DIAGNOSIS OF THE CONDITION OF OPTICAL-LINE LINES ON THE BASIS OF IMPULSIVE OPTICAL REFLEKTOMETER

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Annotatsiya

Ushbu maqola optik tolali chiziqni diagnostika qiluvchi impulsli optik reflektometrning odatiy refleksogrammasiga asoslanib, masofaga qarab aks ettirilgan signalning nisbiy kuchining o'zgarishiga asoslangan.

Аннотация:

Эта статья основана на изменении относительной мощности отраженного сигнала в зависимости от расстояния на основе типичной рефлексограммы импульсного оптического рефлектометра, диагностирующего волоконно-оптическую линию.

Abstract:

This article is based on the change in the relative power of the reflected signal depending on the distance, based on a typical reflexogram of a pulsed optical reflectometer diagnosing a fiber optic line.

Kalit so‘zlar: Impuls, reflektometr, refletogramma, diagnostika, lazer, avlod, dinamik diapazoni, amplituda.

Ключевые слова: Импульс, рефлектометр, рефлектограмма, диагностикалаш, лазер, генерация, динамик диапазон, амплитуда.

In this paper, the dependence of the reflected relative signal power on the distance is justified on the basis of the reflectogram of a pulsed optical reflectometer

Keywords: Pulse, reflectometer, reflectogram, diagnosing, laser, generation, dynamic range, amplitude.

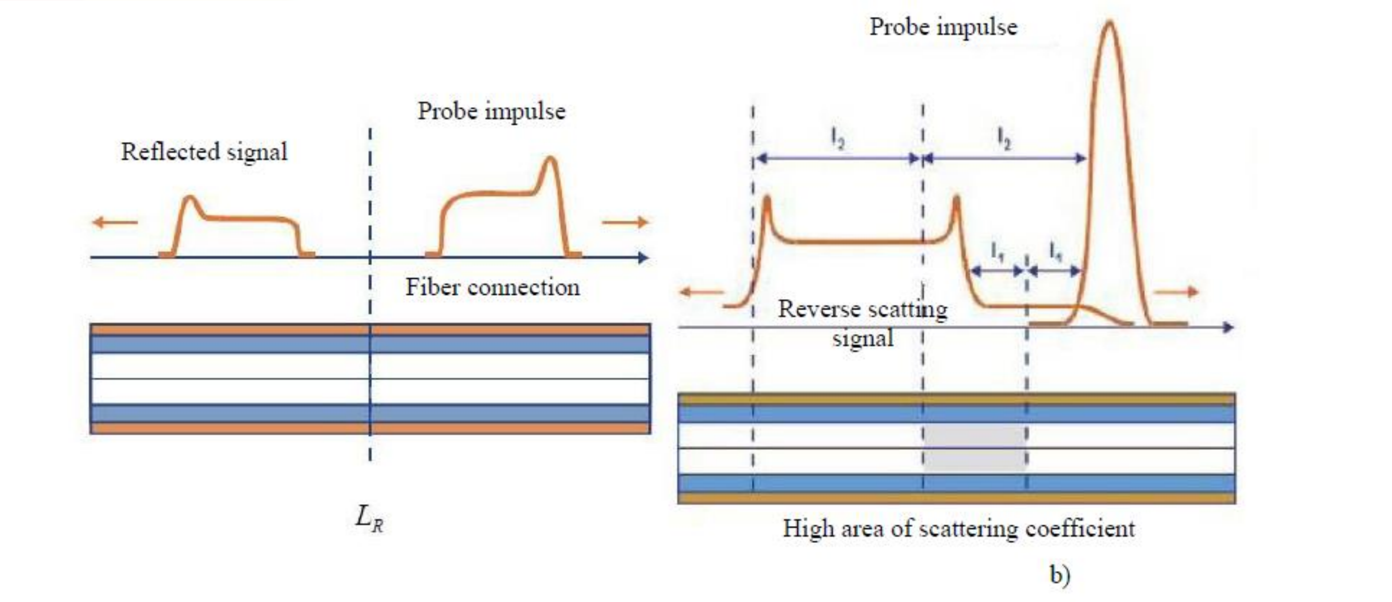
Pulsed reflectometers of various types are widely used at all stages of the development of fiber-optic communication systems, from the production of optical fiber and cable to the construction and operation of fiber-optic communication lines. The optical reflectometer allows quick and convenient diagnostics of the condition of the optical fiber, optical cable and line, in particular:

- fiber-optic communication line on losses distribution;
- of the line defective plots and interruptions clear surface detection;
- line acceptance when done and periodic in testing in it complete losses evaluation;
- mechanical and welded connections losses in measurement;
- return and interference coefficient measurement;
- fiber quality gradually or suddenly deterioration in detection.
- Reflectogram of the communication line is the basis of its documentation in the commissioning of the fiber-optic communication line.

The principle of operation of a pulsed optical reflectometer is based on measuring the intensity of light incident on the return or scattered light from different sections of the line in the propagation of a short-sounding light pulse along a fiber-optic communication line.

In the photoreceptor of the reflectometer, only a fraction of the scattered radiation that is channeled into the fiber and propagated along the core is recorded, as the fiber is located near the end where the probe light pulse is inserted. The time dependence of the scattered radiation incident on the photoreceptor is fiber and fiber-optic communication allows the calculation of a series of characteristics of the line. Agar the scattering coefficient of light is known in any area of the fiber, in which case it is possible to determine the strength of the probe pulse in that area. If, reverse scattering coefficients unknown if but, fiber-optic of the line clear if the sections are the same, then the reflectometer allows the ratio of the signal strengths in these sections to be determined accordingly, as well as the attenuations between these sections. The difference between events such as the return and reverse scattering of light in an optical fiber is that the return is a local event and the scattering is a distributed event. Return to fiber, basically, at the junctions of different types of fibers, there are fractures and course breaks when appears. In nonsense where the scattering is small chaotically occurs, however, is approximately evenly distributed throughout the fiber.

The formation of reflected and scattered radiation in the optical fiber is shown in Figure 1 (a, b) .



1- (a, b) picture. Short light impulse (probe signal) formation of reflected and scattered radiation in optical fiber propagation

As the return occurs with a L R coordinate in a specific area of the fiber, a return light signal is formed, the shape of which corresponds to the shape of the probing signal. (1 (a, b) - picture) The distance from the fiber-optic communication line to the test section is recalculated to determine the retention time corresponding to that section. That's it according to high spatial accuracy time to measure on delay high-precision measurement is required.

In order to achieve accurate measurement results when measuring with a distance reflectometer, it is necessary to ensure that the value of the light refractive index is accurately set, because the distance is equal to the product of the speed of light and the group speed. which is inversely proportional to the magnitude of the refractive index in the fiber. The refractive index of a fiber depends on the wavelength for two reasons. First, the refractive indices of the core and the quartz shell depend on the wavelength (material dispersion). Second, the wave propagates partly in the core and partly in the shell. Second, since the wave propagates partly in the core and partly in the shell, the refractive index of the fiber is the light refractive index of the core and the refractive index of the quartz shell. indicator between middle value has will be. Wavelength change with the depth of transition of the wave to the quartz shell and, accordingly, the effective magnitude of the refractive index (wave dispersion).

It is accepted to characterize the pulse rate as n ch - (group velocity) group refractive index:

n ch = s / n ch (1)

group break indicator n ch - phase break indicator with n ch (2) connected by a relationship. The magnitude of the group refractive index is usually given in the optical cable specification. If not specified, in this case the average group value of the refractive index for a single-fiber fiber in the reflectometer can be set to n ch = 1,467.

In Figure 2 impulse reflectometer typical reflectogram listed.

Reflectometer on the screen graphics in view back return signal relative the change in power depending on the change distance is given in logarithmic units. Such a graph is called a reflectogram, and it can be used to perform a series of quantitative measurements of the condition of the tested section of the fiber-optic communication line.

The vertical scale determines the losses in logarithmic units. The horizontal axis corresponds to the distance from the reflectometer to the test site. In this typical reflexogram, two types of plots can be distinguished:

- Reversible and winning point objects which was plots;
- Strong reversible and absorbent point objects with connecting gone plots.

The first type of reflexograms are reflexograms that do not depend on the shape and duration of the sensing pulse. The slope of the curve in the reflectograms characterizes the extinction coefficient in the fiber in decibels. Measurements of losses or extinction coefficients at these plots using a reflectometer provide high accuracy, even if they are indirect measurements. The return coefficient on the fiber can be considered as a high-precision constant.

The point defects associated with the connection and branches of the fibers can be included in the second type of sections. They correspond to the peaks or leaps in the reflectogram, and they are called reversible or absorbing events, respectively.

The reflectometer makes it possible to accurately determine the distances to such events. It can be used to approximate the losses in such elements and to estimate the integral losses over the entire test plot. But, nonetheless measurements character come came out without, losses
it should be borne in mind that there is an error in the measurement and that false signals may also appear in such measurements. Peaks of return elements characterizes. The strength of the returned signal, i.e., the peak state, the strength of the probing pulse is determined by the return coefficient and does not depend on its duration. Mechanical connections are made to the return elements. The peak in the reflectogram, and the input losses in the separators based on the Fresnel turns on the side of the connecting fibers, lead to a decrease in the magnitude of the scattered signal.

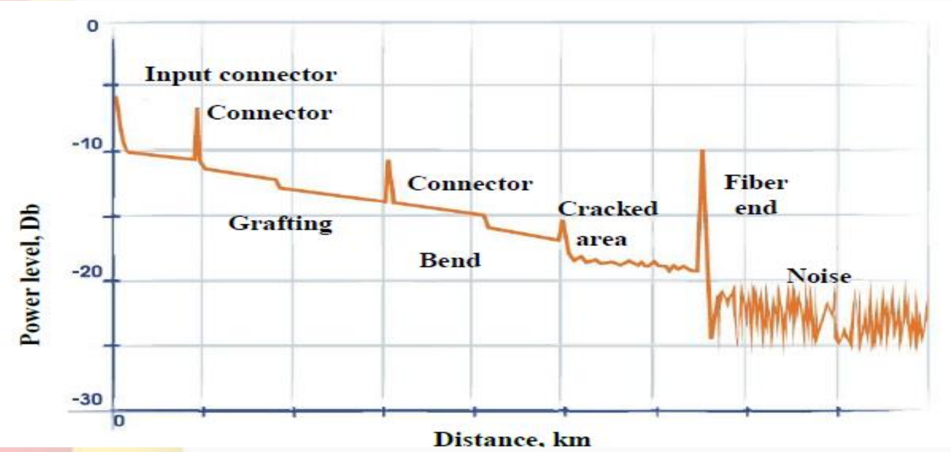


Figure 2 Impulse reflectometer typical reflectogram

The peak amplitude characterizes the connection quality of the fiber. It is known that welded joints are not reversible, and even the presence of a small weak peak indicates that the quality of the weld is poor. There will also be losses in any quality welding.

Losses in micro bending have analogous characteristics that are difficult to distinguish from losses in welding or mechanical connections. Thus, the visual representation of the information about the fiber-optic communication line by the reflectometer allows to assess the quality of this line.

REFERENCES

1. Ivanov A. B. B. Compliance control in telecommunications and communications. Ch. 1. M .: SAYRUS SISTEMS Company, 2001.
2. Andre Jirar. Guide to technology and testing of WDM systems. M .: EXFO, 2001. 252 p.
3. Freeman R. Fiber optic communication systems. M .: Technosphere, 2003. 440 s.
4. Parpiev M.P., Raxmonova G.S., Xaydarbekova M.M., Akhmedova X.X. Metrology. Tutorial. T .: “Top Image Media”, 2017. 382 p.