Methods and Means of Ensuring Information Security of Optical Systems and Communication Networks

Abdugafur Hotamov
Associate Professor of Samarkand Branch of Tashkent University of Information Technologies named after Muhammad al - Khorazmi
abdugafur.xotamov@gmail.com

Tulkin Sultanov
Director of JSC "Uzbektelecom" Samarkand branch, independent researcher of TATU

Abdukhafiz Jurakulov
independent researcher of TATU

Article Info
Page Number: 7384 - 7388
Publication Issue:
Vol 71 No. 4 (2022)

Article History
Article Received*: 25 March 2022*
Revised*: 30 April 2022*
Accepted*: 15 June 2022*
Publication*: 19 August 2022*

Abstract

The communication network will satisfy the needs of the users of services and become global, connecting them on a global scale in all sectors of the economy and helping to increase their productivity. The high efficiency of the telecommunication infrastructure is based on the existence of several standards and measurements aimed at ensuring their safe operation. However, even if standards meet the needs of the network, the increasing use of open interfaces and protocols, the greater diversity of applications and platforms, and the diversity of products that are not always adequately tested increase the potential for malicious use of communications media and networks.

Keywords: statistical analysis, transmitting optical module, receiving optical module, eavesdropping

---

The main part.

In recent years, all global communication networks have seen a dramatic increase in security breaches (such as viruses and data breaches). Therefore, the question of how to support an open

communication infrastructure without compromising the information being transmitted is becoming important.

Broadband signal power determination method and field of application the essence of the technique is to monitor and control the power level of the received broadband signal (Figure 1).

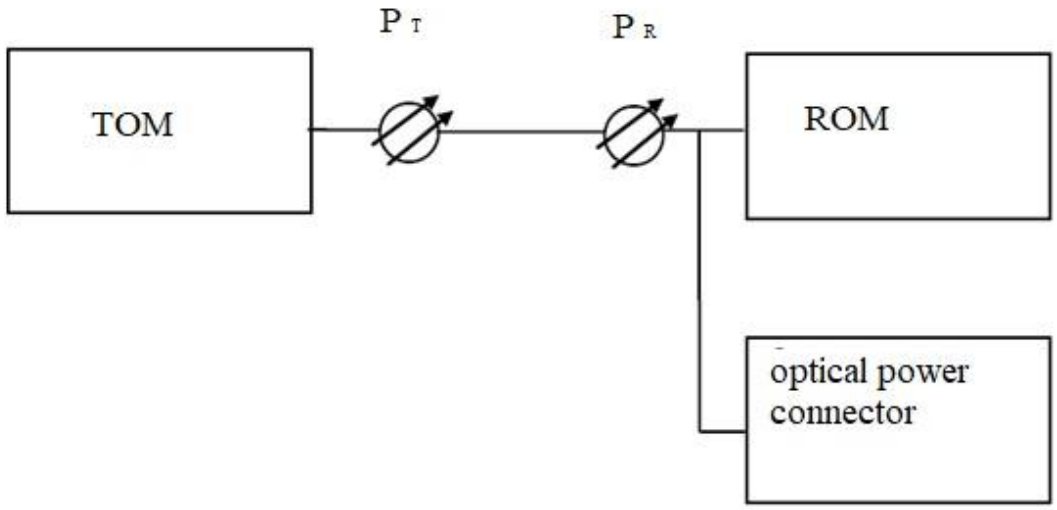

Figure 1. Broadband signal power determination method

In this figure the TOM is the transmitting optical module;

P_T- UOM 's input optical signal power;

P_R- reception optical signal power at the optical module input;

ROM - reception optical module.

This technique is used to observe the change in power level and compare it to the expected step value, where small deviations cannot be detected, or it takes too long. Using statistical analysis, the mathematical expectation of the data in accordance with the law of large numbers requires considerable averaging of the data to adequately determine the statistical value of a given mean of power.

The application of the method allows monitoring of small changes in the signal strength in the channel associated with the aging processes of fiber and network components, as well as restoration work.

Thus, most circuits using a broadband signal strength measurement method have a set of threshold values at which the quality of service is degraded or degraded.

Decisions that rely on measuring and determining the power of the received optical signal are best suited for diagnosing problems with optical amplifier discontinuities. When a useful information signal is blocked by a criminal's signal on the receiving end, the signal power often increases rather than decreases, and the total power may remain constant or decrease slightly. Very small interferences of the criminal, caused by periodic or frequent exposure to the jamming (noise-reducing) unauthorized signal, can lead to the deterioration of the parameters of the intensity of the error bits to sufficiently strong inadmissible values of the average power indicator, which does not allow to detect the movement of the criminal.

The eavesdropping power detection method will not be satisfactory in the following cases:

a) reception-side signal interference results in a change in signal strength such that a determination of impermissible influence is made; This can be achieved if the effects are random and not too large in their transmission length, and the power loss is very small;

b) after the signal is received, optical power is injected into the fiber to compensate for the losses.

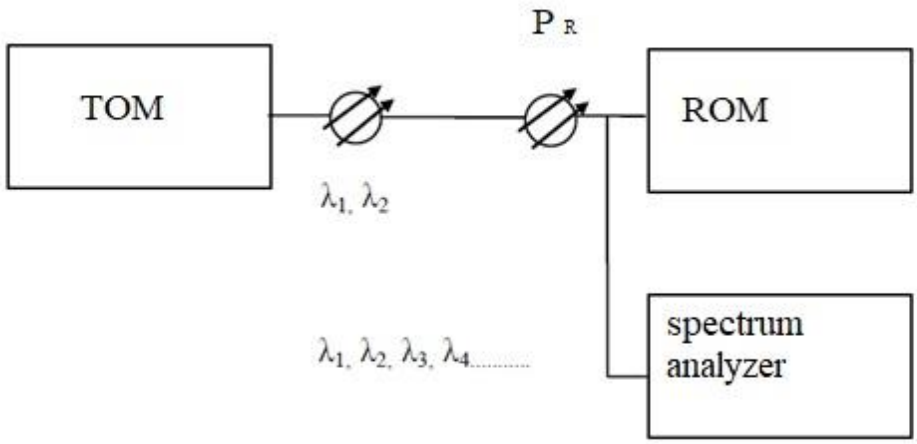

Figure 2. The Broadband power determination method

Here is the TOM-transmitting optical module;

λ1, λ2wavelengths of information signals on the transmitter side;

P_R- the power of the optical signal at the input of the receiving optical module;

λ1 λ2 λ3 λ4 ... wavelengths of optical signals at the input of the spectrum analyzer;

ROM - receiving optical module.

This method (Fig. 2) is based on the analysis of the spectrum of the optical signal and compared to the method of measuring the received signal strength, it has a greater number of methods of its

implementation, as well as greater informativeness and the ability to make a more detailed diagnosis.

This method makes it possible to detect changes in the optical signal spectrum even if the total power of the received signal remains unchanged. Suppose there are two signals in an optical fiber with the same values but different sum power of spectral components.

Using the method of measuring the power of a broadband signal, it is not possible to have two different signals in the OT, which is easily demonstrated by the method of optical spectrum analysis. The optical spectrum analysis method identifies "blockages" that affect the optical spectrum of a signal. Unallowable effects using the crosstalk effect and this method produces results such as a set of power meters tuned to specific wavelengths.

With this method, it is not possible to detect the presence of eavesdropping, except for those points where the selection of signal strength introduces distortions into the transmitted signal, for example, there is a decrease in power on the channel or the spectrum of the received signal becomes wider than it is. If eavesdropping is carried out outside using crossovers, then the spectrum analyzer will not notice any significant changes.

CONCLUSION

Uzbekistan is one of the countries where information and telecommunication technologies are widely developing. Especially in recent years, the optical fiber communication system is widely introduced into the information and telecommunication system of the Republic.

This question is fully answered by the standards, measures, and measures that are developed and developed, aimed at combating security threats in all elements of the communication infrastructure - communication lines, transmission and switching systems, protocols, and application detailing, from OKS #7 signaling to the process of network management. Thus, security must be addressed from the beginning, like a well-thought-out process: from system planning and design, through implementation, to system operation, operation, and maintenance.

The advantage of the optical fiber communication system over other systems is that they use signals in the optical range, which have a large information capacity. Today, the main demand for information and telecommunication systems is to ensure the high reliability of communication systems and information security.

References

1. Fundamentals of optical communication: a study guide/ G.Kh. Mirazimova, Ph.D., Under the editorship of associate professor I. Isaev.-TATU, 2006.

2. Убайдуллаев Р.Р. Волоконно–оптические сети-М.: Эко– Трендз, 2000.

3.Волоконно – оптические системы передачи: учебник для высших учебных заведений / М.М. Бутусов, С.М. Верник, С.Л. Галкин, В.Н. Гомзин, Б.М. Машковцев, К.Н. Щелкунов; Под ред. В.Н. Гомзина.–М.: Радио и связь, 1992.

4. Гальярди Р.М., Карп Ш. Оптическая связь: Перевод с английского С.М. Бабия под ред. А.Т. Шереметьева.–М.: Связь, 1978.

5.Оптические системы передачи: Учебник для вузов/Б.В. Скворцов, В.И. Иванов, В.В. Крухмалев и др.; Под ред. В.И. Иванова.-М.: Радио и связь, 1994.

6. Цифровые и аналоговые системы передачи: Учебник для вузов/ В.И. Иванов, В.Н. Гордиенко, Г.Н. Попов и др.; Под ред. В.И. Иванова.- 2-е изд. –М.: Горячая линия – Телеком, 2003.