EXAMPLES OF HOW TO USE THE OTDR AND AVOID ERRORS

Here are some actual examples of how to use an OTDR properly (and improperly) and some tricks to overcome some of the problems you encounter. The most adamant advice we will give is this: Do not blindly accept the data without interpretation. Most of today's OTDRs have "automatic modes" where they will find splices and connectors and calculate all the losses, *if the data follows preprogrammed guidelines.* In our experience, these numbers are not to be used without human interpretation of the results, as the OTDR is basically a PC, isn't too smart, and the software has limitations if the cable plant has high reflections or short cable runs.

What Does a Good OTDR Trace Look Like?

Take a look at Figure 10. You can see the end of the "pulse suppresser" cable, the first fiber out from the OTDR, allows time for the OTDR to recover from the initial pulse. Note the fibers are all straight lines between "events, as splices and connectors are called in OTDR jargon. Markers for loss measurements should always be set far enough on either side of an event to be on the straight part of the fiber trace. If there is any curve, it is likely caused by the resolution of the OTDR or recovery from an overload

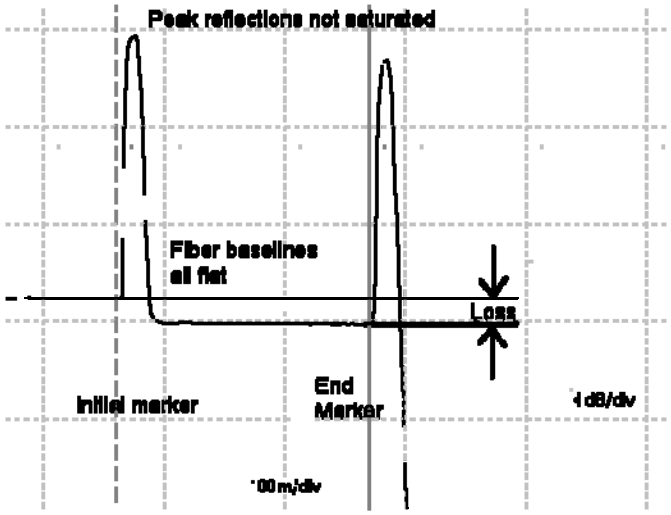

Figure 10. Good OTDR trace for analysis

Setting the markers slightly away from the event won't affect the loss measurement by adding significant fiber loss. Remember fiber loss is only 0.01 dB per 10 meters (33 feet) at 1300 nm! By going further from the event, you reduce the possibility that the measurement is in error because of instrument limitations.

If the trace never shows a straight line between events, like Figure 5, it means either the distance between events is too short for the OTDR resolution or reflections are too high for the recovery time needed before the next event. In this case, you cannot get good data on either fiber loss or event loss.

This "Trick" Can Help

There is a trick you can try if you are desperate. The reflection at an event that causes overloading the OTDR receiver can be tamed by using "index matching fluid" to reduce the effect that causes the reflection. The reflection is caused by an air gap between the ends of the fibers. Connectors are particularly bad at having this air gap and resulting high reflections. An index matching fluid replaces the air with a fluid or gel that closely matches the optical characteristics of the glass, causing the reflections to be greatly diminished.

Figure 11 shows two traces of the same fiber. It is only 700 feet or 200 meters long, which is normally considered quite short for OTDR analysis. The initial trace shows the connector on the OTDR end has high reflections, saturating the OTDR and causing the baseline of the trace to decay slowly. Even the second pulse, from the connector at the far end of the cable has very high reflections. Both reflections cause ghosts also.

Since the baseline between the two ends never becomes flat or straight, there is no reliable reference point for making a loss measurement.

But we can reduce the reflections by adding index matching fluid. We just add a drop of gel or fluid between the two connectors that matches the index of reflection of the glass in the fiber, reducing the reflections. Once we reduce the reflections, causing the receiver overload to go away, the OTDR will give us a good fiber trace just beyond the connector and a flat fiber trace which we can use for measuring the actual loss! We even got rid of the confusing ghosts!

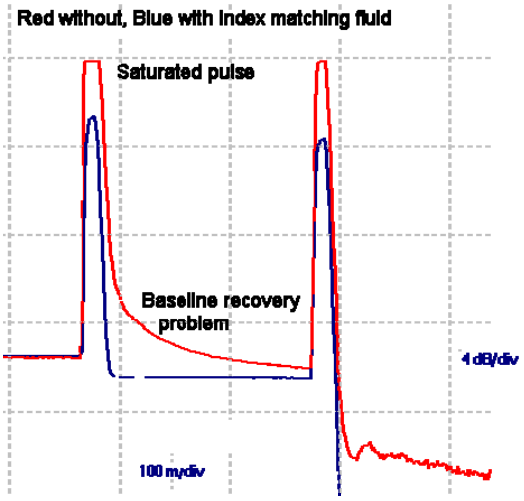

Figure 11. Improving OTDR Traces with Index Matching

Index matching fluid can be purchased from a specialty fiber optic distributor or from your local supermarket or druggist. The special fluids work very well but are expensive. Mineral oil or plain petroleum jelly work almost as well! If you can get silicone "high vacuum grease", it works very well too.

Using this technique gives us visibility we would never have otherwise, but the technique requires care. The index matching fluid or gel must be thoroughly cleaned from the connectors after use with the OTDR. The splice bushing used must not be one in the network hardware, but a separate item that can be used and discarded or thoroughly cleaned in solvent afterwards. Index matching fluid or gel will act like a magnet for dirt if it gets on any hardware or stays on the connectors, as its sticky texture will grab and hold lots of airborne dirt to attenuate the signal in the fiber link.