

Tech Tip

Getting the Most Out of 16 QAM

To keep up with traffic demand – and the unpredictability of that demand – Internet Content Providers (ICPs) are upgrading to 16 QAM modulations to gain 200G out of a single wavelength. This is a cost-effective and flexible way to add the needed capacity and make a Data Center Interconnect (DCI) as efficient as possible, but ICPs currently have no way to know if the connection is performing to its full capacity. Without this knowledge, ICPs can never reach the true efficiency or cost savings they hope to achieve.

The best way to see if 16 QAM modulations are working efficiently is to test the DCI connection. Testing will identify if the full transmission capacity is not being achieved, and even pinpoint the problem so that it can be resolved in the least amount of time. Even before production traffic is sent down a new link, the connection should be stress tested with simulated traffic in order to identify faults. If a fault is identified, testing can help locate and troubleshoot the issue so traffic can be restored. The two tests listed below will give a clear picture of the performance of 16 QAM modulations:

RFC 2544

- **What the test is:** RFC 2544 is a widely used test methodology to verify Key Performance Indicators (KPIs) at the Ethernet or IP level for a single service of data traffic. The standard calls for measurements of throughput, latency, and frame loss. In addition to these, ICPs should also test for packet jitter and Committed Burst Size (CBS).
- **When to use it:** RFC 2544 is the ideal test to ensure Layer 2 (Ethernet) or Layer 3 (IP) connectivity when only a single stream or single Class of Service (CoS) of traffic is present. A single stream could be defined as untagged Ethernet frames, a single Ethernet VLAN, or a single IP DSCP/ TOS.

RFC 6349 TCP Throughput

- **What it is:** RFC 6349 TrueSpeed is a test to measure TCP throughput in both the upstream and downstream directions. TCP throughput (measured at Layer 4) can often be dramatically worse than Ethernet or IP throughput (measured at Layer 2 or 3) because packet loss, network congestion, or changing delay can cause TCP retransmissions. Passing RFC 6349 results ensure that ICPs will get the data throughput that they expect.
- **When to use it:** RFC 6349 is the industry standard for TCP throughput measurements. ICPs should perform an RFC 6349 TrueSpeed test on all connections because poor transmission results could mean it's customers are also having problems.

Testing before traffic turn up and once the traffic is live will keep 16 QAM modulations working at peak performance and allow ICPs to gain the highest efficiency and cost savings. The two tests mentioned above will help get the most out of 16 QAM modulations and create the most reliable DCI connection possible.

Want to learn more? Read the app note [Data Center Interconnect: Getting the Most Out of 16 QAM.](#)

Need to test all aspects of the data center? [VIAVI Data Center Case Study & Test Guide](#) has the answers you need.

Products Used for Testing:

[T-BERD/MTS 5800 – 100G](#)