Abstract

Quantum cryptation is a new radical approach to the art of cryptography. This new method utilizes the quantum nature of single photons. By doing this in conjunction with a specially designed protocol data can be transferred with a proven security.

The objective of this thesis was to design and test a single photon detector, a part in a quantum cryptation experimental setup. Circuits and other mechanical arrangement were developed.

The physical properties of the avalanche photodiode(APD), which is the detection component in the system, is important to understand. The goal is keep the dark count rate as low as possible. The APD which was operated in Geiger mode was sensitive to several parameters. By some preliminary trials it was concluded that the gate width should be as narrow as possible to prevent dark counts. This would also make it possible to increase upper limit of the repetition rate. But a too high value of the repetition rate increases the dark count rate significantly due to a process called trapping.

Some models for evaluating the APD and the performance of the system were developed. A detector efficiency of 50% were achieved with an error rate of 0.5%. Better efficiencies were achieved at the cost of higher error rates, and reverse. Based on the detection efficiency models the system performs better at low detector efficiencies at high rep.rates. But the model did not give a obvious point of where to make settings, and the user must self deside what properties that need to be good.

It was thought that raising the temperature above its normal level of $-198°$, but no improvements were observed for this detector. The performance rather declined.