Termination zo.             50
confIg:  Ser.=mesh Par.=node P <-- Parallel source end
                   Couplings =C C C <-- All "C" couplings.
tYpe: 1=sing 2=doub 3=ratio  2
```

The design these parameters will generate is shown below:

```
 0  ┌─ Termination ─┐          800 Ohms
 1  ├────── L ──────┤       104.44 nHy.
 2  ├────── C ──────┤       22.719 pFd.
    │               │
 3  │               C       1.7169 pFd.
    │               │
 4  ├────── C ──────┤       21.393 pFd.
 5  ├────── L ──────┤       104.44 nHy.
    │               │
 6  │               C       1.3258 pFd.
    │               │
 7  ├────── C ──────┤       21.393 pFd.
 8  ├────── L ──────┤       104.44 nHy.
    │               │
 9  │               C       1.7169 pFd.
    │               │
10  ├────── C ──────┤       22.719 pFd.
11  ├────── L ──────┤       104.44 nHy.
12  └──── Source ───┘          800 Ohms
13   Fc = 99.626 MHz.
```

When The [CALCULATE] button is pressed, the narrow band design module is called and will display the design and a menu of options. For this example, the screen will look like this:



The design impedance is shown along with an average of all of the components in the design. Any notch sections are ignored in the calculation of the averages. A warning message will show in the comments area if notch sections are present in the design. The active design mode is shown by the “radio buttons” to the right.

Design Modes

There are 7 possible operating modes for the design of narrow band filters. These modes and design impedance can be changed using the radio buttons.

(*) Natural Zo design

Natural Zo design is the default mode and is the most common way of designing this type of filter.

(*) Equal section C

Equal section C mode will make all of the capacitors that form the resonant sections of equal value. The actual value may be set by changing the design impedance or by specifying the value in the appropriate average C box..

(*) Equal section L

The "Equal section L" mode functions exactly like the "Equal section C" mode except that the section inductor are made equal value. The value of inductance is a function of design Zo. It may also be specified using average L box.

(*) Fixed (*) Floating

These determine wether the value forced equal throughout the filter is to be allowed to float with changes in design impedance, center frequency and bandwidth or if it will remain a one vale.

These various modes are sometimes inappropriate for some designs. In that case, any attempt to select that mode will simply be ignored.

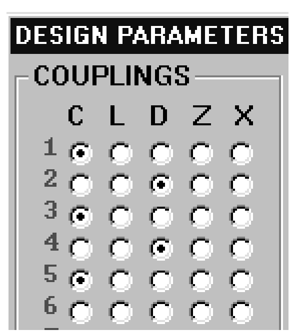
There is one additional design mode that is forced by the use of the "X" coupling on the parameters menu. It is the "Norton / narrow band" mode. No forcing of values is possible when combining direct scaled and narrow band sections.

Combination designs - the "D" coupling

The topology of a bandpass filter will determine the number of zeros of transmission at DC and infinite frequency. This has a major effect on the group delay and the skirt selectivity "skewing" of an L-C filter. The choice of coupling types (L or C) is one way to accomplish controlling these factors. It is usually a good idea to avoid the use of inductors as couplings however. It is well known that a node filter having all capacitive couplings will have a sharper lower frequency skirt compared to its high frequency skirt. A mesh filter having all capacitor coupling will show exactly the opposite condition. It is logical to assume that a filter that is part mesh and part node and coupled entirely with capacitors will have a shirt shape somewhere between these two extremes according to the ratio of the number of mesh to node sections. The "D" coupling feature can be used to take advantage of this. By changing an L or C coupling to a "D" in the couplings area of the parameters dialog box, all of the sections following the "D" will become the "dual" of those before it. All of the remaining couplings will stay what you have set. Only the actual resonant sections will become the "dual". More than one "D" coupling is permitted. This will allow a symmetrical design.

Below is an example of a combination filter where the "D" coupling has been used twice to generate a design having mesh input and output sections and two parallel tuned node sections in the middle. Remember that there is 1 less coupling than there are sections.

```
 File name = default               ,--- Note: "(*) Node or mesh" was
selected
 Design = Narrow band bandpass <---'          to get shunt C couplings
 order N                    6
 passband Ripple (0=Butt.dB)0.05
 Define pass / stop      (dB) 3
 arithmetic   Fo.        MHz. 100
 Bandwidth               MHz. 10
 design Zo.                 10
  Source zo.                50
  Termination zo.           50
 confIg:  Ser.=mesh Par.=node S
                    Couplings =C D C D
C
 tYpe: 1=sing 2=doub 3=ratio  2
```



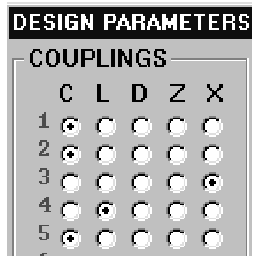
```
 0 ┌─ Termination ─┐            10 Ohms
   │               │
 1 │               C
   │               │
 2 │               L
   │               │
 3 ├────── C ──────┤        187.46 pFd.  <---- Shunt C couplings
   │               │
 4 │               C        15.998 pFd.
   │               │
 5 │               L        181.96 nHy.
   │               │
 6 ├────── C ──────┤        243.66 pFd.
   │               │
 7 │               C        13.977 pFd.
   │               │
 8 ├────── L ──────┤        181.96 nHy. <-,
   │               │                     |     These two sections are of the
 9 │               C       0.72304 pFd.  |  opposite type as the series input
   │               │                     |  section at branches 16 and 17.
10 ├────── C ──────┤        12.446 pFd.  |     All couplings are "C".
11 ├────── L ──────┤        181.96 nHy.  |
   │               │                   <-'
12 │               C       0.81717 pFd.
   │               │
13 ├────── C ──────┤        14.245 pFd.
   │               │
14 │               L        181.96 nHy.
   │               │
15 ├────── C ──────┤        187.46 pFd.
   │               │
16 │               C        15.062 pFd.
   │               │
17 │               L        181.96 nHy.
   │               │
18 └──── Source ───┘            10 Ohms
19  Fc = 99.925 MHz.
```

If you do an analysis on this design, you will see that the group delay peaks that occur near the passband edges are exactly the same. This type of design is well suited for linear phase applications using external predistorted "k and q" values or "standard library files" as the reference lowpass rather than the .05 dB ripple Chebyshev model used here.

The Norton / narrow band mode - the "X" coupling

Another feature provided to help control the design is the "X" coupling. This feature can also be used to control skirt skewing and group delay symmetry along with the "D" coupling feature. The "X" coupling simply turns the narrow band filter into a direct scaled design between the "X" and the termination. It may used in the same filter following a "D" but not before it. The direct scaled portion of the filter is automatically transformed to make all the inductors equal to the first inductor value using Norton Transforms between sections. In the example shown below, note that the two couplings at the termination end (1 and 2 in the couplings window) are shown as "_". This is because there are no couplings in a direct scaled circuit, only the capacitors associated with the Norton transforms.

```
File name = default
Design = Narrow band bandpass
order N                      6
passband Ripple (0=Butt. dB) 0.05
Define pass / stop      (dB) 3
arithmetic   Fo.        MHz. 100
Bandwidth               MHz. 10
design Zo.                   800
 Source zo.                  50
 Termination zo.             50
confIg:  Ser.=mesh Par.=node P
                   Couplings =_ _ X L C
tYpe: 1=sing 2=doub 3=ratio  2
```




```
 0  ┌─ Termination ─┐          6.13 Ohms
                   │
 1  │              L        111.59 nHy.
    │              │
 2  ├───── C ──────┤        21.063 pFd.
    │              │
 3  │              C        1.6924 pFd.
    │              │
 4  ├───── L ──────┤        111.59 nHy.
 5  ├───── C ──────┤        18.854 pFd.
    │              │
 6  │              C        2.4691 pFd.
    │              │
 7  ├───── C ──────┤        43.043 pFd.
    │              │
 8  │              L        111.59 nHy.
    │              │
 9  ├───── C ──────┤        43.151 pFd.
    │              │
10  │              C        2.3603 pFd.
    │              │
11  ├───── C ──────┤        20.518 pFd.
12  ├───── L ──────┤        117.99 nHy.
    │              │
13  │              L        2056.9 nHy.
    │              │
14  ├───── L ──────┤        117.99 nHy.
15  ├───── C ──────┤        21.063 pFd.
    │              │
16  │              C        1.6924 pFd.
    │              │
17  ├───── C ──────┤        21.063 pFd.
18  ├───── L ──────┤        111.59 nHy.
19  └─── Source ───┘           800 Ohms
20  Fc = 99.875 MHz.
```

This example uses a Parallel tuned configuration at the source end. It is actually more useful for the narrow band portion of the filter to be of the series input (mesh) configuration because the direct scaled circuit is lower skirt sharp compared to the high frequency sharp capacitively coupled mesh circuit. The series L coupling between sections 2 and 3 is just to illustrate that it can be done. This design will automatically activate the Norton / narrow band design mode. Note that couplings 1 and 2 on the COUPLINGS buttons of the parameters dialog box are showing “C” couplings. This means nothing. Everything above the “X” is ignored.

Narrow band filters with notch sections

If the reference lowpass filter selected happens to have notch sections, the final design will have notch sections also. An external reference lowpass was used in the example, but a reference generated by the internal lowpass reference pole placer could have been used as well.

File name = default

```
Design = Narrow band bp. (Pi coupling)
arithmetic   Fo.        MHz. 100
Bandwidth               MHz. 10
design Zo.                   611.3
 Source zo.                  50
 Termination zo.             50
confIg:  Ser.=tube Par.=node P
                   Couplings =C _ _ C C
eXternal reference filename: K6C
 Source Zo = 1.24
  0.903409
  1.92973
  1.31056
  1.09454   0.634652
  1.12913
  1.11988
 Termination Zo = 1
```

The results are:

```
 0  ┌─ Termination ─┐         611.1 Ohms
 1  ├────── L ──────┤        87.198 nHy.
 2  ├────── C ──────┤        26.795 pFd.
    │               │
 3  │               C        2.4141 pFd.
    │               │
 4  ├────── C ──────┤        22.752 pFd.
 5  ├────── L ──────┤        101.21 nHy.
    │             ┌─┴─┐
 6. │             L   C      84.634 nHy.        26.69 pFd.  Fx = 105.9 MHz.
    │             └─┬─┘
    │             ┌─┴─┐
 8. │             L   C       95.43 nHy.       30.094 pFd.  Fx = 93.915 MHz.
    │             └─┬─┘
10  ├────── C ──────┤         27.37 pFd.
11  ├────── L ──────┤        87.198 nHy.
    │               │
12  │               C         1.839 pFd.
    │               │
13  ├────── C ──────┤        25.155 pFd.
14  ├────── L ──────┤        87.198 nHy.
    │               │
15  │               C         2.215 pFd.
    │               │
16  ├────── C ──────┤        26.994 pFd.
17  ├────── L ──────┤        87.198 nHy.
18  └──── Source ───┘         611.3 Ohms
19  Fc = 99.726 MHz.
```

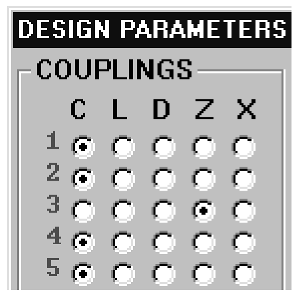
The "X" and "D" coupling features can be used on this type of design as well. As with all the previous designs illustrated, the matcher should be reset ahead of time to finish the design.

An extra stopband notch - the "Z" coupling

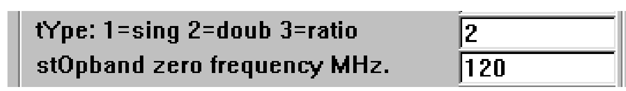
It is often desirable to be able to add a notch or "trap" at some point in a stopband. This can be done using the "Z" coupling. Only one notch frequency can be specified but several notches (all the same frequency) may be in the filter at once. The closer to the passband the notch is positioned the more degradation on return loss will be seen.

Example: A 5 "section" node filter with a 120 MHz. notch placed between the 2rd and 4th resonator.

```
File name = default
Design = Narrow band bandpass
order N                        5
passband Ripple (0=Butt. dB) 0.05
Define pass / stop      (dB) 3
arithmetic Fo.          MHz. 100
Bandwidth               MHz. 10
design Zo.                   800
 Source zo.                  50
 Termination zo.             50
confIg: Ser.=mesh Par.=node  P
Couplings                     C C Z C
tYpe: 1=sing 2=doub 3=ratio  2
stOpband zero freq.     MHz. 120
```




```
 0 ┌─ Termination ─┐             800 Ohms
 1 ├───── C ───────┤           21.67 pFd.
 2 ├───── L ───────┤          108.93 nHy.
   │               │
 3 │               C          1.6998 pFd.
   │               │
 4 ├───── C ───────┤          20.414 pFd.
 5 ├───── L ───────┤          108.93 nHy.
   │               │
 6 │               C          1.2561 pFd.
   │               │
 7 ├───── C ───────┤          22.113 pFd.
 8 ├───── L ───────┤          115.12 nHy.
   │             ┌─┴─┐
 9.│             L   C        622.78 nHy.      2.8316 pFd.  Fx = 119.85 MHz.
   │             └─┬─┘                              The slight error in the
11 ├───── L ───────┤          115.12 nHy.           notch freq is due to the
12 ├───── C ───────┤           21.67 pFd.           fo compensation.
   │               │
13 │               C          1.6998 pFd.
   │               │
14 ├───── C ───────┤           21.67 pFd.
15 ├───── L ───────┤          108.93 nHy.
16 └──── Source ───┘             800 Ohms
17  Fc = 99.75 MHz.
```



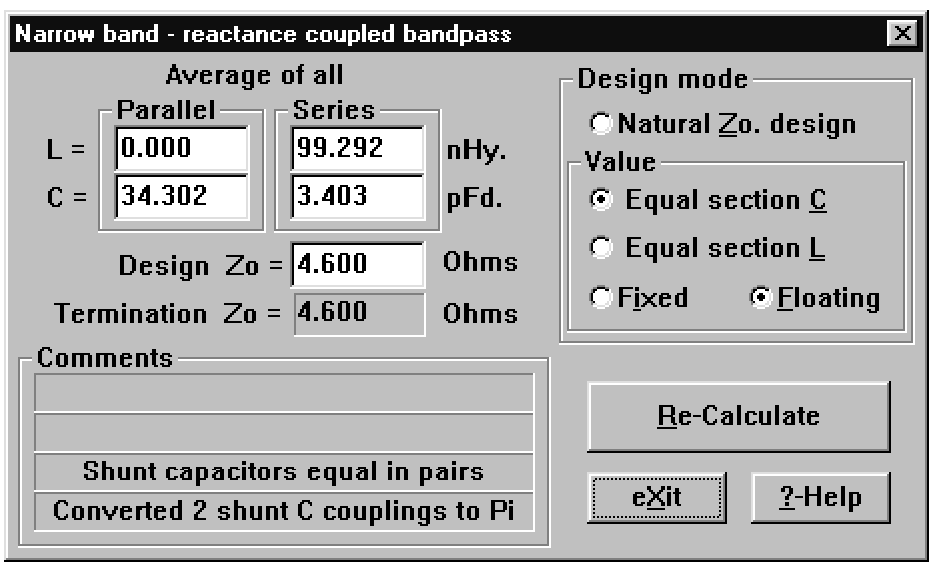
The "tubular" or "coaxial" circuit

The root of this circuit is the shunt C coupled mesh filter. The capacitor associated with the series resonant circuit at each section (except the end sections) is replaced by 2 capacitors of double the value generating a "tee" or "star" configuration that is converted to a "Pi" or "Delta" circuit.

The "L-C Tubular or Node" option of the bandpass menu will do this conversion automatically. When doing this type of design, the "equal section C" mode is automatically turned on. This will make the shunt capacitors around each coupling except the ends equal in pairs. It will not make all of the shunt capacitors throughout the network equal because the equal value involved exists before the "tee to pi" conversion is done. Equal shunt tubulars can be designed as well. That will be explained later.

An example of a "tubular" circuit filter is shown below.

```
File name = default
Design = Narrow band bp. (Pi coupling)
order N                        3
passband Ripple (0=Butt. dB) 0.05
Define pass / stop      (dB) 3
arithmetic   Fo.        MHz. 100
Bandwidth               MHz. 10
design Zo.                   4.6098
 Source zo.                  50
 Termination zo.             50
confIg:  Ser. Par. Tubular   S
                   Couplings =C C
tYpe: 1=sing 2=doub 3=ratio  2
```



The actual design is below:

```
 0  ┌─ Termination ─┐         4.61 Ohms
    │               │
 1  │               L       97.258 nHy.
    │               │
 2  ├────── C ──────┤       22.819 pFd.
    │               │
 3  │               C       3.3954 pFd.
    │               │
 4  ├────── C ──────┤       45.639 pFd.
    │               │
 5  │               L       103.99 nHy.
    │               │
 6  ├────── C ──────┤       45.639 pFd.
    │               │
 7  │               C       3.3954 pFd.
    │               │
 8  ├────── C ──────┤       22.819 pFd.
    │               │
 9  │               L       97.258 nHy.
    │               │
10  └──── Source ───┘         4.61 Ohms
11  Fc = 100.12 MHz.
```

The matcher should be reset before doing this design so that the shunt capacitors normally found at the ends could be added to make the filter work into the 50 Ohms source and load impedance the specifications call for. The matching was left off here intentionally to illustrate the procedure. The matching operation can be done later by using the S and T option of the utilities menu.

Equal shunt symmetrical L-C tubular

L-C tubular filters having all inner shunt capacitors of equal value may be designed using the "Tubular" option of the "confIg" parameter. The "L-C Tubular or Node" narrow band design option is still used. This type of filter can only be specified between equal source and load impedances. Impedance matching is done before the iteration and will be upset by the iteration which forces symmetry. This causes the termination impedance to "float". The program will allow you to use external k&q values or external normalized "G" values for this type of design but any filter that is not naturally symmetrical will end up with a different termination Zo than was
specified after the iteration. The final termination Zo is displayed.

The same L-C tubular as in the previous example now has all shunt capacitor equal to 33 pF. The 4.3323 Ohms design Zo was set by the program when 33 pF was keyed into the parallel C average box.

```
File name = default
 Design = Narrow band bp. (Pi coupling)
 order N                      3
 passband Ripple (0=Butt. dB) 0.05
 Define pass / stop      (dB) 3
 arithmetic Fo.          MHz. 100
 Bandwidth               MHz. 10
 design Zo.                   4.3323
  Source zo.                  50   \    Source and termination must be equal.
  Termination zo.             50   /
 confIg: Ser.  Par.  Tubular  T         <---- "T" option for L-C tubular
 Couplings                     C C
 tYpe: 1=sing 2=doub 3=ratio  2
```

```
 0  ┌─ Termination ─┐          50 Ohms
 1  ├────── C ──────┤      103.22 pFd.
    │               │
 2  │               L      91.403 nHy.
    │               │
 3  ├────── C ──────┤          33 pFd.
    │               │
 4  │               C      4.0355 pFd.
    │               │
 5  ├────── C ──────┤          33 pFd.
    │               │
 6  │               L      138.09 nHy.
    │               │
 7  ├────── C ──────┤          33 pFd.
    │               │
 8  │               C      4.0355 pFd.
    │               │
 9  ├────── C ──────┤          33 pFd.
    │               │
10  │               L      91.403 nHy.
    │               │
11  ├────── C ──────┤      103.22 pFd.
12  └──── Source ───┘          50 Ohms
13  Fc = 100.12 MHz.
```

Coaxial

coaXial Tubular

This design module is used to design symmetrical Chebyshev and Butterworth coaxial / tubular bandpass filters and display the physical size of the mechanical parts used to build the filter. It is identical to the "L-C Tubular –> Coaxial Dimensions" converter utility available on the Utilities menu except that here it is "slaved" to the narrow band design module such that the length of the inner slugs forming the shunt capacitors can be specified directly. The physical length you specify will be converted to its equivalent capacity and passed on to the narrow band design module which will iterate until it has all of the inner slugs equal to that capacity.

A coaxial bandpass filter is built using metal disks, referred to as "slugs", for the shunt capacitors with thin teflon "coupling" washers between them. These "slugs" and coupling washers have holes in the center through which a teflon rod is passed that is screwed into both "end-slugs" to hold the entire assembly together.

The inductors are wound on teflon tubes referred to as "forms" that slip over the teflon rod holding the slugs on each side of each inductor a precise distance apart.

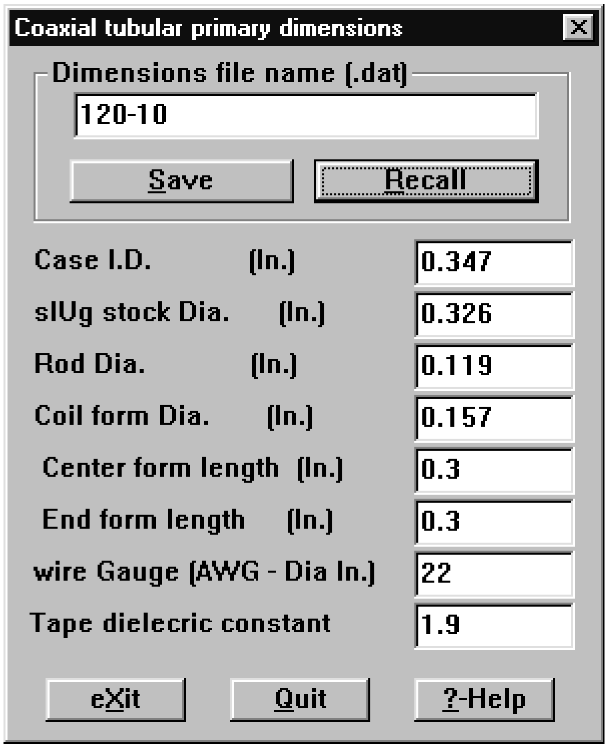
The entire assembly is surrounded by teflon "tape" to insulate it from ground and then pushed down a metal tube to form the shunt capacitors at each slug.

Tuning is done by moving the wires with a pointed tool through access holes drilled in the metal tube above each inductor.

It must be emphasized that the final design will be forced to have all inner slugs equal in size and capacity. Any filter that is normally not symmetrical will end up with a termination impedance other that what was specified. The circuit editor could be used to correct the termination Zo with a Norton transform after the design is complete however.

The design begins with an L-C tubular just as illustrated earlier, except that all of the parameters necessary to build the filter into a metal tube are preset (Shunt 'C' matching, all 'C' couplings, etc.).

In order to calculate the dimensions for the mechanical elements inside a coaxial tubular the dimensions of the materials to be used must be specified. The “primary dimensions” dialog box comes up first. The dimensions may be keyed in and saved to a disk file or recalled from an existing file.




```
Case I.D.            (In.) .347
   Inside diameter of metal tube
slUg stock Dia.      (In.) .326
   Diameter of all "slugs"
Rod Dia.             (In.) .115
   Diameter of the hole in the slugs
Coil form Dia.       (In.) .157
   Diameter of the coil forms
 Center form length  (In.) .3
   Length of all coil forms except ends
 End form length     (In.) .3
   Length of end coil forms
wire Gauge   (AWG or Dia.) 22
   Wire size use to wind coils
```

Once the dimensions have been entered, the [Save] button can be used to record the data to a file for later use with the [Recall] button.

To retrieve this data from a disk file, just type the name of the file (the extension ".dat" is assumed). All of the data in the file must be on one line (no longer the 80 characters) with each item separated by commas. The data must be in this order in the file:

```
      case ID,  slug outer dia.,  rod dia.,  coil form outer dia.,
      center coil form length,  wire gauge (AWG) or diameter (In.),
      tape dielectric constant, mechanical dimensions code number
      A typical file for a "1/2 inch" coaxial using 10 mill thick tape:
.347,.326,.119,.157,.3,22,1.9,0
```

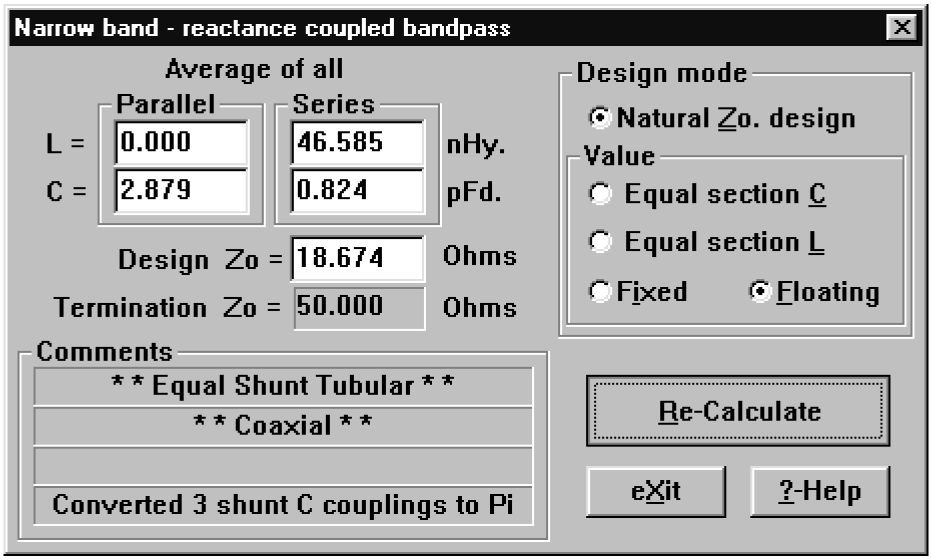
The example shown here is the file 120-10.dat provided with the program. It for a typical “half inch” tubular using 10 mill tape.

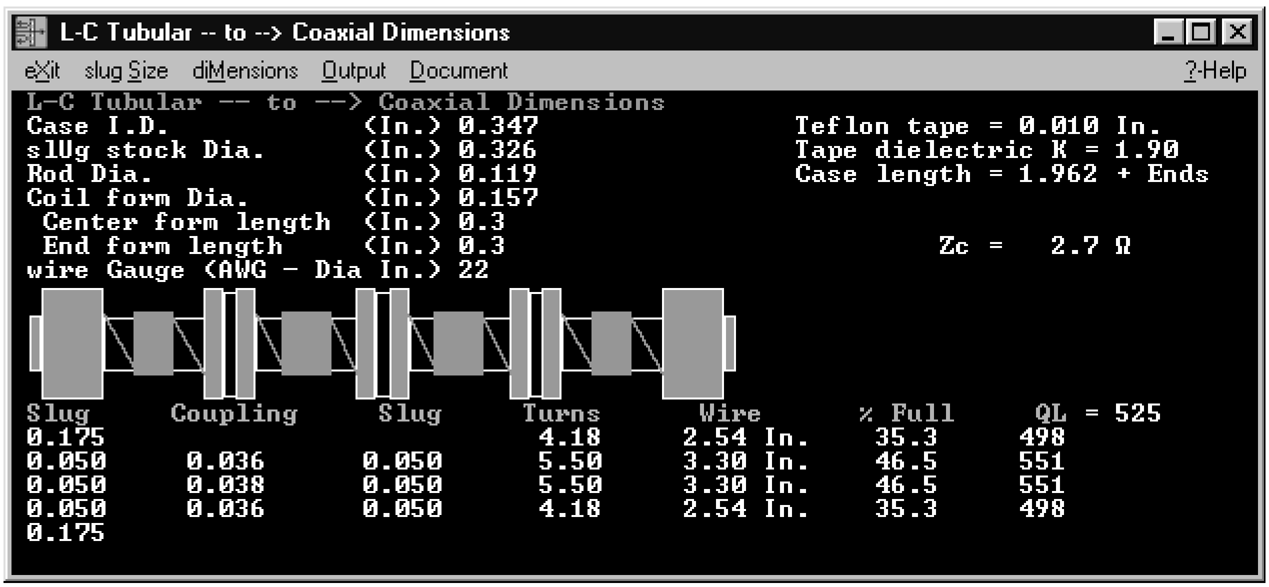
The mechanical dimensions code number at the end of the file must be a number between 0 and 3. This will force the system mechanical notation to one of the 4 mechanical notation options on the notation menu:

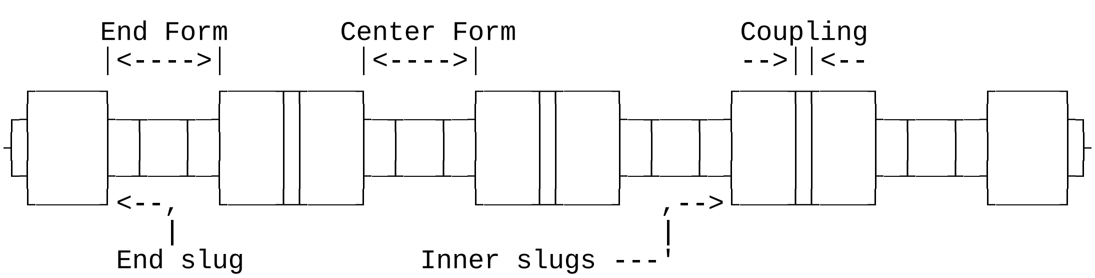
0 = Inches (In.),
1 = Thousandths of an inch (Mils)
2 = Metric in centimeters (cm.),
3 = Metric in millimeters (mm.)

The tape dielectric constant may be used as a fudge factor to compensate for case/slug tightness and the slight air gap that will result if the teflon tape does not wrap completely around the slugs. 2.1 would be theoretically correct for slugs fully wrapped in teflon within a tight case.

The narrow band dialog box and a proportional graphic display of the coaxial (tubular) filter will be displayed simultaneously. By using the graphic display and the dialog box together a practical filter can be designed.


Narrow band - reactance coupled bandpass
Average of all
Parallel
Series
L = 0.000 46.585 nHy.
C = 2.879 0.824 pFd.
Design Zo = 18.674 Ohms
Termination Zo = 50.000 Ohms
Design mode
Natural Zo. design
Value
Equal section C
Equal section L
Fixed
Floating
Comments
* * Equal Shunt Tubular * *
* * Coaxial * *
Converted 3 shunt C couplings to Pi
Re-Calculate
eXit
?-Help


L-C Tubular -- to --> Coaxial Dimensions
eXit slug Size diMensions Output Document ?-Help
L-C Tubular -- to --> Coaxial Dimensions
Case I.D. (In.) 0.347
slUg stock Dia. (In.) 0.326
Rod Dia. (In.) 0.119
Coil form Dia. (In.) 0.157
Center form length (In.) 0.3
End form length (In.) 0.3
wire Gauge (AWG - Dia In.) 22
Teflon tape = 0.010 In.
Tape dielectric K = 1.90
Case length = 1.962 + Ends
Zc = 2.7 Ω
Slug Coupling Slug Turns Wire % Full QL = 525
0.175 4.18 2.54 In. 35.3 498
0.050 0.036 0.050 5.50 3.30 In. 46.5 551
0.050 0.038 0.050 5.50 3.30 In. 46.5 551
0.050 0.036 0.050 4.18 2.54 In. 35.3 498
0.175


End Form
Center Form
Coupling
End slug
Inner slugs

L-C Tubular -- to--> Coaxial Dimensions window

The L-C to tube window top menu has the following options:

eXit

Leave the coaxial design module.

slug Size

Allows the physical length of all of the inner slugs to be specified directly. This information is used to calculate the required capacity for that length and force all of the shunt capacitors in the filter to that value.

diMensions

This brings up the primary dimensions dialog box so that major dimensions can be changed.

Output

The output design can be either transmission line for or L-C form. This chooses between the two.

Document

This opens a pull-down menu that provides for documentation of the design to a printer or a disk file. The data can be tabulated dimensions or a graphic screen dump. The files generated are in PCX form or ASCII data. The ASCII data file will have the extension “0HC” (default.0hc).

Coaxial Lowpass filters with straight wire inductors

`Coaxial straight Wire L`

When the **L-C tubular –to–> coaxial dimensions** converter is being operated from the lowpass design module to design filters with straight wires to form the series inductances the mechanical dimensions file may be used to recall the internal dimensions just as with a "coil and slug" design. The file must be identical to that described earlier. The values in the file for coil form lengths are ignored and may be zero. The coil form diameter will set the diameter of the end slug "nubs" to what ever you like. Specifying zero for the coil form diameter will cause the program to calculate the correct diameter for the load/source impedance of the filter.

The L-C tubular —> coaxial dimensions converter is also accessible from the Utilities menu (the key letter is "X"). Here the "slug Size" menu option simply displays the capacity of the size (length) slug you specify.