

Article Overview

DML optical receivers have been evaluated for BER performance, link budget, and cost-effective PIN-based implementations, showing feasibility for 25G SMF 40 km applications.

Overview of DML Receiver Testing

Directly Modulated Lasers (DMLs) are widely used in short-reach, low-power optical links due to their compact size and cost efficiency, but their limited modulation bandwidth can introduce waveform distortion and nonlinear intersymbol interference, affecting receiver performance. Testing of DML optical receivers typically focuses on bit error rate (BER), optical power margins, and sensitivity to temperature variations.

Test Setup and Methodology

- o Transmitter Options: DML or EML lasers, with DML being simpler and lower cost but more sensitive to high-temperature performance.
- o Receiver Types: PIN photodiodes are preferred for cost-sensitive applications, while APDs offer higher sensitivity but at higher cost.
- o Measurement Parameters: Forward and reflected optical power are measured using calibrated power meters. BER is evaluated under stressed conditions, including high temperature and fiber dispersion.
- o Link Budget Considerations: For a 25G SMF 40 km link, DML+PIN solutions provide limited but sufficient margin (≥ 18 dB), while DML+APD or EML+APD solutions offer higher margins.

Key Test Results

- o BER Performance: DML+PIN receivers meet the required BER for 25G SMF 40 km links, though with smaller optical power margins compared to APD-based receivers.
- o Optical Power Margins: DML+PIN shows limited margin on the transmitter side but satisfies the 18 dB requirement on the receiver side. DML+APD provides adequate margin for both Tx and Rx.
- o Temperature Sensitivity: DML performance is more affected by high temperatures than EML, but careful bias and modulation current optimization can mitigate degradation.
- o Optimization Strategies: End-to-end optimization of bias current, peak-to-peak modulation current, pulse shaping, and receiver equalization improves throughput and reduces waveform distortion.

Practical Implications

- o Cost Efficiency: Using PIN-based receivers with DML transmitters provides a low-cost solution while meeting performance requirements for medium-reach links.
- o System Design: Careful tuning of DML operating parameters and receiver equalization is essential to

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maximize data throughput and maintain BER performance .

o Future Applications: DML+PIN solutions are suitable for 25G short- and medium-reach links, while higher-speed or longer-reach applications may require EML or APD-based receivers . In summary, DML optical receivers, particularly when paired with PIN photodiodes, provide a cost-effective solution for 25G SMF 40 km links, with acceptable BER performance and manageable optical power margins, provided that transmitter biasing and receiver equalization are carefully optimized.

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When discussing optical transceivers (especially 100G), we are often asked about two different types of laser

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