

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.

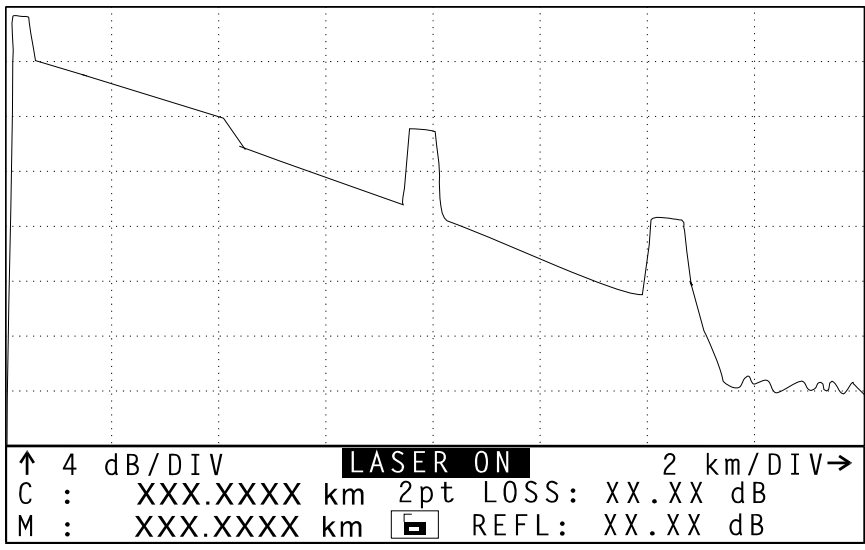


FIGURE 1.

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).

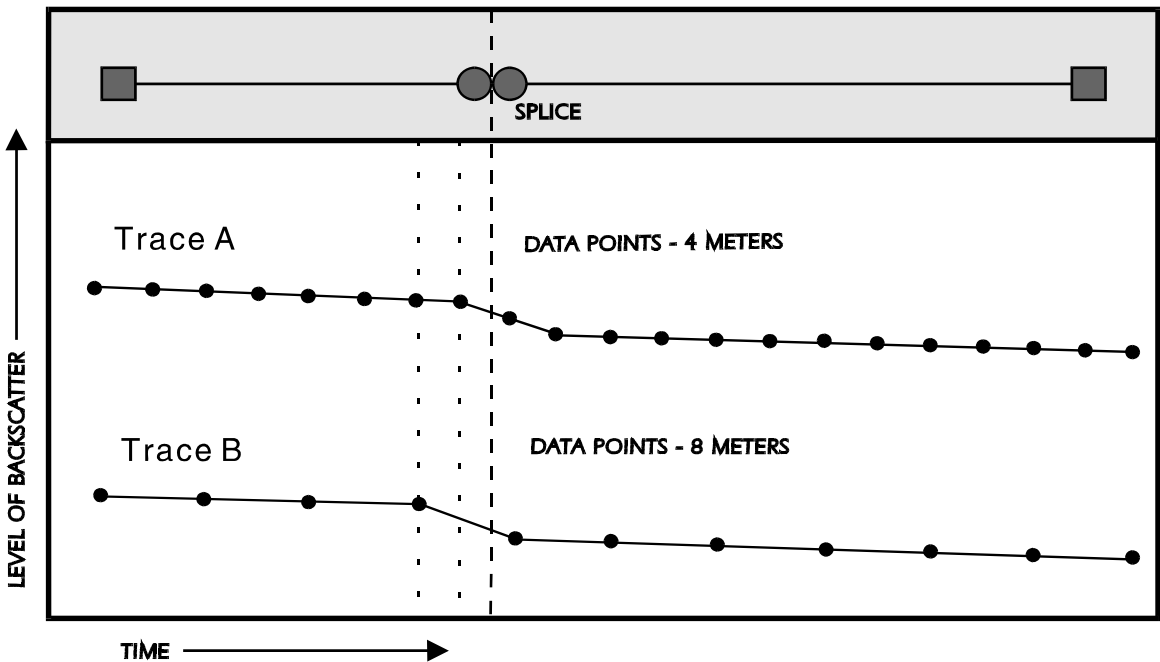


FIGURE 2

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.

Anritsu Corporation

5-1-1 Onna, Atsugi-shi, Kanagawa, 243-8555 Japan
Phone: +81-46-223-1111
Fax: +81-46-296-1264

• U.S.A.

Anritsu Company

1155 East Collins Blvd., Suite 100, Richardson,
TX 75081, U.S.A.
Toll Free: 1-800-267-4878
Phone: +1-972-644-1777
Fax: +1-972-671-1677

• Canada

Anritsu Electronics Ltd.

700 Silver Seven Road, Suite 120, Kanata,
Ontario K2V 1C3, Canada
Phone: +1-613-591-2003
Fax: +1-613-591-1006

• Brazil

Anritsu Eletrônica Ltda.

Praca Amadeu Amaral, 27 - 1 Andar
01327-010-Paraisópolis, São Paulo-Brazil
Phone: +55-11-3283-2511
Fax: +55-11-3288-6940

• Mexico

Anritsu Company, S.A. de C.V.

Av. Ejército Nacional No. 579 Piso 9, Col. Granada
11520 México, D.F., Mexico
Phone: +52-55-1101-2370
Fax: +52-55-5254-3147

• U.K.

Anritsu EMEA Ltd.

200 Capability Green, Luton, Bedfordshire, LU1 3LU, U.K.
Phone: +44-1582-433200
Fax: +44-1582-731303

• France

Anritsu S.A.

16/18 avenue du Québec-SILIC 720
91961 COURTABŒUF CEDEX, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

• Germany

Anritsu GmbH

Nemetschek Haus, Konrad-Zuse-Platz 1
81829 München, Germany
Phone: +49-89-442308-0
Fax: +49-89-442308-55

• Italy

Anritsu S.p.A.

Via Elio Vittorini 129, 00144 Roma, Italy
Phone: +39-6-509-9711
Fax: +39-6-502-2425

• Sweden

Anritsu AB

Borgafjordsgatan 13, 164 40 KISTA, Sweden
Phone: +46-8-534-707-00
Fax: +46-8-534-707-30

• Finland

Anritsu AB

Teknobulevardi 3-5, FI-01530 VANTAA, Finland
Phone: +358-20-741-8100
Fax: +358-20-741-8111

• Denmark

Anritsu A/S

Kirkebjerg Allé 90, DK-2605 Brøndby, Denmark
Phone: +45-72112200
Fax: +45-72112210

• Spain

Anritsu EMEA Ltd.

Oficina de Representación en España

Edificio Veganova
Avda de la Vega, n° 1 (edf 8, pl 1, of 8)
28108 ALCOBENDAS - Madrid, Spain
Phone: +34-914905761
Fax: +34-914905762

• Russia

Anritsu EMEA Ltd.

Representation Office in Russia

Tverskaya str. 16/2, bld. 1, 7th floor.
Russia, 125009, Moscow
Phone: +7-495-363-1694
Fax: +7-495-935-8962

• United Arab Emirates

Anritsu EMEA Ltd.

Dubai Liaison Office

P O Box 500413 - Dubai Internet City
Al Thuraya Building, Tower 1, Suit 701, 7th Floor
Dubai, United Arab Emirates
Phone: +971-4-3670352
Fax: +971-4-3688460

• Singapore

Anritsu Pte. Ltd.

60 Alexandra Terrace, #02-08, The Comtech (Lobby A)
Singapore 118502
Phone: +65-6282-2400
Fax: +65-6282-2533

• India

Anritsu Pte. Ltd.

India Branch Office

Unit No. S-3, Second Floor, Esteem Red Cross Bhavan,
No. 26, Race Course Road, Bangalore 560 001, India
Phone: +91-80-32944707
Fax: +91-80-22356648

• P.R. China (Hong Kong)

Anritsu Company Ltd.

Units 4 & 5, 28th Floor, Greenfield Tower, Concordia Plaza,
No. 1 Science Museum Road, Tsim Sha Tsui East,
Kowloon, Hong Kong
Phone: +852-2301-4980
Fax: +852-2301-3545

• P.R. China (Beijing)

Anritsu Company Ltd.

Beijing Representative Office

Room 1515, Beijing Fortune Building,
No. 5, Dong-San-Huan Bei Road,
Chao-Yang District, Beijing 10004, P.R. China
Phone: +86-10-6590-9230
Fax: +86-10-6590-9235

• Korea

Anritsu Corporation, Ltd.

8F Hyunjuk Building, 832-41, Yeoksam Dong,
Kangnam-ku, Seoul, 135-080, Korea
Phone: +82-2-553-6603
Fax: +82-2-553-6604

• Australia

Anritsu Pty. Ltd.

Unit 21/270 Ferntree Gully Road, Notting Hill,
Victoria 3168, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

• Taiwan

Anritsu Company Inc.

7F, No. 316, Sec. 1, Neihu Rd., Taipei 114, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817