White Paper

VIAVI Solutions

The Skeleton in Your Closet: EF Compliance Impact on Insertion Loss Testing

Overview

Insertion loss and return loss testing (IL/RL) is a critical manufacturing specification known well in the fiber manufacturing and integration sector. Critically, as data centers and other AI-fueled infrastructure leans into higher fiber and connector counts, multimode fiber is playing a larger role in sending critical signals. In this paper we explore what multimode fiber is, how it differs from singlemode fiber, and what this means for your testing requirements.

Multimode Fiber

Multimode fiber foundationally supports many modes of transmission. Unlike singlemode, the beam distribution (or mode distribution) has an impact on the efficient transmission of signals across fiber. The following image shows how while only a single distribution of photons can be supported in singlemode fiber, many variations of distributions can be sent through a multimode fiber.

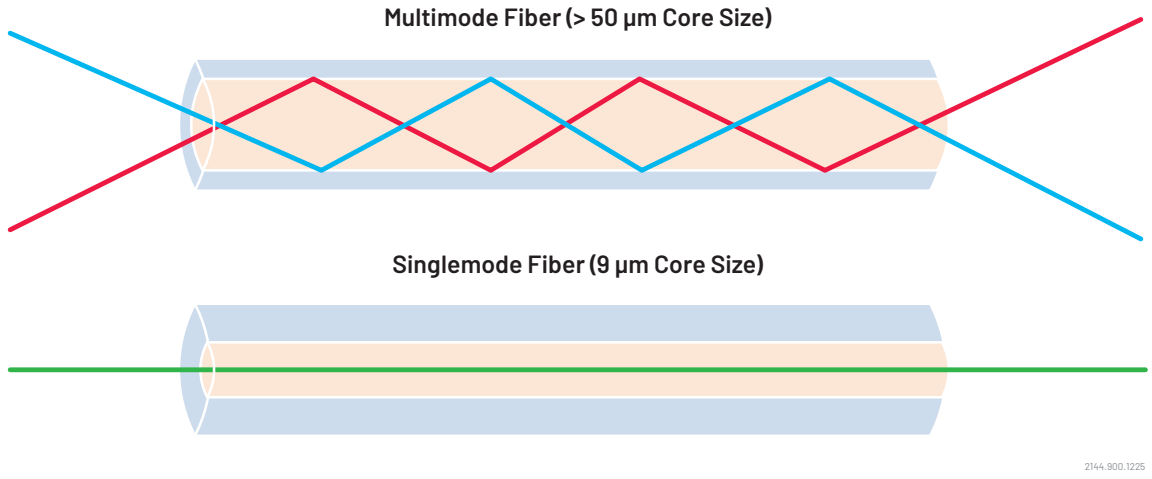

Figure 1. Multimode vs Singlemode Fiber Signal Propagation

Since there is an additional level of variation in signal (spatial distribution), standards have been developed to require signal bearing components to maintain specific distributions of light. This standard is called Encircled Flux (EF). To test the insertion loss and return loss of any multimode system, the tester itself must be EF compliant to appropriately represent the conditions in which the fiber will be used.

The Skeleton in your closet

Any IL/RL tester deviation from EF compliance means that you are not testing your device under test appropriately. You could be introducing errors in the testing process that your customers will notice in the field and misrepresenting the insertion loss and return loss of your device under test.

What does EF Compliance mean and how can I know if my tester is EF compliant?

Encircled Flux (EF) can appear complicated, but simply stated is the cumulative distribution of power integrated over an increasing radius value. The process of measuring this is the following:

1. Launch light from the IL/RL tester being evaluated into a mode imaging system
2. Image the fiber to understand the optical power distribution
3. Measure the total power contained within concentric of variable radius
4. Plot the distribution and compare it to the EF specifications

Modal Explorers exist as market solutions that can perform all these measurements for you and provide a fast and easy way to validate the EF compliance of your IL/RL tester.

The following is an example measurement from VIAVI's mORL IL/RL tester, being evaluated for EF Compliance, using the Arden MPX1 Modal Explorer:

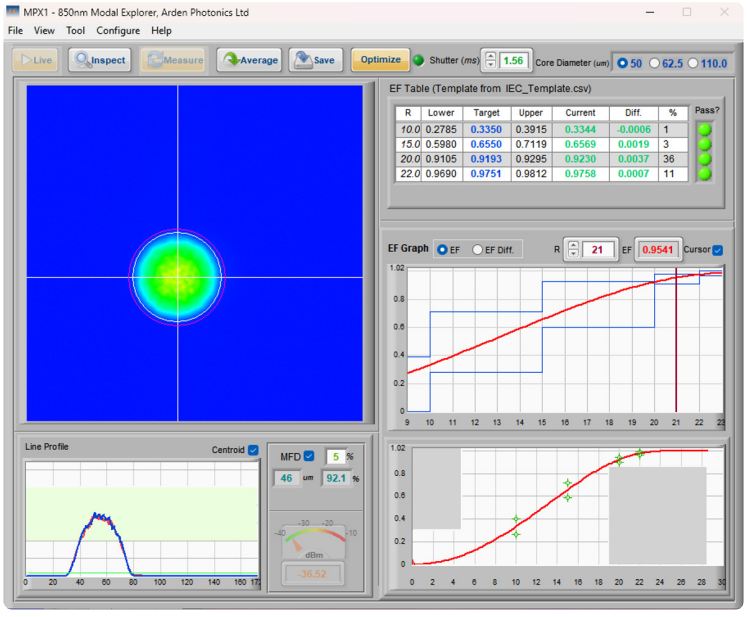

Figure 2: VIAVI mORL is compliant with EF Standards

VIAVI and EF Compliance

VIAVI has a long-standing history of effective and compliant test solutions for both production and field applications. While vendors in the field, and the strong majority of fiber purchasers are often very thoughtful about their EF compliant testing, production test vendors have significantly fallen behind the VIAVI standard. Ensure that your vendor of choice can effectively prove to you their EF compliant processes and validation, and that they are appropriately knowledgeable about the services that they should be providing to you.

What now?

If you have any doubt about your test solution and its EF compliance, contact us to learn more about this critical standard in multimode test and measurement.

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