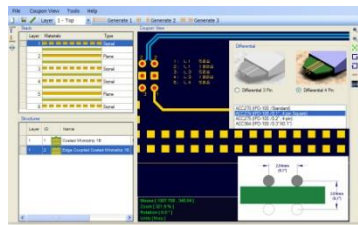
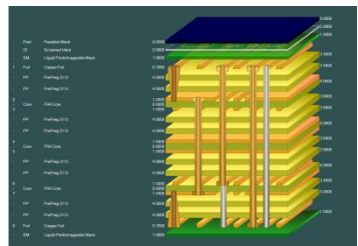
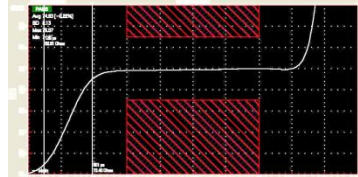
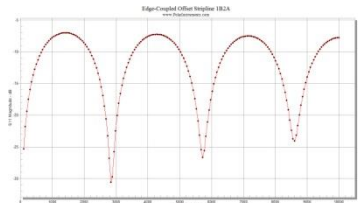
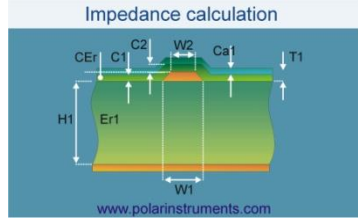




Si9000e Importing Insertion Loss Measurement Data - Preview

Richard Attrill – September 2016 (Rev 3)

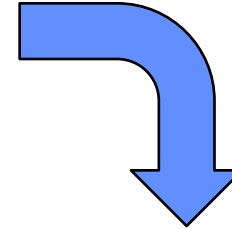
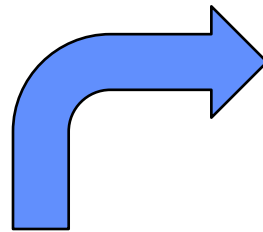


Overview

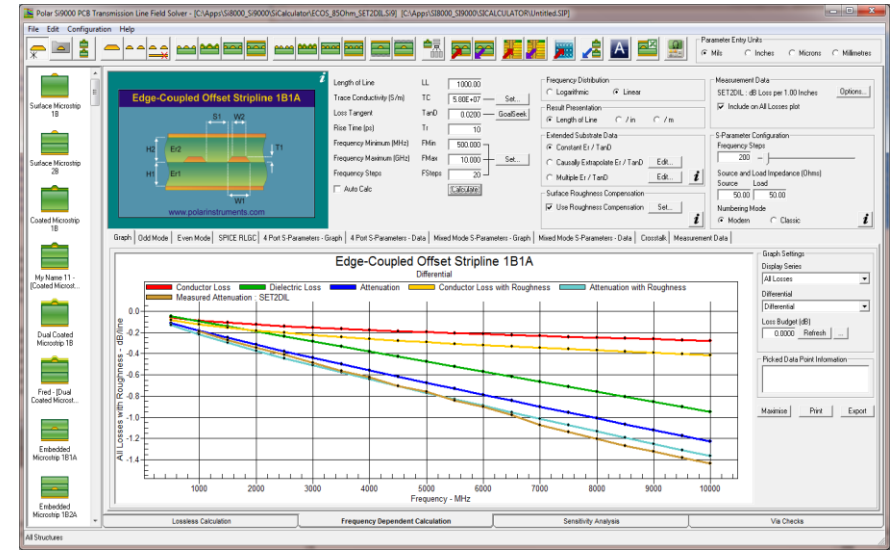
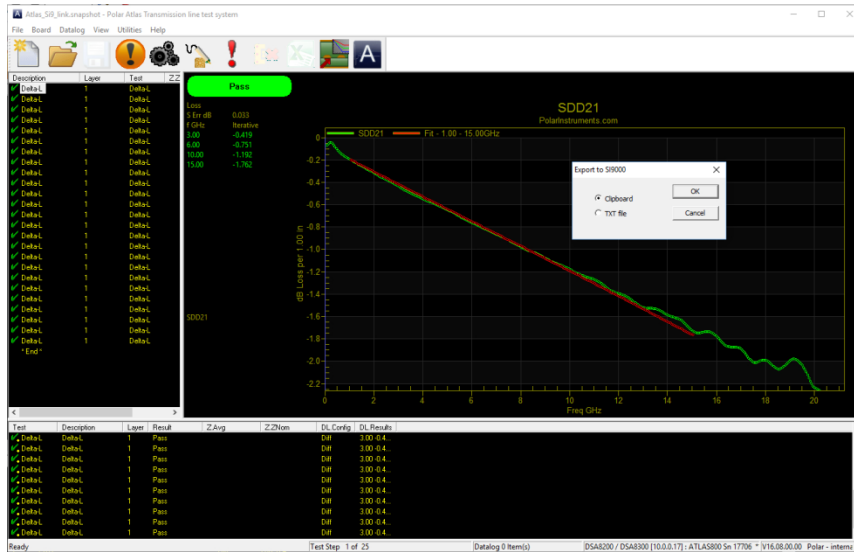
The Polar Si9000e Transmission Line Field Solver allows the user to quickly calculate impedance, insertion loss, RLGC and S-Parameters for a wide range of transmission line structures. Version 16.07 provides the capability to import insertion loss measurement data (S21 / SDD21), allowing for the easy comparison of modelled and measured results. It is possible to:

- a. Import measurement data directly from the Polar Atlas Transmission Line Test System that supports Delta-L, SPP and SET2DIL test methodologies.
- b. Overlay the modelled / measured data for comprehensive analysis
- c. Check and adjust modelling parameters based on the measured results

Workflow



Insertion loss data is transferred from Atlas to the Si9000e using a simple Copy & Paste function



Polar Atlas Transmission Line Test System

Polar Si9000e Transmission Line Field Solver

Importing the measurement data into the Si9000e

```
010110
110011
101000
0001
```

The new 'Paste from Atlas' option provides an easy way to import the insertion loss measurement data. The data is stored with the transmission line structure

Each set of Atlas measurement data includes a header section followed by 240 data points from 1GHz to 25GHz in 100MHz increments

Importing the measurement data into the Si9000e

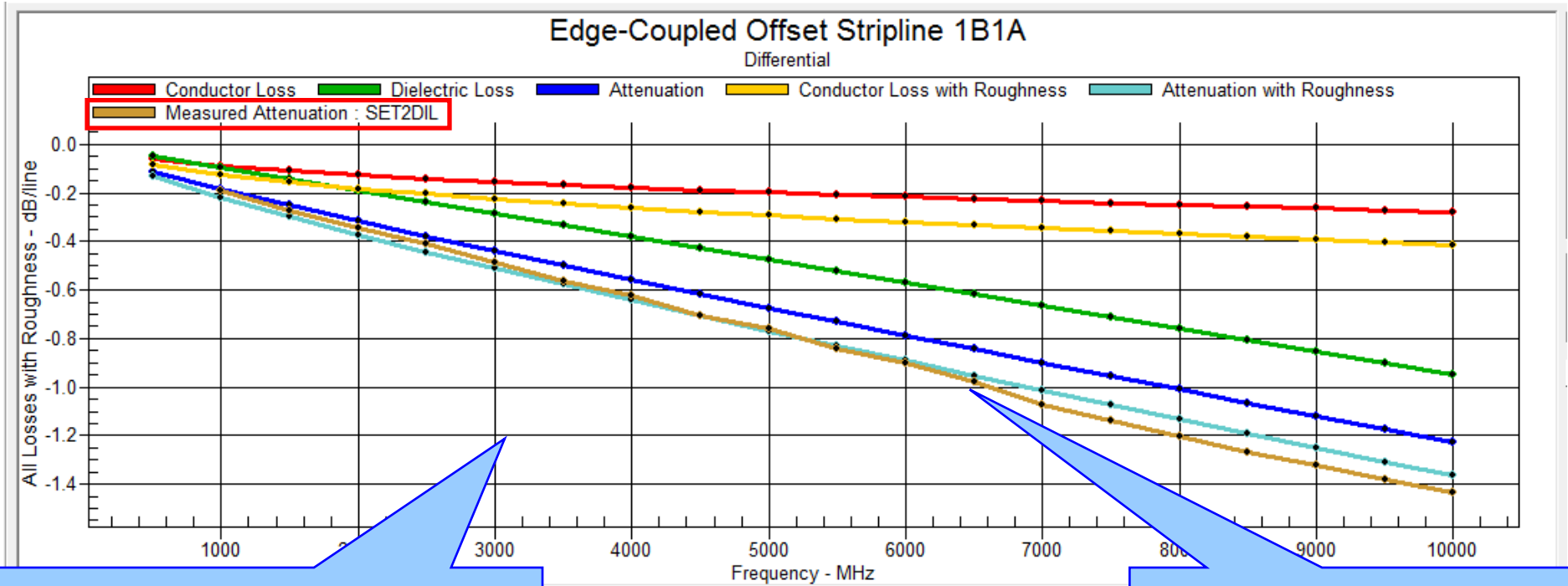
The screenshot displays the Polar Si9000 PCB Transmission Line Field Solver interface. The main window shows a schematic of an "Edge-Coupled Offset Stripline 1B1A" with parameters like Length of Line (1000.00), Trace Conductivity (5.80E+07), and Loss Tangent (0.0200). A parameter entry window is open, showing "Measurement Data" for "SET2DIL : dB Loss per 1.00 Inches" with the option "Include on All Losses plot" checked. A plot titled "Edge-Coupled Offset Stripline 1B1A Differential" shows attenuation in dB/line versus frequency in MHz. The plot includes several data series: Conductor Loss (red), Dielectric Loss (green), Attenuation (blue), Conductor Loss with Roughness (yellow), Attenuation with Roughness (cyan), and Measured Attenuation : SET2DIL (brown). A callout box points to the brown line, stating: "An additional 'Measured Attenuation' data series is added to the All Losses plot. Shown in brown". Another callout box points to the parameter entry window, stating: "Once imported, the Measurement Data frame on the main interface updates, summarising key information about the data imported". A third callout box points to the plot legend, stating: "In this example the Measurement Data imported uses the SET2DIL test methodology in dB per inch".

An additional 'Measured Attenuation' data series is added to the All Losses plot. Shown in brown

Once imported, the Measurement Data frame on the main interface updates, summarising key information about the data imported

In this example the Measurement Data imported uses the SET2DIL test methodology in dB per inch

Measured Attenuation added to the All Losses plot : 1GHz to 10GHz



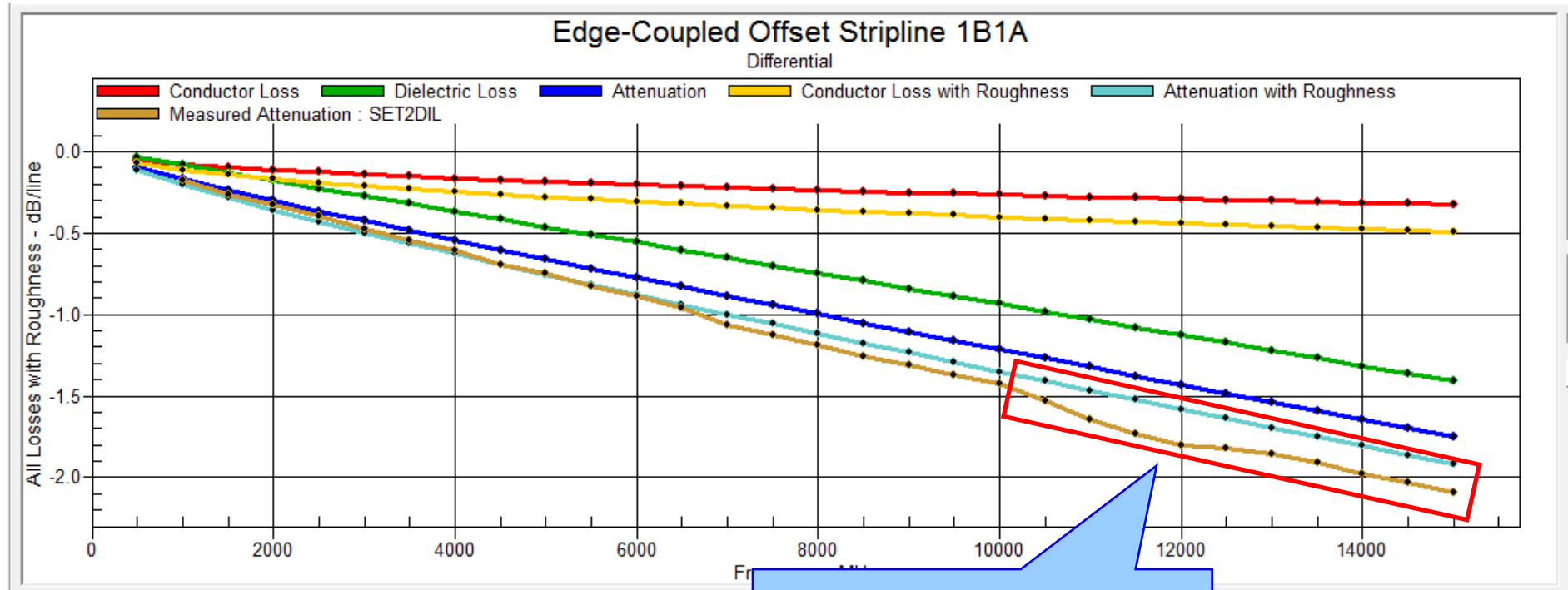
The new 'Measured Attenuation' data series is added to the All Losses plot (brown). It is shown alongside the modelled Conductor Loss, Dielectric Loss and Attenuation with Roughness.

Comparing the Attenuation with Roughness (cyan) with the Measured Attenuation (brown) indicates there is good correlation

Measured Attenuation added to the All Losses plot : 1GHz to 15GHz

Frequency Minimum (MHz)	FMin	500.000	Set...
Frequency Maximum (GHz)	FMax	15.000	
Frequency Steps	FSteps	30	

By altering Frequency Minimum / Maximum for the structure it is possible to extend the model out to 15GHz



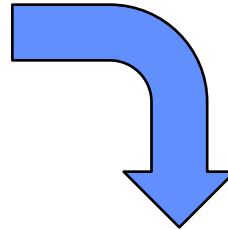
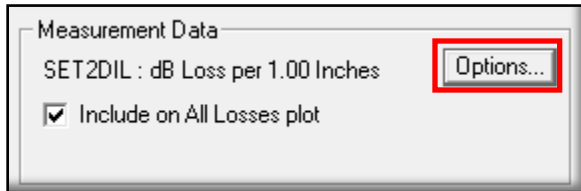
Notice how the modelled / measured results diverge, possibly due to a measurement artefact

Viewing the measurement data in table form

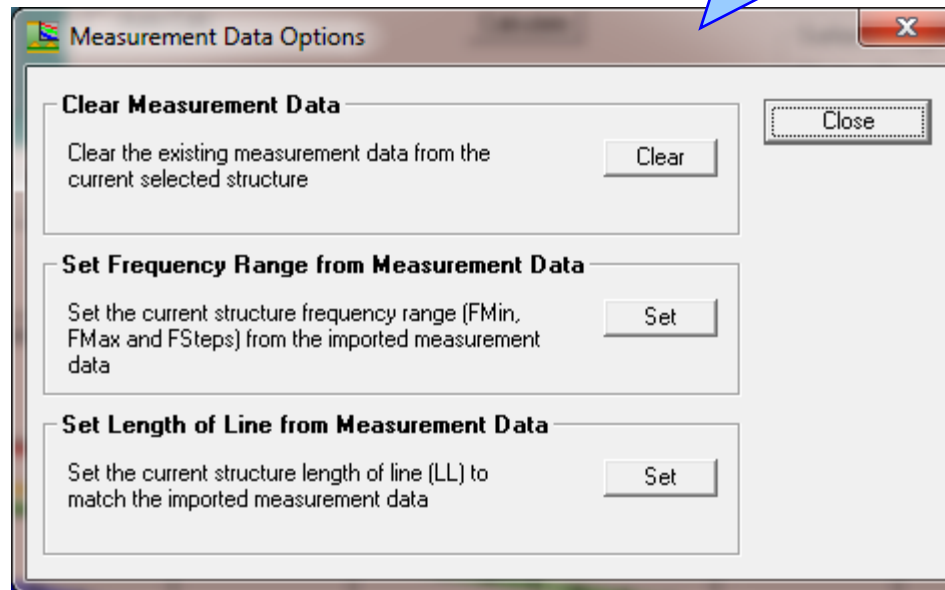
The screenshot shows the Polar Si9000 PCB Transmission Line Field Solver interface. A table of measurement data is displayed in the center, showing Frequency (Hz), Measured Attenuation (dB Loss per 1.00 Inches), and Effective Er. A callout box points to the 'Measurement Data' tab in the software interface, stating: 'A new Measurement Data tab has been introduced. Selecting this tab displays the measurement data table'.

Frequency Hz	Measured Attenuation : dB Loss per 1.00 Inches	Effective Er
1.000E+09	-0.192	3.356
1.100E+09	-0.210	3.357
1.200E+09	-0.225	3.355
1.300E+09	-0.239	3.357
1.400E+09	-0.260	3.356
1.500E+09	-0.274	3.353
1.600E+09	-0.289	3.351
1.700E+09	-0.300	3.349
1.800E+09	-0.314	3.350
1.900E+09	-0.331	3.348
2.000E+09	-0.342	3.346
2.100E+09	-0.357	3.344
2.200E+09	-0.367	3.343
2.300E+09	-0.385	3.342
2.400E+09	-0.399	3.338
2.500E+09	-0.409	3.338
2.600E+09	-0.430	3.336
2.700E+09	-0.437	3.334
2.800E+09	-0.459	3.335
2.900E+09	-0.477	3.331
3.000E+09	-0.489	3.331
3.100E+09	-0.516	3.329

Measurement Data options



The Measurement Data Options dialog provides a method to clear the previously imported measurement data from the structure. It is also possible to auto-set the current structure frequency range and length of line to match the data imported.



Importing the measurement data – another example

The screenshot displays the Polar Si9000 PCB Transmission Line Field Solver interface. The main window shows the configuration for an "Edge-Coupled Offset Stripline 1B1A". The "Measurement Data" section is highlighted with a red box, showing the following settings:

- Measurement Data: SPP : dB Loss per 10.00 Millimetres
- Include on All Losses plot

A callout box provides a closer look at these settings:

Measurement Data
 SPP : dB Loss per 10.00 Millimetres
 Include on All Losses plot

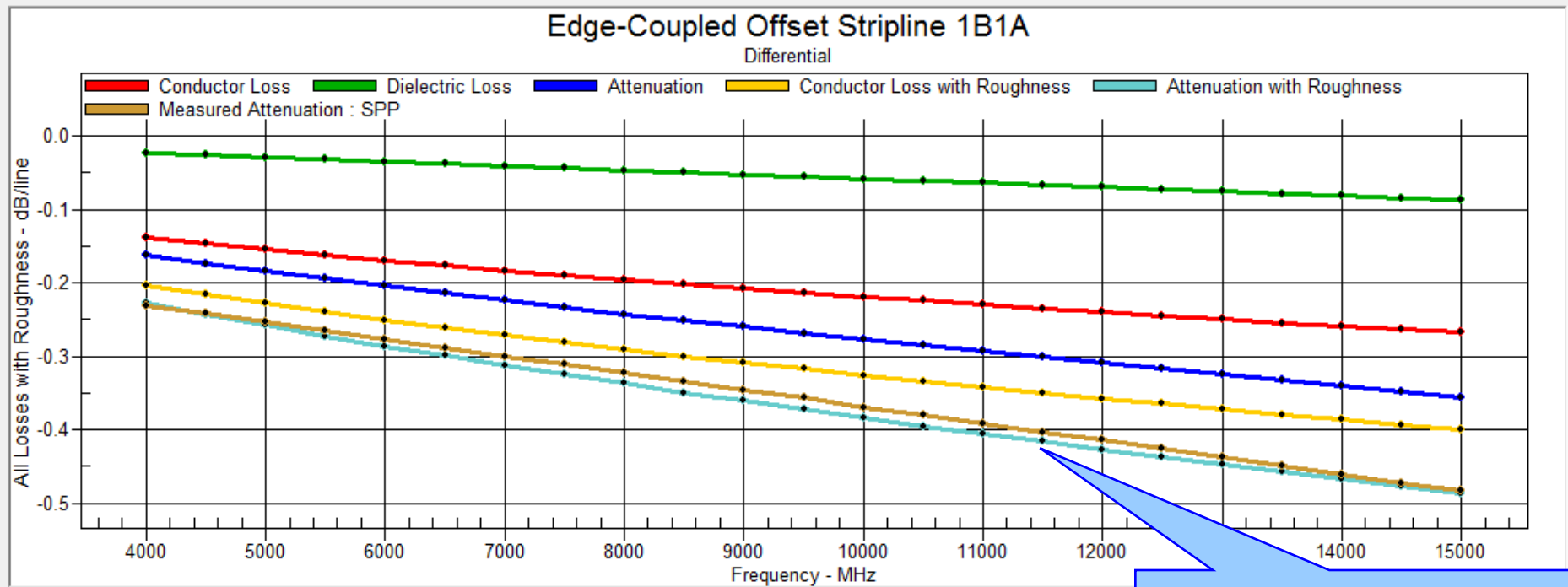
The main plot, titled "Edge-Coupled Offset Stripline 1B1A Differential", shows "All Losses with Roughness - dB/line" versus "Frequency - MHz". The plot includes several data series:

- Conductor Loss (Red line)
- Dielectric Loss (Green line)
- Attenuation (Blue line)
- Conductor Loss with Roughness (Yellow line)
- Attenuation with Roughness (Cyan line)
- Measured Attenuation : SPP (Brown line)

The plot shows that the measured attenuation (SPP) closely follows the calculated attenuation with roughness, indicating that the imported measurement data is being used for comparison against the simulation results.

In this example the Measurement Data imported uses the SPP test methodology in dB per 10 mm (per cm)

Measured Attenuation added to the All Losses plot : 4GHz to 15GHz

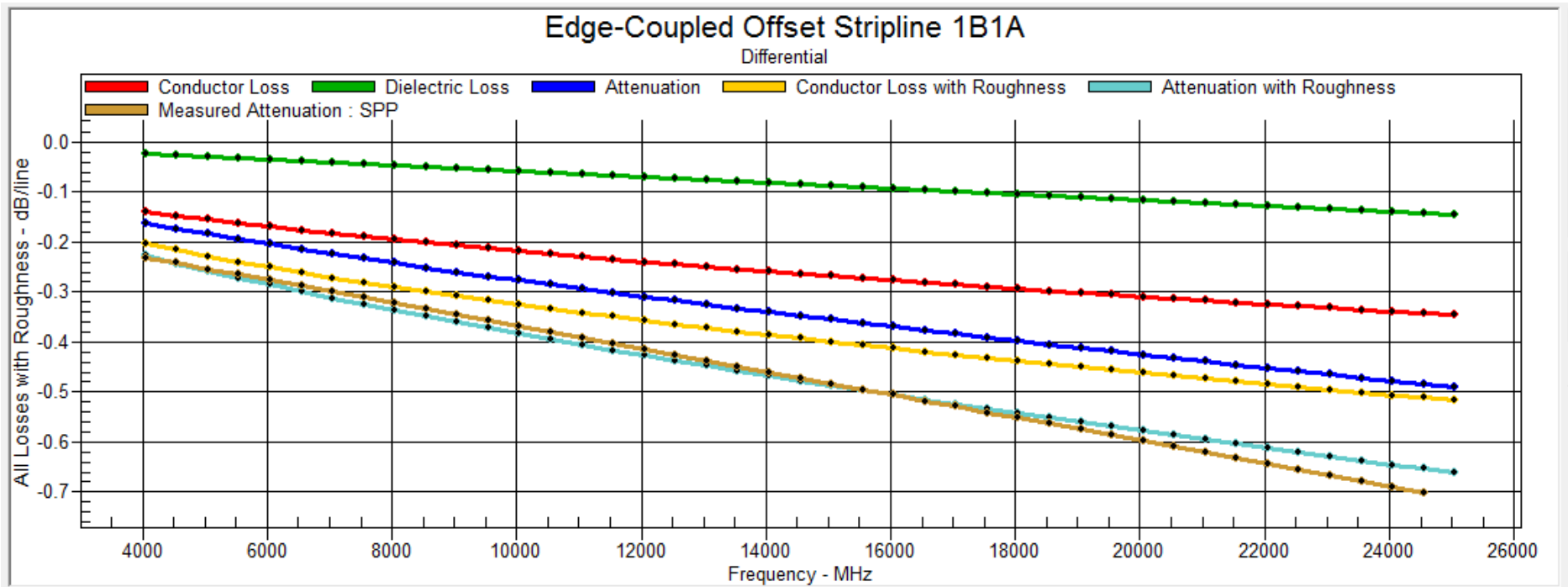


Comparing the Attenuation with Roughness (cyan) with the Measured Attenuation (brown) indicates there is good correlation

Measured Attenuation added to the All Losses plot : 4GHz to 25GHz

Frequency Minimum (MHz)	FMin	4000.000	Set...
Frequency Maximum (GHz)	FMax	25.000	
Frequency Steps	FSteps	43	

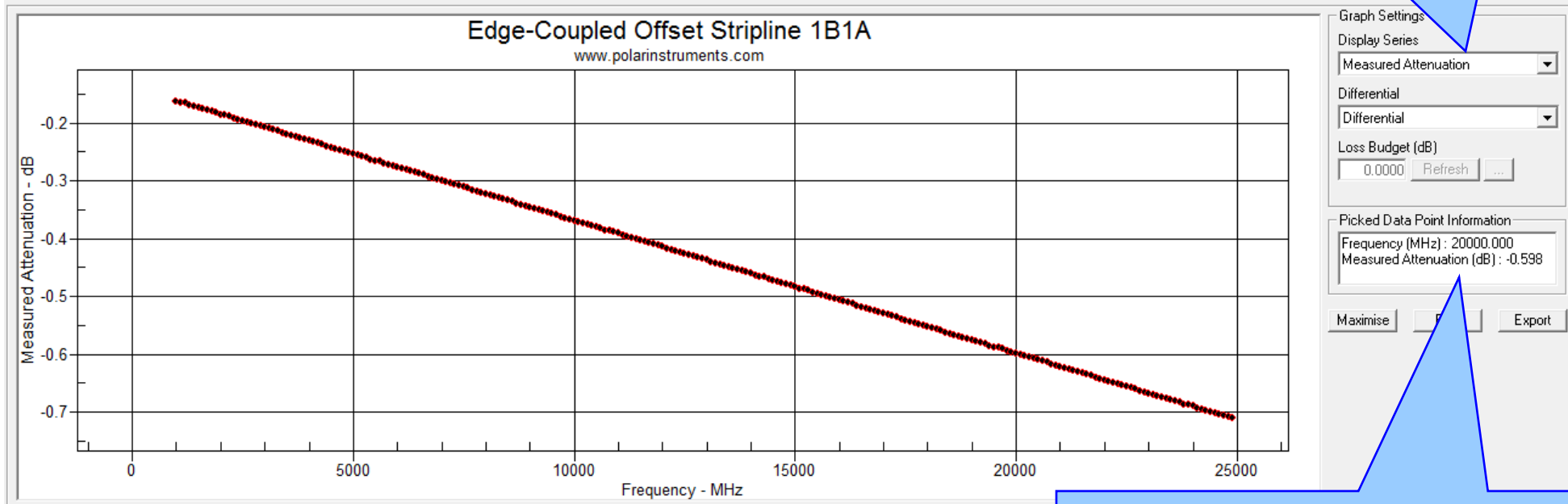
By altering Frequency Minimum / Maximum for the structure it is possible to extend the model out to 25GHz



Measured Attenuation plot : 1GHz to 25GHz

Selecting the Measured Attenuation display series allows the measurement data to be plotted without the modelling data.

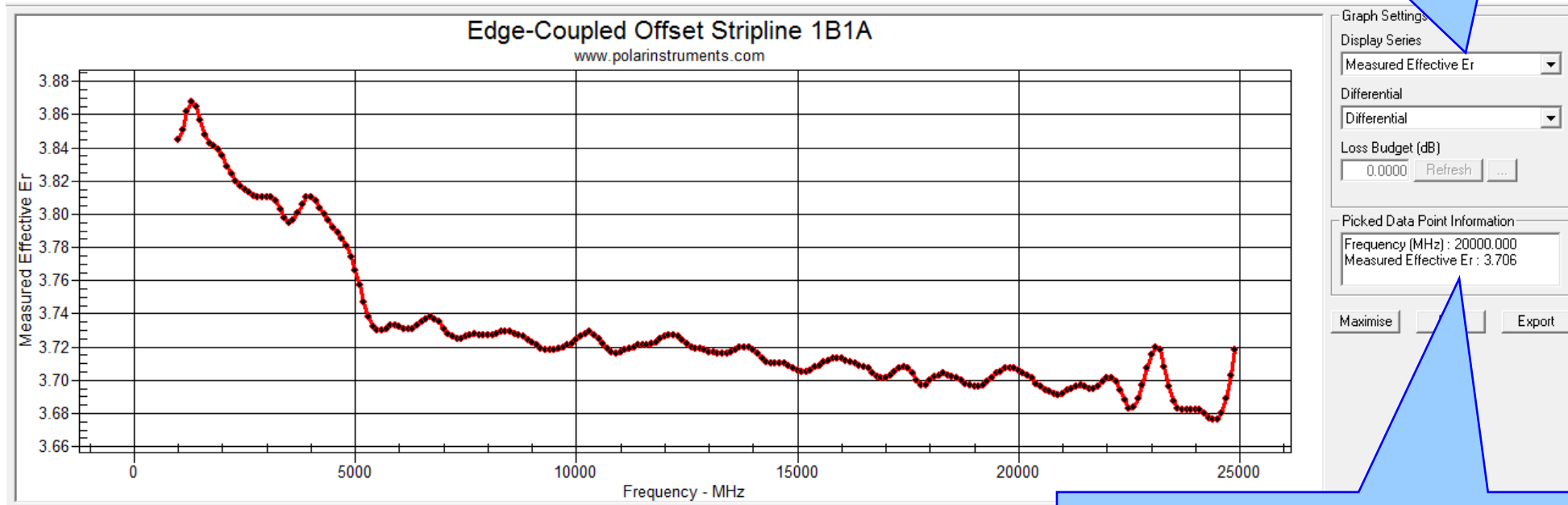
Notice that a line fit algorithm has been applied to the raw measurement data



By clicking on a plotted data point it is possible to query the attenuation at a frequency. In this example, at 20 GHz the attenuation is -0.598 dB per 10 mm

Measured Effective Er plot : 1GHz to 25GHz

Selecting the Measured Effective Er display series allows the measurement data to be plotted without the modelling data.



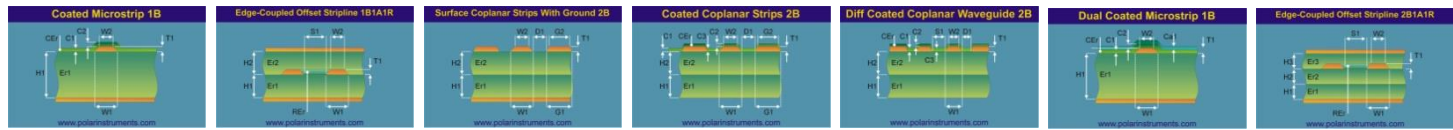
By clicking on a plotted data point it is possible to query the Effective Er at a frequency. In this example, at 20 GHz the Effective Er is 3.706

Summary

The Polar Si9000e functionality has been extended to import Delta-L, SPP and SET2DIL insertion loss measurement data from the Polar Atlas Transmission Line Test System.

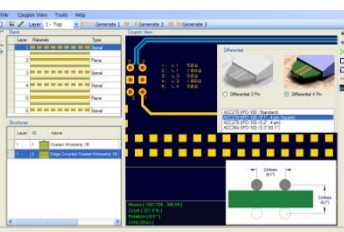
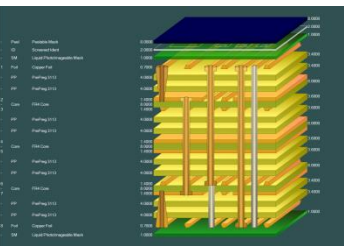
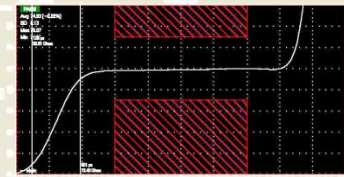
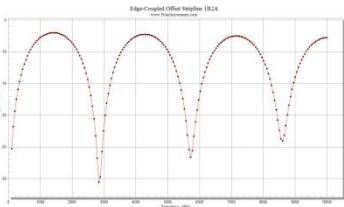
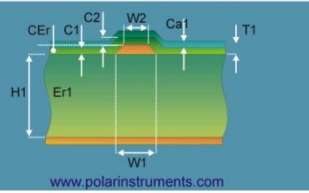
This allows the user to quickly overlay the modelled / measured data for comprehensive comparison and analysis

Using the powerful modelling capability of the Si9000e it is possible to fine tune the structure parameters based on the reality of measurement data. For instance, adjust the substrate height and trace width / separation geometries, goal seek the loss tangent and model the affect of surface roughness on the conductor layers.



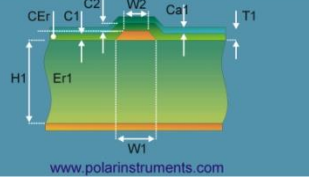
Thank you

Impedance calculation



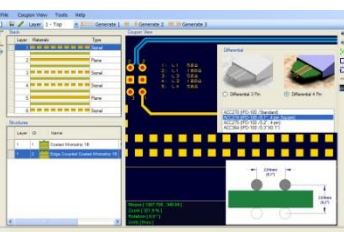
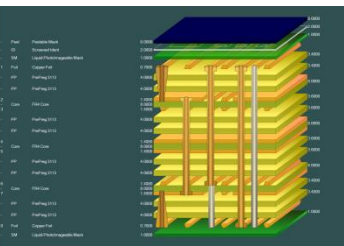
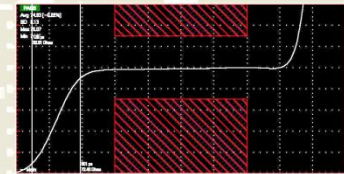
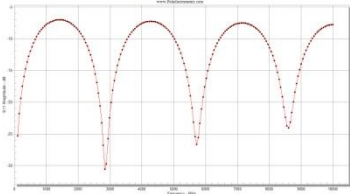


Impedance calculation



www.polarinstruments.com

Edge-Coupled Offset Stripline 1B2A



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