

Calculating Quantum Efficiency in Fiber Optic Communication



Article Overview

Quantum efficiency (QE) in fiber optic communication is calculated as the ratio of the number of electrons generated by a photodetector to the number of incident photons, expressed as a percentage.

Definition of Quantum Efficiency

Quantum efficiency (QE) measures how effectively a photodetector converts incident photons into electrical charge carriers (electrons or holes) in a fiber optic system. It is a critical parameter for optical receivers, as higher QE leads to more efficient signal conversion and improved data transmission reliability. QE is typically expressed as a percentage: $QE (\%) = (\text{Number of electrons collected} / \text{Number of incident photons}) \times 100$.

Step-by-Step Calculation

- Determine the number of incident photons: The number of photons hitting the photodetector can be calculated from the optical power of the fiber and the photon energy: $N_{\text{photons}} = P_{\text{in}} \cdot t / h \cdot \nu$ where P_{in} is the incident optical power, t is the measurement time, h is Planck's constant, and ν is the frequency of the light.
- Measure the number of electrons generated: The photodetector produces a photocurrent I_p proportional to the number of electron-hole pairs generated. The total number of electrons can be calculated as: $N_{\text{electrons}} = I_p \cdot t / q$ where q is the elementary charge.
- Compute QE: Divide the number of electrons by the number of incident photons a...

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Quantum Limits in Optical Communications

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Calculating Quantum Efficiency in Fiber Optic Communication

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2 Capacity and Quantum Limits in Optical Systems This chapter briefly introduces the historical development, emergence, and

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FIBER OPTICAL COMMUNICATIONS (R17A0418)

UNIT I general Optical Fiber communication system, advantages of optical fiber communications. Optical fiber wave guides-

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