

Comparison of Anti-tracking Delay of Desktop Insertion Loss Analyzer



Overview

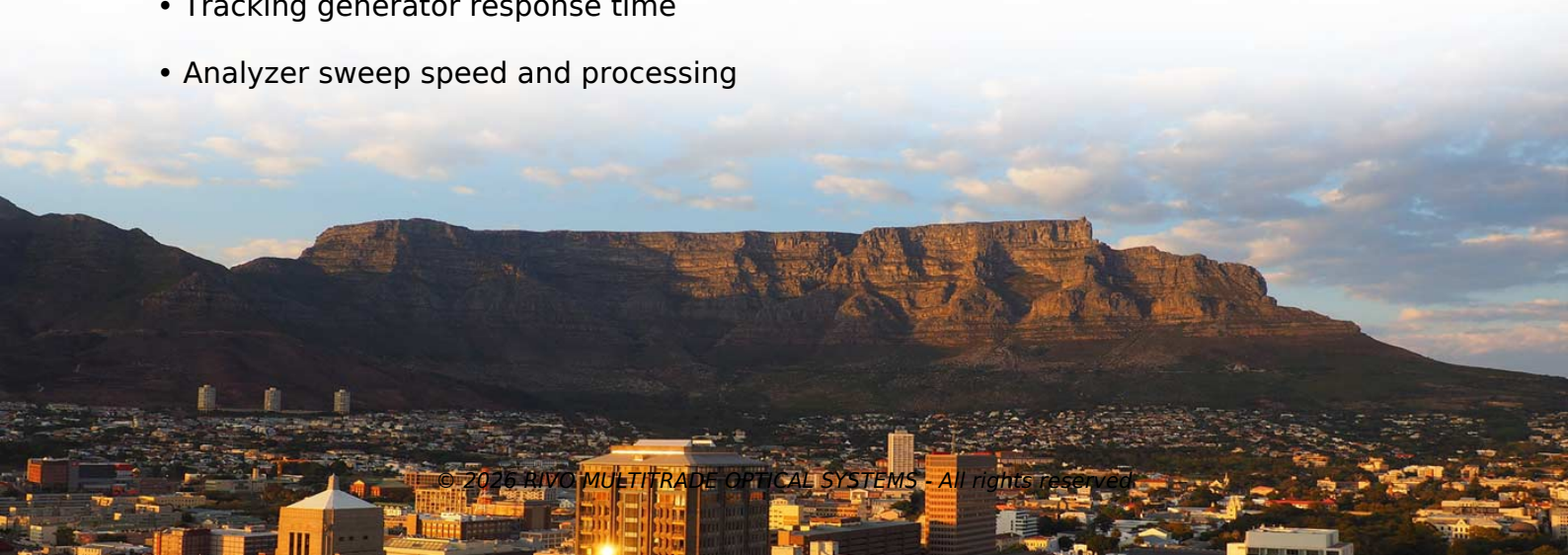
There are a number of portable spectrum analyzers on the market today available with tracking generators.

Key Takeaways

Anti-tracking delay in desktop insertion loss analyzers is influenced by the measurement method, de-embedding workflow, and tracking generator synchronization, with algorithms like Delta-L providing faster, mathematically corrected results compared to full fixture characterization. Overview of Anti-Tracking Delay

Anti-tracking delay refers to the time lag or error introduced when a tracking generator and analyzer system attempts to follow a swept signal through a device under test (DUT). In desktop insertion loss analyzers, this delay can affect the accuracy of high-frequency measurements, particularly when measuring PCB traces or cables with multiple vias and connectors. The delay is influenced by:

- Tracking generator response time
- Analyzer sweep speed and processing



- De-embedding or correction algorithms used to remove fixture and probe effects

Measurement Methods and Their Impact

- Delta-L Algorithm

- Delta-L calculates insertion loss per inch of a PCB trace by mathematically removing lead-in, lead-out, and via contributions from test coupons of different lengths .

- Because it relies on algorithmic correction rather than full fixture characterization, Delta-L minimizes the anti-tracking delay by reducing the number of physical measurements and processing steps.

- It is fully integrated into VNAs like R&S®ZNA, ZNB, ZNBT, and ZND, allowing real-time calculation of insertion loss with minimal tracking lag.

- Full Fixture Characterization and De-Embedding

- Methods such as TRL (Thru-Reflect-Line) or Smart Fixture De-Embedding (SFD) require extensive measurement of multiple structures to shift the reference plane to the DUT .

- While highly accurate, these methods introduce longer anti-tracking delays due to the additional measurement steps and data processing required to de-embed the fixture effects.

- They are preferred when absolute accuracy is critical, but the trade-off is slower measurement throughput.

- SET2DIL and Delta-L Variants

- These approaches offer a compromise between speed and accuracy, providing moderate anti-tracking delay while still correcting for fixture and via effects .

- They are suitable for high-volume PCB testing where rapid insertion loss verification is needed without full TRL-level precision.

Practical Considerations

- Frequency Dependence: Higher frequencies exacerbate anti-tracking delay effects due to faster signal changes and increased sensitivity to fixture imperfections .

- VNA Integration: Desktop analyzers with integrated Delta-L or similar algorithms reduce delay by synchronizing the tracking generator and analyzer sweep, ensuring the measured signal closely follows the DUT response.

- Measurement Workflow: Using fewer test structures and relying on algorithmic corrections (Delta-L 1L, 2L, or 3L methods) reduces the cumulative delay compared to full TRL or SFD workflows .

Summary

- Delta-L: Fastest anti-tracking response, suitable for per-inch insertion loss measurement, minimal physical setup, algorithmically corrected.

- TRL/SFD: Highest accuracy, longer anti-tracking delay due to multiple de-embedding steps.
- SET2DIL/Delta-L variants: Balanced approach, moderate delay, good for high-volume testing. In conclusion, desktop insertion loss analyzers achieve lower anti-tracking delay when using algorithmic methods like Delta-L, while full fixture characterization methods prioritize accuracy at the cost of increased delay. The choice depends on the trade-off between measurement speed and precision required for the application.

Article Content

Comparison of Energy-Saving and Delay Types of Desktop Insertion

This application note explains how Site Master is used to measure cable insertion loss with different test methods and how to predict

Techniques for Precise Cable and Antenna Measurements in

In the next few sections of this application note, measurement examples will be provided showing techniques for

Attenuation_Measurement_White Paper_Final.qxd

Executive Summary The purpose of the white paper is to review the different methods of measuring insertion loss in coaxial cable

Advanced VNA Cable Measurements Product Brief

Advanced VNA Cable Measurements For the contractor, engineer or field technician burdened with bringing powerful instrumentation

Cable and Antenna Measurements Using Tektronix USB

There are a number of portable spectrum analyzers on the market today available with tracking generators. However, the majority of

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This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

