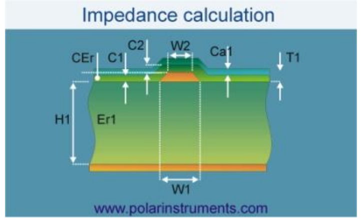
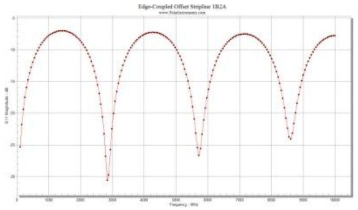
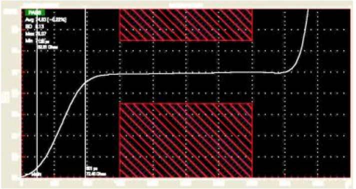
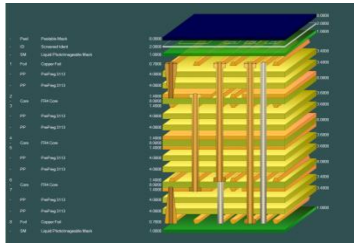
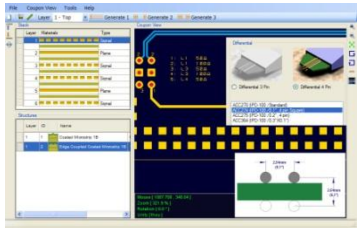







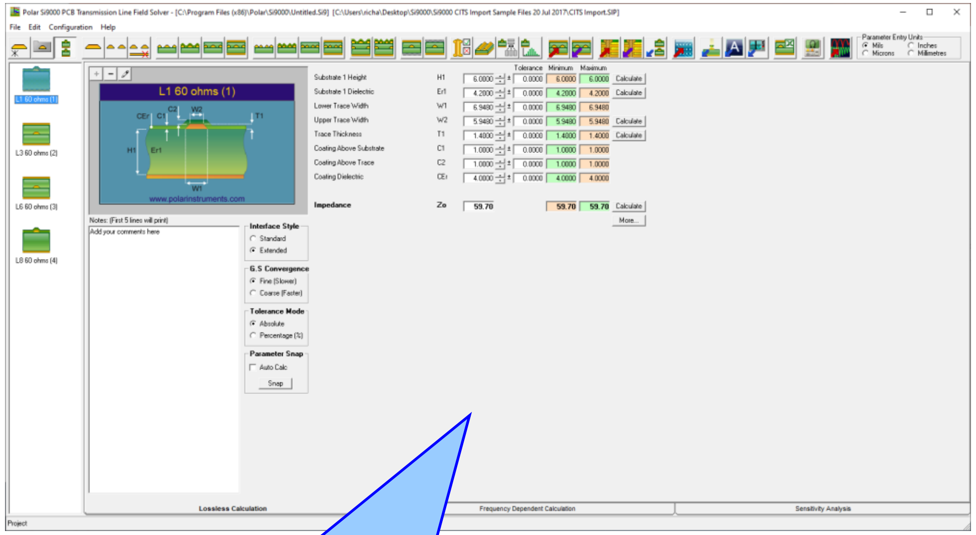


# Si8000m / Si9000e 2021 – 2025

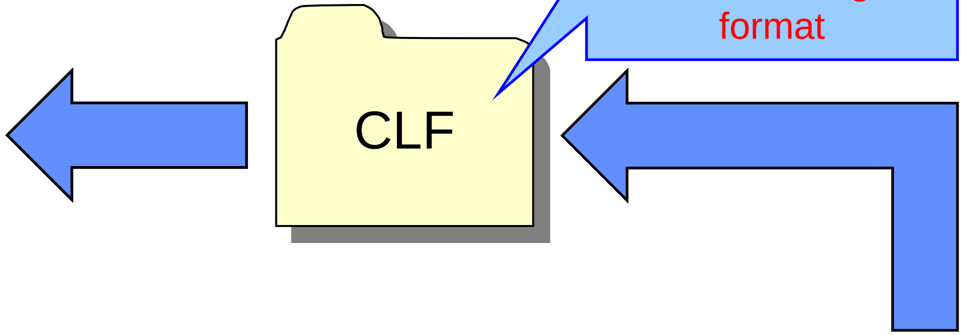
Richard Attrill – March 2025 (Rev 9)

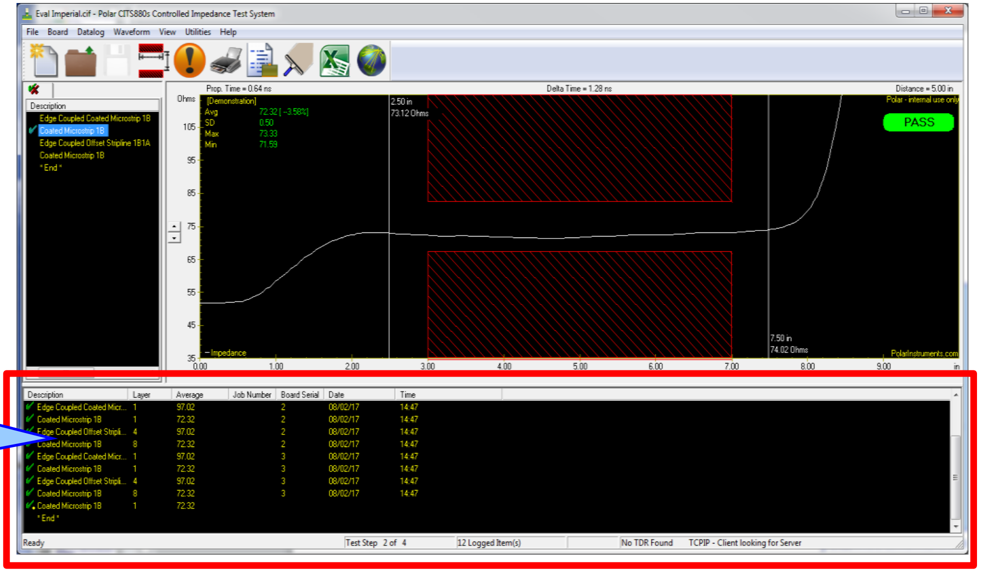
# v25.02.01 (February 2025)

# Enhancements to the Import Polar CITS Datalog File option



New for v25.02
Now supports the latest CITS880s v24.12 data log file format



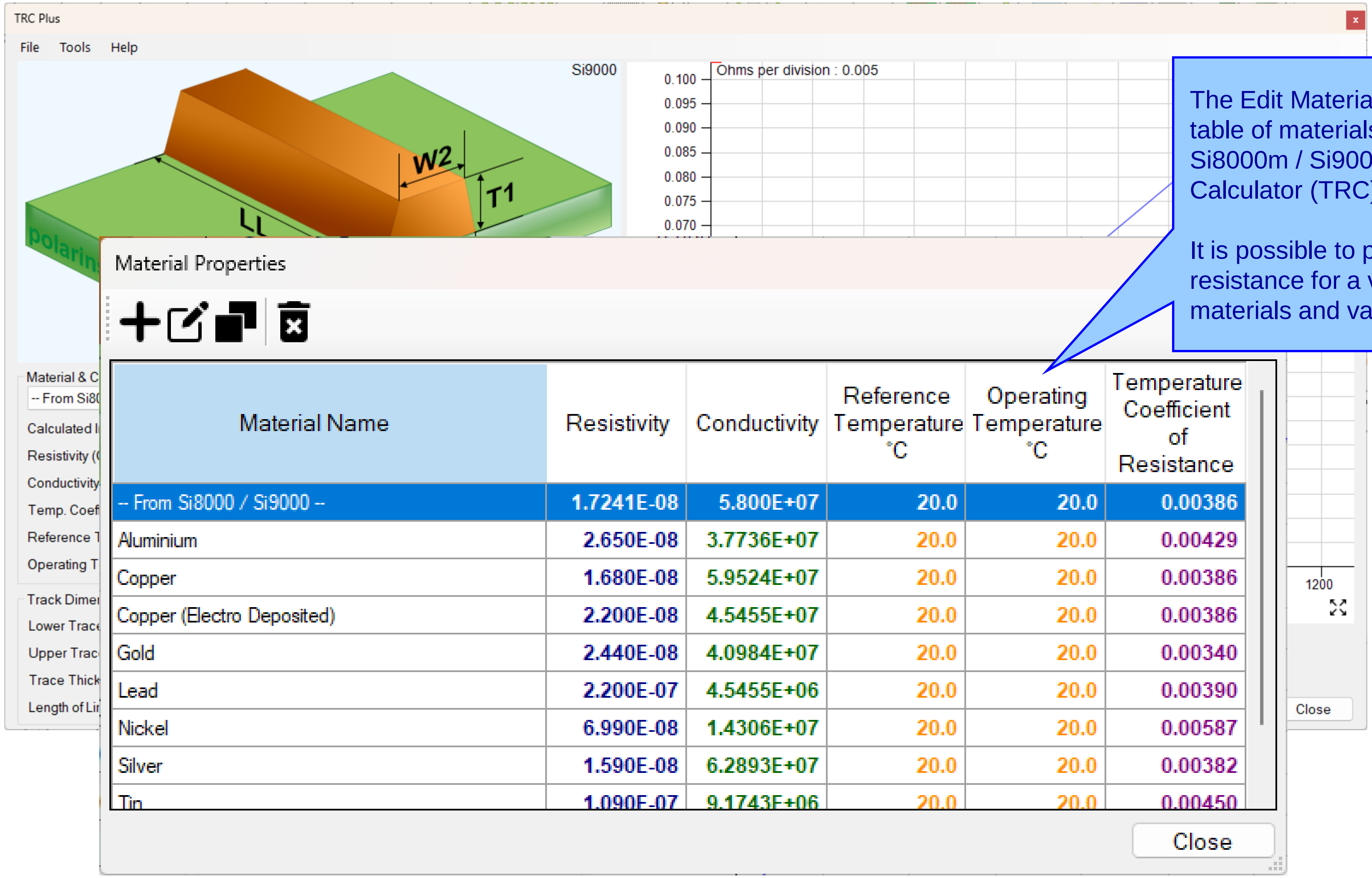



Overview
The Polar Si8000m / Si9000e field solver products have the capability to read a Polar CITS Data Log File (.CLF). This file contains comprehensive impedance measurement data and, along with existing modelled structure information, offers graphing capabilities and statistical analysis where the modelled and measured data can be presented together.
**See slide #34 onwards for further information on this feature

The Data Log of the CITS software is stored in a CLF file

# v25.01.01 (January 2025)

# TRC Plus - Edit Materials option now improved

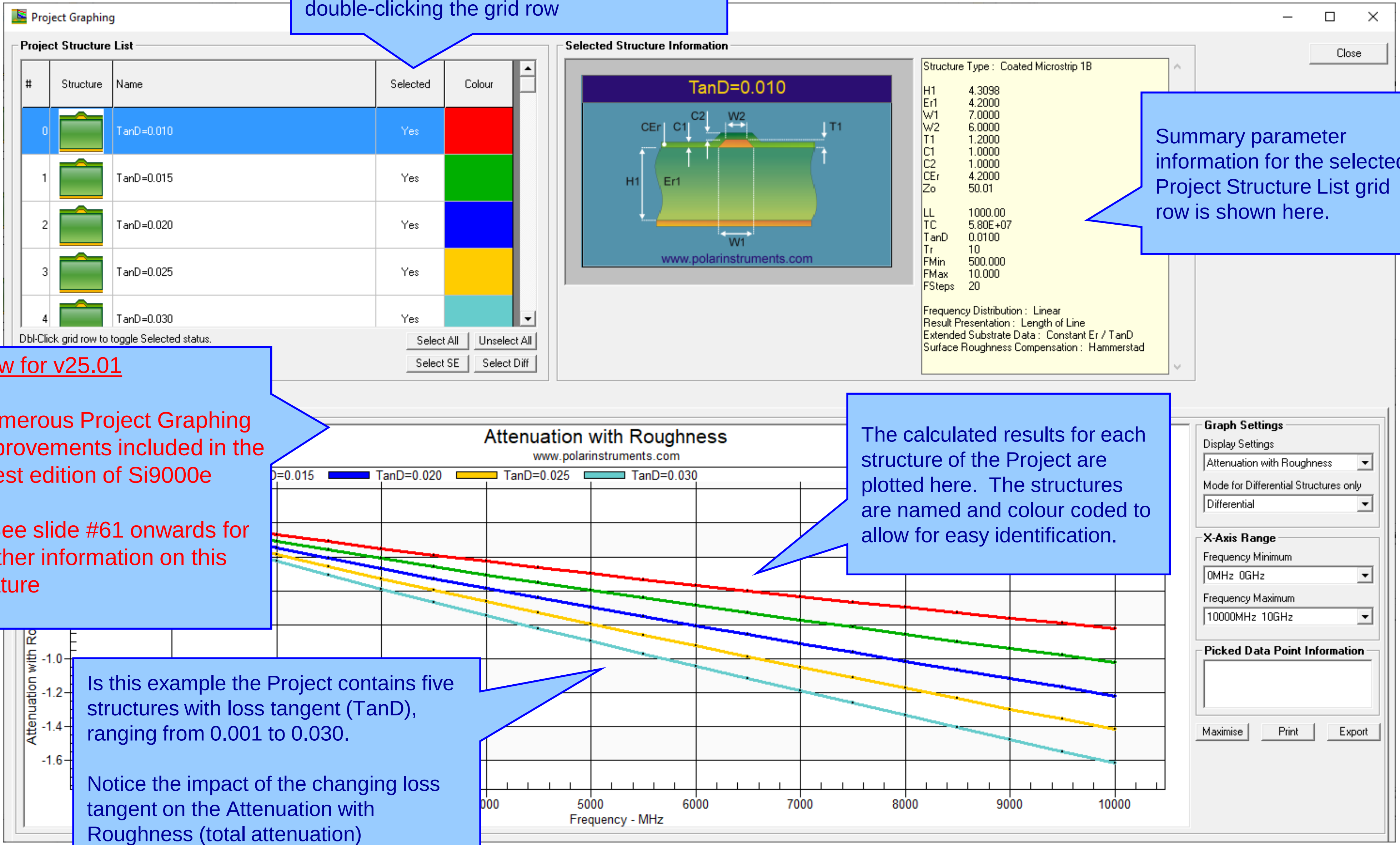



| Material Name | Resistivity | Conductivity | Reference Temperature °C | Operating Temperature °C | Temperature Coefficient of Resistance |
|---|---|---|---|---|---|
| -- From Si8000 / Si9000 -- | 1.7241E-08 | 5.800E+07 | 20.0 | 20.0 | 0.00386 |
| Aluminium | 2.650E-08 | 3.7736E+07 | 20.0 | 20.0 | 0.00429 |
| Copper | 1.680E-08 | 5.9524E+07 | 20.0 | 20.0 | 0.00386 |
| Copper (Electro Deposited) | 2.200E-08 | 4.5455E+07 | 20.0 | 20.0 | 0.00386 |
| Gold | 2.440E-08 | 4.0984E+07 | 20.0 | 20.0 | 0.00340 |
| Lead | 2.200E-07 | 4.5455E+06 | 20.0 | 20.0 | 0.00390 |
| Nickel | 6.990E-08 | 1.4306E+07 | 20.0 | 20.0 | 0.00587 |
| Silver | 1.590E-08 | 6.2893E+07 | 20.0 | 20.0 | 0.00382 |
| Tin | 1.090E-07 | 9.1743E+06 | 20.0 | 20.0 | 0.00450 |

The Edit Materials option allows for a table of materials to be added to the Si8000m / Si9000e Trace Resistance Calculator (TRC).

It is possible to predict the trace resistance for a variety of conductive materials and varying temperatures

The Project Structure List provides options to choose which structures from the Project are plotted. Individual structures can toggled between selected / deselected by double-clicking the grid row




Summary parameter information for the selected Project Structure List grid row is shown here.

New for v25.01

Numerous Project Graphing improvements included in the latest edition of Si9000e

**See slide #61 onwards for further information on this feature

The calculated results for each structure of the Project are plotted here. The structures are named and colour coded to allow for easy identification.

Is this example the Project contains five structures with loss tangent (TanD), ranging from 0.001 to 0.030.

Notice the impact of the changing loss tangent on the Attenuation with Roughness (total attenuation)



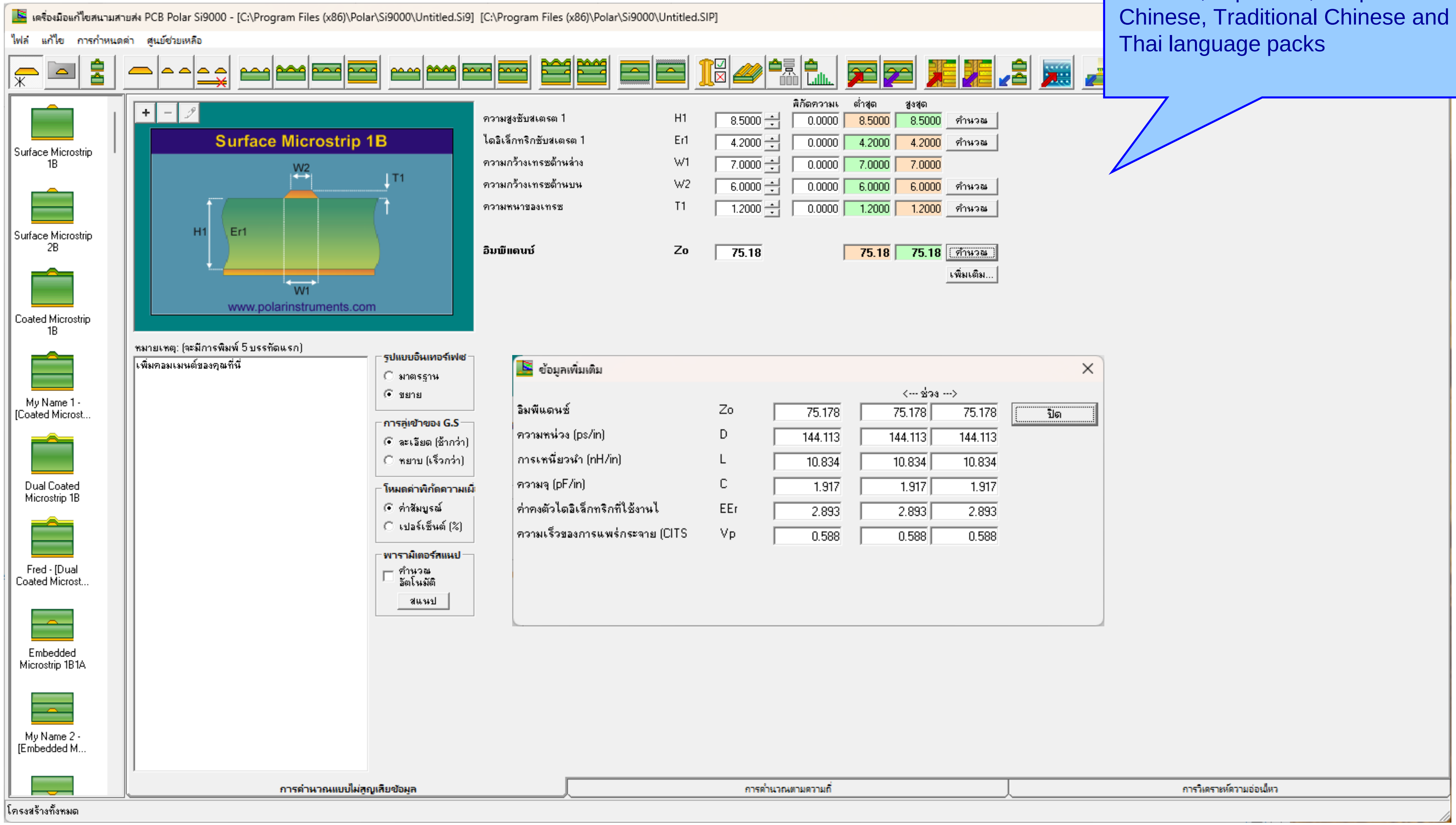


Si9000e only

# v24.10.01 (October 2024)

# Multilingual Support - Thai language added

Si9000e now supports English, German, Japanese, Simplified Chinese, Traditional Chinese and Thai language packs



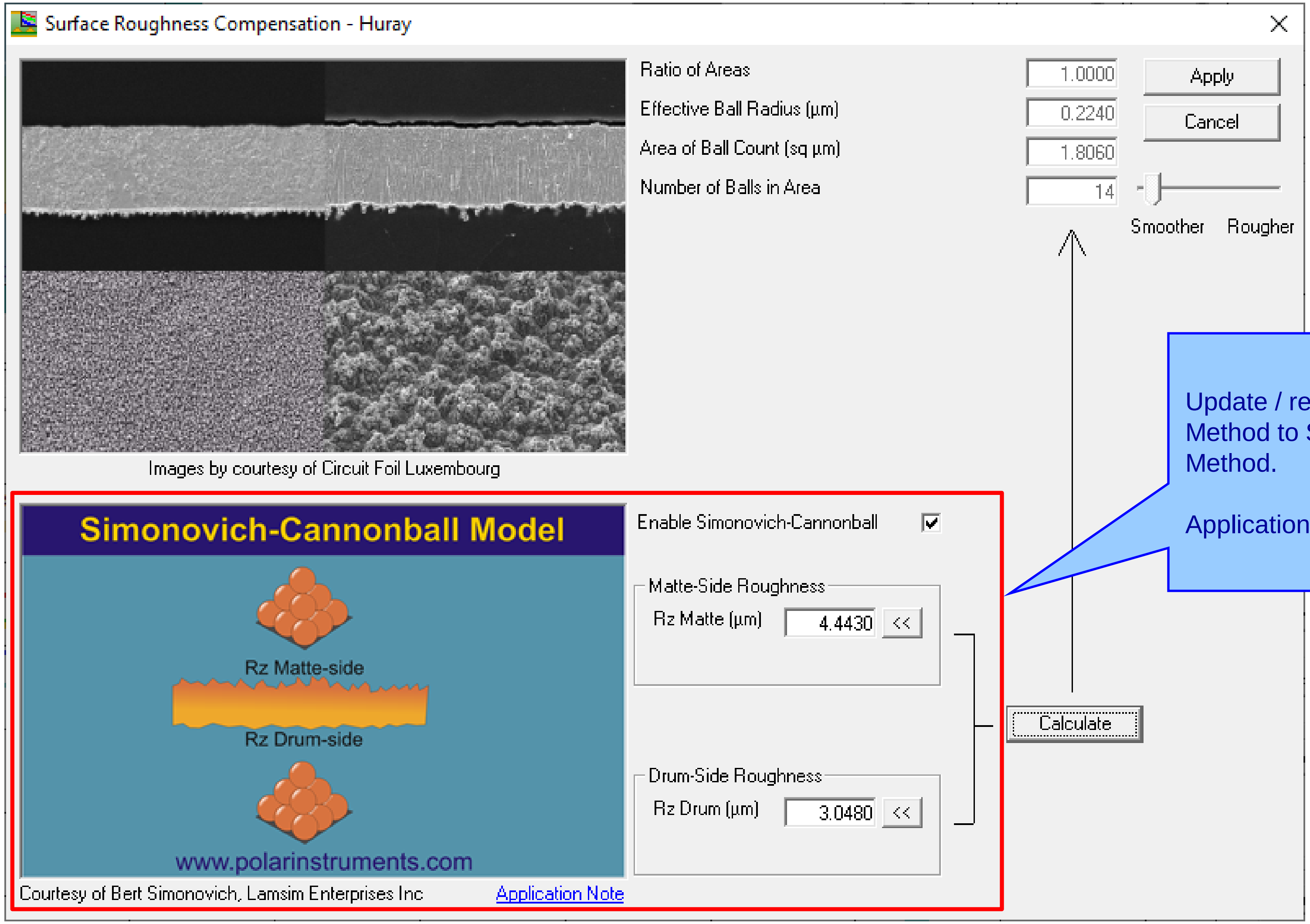





polarinstruments.com

# v24.03.13 (March 2024)

# Update Cannonball-Huray Method to Simonovich-Cannonball Method



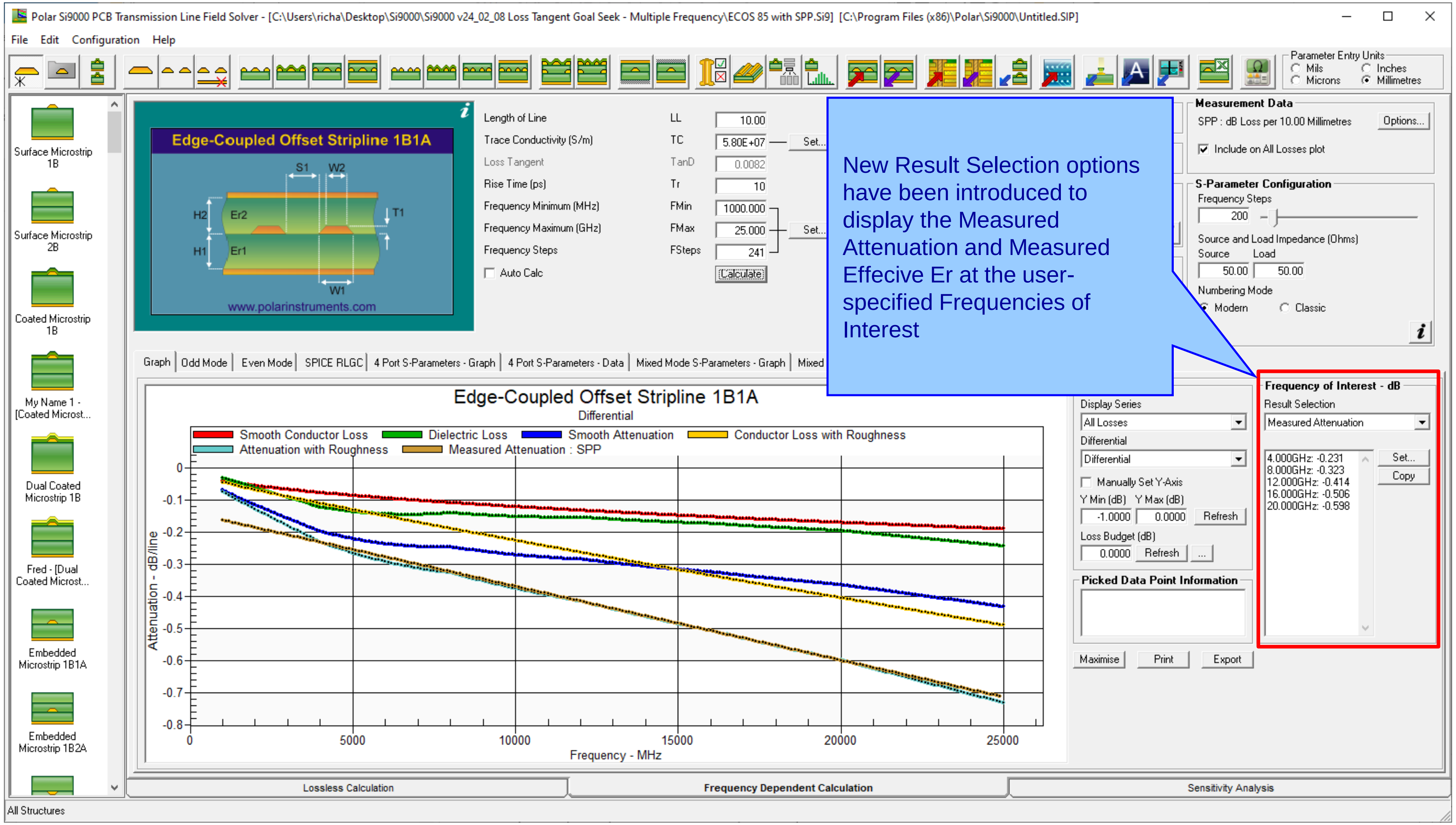

Update / rebrand of the Cannonball-Huray Method to Simonovich-Cannonball Method.

Application Note now links to two papers

Si9000e only

# v24.02.08 (February 2024)

# New Frequency of Interest option enhancements

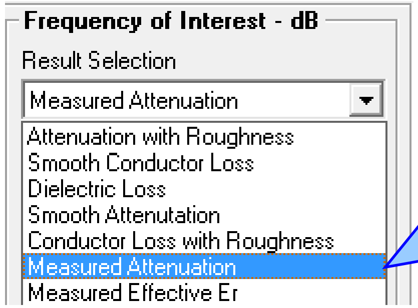




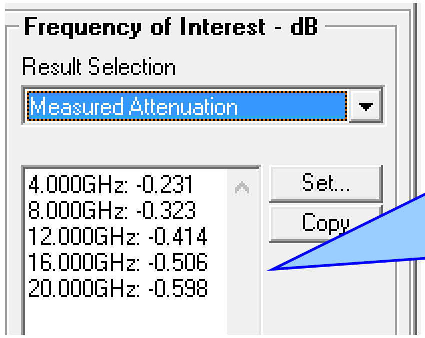



Si9000e only

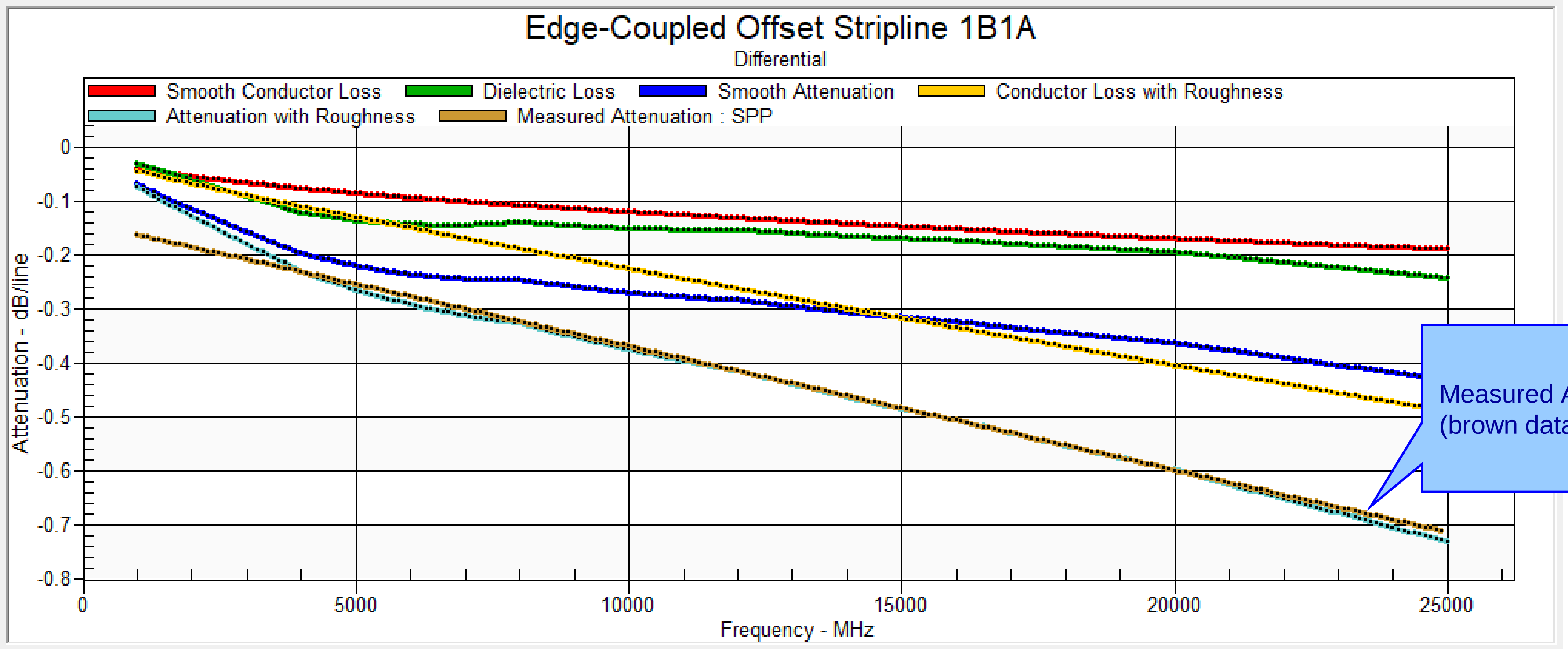
# New Frequency of Interest option enhancements




When importing insertion loss measurement data from the Polar Atlas it is often useful to know the exact measured attenuation dB values as specific frequencies. The new Result Selection options have been introduced to achieve this.

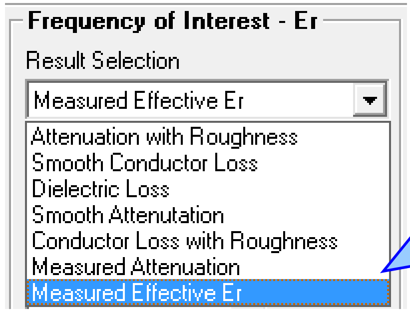



In this example the Frequency of Interest values have been set to 4, 8, 12, 16 and 20GHz. The measured attenuation (brown data series on the plot below) is examined and the dB loss values at those frequencies are displayed here

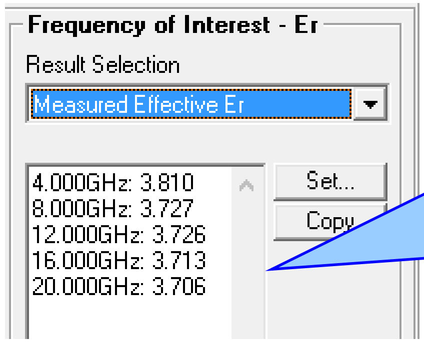



Measured Attenuation (brown data series)

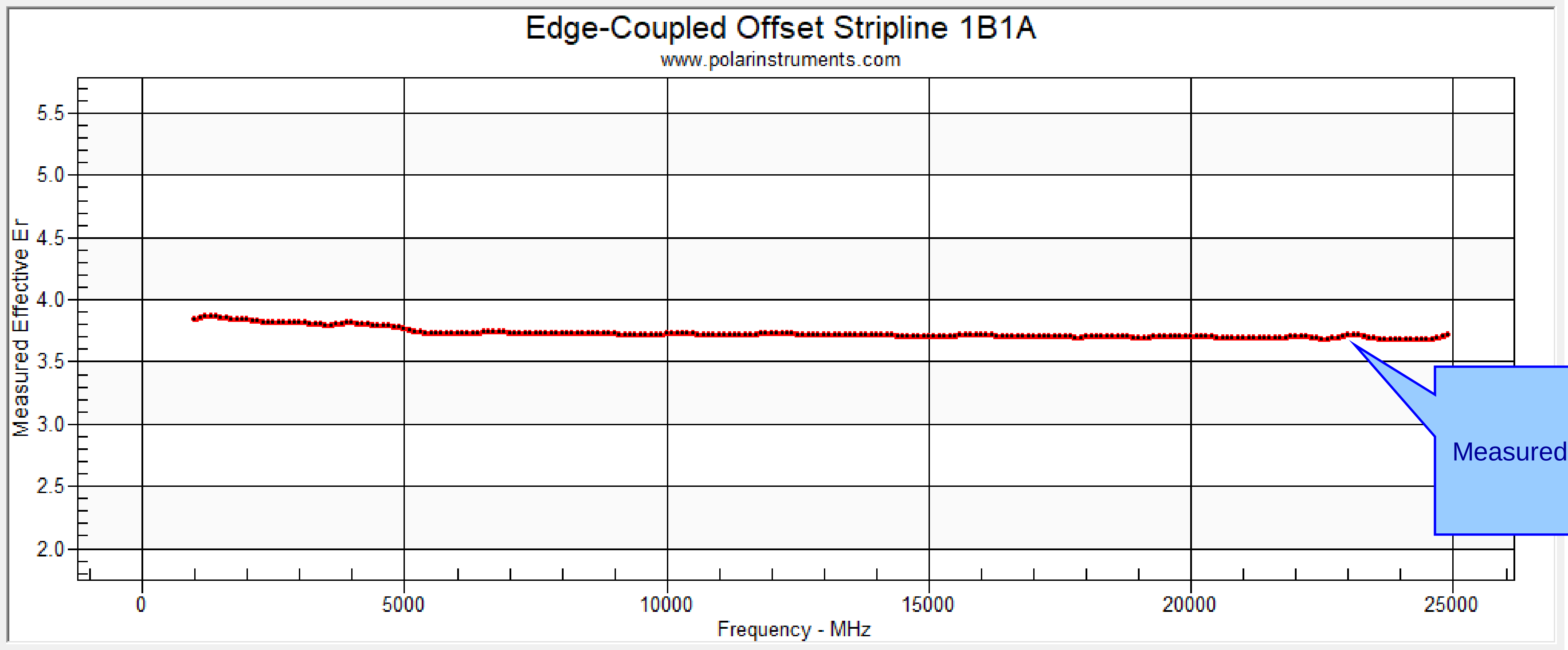
# New Frequency of Interest option enhancements




Similar to the new Measured Attenuation selection, it is now possible to select the Measured Effective Er.




Using the same Frequency of Interest values of 4, 8, 12, 16 and 20GHz, the imported measurement data is examined and the effective dielectric constant values at those frequencies are displayed here

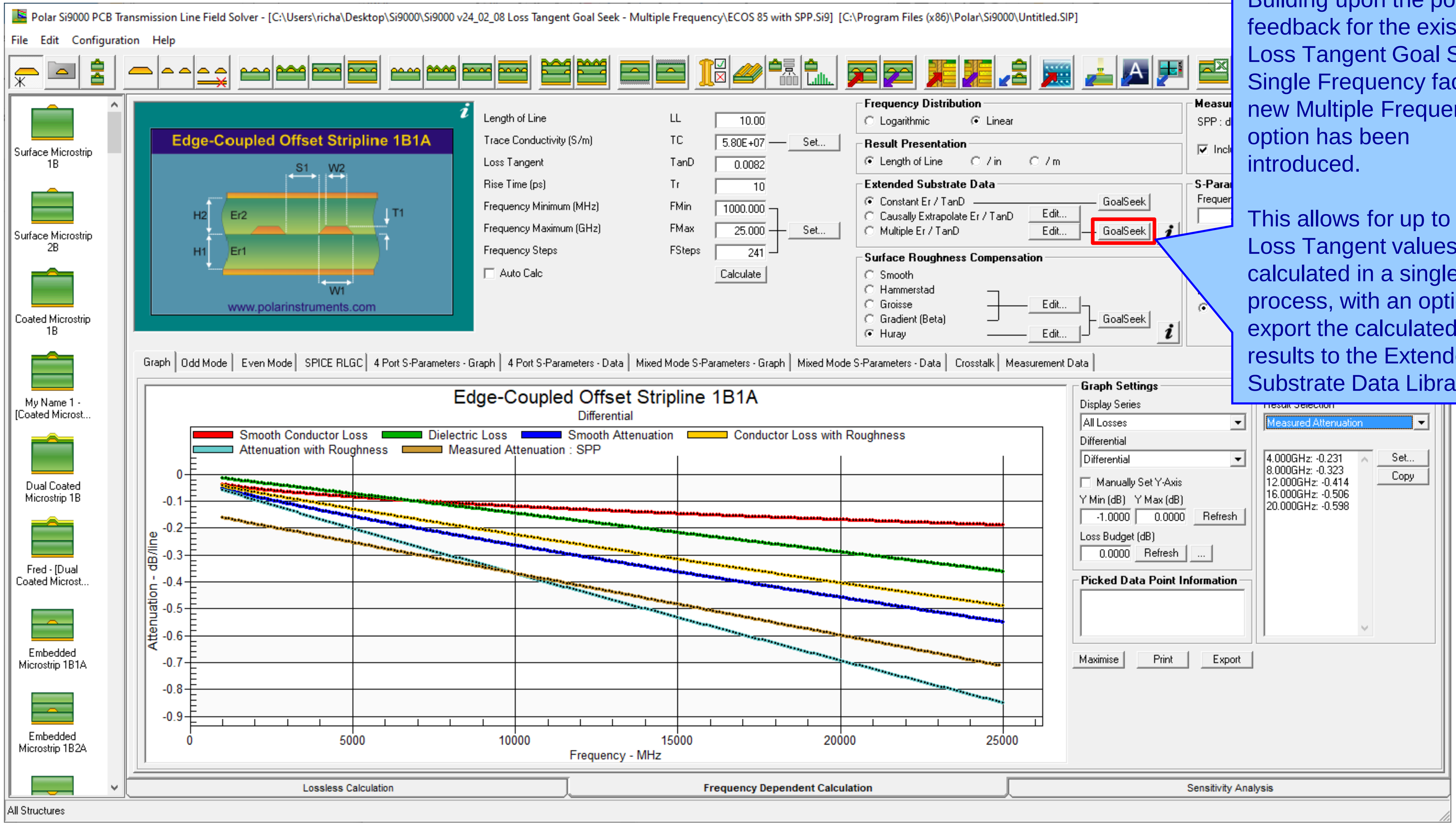



Measured Effective Er



Si9000e only

# New Loss Tangent Goal Seek – Multiple Frequency option



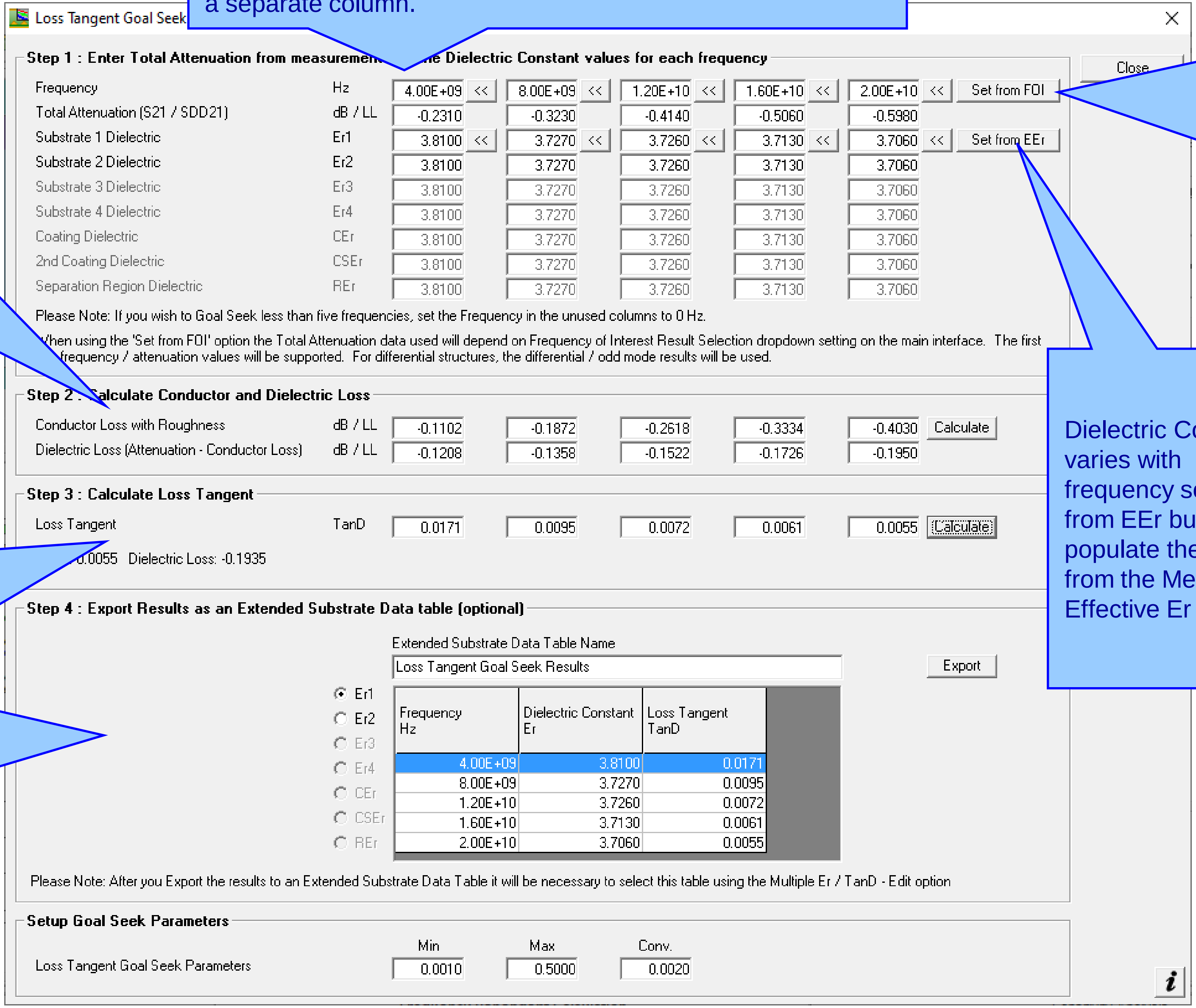

Building upon the positive feedback for the existing Loss Tangent Goal Seek – Single Frequency facility, a new Multiple Frequency option has been introduced.

This allows for up to five Loss Tangent values to be calculated in a single process, with an option to export the calculated results to the Extended Substrate Data Library



Si9000e only

The new Loss Tangent Goal Seek - Multiple Frequency option allows for up to five Loss Tangent values to be calculated in a single process.
The input data and results for each frequency are contained in a separate column.




The input parameter data can be keyed in or the Set from FOI (Frequency of Interest) button will automatically set the Frequency and Total Attenuation values from the main dialog.

The calculated Conductor and Dielectric Loss results will be displayed here

The calculated Loss Tangent results will be displayed here

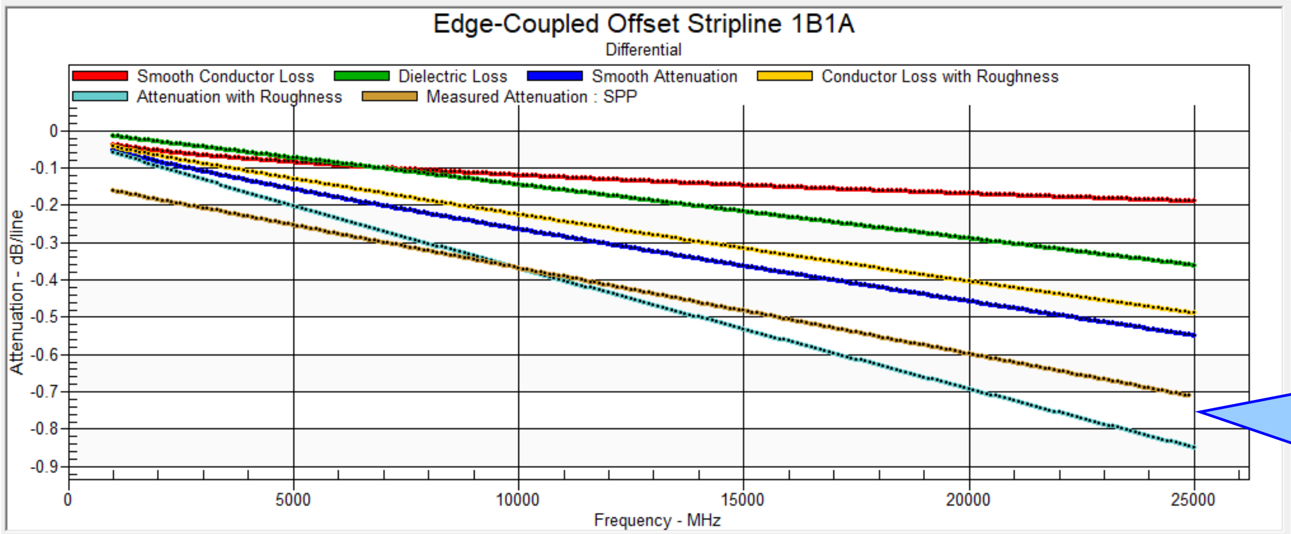
The results can also be exported to the Extended Substrate Data Library

Dielectric Constant varies with frequency so the Set from EEr button will populate these fields from the Measured Effective Er data



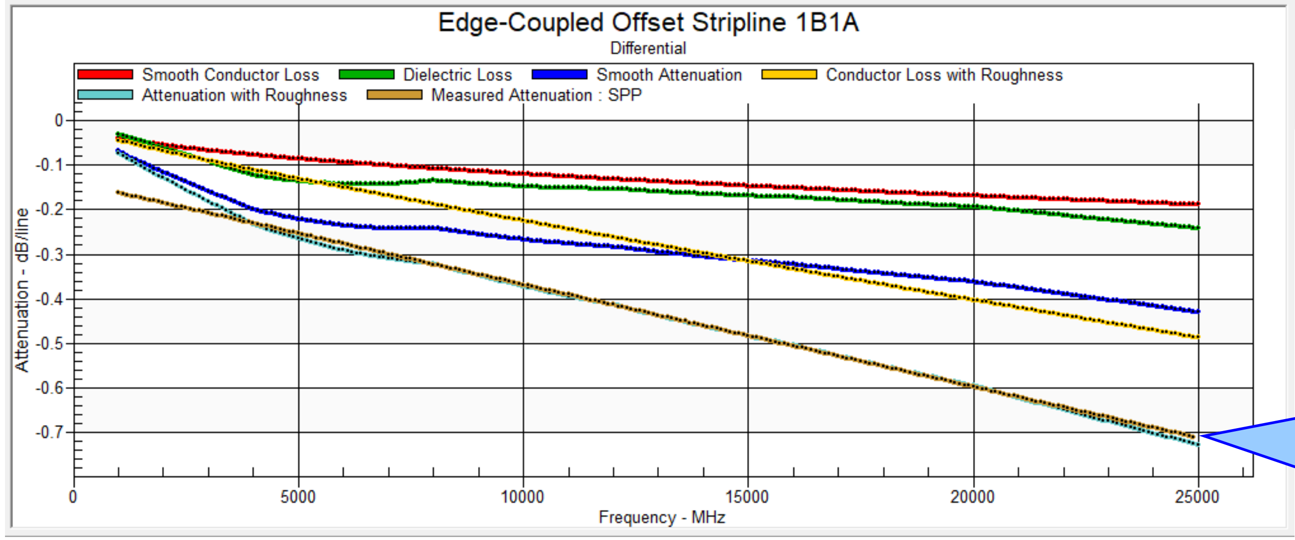

Si9000e only

# New Loss Tangent Goal Seek – Multiple Frequency option





The Attenuation with Roughness (cyan) and Measured Attenuation (brown) do not correlate very well when using Constant Er / TanD mode





Once the Loss Tangent Goal Seek is complete it is possible to use the exported results to improve the correlation between the calculated Attenuation with Roughness (cyan) and Measured Attenuation (brown).




Si9000e only

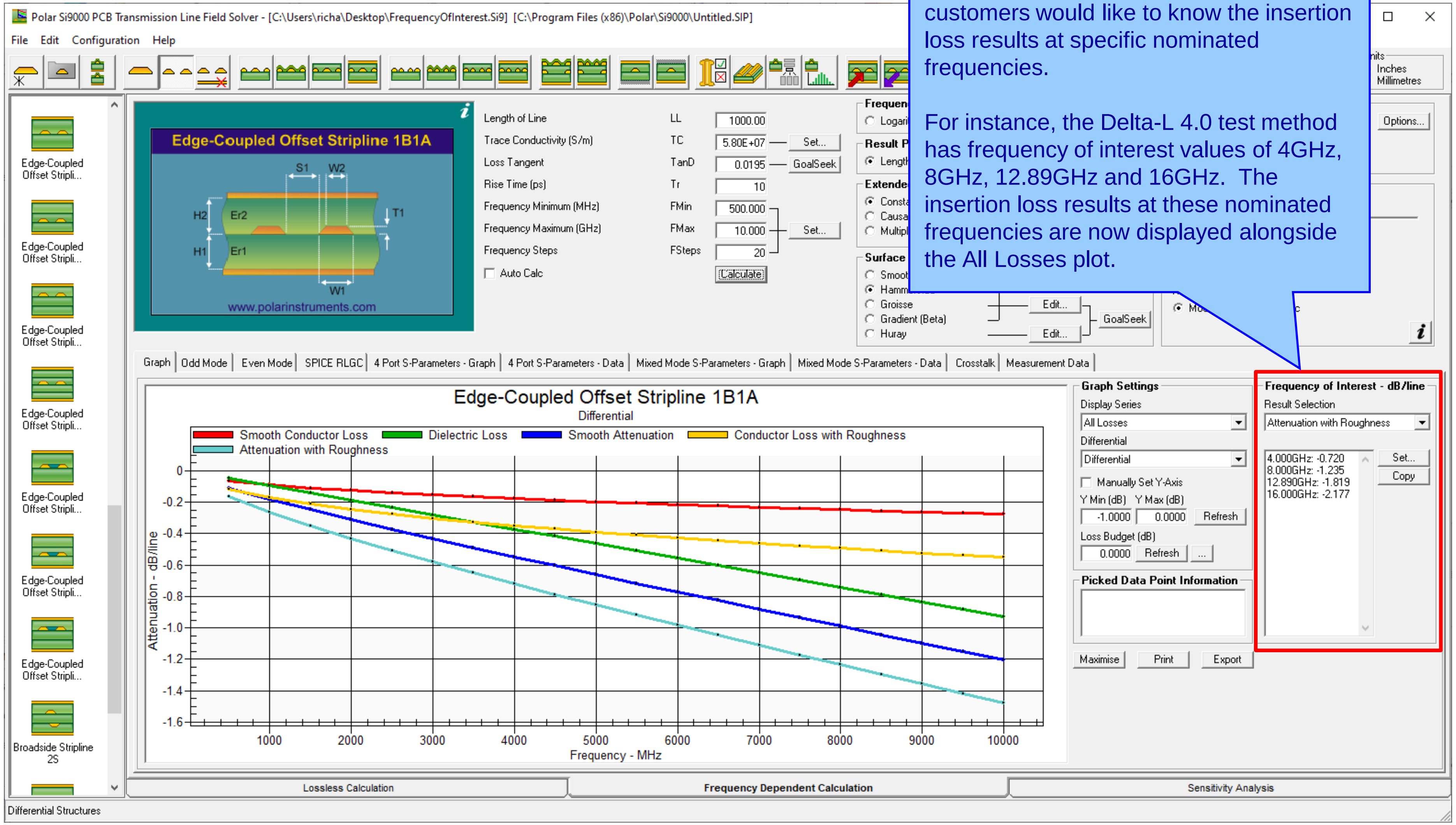
# v24.01.01 (January 2024)

## Enhancements

- From 2024 the Track Resistance Calculator (TRC) will be running on the Microsoft .Net Framework 4.8. It has migrated as a result of customer IT policy requests.

# v23.09.21 (September 2023)

# New Frequency of Interest option added




In addition to the insertion loss plots that are generated with Si9000e, some customers would like to know the insertion loss results at specific nominated frequencies.

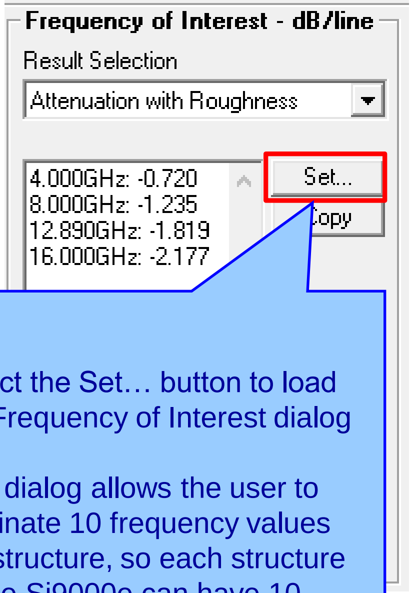
For instance, the Delta-L 4.0 test method has frequency of interest values of 4GHz, 8GHz, 12.89GHz and 16GHz. The insertion loss results at these nominated frequencies are now displayed alongside the All Losses plot.

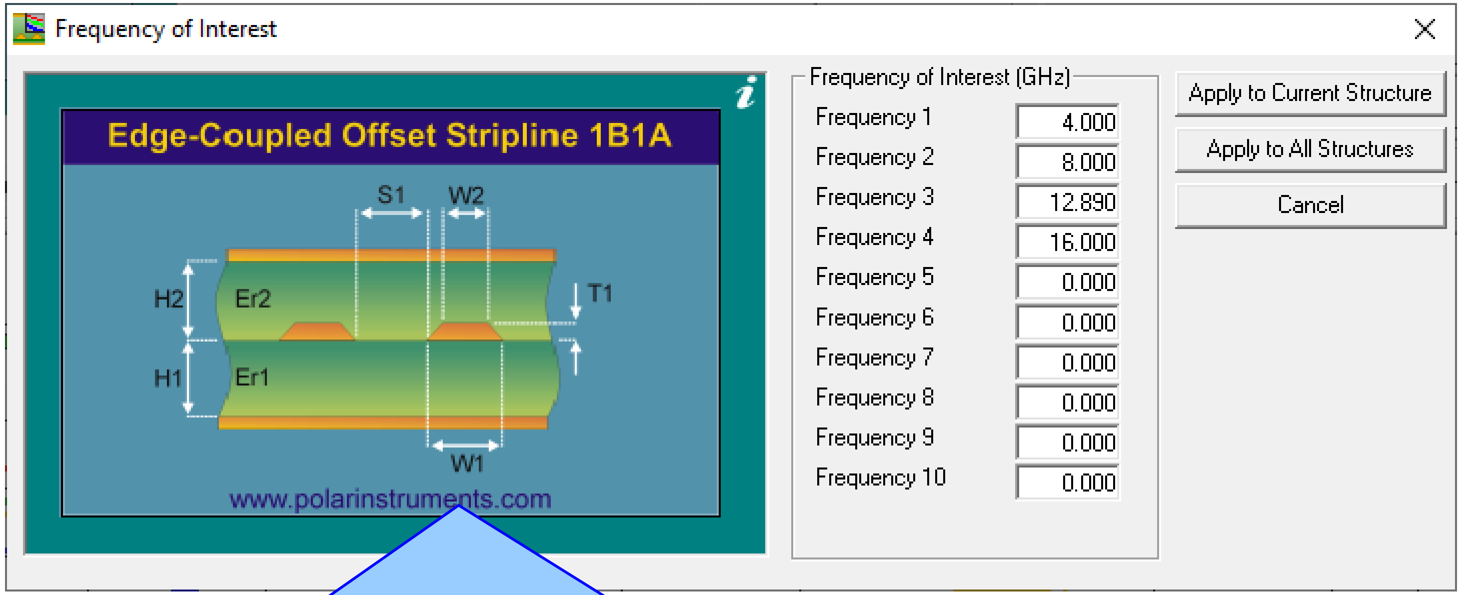




Si9000e only

# New Frequency of Interest option added




Select the Set… button to load the Frequency of Interest dialog

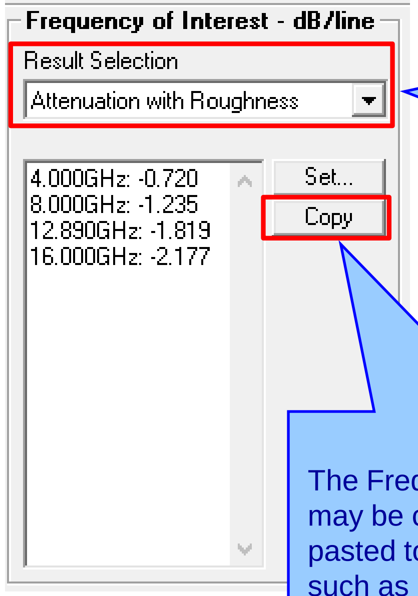
This dialog allows the user to nominate 10 frequency values per structure, so each structure inside Si9000e can have 10 unique frequency values.

- Selecting Apply to Current Structure will place those frequency values with the current selected structure so the next time the structure is calculated the results for each specified frequency will be placed on the main dialog, giving immediate feedback of the results at those frequency values.
- Selecting Apply to All Structures will place those same nominated frequency values on all structures in the Si9000e, including those structures that exist in a Project.
- In this example we have keyed in the four Delta-L 4.0 frequencies of 4GHz, 8GHz, 12.89GHz and 16GHz



Si9000e only

# New Frequency of Interest option added




Use the Result Selection dropdown to choose which loss result is displayed. The options available are Attenuation with Roughness, Smooth Conductor Loss, Dielectric Loss, Smooth Attenuation and Conductor Loss with Roughness.

Like the All Losses plots, the formatting of the dB results will match that as specified by Result Presentation, so the dB results will be by /Length or /inch or /metre

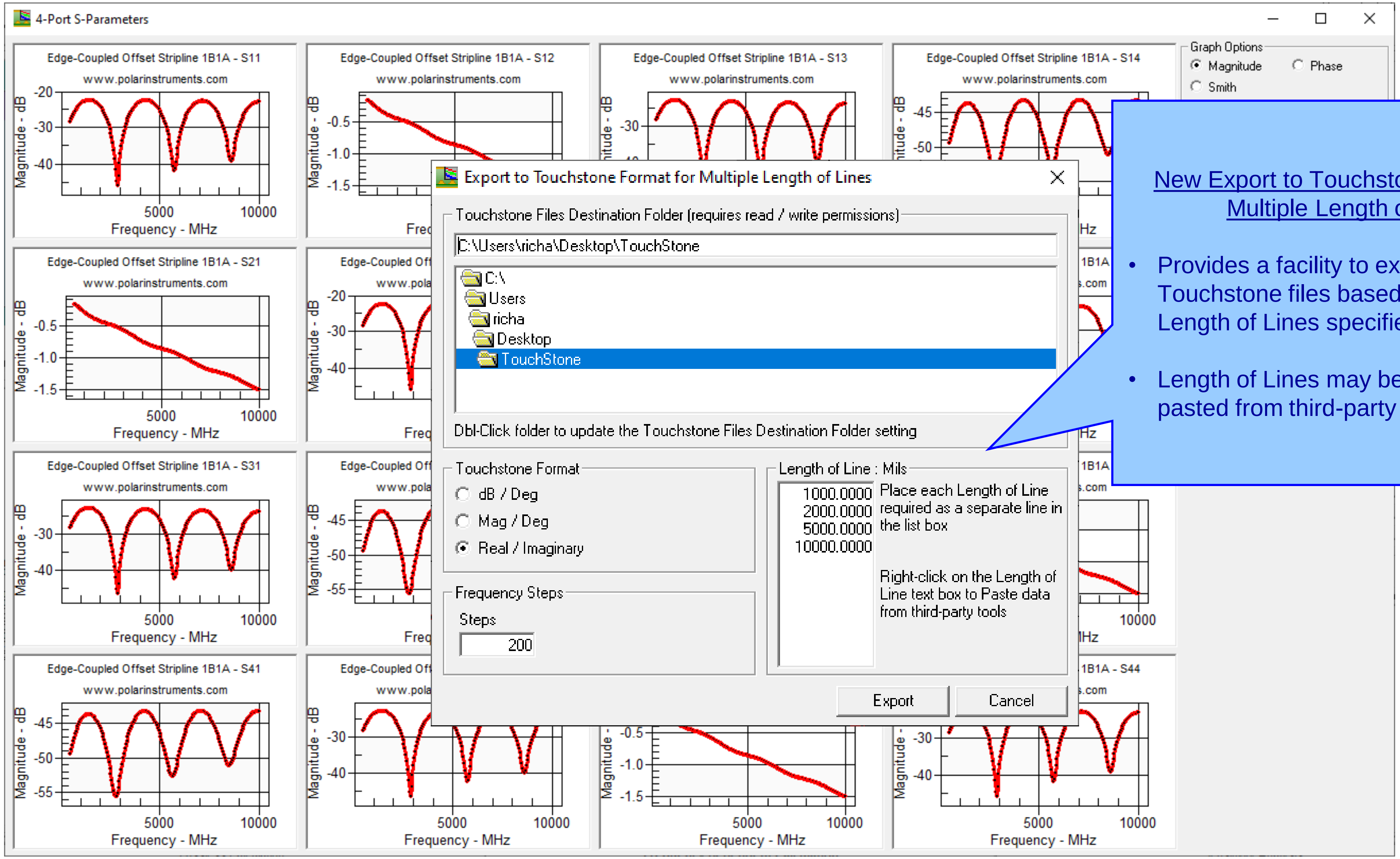
The Frequency of Interest results may be copied to the clipboard, then pasted to third-party applications such as Excel



Si9000e only

# v23.08.02 (August 2023)

# New Export to Touchstone Format for Multiple Length of Lines




## New Export to Touchstone Format for Multiple Length of Lines

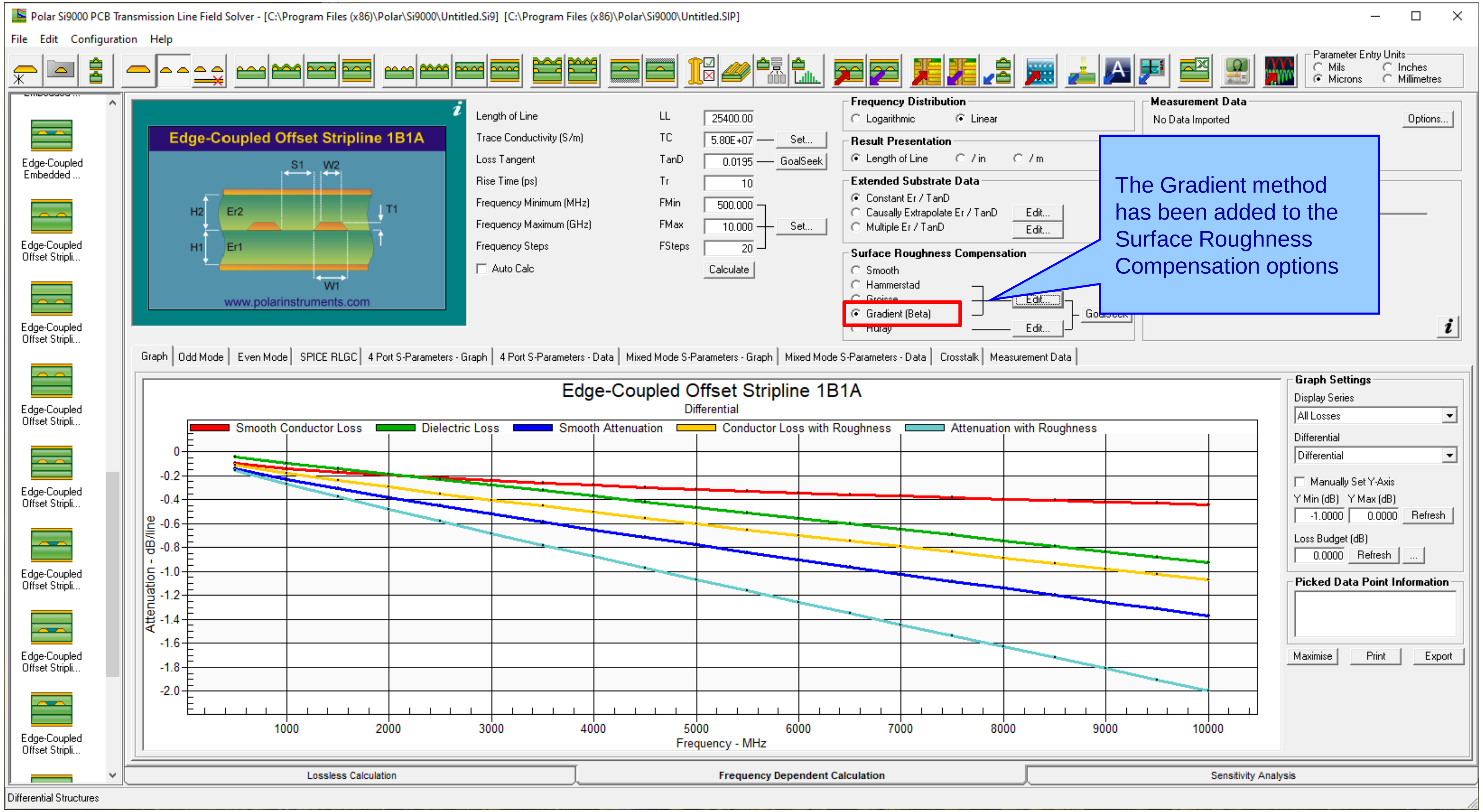
- Provides a facility to export multiple Touchstone files based upon the Length of Lines specified
- Length of Lines may be keyed in or pasted from third-party applications



Si9000e only

# v23.06.01 (June 2023)

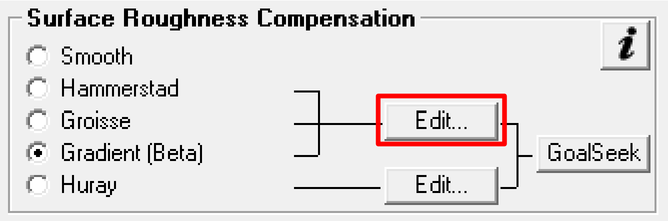
# New Gradient Surface Roughness Compensation Method added





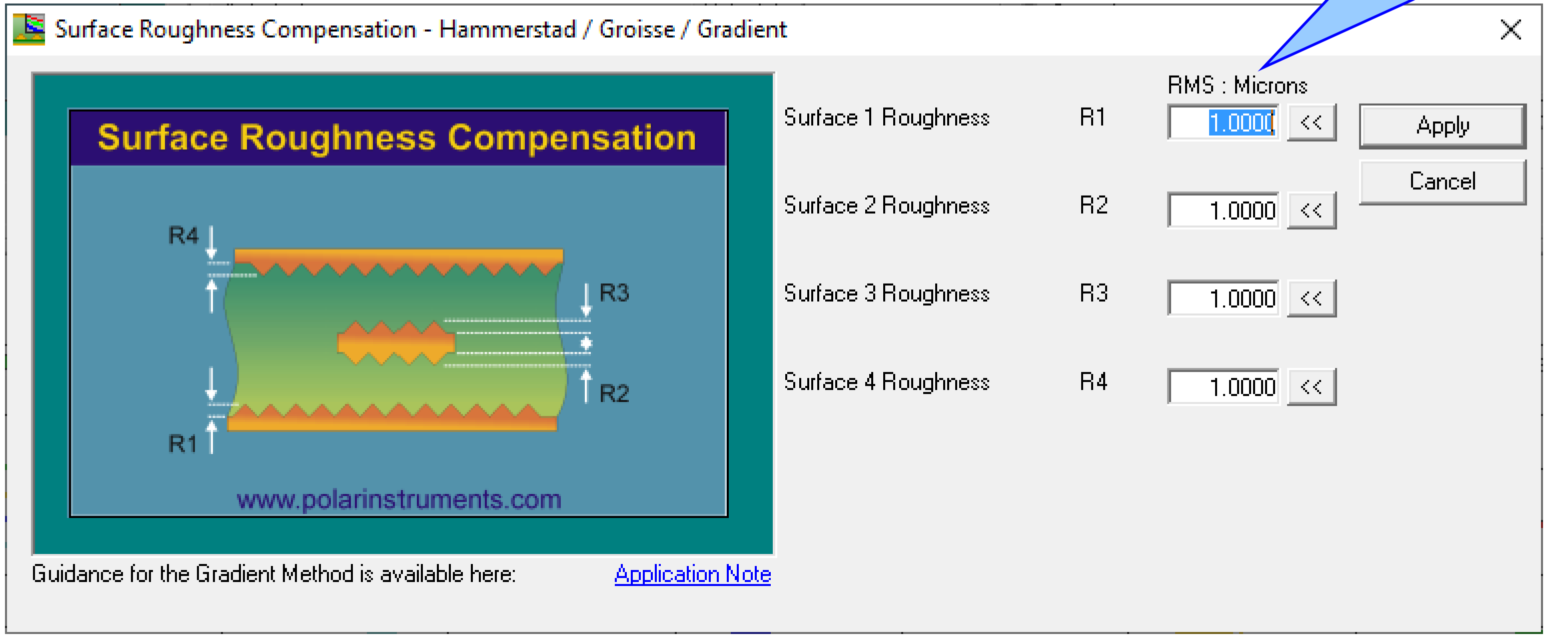

Si9000e only

# New Gradient Surface Roughness Compensation Method added




Selecting the Edit button will allow the RMS roughness values to be entered.

In this example 1µm roughness for all significant surfaces

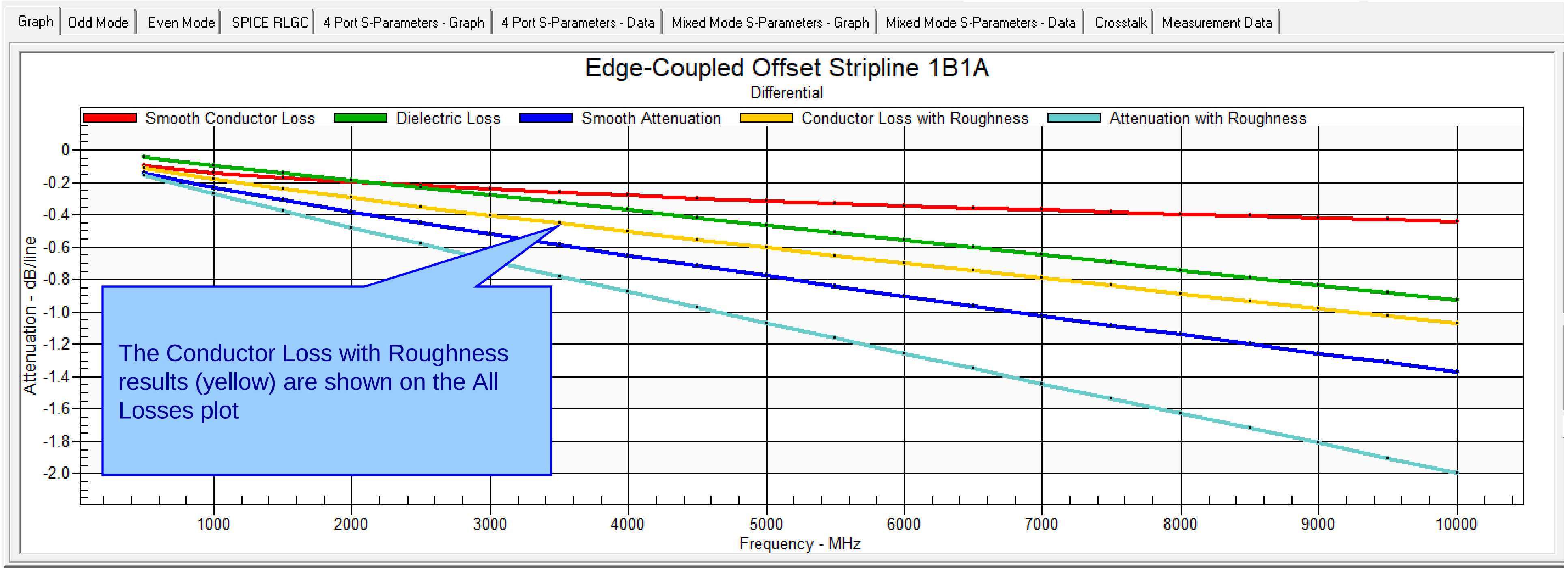






Si9000e only

# New Gradient Surface Roughness Compensation Method added







Si9000e only

# New Gradient Surface Roughness Compensation Method added

Graph | Odd Mode | Even Mode | SPICE RLGC | 4 Port S-Parameters - Graph | 4 Port S-Parameters - Data | Mixed Mode S-Parameters - Graph | Mixed Mode S-Parameters - Data | Crosstalk | Measurement Data

| Frequency Hz | Impedance Real Ohms | Impedance Imaginary Ohms | Impedance Magnitude Ohms | Inductance H/line | Resistance Ohms/line | Capacitance F/line | Conductance S/line | Skin Depth m | Smooth Conductor Loss dB/line | Dielectric Loss dB/line | Smooth Attenuation dB/line | Conductor Loss with Roughness dB/line | Attenuation with Roughness dB/line | Modal Phase Velocity m/s | Alpha Np/line | Alpha dB/line | Beta rad/line |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.000E+08 | 3.161E+01 | -3.664E-01 | 3.161E+01 | 5.955E-09 | 7.989E-01 | 5.964E-12 | 3.653E-04 | 2.955E-06 | -9.873E-02 | -4.717E-02 | -1.459E-01 | -1.128E-01 | -1.599E-01 | 1.348E+08 | 1.841E-02 | -1.599E-01 | 5.921E-01 |
| 1.000E+09 | 3.138E+01 | -2.268E-01 | 3.138E+01 | 5.869E-09 | 1.253E+00 | 5.964E-12 | 7.307E-04 | 2.090E-06 | -1.399E-01 | -9.376E-02 | -2.337E-01 | -1.792E-01 | -2.730E-01 | 1.358E+08 | 3.142E-02 | -2.730E-01 | 1.176E+00 |
| 1.500E+09 | 3.126E+01 | -1.675E-01 | 3.126E+01 | 5.827E-09 | 1.660E+00 | 5.964E-12 | 1.096E-03 | 1.706E-06 | -1.715E-01 | -1.403E-01 | -3.118E-01 | -2.391E-01 | -3.794E-01 | 1.363E+08 | 4.368E-02 | -3.794E-01 | 1.757E+00 |
| 2.000E+09 | 3.119E+01 | -1.330E-01 | 3.119E+01 | 5.799E-09 | 2.043E+00 | 5.964E-12 | 1.461E-03 | 1.478E-06 | -1.982E-01 | -1.867E-01 | -3.849E-01 | -2.957E-01 | -4.824E-01 | 1.366E+08 | 5.554E-02 | -4.824E-01 | 2.337E+00 |
| 2.500E+09 | 3.113E+01 | -1.097E-01 | 3.113E+01 | 5.779E-09 | 2.410E+00 | 5.964E-12 | 1.827E-03 | 1.322E-06 | -2.217E-01 | -2.331E-01 | -4.548E-01 | -3.501E-01 | -5.832E-01 | 1.368E+08 | 6.714E-02 | -5.832E-01 | 2.916E+00 |
| 3.000E+09 | 3.109E+01 | -9.260E-02 | 3.109E+01 | 5.763E-09 | 2.766E+00 | 5.964E-12 | 2.192E-03 | 1.207E-06 | -2.429E-01 | -2.795E-01 | -5.224E-01 | -4.028E-01 | -6.823E-01 | 1.370E+08 | 7.856E-02 | -6.823E-01 | 3.495E+00 |
| 3.500E+09 | 3.105E+01 | -7.937E-02 | 3.105E+01 | 5.750E-09 | 3.112E+00 | 5.964E-12 | 2.557E-03 | 1.117E-06 | -2.624E-01 | -3.259E-01 | -5.883E-01 | -4.543E-01 | -7.802E-01 | 1.372E+08 | 8.982E-02 | -7.802E-01 | 4.072E+00 |
| 4.000E+09 | 3.102E+01 | -6.871E-02 | 3.102E+01 | 5.739E-09 | 3.452E+00 | 5.964E-12 | 2.923E-03 | 1.045E-06 | -2.806E-01 | -3.723E-01 | -6.529E-01 | -5.047E-01 | -8.770E-01 | 1.373E+08 | 1.010E-01 | -8.770E-01 | 4.650E+00 |
| 4.500E+09 | 3.100E+01 | -5.988E-02 | 3.100E+01 | 5.730E-09 | 3.785E+00 | 5.964E-12 | 3.288E-03 | 9.851E-07 | -2.976E-01 | -4.187E-01 | -7.163E-01 | -5.543E-01 | -9.730E-01 | 1.374E+08 | 1.120E-01 | -9.730E-01 | 5.227E+00 |
| 5.000E+09 | 3.097E+01 | -5.241E-02 | 3.097E+01 | 5.721E-09 | 4.114E+00 | 5.964E-12 | 3.653E-03 | 9.346E-07 | -3.138E-01 | -4.650E-01 | -7.788E-01 | -6.032E-01 | -1.068E+00 | 1.375E+08 | 1.230E-01 | -1.068E+00 | 5.803E+00 |
| 5.500E+09 | 3.095E+01 | -4.597E-02 | 3.095E+01 | 5.714E-09 | 4.437E+00 | 5.964E-12 | 4.019E-03 | 8.911E-07 | -3.291E-01 | -5.114E-01 | -8.405E-01 | -6.515E-01 | -1.163E+00 | 1.376E+08 | 1.339E-01 | -1.163E+00 | 6.379E+00 |
| 6.000E+09 | 3.094E+01 | -4.034E-02 | 3.094E+01 | 5.707E-09 | 4.757E+00 | 5.964E-12 | 4.384E-03 | 8.532E-07 | -3.438E-01 | -5.577E-01 | -9.015E-01 | -6.992E-01 | -1.257E+00 | 1.377E+08 | 1.447E-01 | -1.257E+00 | 6.955E+00 |
| 6.500E+09 | 3.092E+01 | -3.536E-02 | 3.092E+01 | 5.702E-09 | 5.073E+00 | 5.964E-12 | 4.750E-03 | 8.197E-07 | -3.579E-01 | -6.040E-01 | -9.619E-01 | -7.464E-01 | -1.350E+00 | 1.377E+08 | 1.555E-01 | -1.350E+00 | 7.531E+00 |
| 7.000E+09 | 3.091E+01 | -3.091E-02 | 3.091E+01 | 5.696E-09 | 5.387E+00 | 5.964E-12 | 5.115E-03 | 7.899E-07 | -3.714E-01 | -6.503E-01 | -1.022E+00 | -7.931E-01 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 7.500E+09 | 3.089E+01 | -2.691E-02 | 3.089E+01 | 5.691E-09 | 5.697E+00 | 5.964E-12 | 5.480E-03 | 7.631E-07 | -3.845E-01 | -6.967E-01 | -1.081E+00 | -8.395E-01 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 8.000E+09 | 3.088E+01 | -2.327E-02 | 3.088E+01 | 5.686E-09 | 6.005E+00 | 5.964E-12 | 5.846E-03 | 7.389E-07 | -3.971E-01 | -7.430E-01 | -1.140E+00 | -8.855E-01 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 8.500E+09 | 3.087E+01 | -1.995E-02 | 3.087E+01 | 5.682E-09 | 6.310E+00 | 5.964E-12 | 6.211E-03 | 7.168E-07 | -4.093E-01 | -7.893E-01 | -1.199E+00 | -9.311E-01 | -1.720E+00 | 1.380E+08 | 1.981E-01 | -1.720E+00 | 9.831E+00 |
| 9.000E+09 | 3.086E+01 | -1.690E-02 | 3.086E+01 | 5.678E-09 | 6.613E+00 | 5.964E-12 | 6.576E-03 | 6.966E-07 | -4.212E-01 | -8.356E-01 | -1.257E+00 | -9.764E-01 | -1.812E+00 | 1.380E+08 | 2.086E-01 | -1.812E+00 | 1.041E+01 |
| 9.500E+09 | 3.085E+01 | -1.409E-02 | 3.085E+01 | 5.674E-09 | 6.914E+00 | 5.964E-12 | 6.942E-03 | 6.780E-07 | -4.328E-01 | -8.819E-01 | -1.315[illegible] | -1.021E+00 | -1.903E+00 | 1.381E+08 | 2.191E-01 | -1.903E+00 | 1.098E+01 |
| 1.000E+10 | 3.084E+01 | -1.148E-02 | 3.084E+01 | 5.671E-09 | 7.213E+00 | 5.964E-12 | 7.307E-03 | 6.609E-07 | -4.441E-01 | -9.282E-01 | [illegible] | -1.066E+00 | -1.994E+00 | 1.381E+08 | 2.296E-01 | -1.994E+00 | 1.155E+01 |

Copy Results to Clipboard (for Excel)

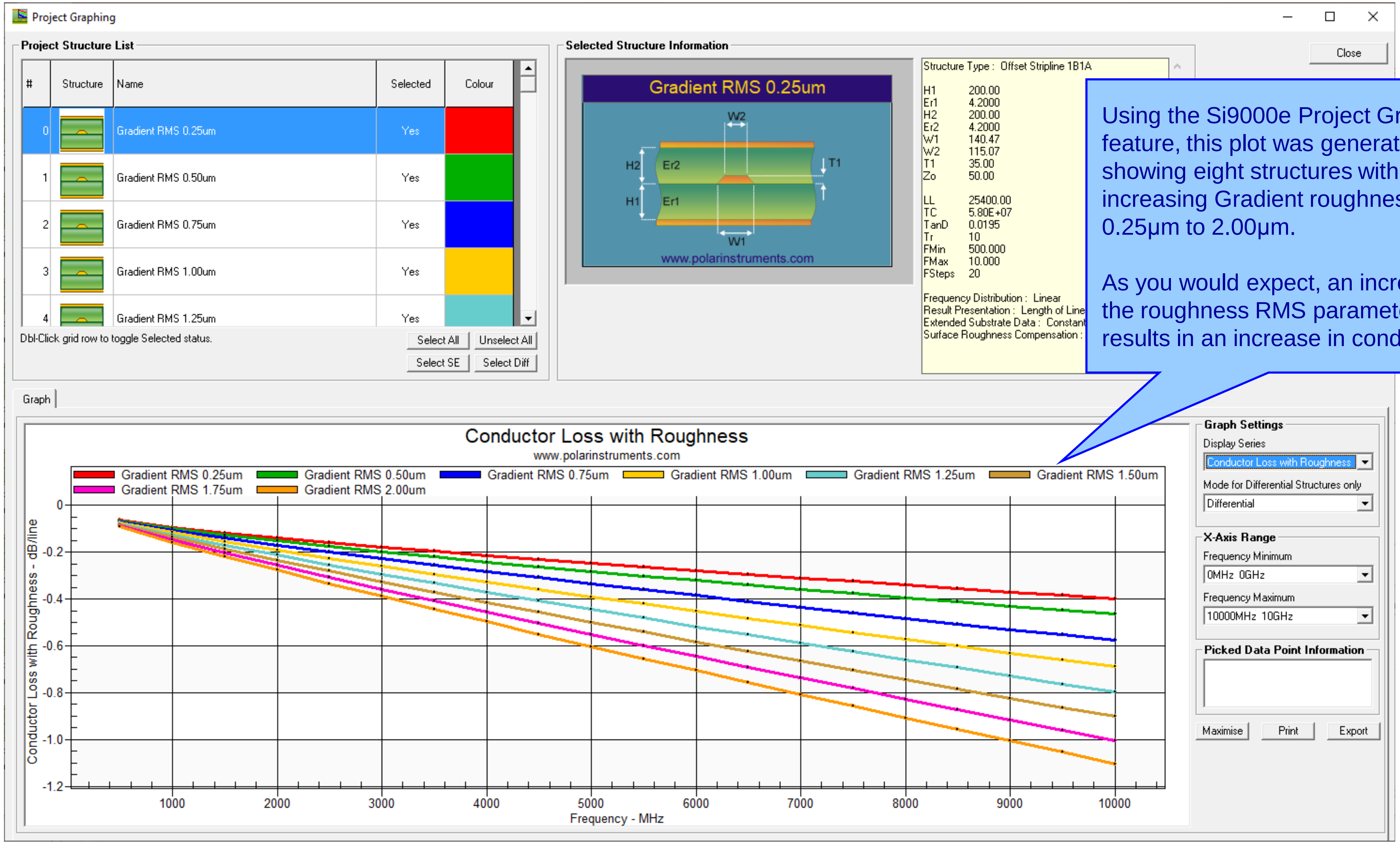
The Conductor Loss with Roughness results data is also shown alongside the other field solver results.

The complete set of results can be exported to third-party tools like Excel using the right-click menu | Copy Results to Clipboard



Si9000e only

# New Gradient Surface Roughness Compensation Method added



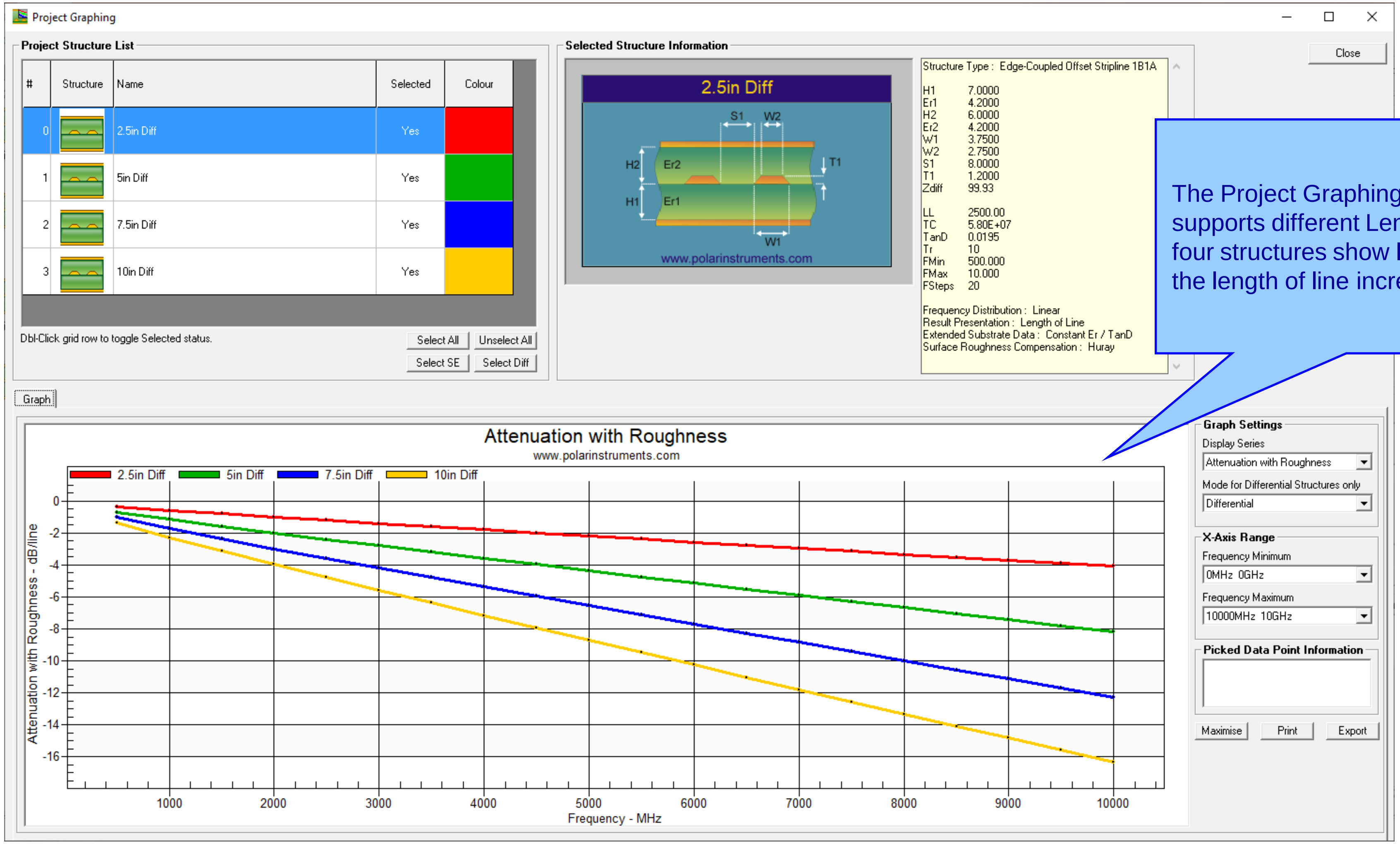

Using the Si9000e Project Graphing feature, this plot was generated showing eight structures with an ever increasing Gradient roughness from 0.25µm to 2.00µm.

As you would expect, an increase in the roughness RMS parameter value results in an increase in conductor loss



Si9000e only

# Project Graphing Enhancements - now supports structures within the Project with varying Length of Line




The Project Graphing feature now supports different Length of Lines. The four structures show loss increases as the length of line increases



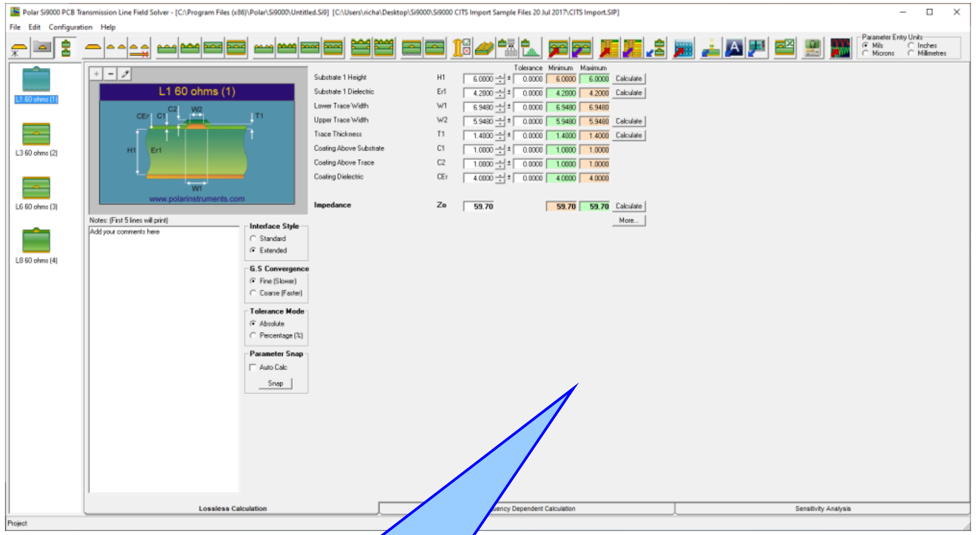
Si9000e only

# Other enhancements

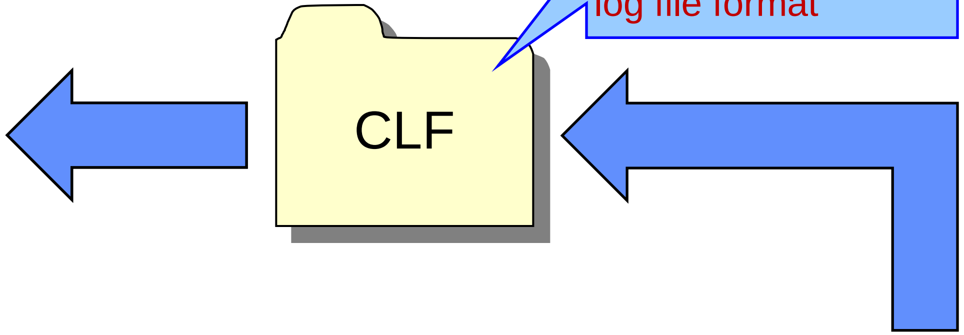
- FlexNet Publisher / FLEXlm v11.19.0.0 supported

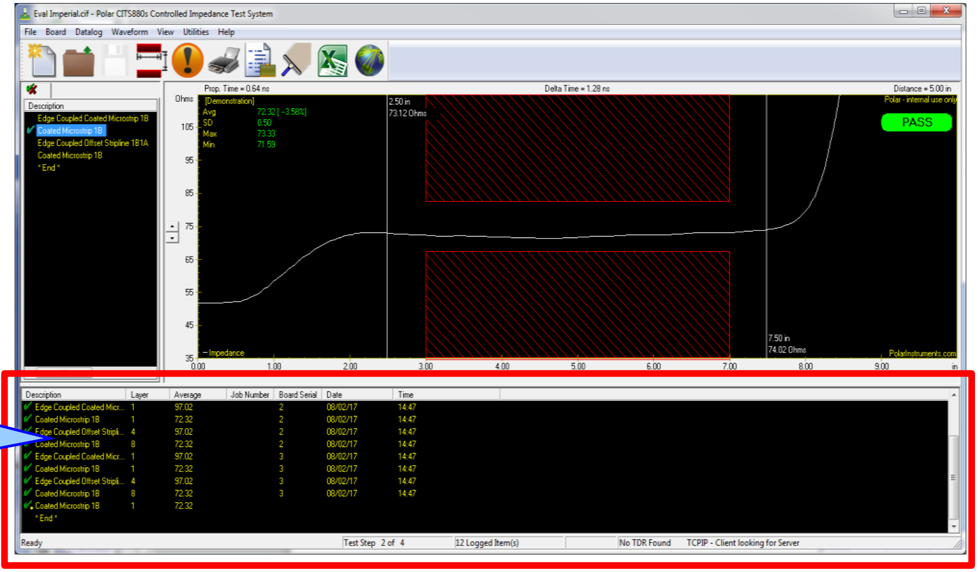
# v22.09.01 (September 2022)

# Enhancements to the Import Polar CITS Datalog File option



New for v22.09.01
Now supports the latest CITS880s data log file format



Overview
The Polar Si8000m / Si9000e field solver products have the capability to read a Polar CITS Data Log File (.CLF). This file contains comprehensive impedance measurement data and, along with existing modelled structure information, offers graphing capabilities and statistical analysis where the modelled and measured data can be presented together.

The Data Log of the CITS software is stored in a CLF file

# Import CITS Datalog File option – feature recap

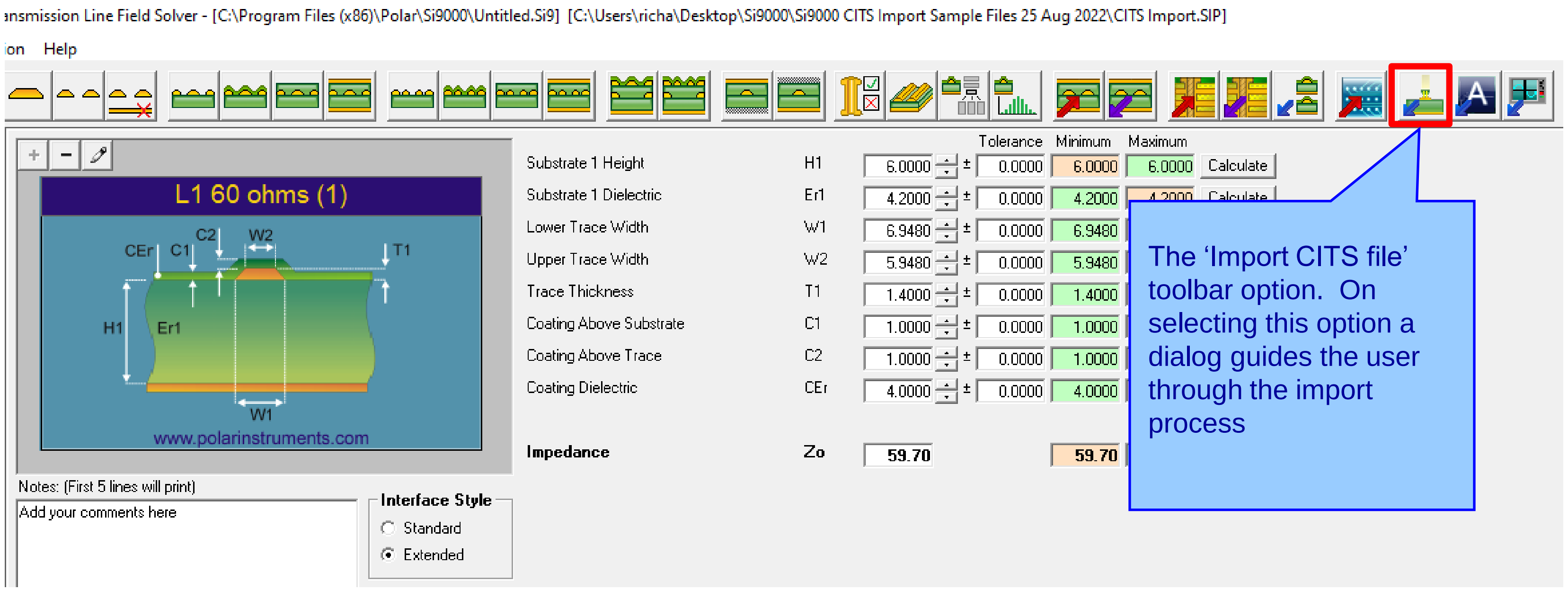
Whilst working with controlled impedance designs it is often desirable to compare the reality of the measurement data against the modelled structure.

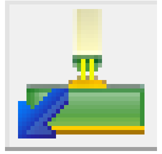
'Closing the loop' between the predicted and actual measured results has a number of benefits for both the design and fabrication environments.  It allows for fine tuning of the structure parameters in future manufacturing batches, statistical analysis and improved overall process control.

This capability within the Polar's Si8000m / Si9000e field solver products allows the user to quickly import measurement data directly from the industry-standard Polar Controlled Impedance Test System (CITS).

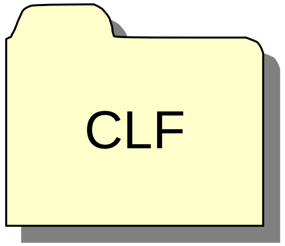
If you are a design customer using the Si8000m / Si9000e and would like to use this feature, please request the Polar CITS Datalog File from your fabricator.

# Import CITS Datalog File option – feature recap

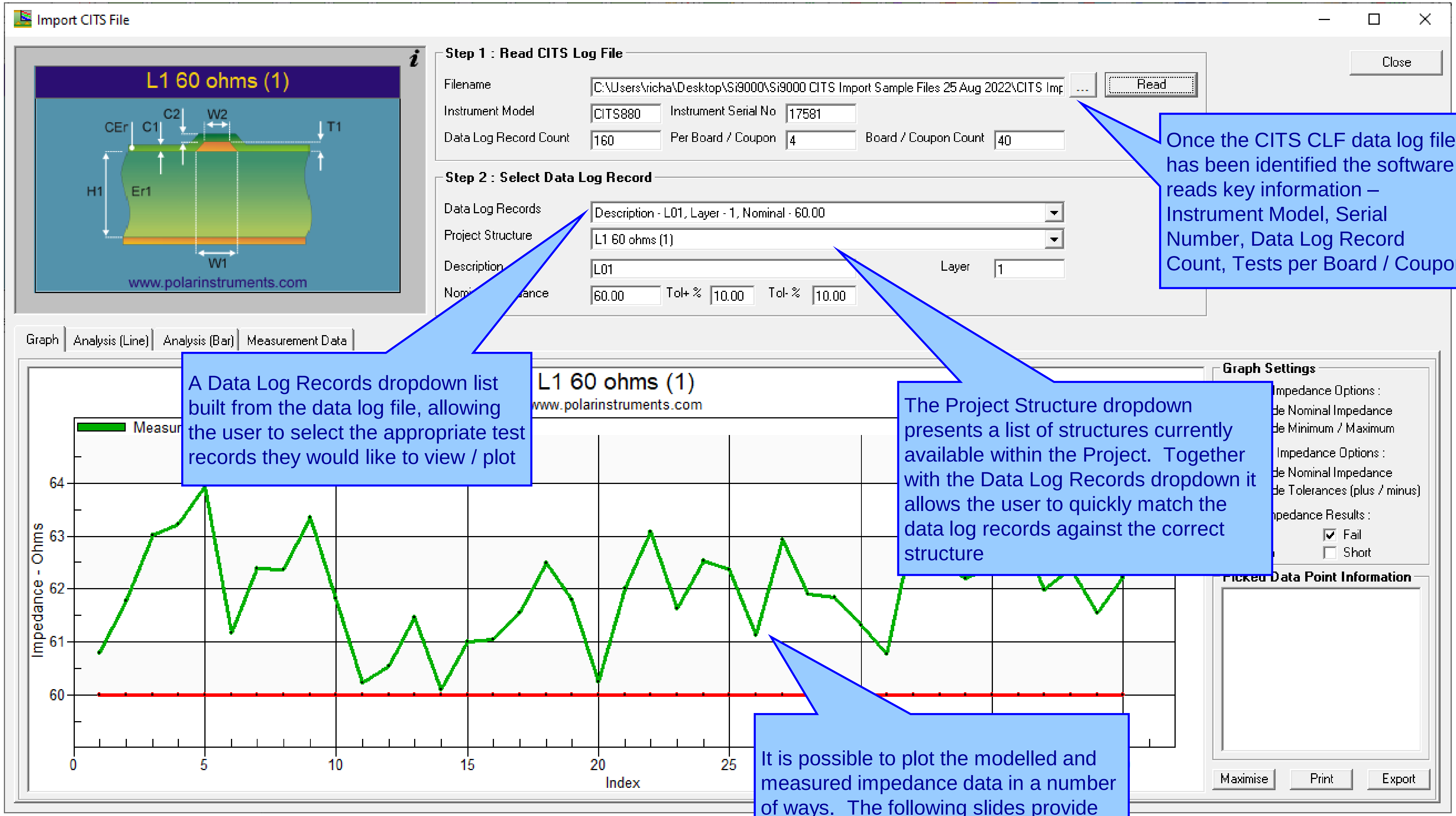


The 'Import CITS file' toolbar option. On selecting this option a dialog guides the user through the import process



# Import CITS Datalog File option – feature recap



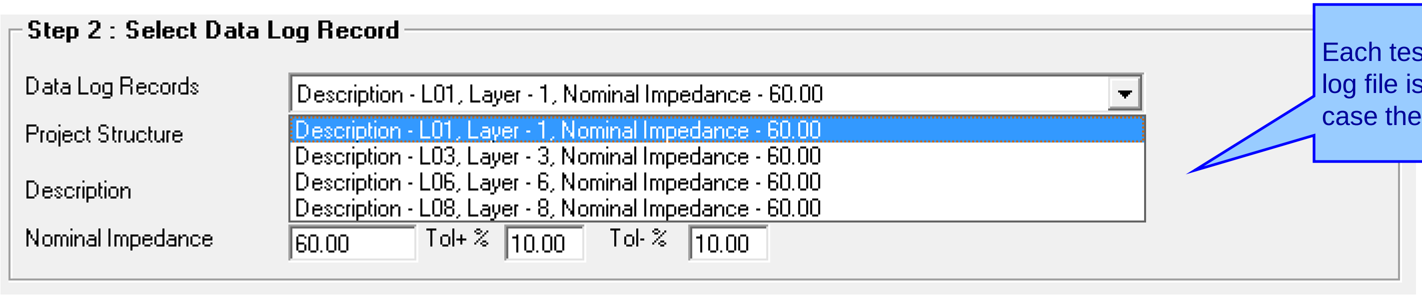

Once the CITS CLF data log file has been identified the software reads key information – Instrument Model, Serial Number, Data Log Record Count, Tests per Board / Coupon

A Data Log Records dropdown list built from the data log file, allowing the user to select the appropriate test records they would like to view / plot

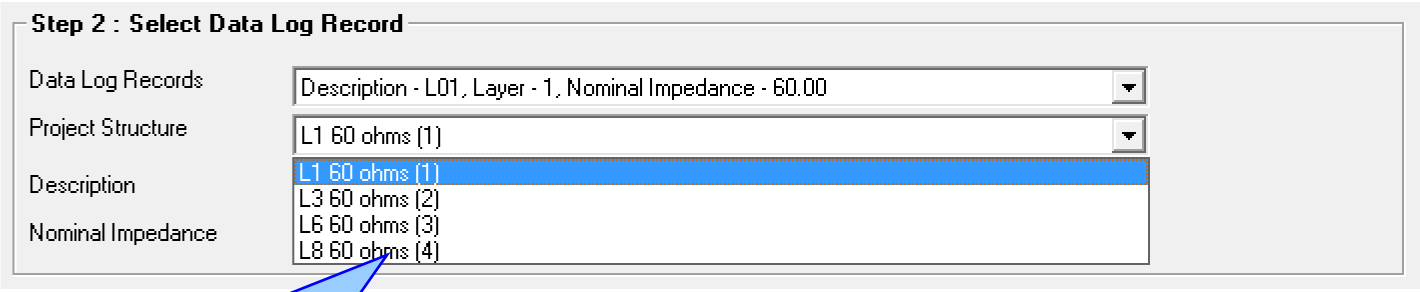
The Project Structure dropdown presents a list of structures currently available within the Project. Together with the Data Log Records dropdown it allows the user to quickly match the data log records against the correct structure

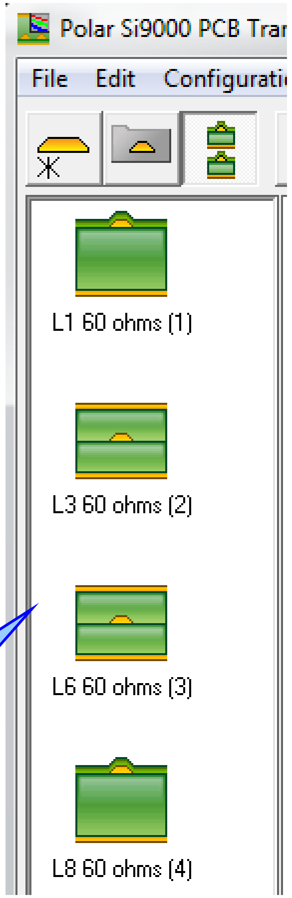
It is possible to plot the modelled and measured impedance data in a number of ways. The following slides provide more details

# Import CITS Datalog File option – feature recap




Each test record type found in the data log file is listed in the drop down. In this case there are four tests.



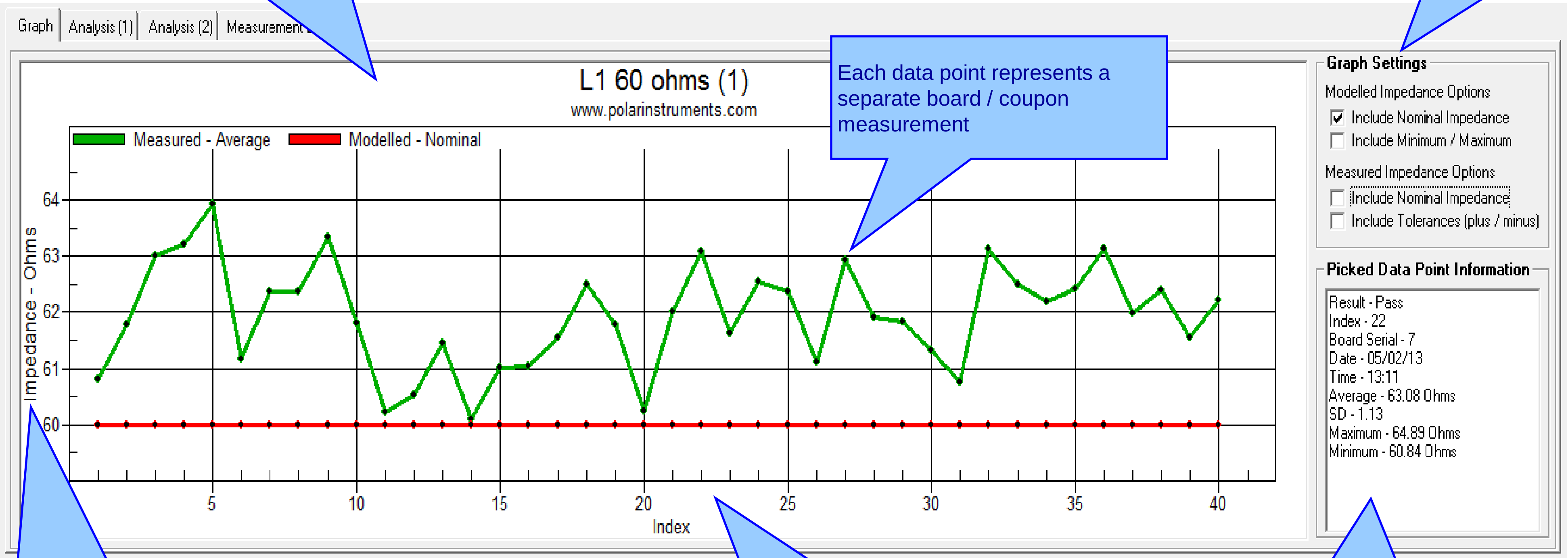

To match one of the four modelled structures from the Project group against a data log test record simply select the structure from the Project Structure dropdown

Four structures loaded into the Project group

# Import CITS Datalog File option – feature recap

The Graph tab provides a number of plot options. In this case the measured data is shown in Green, the modelled data in Red

Graph Settings allow the selection of modelled / measured data to be plotted




Each data point represents a separate board / coupon measurement

The y-axis is the measured impedance for each board / coupon

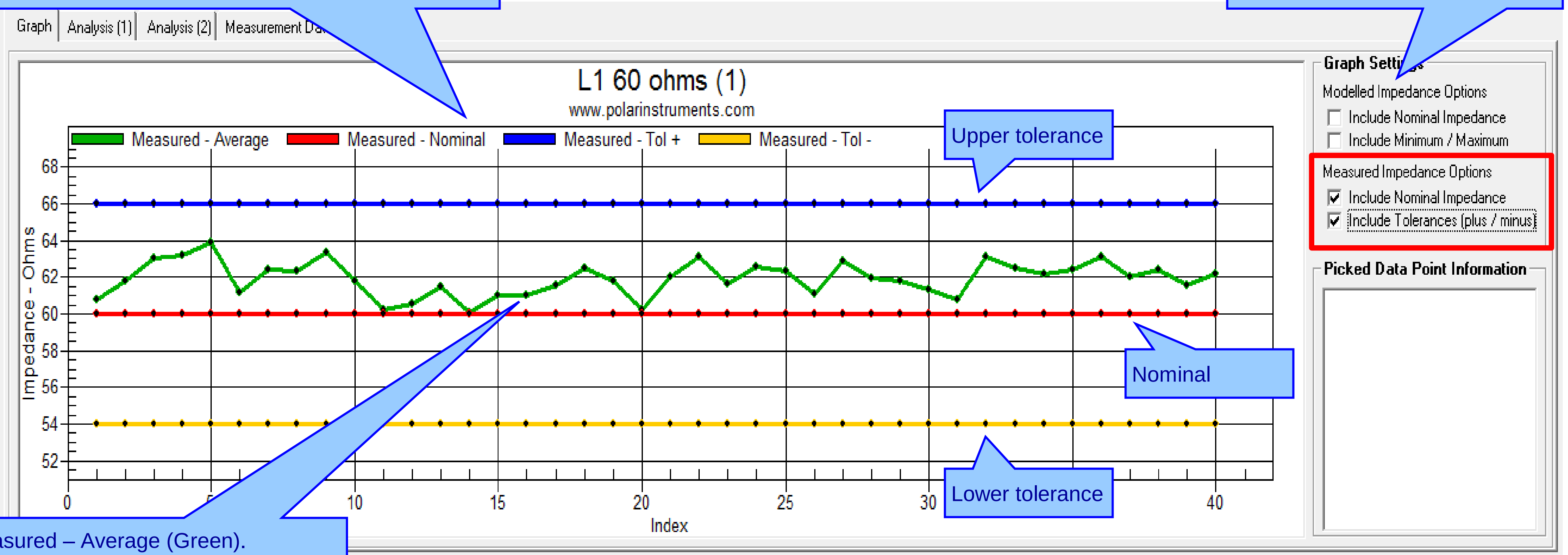
The x-axis is the identifying Index of the board / coupon read from the data log file

It is possible to pick a measured data point, key information is displayed here

# Import CITS Datalog File option – feature recap

In this case the Graph contains:
Measured – Average (Green)
Nominal (Red)
Upper Tolerance (Blue)
Lower Tolerance (Yellow)

Graph Settings allow the selection of modelled / measured data to be plotted

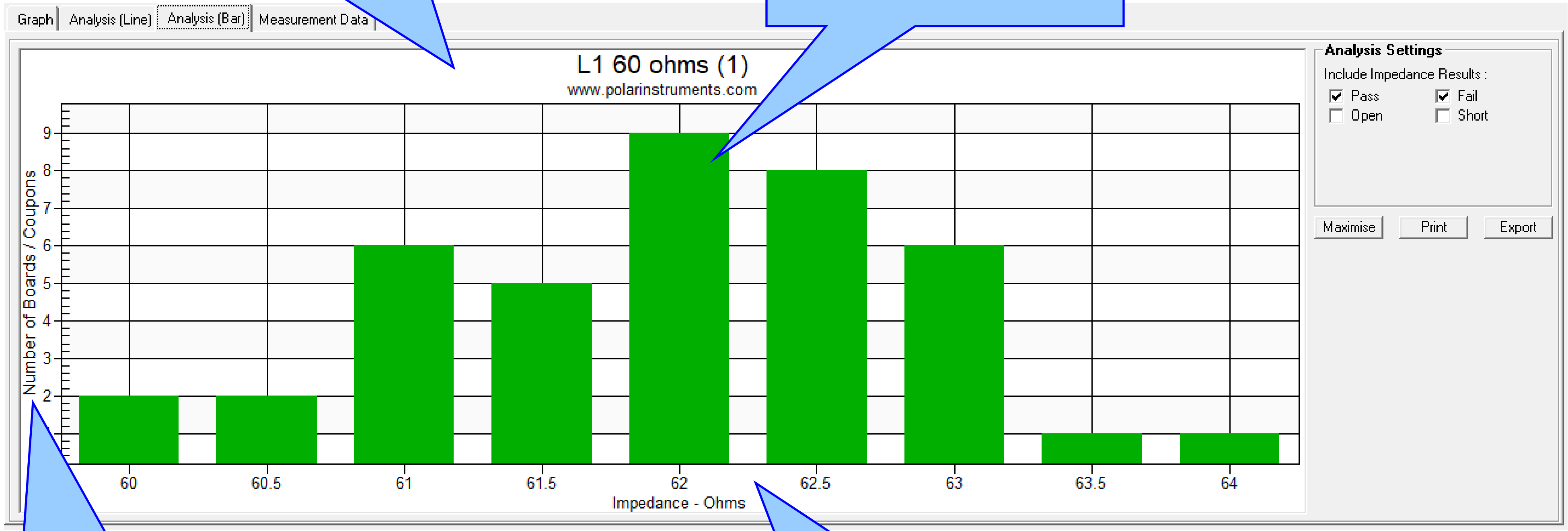



Measured – Average (Green).
Whilst reading slightly higher than the Nominal (60 ohms) all measured data points are within the upper and lower tolerance bands

# Import CITS Datalog File option – feature recap

Analysis options:
This bar chart shows the distribution of measurement results over an impedance range

From this batch of 40 board / coupon measurements, 62 +/- 0.25 ohms is the most common result




The y-axis is the number of boards / coupons that fall within a given impedance as detailed on the x-axis

The x-axis is the measured impedance in 0.5 ohm increments

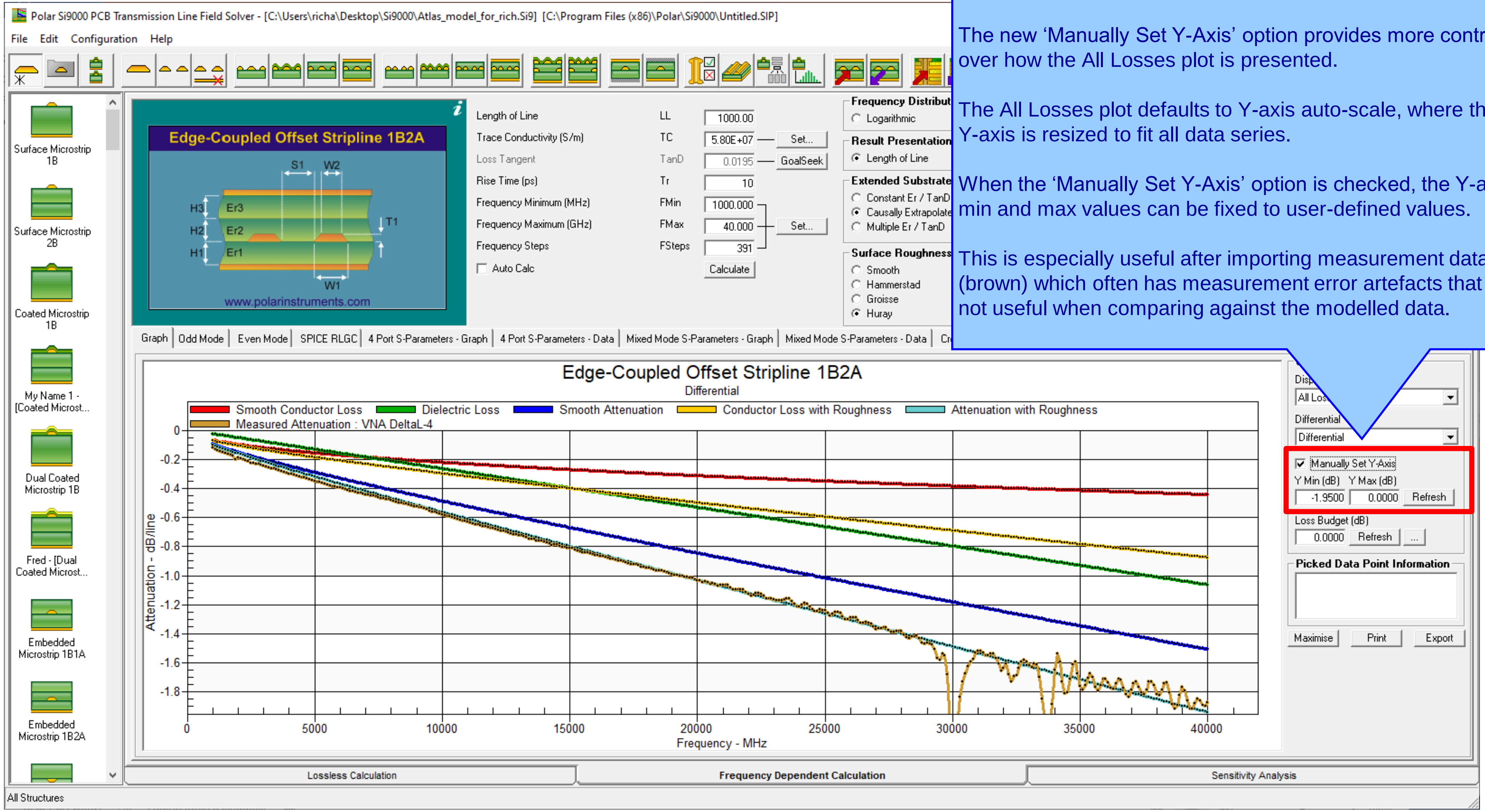
# Import CITS Datalog File option – feature recap

Measurement Data:
The CITS Data Log data may also be viewed in a data grid layout. This is especially useful for viewing the Result data (Pass / Fail)

Graph | Analysis (Line) | Analysis (Bar) | Measurement Data

| Result | Index | Board Serial | Date | Time | Average | SD | Maximum | Minimum | Station | Description | Layer | Nominal | Tol+ % | Tol- % | Instrument | Serial No |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Passed | 1 | 24 | 05/02/13 | 12:48 | 60.8 | 0.8 | 61.9 | 59.56 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 2 | 29 | 05/02/13 | 12:50 | 61.77 | 0.95 | 63.21 | 59.93 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 3 | 17 | 05/02/13 | 12:51 | 63.01 | 0.94 | 64.48 | 61.68 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 4 | 39 | 05/02/13 | 12:52 | 63.22 | 1.07 | 64.62 | 61.29 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 5 | 8 | 05/02/13 | 12:59 | 63.93 | 0.95 | 65.32 | 62.2 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 6 | 10 | 05/02/13 | 13:00 | 61.17 | 0.89 | 62.69 | 59.63 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 7 | 32 | 05/02/13 | 13:01 | 62.38 | 0.88 | 63.58 | 60.72 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 8 | 21 | 05/02/13 | 13:01 | 62.37 | 0.82 | 63.88 | 60.98 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 9 | 4 | 05/02/13 | 13:02 | 63.35 | 0.68 | 64.41 | 61.75 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 10 | 33 | 05/02/13 | 13:03 | 61.81 | 0.78 | 62.95 | 60.09 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 11 | 18 | 05/02/13 | 13:03 | 60.22 | 0.62 | 61.48 | 59.09 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 12 | 3 | 05/02/13 | 13:04 | 60.54 | 0.75 | 62.1 | 59.19 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 13 | 15 | 05/02/13 | 13:05 | 61.46 | 0.73 | 62.83 | 60.12 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 14 | 2 | 05/02/13 | 13:05 | 60.09 | 0.67 | 61.24 | 58.57 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 15 | 23 | 05/02/13 | 13:06 | 61.01 | 0.78 | 62.4 | 59.69 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 16 | 5 | 05/02/13 | 13:07 | 61.05 | 0.63 | 62.14 | 59.49 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 17 | 6 | 05/02/13 | 13:07 | 61.54 | 0.8 | 62.98 | 60.11 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 18 | 76 | 05/02/13 | 13:08 | 62.49 | 0.92 | 63.44 | 60.32 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 19 | 11 | 05/02/13 | 13:09 | 61.79 | 0.83 | 63.08 | 60.37 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 20 | 31 | 05/02/13 | 13:09 | 60.25 | 0.65 | 61.37 | 58.85 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 21 | 12 | 05/02/13 | 13:10 | 62.01 | 0.69 | 63.24 | 60.65 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 22 | 7 | 05/02/13 | 13:11 | 63.08 | 1.13 | 64.89 | 60.84 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |
| Passed | 23 | 19 | 05/02/13 | 13:11 | 61.63 | 0.72 | 62.81 | 60.19 | _TEST STATION 1_ | L01 | 1 | 60 | 10 | 10 | CITS880 | 17581 |

# New Manually Set Y-Axis option for the All Losses plot



The new 'Manually Set Y-Axis' option provides more control over how the All Losses plot is presented.

The All Losses plot defaults to Y-axis auto-scale, where the Y-axis is resized to fit all data series.

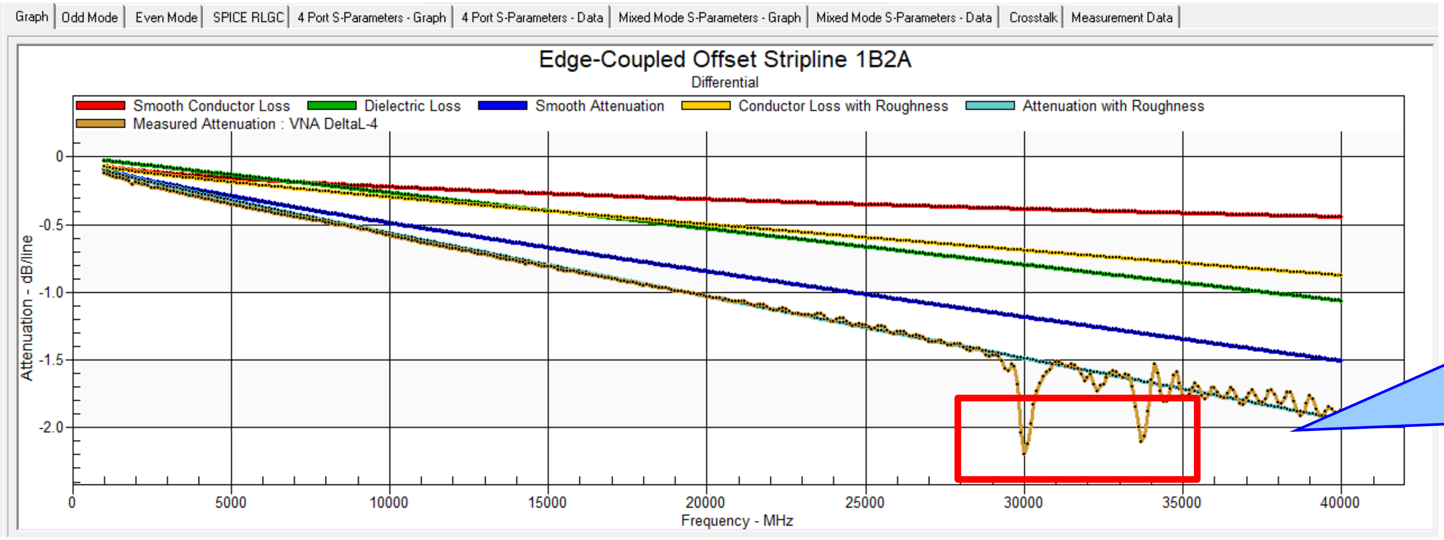
When the 'Manually Set Y-Axis' option is checked, the Y-axis min and max values can be fixed to user-defined values.

This is especially useful after importing measurement data (brown) which often has measurement error artefacts that are not useful when comparing against the modelled data.



Si9000e only

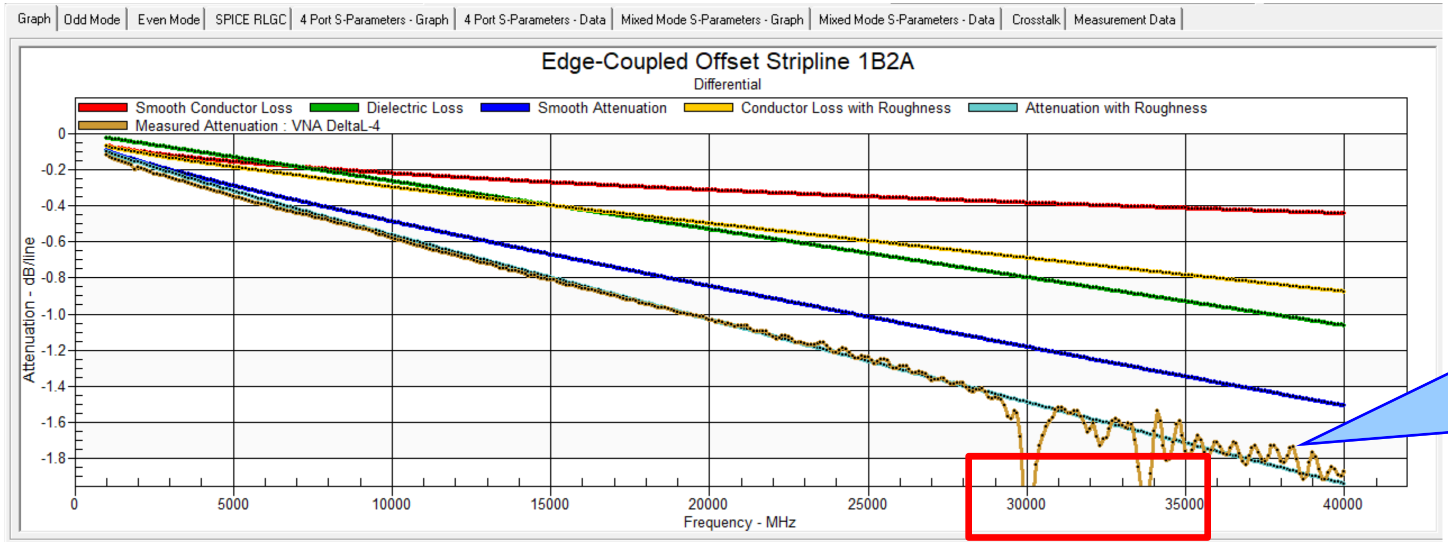
# New Manually Set Y-Axis option for the All Losses plot





'Manually Set Y-Axis' unchecked, the Y-axis will auto-scale.

Notice the plot will scale the Y-axis to include all the measurement data including the measurement error artefacts





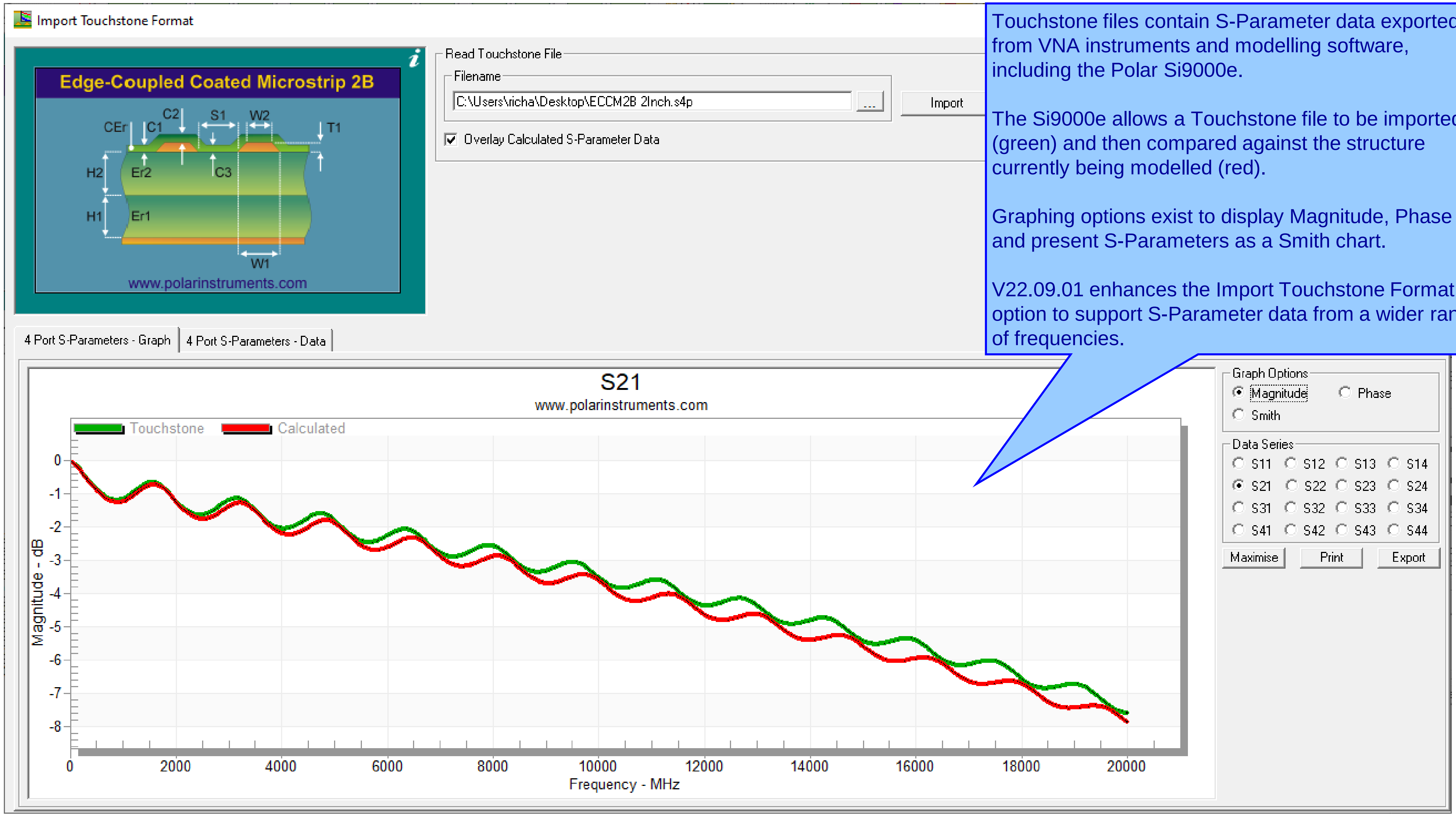
'Manually Set Y-Axis' is checked, the Y Min is set to -1.95 dB

Notice the plot will fix the Y-axis min / max to the values specified, the measurement error artefacts will be ignored.




Si9000e only

# Enhancements to the Import Touchstone Format option




Touchstone files contain S-Parameter data exported from VNA instruments and modelling software, including the Polar Si9000e.

The Si9000e allows a Touchstone file to be imported (green) and then compared against the structure currently being modelled (red).

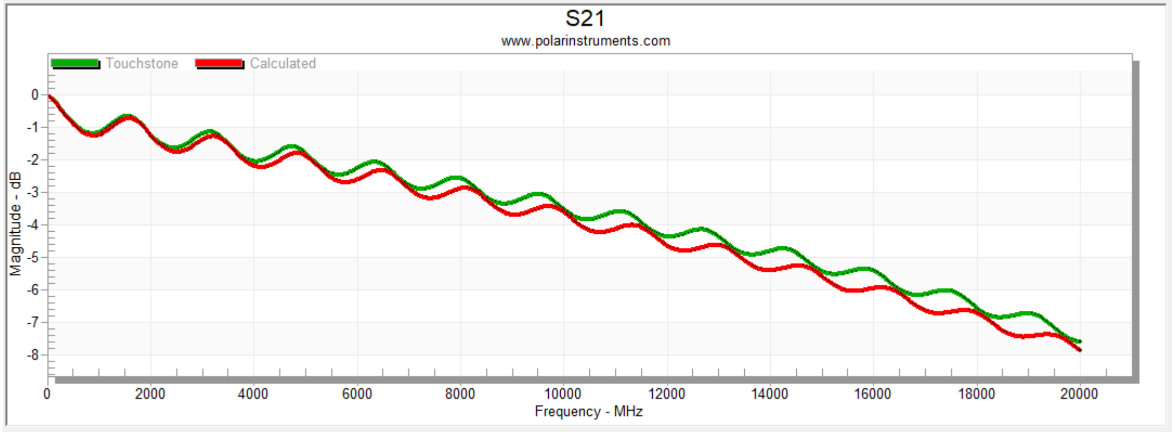
Graphing options exist to display Magnitude, Phase and present S-Parameters as a Smith chart.

V22.09.01 enhances the Import Touchstone Format option to support S-Parameter data from a wider range of frequencies.

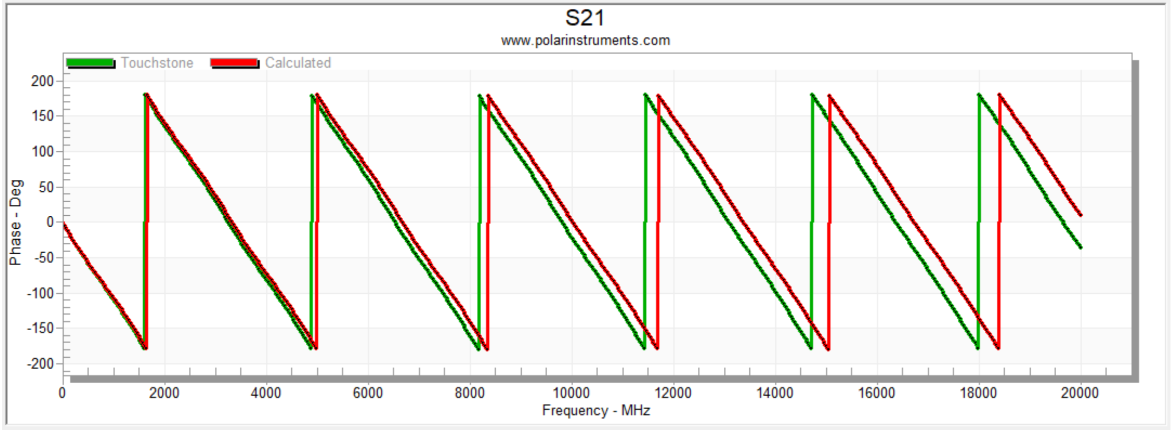


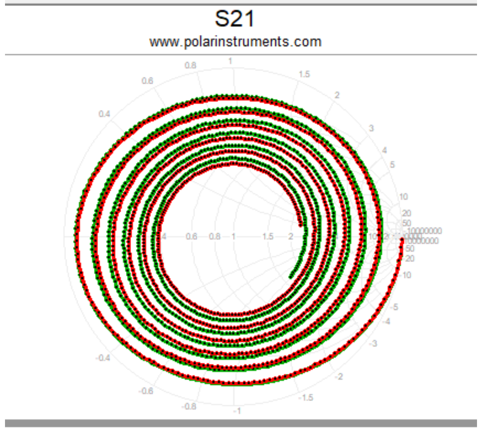
Si9000e only

# Enhancements to the Import Touchstone Format option




In this example a Touchstone 4-port file (.S4P) has been imported into the Si9000e. Magnitude, Phase and Smith Chart are shown for S21



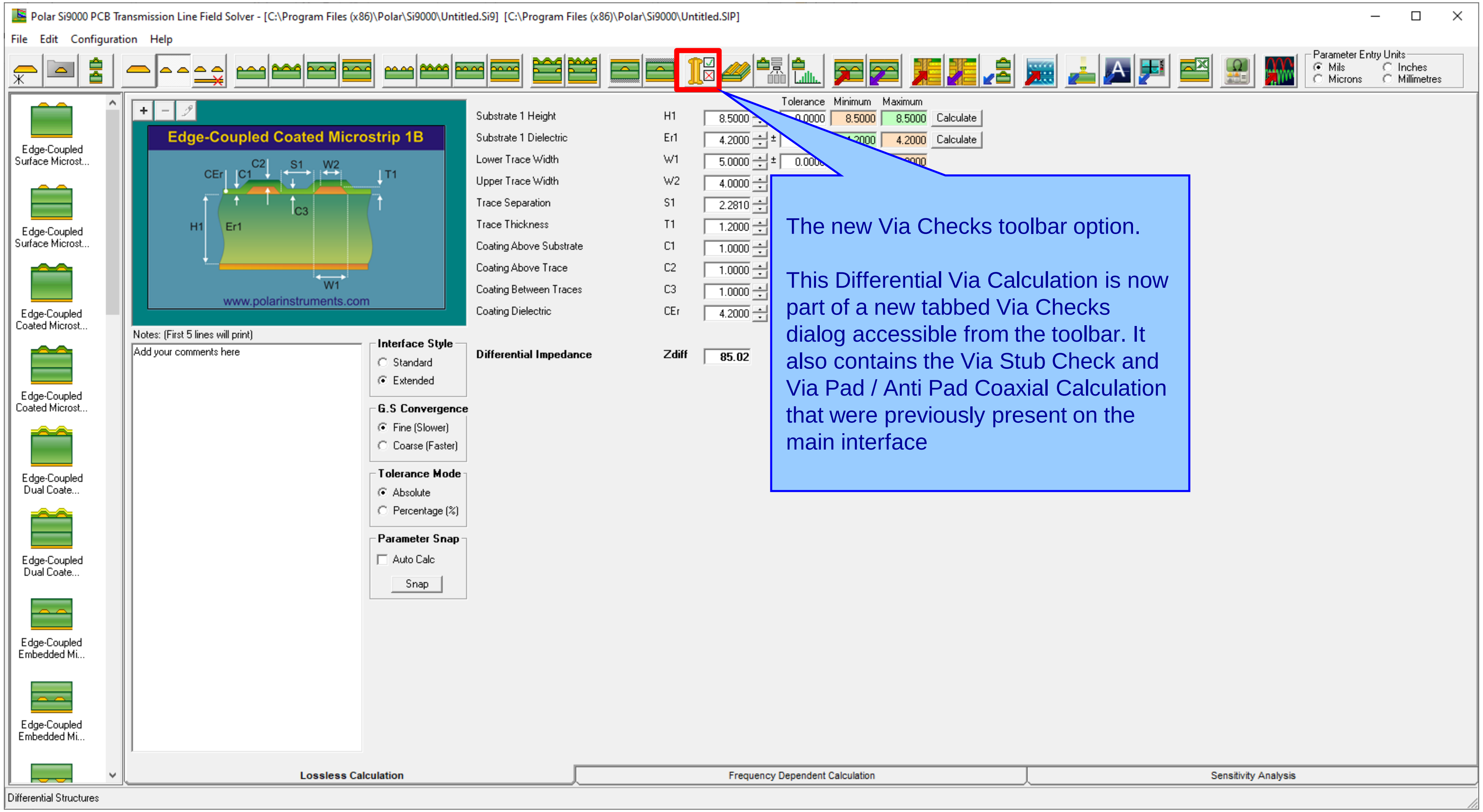






Si9000e only

# v22.04 (April 2022)

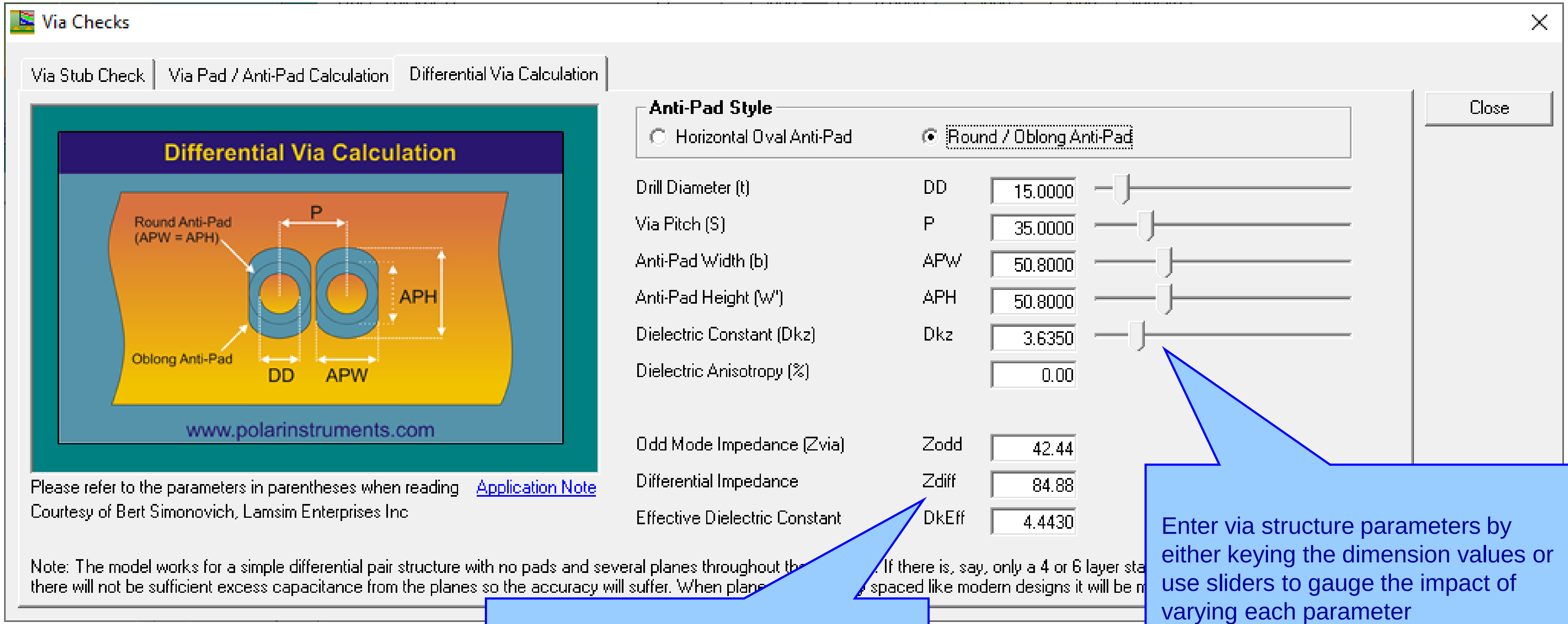
# New Differential Via Calculation capability




The new Via Checks toolbar option.

This Differential Via Calculation is now part of a new tabbed Via Checks dialog accessible from the toolbar. It also contains the Via Stub Check and Via Pad / Anti Pad Coaxial Calculation that were previously present on the main interface

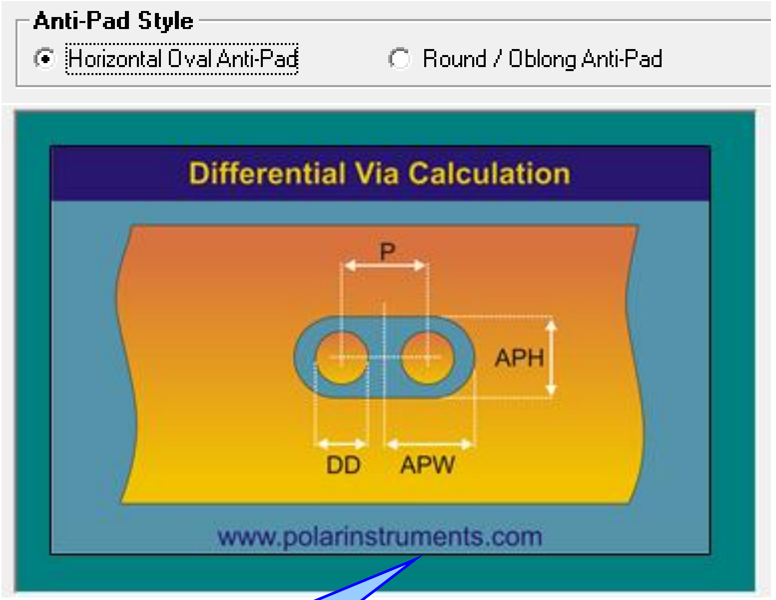
# New Differential Via Calculation

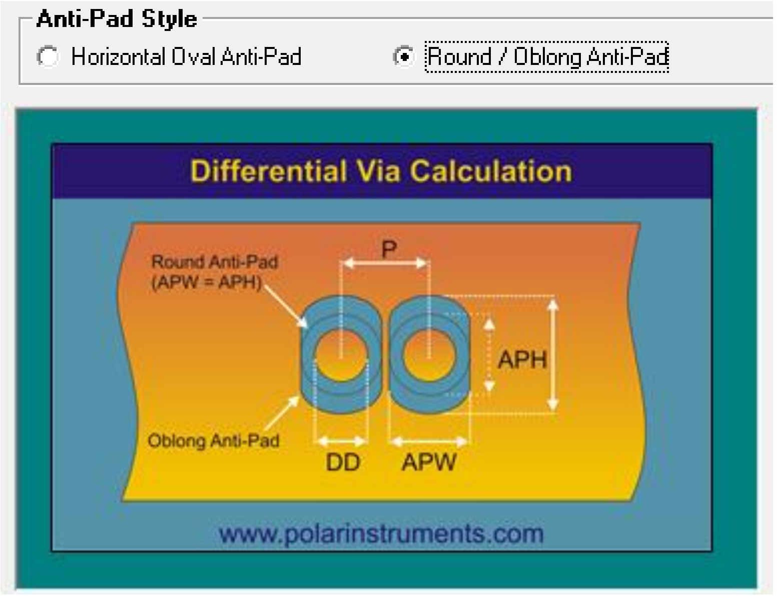



Calculation results are presented here

Enter via structure parameters by either keying the dimension values or use sliders to gauge the impact of varying each parameter

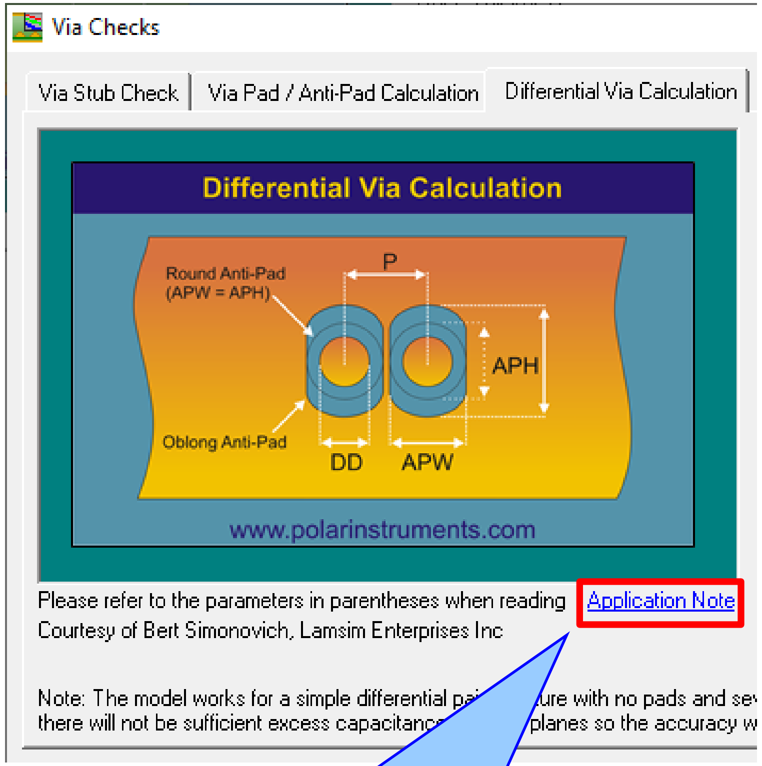
# New Differential Via Calculation



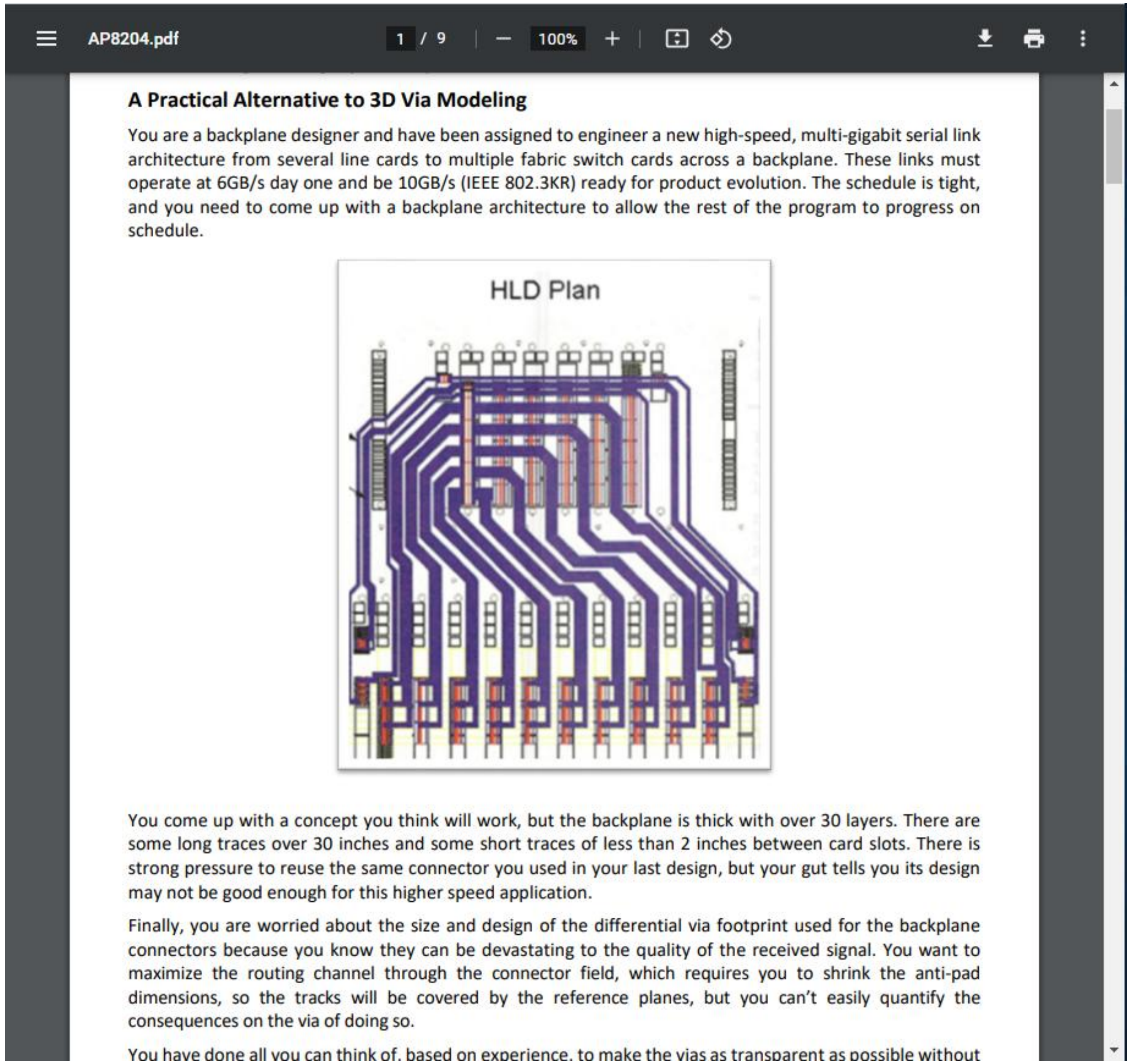




Two different selectable Anti-Pad Styles available

# New Differential Via Calculation




The Application Note link provides further details of how the model works




**A Practical Alternative to 3D Via Modeling**

You are a backplane designer and have been assigned to engineer a new high-speed, multi-gigabit serial link architecture from several line cards to multiple fabric switch cards across a backplane. These links must operate at 6GB/s day one and be 10GB/s (IEEE 802.3KR) ready for product evolution. The schedule is tight, and you need to come up with a backplane architecture to allow the rest of the program to progress on schedule.

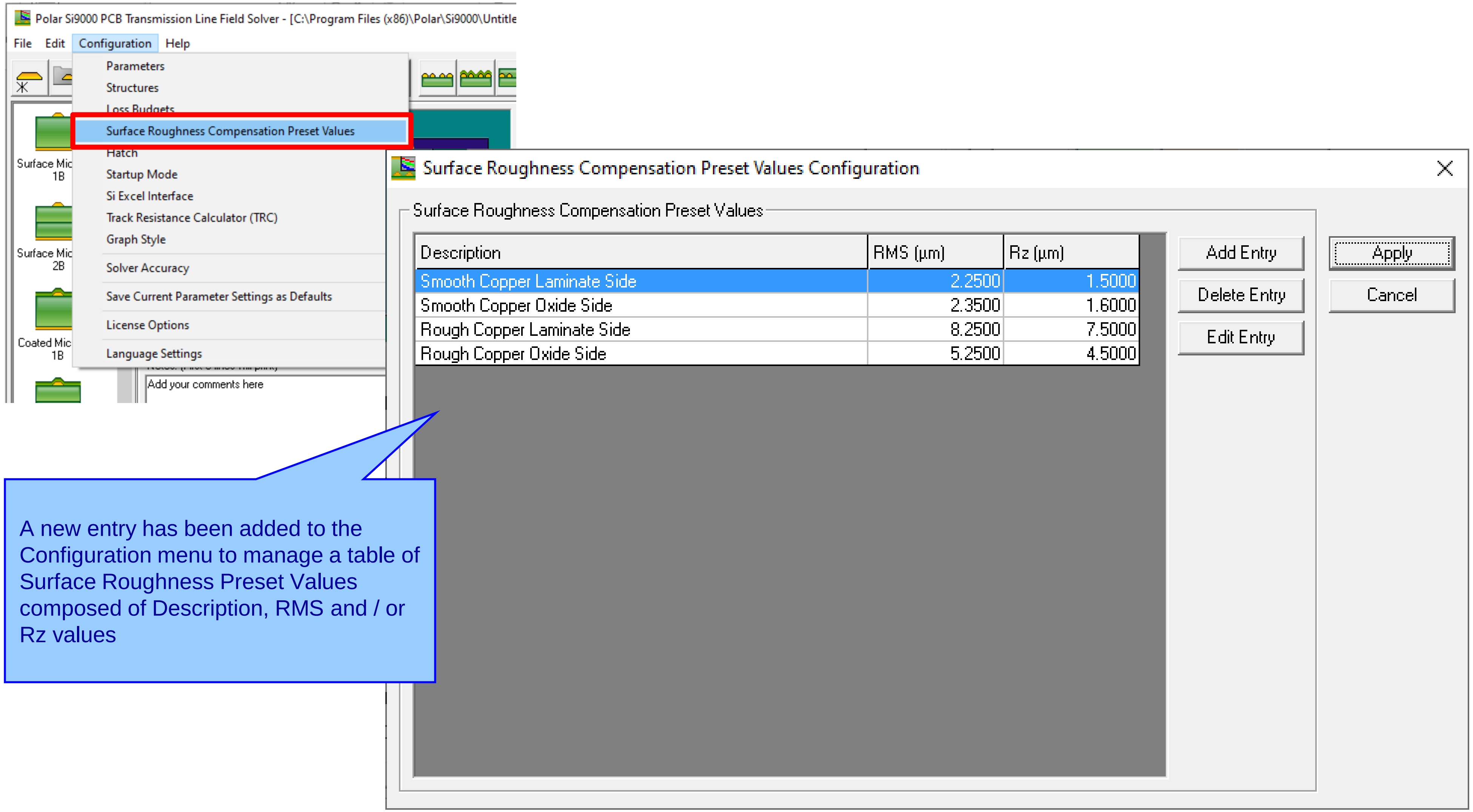
You come up with a concept you think will work, but the backplane is thick with over 30 layers. There are some long traces over 30 inches and some short traces of less than 2 inches between card slots. There is strong pressure to reuse the same connector you used in your last design, but your gut tells you its design may not be good enough for this higher speed application.

Finally, you are worried about the size and design of the differential via footprint used for the backplane connectors because you know they can be devastating to the quality of the received signal. You want to maximize the routing channel through the connector field, which requires you to shrink the anti-pad dimensions, so the tracks will be covered by the reference planes, but you can't easily quantify the consequences on the via of doing so.

You have done all you can think of, based on experience, to make the vias as transparent as possible without

# v22.03 (March 2022)

# New Surface Roughness Compensation Preset Values option

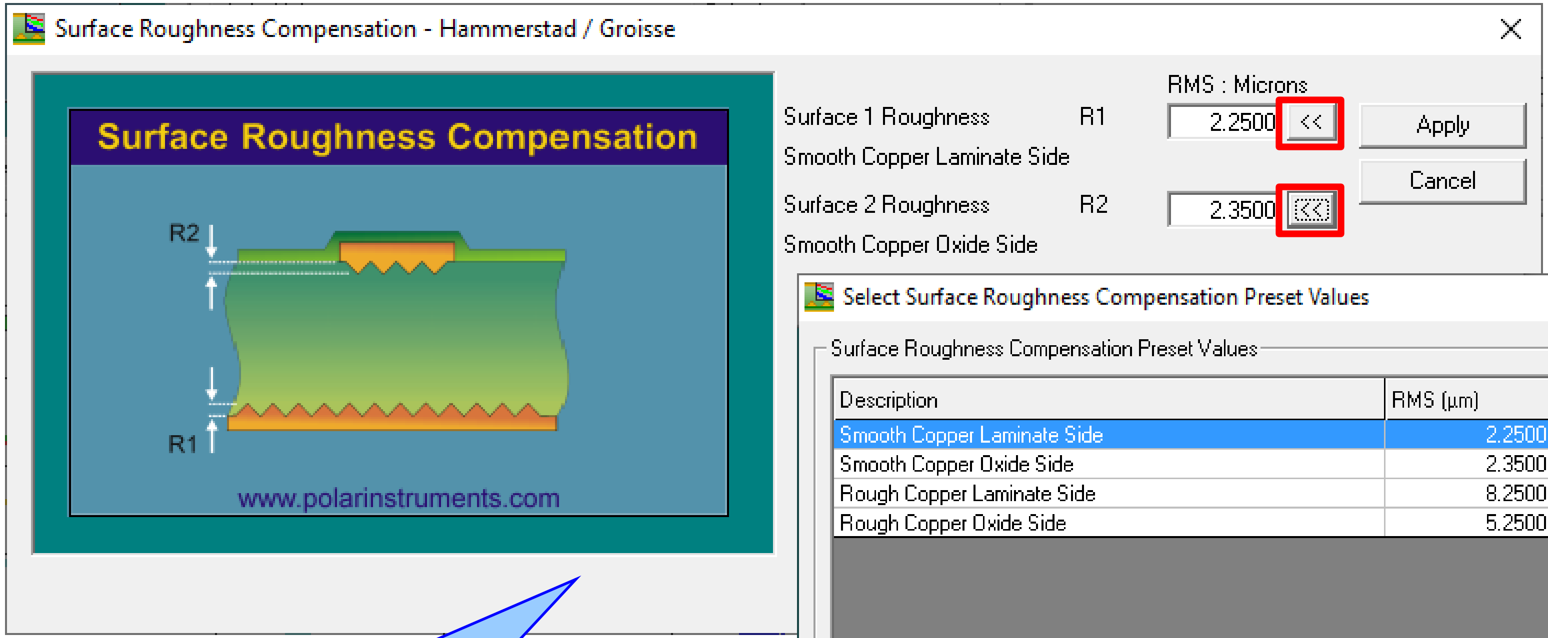


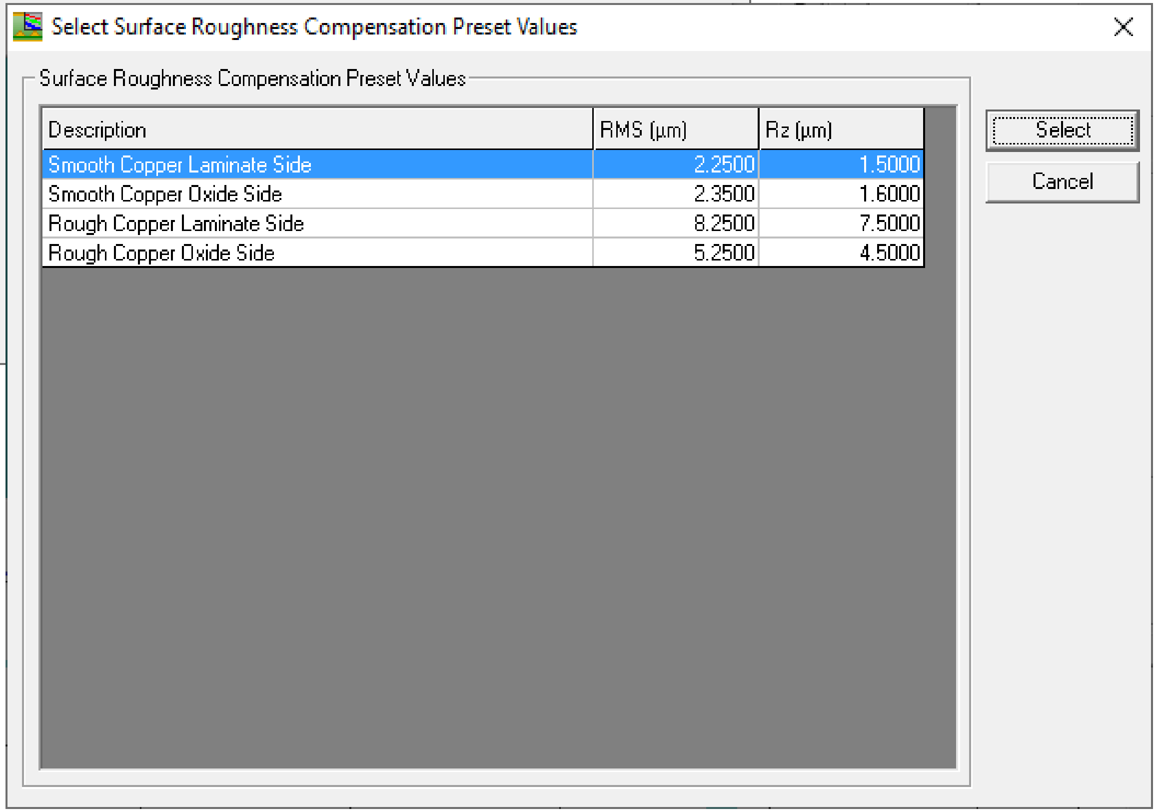

A new entry has been added to the Configuration menu to manage a table of Surface Roughness Preset Values composed of Description, RMS and / or Rz values



Si9000e only

# New Surface Roughness Compensation Preset Values option




The Hammerstad / Groisse dialog has been updated with the addition of '<<' options to select the required Surface Roughness Preset Values.

Once chosen the roughness preset item Description and RMS value are passed back to the surface roughness dialog.

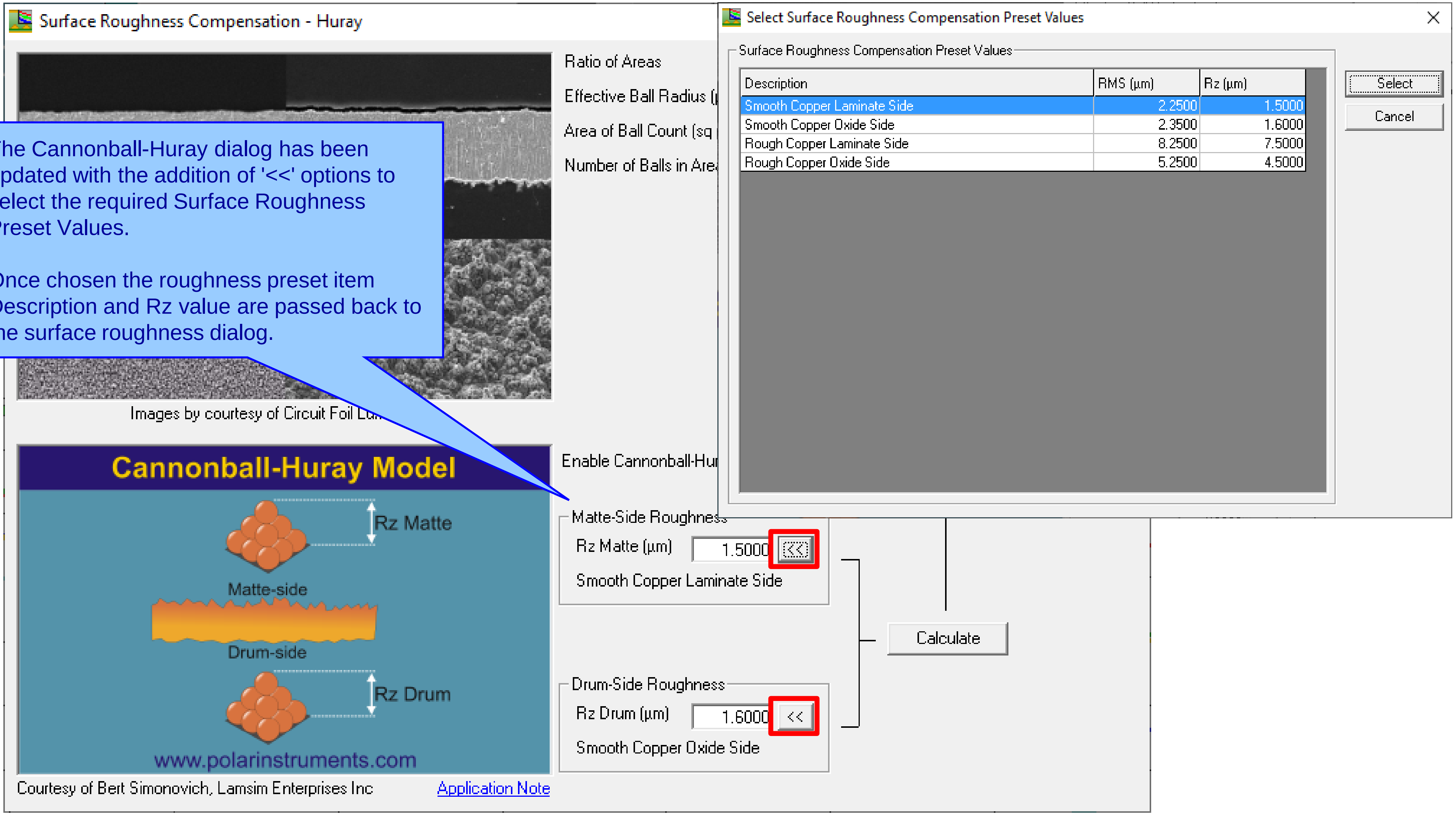


Si9000e only

# New Surface Roughness Compensation Preset Values option

The Cannonball-Huray dialog has been updated with the addition of '<<' options to select the required Surface Roughness Preset Values.

Once chosen the roughness preset item Description and Rz value are passed back to the surface roughness dialog.

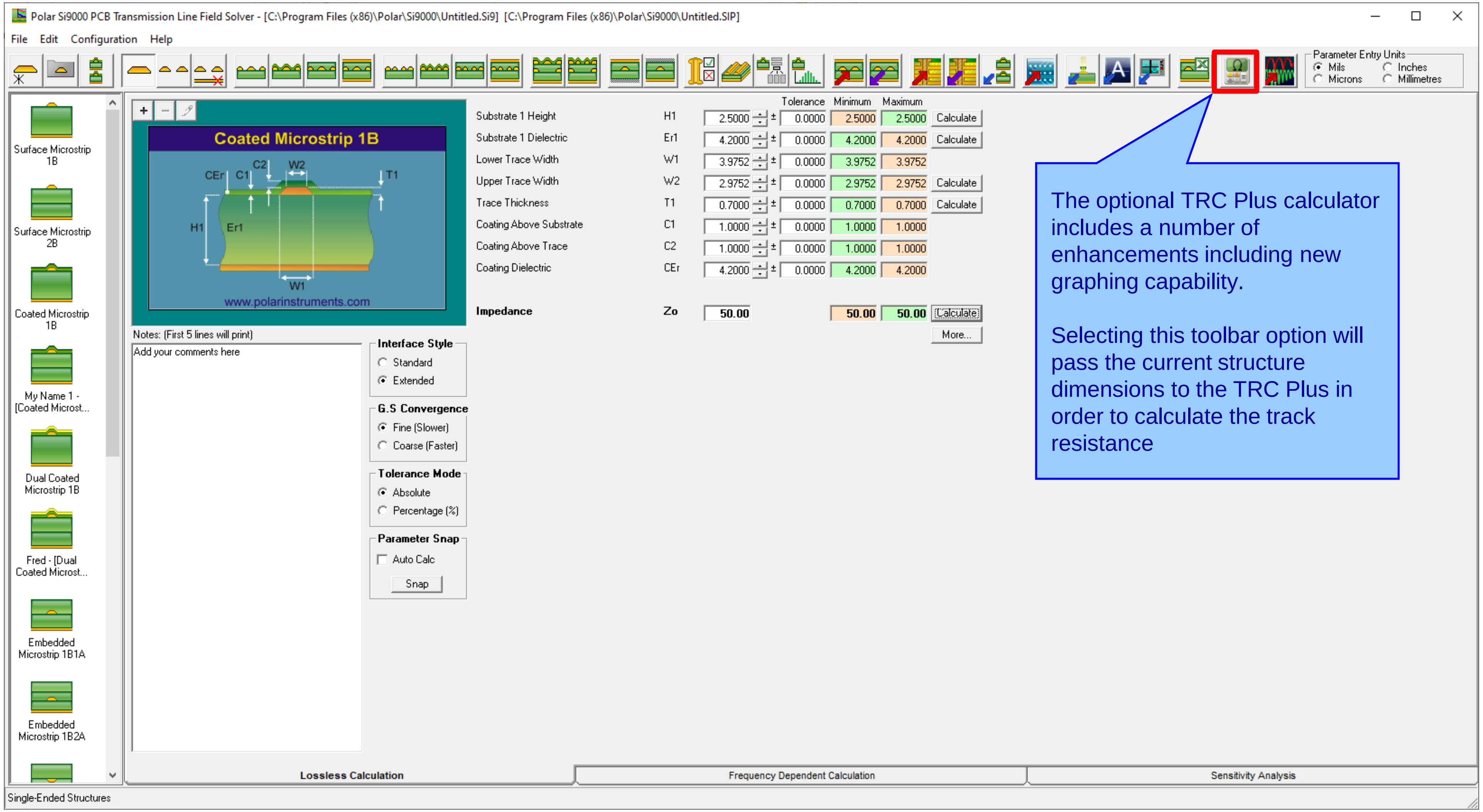





Si9000e only

# v22.02 (February 2022)

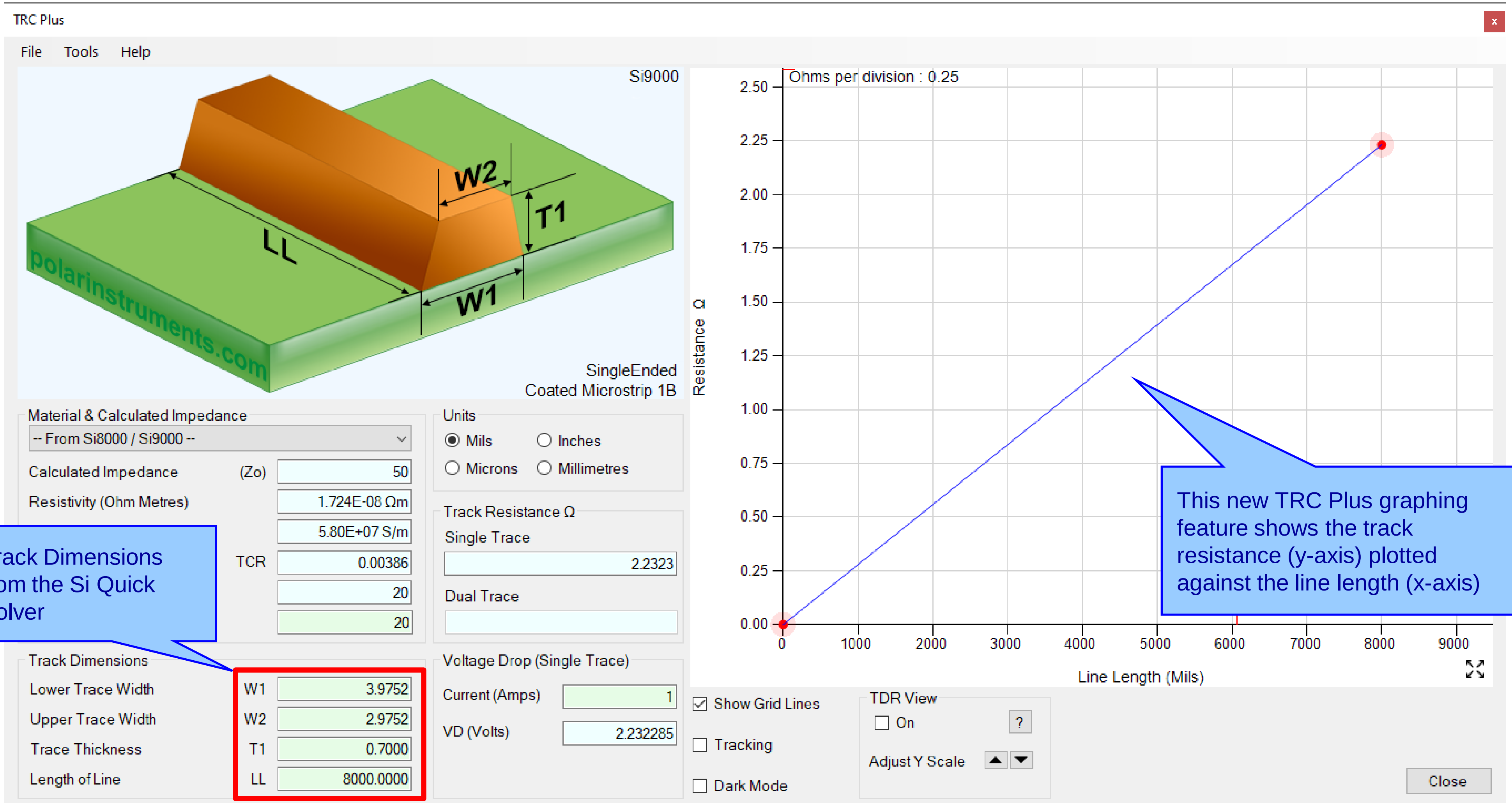
# Track Resistance Calculator (TRC Plus) enhancements




The optional TRC Plus calculator includes a number of enhancements including new graphing capability.

Selecting this toolbar option will pass the current structure dimensions to the TRC Plus in order to calculate the track resistance

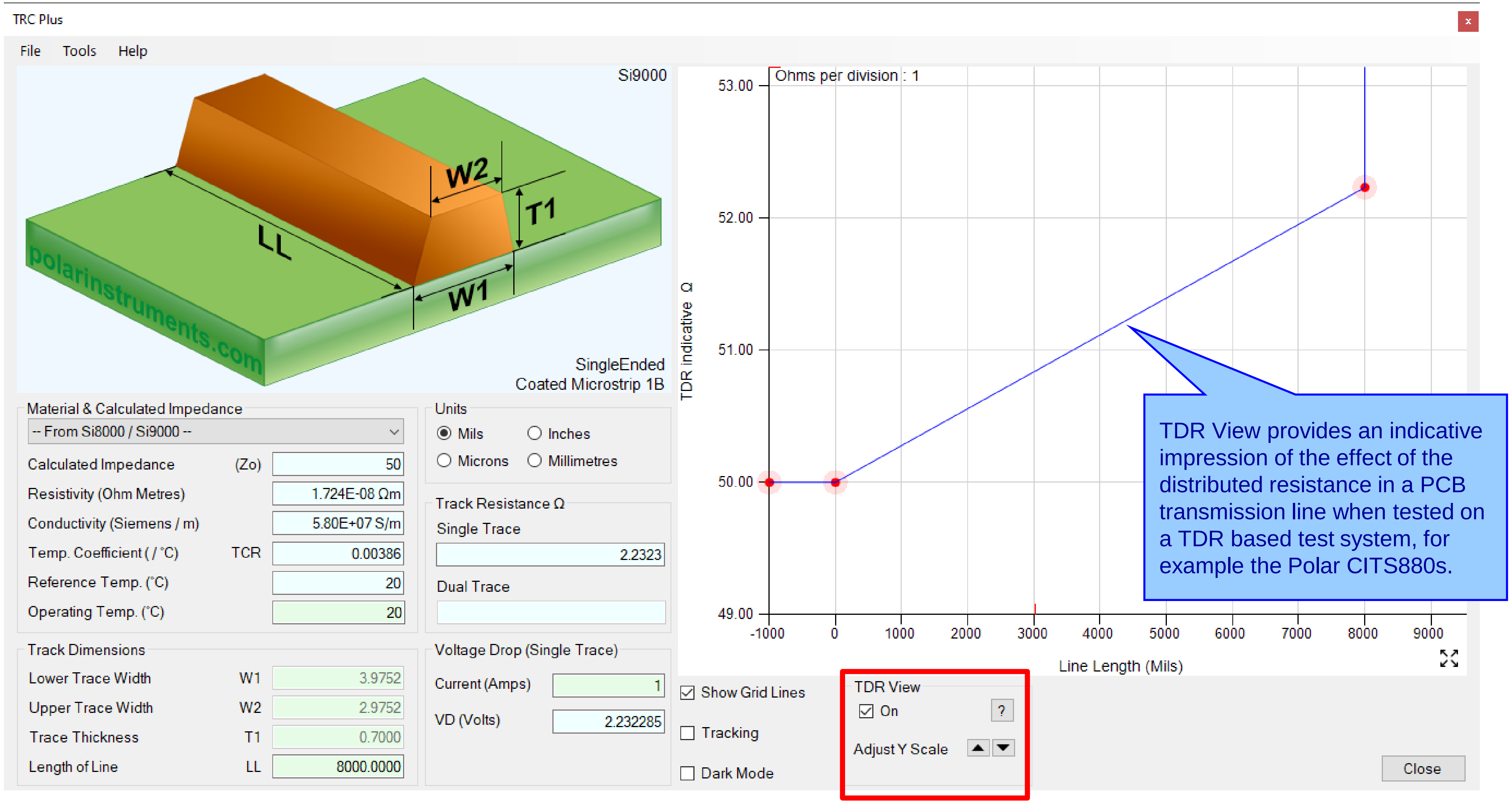
# Track Resistance Calculator (TRC Plus) enhancements




Track Dimensions from the Si Quick Solver

This new TRC Plus graphing feature shows the track resistance (y-axis) plotted against the line length (x-axis)

# Track Resistance Calculator (TRC Plus) enhancements



# v21.09 (Sept 2021)

# Project Graphing – Introduction *(requires the Si Projects feature)*

It is often useful to compare the results from similar structures, especially with frequency dependent calculations where changing just one or two parameters can have significant impact.

Until now the Si9000e Quick Solver graphing has focused on a single structure, for instance the All Losses graph will display a single plot that includes multiple data series for the same structure.

The new Project Graphing option calculates all the results for a group of structures contained in the Project and then plots the selected data series (total attenuation, conductor loss or dielectric loss etc) on the same graph.

A single graph that combines results from multiple structures is useful in a number of ways.  Comparing the impact of different dielectric materials, different roughness, sensitivity analysis for lossy calculations and many more uses.

# Project Graphing

A project with five structures, all with matching parameters and Zo of 50 ohms. The only difference between the structures is the loss tangent (TanD), ranging from 0.001 to 0.030


The Projects right-click menu contains a new Graphing option. When selected the Si9000e runs a full frequency dependent calculation for each structure in the project and stores the results.

The following new dialog then displays …

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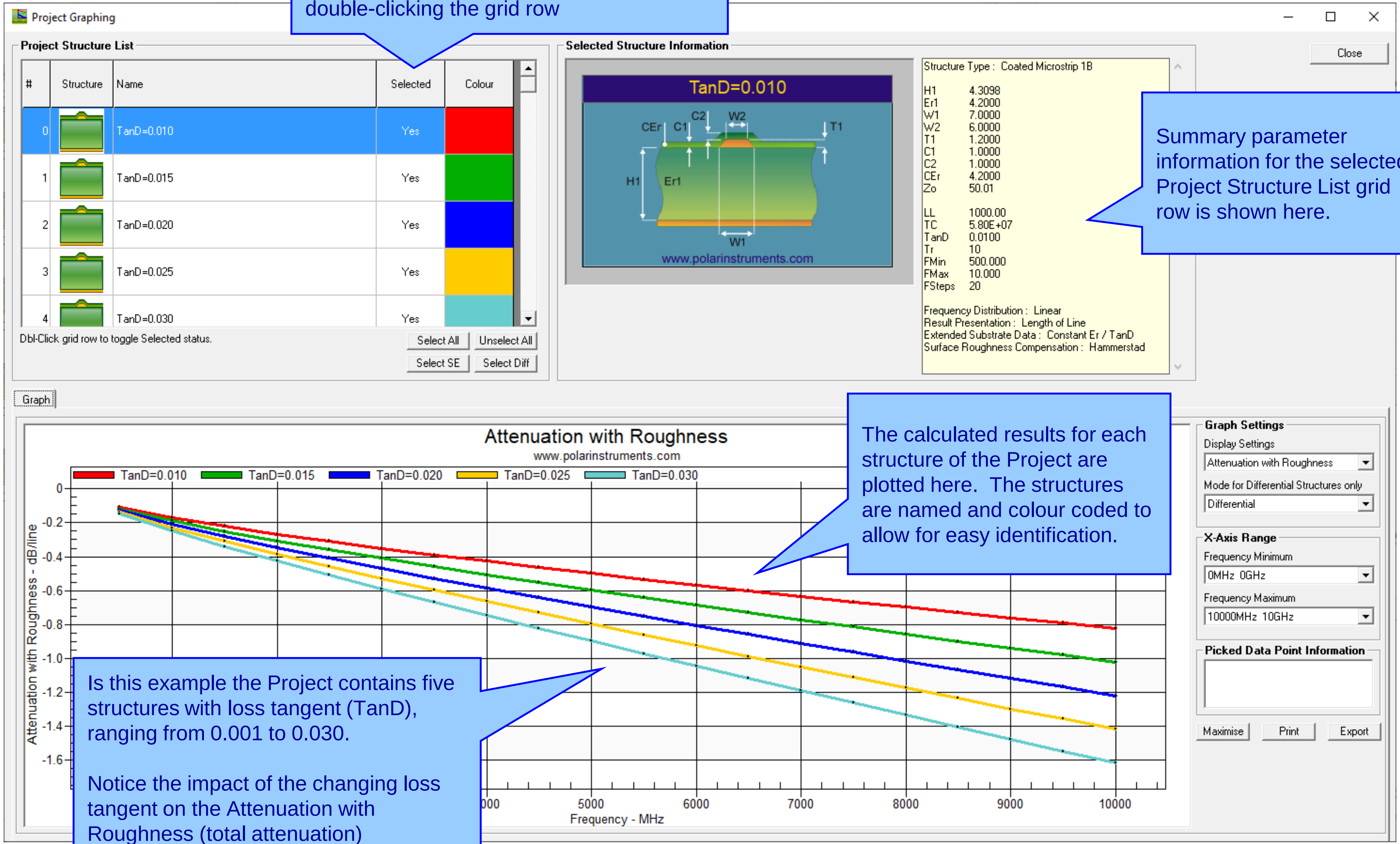
The Project Structure List provides options to choose which structures from the Project are plotted. Individual structures can toggled between selected / deselected by double-clicking the grid row

Summary parameter information for the selected Project Structure List grid row is shown here.

The calculated results for each structure of the Project are plotted here. The structures are named and colour coded to allow for easy identification.

Is this example the Project contains five structures with loss tangent (TanD), ranging from 0.001 to 0.030.

Notice the impact of the changing loss tangent on the Attenuation with Roughness (total attenuation)



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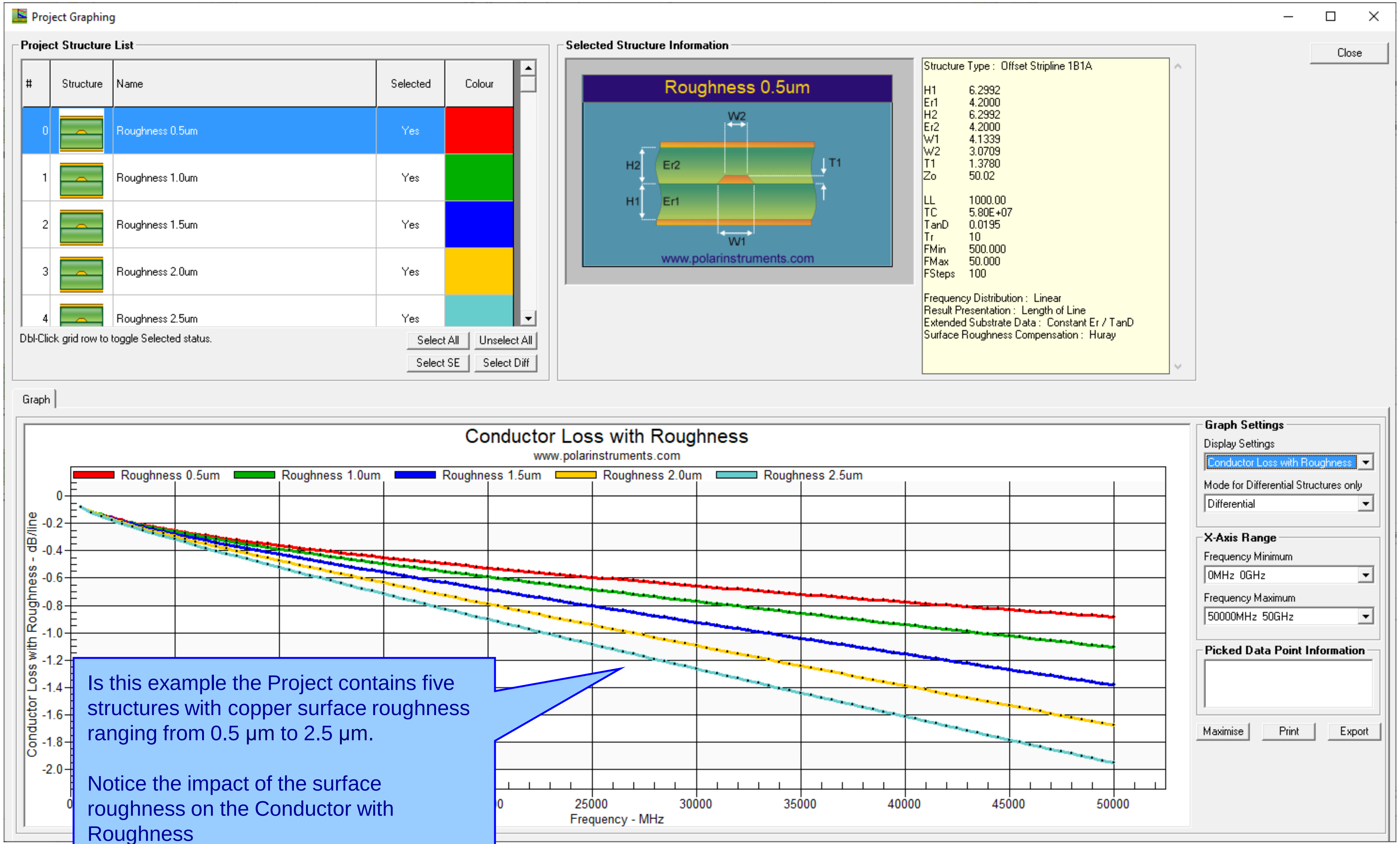


Is this example the Project contains five structures with copper surface roughness ranging from 0.5 µm to 2.5 µm.

Notice the impact of the surface roughness on the Conductor with Roughness




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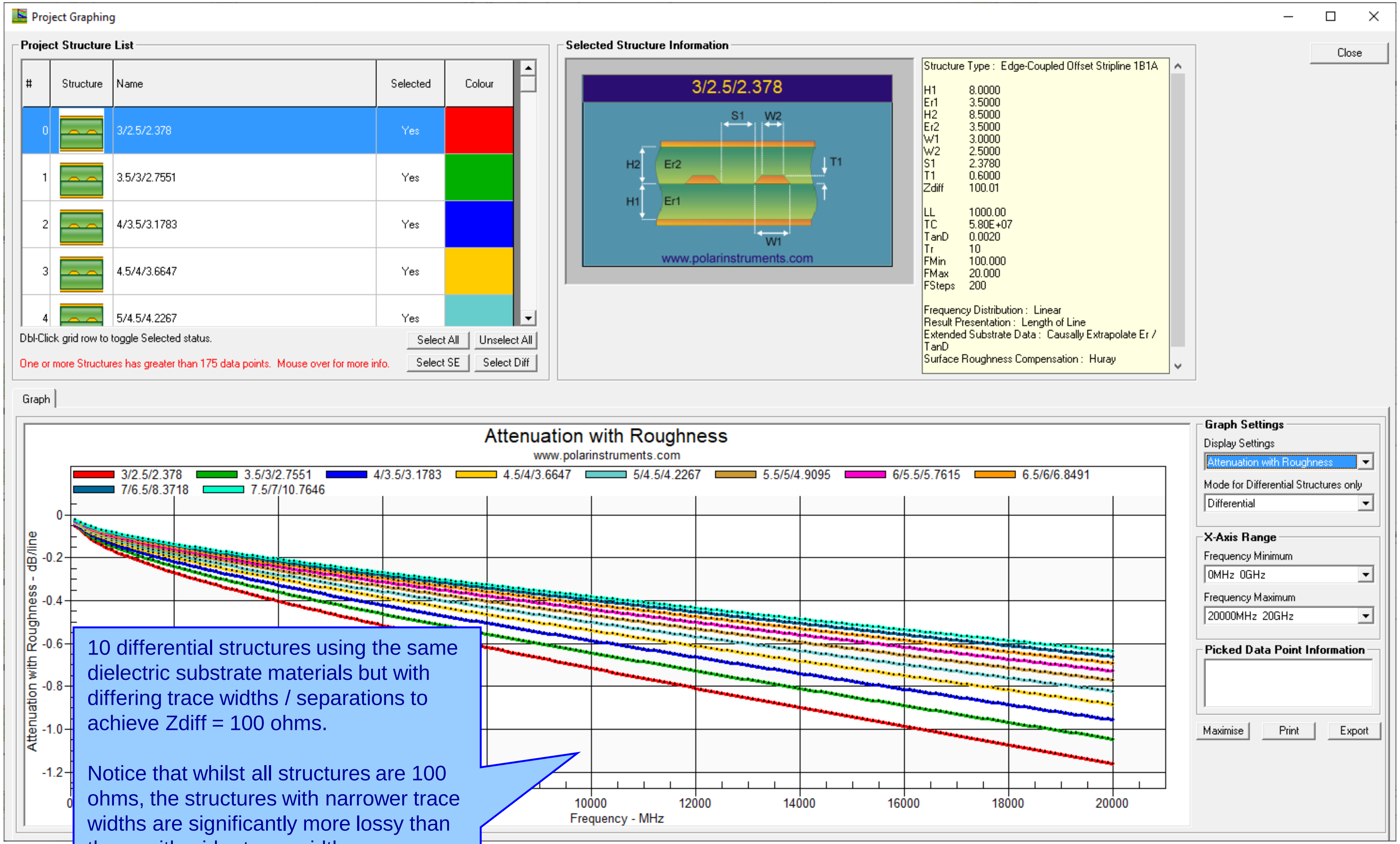


10 differential structures using the same dielectric substrate materials but with differing trace widths / separations to achieve Zdiff = 100 ohms.

Notice that whilst all structures are 100 ohms, the structures with narrower trace widths are significantly more lossy than those with wider trace widths.



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# Project Graphing – Summary

- The new Graphing option for Si Projects provides useful plots that contain data from multiple structures
- There are numerous uses for this type of option - comparing the impact of different dielectric materials, different roughness, sensitivity analysis for lossy calculations and more
- ‘What if’ scenarios where one structure in the project would use the current design parameters and the second structure would contain a modified set based on a newer material.  The plots comparing the original versus the new material will instantly show the impact
- Useful to both fabricators and design companies



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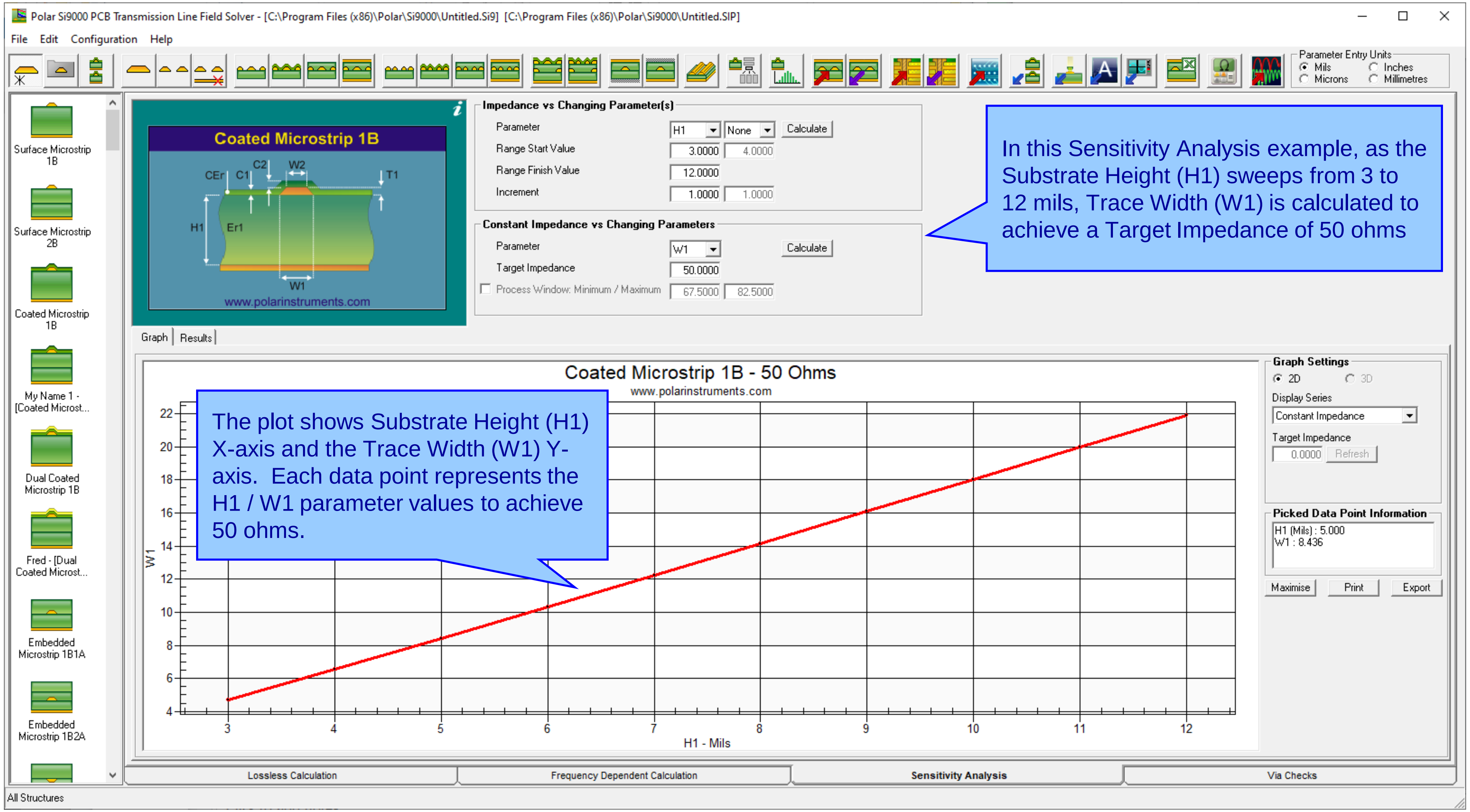
# Populate a Project from Sensitivity Analysis Results

*(requires the Si Projects feature)*

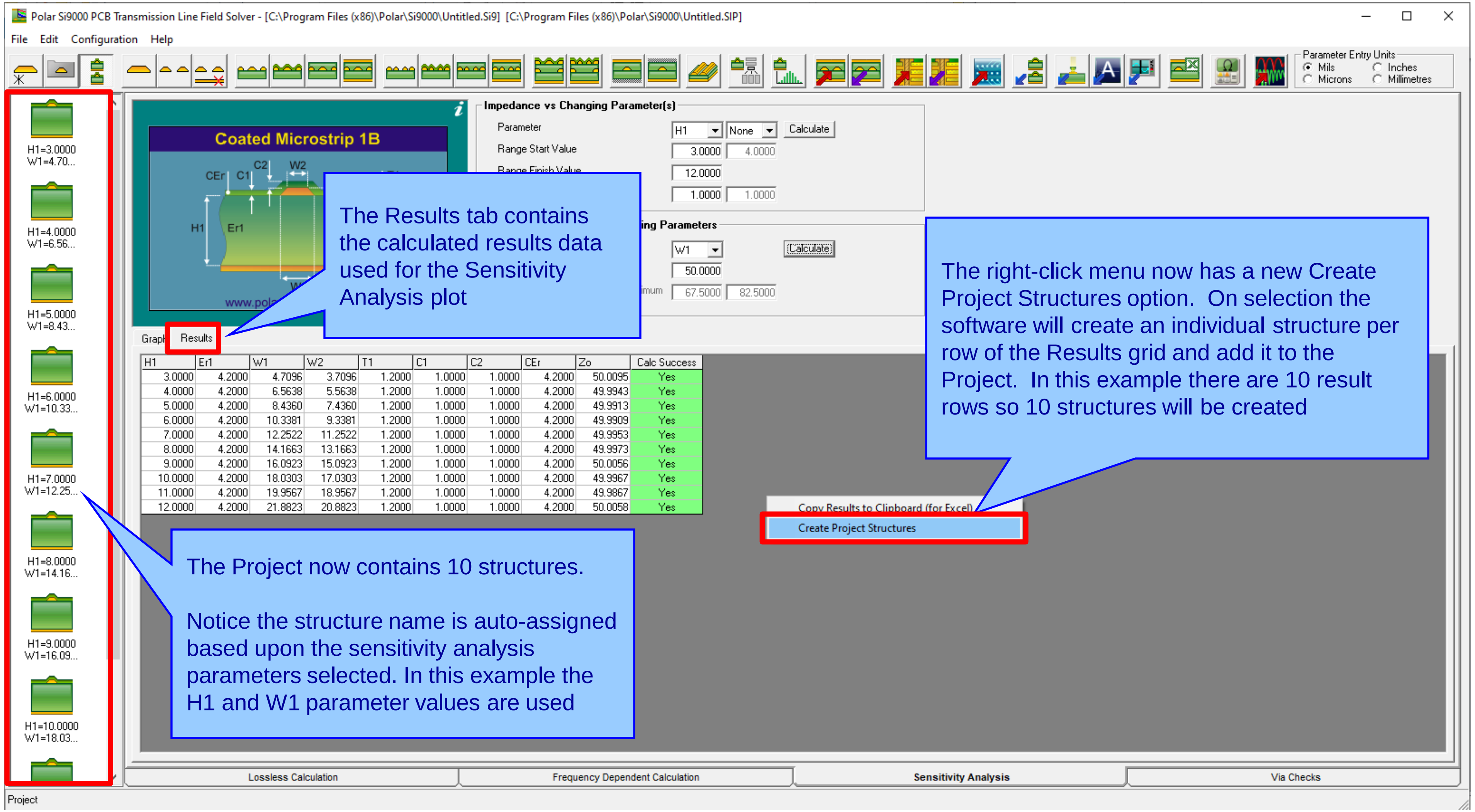
When using the Sensitivity Analysis option it is often useful to examine the calculated results in more details. It is now possible to auto-create a Project containing structures based upon the Sensitivity Analysis results data.

The following slides provide further details:

# Populate a Project from Sensitivity Analysis Results

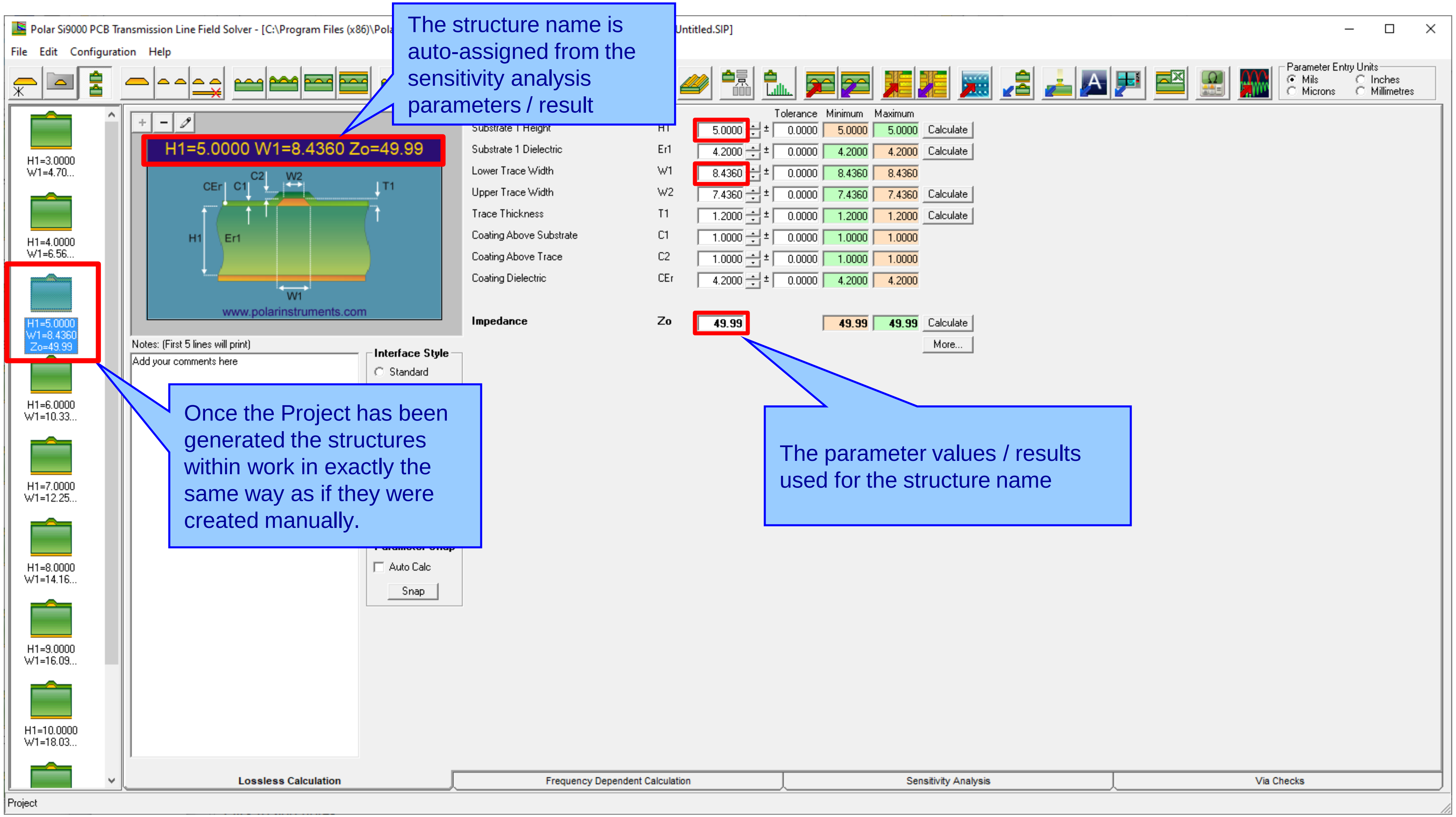


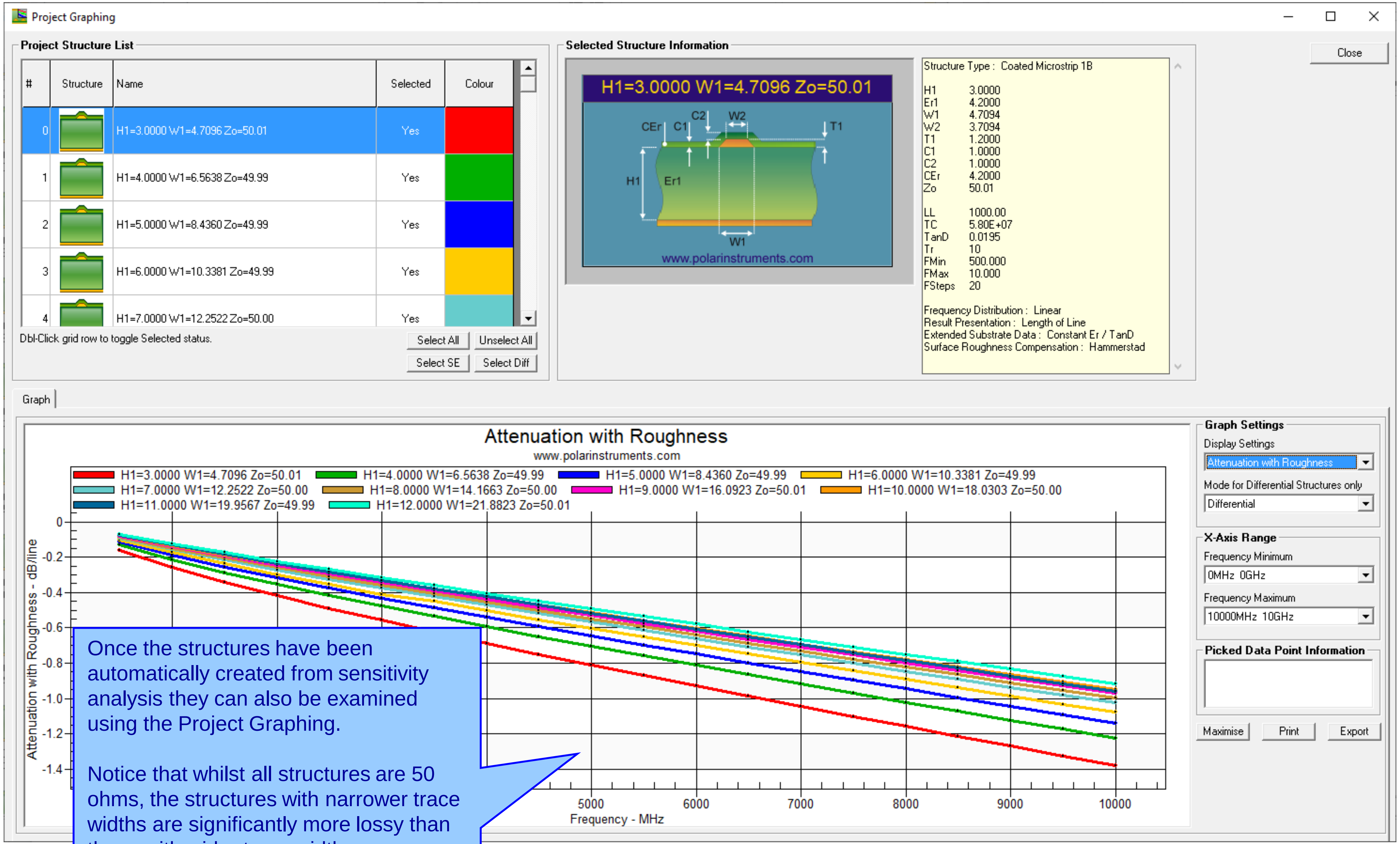
# Populate a Project from Sensitivity Analysis Results




| H1 | Er1 | W1 | W2 | T1 | C1 | C2 | CEr | Zo | Calc Success |
|---|---|---|---|---|---|---|---|---|---|
| 3.0000 | 4.2000 | 4.7096 | 3.7096 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 50.0095 | Yes |
| 4.0000 | 4.2000 | 6.5638 | 5.5638 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 49.9943 | Yes |
| 5.0000 | 4.2000 | 8.4360 | 7.4360 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 49.9913 | Yes |
| 6.0000 | 4.2000 | 10.3381 | 9.3381 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 49.9909 | Yes |
| 7.0000 | 4.2000 | 12.2522 | 11.2522 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 49.9953 | Yes |
| 8.0000 | 4.2000 | 14.1663 | 13.1663 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 49.9973 | Yes |
| 9.0000 | 4.2000 | 16.0923 | 15.0923 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 50.0056 | Yes |
| 10.0000 | 4.2000 | 18.0303 | 17.0303 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 49.9967 | Yes |
| 11.0000 | 4.2000 | 19.9567 | 18.9567 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 49.9867 | Yes |
| 12.0000 | 4.2000 | 21.8823 | 20.8823 | 1.2000 | 1.0000 | 1.0000 | 4.2000 | 50.0058 | Yes |

# Populate a Project from Sensitivity Analysis Results






Once the structures have been automatically created from sensitivity analysis they can also be examined using the Project Graphing.

Notice that whilst all structures are 50 ohms, the structures with narrower trace widths are significantly more lossy than those with wider trace widths.



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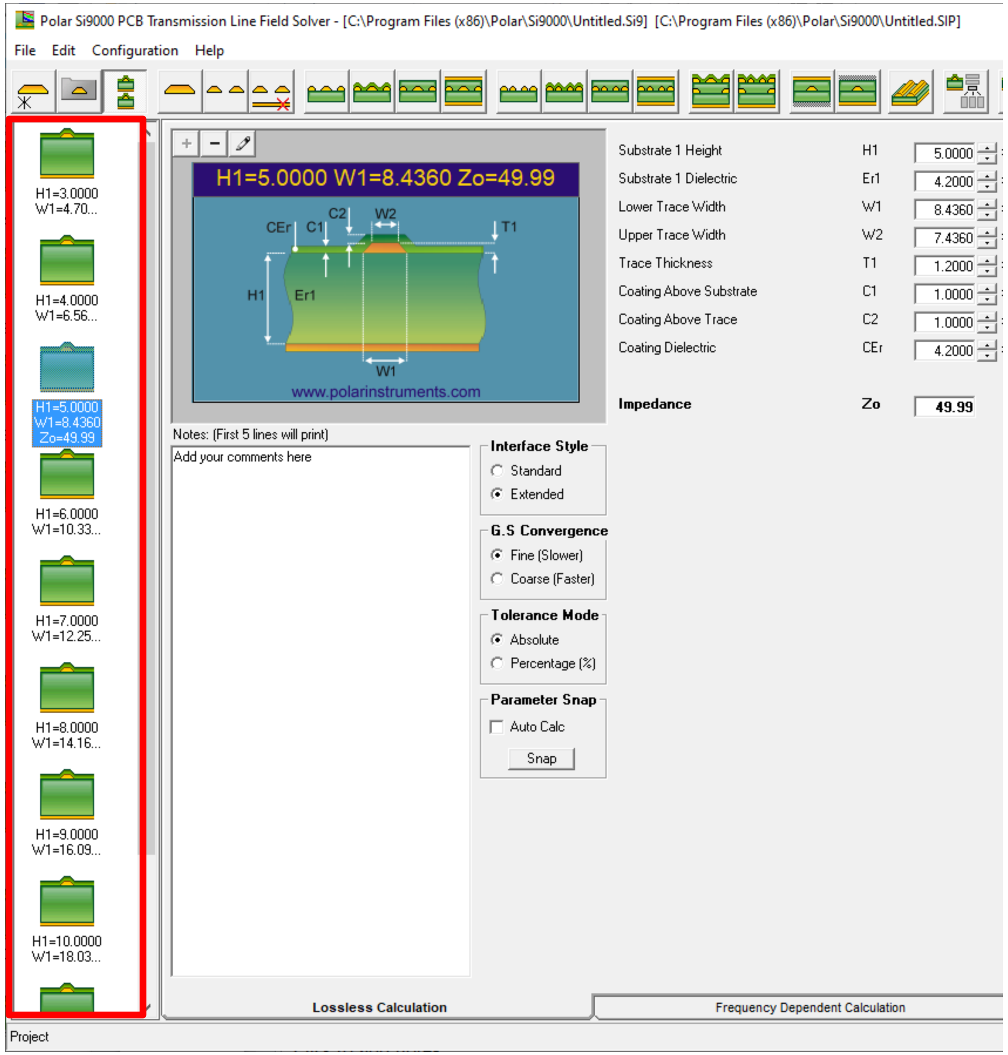
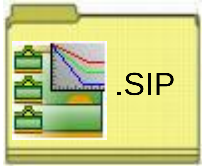
# Populate a Project from Sensitivity Analysis Results




Save the newly created project to the Si Project file format (.SIP) so that it can be recalled at a later date.

# Populate a Project from Sensitivity Analysis Results - Summary

- As separate structure in a Project it is now possible to examine the results in a lot more detail than when in sensitivity analysis
- Lossy calculations can be performed and compared
- As a Project the structure data can be stored as a .SIP file and recalled later
- Useful to both fabricators and design companies

# Surface Roughness Goal Seek option

New option to back calculate the surface roughness value for a structure from the insertion loss measurement data. The measurements can be generated using the Polar Atlas system or others that are capable of measuring insertion loss.

Cyan = Modelled Attenuation with Roughness (insertion loss)
Brown = Insertion Loss measurement data from Polar Atlas

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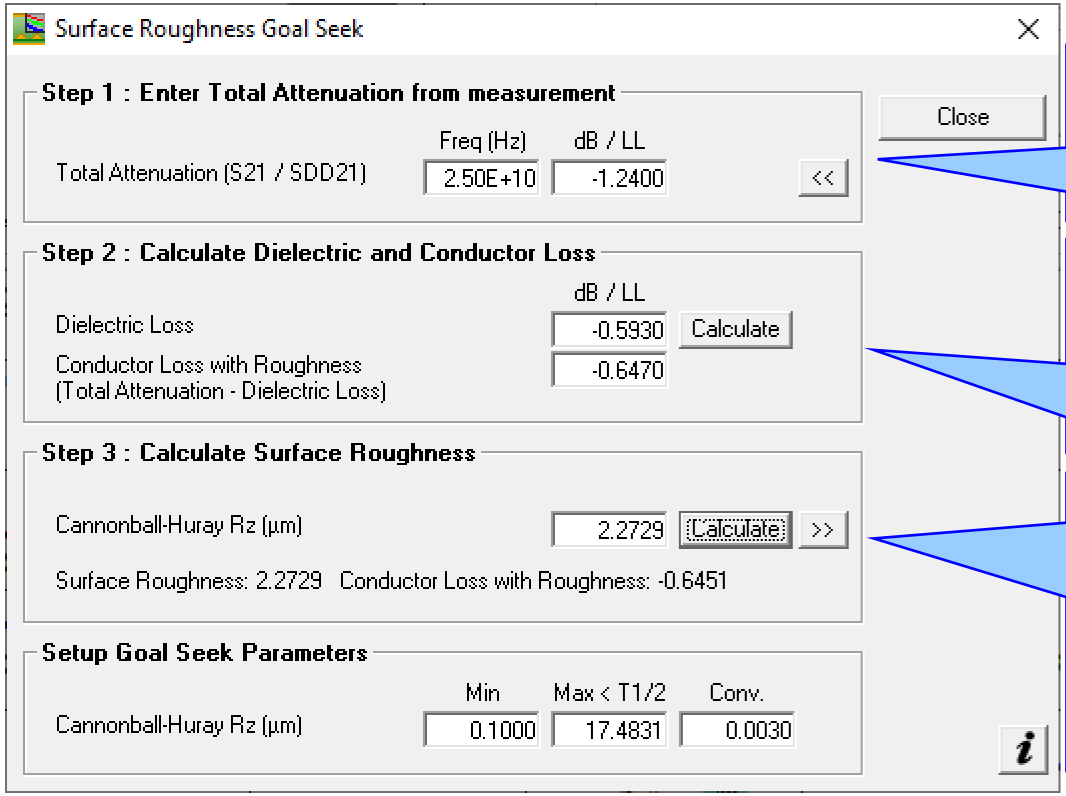
# Surface Roughness Goal Seek option




**Step 1**
Key in or pick the total attenuation (S21 / SDD21) at a given frequency from the insertion loss measurement data

**Step 2**
Calculate the dielectric loss for the frequency entered from the current structure parameters. Subtracting this calculated dielectric loss from the total attenuation will leave the target conductor loss

**Step 3**
Use the Si9000 Goal Seek algorithm to vary the surface roughness until it matches the required value to achieve the conductor loss as calculated in Step 2.
In this example a Surface Roughness of 2.2729 µm is required



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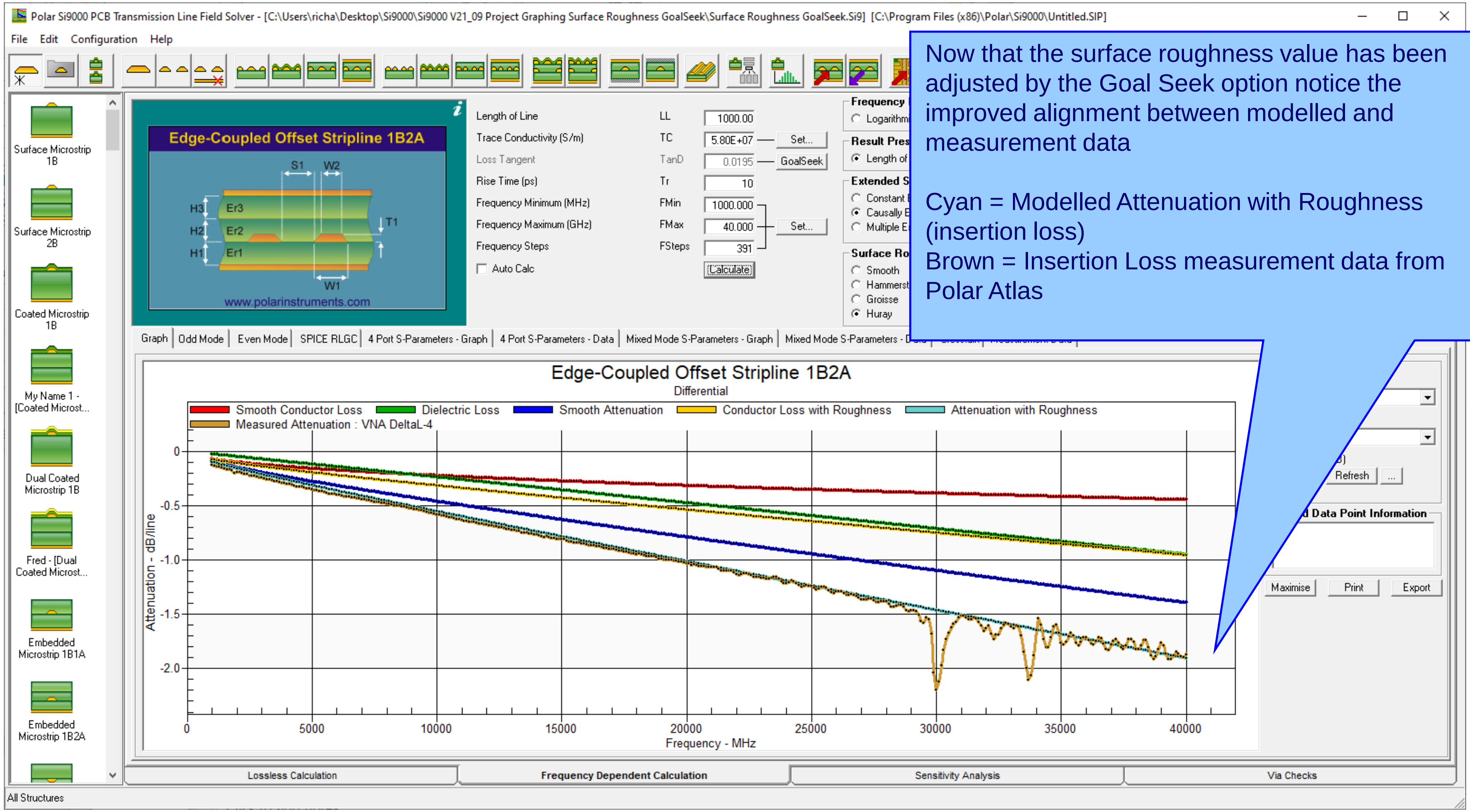
# Surface Roughness Goal Seek option




Now that the surface roughness value has been adjusted by the Goal Seek option notice the improved alignment between modelled and measurement data

Cyan = Modelled Attenuation with Roughness (insertion loss)
Brown = Insertion Loss measurement data from Polar Atlas



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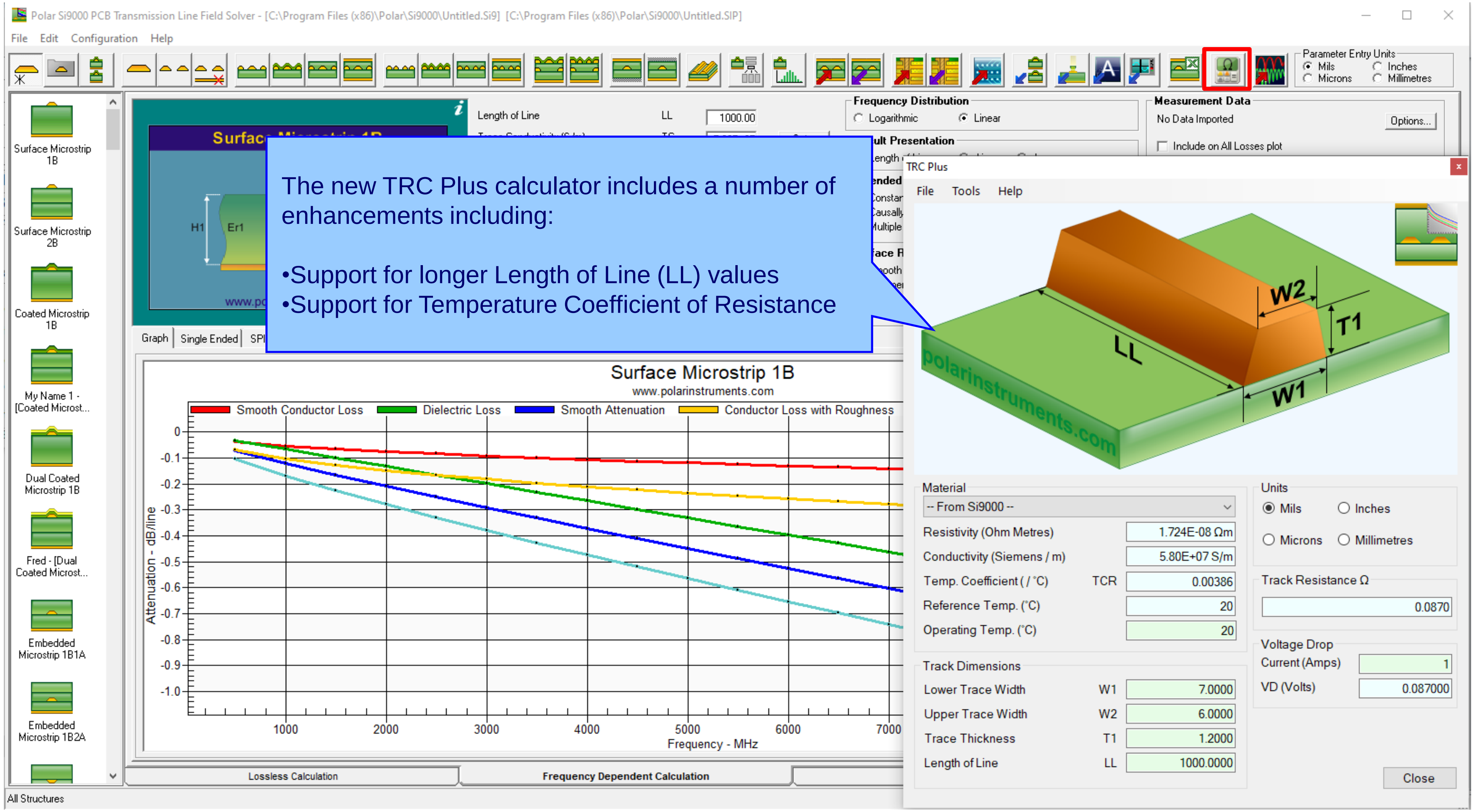
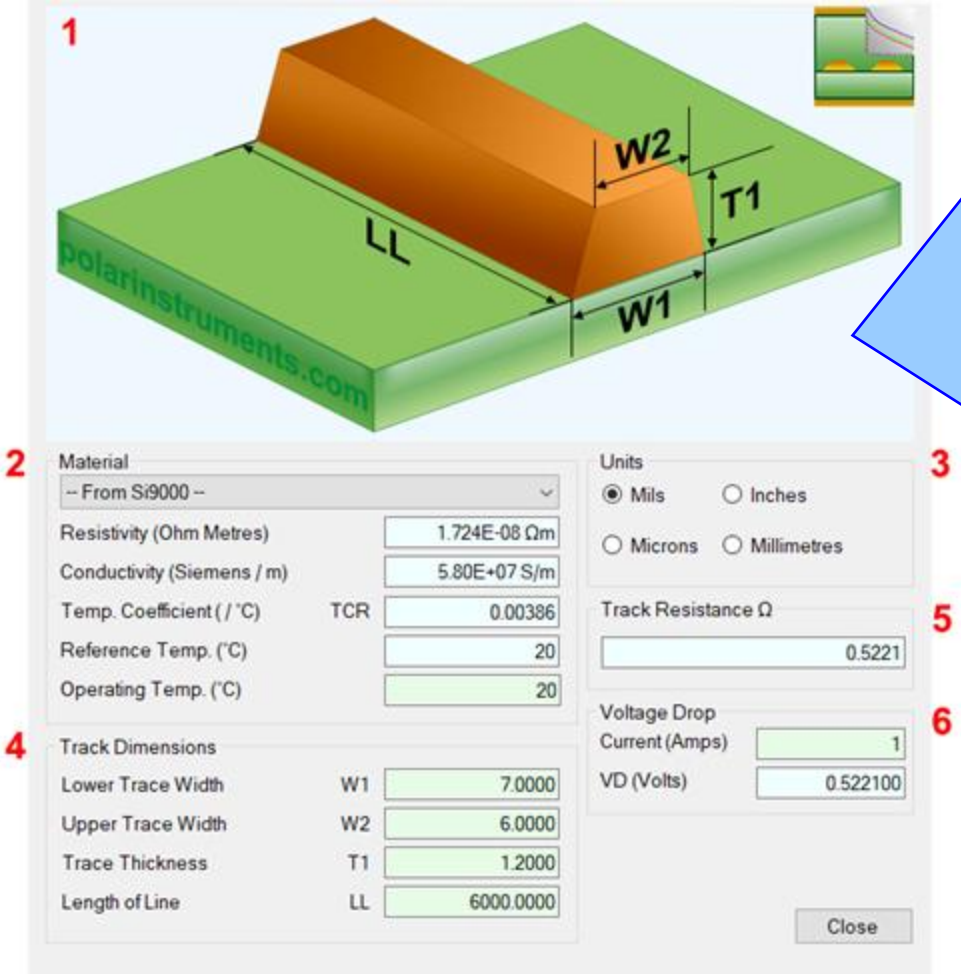
# Track Resistance Calculator (TRC Plus)



# Track Resistance Calculator (TRC Plus)




**1. Interactive track material image.**
Clicking on a track parameter label will highlight the associated Track Dimension field (text box). Enter data into the active field.

Double-clicking anywhere on the image will bring up the Materials Editor.

**2. Material selection and properties**
Select the material via the drop-down list.

Fields coloured in light-blue are not directly editable but the field values can be in the Materials Editor.

Fields coloured in light-green are editable by the user. For example, Operating Temperature will determine a material's resistivity at that temperature, which in turn will be applied in calculating the track resistance.

**3. Units**
Switch to your preferred units by clicking the associated option button – imperial units include Mils (Thou) and Inches; for metric units choose Microns (Micrometres) or Millimetres.

**4. Track or trace dimensions**
Enter or change track dimensions in the Track Dimensions in the chosen units.

**5. Resistance result**
Calculation of the track resistance. The result should update immediately upon any changes to the editable (light-green) fields.

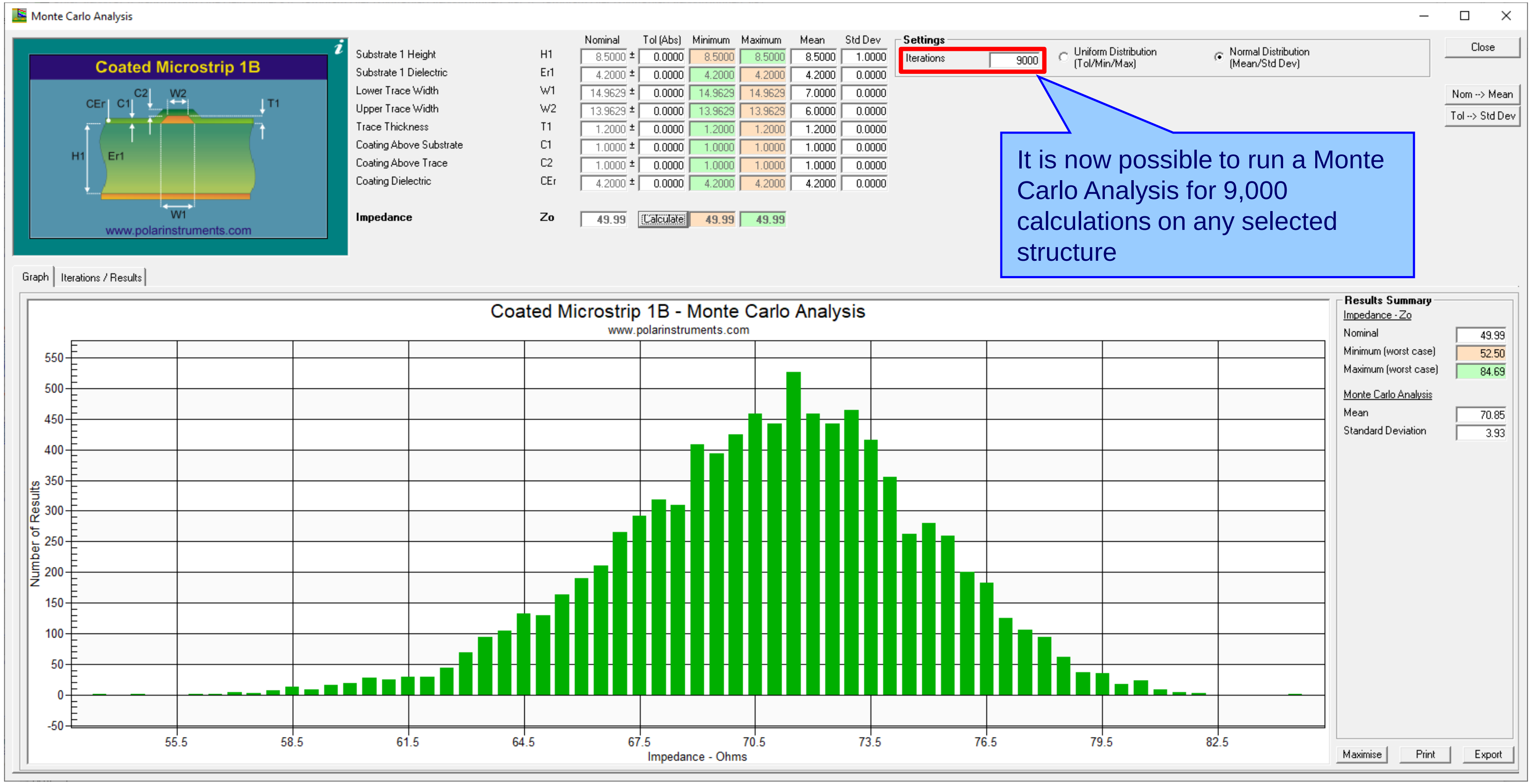
**6. Voltage Drop calculation result**
The calculated Voltage Drop is displayed in the VD (Volts) text box

## Other enhancements

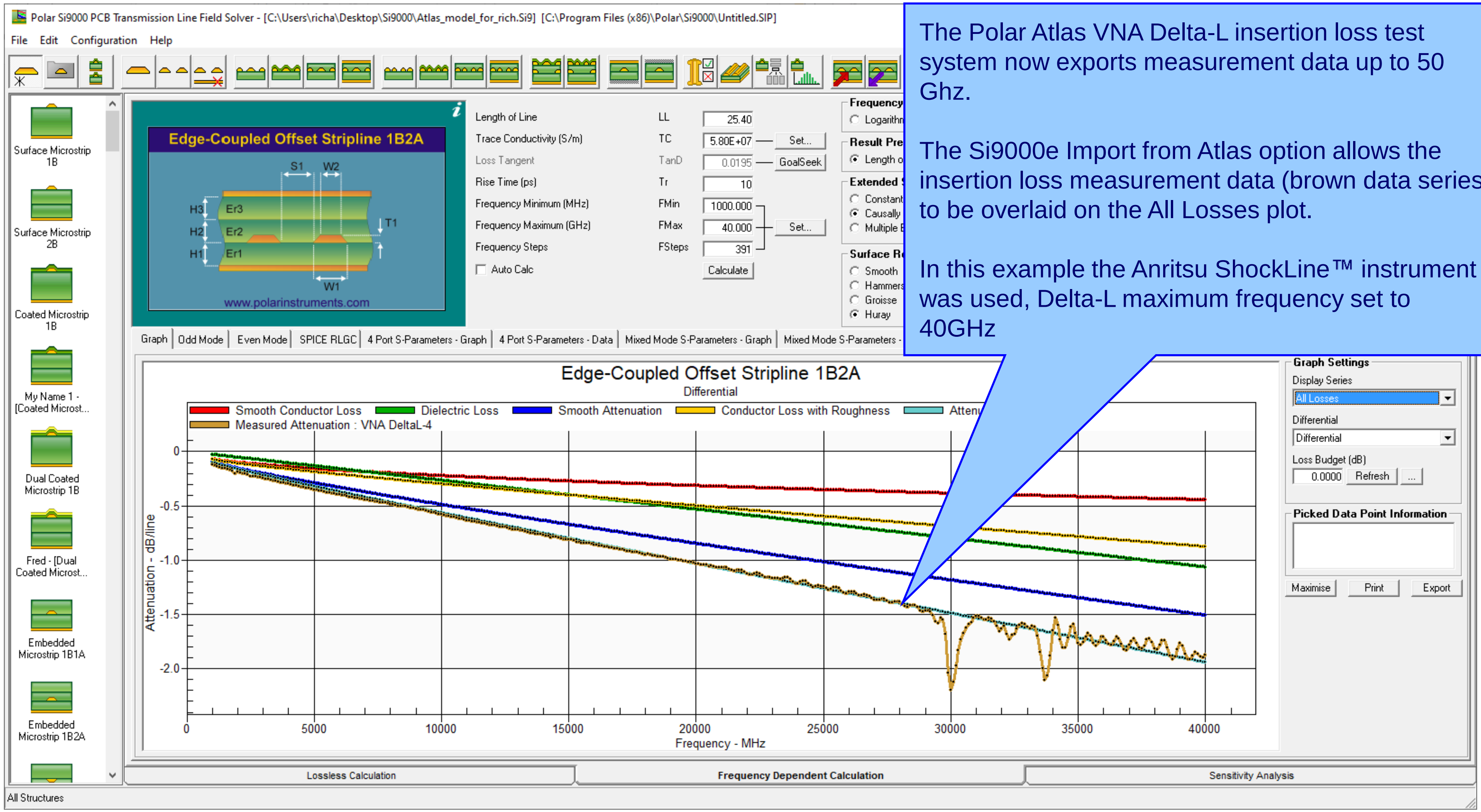
- Monte Carlo Analysis. New option added to export the Iterations / Results to Clipboard (for Excel), accessible from the right-click menu
- Causally Extrapolated Substrate Data. New option added to export the Results to Clipboard (for Excel), accessible from the right-click menu

# v21.04 (April 2021)

# Monte Carlo Analysis maximum iteration increased to 9000



# Import from Atlas enhanced to support measurement data to 50GHz




The Polar Atlas VNA Delta-L insertion loss test system now exports measurement data up to 50 Ghz.

The Si9000e Import from Atlas option allows the insertion loss measurement data (brown data series) to be overlaid on the All Losses plot.

In this example the Anritsu ShockLine™ instrument was used, Delta-L maximum frequency set to 40GHz



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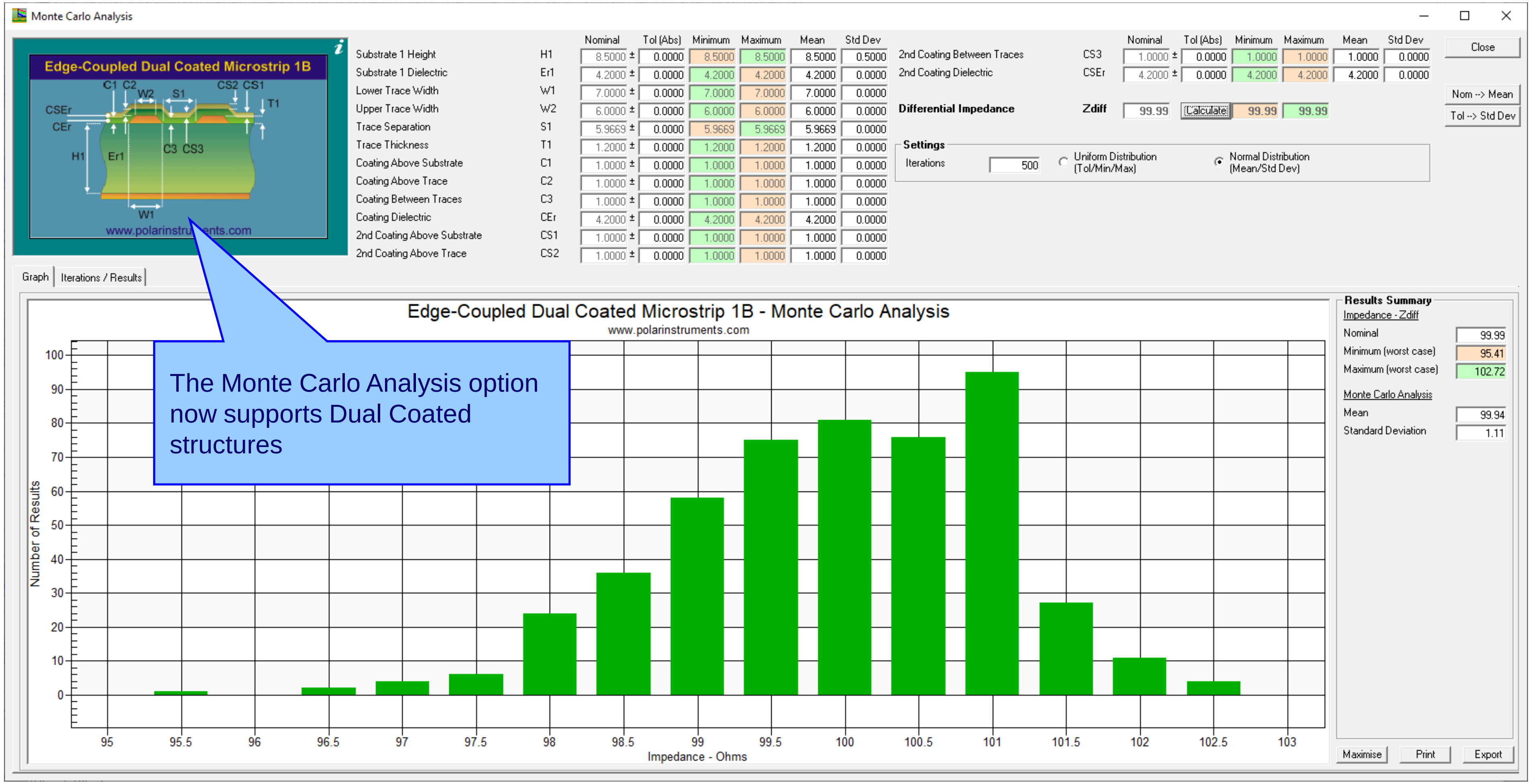
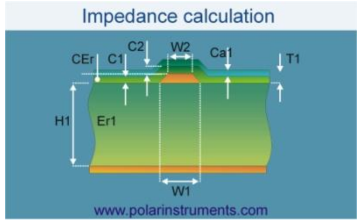
# v21.01 (January 2021)

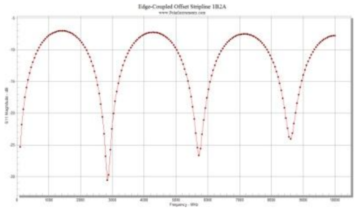
# Monte Carlo support added for Dual Coated structures

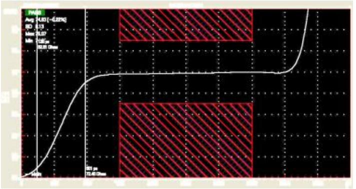


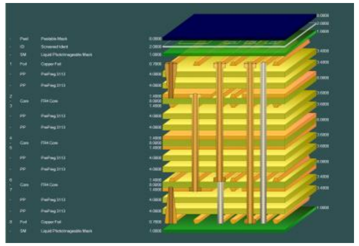
## Other enhancements

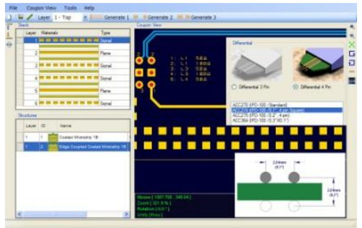
- FlexNet Publisher / FLEXlm v11.17.2.0 supported



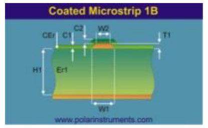


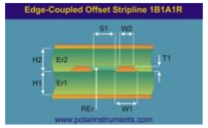


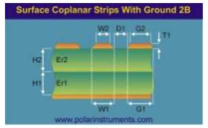
*Thank you for viewing this Si8000m / Si9000e 2021 – 2025 preview. If you have questions we would be delighted to help you. Your local contact information is contained on the following slide*

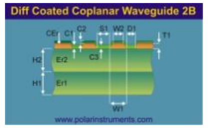


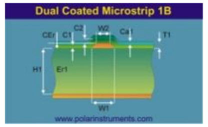
**polarinstruments.com**

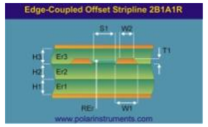


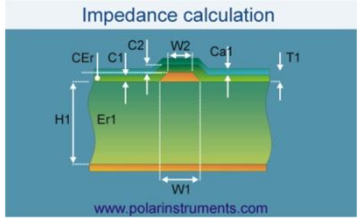


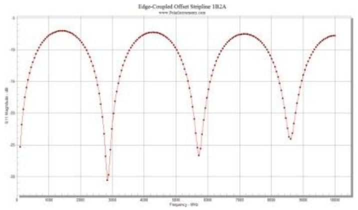
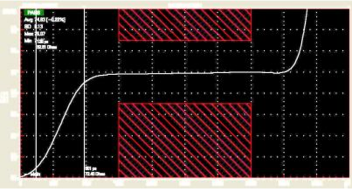
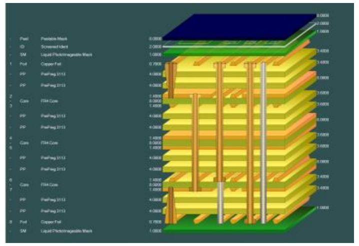
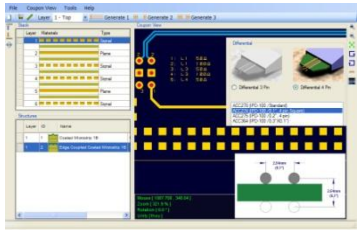










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