all around you

Introduction to Qorvo® MatchCalc™

A guide to installation and use

Sections

Overview of Qorvo® MatchCalc™

What Is Qorvo® MatchCalc™?

- Simple, user friendly RF/Microwave match calculator
  - Specifically for matching calculations
  - Based on Central S2P File with ideal or S2P passive components
    - Measured S2P performance for a passive elements or components can be used
  - Can be used without S2P file by selecting THRU for central S2P File
  - Can model simple transmission line elements
- No license required
  - After installation, can be used where there is no WiFi access for license checkout
  - Can be used by customers with minimal training or instruction

What Qorvo® MatchCalc™ Is Not:

- Not intended as a replacement for full function RF simulators
- Not intended as a general purpose simulator
  - No active component models
  - Central S2P file can be an active component
  - Complex ideal components can be used to develop non-ideal components, but no program support to help with non-ideal component creation
- Not featured for extremely complicated matching topologies

Qorvo® MatchCalc™ User Interface

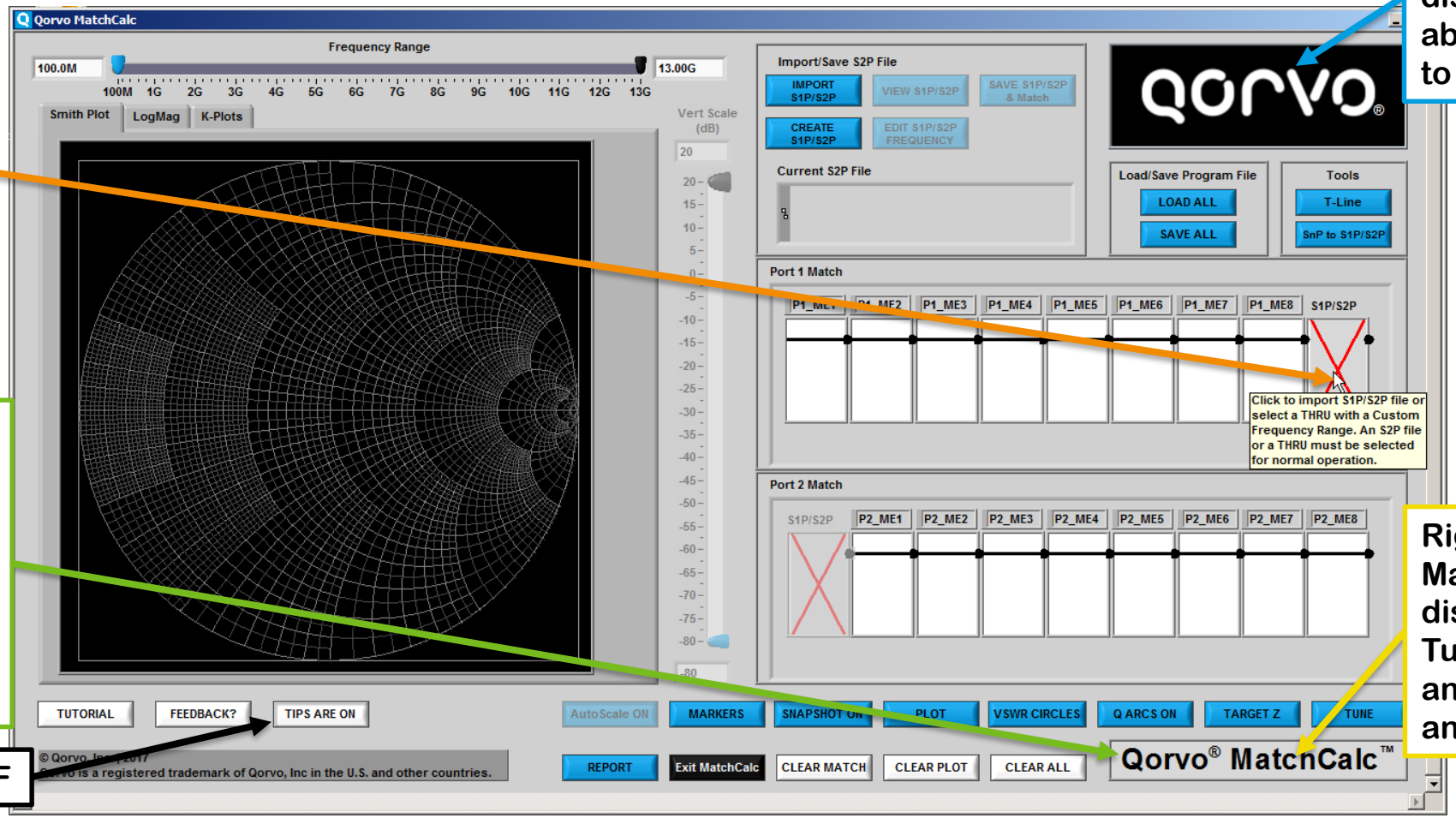
With Smith Plot Tab

Hovering the mouse over most controls and buttons will display tips for the operation of the control. Many controls also have right click options as well as normal operation with a left click

Left Click the Qorvo® MatchCalc™ Icon to display MatchCalc™ Version information, links to the Qorvo resources page and to send MatchCalc™ feedback email

Tips can be ON or OFF

Left or Right Click the Qorvo Logo to display information about Qorvo and links to the Qorvo Webpage



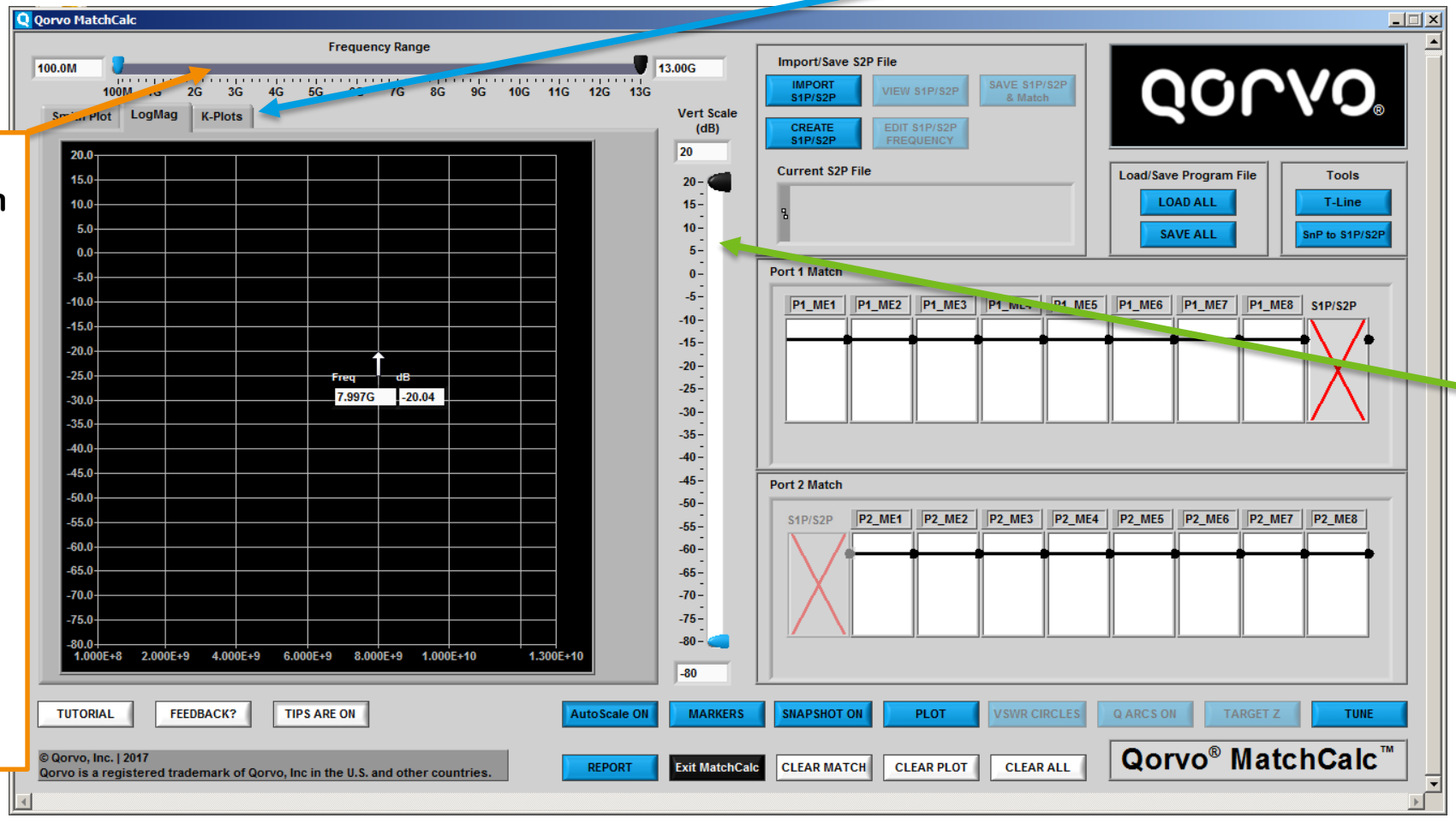
Right Click the Qorvo ® MatchCalc™ Icon to display MatchCalc™ Tutorial, Examples, and a list of Tips and FAQs

Qorvo® MatchCalc™ User Interface

With LogMag Tab

TABS to select Plot View Choices are Smith Plot, LogMag or K-Plots

The displayed Frequency range can be changed for both LogMag and Smith Plots by dragging the sliders or by entering the Start and Stop Frequency values (in SI notation) Press <Enter> to confirm the frequency entry when typing numbers into the boxes



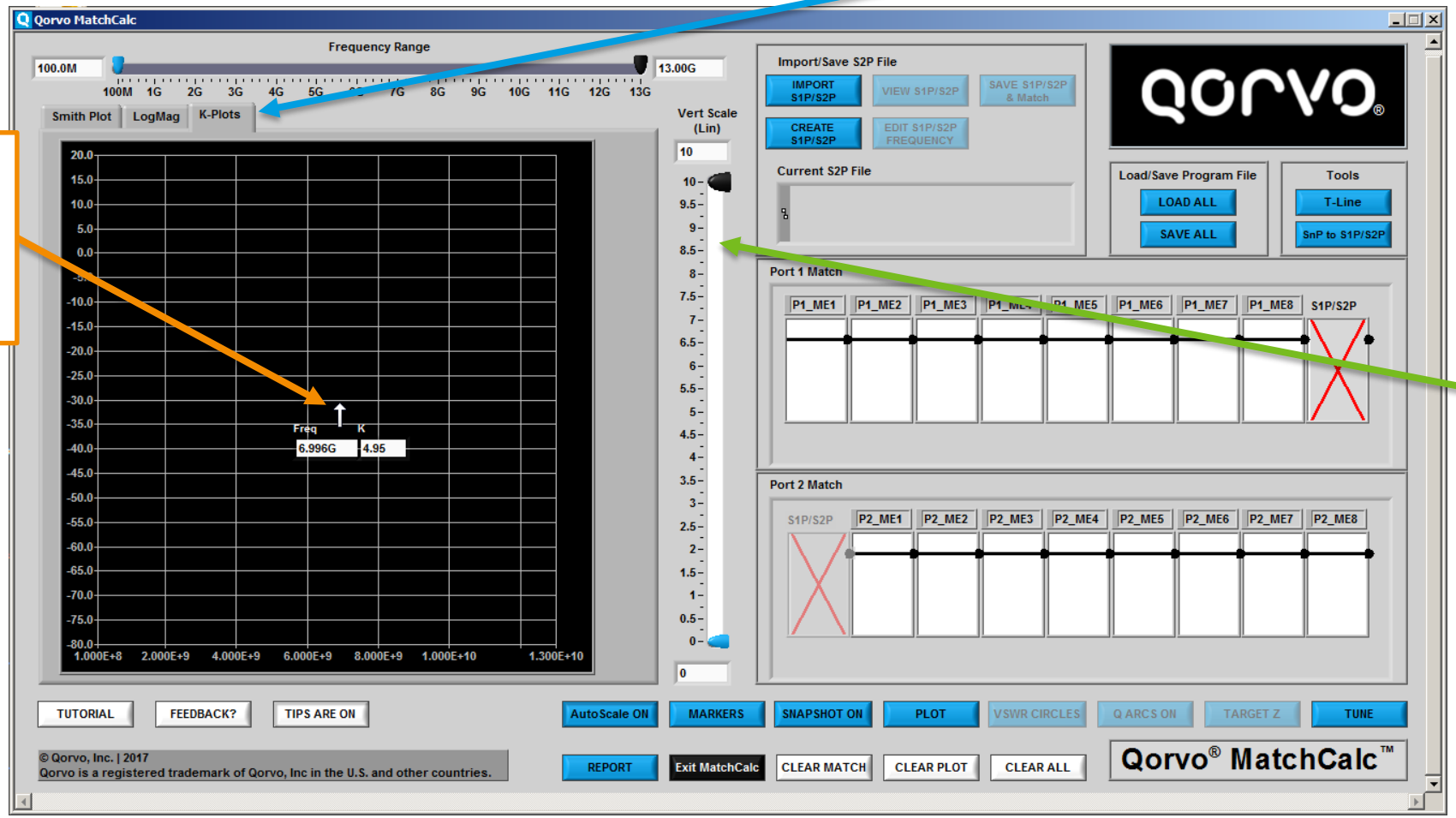
The displayed Vertical range can be changed for LogMag Plots or K-Plots by Dragging the sliders or by entering the Max and Min amplitude values (Press <Enter> to confirm the amplitude entry when typing numbers into the Boxes)

Qorvo® MatchCalc™ User Interface

With K-Plots Tab

TABS to select Plot View Choices are Smith Plot, LogMag or K-Plots

Hovering the mouse Pointer over a graph Displays the data for The pointer location On all plot types



The displayed Vertical range can be changed for LogMag Plots or K-Plots by Dragging the sliders or by entering the Max and Min amplitude values (Press <Enter> to confirm the amplitude entry when typing numbers into the Boxes)

Qorvo® MatchCalc™ User Interface

Example 1: Match calculation complete, Smith Plot Tab selected

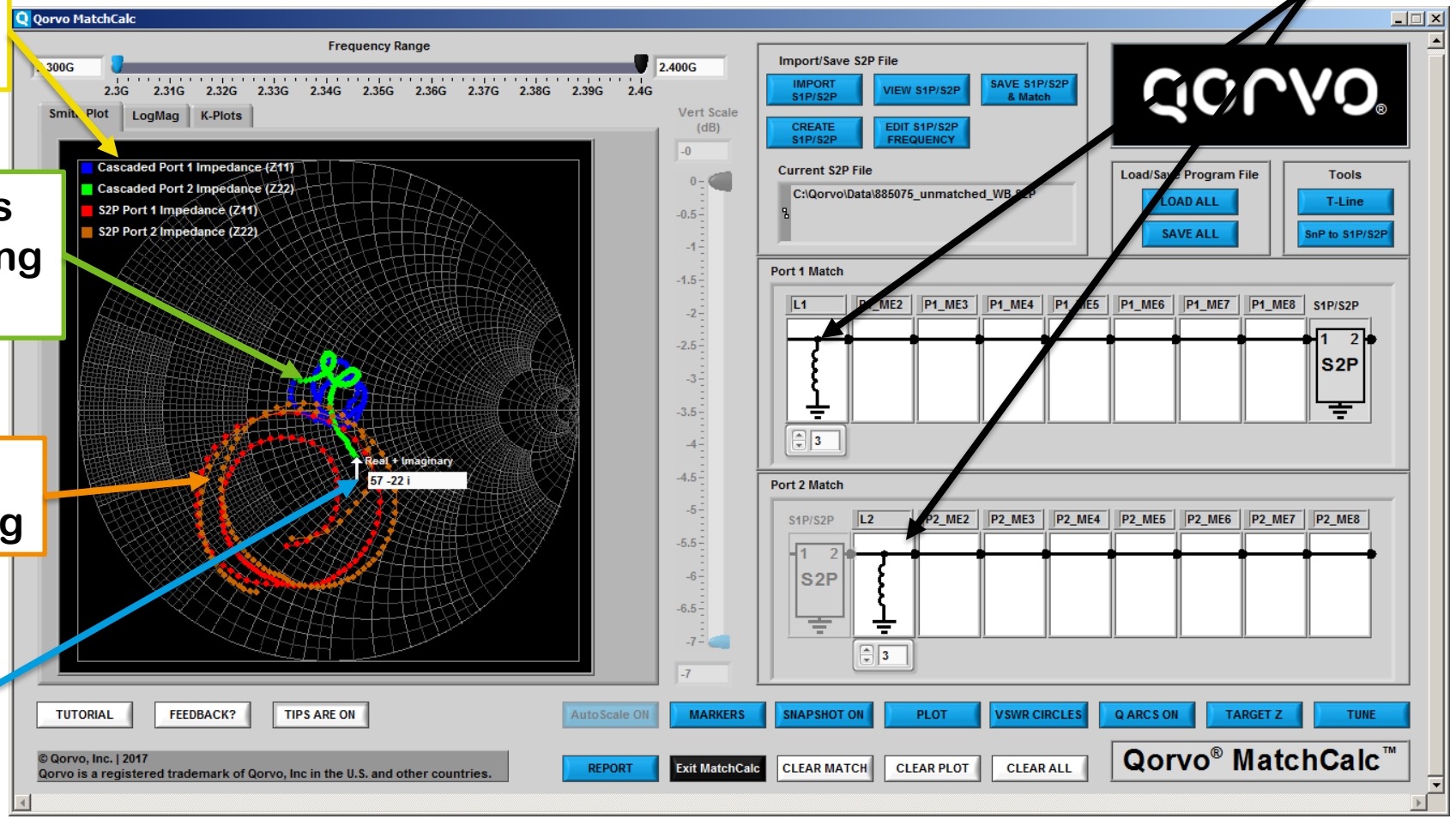
Legend to keep track of traces

Cascaded Traces Including matching elements

Original S2P file without matching

Data at pointer location

Matching Elements



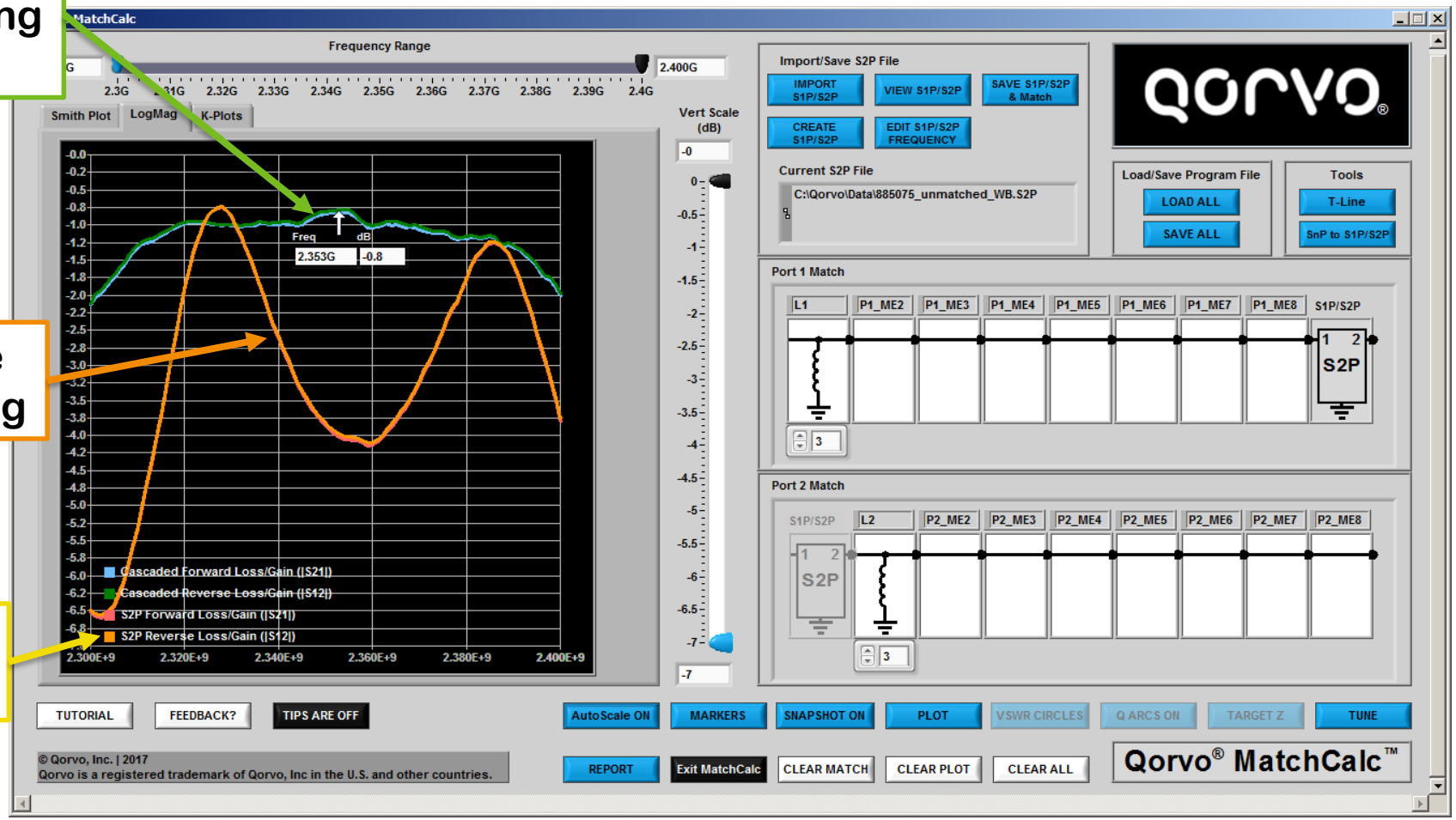
Qorvo® MatchCalc™ User Interface

Example 1: Match calculation complete, LogMag Tab selected

Cascaded Traces Including matching elements

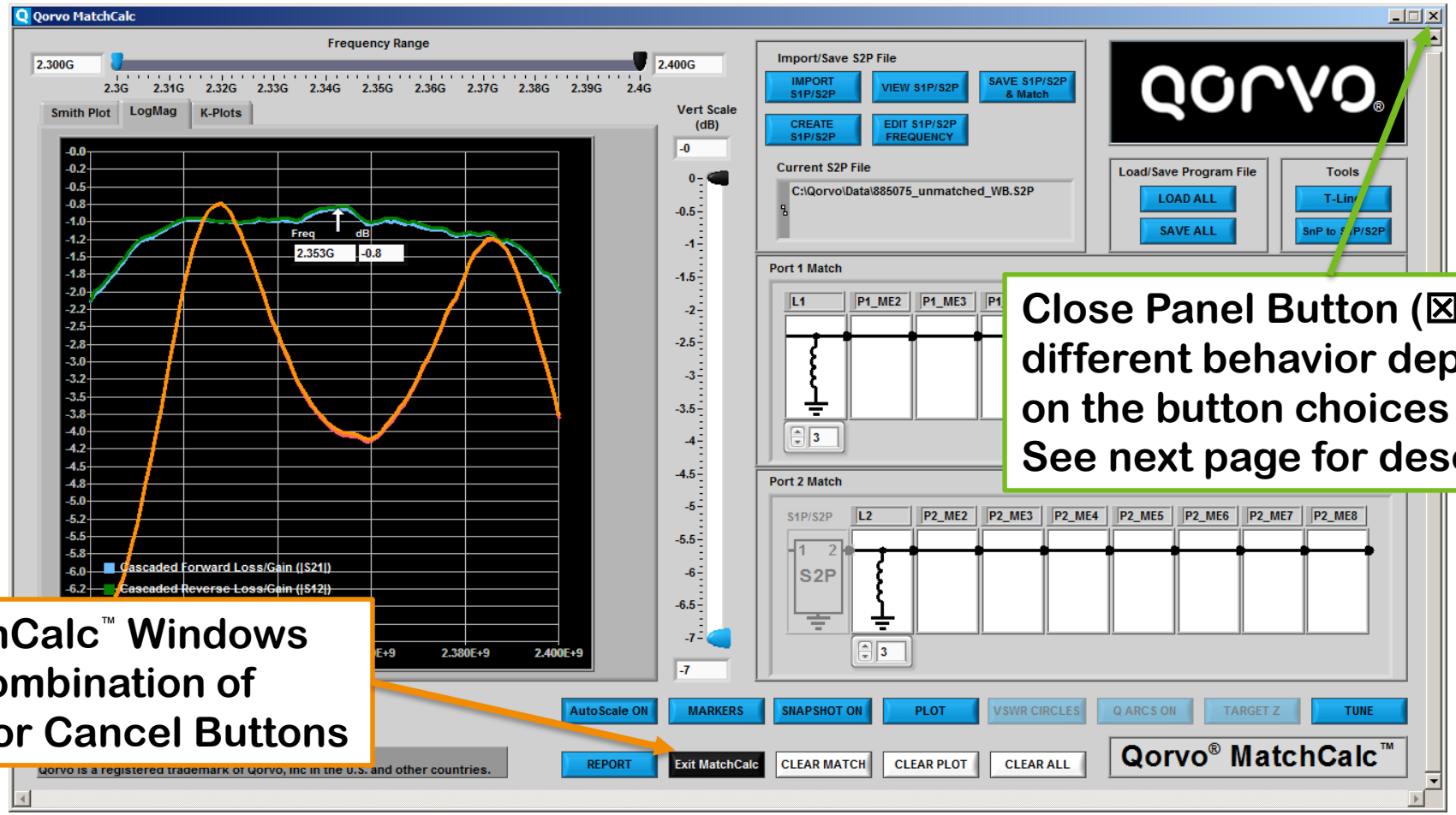
Original S2P file without matching

Legend to keep track of traces



Qorvo® MatchCalc™ User Interface

Closing the Qorvo® MatchCalc™ or other Windows in the application



Close Panel Button (☒) has different behavior depending on the button choices available See next page for description

All Qorvo® MatchCalc™ Windows Include some combination of Close, Exit, OK or Cancel Buttons

Close Panel (☒) Operation Variations

Depends on buttons available

- Any single, stand alone button such as OK, Cancel, Exit, Close, etc.
  - ☒ behaves as the single button on the window
- Any combination of two or more buttons that include CANCEL
  - ☒ behaves as the Cancel button on the window
  - In general, any changes made while the window was open are discarded with no modifications to information in Qorvo® MatchCalc™
- This means if you want to change something with the window displayed and there are multiple buttons to choose from, you must select OK to accept the changes
- CANCEL will always discard any changes made in the window

How Does Qorvo® MatchCalc™ Work?

How Qorvo® MatchCalc™ Works

Frequency Range

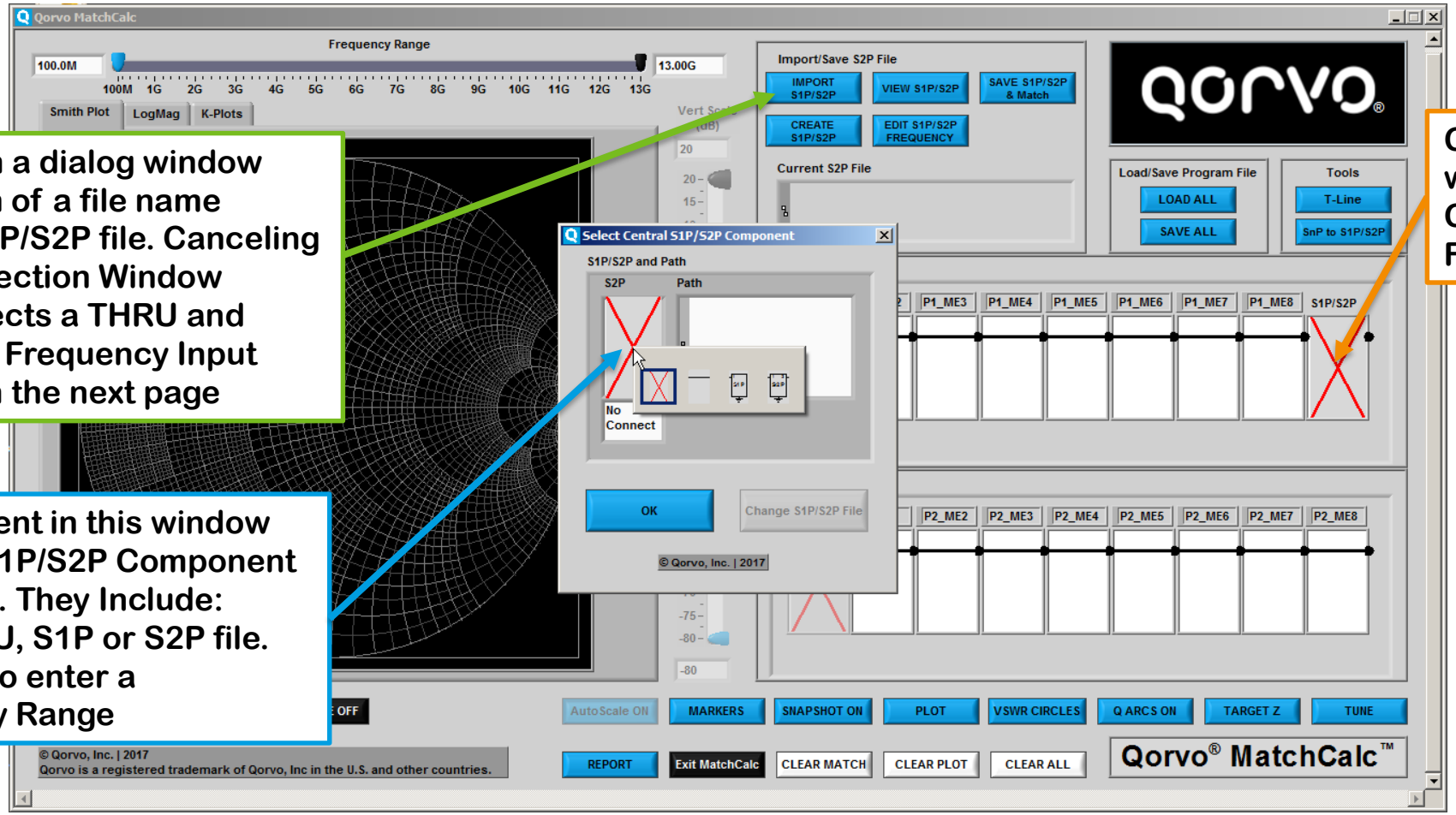
- Frequency Range is determined in one of two ways:
  - 1. Load an S1P/S2P File as the central S2P element
    - S1P/S2P file frequency range is the Qorvo® MatchCalc™ frequency range
    - All calculations and data points displayed are at the frequencies of the points in the S2P file
  - 2. Load a THRU for the central S2P file
    - A Manual Frequency Selection Window appears. Enter the start and stop frequency and the step size (or number of points desired), press <Enter> and click OK
    - Note: It is necessary to press the <Enter> key to confirm numeric entries
- Qorvo® MatchCalc™ uses central S1P/S2P file points for all calculations
  - Loading new central S1P/S2P file changes calculation frequencies to the new file points
  - The Frequency Slider control changes the lower/upper limits of displayed frequencies (does not alter file contents)

Manual Frequency Input

Start Manual Frequency Input by Selecting a THRU for the Central S1P/S2P component

Click here to open a dialog window allowing selection of a file name for the desired S1P/S2P file. Canceling out of the File Selection Window automatically selects a THRU and opens the Manual Frequency Input Window shown on the next page

Click the component in this window to show Central S1P/S2P Component Selection Options. They Include: No Connect, THRU, S1P or S2P file. Select the THRU to enter a Manual Frequency Range

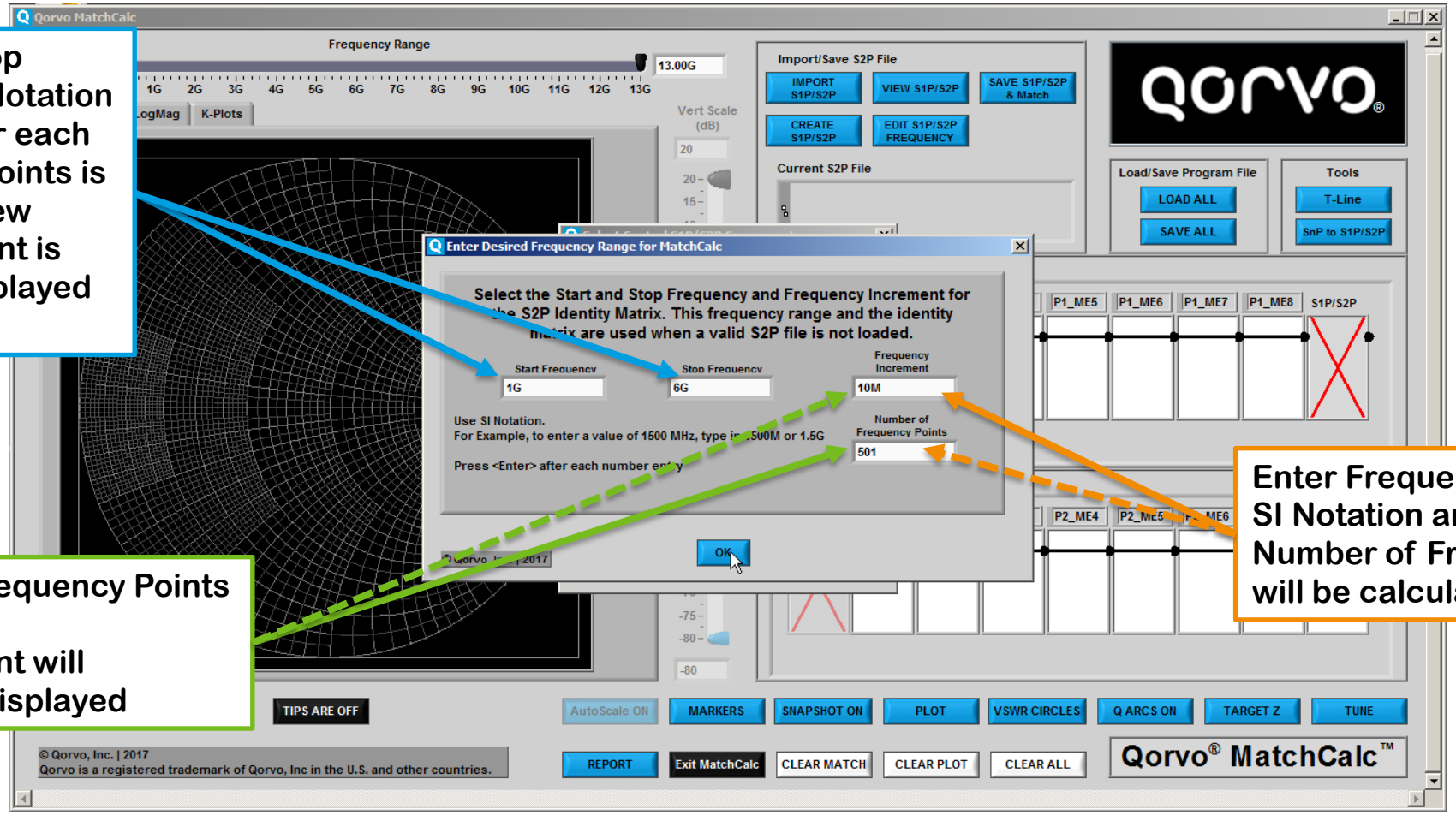


Click here to open a window allowing Central S1P/S2P File Selection

Manual Frequency Input

After Selecting the THRU, the Frequency Range window appears
Input Start Freq, Stop Freq & either Freq Increment or Number of Freq Points

Enter Start and Stop Frequencies in SI Notation Press <Enter> after each entry. Number of points is retained and the new frequency increment is calculated and displayed after each entry



Enter Number of Frequency Points and press <Enter> Frequency Increment will be calculated and displayed

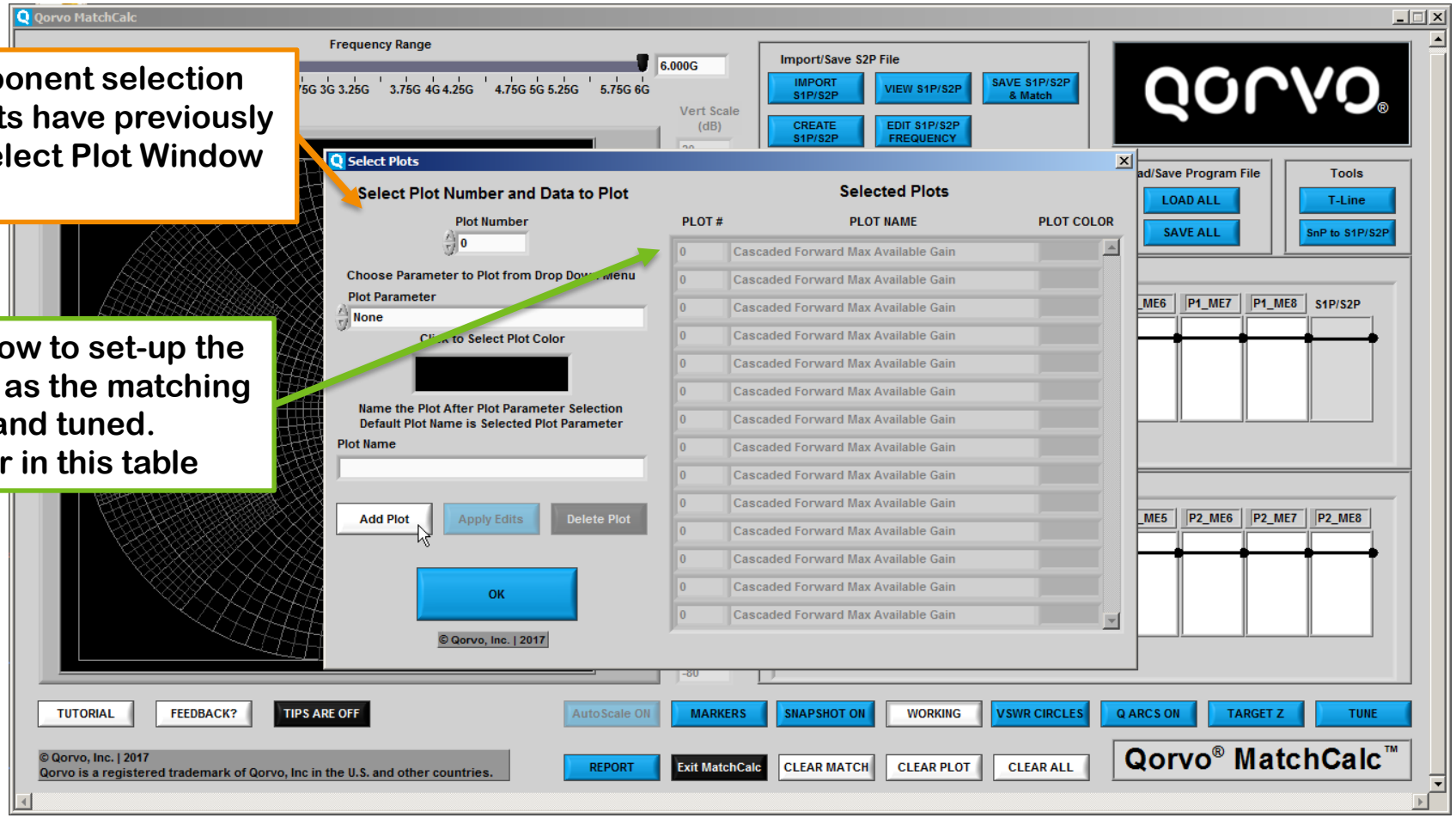
Enter Frequency Increment in SI Notation and press <Enter> Number of Frequency Points will be calculated and displayed

Qorvo® MatchCalc™ Display, Add Plots

THRU Component Selected for Central S2P file with No Plot Set-Up

When an S2P component selection is made and no plots have previously been set-up, the Select Plot Window will appear

Use Select Plot window to set-up the plots you want to see as the matching network is designed and tuned. Selected Plots appear in this table

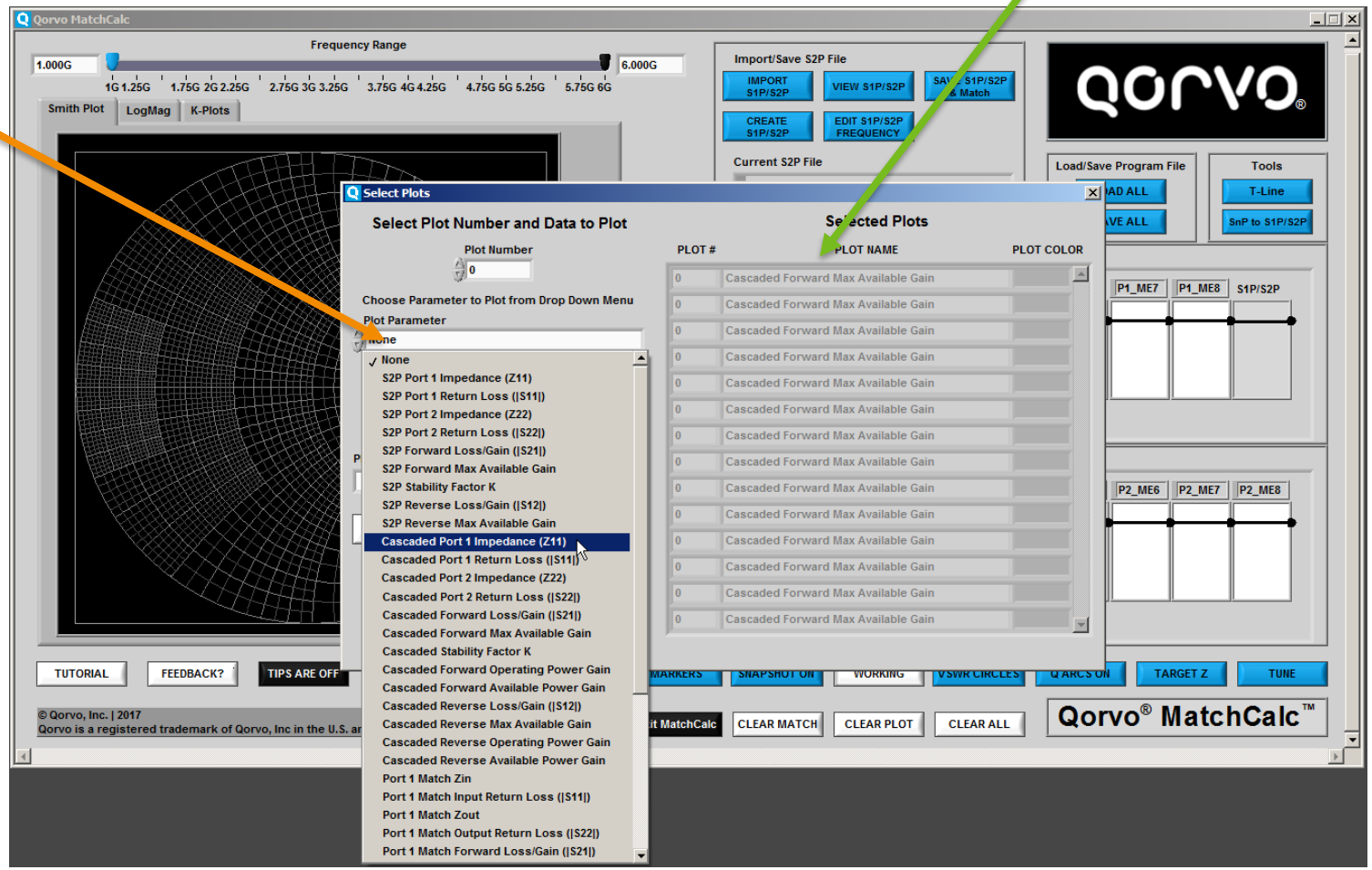


Qorvo® MatchCalc™ Display

Setting Up Plots

Select Plot Parameter From the drop down Menu first

No plots appear in the Selected Plots Table



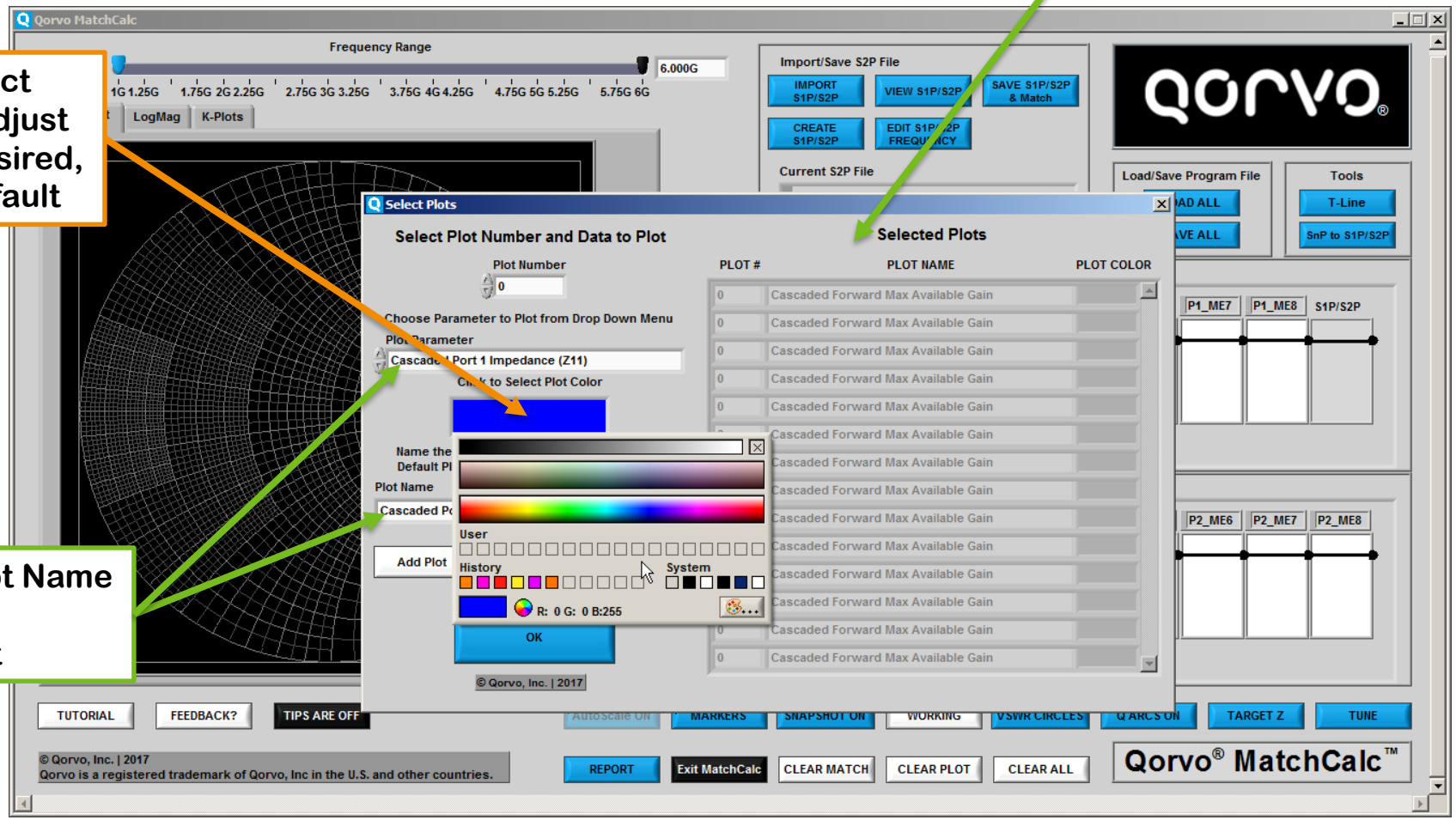
Qorvo® MatchCalc™ Display

Setting Up Plots

No plots appear in the Selected Plots Table

Next, click the Select Plot Color Box to adjust the plot color, if desired, or just keep the default

Note the default Plot Name Is the same as the Plot Parameter Text



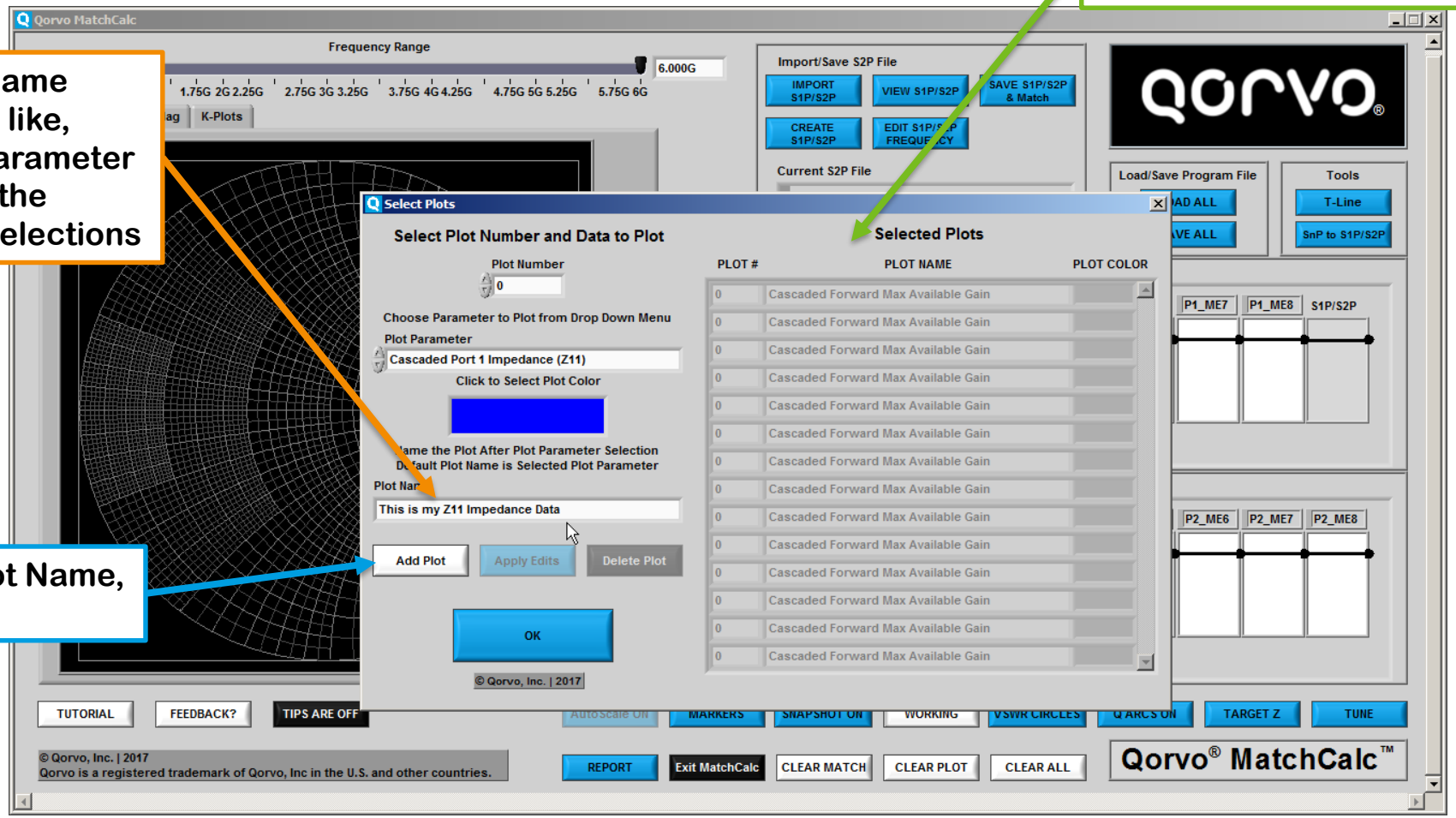
Qorvo® MatchCalc™ Display

Setting Up Plots

No plots appear in the Selected Plots Table
Until after the Add Plot Button is clicked

Now edit the Plot Name
Call it anything you like,
But note the Plot Parameter
names are fixed to the
Drop Down Menu Selections

After editing the Plot Name,
Click Add Plot



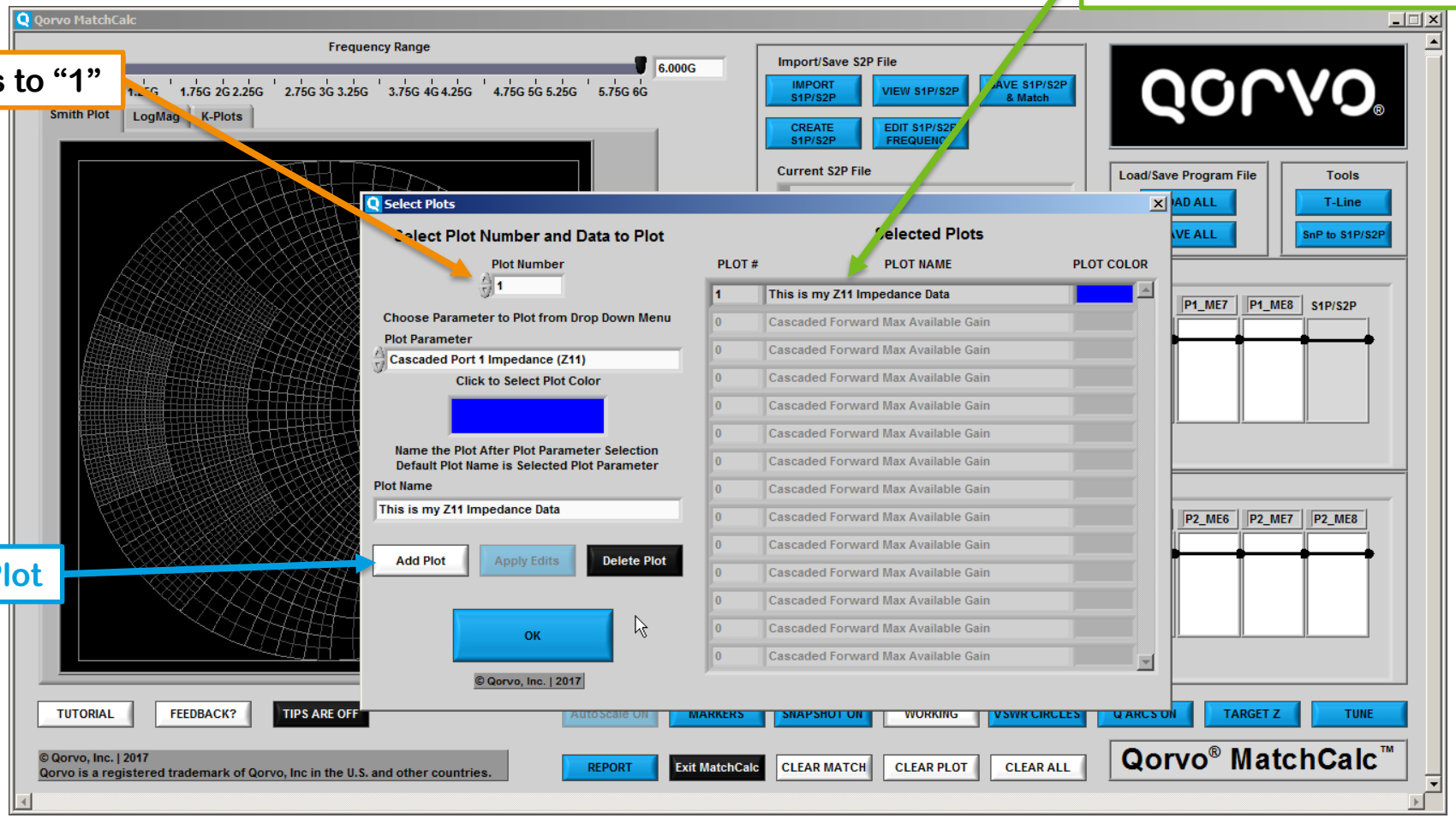
Qorvo® MatchCalc™ Display

Setting Up Plots

The plot created and added now appears In the Selected Plots Table

Plot Number Moves to “1”

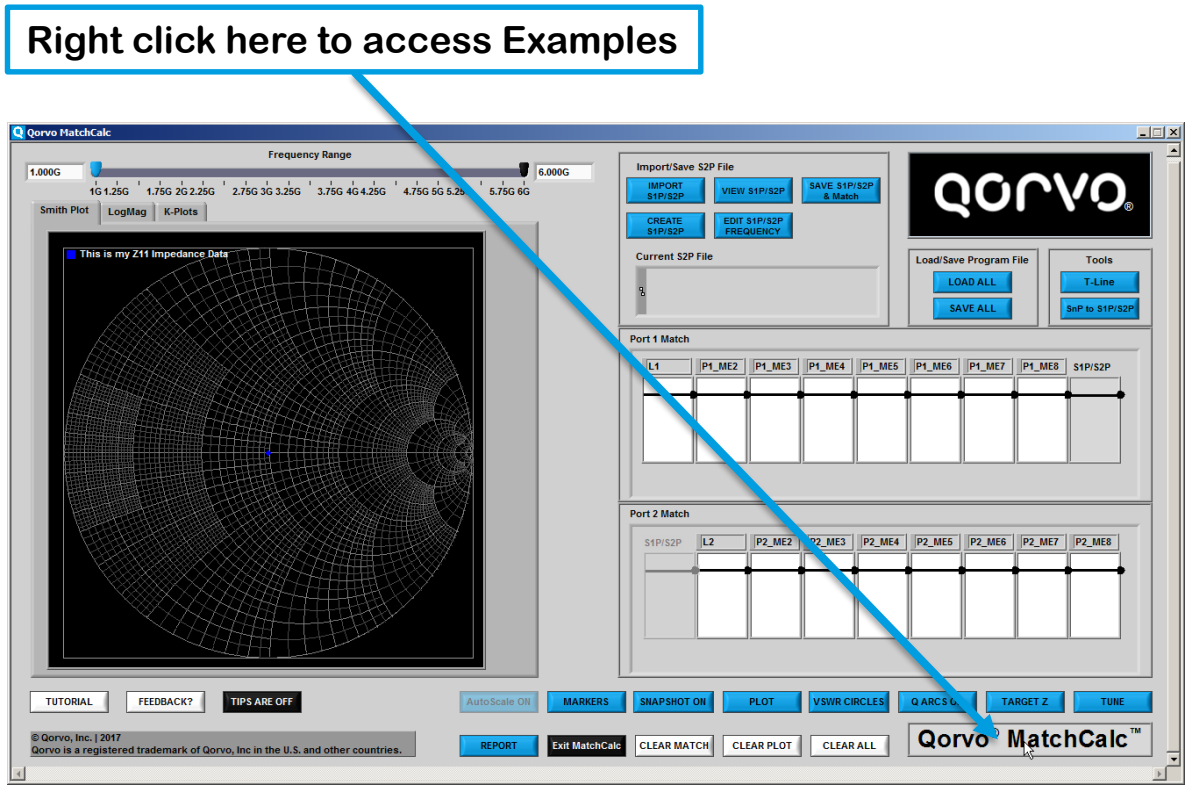
After clicking Add Plot



Qorvo® MatchCalc™ Display

Additional Help

- Work through the Examples for a Step by Step Guide to setting up Plots and other features of Qorvo® MatchCalc™
- To access Examples, right click the Qorvo® MatchCalc™ Logo in the lower right hand portion of the Start Window



Uses for MatchCalc without an S2P file

MatchCalc can display the impedance of passive components and the loss associated with them when a THRU is selected as the Central S2P Element

- Select a THRU for the central S2P element and enter the desired Start Frequency, Stop Frequency and Number of Points or Frequency Increment
- Set up Plots to show the desired data for Port 1 (Input), Port 2 (Output) or Cascaded plots as desired
- Select input and/or output matching components
- Tune as desired
- Save the Qorvo MatchCalc session using SAVE ALL button
- Save the Matched S2P file using SAVE S1P/S2P & MATCH button
- A Report can also be generated using the REPORT button
  - The Report is generated in Microsoft Word and includes the Smith Plot, Log Mag Plot, K-Plots, matching networks and a list of the values of the matching components

Installing Qorvo® MatchCalc™

Installation

File Directory

- Installation Directory:
  Find Qorvo® MatchCalc™ on the Qorvo Webpage under Resources
  - http://www.qorvo.com/design-hub/design-tools
- Click on the link
- If the installation does not start automatically, double click the Setup.exe file to install
- Accept the Software License Agreement and Disclaimer
- Accept the defaults
  - Advanced: You may change the installation directory if you like
- Launch Qorvo® MatchCalc™

General Matching Process
Quick Start Guide

General Matching Process

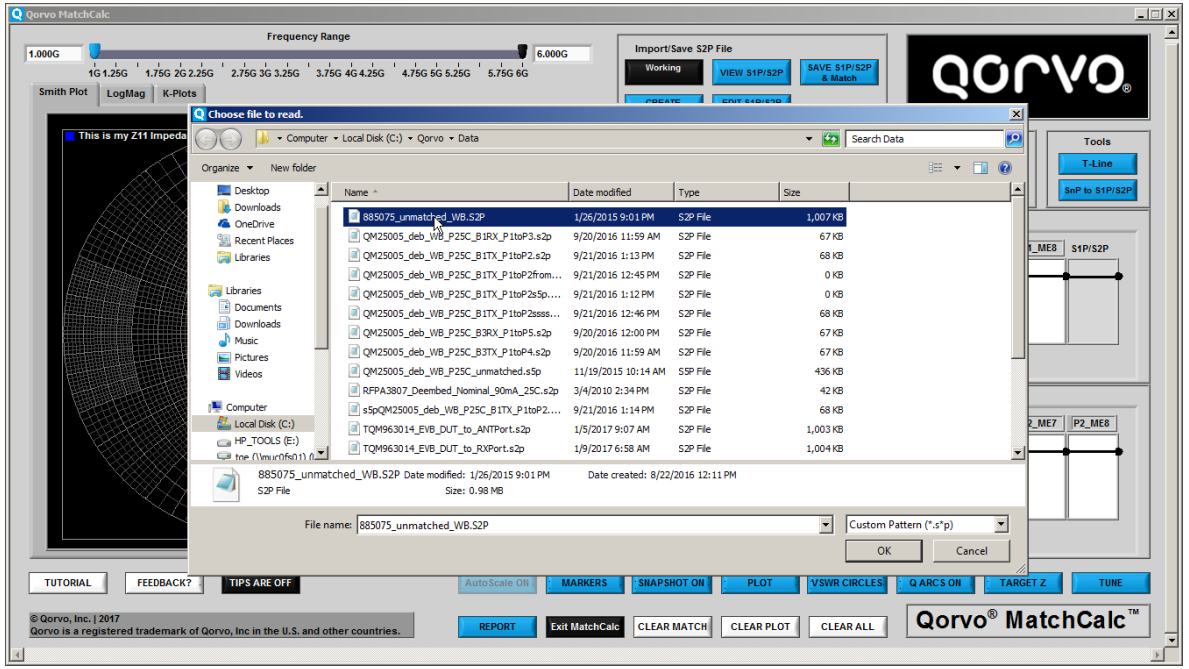
Summary

- General Matching Process consists of the following steps:
  - See Example 1 for the files used here
    - Example 1 can be found by right clicking Qorvo® MatchCalc™ in the lower right hand corner of the main window and clicking the Examples tab
  - Import an S2P file to work with
  - Select the desired plots to view the data
  - Limit Frequency Range as desired
  - Adjust LogMag Amplitude as desired
  - Add snapshots to view interim matching attempts
  - Add matching components as desired
  - Tune the matching components to complete the design
  - View entire frequency range results
  - Save the finished file for future recall and reference
  - Generate a Report in Microsoft Word

General Matching Process-1

Load an S2P file to match

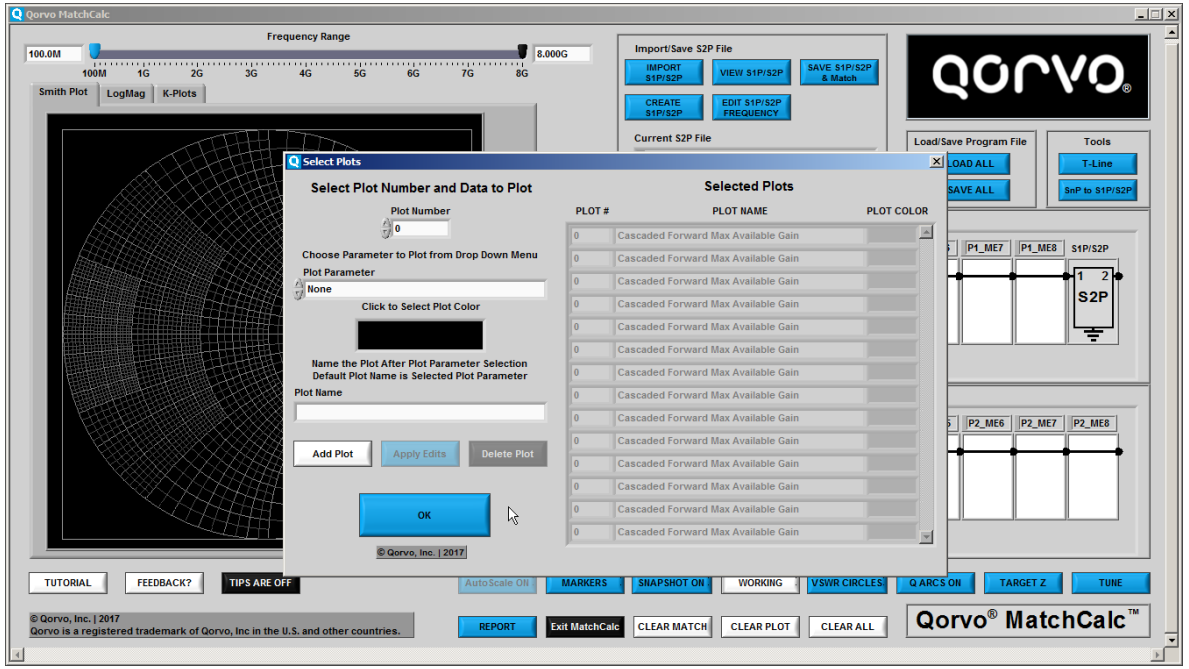
- Launch Qorvo® MatchCalc™ :
- Load S2P File Using IMPORT S2P Button or clicking on the S1P/S2P area of the matching network
- Navigate to the desired S2P file, select it and click OK to load the file
- For now, select the S2P file for 885075_unmatched_WB.s2p
- The actual full path for the location of this file will appear as follows: \\<Local Disk Name:>\Program Files (x86)\Qorvo MatchCalc\Data\ 885075_unmatched_WB.s2p



General Matching Process-3

S2P File loaded, but no Plots previously set-up

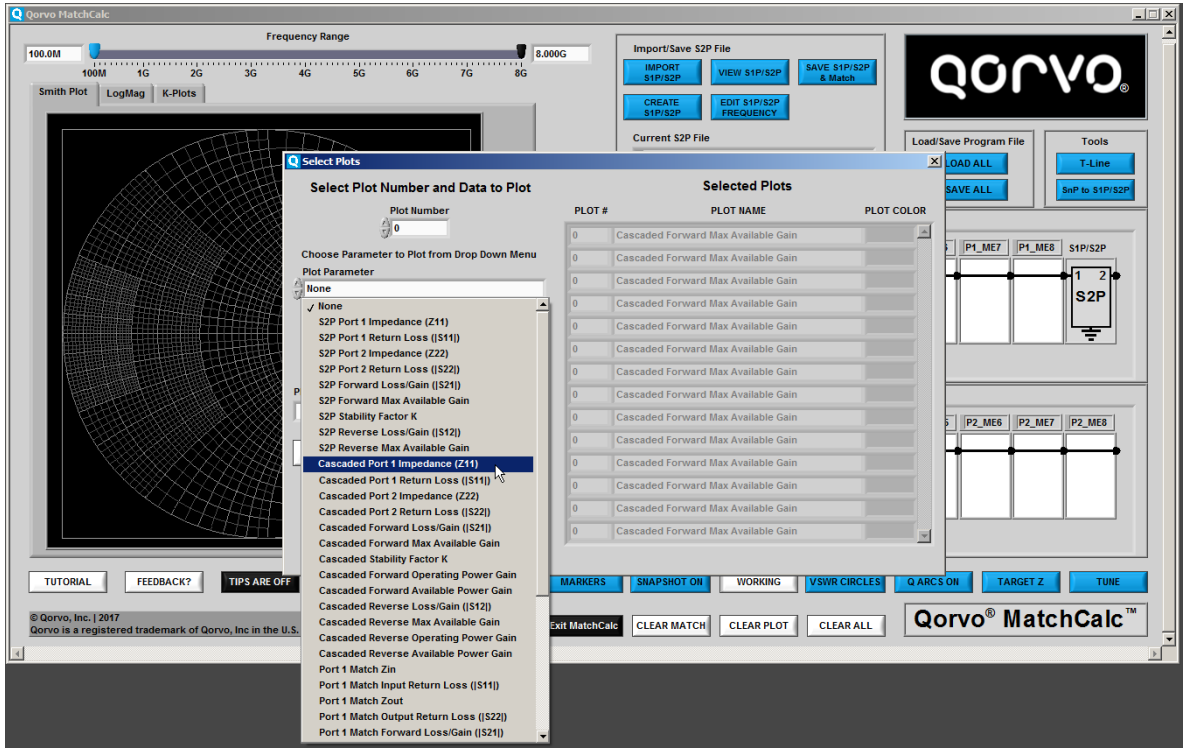
- If no plots have previously been set-up, the Plot Window will appear as shown
- “Plot Number” is at 0
- “Plot Parameter” box shows None
- “Click to Select Plot Color” is Black
- “Plot Name” is Blank
- Add Plot button is active, but Apply Edits and Delete Plot are dimmed
- The Selected Plots window on the right side of the window is all dimmed since no Plots are selected



General Matching Process-4

Click in Plot Parameter Box to display drop down List of Available Plots

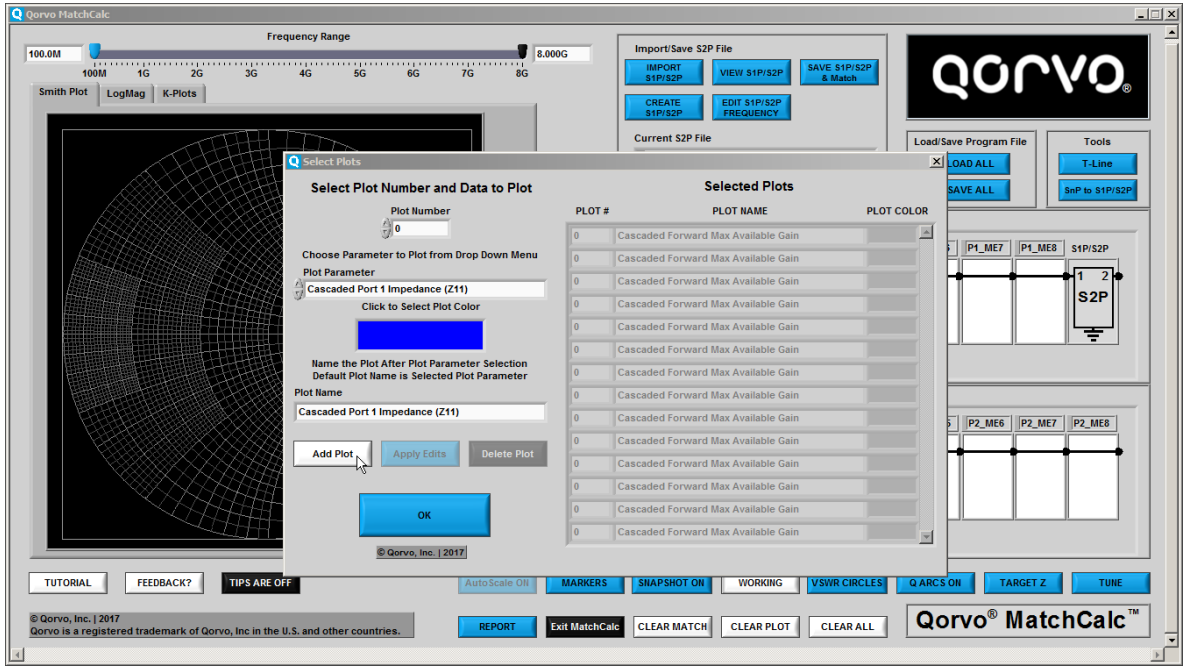
- S2P Plots show only the data at the input and output ports of the actual S2P file. No matching networks are included with these plots
- The Cascaded Plots include all matching components and the central S2P file
- Port 1 and Port 2 Plots show only the matching components before or after the S2P file, with each section terminated in 50 ohms
- Select Cascaded Port 1 Impedance (Z11)



General Matching Process-5

Select remaining Plot details and Add Plot

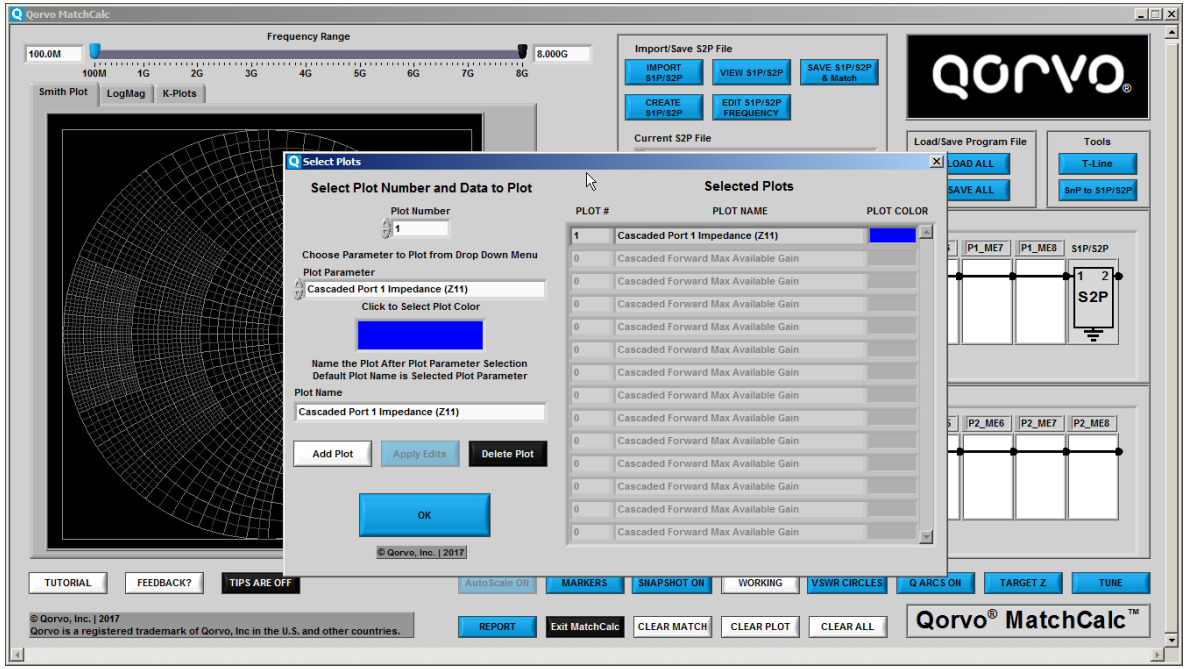
- Note there are still no “Selected Plots” on the right side of the Window
- “Click to Select Plot Color” has changed to blue (Default color for this plot)
- Click in the blue box, if desired, to change the color
- “Plot Name” has changed to the name of the Plot Parameter as a default name
- Click and type in the “Plot Name” box to change or edit the name of the plot
- Once the Plot details are complete, click Add Plot



General Matching Process-6

Repeat to add an additional plot

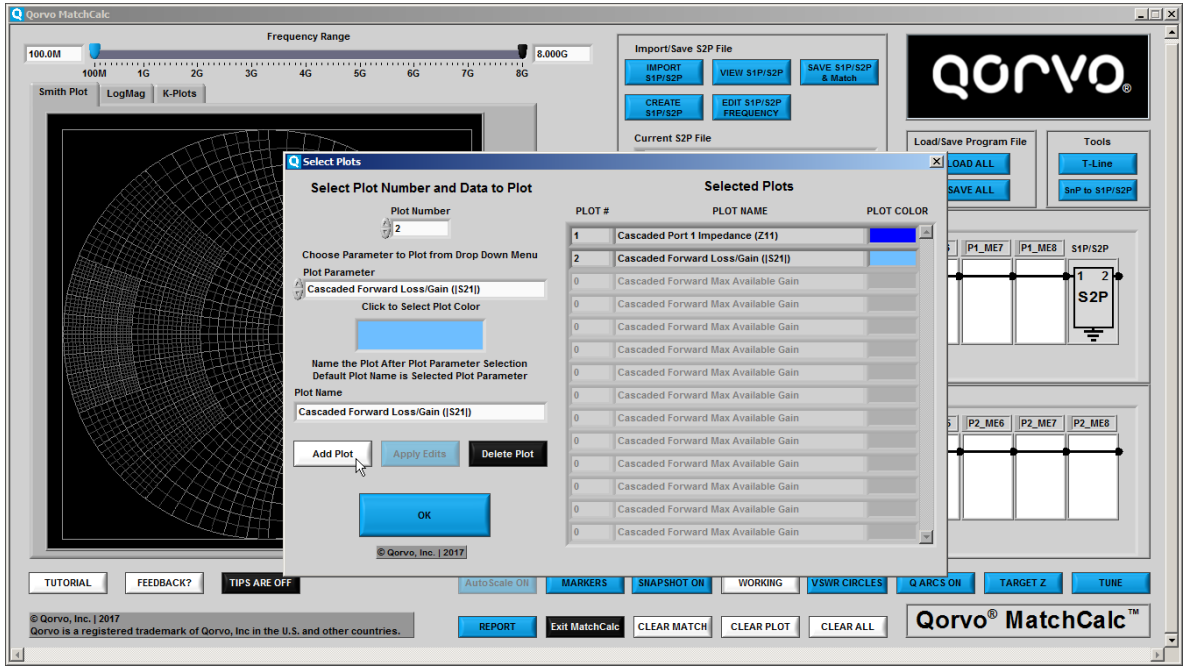
- Results shown at right
  - One Plot now shows in the “Selected Plots” part of the window with the Plot Name and Plot color as selected
  - Note that Delete Plot is now available
- Repeat the process to add “Cascaded Forward Loss/Gain (|S21|)”
- “Plot Number” can now be set to 0 or 1
  - Setting the Plot Number to 1 allows you to edit Plot 1 or to add a new plot after Plot 1
  - To Add a Plot before Plot 1, set the Plot Number to 0 and the new plot will be inserted before Plot 1



General Matching Process-7

Completed adding two plots

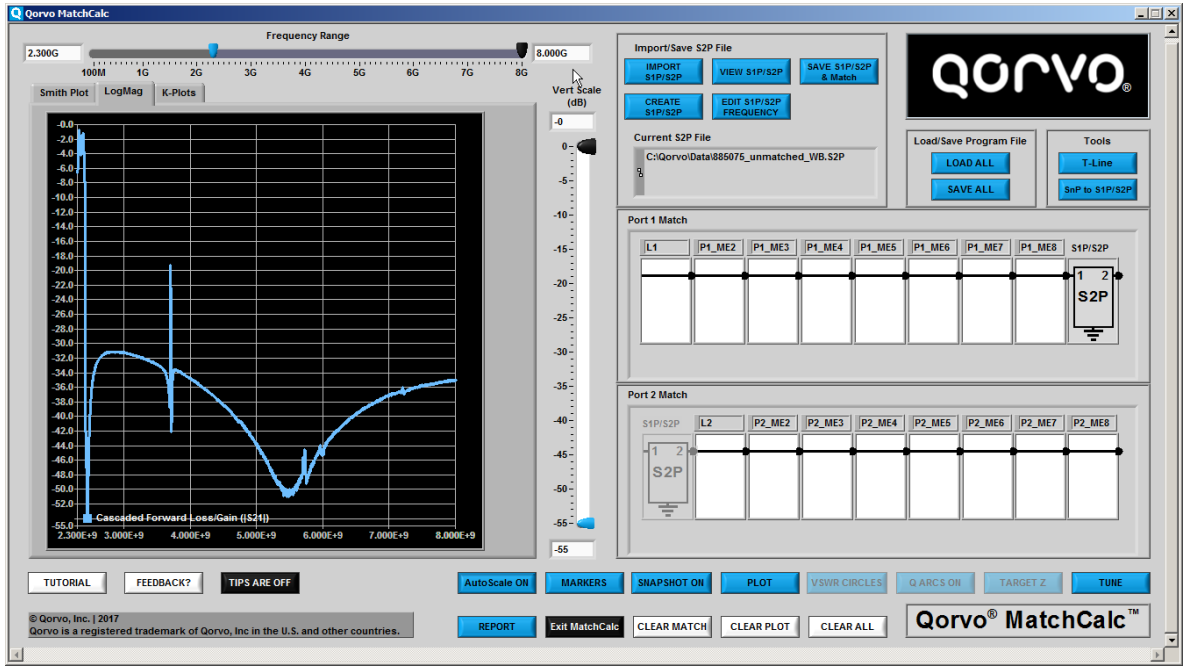
- Results shown at right
  - Two Plots now show in the “Selected Plots” part of the window with the Plot Names and Plot colors as selected
  - Note that Delete Plot is now available
- Click OK to exit PLOT



General Matching Process-8

Limit Frequency Range as desired

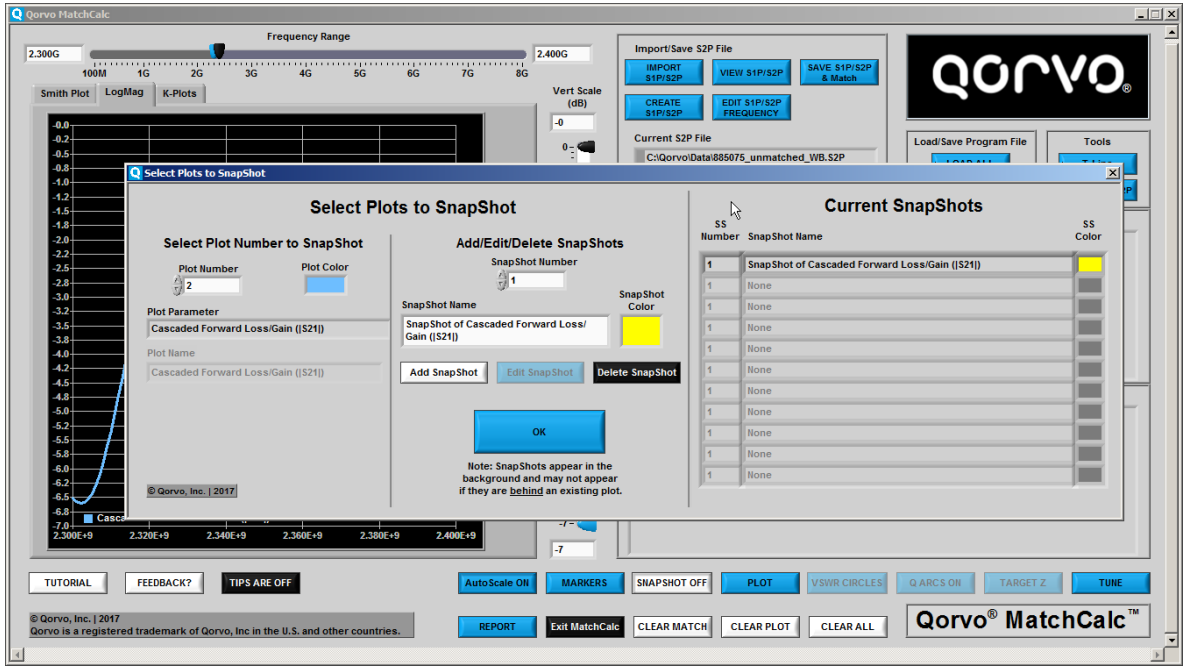
- Limiting the frequency range speeds up match calculations and improves responsiveness during tuning
- Set the Start Frequency to 2300 MHz by sliding the lower frequency marker to the right
  - You can also just type 2.3G or 2300M in the left hand box on the frequency display
- Repeat with the upper frequency marker to select 2400 MHz for the stop frequency



General Matching Process-9

Add SnapShots to keep record of starting point or interim steps

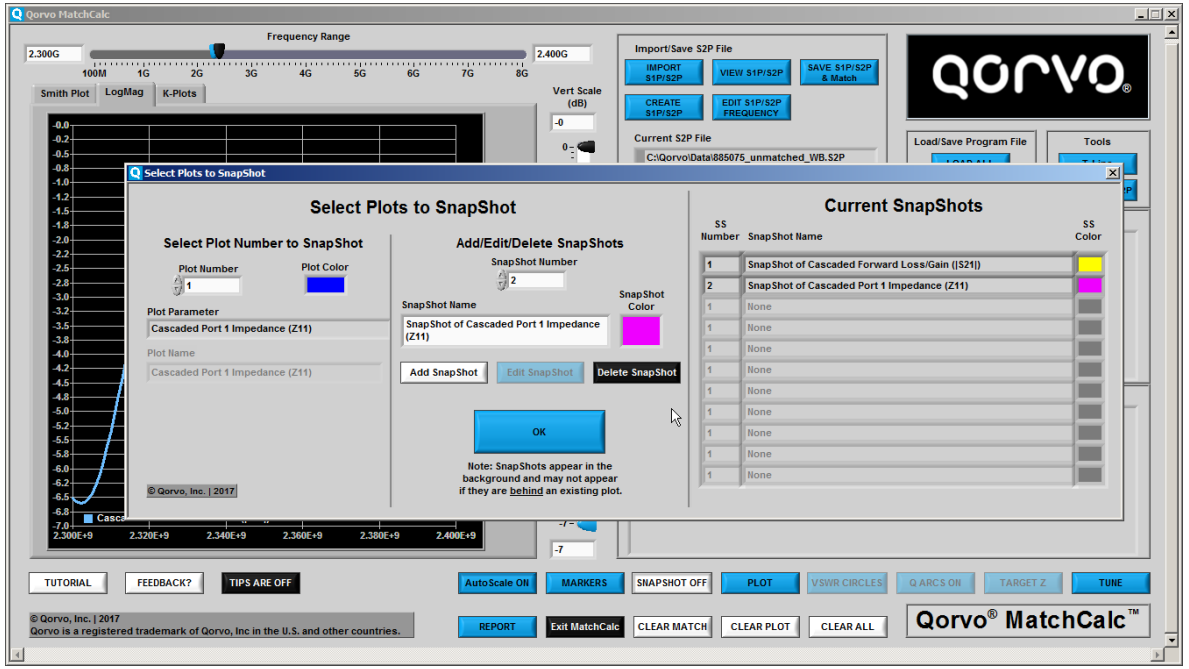
- SNAPSHOT is a static copy of a plot
  - Fixed value, not affected by further changes to match
  - Add SNAPSHOT of starting point so that you can compare to match results
- Click the SNAPSHOT ON Button
  - SNAPSHOT window appears.
  - Note Plot # 2 shows on the left side of the window. Plot 1 or Plot 2 can be selected
- At window center, click on Add SnapShot, click on SnapShot color to select a color for the SnapShot, Type a SnapShot name
- Click Edit SnapShot
- You can also just change the color and the SnapShot name before clicking Add SnapShot



General Matching Process-10

Repeat previous step to add a second SnapShot for the other plot

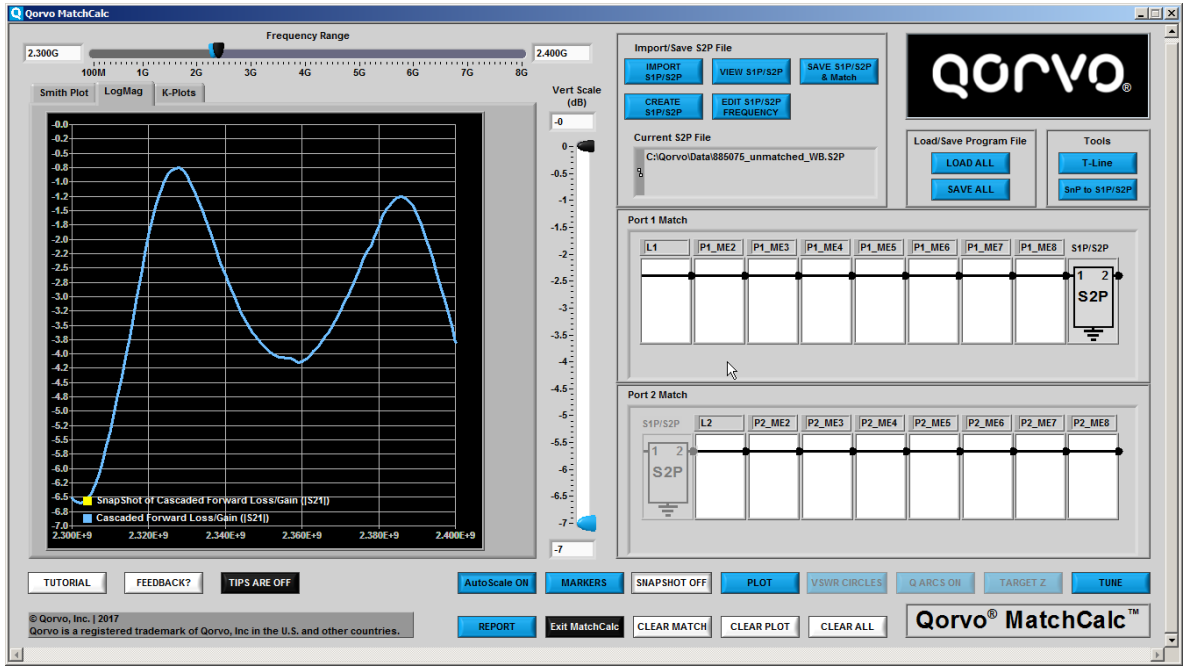
- Results of adding second SnapShot shown at right
- You can edit the SnapShots as desired by selecting the number of the SnapShot you want to edit
- Click OK to exit SnapShot



General Matching Process-11

SnapShots are in the background

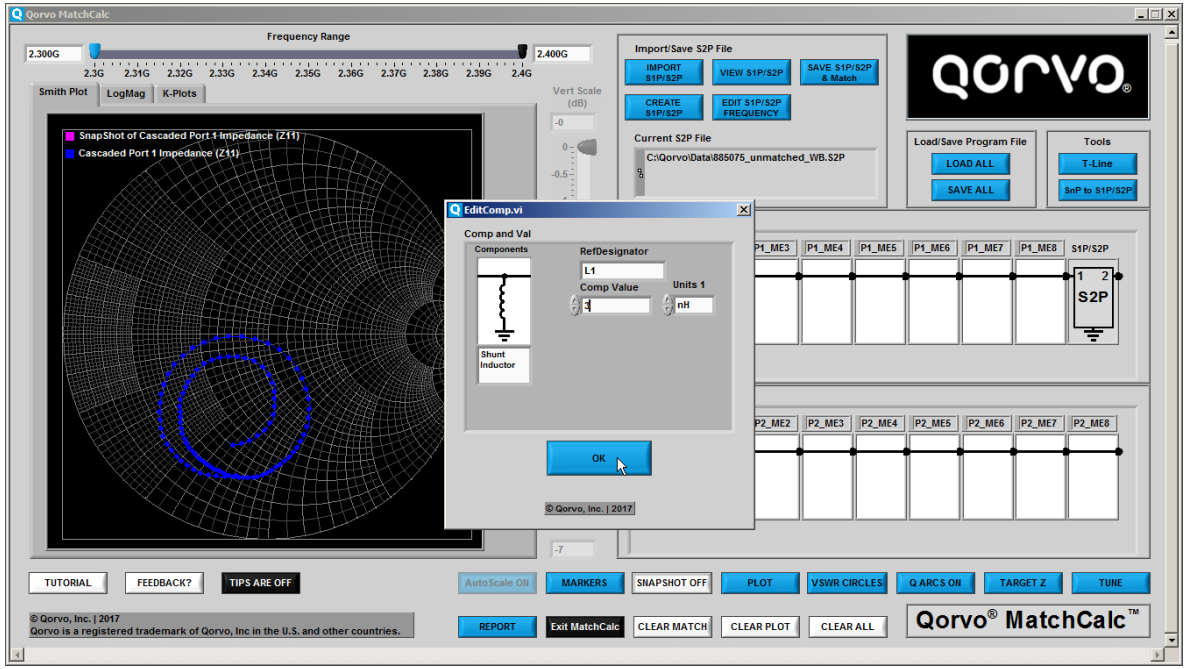
- Note that on both LogMag and Smith Plot displays, the legend now shows the SnapShot as well as the original plots
- The SnapShot is not visible because it is directly under Plot 1 or Plot 2



General Matching Process- 12

Add Matching Components - 1

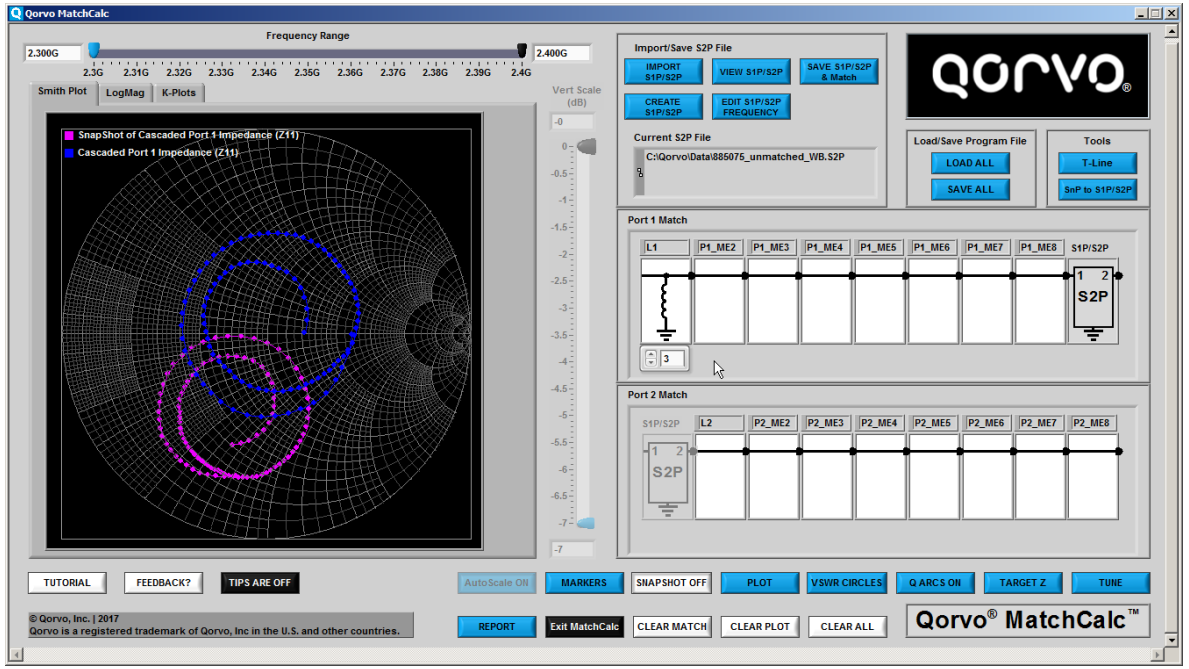
- Select the Smith Plot Tab
- Add Matching Components as Needed
  - Click on any of the Matching Elements on the Port 1 side of the S2P file
  - Click on the Component box and select the shunt inductor
  - Type L1 in the Ref Designator box
  - Type 3 for the component value
- You should see the window at the right and you are ready to click OK



General Matching Process- 13

Add Matching Components - 2

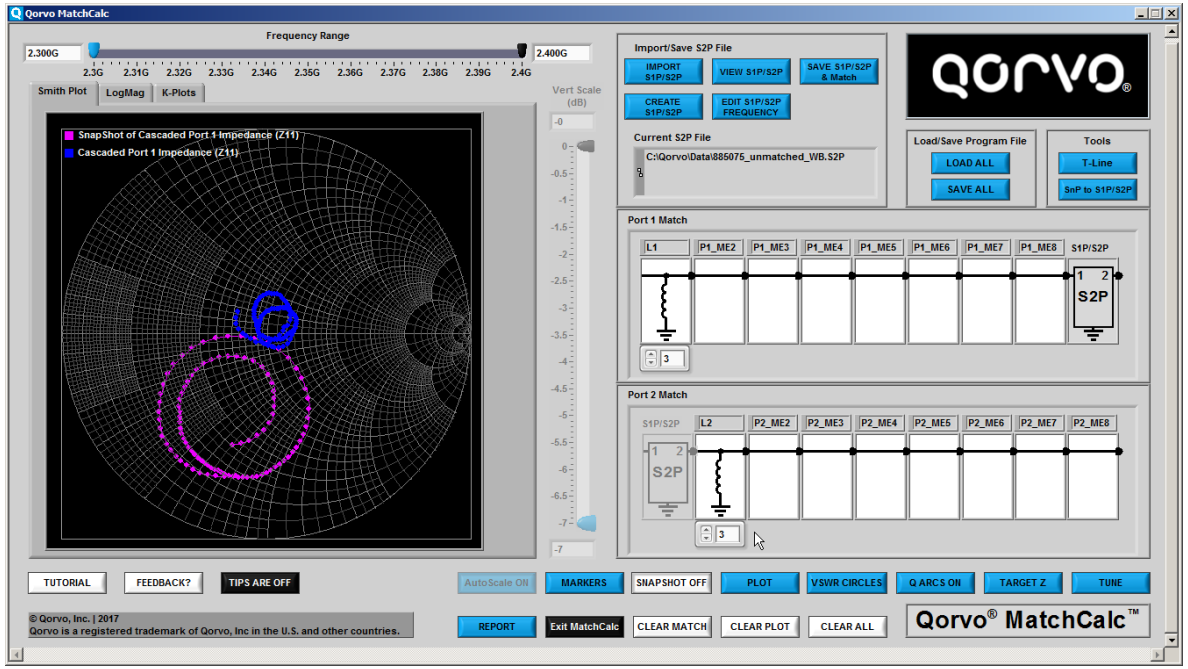
- See results at right
- The SnapShot (starting point) is in Magenta while the Current Match is in Blue
- This particular filter requires a shunt phasing inductor of about 3 nH at the output (Port 2) to reduce the locus of points
- Add that inductor now and move on to the next page



General Matching Process- 14

Add Matching Components - 3

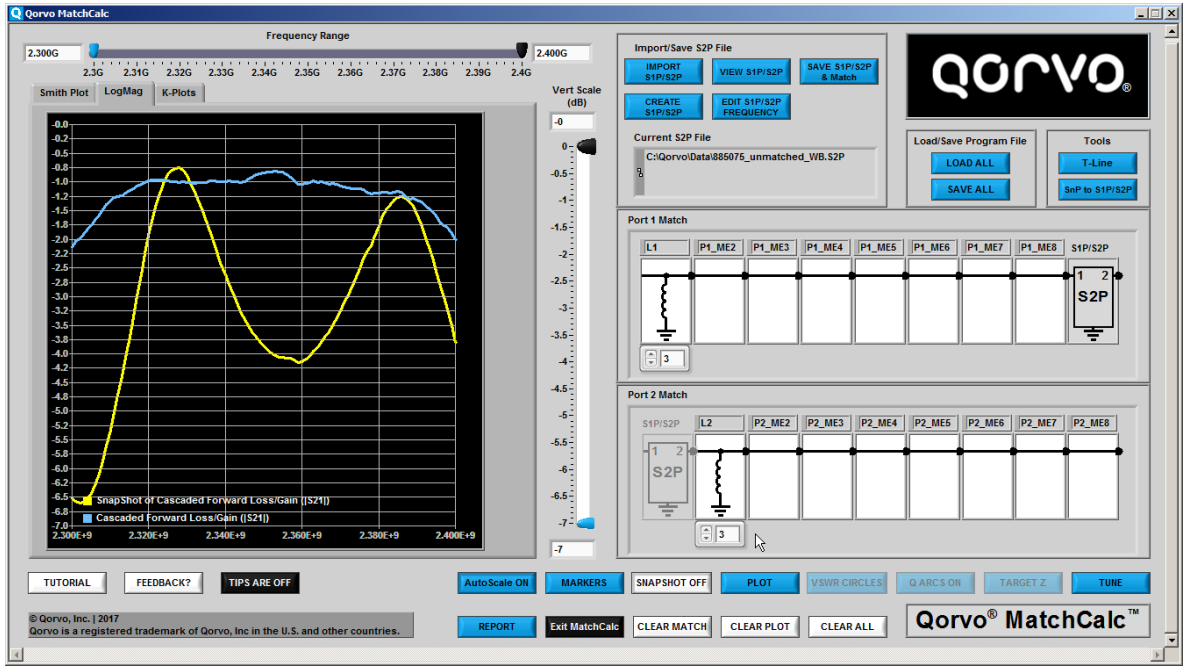
- Smith Plot results with phasing inductor added
- Now the match is about 1.5:1
- The next page show the LogMag Results



General Matching Process- 15

Add Matching Components - 4

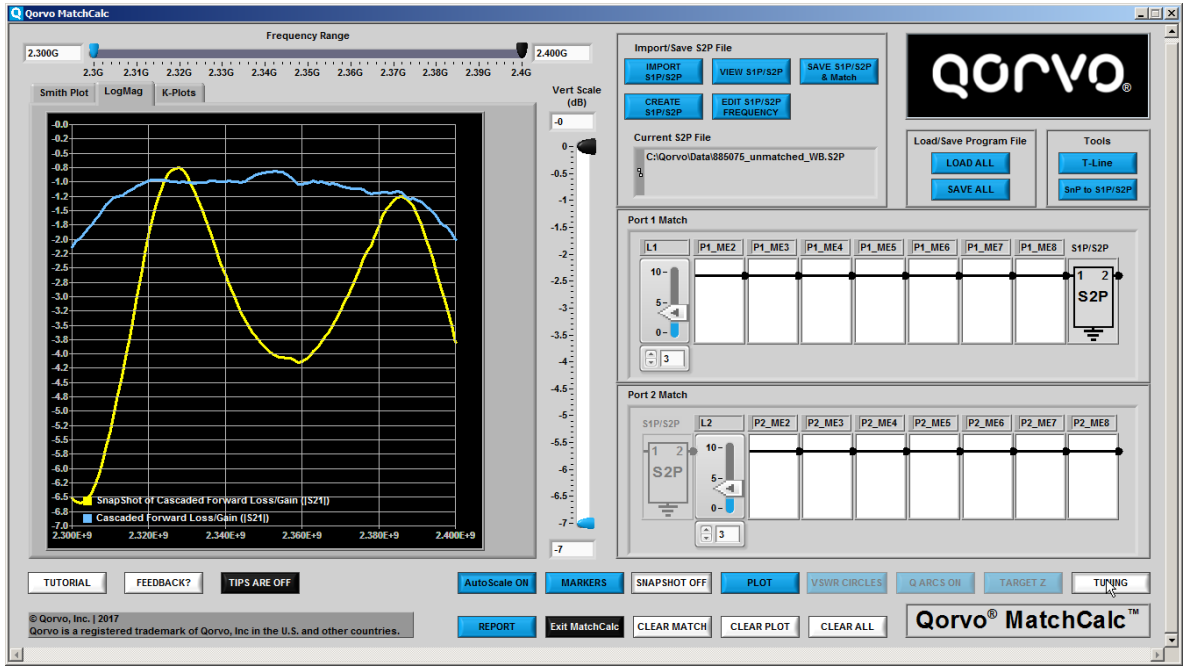
- LogMag Plot results with phasing inductor added
- Vertical Scale Auto Scales to show a range of -5 dB to 0 dB



General Matching Process-16

Using the TUNE button

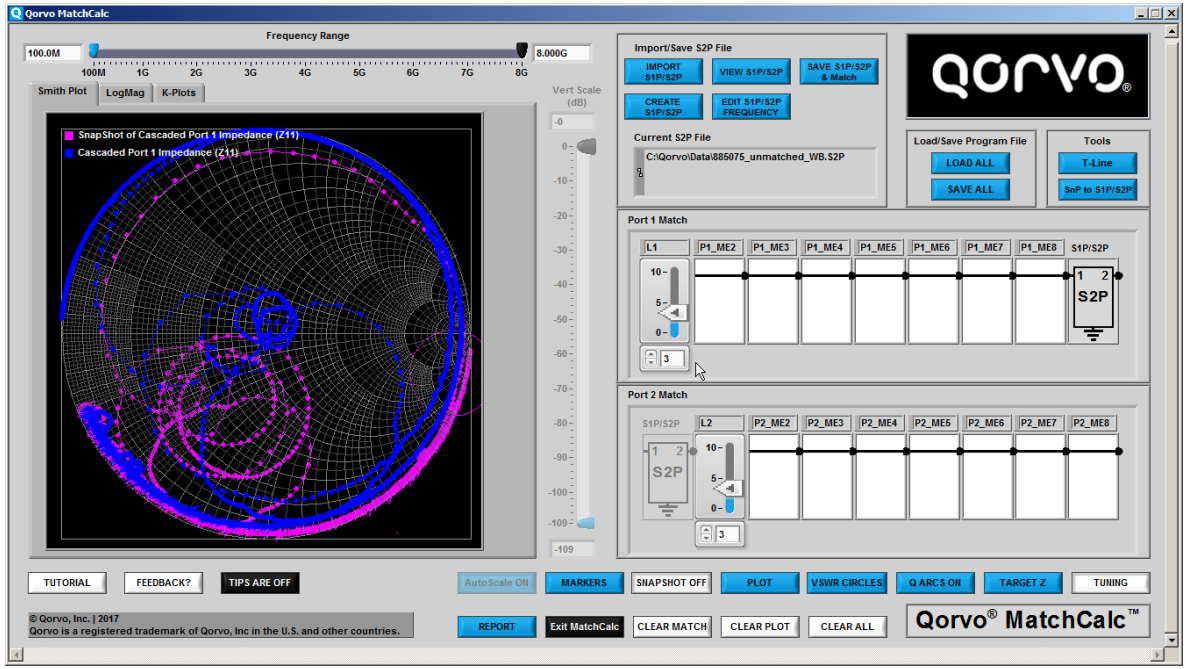
- Use TUNE Button to Enable Slide Control of Component Values
  - Complete Matching Process
  - You can also increment or decrement the component value in 0.1 increments using the arrows next to the component values with or without TUNING active



General Matching Process-17

View Smith Plot data over full frequency range

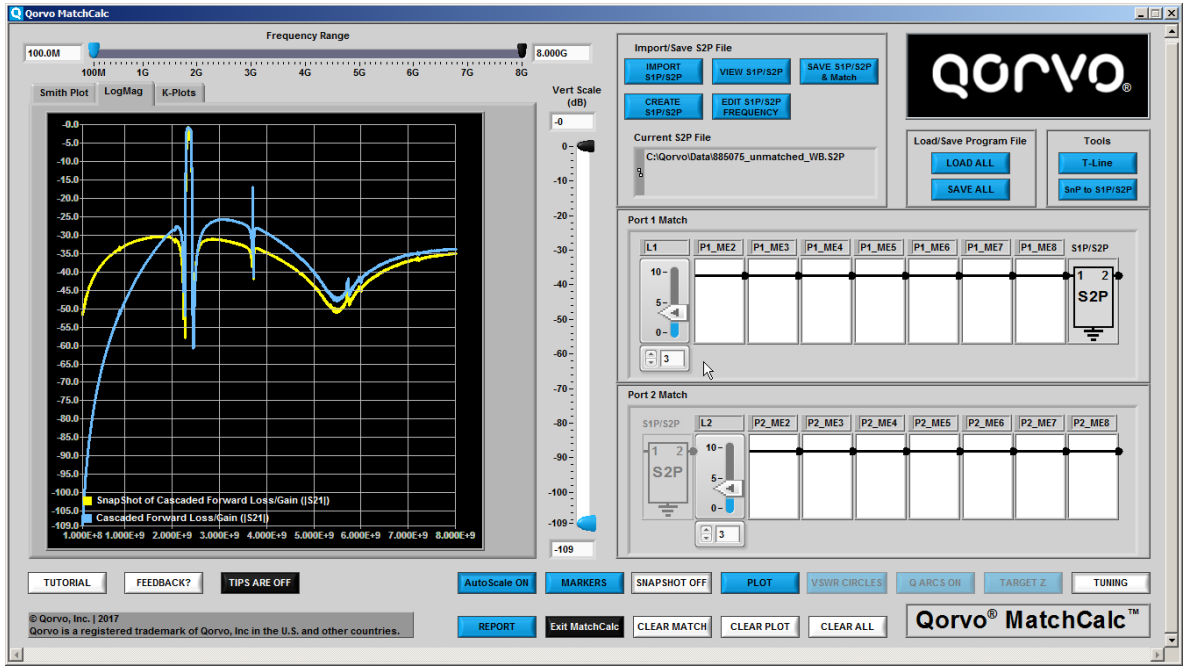
- View full frequency range by adjusting the frequency slider to its original limits
  - Right Click the Frequency Bar and select Max Limits
  - Grab each of the sliders and move it to the end of the bar or type the value at the end of the bar into the box on either end of the frequency bar
- The next pages shows the LogMag Display for full frequency



General Matching Process-18

View LogMag data over full frequency range

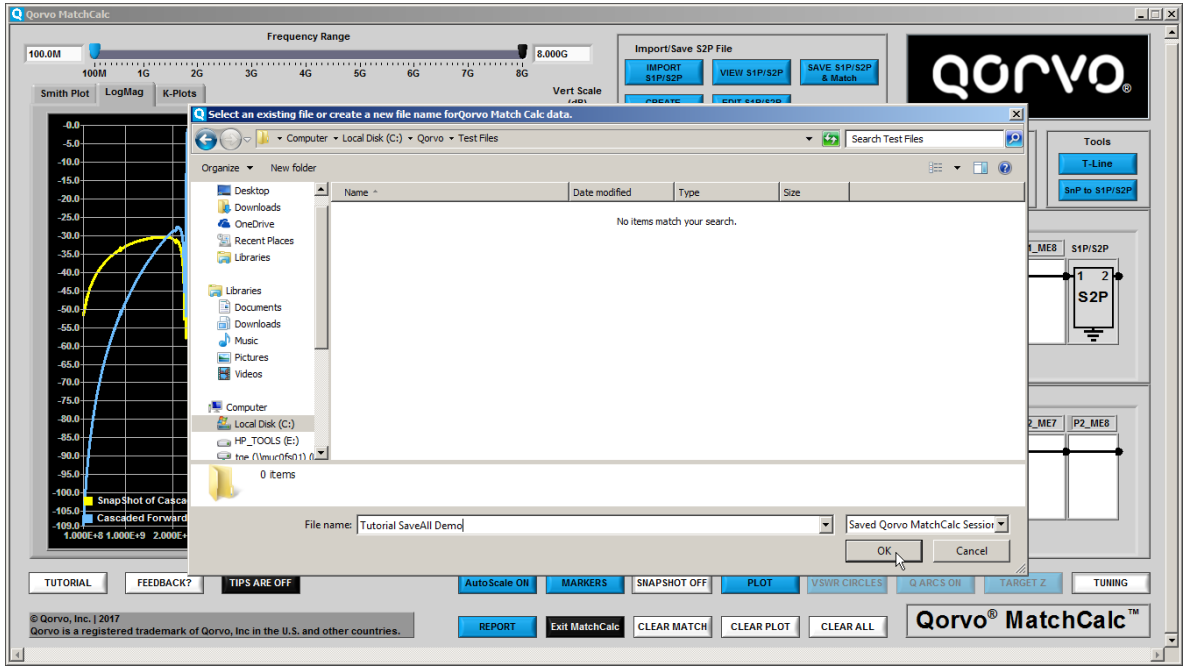
- View full frequency range by adjusting the frequency slider to its original limits
- The session can be saved using the Save All button
- A Report can also be generated in Microsoft Word using the REPORT button



General Matching Process-19

SAVE ALL

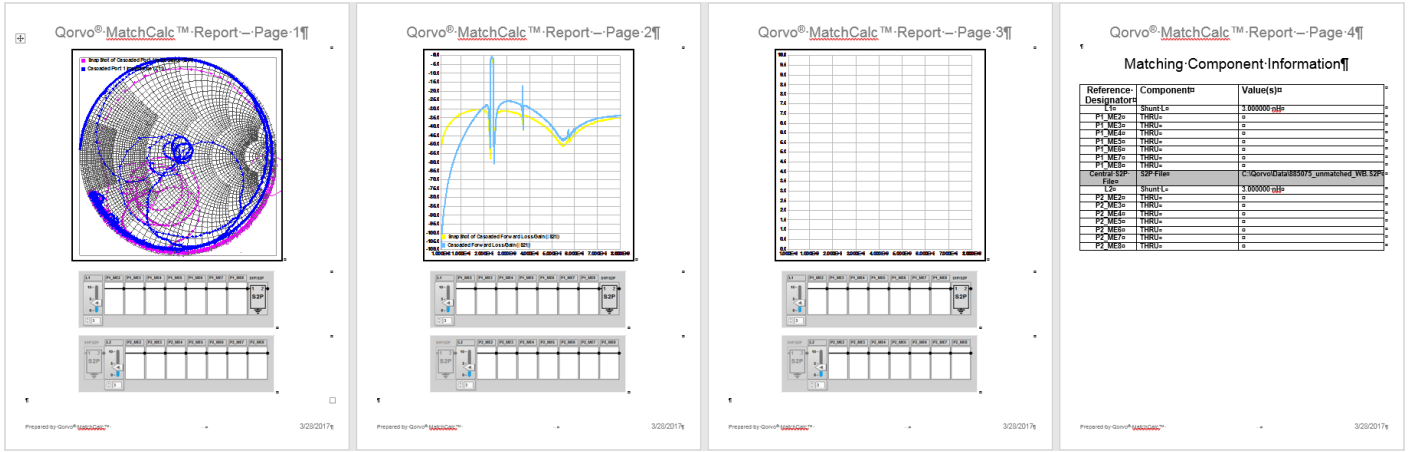
- Type in a file name for the saved session. The extension for Qorvo® MatchCalc™ is .QMCx and is applied automatically to the file name
- The Load All button can be used to load an existing Qorvo® MatchCalc™ file



General Matching Process-20

REPORT

- To Generate a Report, Click the REPORT button
- This option requires Microsoft Word installed on your computer
- You can also right click the Smith Plot or LogMag Plots to copy the respective plots or data to the clipboard or to a file to generate your own Report format with other word processing programs or spreadsheets



Plot Definitions

Viewing your data and work

Power Gain Definitions

Power Gain

- Qorvo® MatchCalc™ source and load impedances are defined as Z_0
  - It is not possible in Qorvo® MatchCalc™ to terminate a network in an arbitrary impedance
- Loss or Gain (Also known as Transducer Gain for Z_0 systems)
  - Ratio of power delivered to the load to the power available from the source
  - $Forward\ Gain = Transducer\ Gain(at\ Z_0) = \ 10 * log(|S_{21}|^2)$ (in dB)
- Operating Power Gain (Also known as Operating Gain for Z_0 systems)
  - Ratio of power delivered to the load to the power delivered to network from source
  - $Operating\ Power\ Gain = 10 * log(\frac{|S_{21}|^2}{(1-|S_{11}|^2)})$
- Available Power Gain
  - Ratio of power available from network output port to power from available from source
  - $Available\ Power\ Gain = 10 * log(\frac{|S_{21}|^2}{(1-|S_{22}|^2)})$

Max Available Gain Definition

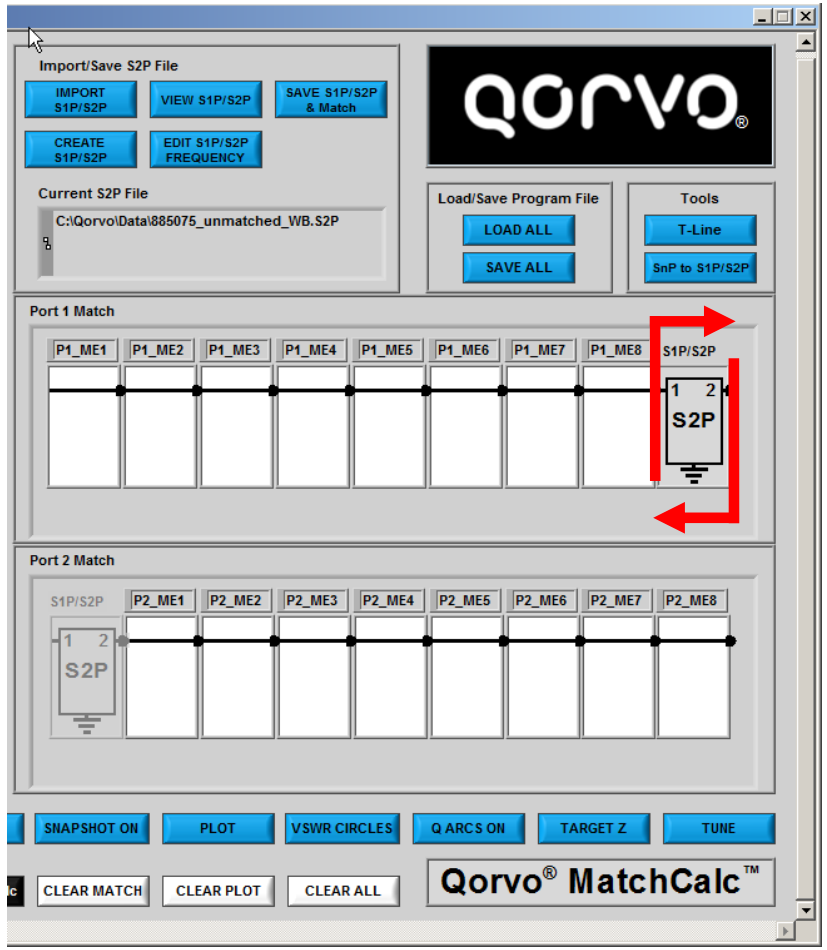
Max Available Gain

- **Qorvo® MatchCalc™ source and load impedances are defined as Z_0**
  - **It is not possible in Qorvo® MatchCalc™ to terminate a network in an arbitrary impedance**
- **Max Available Gain is defined as:**
  - $G_{MAX} = \left[10 * \log\left(\frac{1}{(K+\sqrt{K^2-1})} * \left|\frac{S_{21}}{S_{12}}\right|\right)\right]$ **dB for K>1 and B1>0, or**
  - $G_{MAX} = \left[10 * \log\left(\left(K+\sqrt{K^2-1}\right) * \left|\frac{S_{21}}{S_{12}}\right|\right)\right]$ **dB for K>1 and B1<0, where**
  - **where**
  - $K = \frac{1-|S_{11}|^2-|S_{22}|^2+|S_{11}*S_{22}-S_{12}*S_{21}|^2}{2*|S_{21}S_{12}|}$
  - $B1 = 1 + |S11|^2 - |S22|^2 - |S_{11} * S_{22} - S_{12} * S_{21}|^2$
  - $G_{MAX} = \left|\frac{S_{21}}{S_{12}}\right|$ **for K≤1 (Also known as Max Stable Gain or G_{MSG})**

Plot Definitions-1

S2P Plots

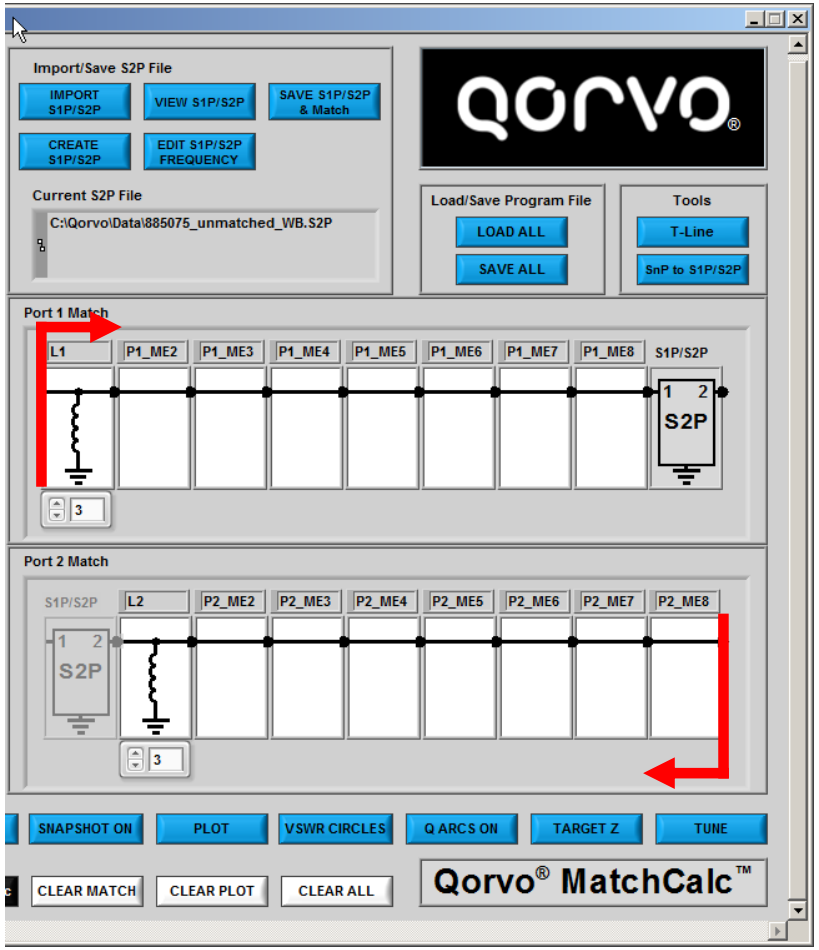
- S2P Port 1 Impedance (Z11)
  S2P Port 1 Return Loss (|S11|)
  S2P Port 2 Impedance (Z22)
  S2P Port 2 Return Loss (|S22|)
  S2P Forward Loss/Gain (|S21|)
  S2P Forward Max Available Gain
  S2P Reverse Loss/Gain (|S12|)
  - Reference Planes shown at right
  - Plots refer to Central S2P file only
  - No contribution from matching networks
  - All ports referenced to 50 Ohm port impedance



Plot Definitions-2

Cascaded Plots

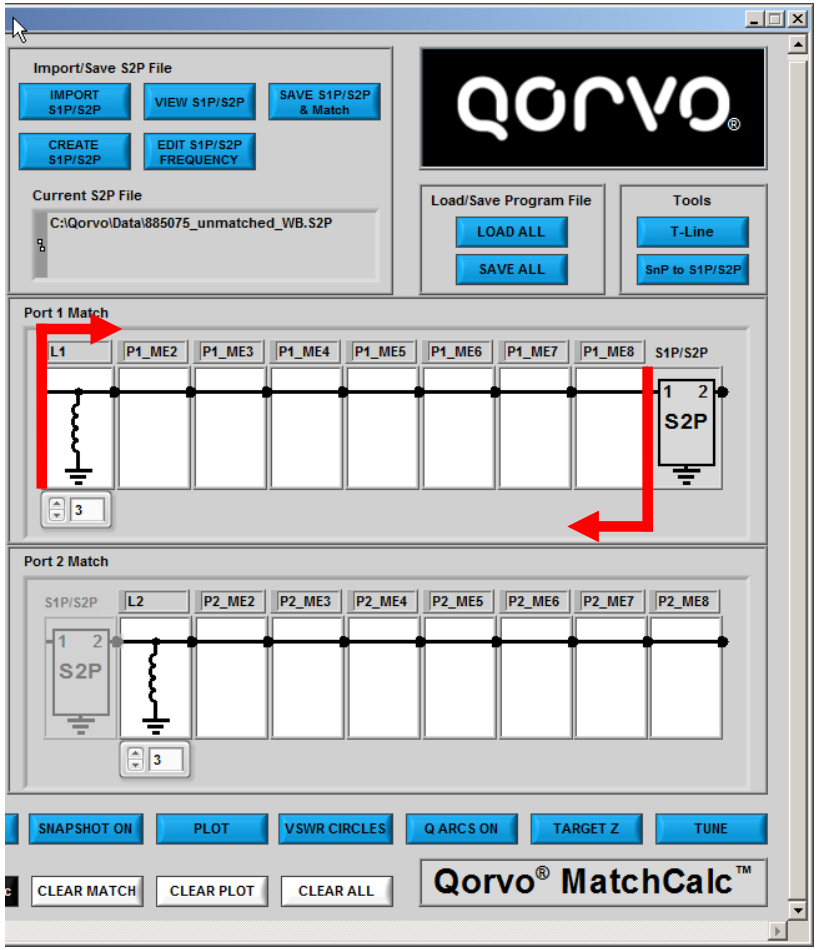
- Cascaded Port 1 Impedance (Zin)
  Cascaded Port 1 Return Loss (|S11|)
  Cascaded Port 2 Impedance (Zout)
  Cascaded Port 2 Return Loss (|S22|)
  Cascaded Forward Loss/Gain (|S21|)
  Cascaded Forward Max Available Gain
  Cascaded Forward Power Gain
  Cascaded Forward Available Pwr Gain
  Cascaded Reverse Loss/Gain (|S12|)
  - Reference Planes for these plots at right
  - Plots refer to Full Cascaded Network
  - All plots referenced to 50 ohm port impedance



Plot Definitions-3

Port 1 Match Section Plots

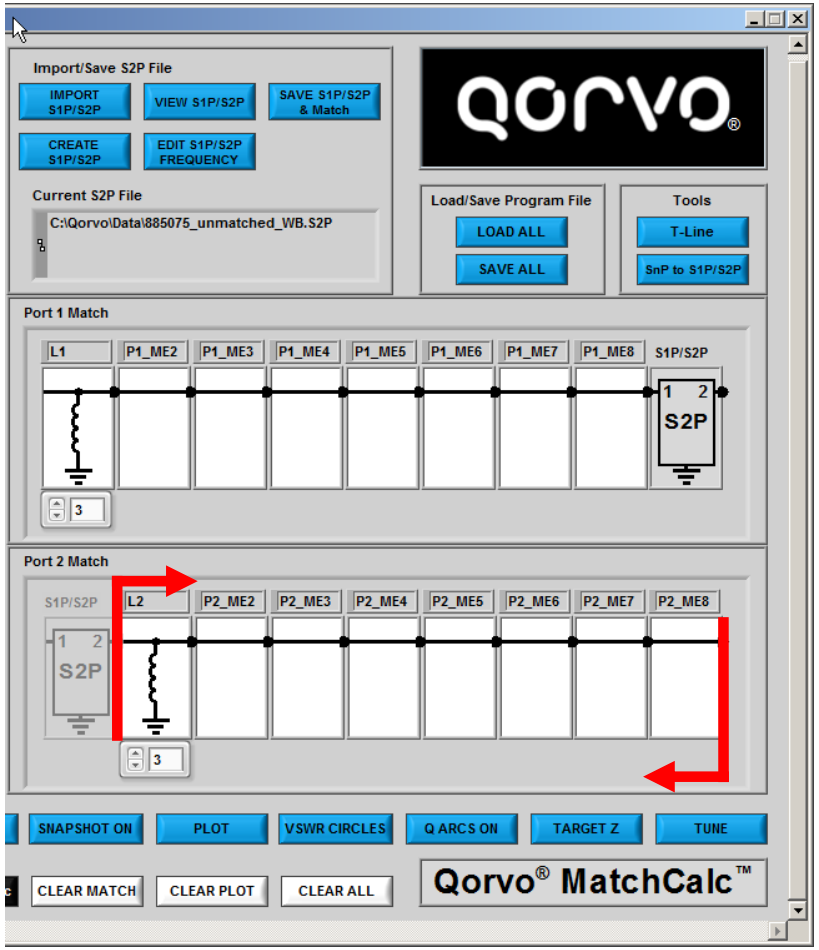
- Port 1 Match Impedance (Z11)
  Port 1 Match Return Loss (|S11|)
  Port 1 Match Impedance (Z22)
  Port 1 Match Return Loss (|S22|)
  Port 1 Match Forward Loss/Gain (|S21|)
  Port 1 Match Forward Max Available Gain
  Port 1 Match Reverse Loss/Gain (|S12|)
  - Reference Planes for these plots at right
  - Plots refer to Port 1 Match Section Only
  - No contribution from S2P File or Port 2 Match Section
  - All ports referenced to 50 Ohm port impedance



Plot Definitions-4

Port 2 Match Section Plots

- Port 2 Match Impedance (Z11)
  Port 2 Match Return Loss (|S11|)
  Port 2 Match Impedance (Z22)
  Port 2 Match Return Loss (|S22|)
  Port 2 Match Forward Loss/Gain (|S21|)
  Port 2 Match Forward Max Available Gain
  Port 2 Match Reverse Loss/Gain (|S12|)
  - Reference Planes for these plots at right
  - Plots refer to Port 2 Match Section Only
  - No contribution from S2P File or Port 1 Match Section
  - All ports referenced to 50 Ohm port impedance



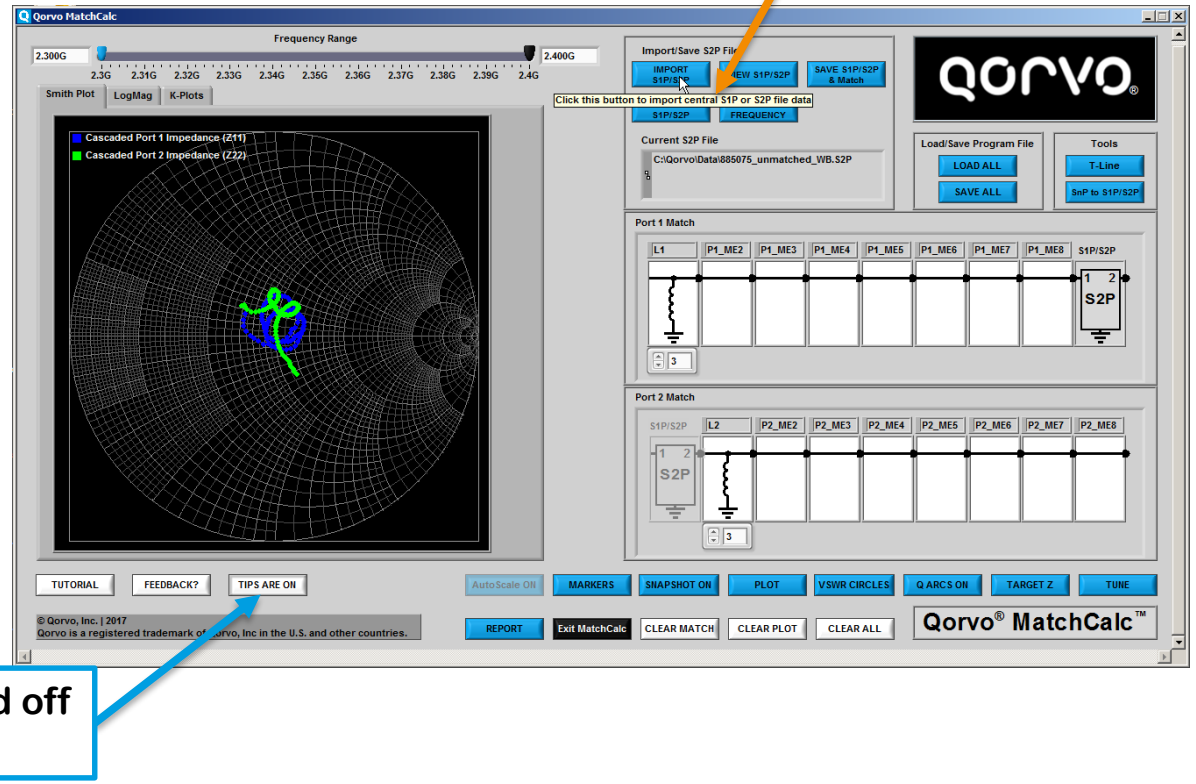
What the buttons do

Getting around Qorvo® MatchCalc™

What the Buttons Do- General

TipStrips

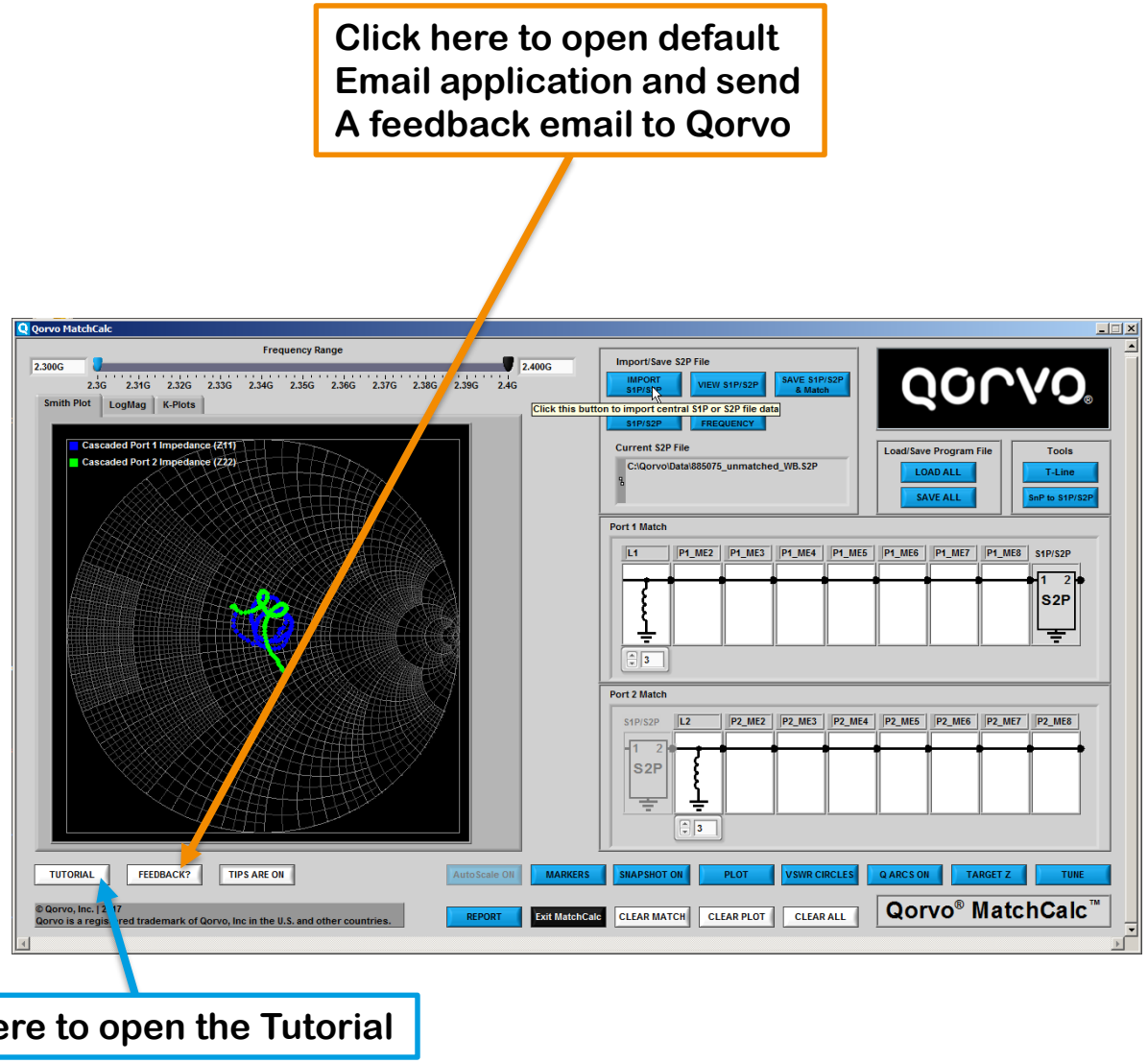
- TipStrips
  - Hovering over any button or control will generally cause a TipStrip to appear
  - These TipStrips provide reminders and information about how to use the button
  - They also provide info about whether or not a Left Click or Right Click option exists
  - Tip Strips can be turned off with the button shown at right



What the Buttons Do- General

TUTORIAL and FEEDBACK?

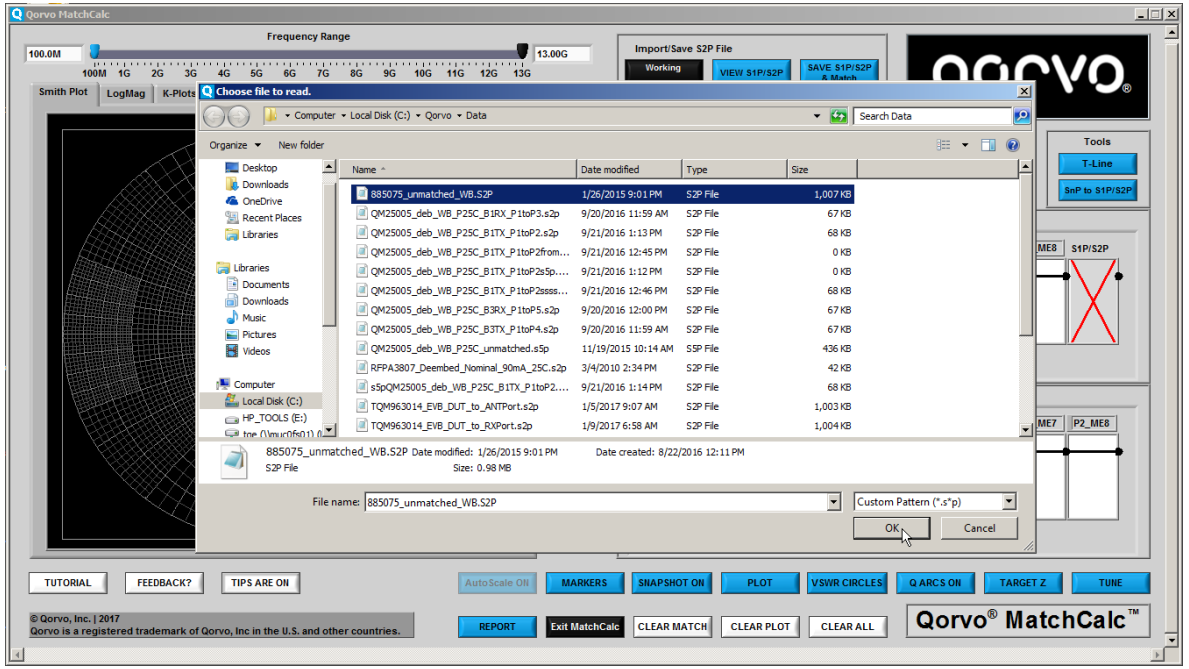
- **TUTORIAL**
  - Opens the default pdf viewer and a copy of the tutorial information
  - Tutorial may be moved off to the side and left open while operating Qorvo® MatchCalc™
- **FEEDBACK?**
  - Opens the default email application and addresses an email to Qorvo, allowing you to provide comments, report bugs or errors, or communicate in any way relative to Qorvo® MatchCalc™



What the Buttons Do-1

IMPORT S1P/S2P

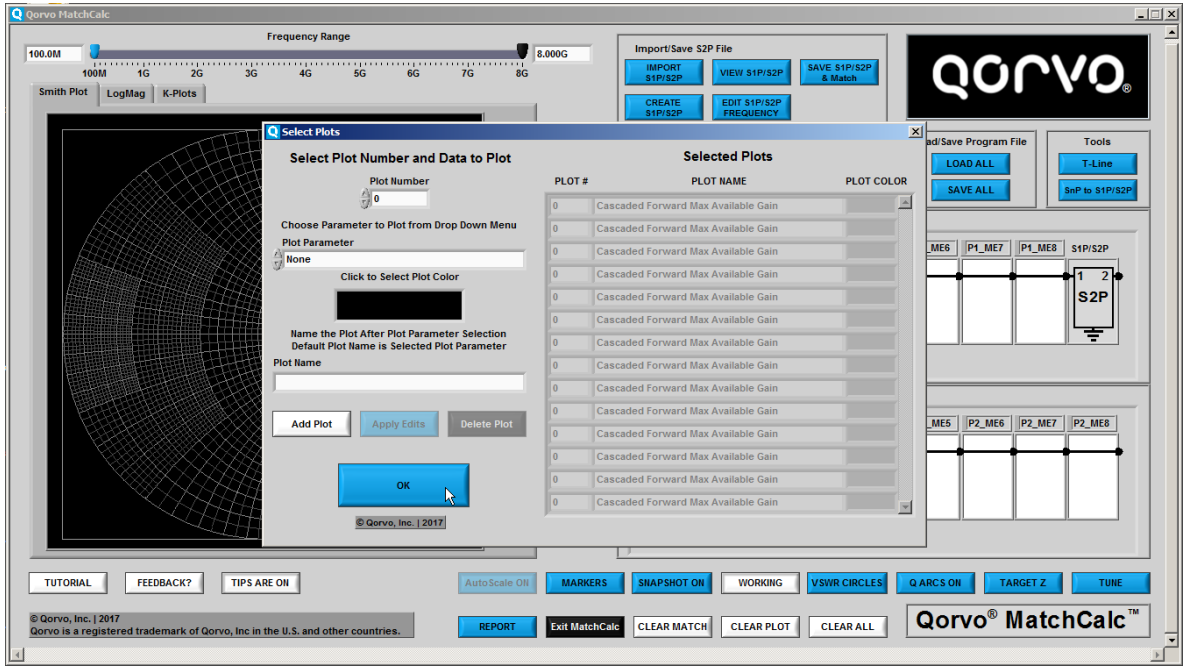
- **IMPORT S1P/S2P**
  - Brings up file selection window
  - Navigate to desired directory
  - Select desired file
  - Note: The S2P file determines the frequency range for the plots and tuning calculations
  - If Cancel is selected with the file selection window open, a THRU is automatically selected for the central S2P component and the Manual Frequency Window appears



What the Buttons Do-2

After S1P/S2P File Import:

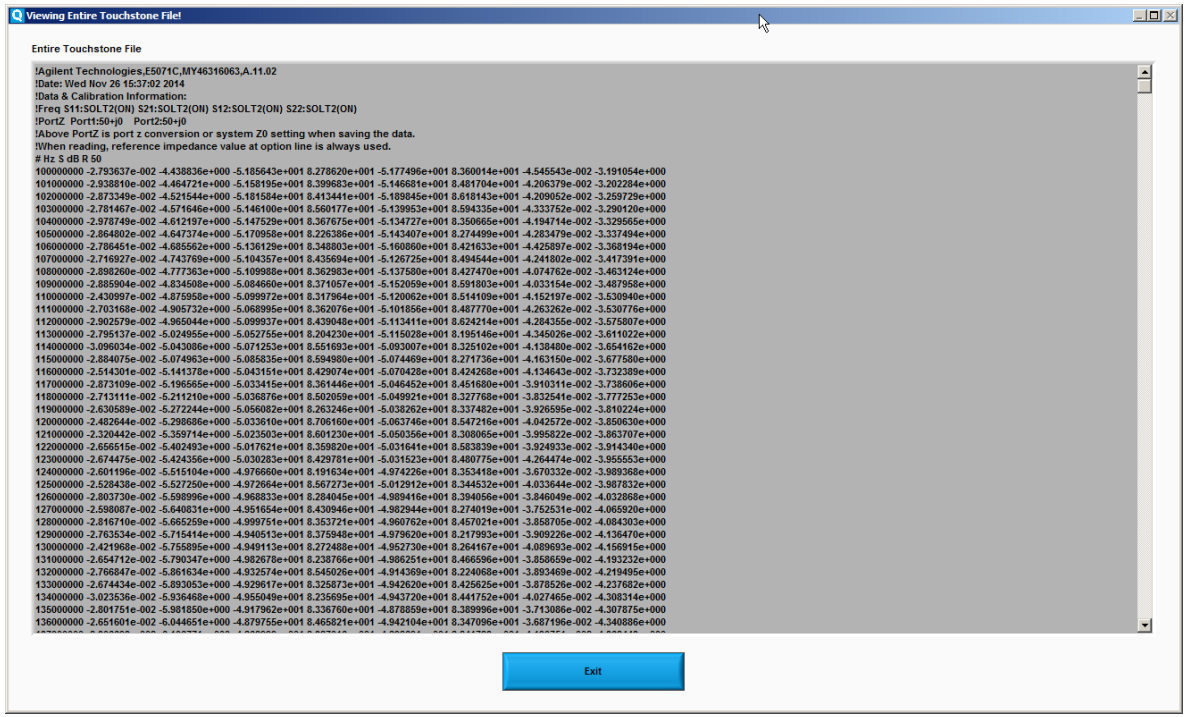
- **Select Plots**
  - After the S1P or S2P file is loaded, the Select Plots window appears unless you have previously set up plots for this session
  - This is to remind you that no data can be viewed until you have selected the data to plot
  - Add one or more plots to the Selected Plots table to keep this window from appearing automatically
  - Select Plots window always appears when the PLOT button is clicked



What the Buttons Do-3

VIEW S1P/S2P

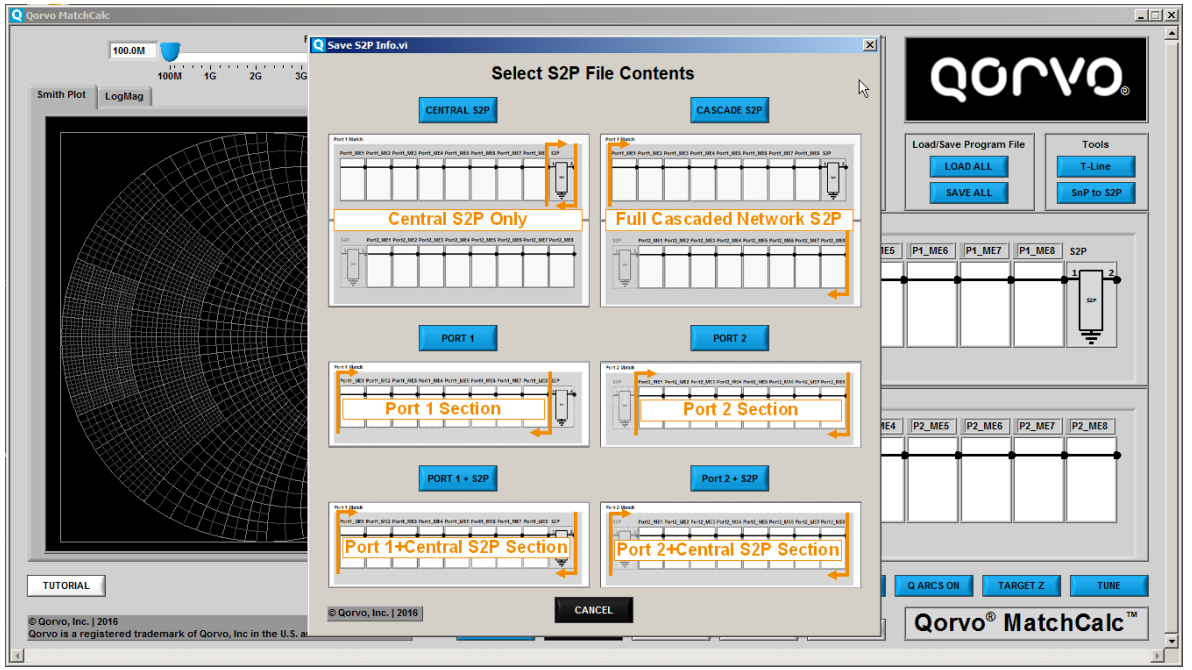
- **VIEW S1P/S2P**
  - Opens a window showing the text file containing the data in the S2P File
  - Click **Exit** to close the window
  - SnP files can also be viewed with NotePad or any other text editor available



What the Buttons Do-4

SAVE S1P/S2P & MATCH

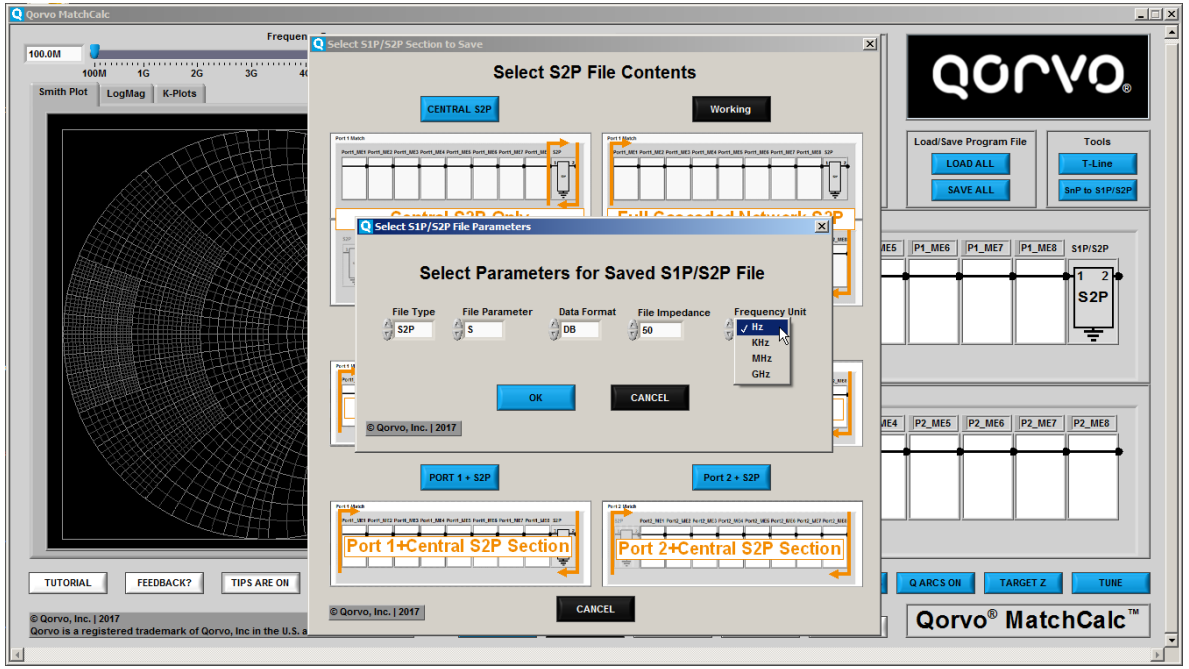
- SAVE S1P/S2P & MATCH
  - Brings up a window to select the portion of the matching circuit and S1P/S2P files to save into a new S2P file
- Choices are:
  - CENTRAL S2P
  - CASCADE S2P
  - PORT 1
  - PORT 2
  - PORT 1 Plus Central S2P
  - PORT 2 Plus Central S2P
  - CANCEL



What the Buttons Do-5

After Selecting a SAVE S1P/S2P Option:

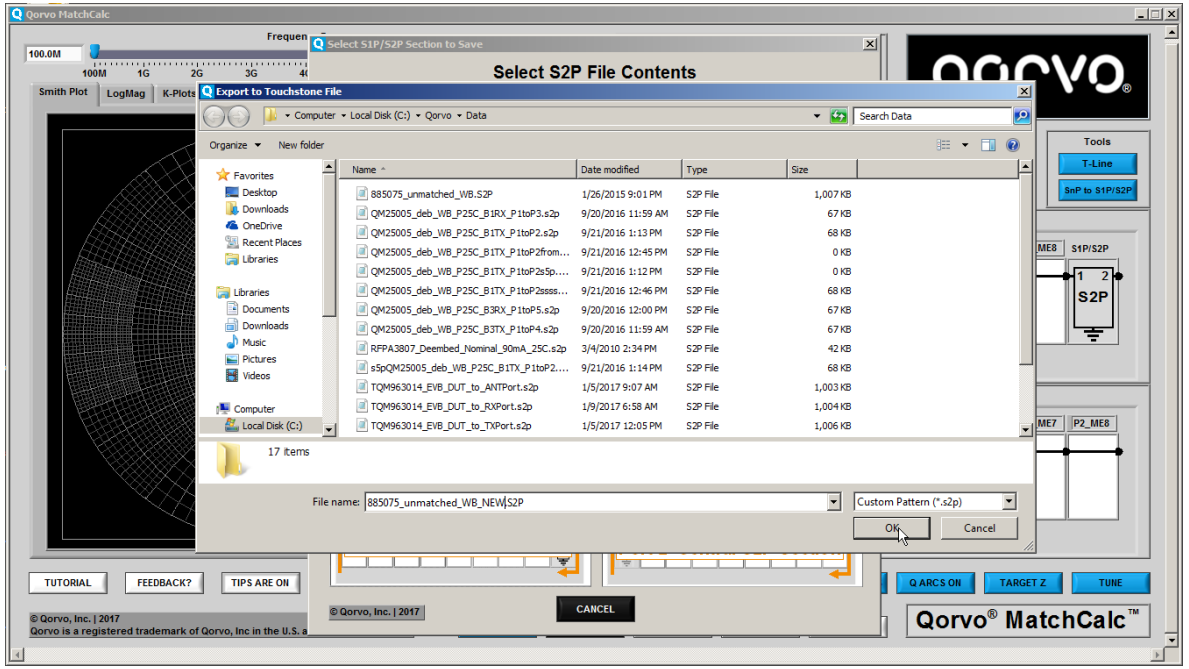
- Click OK in Warning Window to proceed
- Select File Parameter Options for the new S1P/S2P File to be saved
- Fixed Options for MatchCalc:
  - File Type – Only S1P/S2P Files are supported
  - File Parameter – Only S Parameters are supported
- Variable Options
  - Data Format – dB/Angle, Mag/Angle and Real-Imaginary are supported
  - File Impedance – Enter any value, 50 is most common
  - Frequency Unit – Select one from the list



What the Buttons Do-6

After Selecting Parameters for Saved S2P File:

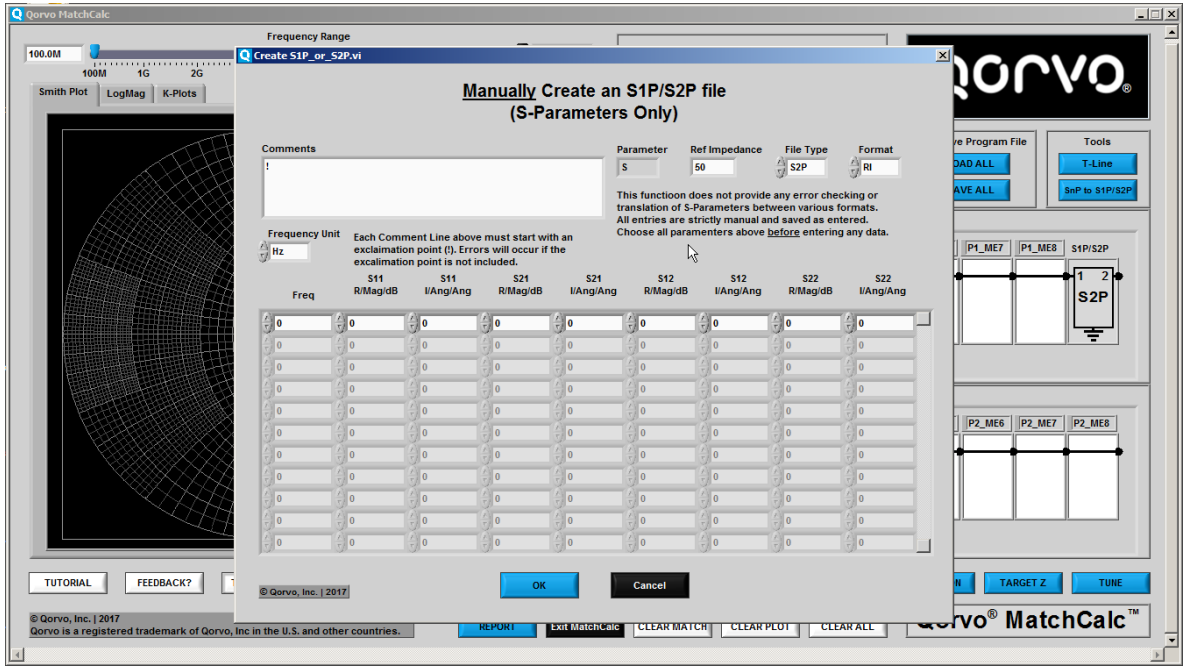
- Directory/File Name Selection Window appears
- Navigate to the desired Directory and select and existing file (will be overwritten) or enter a new file name (recommended)
- The file is immediately saved



What the Buttons Do-7

CREATE S1P/S2P

- CREATE S1P/S2P
  - Warning Window appears: New S2P file will overwrite the current Central S2P file in memory (Any saved file is not affected)
  - Clicking OK brings up a window allowing manual entry of S1P/S2P data.
  - NOTE: This is not recommended for data of more than a few points as it is very tedious and subject to errors
  - Whenever possible, load a previously captured S2P file from a test instrument source such as a Network Analyzer



What the Buttons Do-8

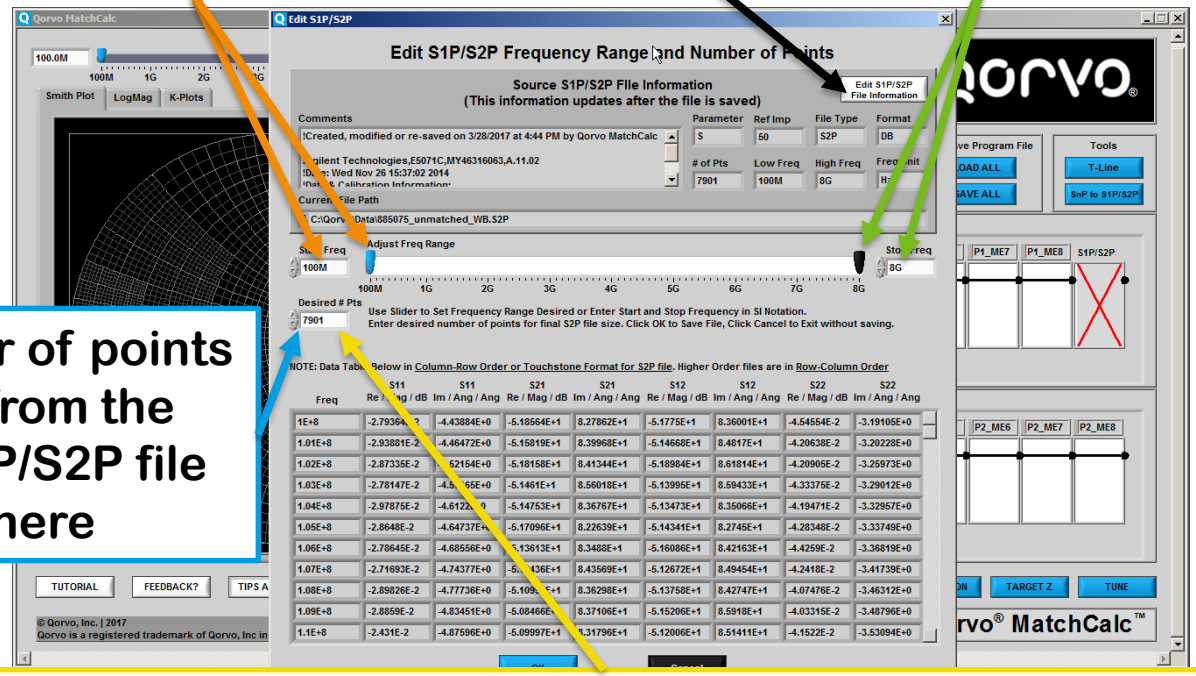
EDIT S1P/S2P FREQUENCY

- **EDIT S1P/S2P FREQUENCY**
  - Opens window to allow editing the frequency range of the S2P file and/or number of points in the file
  - Reducing frequency range and/or number of points can speed up calculations
  - Clicking OK opens a window to save the file under a new or existing name
  - If the save operation is cancelled, the edits are lost
  - At the completion of the save operation, the new file is loaded

Start here and make any changes to the S1P/S2P file format first

Enter Start Freq in SI Notation or use Blue Slider

Enter Stop Freq in SI Notation or use Black Slider



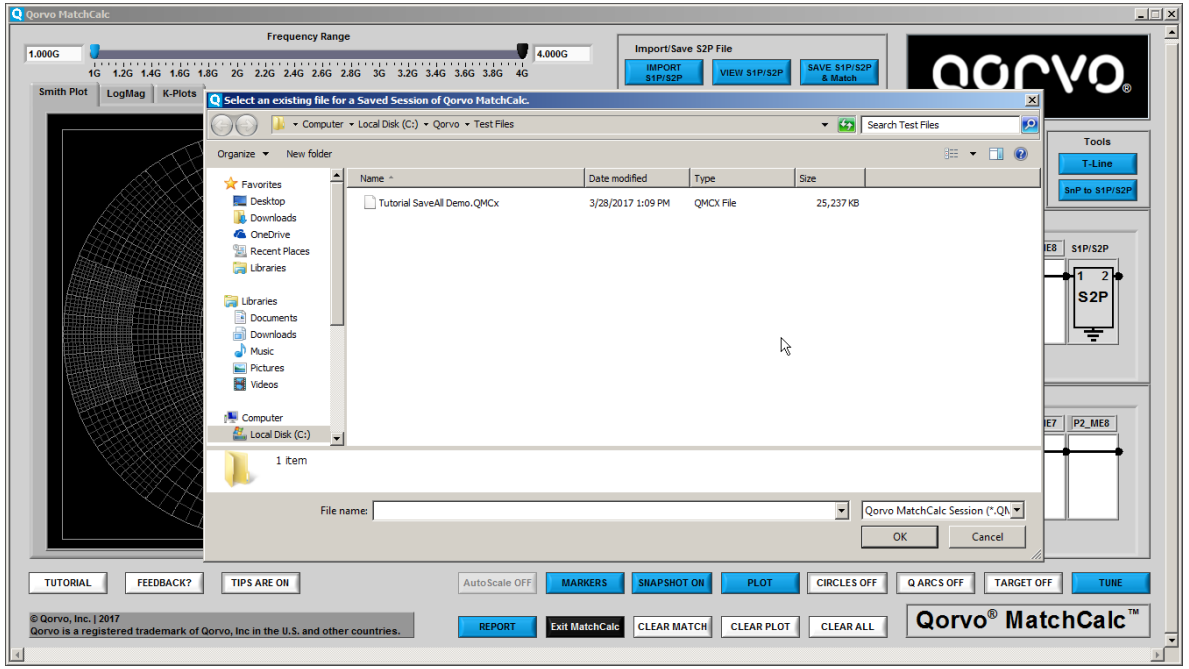
The number of points remaining from the original S1P/S2P file are shown here

The number of points may be changed, but the new points are applied uniformly across frequency. This operation does not support segmented files

What the Buttons Do-9

LOAD ALL/SAVE ALL

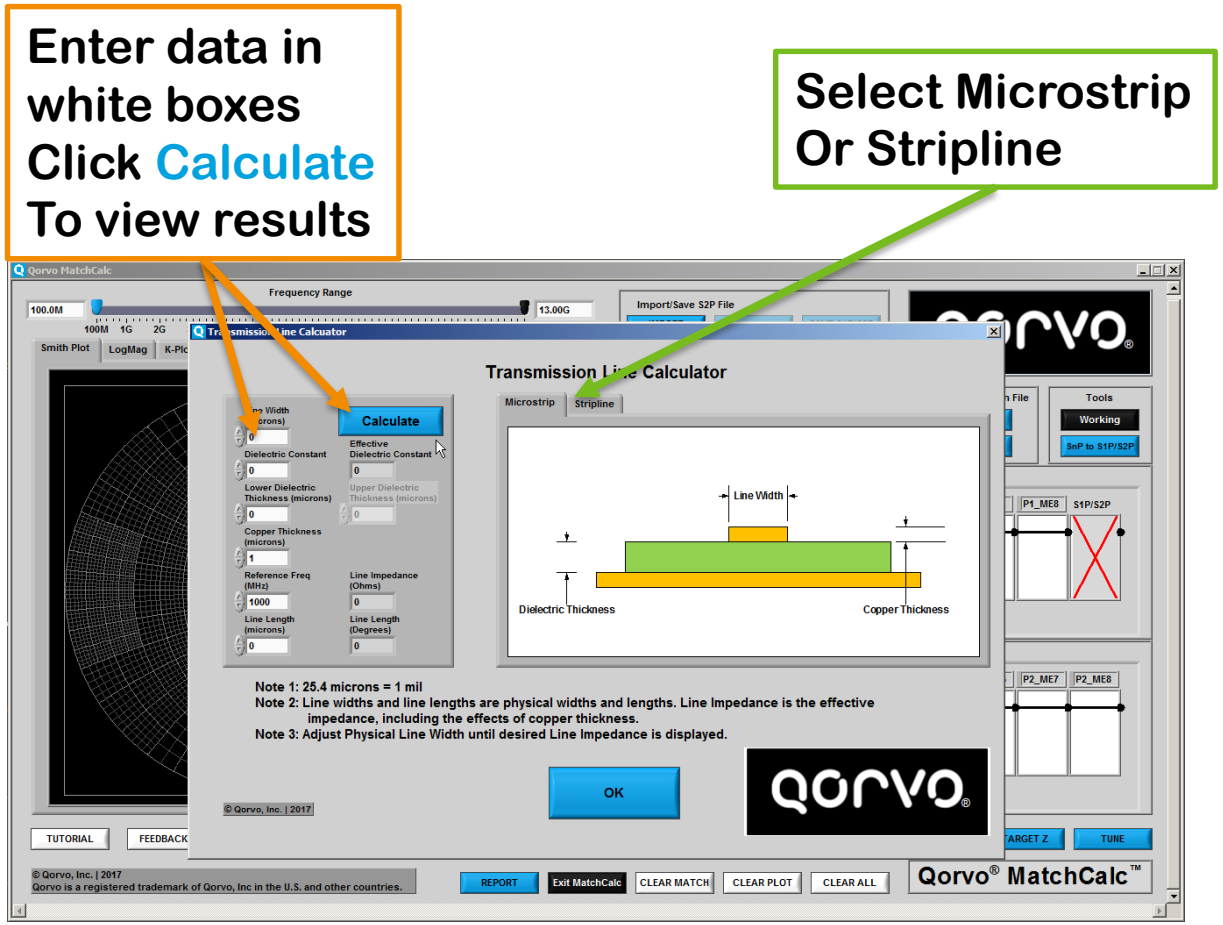
- **SAVE ALL**
  - Brings up a window to allow selecting a location/file name to save the session for later use
  - Information saved with .QMCx extension
  - This file extension stands for QorvoMatchCalcx
  - Saves the entire session including all components, component values and plots
- **LOAD ALL**
  - Loads a previously saved MatchCalc™ session into memory



What the Buttons Do-10

T-Line (Microstrip Tab)

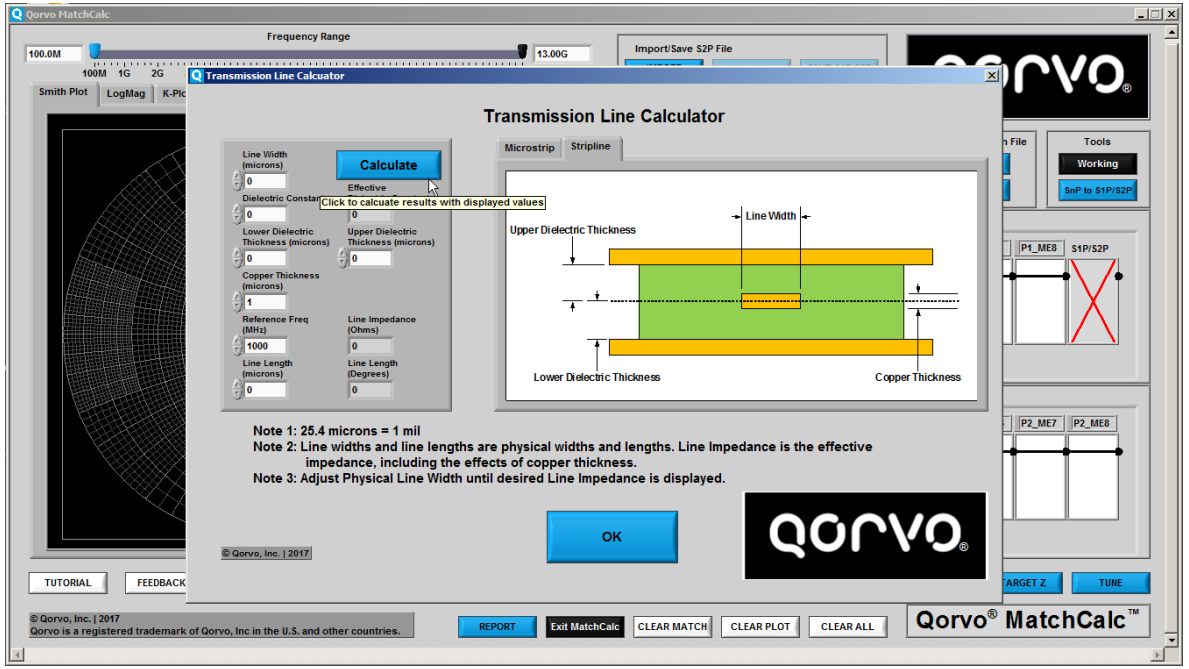
- T-Line (Microstrip Tab)
  - Opens utility to calculate impedance and line length of transmission line in Microstrip/Stripline format
  - Note: This utility included for reference purposes only and should not be used as stand alone design tool
  - Data and results not available after window closed
- Tool also available as part of component selection for all transmission line components
  - Results loaded into component info



What the Buttons Do-11

T-Line (Stripline Tab)

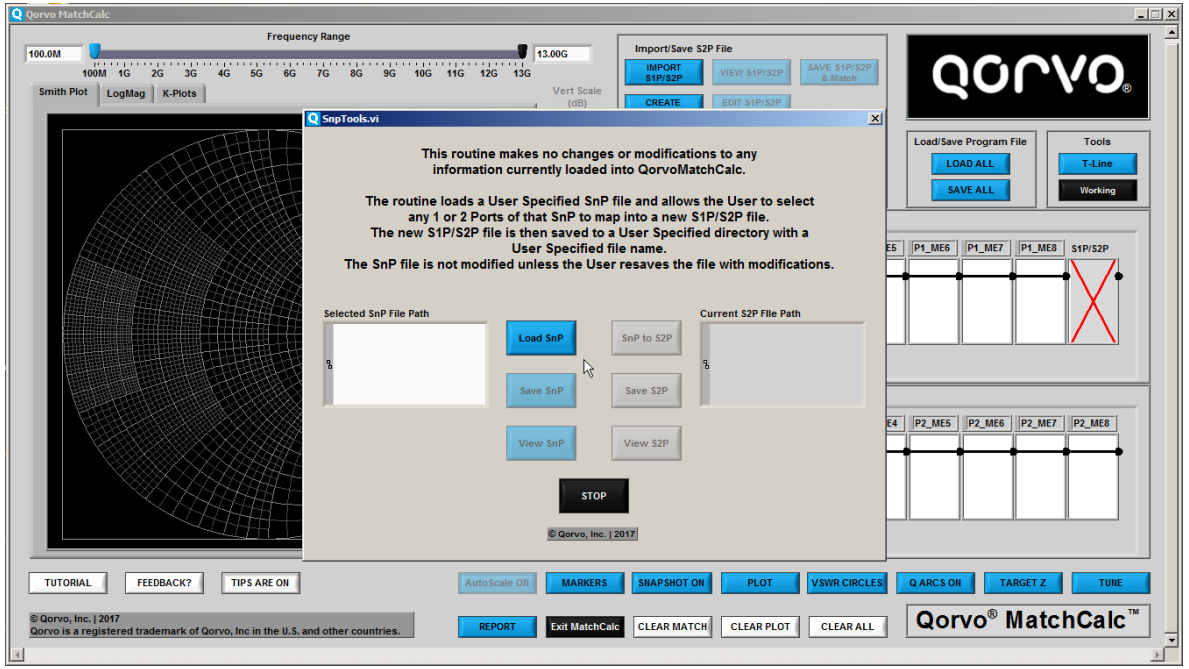
- T-Line (Stripline Tab)
  - Brings up a utility to calculate the impedance and line length of a transmission line in either Microstrip or Stripline format (Stripline shown)
  - Note: This utility is included for reference purposes only and should not be used as a stand alone design tool



What the Buttons Do-12

SnP to S1P/S2P

- SnP to S1P/S2P
  - Brings up a utility to extract S1P or S2P parameters from SnP files up to S20P
  - Can be used with more complicated modules to get the data required for a 2 port match
  - Can be used to reverse the ports on an S2P file

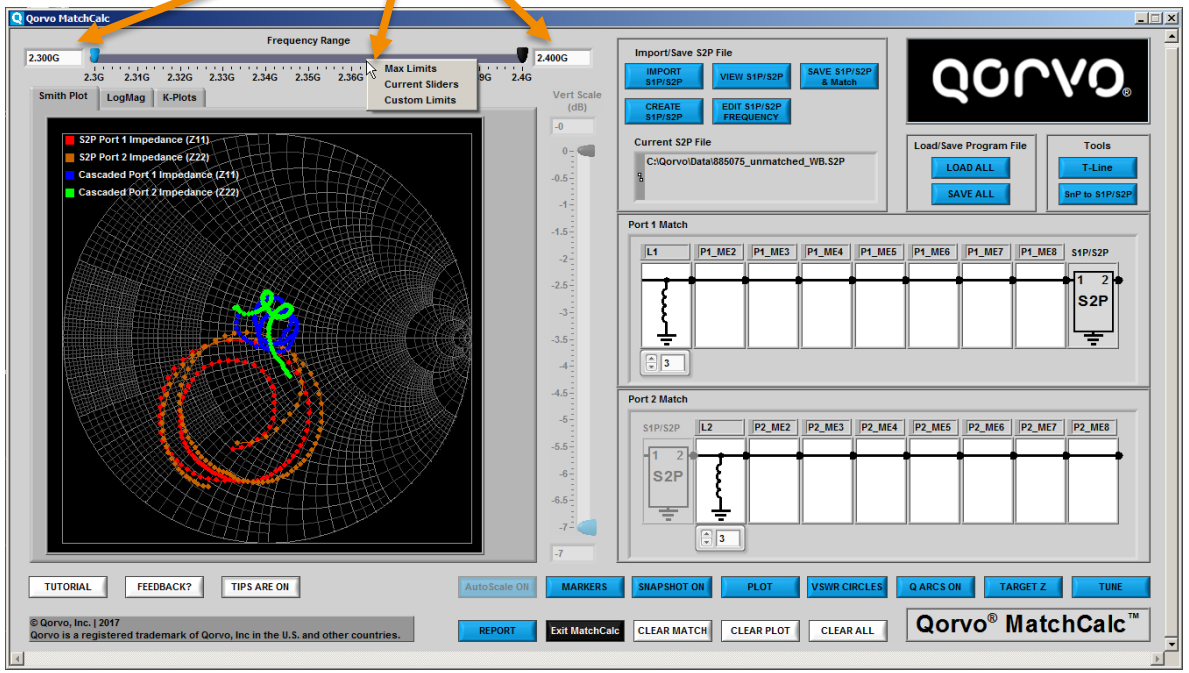


What the Buttons Do-13

FREQUENCY SLIDER

- **Frequency Slider**
  - Located immediately above the Smith Plot/Log Mag Tab Area
  - Allows adjustment of displayed frequency range without modifying S2P file
  - **BLUE** marker is lower frequency, **BLACK** marker is upper frequency
  - Values can also be typed into boxes in SI format (Use 1500M or 1.5G for 1500 MHz)
  - Scale end points can be adjusted by right clicking the Frequency Slider as shown at right: Choices are Max Limits, Current Markers, or Custom Limits

The displayed frequency range is changed for all plots:
Smith Plots, LogMag and K-Plots
Drag the sliders or enter the
Start & Stop Frequencies (in SI notation)
Press <Enter> to confirm the frequency entry when typing numbers into the boxes

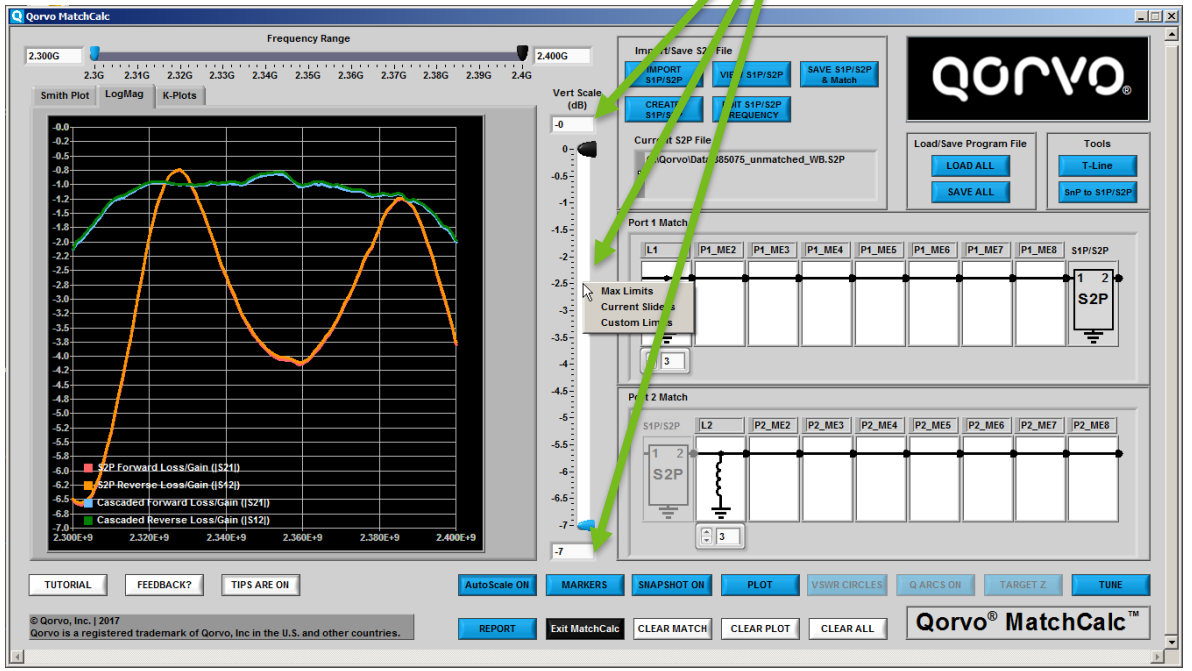


What the Buttons Do-14

LogMag VERTICAL SCALE SLIDER

The displayed Vertical range can be changed for LogMag plots by Dragging the sliders or by entering The Max and Min amplitude values Press <Enter> to confirm the amplitude entry when typing numbers into the boxes

- LogMag Vert Scale Slider
  - Applies only to LogMag Display
  - Same operation as Frequency Slider
  - Note that values are generally negative for the vertical scale unless one of your S2P files has gain
  - None of the passive components (except S2P files) are capable of gain
  - Scale end points can be adjusted by right clicking the Vertical Slider as shown at right: Choices are Max Limits, Current Markers, or Custom Limits
  -

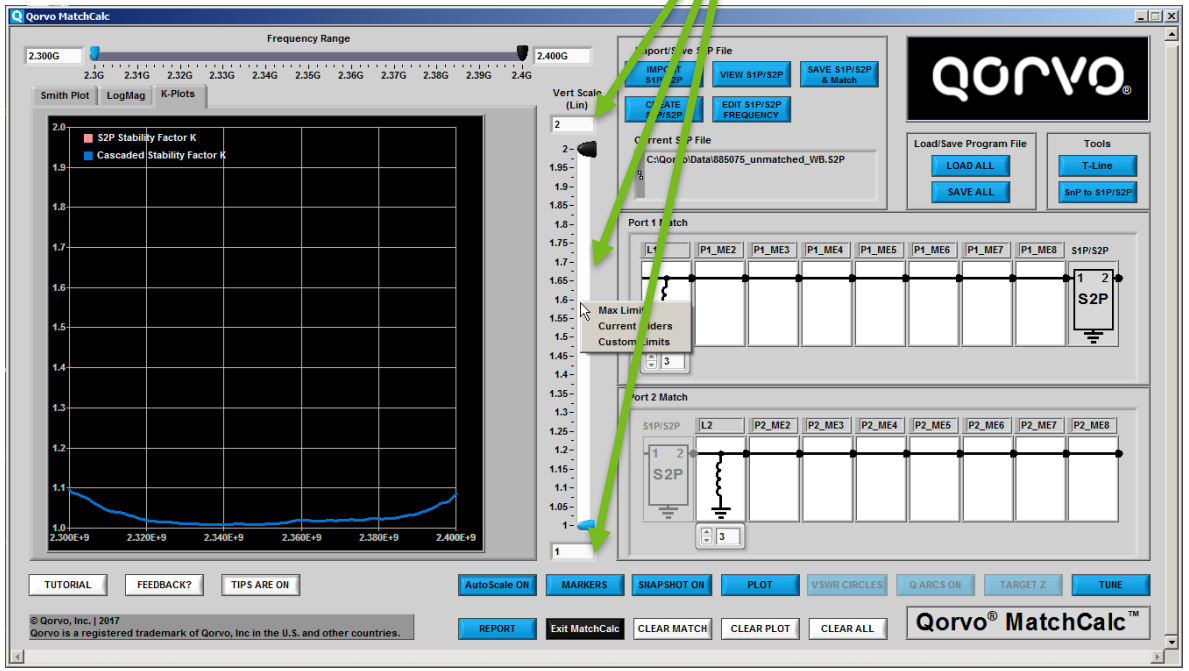


What the Buttons Do-15

K-Plot VERTICAL SCALE SLIDER

- **K-Plot Vert Scale Slider**
  - Applies only to K-Plots Display
  - Same operation as Frequency Slider
  - Scale end points can be adjusted by right clicking the Vertical Slider as shown at right: Choices are Max Limits, Current Markers, or Custom Limits

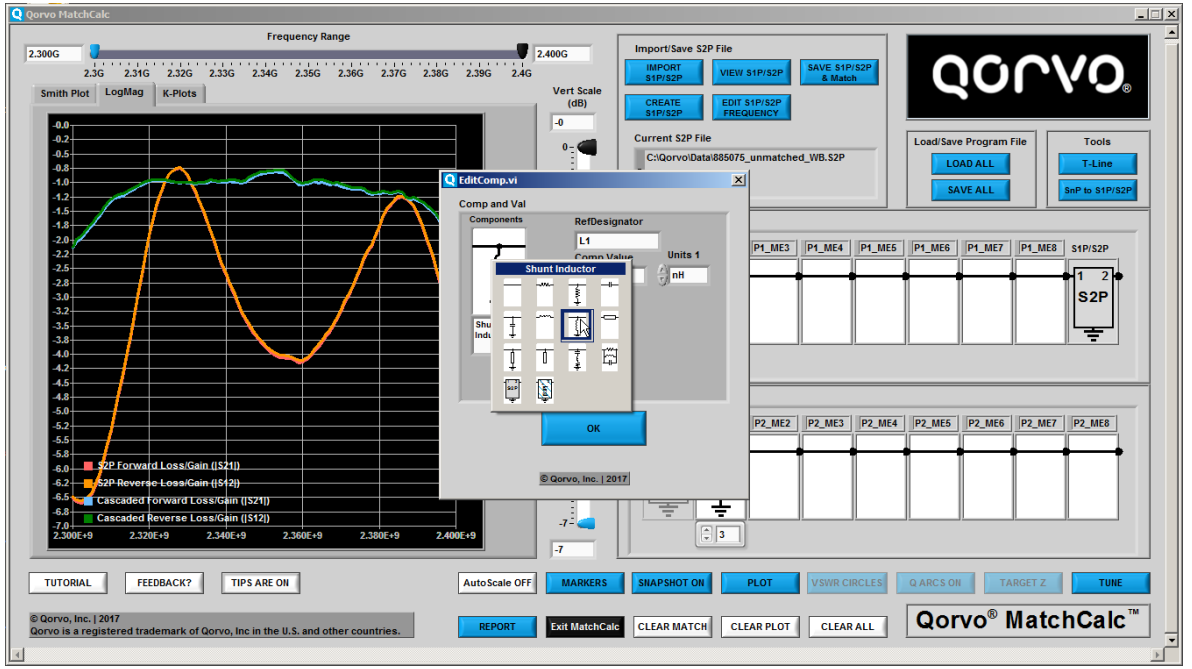
The displayed Vertical range can be changed for K-Plots by Dragging the sliders or by entering The Max and Min values
Press <Enter> to confirm the entry when typing numbers into the boxes



What the Buttons Do-16

COMPONENT SELECTOR

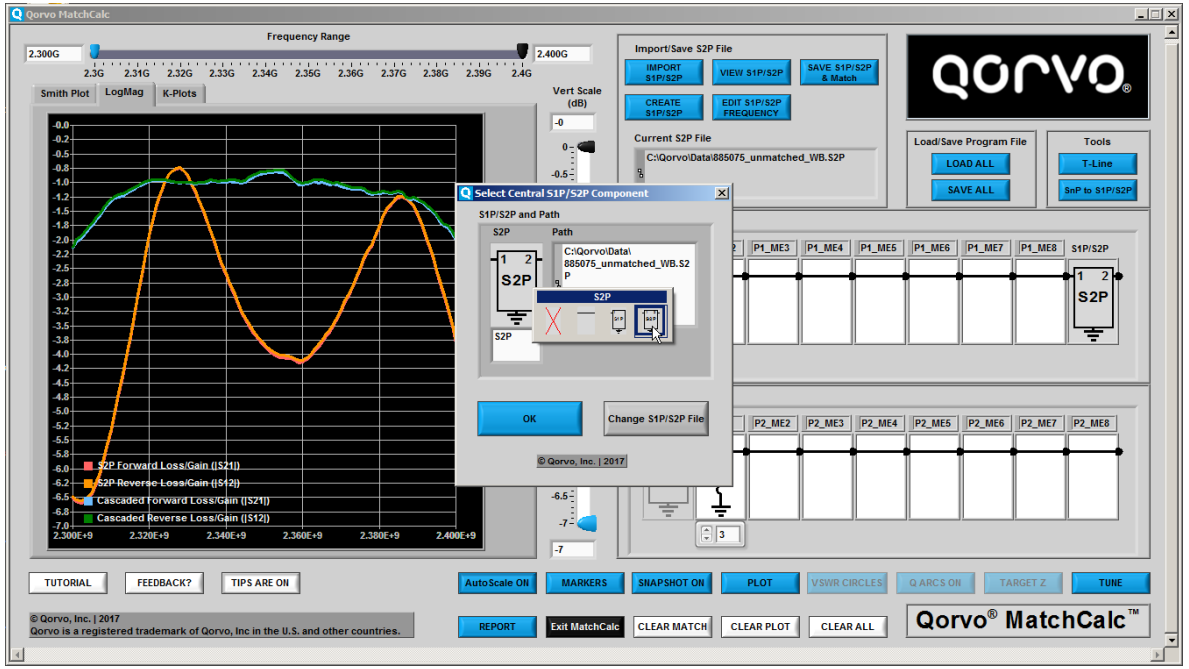
- **Component Selector**
  - Clicking on a component location opens window to select component type, value & other parameters for that component type
  - Choices are: THRU (no electrical length connection), Series Resistor, Shunt Resistor, Series Cap, Shunt Cap, Series Inductor, Shunt Inductor, Series T-Line, Shunt Shorted T-Line, Shunt Open T-Line, Shunt CLR, Series CLR, S2P and De-Embed S2P components
  - If one of the Transmission Line components is selected, the T-Line Calc button is active, allowing you to calculate T-Line parameters for the component



What the Buttons Do-17

S1P/S2P SELECTOR

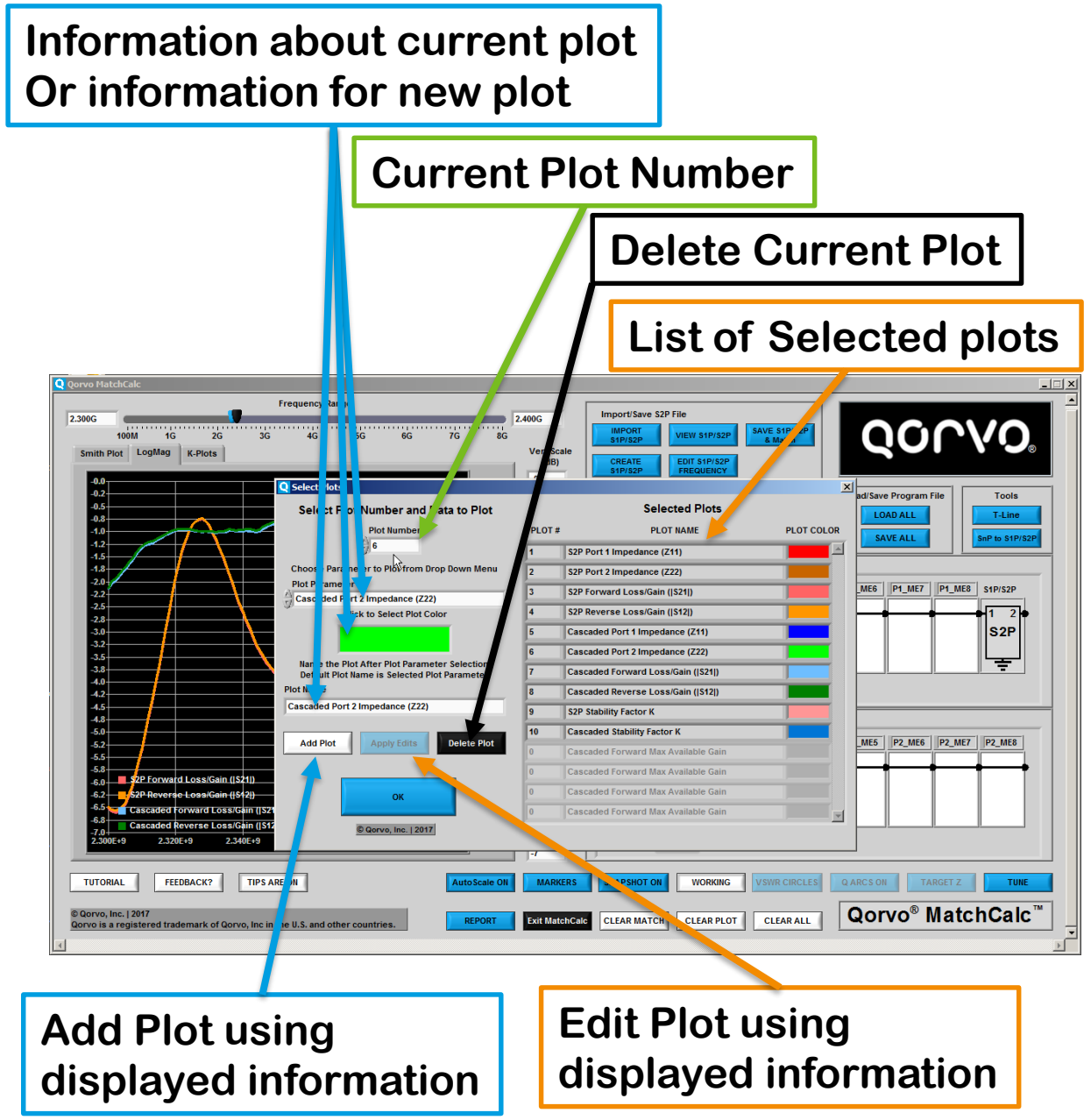
- S1P/S2P Selector
  - Operates the same as IMPORT S1P/S2P
  - Choices are THRU, S1P, S2P and No Connect
  - Note that No Connect is not a viable choice for plot calculations and is only used to graphically show that nothing has been selected for the central S1P/S2P file
  - If S1P or S2P is selected and then the file selection operation is canceled, the manual frequency selection window appears and a THRU is selected by default



What the Buttons Do-18

PLOT

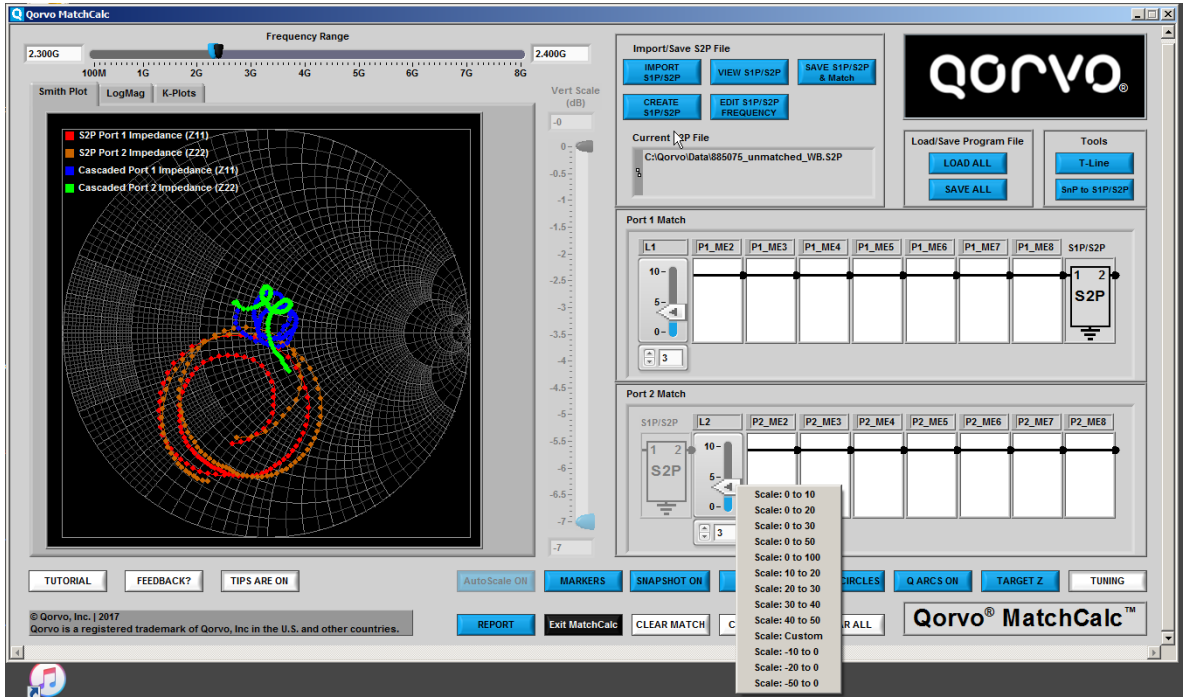
- **PLOT**
  - Opens window to allow selecting the information to plot
  - Plot Number is the currently selected plot
    - The information below Plot Number is the information for the current plot unless it is being changed to add a new plot or edit the existing plot
  - Left side of window shows information about the currently selected plot
  - Right Hand side of window shows a list of the selected plots
  - Selected Plot can be deleted or new information can be used to Add a Plot or Edit the selected plot



What the Buttons Do-19

TUNE

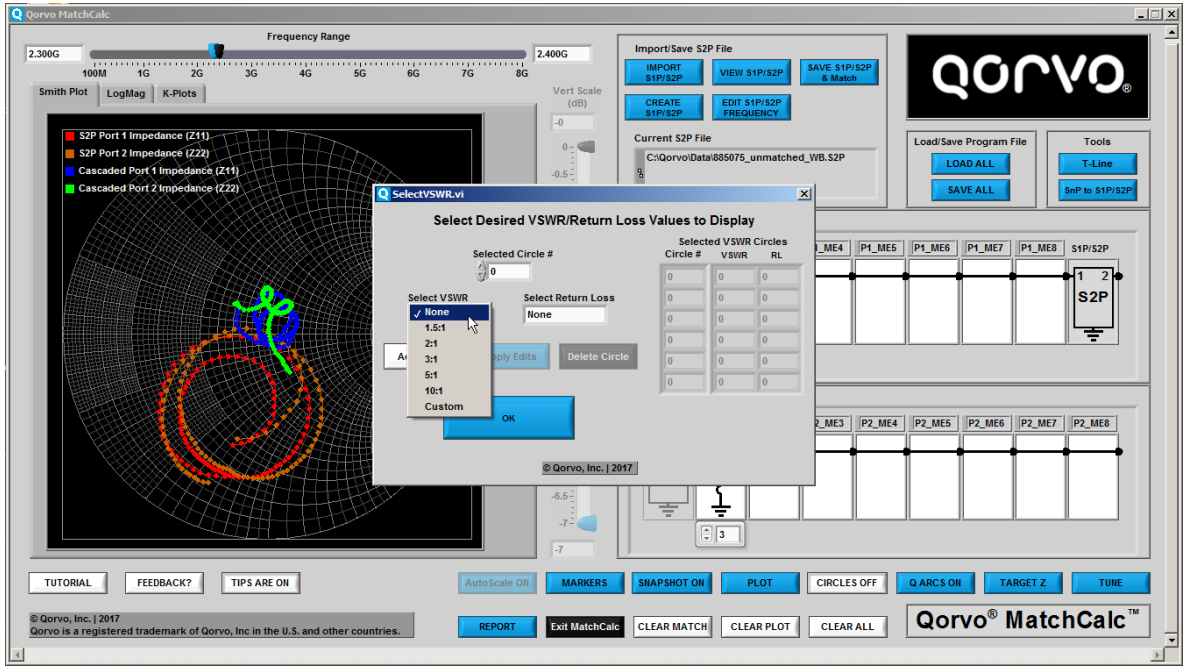
- **TUNE**
  - Turns on tuning sliders for each component except THRU, S2P file or De-Embed S2P
  - Drag the slider arrows to tune the value over the displayed range
  - Adjust the scale by right clicking the slider. Choices include a custom range and negative ranges
  - The component value may be negative for de-embedding. Access negative values by typing a negative value in any value window below the component or by selecting a negative range and adjusting the slider



What the Buttons Do-20

VSWR CIRCLES

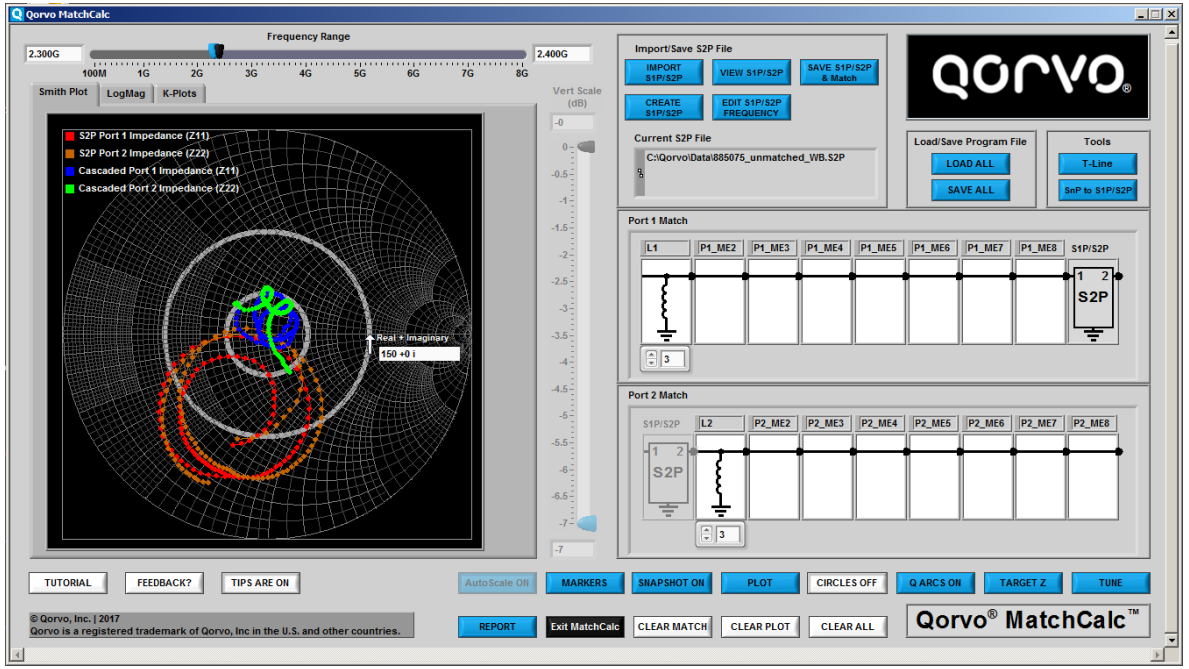
- **VSWR CIRCLES**
  - Only active for Smith Plot Tab
  - Opens window to select value of VSWR circles
  - Circles can be defined in terms of VSWR or equivalent Return Loss
  - Custom selection allows any arbitrary VSWR or Return Loss to be entered
  - Window operation similar to PLOT selection
  - Multiple circles are allowed



What the Buttons Do-21

After VSWR CIRCLES selection:

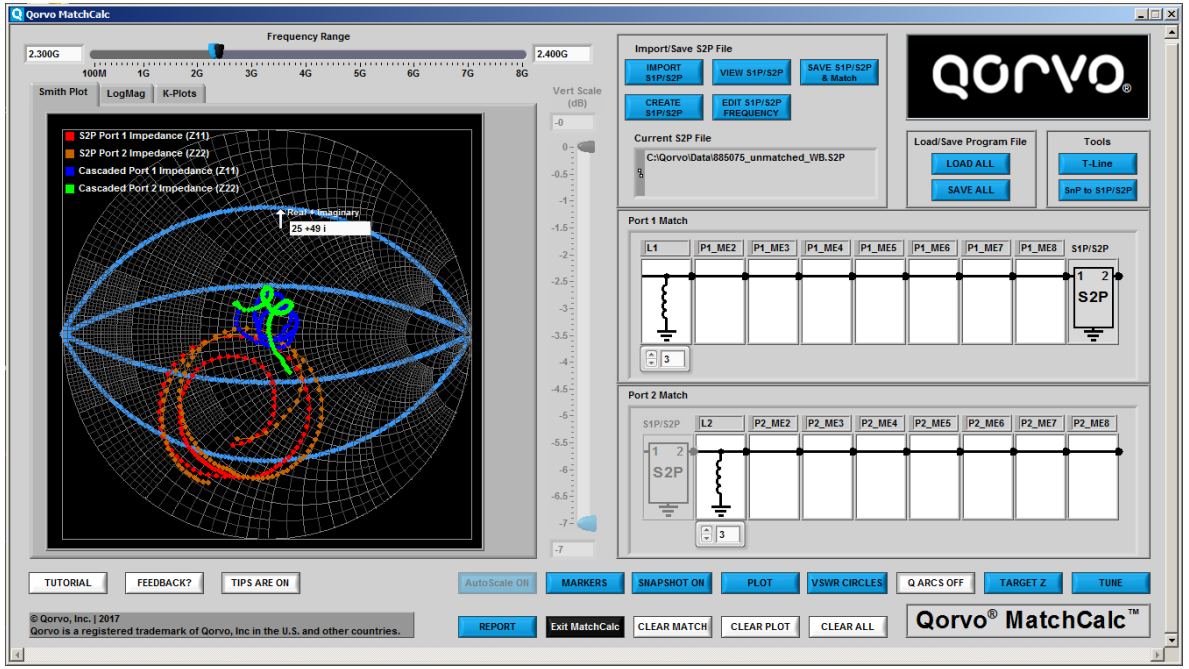
- **VSWR CIRCLES**
  - **Qorvo® MatchCalc™ with VSWR circles displayed for 1.5:1 and 3:1**
- **Select CIRCLES OFF to turn off VSWR Circles**



What the Buttons Do-22

Q ARCS ON

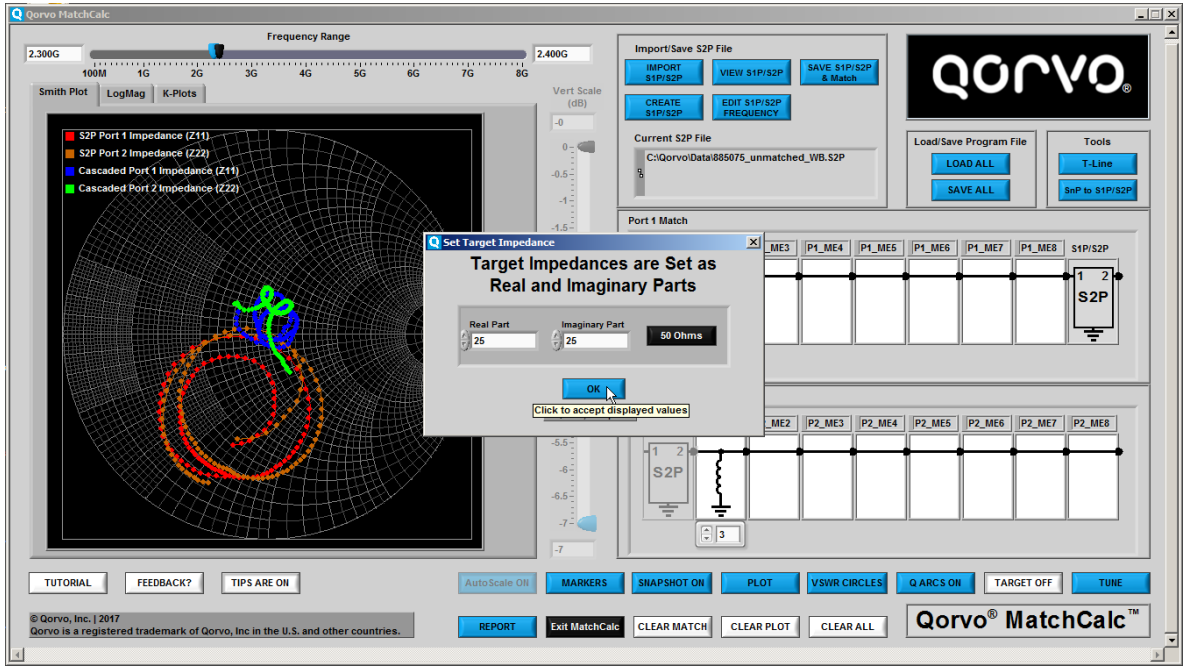
- **Q ARCS ON**
  - Displays window to select desired Q factors to display
  - Q Factor selection similar to VSWR
  - Displays Arcs of constant Q factor
  - Can be used to control the overall match bandwidth and Q
  - Values of 0.5 and 2 shown at right



What the Buttons Do-23

TARGET IMPEDANCE

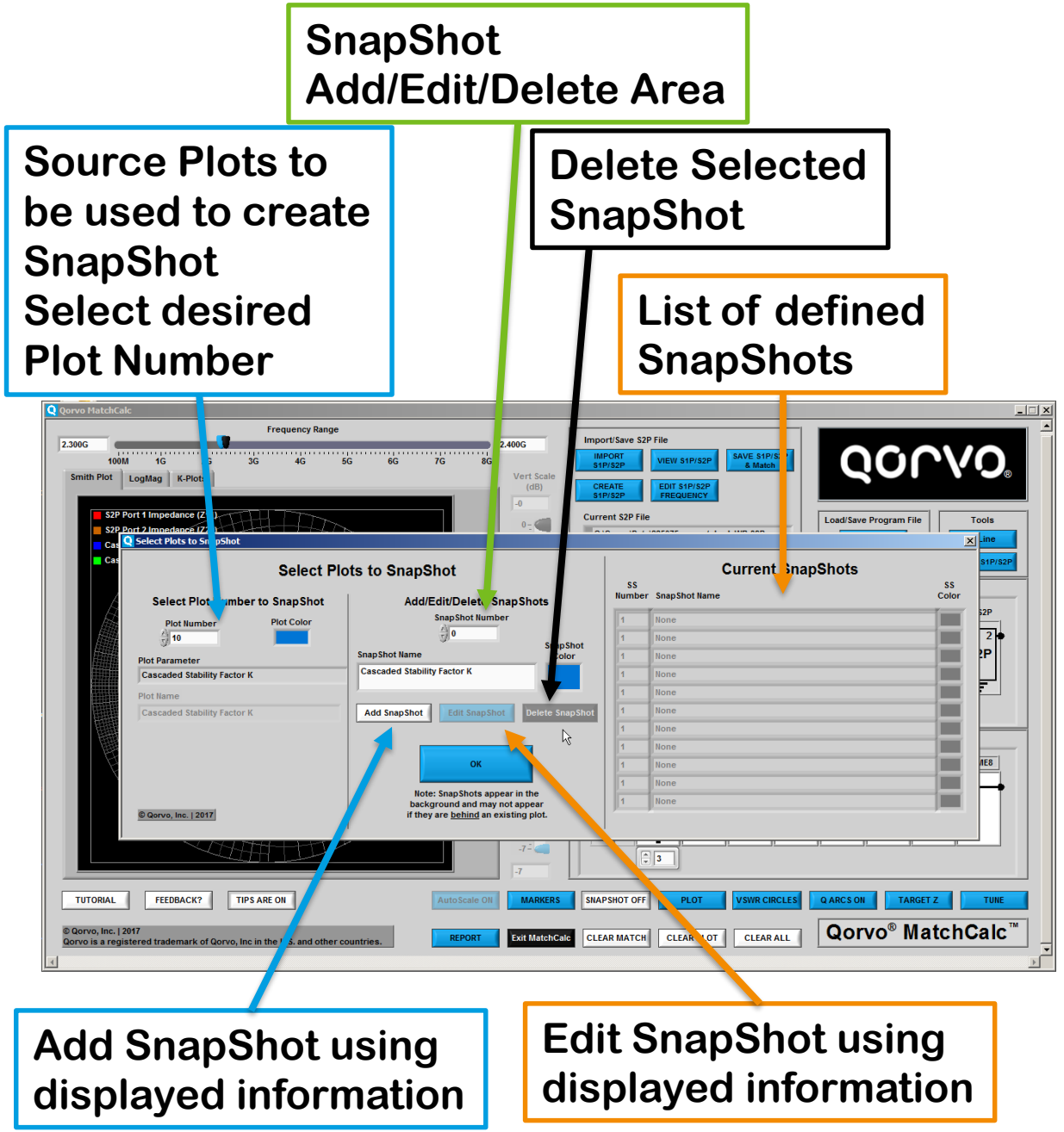
- **Target Impedance**
  - Displays a single impedance point as a reference
  - Can be used to show the desired match point from Load Pull data, Gamma Opt or to verify the impedance of a point on the Smith Chart
  - Can be entered referenced to Central S2P file Impedance (Usually 50 Ohms) or normalized



What the Buttons Do-24

SNAPSHOT ON

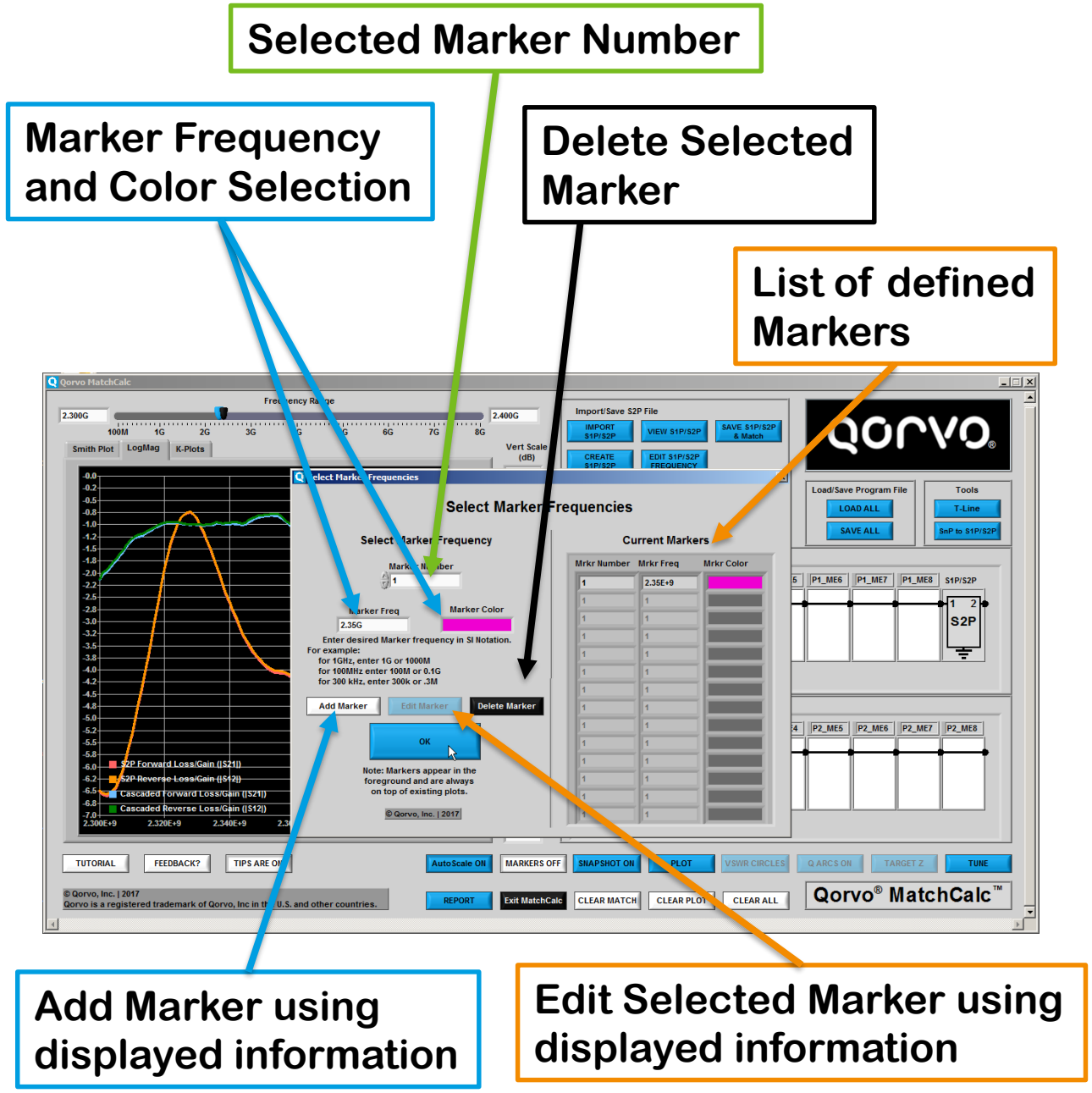
- **SNAPSHOT ON**
  - Displays a SnapShot of a trace which freezes the data so that it is no longer subject to changes due to matching components and values
  - Window operation is similar to Plots window
  - Can be used to keep track of the progress of a matching exercise
  - Input trace to SnapShot is shown on the left hand part of the window. After the trace to be SnapShot is selected, edit color and name as desired, then click the Add SnapShot button in the center section of the window
- Change the SnapShot Color and name so it is easy to identify in the plots



What the Buttons Do-25

MARKERS

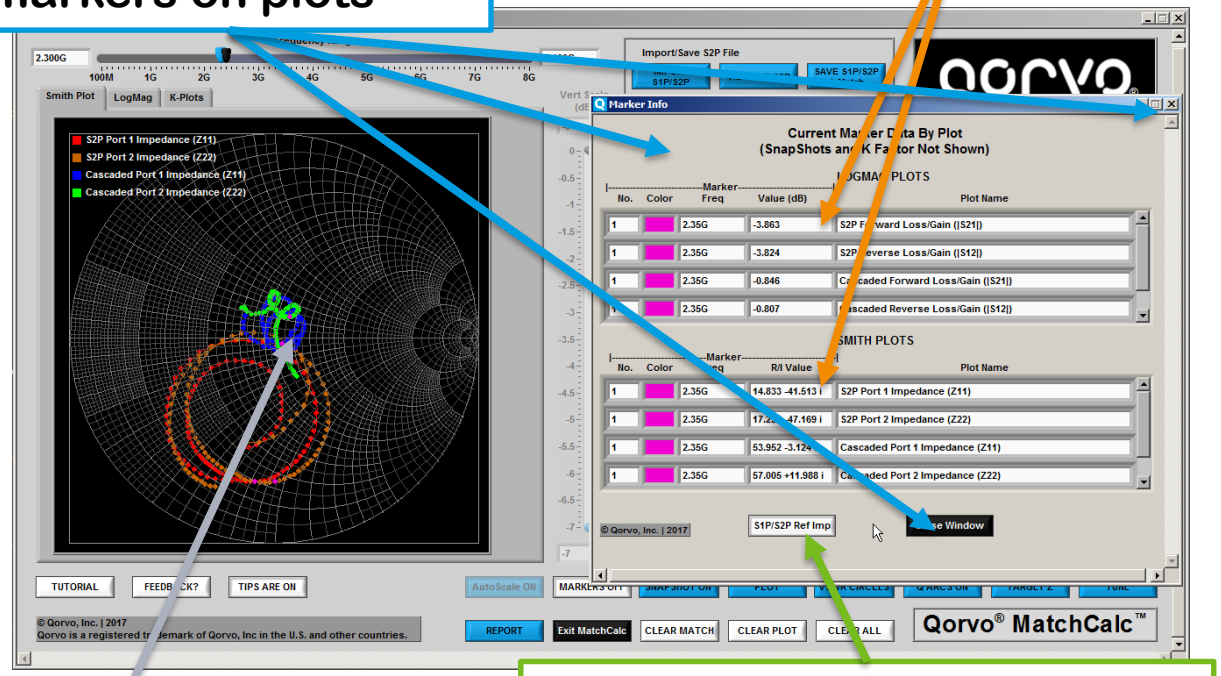
- **MARKERS**
  - Opens a window to select marker frequencies and colors for the current plot set. All active plots will receive a marker at the frequency selected
  - Window operation is similar to Plot and SnapShot windows
  - SnapShots do not receive a marker
  - Enter a Frequency for the Marker. Be sure to use SI notation for the Frequency
  - Click ADD Marker to add the marker to the list on the right side of the window. The marker is not active unless it appears on the table at the right
  - Marker number is automatically incremented as Markers are added



What the Buttons Do-26

After MARKERS entered and OK clicked – Smith Plot

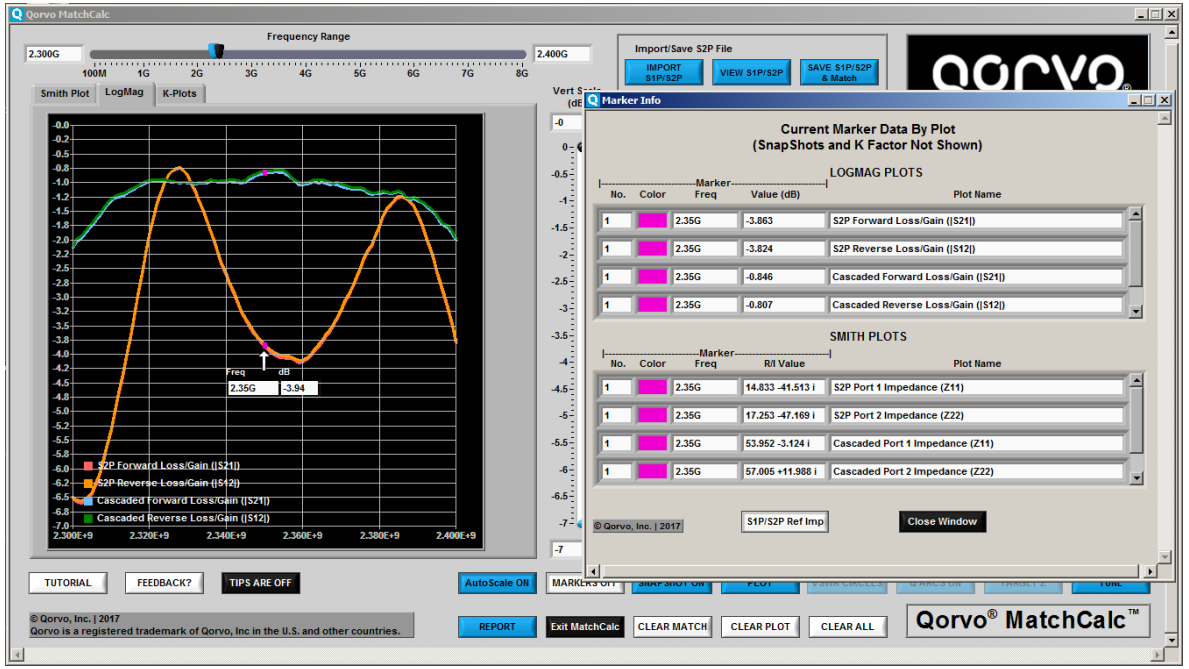
- **MARKERS ON**
  - Table appears that shows marker info and data associated with markers
  - The frequency point on the Smith Chart and the LogMag displays are changed to the marker color
  - The Marker Data window may be closed or minimized leaving the marker point on the plots as shown
  - The Reference Impedance can be shifted between the Central S2P file's Impedance and Normalized



What the Buttons Do-27

After MARKERS entered and OK clicked – LogMag Plot

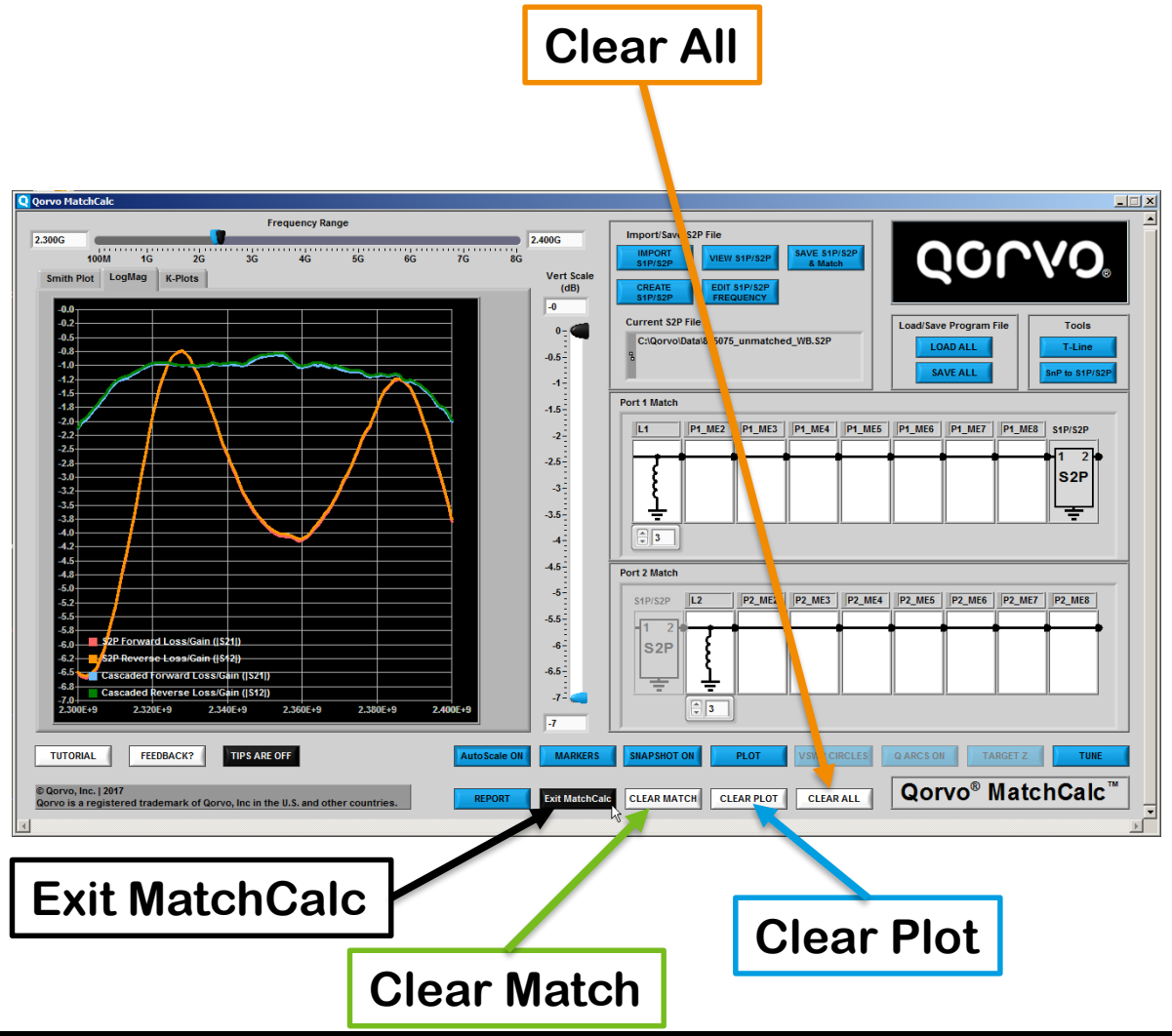
- **MARKERS ON**
  - Table appears that shows marker info and data associated with markers
  - The frequency point on the Smith Chart and the LogMag displays are changed to the marker color
  - The Marker Data window may be closed or minimized leaving the marker point on the plots shown



What the Buttons Do-28

CLEAR Buttons

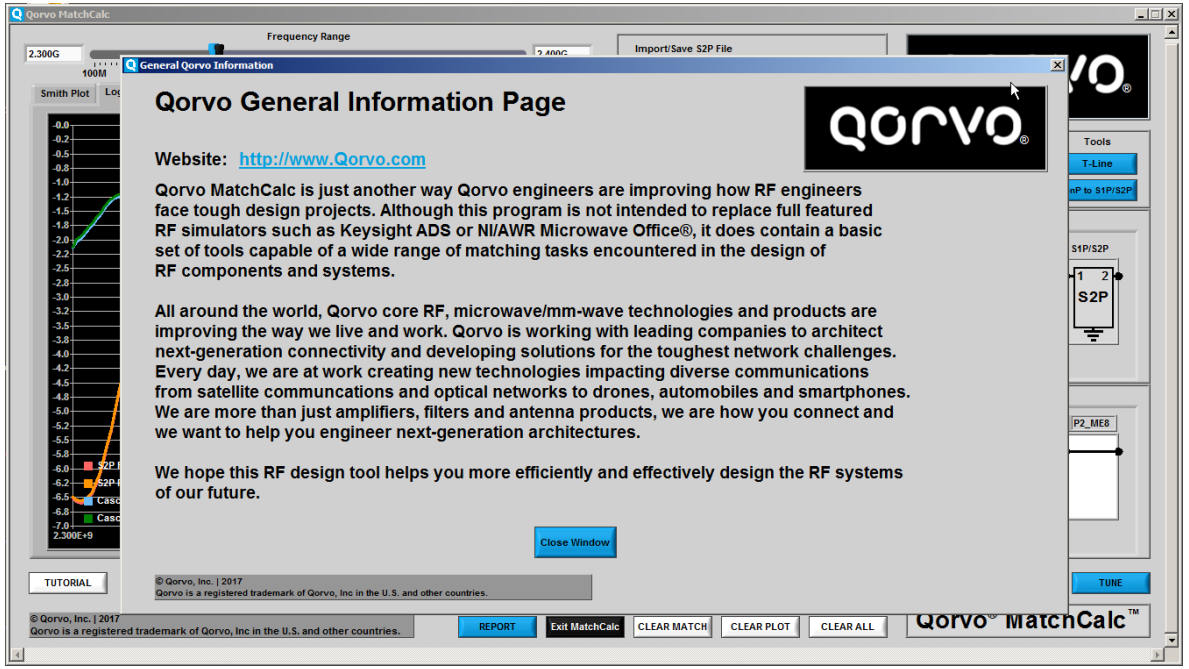
- **CLEAR MATCH**
  - Clears the current match values and resets all components to THRU (Does not affect central S1P/S2P file loaded or Plots selected)
- **CLEAR PLOT**
  - Clears all plots, does not affect match or central S1P/S2P file
- **CLEAR ALL**
  - Clears all Match elements, plots and central S1P/S2P files
- **Exit MatchCalc**
  - Exits the Program



What the Buttons Do-29

QORVO Logo

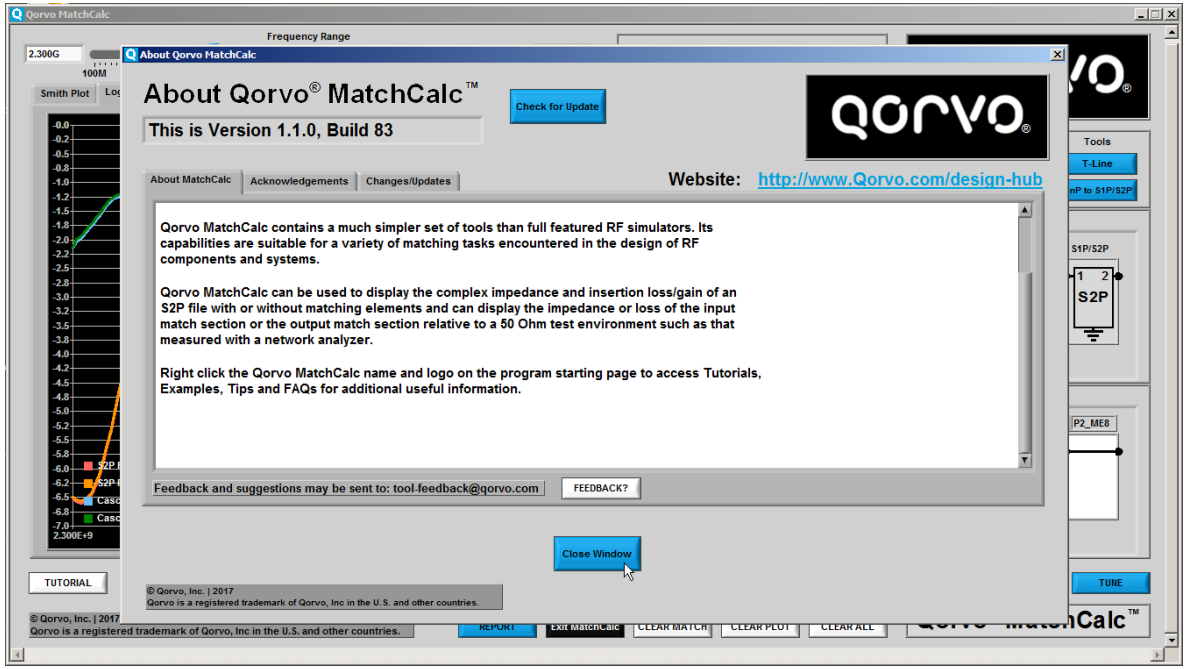
- **Left/Right Click Qorvo Logo**
  - Displays general information about Qorvo, including a link to the company webpage
  - Link to Qorvo Website



What the Buttons Do-30

Qorvo® MatchCalc™ Logo

- **Left Click Qorvo® MatchCalc™ Logo**
  - Displays the "About Qorvo® MatchCalc™" window
  - Tabs for this window display "About MatchCalc", Acknowledgements, and Changes/Updates
  - Links to Qorvo Website resources page to check for updates
  - **FEEDBACK?** link to provide feedback or suggestions on Qorvo® MatchCalc™



What the Buttons Do-31

Qorvo® MatchCalc™ Logo

- **Right Click Qorvo® MatchCalc™ Logo**
  - Displays Tutorial and Examples Window
  - Tabs for Tutorial, Examples, Tips, and FAQs
  - Clicking the Launch Tutorial button on the Tutorial Tab, displays this presentation in the local system's native pdf file viewer
  - Examples Tab contains Six Examples that walk through the operation of Qorvo® MatchCalc™ each example building on the information in the previous example