

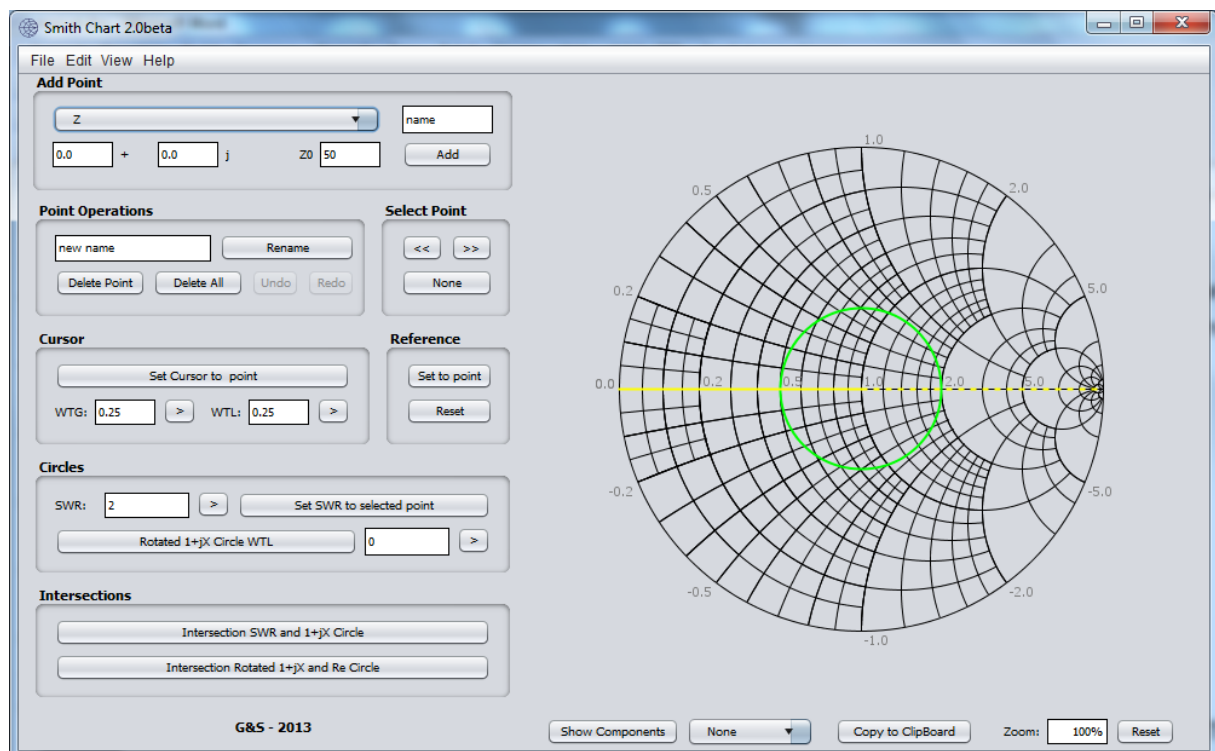
G&S Smith Chart Calculator Manual

What is new in version 2.1

Solved some minor issues like unable to adjust the Z0 in some cases.

But the incompatibility with MAC concerning the copy to clipboard and saving files might still be an issue.

Manual



The program has 2 parts the control side and the Smith Chart.

The Smith Chart

Verify which version you have.

Starting from 1.2beta a build is added so the user can verify whether he has the latest version. This can be done by using the menu Help > About

Exiting this window is done by clicking on the window containing the build info.

Actions

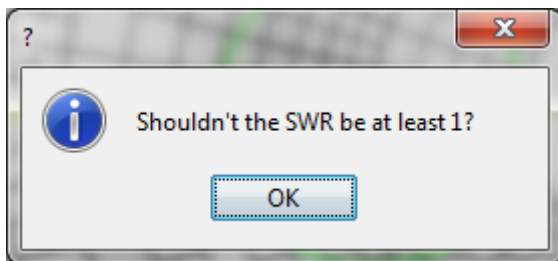
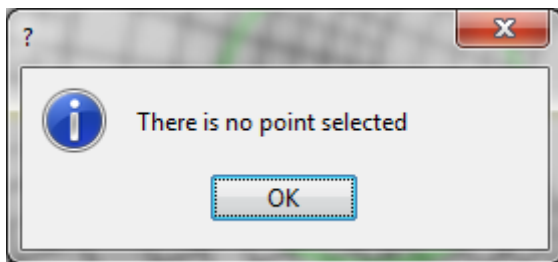
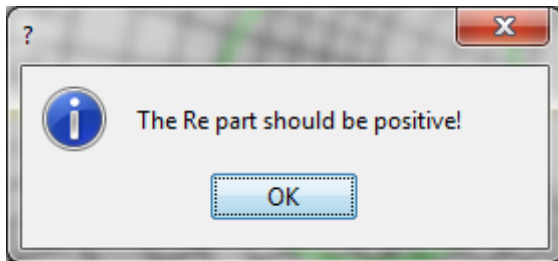
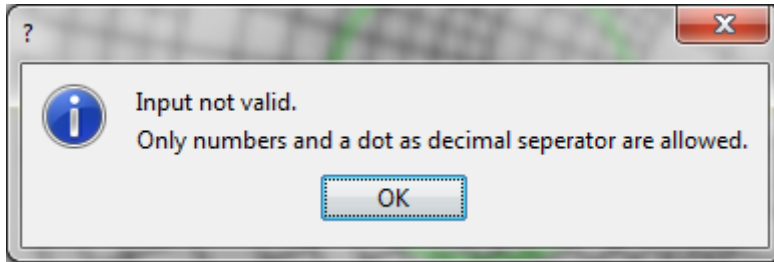
Select a point: Single click. Useful to set SWR circle or Cursors and other actions depending on the selected point.

Zoom and drag: Since version 1.4beta one can zoom in or out by scrolling the mouse and move/drag the smith chart by dragging with the mouse. To reset your zoom press the "Reset Zoom" button.

The Control panel

Note: All values should be entered with a "." as decimal separator and all numbers.

If there is something wrong one of the following messages could appear:



Add a point

Note: A capital Z/Y stands for a not normalized impedance/admittance. A small z/y stands for a normalized impedance/admittance.

Adding a point is possible via various options:

* Adding a given point

Select the type of impedance/admittance/reflection combination you want to use from the Add Point dropdown menu.

Enter a name in the name field

Enter your desired values

Press "Add"

Note: the options to add a Z/Y to the selected point, give you the possibility to combine parallel admittances and series impedances.

** Adding a point when you know the SWR and the angle.*

Set the Cursor at the right angle (see Cursors)

Set the SWR to the desired value.

Choose the "Z Cursor and SWR" or "Y Cursor and SWR" from the Add Point dropdown menu.

Enter a the desired name.

Press "Add"

** Adding a point by inverting an impedance to an admittance and vice versa.*

A point can also be created when you desire the Y of a Z or the other way around.

Select the desired point and select the "Z <=> Y" from the Add Point dropdown menu.

The name is automatically set to the selected point and can only be altered afterwards with rename.

Press Add.

** Adding a point with a different characteristic impedance.*

Select the point which needs to be altered.

Select "Change Z0" from the Add Point dropdown menu and fill in the new characteristic impedance.

The name is automatically set to the selected point and can only be altered afterwards with rename.

Press Add.

Note: this is required when you have 2 different characteristic impedances connected together. e.g. quarter wave transformer.

Point operations

Rename Point: Select the point you would like to rename, enter the new name and press "Rename Point"

Delete point: select the point you would like to remove and then press "Delete Point". This can also be done by pressing the Delete button. Note that the chart needs to be active to do so. If this button doesn't work, select the point prior to pressing the delete button.

"Delete All Points" deletes all points.

Undo: Undo last action. You can maximally undo 5 actions.

Redo: Redo last action. This is actually the undo of the undo. You can only redo 2 actions.

Next point (>>) and previous point (<<)

When you are unable to select the right point by clicking the on the smith chart these buttons could be helpful.

Selects the next and previous point. This could be useful when points are laying on top of each other.

You can also select no point by pressing none.

Starting from version 2.0, one can also use the keyboard arrows to navigate between points.

Cursors

The cursors will show you how many wavelengths you need to travel and allow you to enter the amount of wavelengths you want to travel.

The yellow dashed cursor is the “reference cursor” (point of 0 WTG), the solid line is the “cursor”.

Set Reference to Point: Select a point and afterwards press this button. This will set the reference cursor to the selected point.

Reset: Sets the Reference cursor to its default position.

Set Cursor to Point: Select a point and afterwards press this button. This will set the reference (point of 0 WTG) to the selected point. You can read the values in the WTG (Wavelengths Towards Generator) and WTL (Wavelengths Towards Load) fields.

Setting the cursor at a certain WTG or WTL is possible by just entering the value in a WTG or WTL field. Update by pressing the ENTER or RETURN key or use the update button.

Note: The values will be simplified to the range 0 to 0.5.

Circles

SWR: Set the SWR circle to a desired value OR read the SWR value of the current SWR circle.

Set SWR to Selected Point: Sets the SWR circle to the selected point.

Rotated $1+jX$ circle: Used for the double stub method. Enter the desired value at the input field and enable the rotated circle by clicking the “Rotated Circle WTL” button.

Intersections

Intersection SWR and $1+jX$: Used in the single stub method and double stub method. It will give you the 2 options.

Intersection Rotated $1+jX$ and Re: Used in the double stub method. It will give you the 2 options or an error message when there are no intersections or infinite solutions.

Reset Zoom

To reset the zoom of the smith chart.

Since build 27 the zoom setting is bidirectional. You can also type the desired value.

Show Components

This will show you the relationships between the forward the reflected/backward and total voltage/current. (Voltage when the point is an impedance, current when the point is an admittance)

Show Angle

Gives you the option to show an arc which represents the amount of wavelengths between the cursors.

FILE MENU

Export data

Generates a “.gnssc” file which can be imported into a spread sheet editor. Don't forget to select the "." as decimal separator.

Import data

This allows you to import an original 1.5beta “.gnssc” file. Once the layout of your gnssc-file has been tampered the import functions will not work. In the student edition, it will be verified that you are

the same user on the same PC as previously.

Note: older dat files are no longer compatible with the gnssc file structure.

Export PNG

Export an image.

Export PNG settings

One can choose the option to add a watermark. This feature is not longer possible to enable in the normal edition. The Student edition has this option enabled automatically.

You can also choose to enable or disable the SWR, rotated $1+jX$ and Cursors. (default: enable)

EDIT MENU

Undo

Same functionality as the Undo button

Redo

Same functionality as the Redo button

HELP MENU

Help

Will direct you to the online PDF.

About

Will give you an overview of the version, build and contact info.

VIEW MENU

Re and Im coordinates

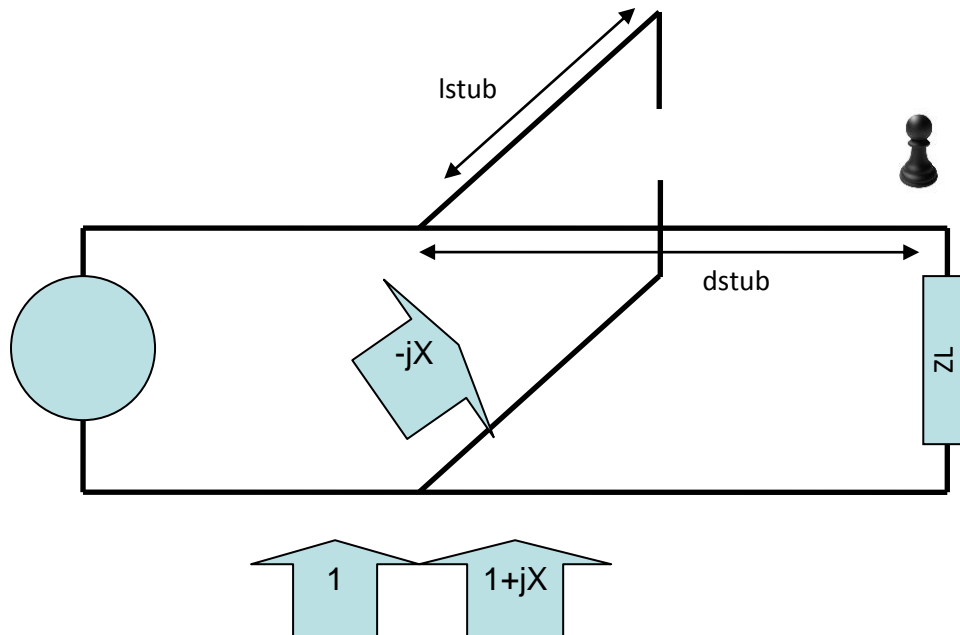
Allows you to enable/disable the markers of the Re and Im circles.

SWR Circle

Allows you to enable/disable the SWR circle.

Example 1: Single stub

Use a single parallel open stub to match a load impedance of $15+10j \Omega$ to a 50Ω transmission line. Find the distance and length of the open stub circuit.



To solve any exercise you should first draw the schematic and add a (imaginary) pawn to know where you are at that moment. Here @ Z_L

Select Z from the add point drop down box.

Since $Z_L = 15 + 10j$, type your desired name (L) and type 15, 10 and 50 in the respective text fields.

Press Add

Since this is a parallel stub we need to go to admittances. Select $Z \leftarrow Y$ from the Add point drop down box and make sure that Z_L is selected/highlighted. A new point Y_L is generated

Now we need to know the place on the cable where we have $1+jX$ so that by adding a stub with input admittance $-jX$ we get $1+0j$. There is a button for this option. Press intersection SWR and $1+jX$. The 2 valid options will appear. Let us take option B.

To know the distance between the load and the stub we need to use the cursors.

Select the Y_L and click Set reference Select Y_{opt_B} and click Set cursor to point.

Read the value from the WTG text field: 0.044029λ

Why WTG? take a look at the schematic your pawn should move from Z_L to the spot where the stub will be put.

y_{opt_B} normalised is $1-1.32916j$ if we add a stub of $y_{normalised} = 1.32916j$ the sum will be nicely 1. (this point is Y_{in})

If you would like to do this select Add normalised z/y to selected from the dropdown box and complete with the desired values (0, 1.32916, 50).

OK back to the length of the stub:

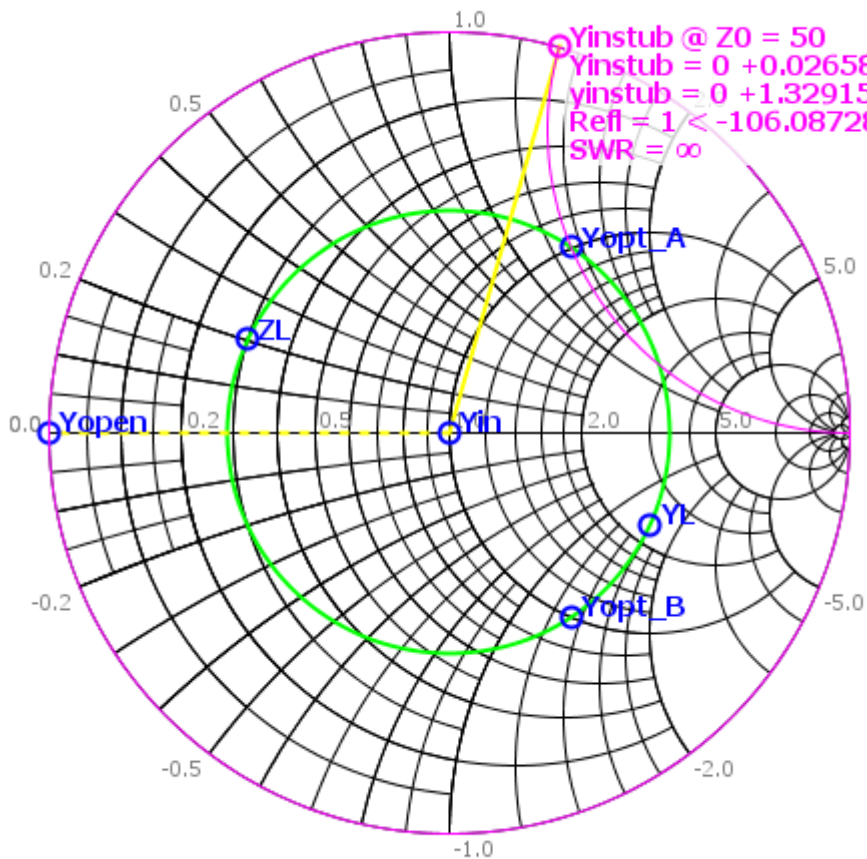
Choose y normalised from the drop down menu. Type the name "instub" and the values 0, 1.32916 and 50. To know the length we will put our pawn at the open. Add the admittance of an open on the smith chart. Choose (normalised) admittance from the dropdown menu and type "open", 0, 0 and 50. Press Add.

Press reference set to point (Yopen is selected)

Select Yinstub and press set cursor to point.

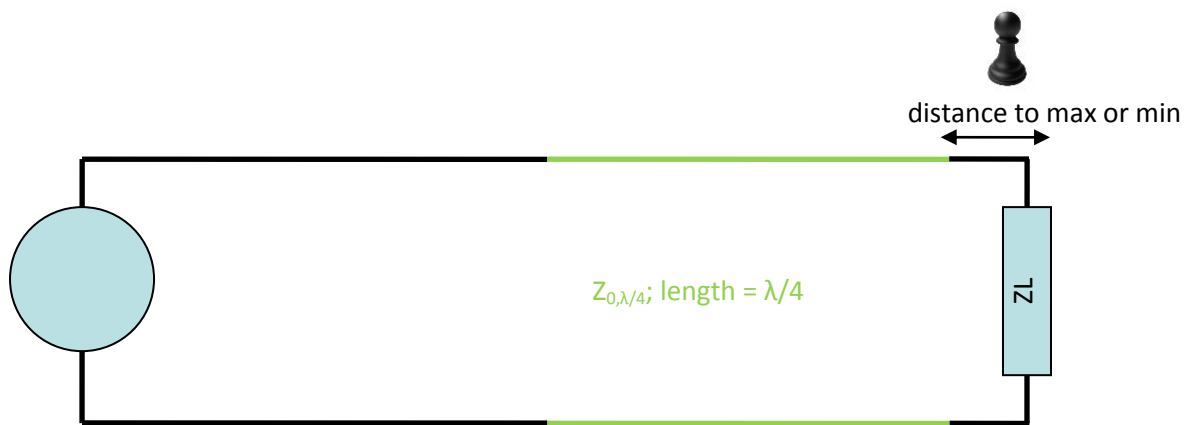
Read the value from WTG: 0.147343 λ

SOLUTION: The stub needs to be at a distance of 0.044029 λ and has a length of 0.147343 λ .



Example 2: Quarter wave transformer

A 50 Ohm transmission line has a load of $100 + j$ Ohm. Match this circuit using a quarter wave transformer.

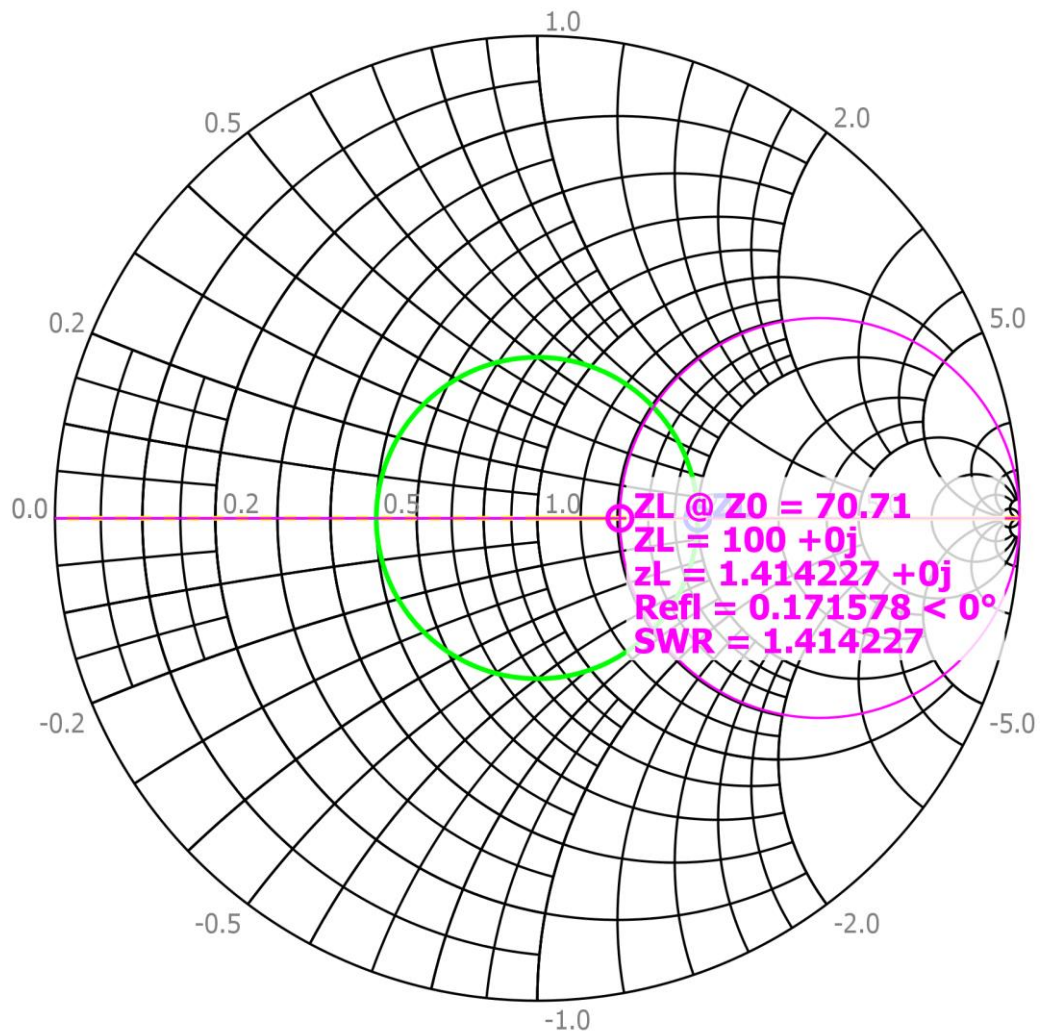


To solve this question we will first plot ZL. Select Z from the add point drop down box. Since $Z_L = 100$, type your desired name (L) and type 100, 0 and 50 in the respective text fields. Press Add

Next we need to look for a maximum or a minimum. ZL is already at a maximum. So this is where we will insert the transformer. The distance to the transformer is 0.

Calculate the characteristic impedance of the transformer. Since $Z_{0,\lambda/4}$ is the square root of Z_{in} at the maximum and Z_0 of the original cable this gives us 70.71.

Now we will move to the point at the beginning of the cable. Select change Z_0 from the drop down box in the add menu and make sure the ZL point is selected. Fill in 70.71 and press Add.



Now we need to move to this point to the end of the transformer. Select Move selected WTG along SWR and fill in 0.25. Use e.g. "@end trafo" as name and press Add.

Now we need to go back to the original cable. Select change Z0 and fill in 50. Give this point the name "after trafo"

