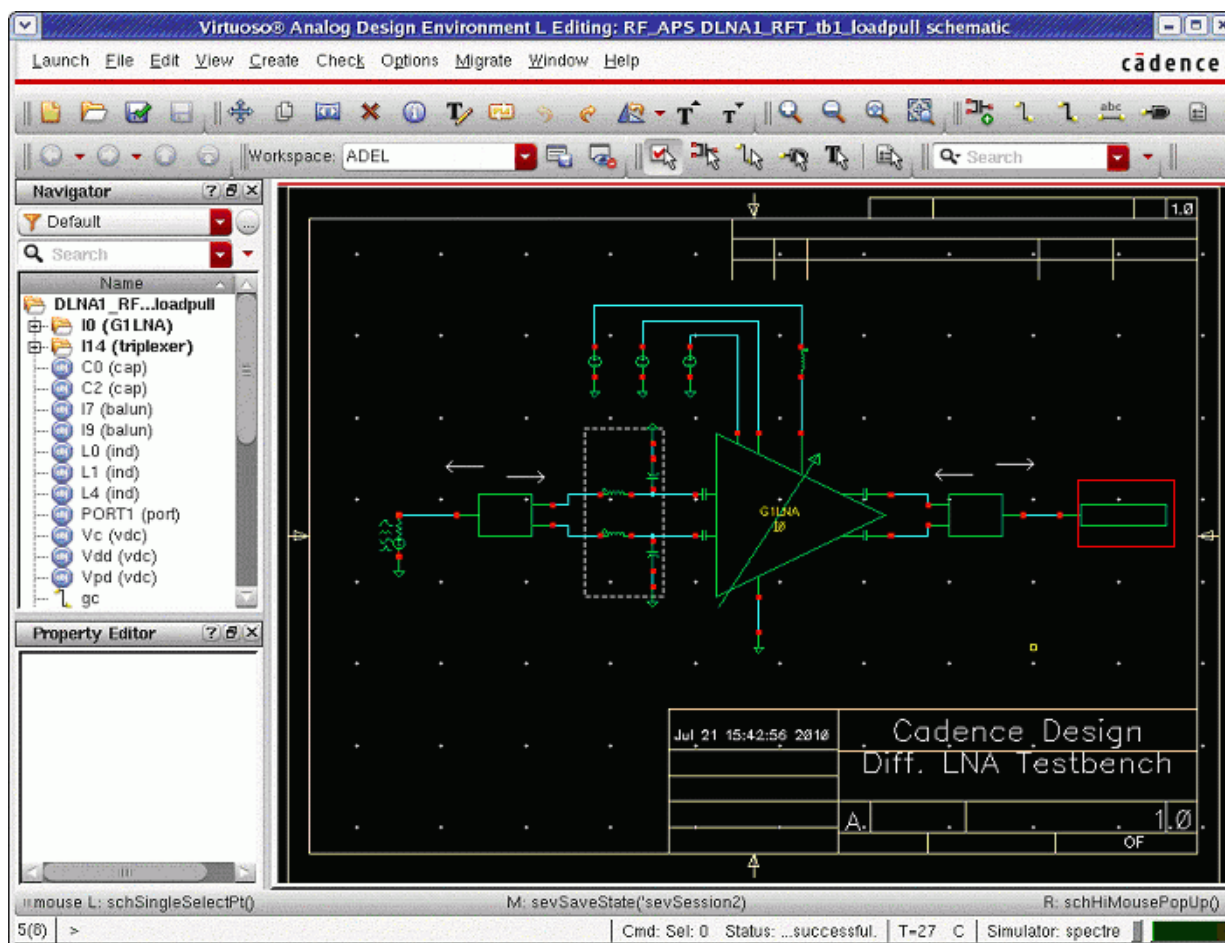


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Loadpull

For a loadpull simulation, add a triplexer (for setting the reflection and angle for up to three harmonics) or the ten_plexer (for up to 10 harmonics) as the load to the circuit. These are in the `rfLib` library.



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Normally, properties are used to set the reflection coefficient magnitude and phase for the harmonics that are present in the triplexer or ten_plexer. The example below shows the ten_plexer, and has 0 (zero) set for all the reflection coefficients and angles.

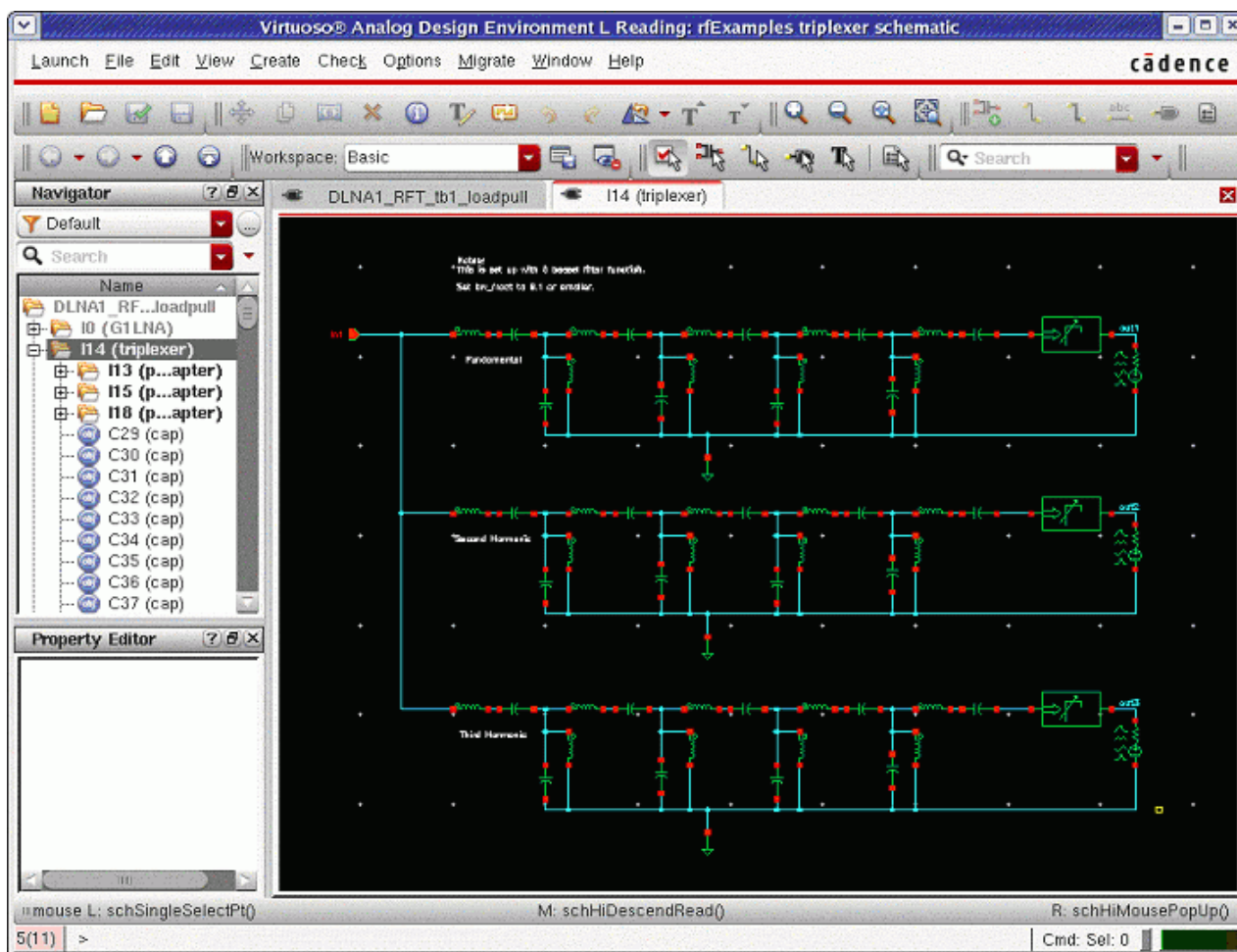
The screenshot shows the 'Edit Object Properties' dialog box for a component named 'ten_plexer'. The dialog is organized into several sections:

- Apply To:** 'only current' (selected) and 'instance'.
- Show:** 'system' (unchecked), 'user' (checked), and 'CDF' (checked).
- Buttons:** 'Browse' and 'Reset Instance Labels Display'.
- Property Table:** A table with columns 'Property', 'Value', and 'Display'. It contains entries for 'Library Name' (rflib), 'Cell Name' (ten_plexer), 'View Name' (symbol), and 'Instance Name' (I8).
- User Property Table:** A table with columns 'User Property', 'Master Value', 'Local Value', and 'Display'. It contains entries for 'interfaceLastCh...' (26 13:50:09 2010), 'partName' (ten_plexer), and 'vendorName'.
- CDF Parameter Table:** A large table with columns 'CDF Parameter', 'Value', and 'Display'. It lists parameters for harmonics 1 through 10, including 'freq_harm1', 'Zo', 'bw_fract', and various 'mag_harm' and 'angle_harm' parameters. All 'Value' fields are set to 0, and all 'Display' fields are set to 'off'.

At the bottom of the dialog are buttons for 'OK', 'Cancel', 'Apply', 'Defaults', 'Previous', 'Next', and 'Help'.

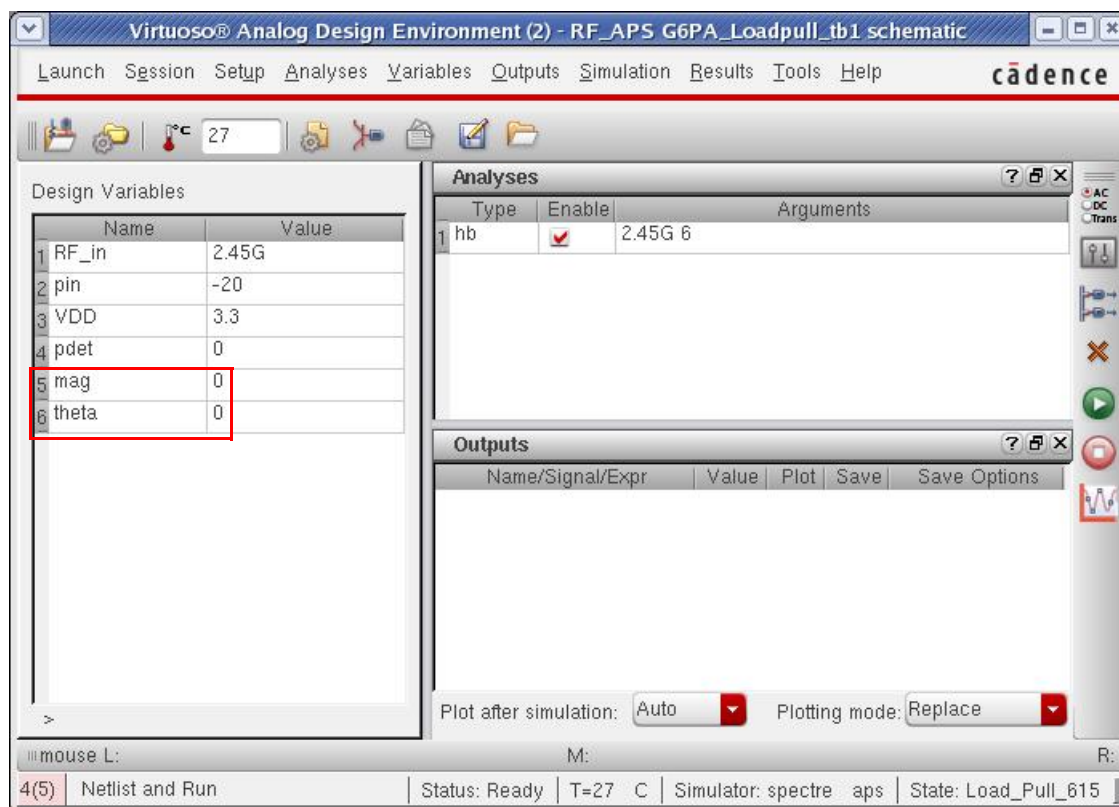
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Descend-read into the triplexer or ten_plexer. Triplexer is shown. The top bandpass filter is for the first harmonic. The middle is the second harmonic. The bottom is the third harmonic.



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1. Add two variables in ADE.



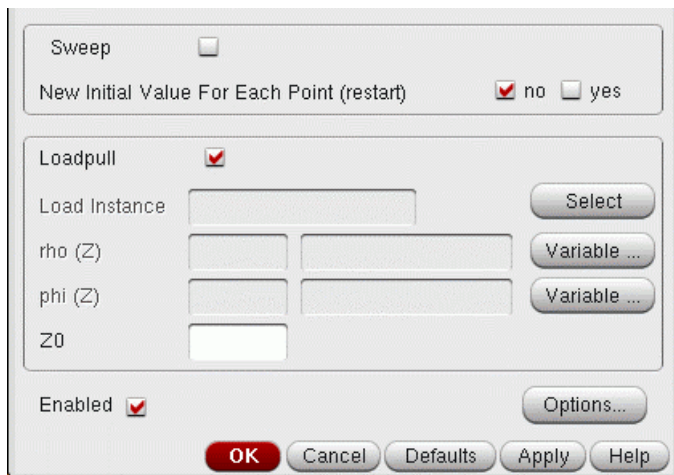
The example above shows *mag* and *theta* variables added. These variables should not be used to set any component values in the circuit.

Triplexer from *rfLib* directory contains three filters for the first, second, and third harmonics and portAdapters with port loads for each of the three filters.

2. Open the pss or hb *Choose Analyses* form.

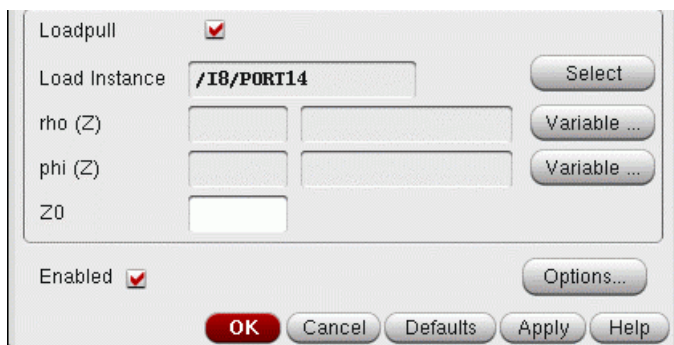
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3. Select the *Loadpull* checkbox.



4. Click the *Select* button on the right of the greyed out *Load Instance* field.
5. In the triplexer schematic, select the topmost port on the right side of the schematic, if you want a loadpull for the first harmonic. Select the next port down for a loadpull of the second harmonic. Select the third port down for the third harmonic.

The instance name is entered in the *Load Instance* field. Direct entry by typing is not allowed for this field.

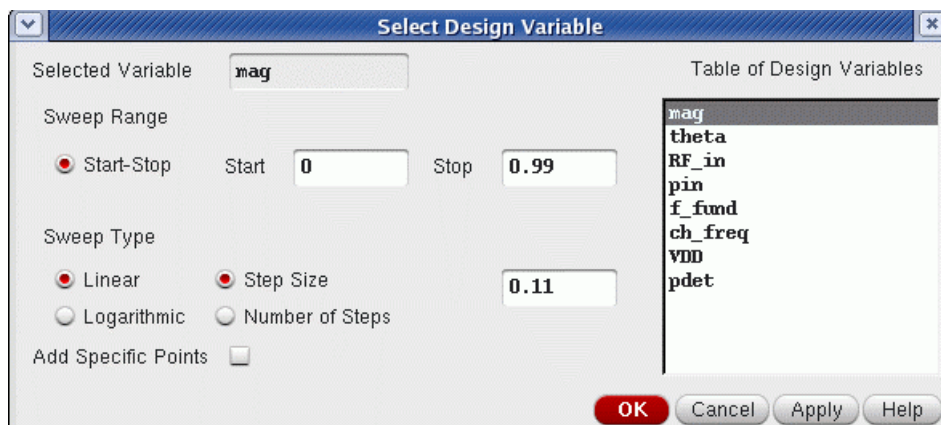


6. Click the *Variable* button on the right of the *rho (Z)* field. Select the variable you entered in ADE.

This variable will be used to set the value of the reflection coefficient in the port.

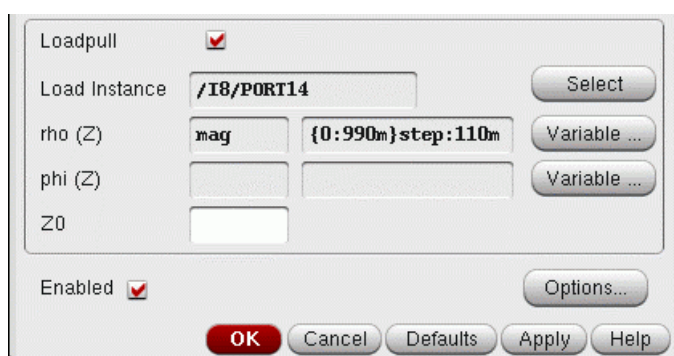
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7. Specify a sweep range, and set the spacing.



8. When completed, click **OK**.

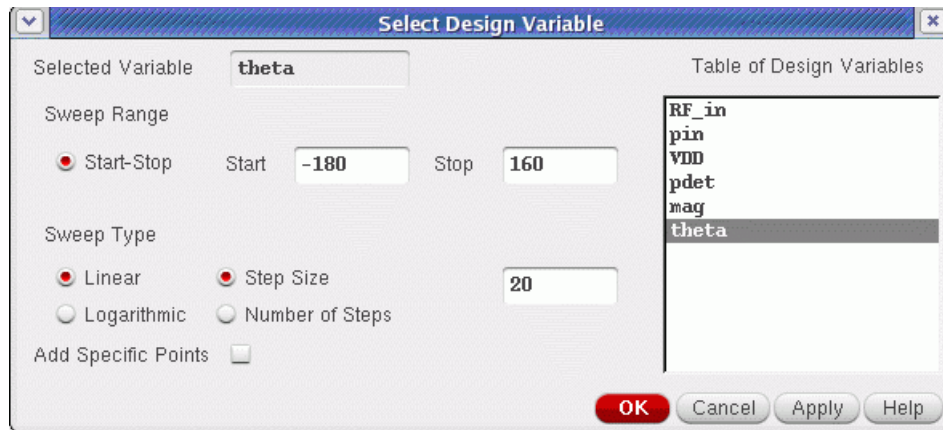
The values are displayed in the *Choosing Analyses* form.



9. Click the *Variable* button on the right of the *phi (Z)* field. This sets the angle of the reflection coefficient.

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10. In the *Select Design Variable* window, select the second variable you entered and specify the sweep limits.



11. When completed, click *OK*.

The *Choosing Analyses* form is updated.

12. Specify the system resistance in the *Z0* field.

The *Choosing Analyses* form should appear similar to the one below.

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Choosing Analyses – Virtuoso® Analog Design Environ

Analysis ☐ tran ☐ dc ☐ ac ☐ noise
☐ xf ☐ sens ☐ dcmatch ☐ stb
☐ pz ☐ sp ☐ envlp ☐ pss
☐ pac ☐ pstb ☐ pnoise ☐ pxf
☐ psp ☐ qpss ☐ qpac ☐ qpnoise
☐ qpxf ☐ qpdp ☒ hb ☐ hbac
☐ hbnoise ☐ hbsp

Harmonic Balance Analysis

Transient-Aided Options

Run transient?

Detect Steady State ☒ Stop Time(tstab)

Save Initial Transient Results (saveinit) ☐ no ☐ yes

Tones ☒ Frequencies ☐ Names

Number of Tones ☒ 1 ☐ 2 ☐ 3 ☐ 4

Tone 1

Fundamental Frequency

Number of Harmonics

Oversample Factor

Freqdivide Ratio for Tone 1

Harmonics

Accuracy Defaults (errpreset)
☐ conservative ☒ moderate ☐ liberal

Oscillator ☐

Sweep ☐

Loadpull ☒

Load Instance

rho (Z)

phi (Z)

Z0

Enabled ☒

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13. When completed, click *OK* and run the simulation in ADE.

14. In ADE, select *Results - Direct Plot - Main Form*.

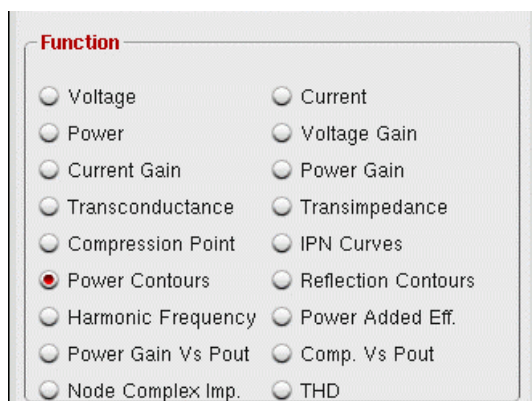
There are two methods of plotting loadpull curves.

First Method

1. Select *pss or hb results*.

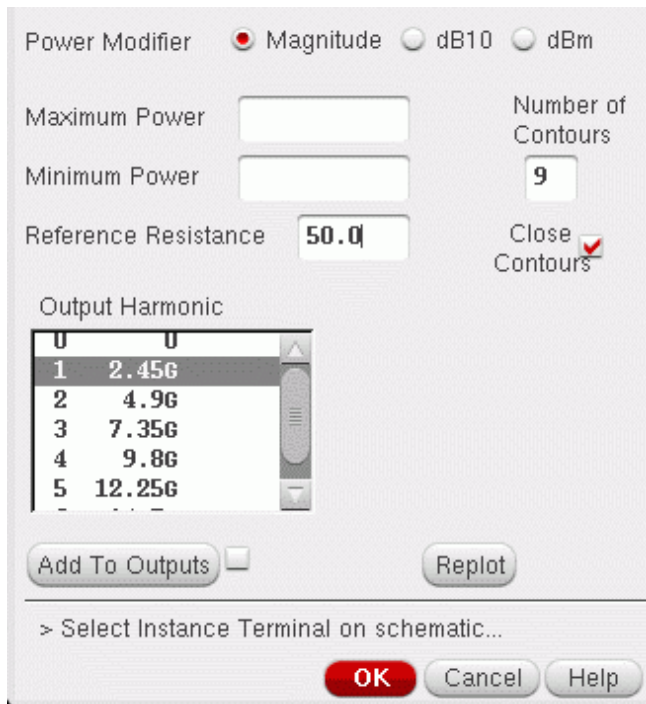


2. Select *Power Contours*.



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3. Select *Magnitude*, *dB10*, or *dBm*.



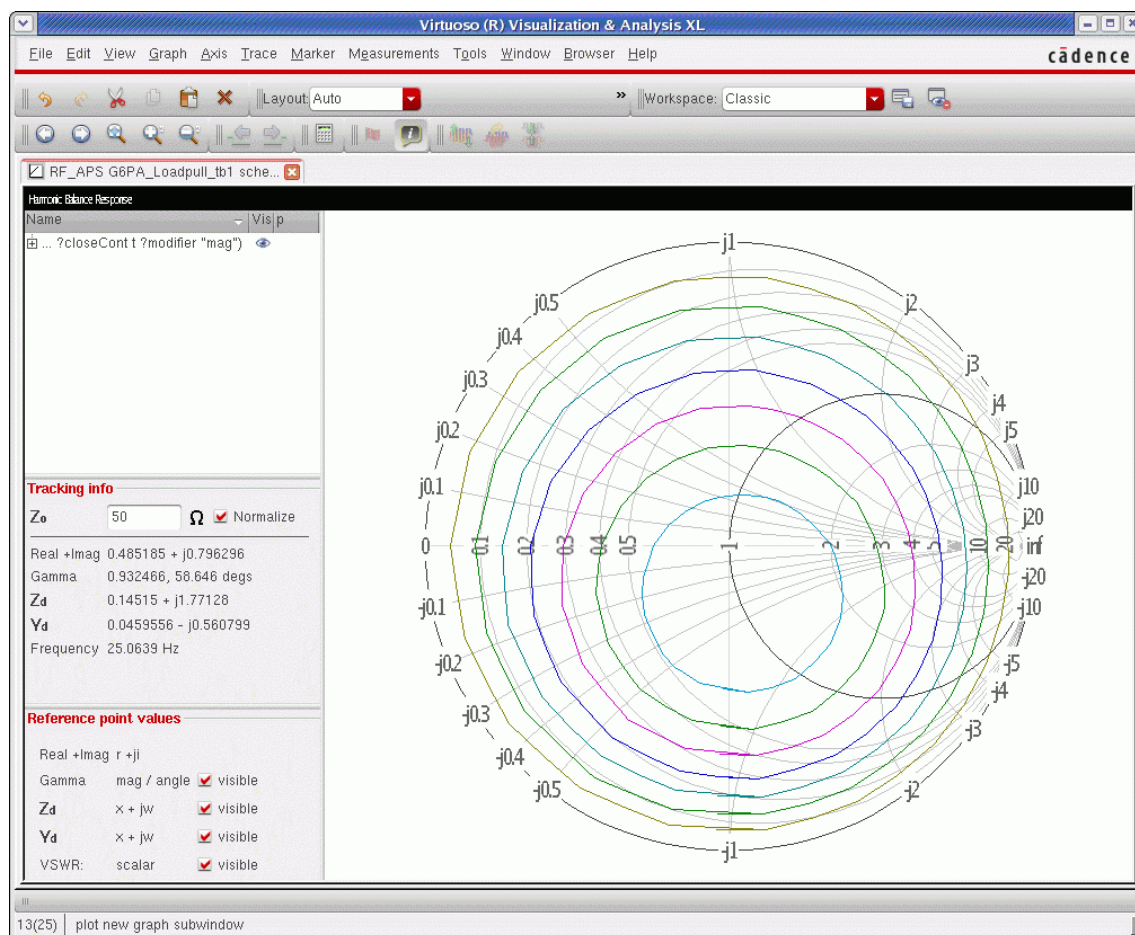
4. Specify 2 more than the number of contour lines you want.

The smallest and largest power occurs at a single point which is plotted, but are very difficult to see in the waveform tool.

5. Select the *Close Contours* check box. This causes the contours from the loadpull to be displayed as circles or ellipses, depending on the distortion of the circuit.
6. Select the first harmonic.
7. Select the top terminal of the top port in the triplexer.

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The power contours appear.



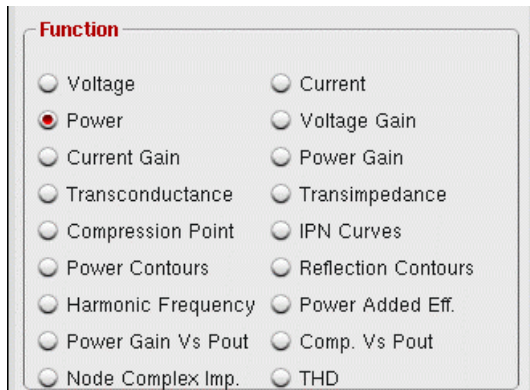
Second Method

1. Select *pss* or *hb* results.



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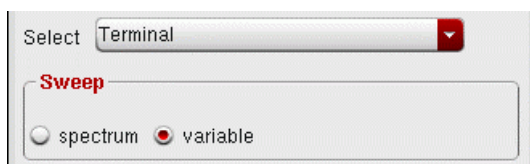
2. Select *Power*.



The 'Function' dialog box contains a grid of radio buttons for selecting the analysis function. The 'Power' option is selected.

Function	
<input type="radio"/> Voltage	<input type="radio"/> Current
<input checked="" type="radio"/> Power	<input type="radio"/> Voltage Gain
<input type="radio"/> Current Gain	<input type="radio"/> Power Gain
<input type="radio"/> Transconductance	<input type="radio"/> Transimpedance
<input type="radio"/> Compression Point	<input type="radio"/> IPN Curves
<input type="radio"/> Power Contours	<input type="radio"/> Reflection Contours
<input type="radio"/> Harmonic Frequency	<input type="radio"/> Power Added Eff.
<input type="radio"/> Power Gain Vs Pout	<input type="radio"/> Comp. Vs Pout
<input type="radio"/> Node Complex Imp.	<input type="radio"/> THD

3. Select *variable*.



The 'Sweep' dialog box shows a 'Select' dropdown menu set to 'Terminal'. Below it, the 'variable' radio button is selected.

Select: Terminal

Sweep:

☐ spectrum ☒ variable

4. Select *Magnitude, dB10, or dBm*.

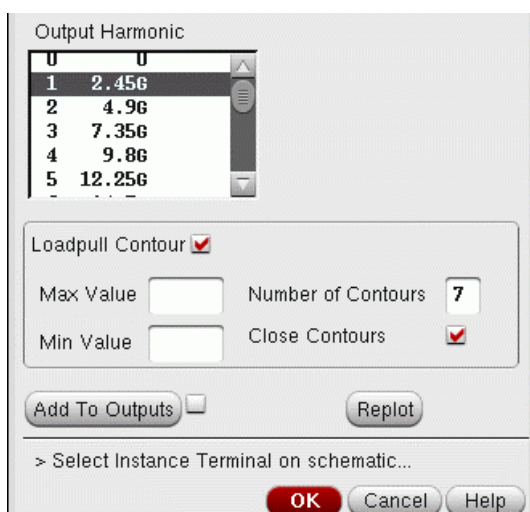


The 'Modifier' dialog box contains three radio buttons: 'Magnitude', 'dB10', and 'dBm'. The 'dBm' option is selected.

Modifier:

☐ Magnitude ☐ dB10 ☒ dBm

5. Select the *harmonic number*.



The 'Output Harmonic' dialog box shows a list of harmonics. The 'Loadpull Contour' checkbox is checked. The 'Number of Contours' is set to 7. The 'Close Contours' checkbox is checked. The 'Add To Outputs' checkbox is unchecked. The 'Replot' button is visible. The 'OK', 'Cancel', and 'Help' buttons are at the bottom.

Output Harmonic

Harmonic	Value
0	0
1	2.456
2	4.96
3	7.356
4	9.86
5	12.256

Loadpull Contour ☒

Max Value Number of Contours

Min Value Close Contours ☒

Add To Outputs ☐ Replot

> Select Instance Terminal on schematic...

OK Cancel Help

6. Select *Loadpull Contour*.

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- Specify 2 more than the number of curves you want.
- Select the *Closed Contours* check box. This causes the contours from the loadpull to be displayed as circles or ellipses, depending on the distortion of the circuit.
- Select the top terminal of the top port of the triplexer circuit.

The loadpull curves appear in the waveform tool.

