

Data Sampling Resolution And OTDR Accuracy

By Anritsu Sales Staff

Introduction

This white paper is directed at service providers and technicians who work on the Outside Plant. It addresses the optimal setting for any given fiber as it relates to resolution setting on the OTDR. Many user-controlled parameters can affect the accuracy of an OTDR distance measurement. These parameters include the following. The last point – resolution setting – is the topic of this paper.

- Correct setting of the Index of Refraction.
- Proper Range setting on OTDR.
- Proper Pulse Width setting for given fiber length.
- Optimal Resolution setting for given fiber.

OTDR

An Optical Time Domain Reflector (OTDR) test instrument analyzes the light loss in an optical fiber. It is used in optical network troubleshooting. It injects a short, intense laser pulse into the optical fiber and measures the backscatter and reflection of light as a function of time. The reflected light characteristics are analyzed to determine the location of any fiber optic breaks or splice losses.

Data Sampling and OTDR Accuracy

Even though a majority of newer generation OTDRs have an Automode selection for the optical resolution, in order to choose the setting for the best distance accuracy, it is necessary to understand its function.

The user's first tendency is to set the resolution for the smallest value. However, this can lead to increased scan times for a given desired accuracy. In fact, test times increase in a linear manner with the change in resolution setting. In other words, the time it takes for a 2-meter sampling resolution is approximately 4 times that of an 8-meter resolution setting. This is clearly a factor when evaluating a long span of fiber.

In order to clarify the issue of resolution, it is crucial to understand how this parameter relates to distance accuracy measurements. Simply put, measurement resolution is the spacing between data points on a fiber trace. Higher resolution, or closer data points, provide more detail about a fiber, but take longer to test than a lower resolution test. At this point, it should be noted that this measurement parameter is not the same as the display resolution on the CRT or the cursor resolution readings.

If time for data acquisition is not a factor, then the higher resolution is ideal; this is because it determines the location of an event on a fiber with more accuracy. For instance, if the OTDR takes measurements every 8 meters along a fiber span, then it is possible that a break or event could occur 7 meters after a data point. The resulting Fresnel reflection, if reflective, would appear to start at the previous data point, which is located where the last backscatter level occurred. Since the distance to an event on a fiber span is always taken on the linear backscatter portion of the fiber trace, and since the last point on the backscatter is on the previous data point, then the distance measurement is actually off the incident by 7 meters, or 23 feet due to the data point spacing or resolution.

If the data resolution is set to a higher resolution of 0.5 meters, then the same event's location is plus or minus approximately 1 foot. The following graphical representation demonstrates how the resolution setting can affect the distance location accuracy for any event and/or fault on a fiber span.

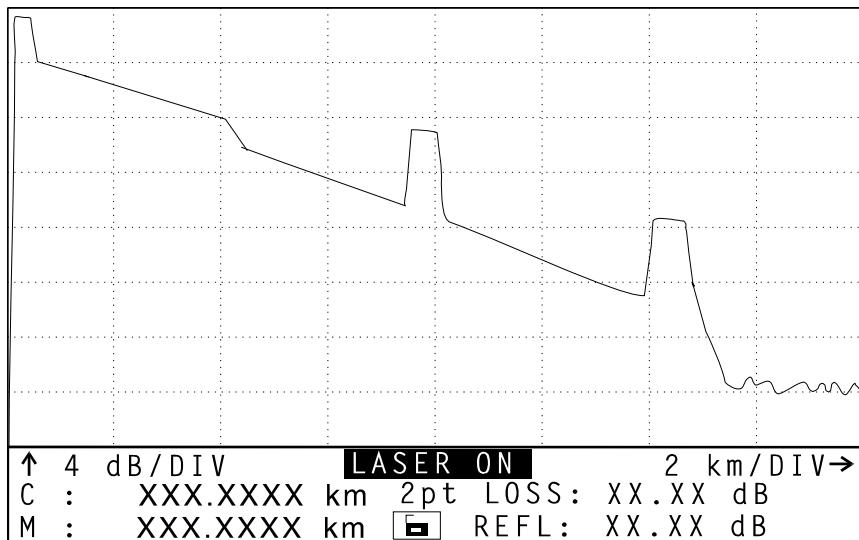


FIGURE 1.

Figure 1 illustrates a typical OTDR trace with multiple events, as well as an end of fiber. Note how the resolution affects the ability of the user to correctly measure events.

For clarity purposes, notice one portion of the above trace – the first non-reflective event. It is shown below with imaginary data points on the trace. (This is to help visualize what the OTDR actually computes).

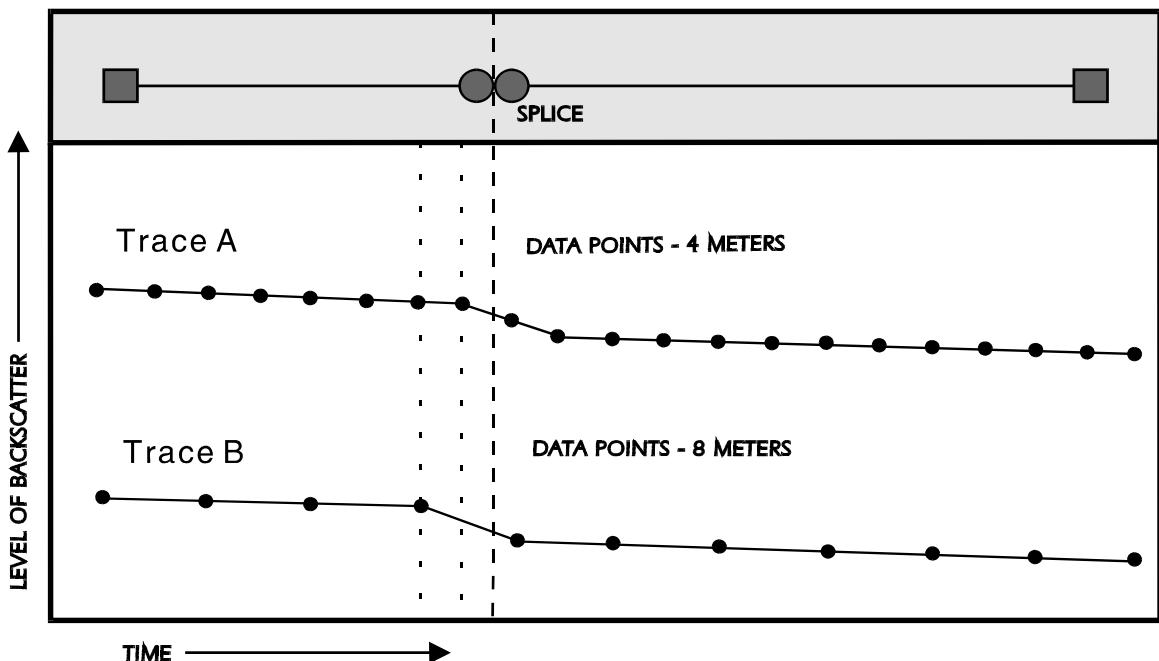


FIGURE 2

In Figure 2, Trace A shows the fiber splice at 4 meter sampling resolution, while Trace B shows the same splice at an 8 meter resolution. It is clear that the resolution setting of the OTDR can significantly affect the accuracy of any distance measurement.

At this point, if the user chooses not to utilize the Automode selection on newer OTDRs, there is a trade-off between time and desired accuracy. As experience is gained in the correct operation of the OTDR, this selection process become easier and test results are more consistent with the desired trade-off of test time versus accuracy. The location accuracy may be insignificant compared to the length of the entire span and therefore is not of any consequence. In this case, the lower resolution setting is appropriate, because the location is obtained in a relatively shorter period of time.

Conclusion

This white paper is directed at service providers and technicians who work on the Outside Plant. It addresses the optimal setting for any given fiber as it relates to resolution setting on the OTDR.

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