Optical Splitter Bandwidth Capacity

Overview

For example, a 1:32 splitter takes 1 input signal and splits it into 32 equal (or nearly equal) output signals.

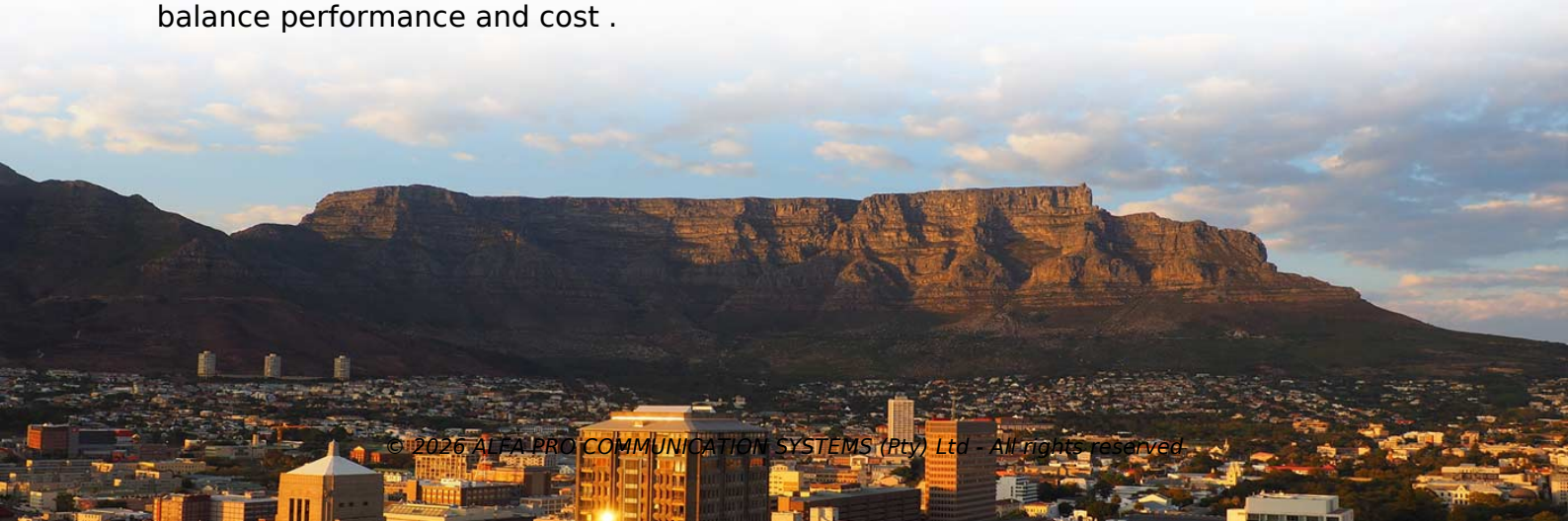
Key Takeaways

The maximum bandwidth per user in a PON is determined by the splitter ratio and the PON standard, with practical limits typically ranging from 1 Gbps per ONU in GPON to 10 Gbps in XGS-PON, shared among all outputs.How Splitters Affect Bandwidth

Optical splitters divide a single optical signal from an OLT into multiple outputs for ONTs, allowing one fiber to serve many users. The split ratio (e.g., 1:8, 1:32, 1:64) directly impacts the bandwidth available per user: the higher the split ratio, the more users share the same total bandwidth, reducing the effective bandwidth per ONU . For example, in a GPON system with 2.5 Gbps downstream, a 1:32 split yields roughly 78 Mbps per ONU on average, while a 1:64 split reduces it to about 39 Mbps per ONU .

Practical Split Ratios and Bandwidth
• EPON: Supports a maximum split ratio of 1:64, with typical deployments using 1:32 to maintain stable bandwidth and quality of service .

• GPON: Theoretical maximum split ratio is 1:128, but 1:64 is commonly used to balance performance and cost .



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• XGS-PON: Supports 10 Gbps downstream, and operators may use 1:32 or 1:64 split ratios depending on subscriber density and bandwidth demand .

Splitter Types and Performance

• FBT Splitters: Suitable for small split ratios (1:2, 1:4), cost-effective but wavelength-sensitive and less uniform in power distribution .

• PLC Splitters: Ideal for larger splits (1:32, 1:64), provide uniform power distribution, low insertion loss, and better spectral performance, supporting higher bandwidth per user .

Bandwidth Considerations

The maximum bandwidth of an optical splitter is not a fixed number; it depends on:

• PON standard: Determines total available bandwidth (e.g., 2.5 Gbps for GPON, 10 Gbps for XGS-PON).

• Split ratio: Higher splits reduce per-user bandwidth.

• Distance and optical power budget: Longer fiber runs and higher splits increase insertion loss, potentially limiting achievable data rates .

• Network architecture: Centralized vs. cascaded splitters can affect fiber management and bandwidth distribution .

Summary

While optical splitters themselves do not generate bandwidth, they share the available PON bandwidth among multiple users. In practice:

• GPON with 1:64 split: ~39 Mbps per ONU average.

• XGS-PON with 1:32 split: ~312 Mbps per ONU average.

• Higher split ratios reduce per-user bandwidth and require careful planning of optical power budgets and network design . Choosing the right splitter type and ratio is essential to maximize bandwidth efficiency while maintaining signal quality and network scalability.

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PON consists of an optical line terminal (OLT) at the service provider''s central office and optical network units (ONUs) near or at the

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