



# Dionysus



**Microwave Filter design  
that leaves more time for  
wine and song**



## Available Filter Types

- Low Pass
- High Pass
- Band Pass
- Band Stop
- All Pass





# Available Transfer Functions

**Lowpass -> BandPass** [X]

Number of Poles:

Center Frequency (MHz):

Bandwidth (MHz):

Bandwidth Cutoff (dB):

TCheb. Rip./0 for Butt.(dB)

Term. Ratio (0 for Single)

External Impedance (Ohm):

Internal Impedance (Ohm):

First Resonator Config:

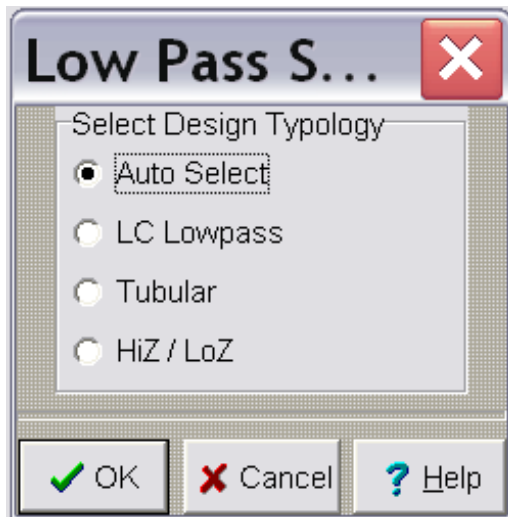
Transfer Function

TCheb/Butterworth     User Input Gvals  
 Bessel     User Input KQ's  
 Gaussian to 6     Elliptic  
 Gaussian to 12     Pole Placer

- Butterworth
- TChebyshev
- Bessel
- Gaussian to 6 & 12
- Elliptic
- Pole Placer
- G values and K's and Q's
- Custom  
and other Transfer Functions



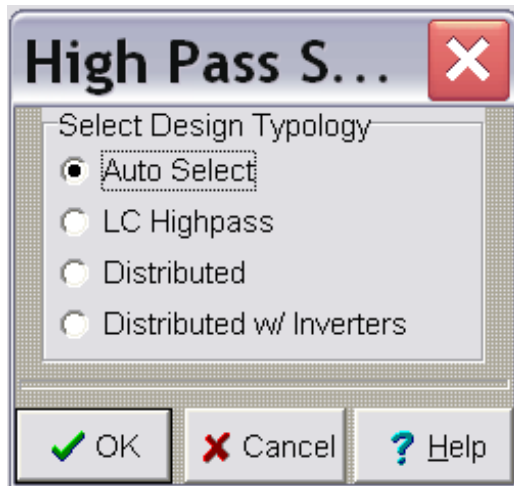
# Lowpass Structures



- Inductor / Capacitor
- Tubular
- High Z / Low Z
- Printed filters



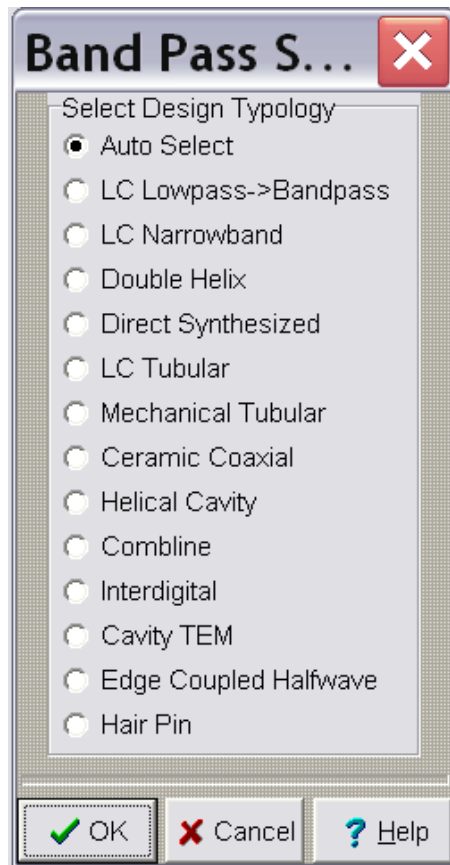
# High Pass Structures



- Inductor / Capacitor
- Distributed
- Hybrid designs



# Bandpass Structures



- Wideband LC
  - LP to BP
  - Highpass/Lowpass
- Narrow Band LC
  - Tank
  - Mesch
  - Tubular
  - Mixed mode
- Wideband Cavity
  - Interdigital
- Narrow Band Cavity
  - TEM
  - Ceramic
  - Comblin
  - Helical



# Bandpass Autoselect

**Bandpass Auto Select**

Center Frequency (MHz): 500.00000  
Cutoff Bandwidth (MHz): 20.00000  
Desired Cutoff: 3.00000  
Passband Ripple: 0.01000  
# of Stop Bandwidth Steps: 4

	Rejection Bandwidths (MHz)	Spec (dB)	Actual (dB)
1)	30, 40	42.84	
2)	40, 50	59.12	
3)	50, 60	62.87	
4)	60, 70	74.78	

Filter Order: 9 poles, Step 1    Required Q: 670  
Loss at Fo: 2.36423    Loss at Fc: 6.11893

Possible Design Selections (Click to goto Design)

- Narrow Band Double Helix
- Helical Bandpass
- Coaxial Tubular BandPass
- Narrow Band BandPass
- LC Tubular BandPass

Buttons: Cancel, Calc N, Help

- Enter in desired specs
- Routine automatically selects from multiple typologies
- Selecting typology jumps program to that design routine



# BandStop Structures

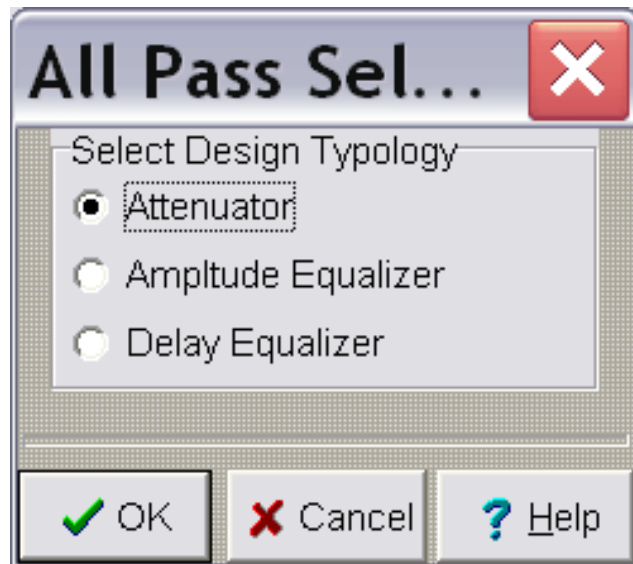


- Wideband LC
  - LP to BS
  - Highpass/Lowpass
- Narrow Band LC
  - Geffe Embedded
  - LC Distributed
- Wideband Cavity
  - Distributed
- Narrow Band Cavity
  - TEM
  - Distributed Stub





# All Pass Structures



- Attenuator
- Amplitude Equalizer
- Delay Equalizer



# S Parameter Analysis

- Circuit Qs
- Sweep Parameters
- Displays
  - Return Loss / Attenuation
  - Phase / Delay
  - Tabular
  - Smith Chart
- Write S-parameter Files

**Sweep Setup** [X]

Frequency is expressed in MHz's

Cap Q: 1530.9	Start Sweep: 860
Ind Q: 495.37	Stop Sweep: 1060
TLine Q: 495.37	Step Freq (- # of pts): 1

Run outline routine to get accurate unloaded Q's

DelayMode: <input checked="" type="radio"/> Step <input type="radio"/> delta	Status: Ready	<input checked="" type="checkbox"/> Return Loss/Attenuation
<input type="checkbox"/> Write S-Parameter file		<input checked="" type="checkbox"/> Phase /Delay
AP960.s2p		<input type="checkbox"/> Tabular Data
		<input type="checkbox"/> Smith Chart

[Trace] [Grid] [Sweep] [Cancel] [Help]



# Power Analysis

- Sweep Frequencies
- Power level
- Phase Step
- Load Mismatch
- View Max Voltage, Max Current, or Max Power dissipation
- Straight match
- Spinning loads

**Power Analysis** [Close]

Dimensions are expressed in MHz's and ohm's

Run outline routine to get accurate unloaded Q's

Output	Cap Q: 1530.9	Start Sweep: 860
<input type="radio"/> Max Power	Ind Q: 495.37	Stop Sweep: 1060
<input checked="" type="radio"/> Max Voltage	TLine Q: 495.37	Step Freq (- # of pts): 1
<input type="radio"/> Max Current		
<input type="radio"/> Graph of All 3		

Status: Ready

Impedance Mode (ohm,ohm):  Rectangular  Polar

SpinMode:  Source  Load

Source Z (Re,Im): 50 .0

Phase Step (Degs): 15

Load Z (Re, Im): 50 .0

MisMatch (#:1): 2

Buttons: Load, Rotate, Done, Help



# Fourier Analysis

- Carrier Frequency
- Pulse Set
- Noise level
- View FFT of Pulse
- View Pulse Distortion in Time Domain distortion

**Fourier Analysis** [X]

Dimensions are expressed as MHz's and nsec's

Carrier Frequency:	960
Pulse Width:	200
Number of Pulses:	2
Interpulse Spacing:	200
Signal to Noise (dB):	35

Display Mode

Frequency Plot:	10 dB
Time Plot:	Linear

[Calc] [Cancel] [Help]

# Design Utilities

## Resonator Design



Mode Match Designed TE Resonator     $\frac{1}{4}$  &  $\frac{1}{2}$  Wave TEM Resonator

**Dielectric Puck Resonator Design** [X]

Dimensions are expressed in MHz's and mil's

Resonator Frequency	960	Cavity Diameter	500
Puck Diameter	450	Cavity Height	500
Puck Height	170.968	Puck To Floor	150
Puck Inner Diameter	200	Puck to Tuning Disk	179.032
Dielectric Constant	92	Core Material (er)	1
Mount Material (er)	1	Core Height (Length)	0
# of Modes (<=16)	16	Core Offset	0

Calculated Value:  Frequency,  Puck Diameter,  Inner Diameter,  Puck Height,  Material,  Tuning Height

Cavity Shape:  Round,  Square

Cavity Finish:  Silver,  Copper,  Aluminum,  Brass

Mode:  TE,  TM

Type:  Courtney,  Cavity

Buttons: Calc, NextMode, Cancel, Help

Residue = 0.0    DomMode    Approx. Q = \*\*\*\*

**Coaxial Resona...** [X]

Frequency (MHz):	960.00000
Electrical Length (degs)	90.00000
Dielectric K	92
Resonator Size (mm)	8
Physical Length (mil):	0.0
Tolerance:	F: Full Coat

Calculated Value:  Frequency,  Length,  Dielectric K

Tab:  No,  Yes

Approx. Q: \*\*\*\*\*

Buttons: Calc, Cancel, Help



# Design Utilities

## Capacitor & Inductors

Parallel  
Plate Caps

Coaxial  
Caps

**Capacitor De...** [X]

Capacitance is in (pF). Length is in (mil)

Plate Cap    Coaxial Cap

Input Values

Capactance Value: 1.000

Width of Plate: 200.000

Thickness of Plate: 63.000

Dielectric Constant: 2.100

Calculated Values

Length of Plate: 0.000

Plate Area: 0.000

WaveGuide Freq (MHz): 0.000

Fringe Cap.: 0.000

..... 0.000

..... 0.000

[?] Help   [Calc]   [Close]

Air Coils

Straight  
Wire

**Inductor Des...** [X]

Inductance is in (nH). Length is in (mil)

Air Coil    Straight Wire

Input Values

Inductance Value: 25.000

Diameter of Form: 62.000

Frequency for Q (MHz): 1000.000

Wire Gauge (AWG): 28.000

Calculated Values

Number of Turns: 0.000

Length: 0.000

L/D (0.7<#<1.5): 0.000

Inductor Q: 0.000

Resonant Freq (MHz): 0.000

Max Current: 0.000

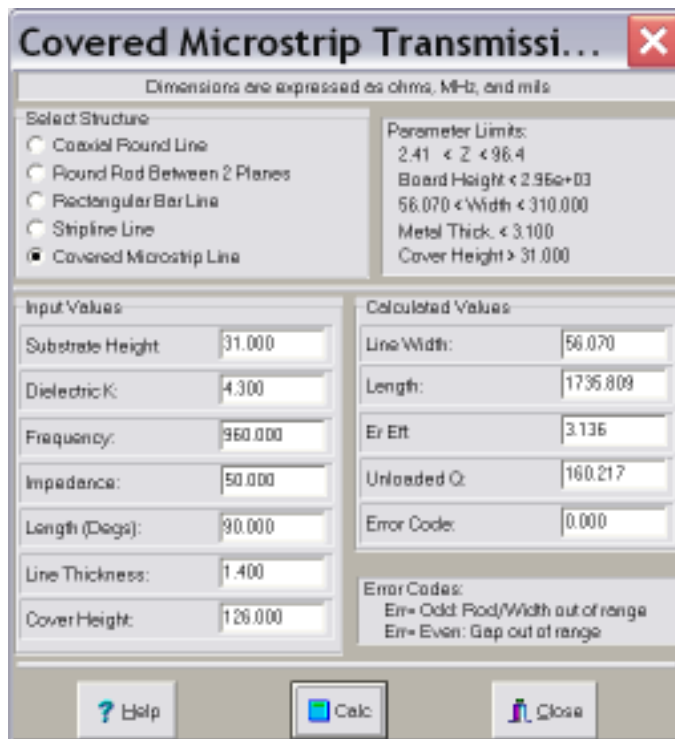
[?] Help   [Calc]   [Close]

# Design Utilities

## Transmission lines



- Transmission Lines



**Covered Microstrip Transmissi...**

Dimensions are expressed as ohms, MHz, and mils

Select Structure:

- Coaxial Round Line
- Round Rod Between 2 Planes
- Rectangular Bar Line
- Stripline Line
- Covered Microstrip Line

Parameter Limits:

- 2.41 < Z < 96.4
- Board Height < 2.95e+03
- 56.070 < Width < 310.000
- Metal Thick. < 3.100
- Cover Height > 31.000

Input Values:

Substrate Height	31.000
Dielectric K	4.300
Frequency	960.000
Impedance	50.000
Length (Degs)	90.000
Line Thickness	1.400
Cover Height	126.000

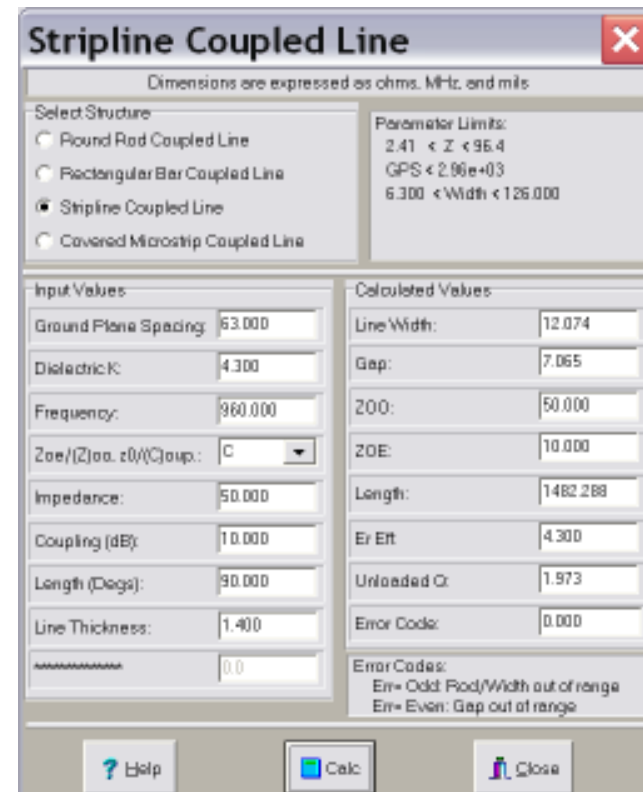
Calculated Values:

Line Width	56.070
Length	1736.809
Er Eff	3.136
Unloaded Q	160.217
Error Code	0.000

Error Codes:  
Er= Odd: Rod/Width out of range  
Er= Even: Gap out of range

? Help   Calc   Close

- Coupled Lines



**Stripline Coupled Line**

Dimensions are expressed as ohms, MHz, and mils

Select Structure:

- Round Rod Coupled Line
- Rectangular Bar Coupled Line
- Stripline Coupled Line
- Covered Microstrip Coupled Line

Parameter Limits:

- 2.41 < Z < 96.4
- GPS < 2.96e+03
- 6.300 < Width < 126.000

Input Values:

Ground Plane Spacing	63.000
Dielectric K	4.300
Frequency	960.000
Impedance	50.000
Coupling (dB)	10.000
Length (Degs)	90.000
Line Thickness	1.400
.....	0.0

Calculated Values:

Line Width	12.074
Gap	7.065
Z00	50.000
ZOE	10.000
Length	1482.288
Er Eff	4.300
Unloaded Q	1.973
Error Code	0.000

Error Codes:  
Er= Odd: Rod/Width out of range  
Er= Even: Gap out of range

? Help   Calc   Close





# Design Utilities

## Distributed Filter Dimensions

- Distributed Dimensions For Comblin, Interdigital, etc.

Round Rod

Rectangular bar

Stripline

Microstrip

**Round Rod Mechanical Dimension**

Dimensions are expressed in MHz's and mil's

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of this software and ComNav Engineering Inc.

Comblin Bandpass   
Freq=960.976 MHz   
<\*\*\* Round Resonators \*\*\*>   
Ground Plane Spacing = 750   
Unloaded Q (Cu in air)= 1626.7   
Er = 1 : Eeff = 1   
Resonator Length = 1536   
In Tap Loc. = 290.9   
Out Tap Loc. = 277.2   
Total Filter Length = 3258.69

Resonator Spacings mil				
#	Dia/Width	Gap	Cntr-Cntr	ErrCoc
1	250	251.3	376.3	0
2	250	561.7	811.7	0
3	250	634	884	0
4	250	561.7	811.7	0
5	0	250	375	0

Parameter Limits:   
Ground Plane Spacing < 6147.474 mil   
Impedance: 5.000ohm < Z < 150.000ohm   
Diameter: 30.000 < Dia. < 675.000   
Distance to wall > 125.000

Ground Plane Spacing: 750.000   
Rod Diameter, Za= 80.320: 250.001   
N/A: N/A   
Spacing, end rod to wall: 250.001   
Equal Rods (Y/N): Yes   
Dielectric Constant: 1.000

Error Codes   
Error = Odd Number: Rod/Width out of range   
Error = Even Number: Spacing out of range

? Help X Cancel Close Calc





# Design Utilities

## Miscellaneous Tools

### Unloaded Q Calc

Unloaded Q Calcul... [X]

VSWR @ FLo	VSWR @ Fo	VSWR @ FHi
1e6	2.0	1e6

Impedance Phase

Load > 50 ohms  
 Load < 50 ohms

VSWR @ Q BW: 4.2656

Q Bandedge Lo	Unloaded Q	Q Bandedge Hi
999	500	1000

[Calc] [Cancel] [Help]

### Circuit Joining

Series, Parallel,  
and Multiplex

Load and Multiplex Circuits [X]

1030LC	1.	2
1090LC	1.	3

Number of Circuits to Multiplex: 2

Number of Output Ports: 3

Common Port Impedance (ohm): 50

Output Impedance (ohm): 55

List external Ports first, then internal ports.  
Select all networks from the same directory

Dir: C:\temp\

[Load] [Help] [Cancel] [OK]

### Define Dimensions

Set Global ... [X]

Frequency: MHz

Capacitance: pF

Inductance: nH

Resistance: Ohm

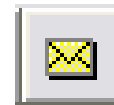
Length: mil

Time: nSec

[OK] [Cancel] [Help]



Direct link to ComNav's  
filter archive



Email current design to  
ComNav for quoting



## Conclusion

- Dionysus provides an excellent “what if” tool during initial system architecture
- Dionysus drastically speeds the filter quoting/purchasing process
- Dionysus minimizes the need to come back for “spec exception”
- Dionysus provides a handy desktop tool kit that speeds up the design process