# PCB insertion loss test system


## Accurate measurement of transmission line insertion loss for multi-GHz PCB fabrication

Atlas Si - for SET2DIL
Atlas Si - for SPP

- Ensures accurate insertion loss measurement
- Incorporates IPC TM650 compliant SET2DIL and Short Pulse Propagation methods
- Easy to use for non-skilled operators
- Supports bi-directional SET2DIL
- Support for SPP testing with emulated impulse forming networks
- SET2DIL tests extract effective Er and phase

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Ergonomic ESD safe GGB probe body

**Atlas Si is a precision insertion loss measurement package designed specifically for PCB fabricators and OEMs. It provides accurate, repeatable measurements of frequency based transmission line losses, allowing fabricators to meet stringent targets that maintain signal integrity within the limits of the latest high-speed chipsets.**

The emergence of a new generation of high-speed busses, such as SuperSpeed USB 3.0, PCI Express® Gen2.0, XAUI and RocketIO™ means that PCB fabricators must be ready to provide tight control over losses from multi-GHz PCB transmission lines.

Snapshot archive of full or single test data including both results and $S_{DD}21$ displays

The differential signalling techniques used by these new busses allow PCBs operating at multi-GHz to be manufactured using conventional and cost-effective PCB base materials. However, while this gives OEM designers the combination of high performance and low PCB costs, it means that PCB fabricators must be able to accurately measure and control transmission line losses.

Using Polar Atlas insertion loss measurement systems in conjunction with the industry standard Si9000e field solver enables PCB fabricators to predict and measure the characteristics of ultra high speed differential signal lines and reduce the number of prototype turns before committing to production.

All new IPS series ergonomic probes (identified by the blue color on the tip and the labels, and the robust metal insert supporting the SMAconnector) are compatible with Atlas in situations where there is a need to measure both impedance and insertion loss

ACCURATE AND REPEATABLE INSERTION LOSS MEASUREMENTS IN A PCB FABRICATION ENVIRONMENT.

## Multi-GHz PCB fabrication

While frequency-based losses are usually negligible on PCBs operating below 2GHz, above this level signal losses become a major problem for PCBs manufactured in conventional FR4 and other low-cost laminate materials.

As more OEMs integrate high-speed chipsets onto their boards, the need for PCB fabricators to measure and control frequency-based losses increases. Measuring transmission line losses presents fabricators with a set of challenges very different from those for controlling impedance: whereas trace width and dielectric separation are among the most important criteria for impedance control, dielectric loss and smoothness of the copper foils are the crucial parameters for controlling frequency-based losses.

Use the Atlas DRG Pro to provide professionally presented customer conformance reports. Alternatively, Atlas now offers direct export of results in Microsoft excel format.

Fast and accurate measurement of transmission line losses in the production environment allows you to increase manufacturing yield and reduces the comparatively high cost of multi-GHz PCB fabrication.

## Atlas software

Atlas uses powerful mathematical processing techniques to allow non-skilled operators to measure differential frequency-dependent losses from a test coupon quickly and easily. The system is easy to set up, easy to use and delivers fast results without the need for extensive operator training. A single insertion loss test can be performed in a fraction of the time needed for traditional techniques.

Atlas is compliant with IPC TM650 2.5.5.12 (Test Methods to Determine the Amount of Signal Loss on Printed Boards) and provides support for SPP (Short Pulse Propagation) Bi-directional SET2DIL (Single Ended TDR to Differential Insertion Loss) and SET2SEIL (Single Ended TDR to Single Ended Insertion Loss).

SPP allows extraction of PCB electrical characteristics that impact signal propagation. The technique uses your existing TDR/TDT equipment and produces frequency dependent parameters such as the propagation constant (alpha, attenuation and beta, phase constant) and effective dielectric constant along with the characteristic impedance (including even and odd mode impedance). Atlas measurements include launch point extrapolation/long line regression fit.

Atlas also employs the SET2DIL test method to extract differential insertion loss and SET2SEIL to extract single ended insertion loss along with effective Er. Customers may license either or both techniques.

Atlas is compatible with the Tektronix DSA8300, DSA8200 and TDS8000 oscilloscopes and 80E series TDR sampling heads which provide the raw data from which Atlas can calculate insertion loss results.

### Choose between hardware and software impulse forming networks

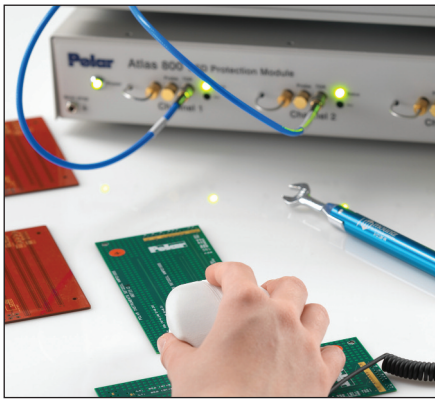
Atlas provides support for both hardware and software emulated impulse forming networks (IFNs) for SPP testing. Atlas allows the SPP test steps to be performed in any order guiding the user graphically through the test via a series of helpful screens detailing the connection of cables and impulse forming networks. Test results in both table and waveform format can be saved and retrieved as snapshots for subsequent sharing, viewing and analysis or exported in CSV format for evaluation and study.

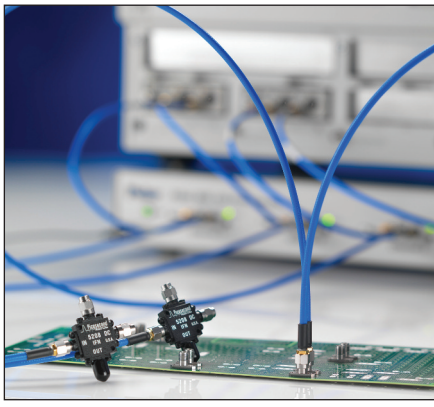
### Ideal for backplane testing

Unique to Polar's Atlas, emulated impulse forming networks (pulse differentiators) will save both testing time and equipment costs – and increase signal / noise ratio and allow SPP testing on longer lines.

### ESD protection designed for SET2DIL & SPP applications – Atlas 800

As high bandwidth systems are inherently sensitive to electrostatic discharge (ESD) they must be implemented with the highest level of ESD control that is practical in the test environment. Atlas software is fully integrated with the Atlas 800 ESD protection unit which provides both 26GHz bandwidth switching and active coupon pre-discharge. Atlas 800 ESD protection unit should be used in an environment with good ESD practice in order to minimise your running costs.



Atlas test system for SET2DIL testing of frequency-based insertion losses – $S_{DD}21$ and S21

Compatible with Tektronix DSA8300 Time Domain Reflectometer (TDR) with 80E series TDR sampling modules

Compatible with GGB Picoprobe type TLP-1 450 micron GSSG (for SET2DIL testing)

Compatible with other Polar GHz PCB design and fabrication tools – Si9000e / Speedstack Si and CGen Si – Insertion Loss Coupon Generator.


**Atlas is compatible with both commonly specified test techniques for TDR-based insertion loss ($S_{DD}21$) measurement, SET2DIL & SPP.**

Atlas can be used for standalone testing of insertion loss at the point of fabrication or as part of a suite of GHz PCB fabrication tools with other Polar products, including the Si9000e Transmission Line Field Solver, Speedstack Si Layer Stack-up Design System and the CGen Si Insertion Loss Coupon Generator. The combination of these powerful tools can help to improve manufacturing yields as well as reduce the cost of multi-GHz PCB fabrication.

Using the Si9000e to analyse and predict losses during the design stage, the fabricator can quickly model a range of scenarios, dramatically reducing both material costs and engineering time, to improve manufacturing yields. The data on the modeled stack geometries can then be imported into the CGen coupon generator to create accurate Atlas SET2DIL test coupons.

- Insertion loss testing uses criteria different from impedance control
- Allows PCBs over 2GHz to be manufactured with the most cost-effective laminates
- Meets PCB fabricators' growing need to test lossy lines
- Reduces the high cost of multi-GHz PCB fabrication
- Insertion loss testing is often specified in addition to impedance control

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## Specifications

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|---|---|
| Insertion Loss measurement | $S_{DD}21$ magnitude vs frequency over the widest range practical for a coupon of defined characteristics |
| Impedance measurement | Single ended and differential impedance<br>Accuracy specifications: as defined by the TDR manufacturer |
| SET2DIL | $S_{DD}21$ measured using the IPC-TM-650 defined SET2DIL technique. |
| SPP | $S_{DD}21$ measured using the IPC-TM-650 defined SPP – Short Pulse Propagation technique |
| Impedance | Controlled (characteristic) lossless impedance – included as standard with SPP and SET2DIL |
| ESD protection | Included as standard |
| Datalogging and output | All tests data logged and output as pipe delimited text files for customer processing<br>Microsoft Excel® CSV file export<br>Printable test lists and waveforms |
| Probe | GGB Picoprobe type TLP-1 450 micron GSSG for SET2DIL |
| Bandwidth monitoring | Real time monitoring of system bandwidth |
| Acquisition system | Tektronix DSA 8300 with 80E series TDR samplers (Polar or customer supplied) |
| Accessories | ACC383: USB footswitch |
| PC requirements | PC running Windows 7 or later<br>Refer to Polar Application Note AP605 |
| Applicable standards | IPC TM-650 2.5.5.12 |

## Ordering Information

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|---|---|
| Atlas for SET2DIL insertion loss measurement: | Atlas SET2DIL |
| Atlas for SPP insertion loss measurement: | Atlas SPP |
| Atlas for both SET2DIL and SPP techniques: | Atlas SET2DIL & SPP |
| Atlas 2 channel impedance test & ESD isolation: | Atlas PCB 2CH |
| Atlas 4 channel impedance test & ESD isolation: | Atlas PCB 4CH |
| Datalogging: | Atlas DRG Pro |

Included in all of the above Atlas 800 ESD protection unit compatible with SPP & SET2DIL testing.

### About Polar Instruments

*Polar Instruments is a market leader in designing and manufacturing tools to simplify and enhance the design, fabrication and testing of printed circuit boards (PCBs). Their innovative tools include the industry-standard Controlled Impedance Test System (CITS) which provides the global PCB industry with an easy-to-use test system for high-speed digital and RF boards, as well as class-leading tools for fast and accurate design and testing of controlled impedance in PCBs. Polar also leads the industry in tools for automated PCB layer stackup design and documentation. Polar Instruments was established in 1976 and now has operations and channel partners in the US, UK, Europe and Asia Pacific.*

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